

REVISION OF THE GENUS *CALENDRA*  
(FORMERLY *SPHENOPHORUS*) IN  
THE UNITED STATES AND  
MEXICO (COLEOPTERA,  
CURCULIONIDAE)

PATRICIA VAURIE

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## INTRODUCTION

PERHAPS A DOZEN or more weevils of the genus *Calendra*, commonly called billbugs, are well known to the farmer for their destruction to his crops, and probably the same ones are recognized by collectors, but there are at least another 50 species, especially in the western states and in Mexico, which are seldom seen and about which little is known. They are, with a few exceptions, black or dull red insects, many of them possessing a yellow or gray, pruinose, felt-like coating, or a waxy exudation to which mud readily adheres as they push their way through the soil like "small animated lumps of earth" (Satterthwait, 1932). They are robust and hard bodied, with a long beak, the abdomen broadly exposed beyond the elytra, the elbowed antennae (long scape, large, bulbous antennal club) inserted at the extreme base of the extended beak, and a stout claw bending inward at the apex of the tibiae.

In deciding on a group of New World weevils for study, I chose this one for a number of reasons. First, the genus was easily recognizable among the hundreds of genera of the Curculionidae; second, it was thought the species would show subspeciation; third, although over 50 species had been described since 1876, no revision had been written since that time; and fourth, Dr. Mont A. Cazier, who suggested the group, had fine series of some of the western species which were being incorporated into the collection of the American Museum of Natural History.

Of the 116 species and 18 varieties of described *Calendra* from the United States and Mexico, 71 are recognized as valid species in this revision, with 20 species having been already synonymized by former authors and an additional 21 species synonymized by the present author. Two species are described as

new, one from Texas, one from northern Mexico, and 12 forms formerly considered as species are here treated as subspecies. Sixteen of the 18 described "varieties" were found to be synonyms, but the other two are considered to be distinct species. The monotypic genus *Trichischius* was found to be congeneric with *Calendra*.

Of the 71 species recognized, 50 occur in the United States (or Canada) only, seven in Mexico only, and 14 are common to both countries. With further collecting in Mexico, no doubt more United States species will be taken there, since north central Mexico is but a continuation of the southwestern plateau region.

The types of 113 of the 134 names in the genus have been examined. Of the others, 10 have been lost or destroyed; six are supposed to be in various European institutions, but for one reason or another were not available to me; five are in the United States. Of the latter, however, either paratypes or cotypes have been examined; they are *cubensis*, *minima*, *sequoiae*, *subulata*, and *subopacus*. The European types not examined are *cariosa*, *compressirostris* Germar, not Say, *larvalis*, *melanocephala*, *parvula*, and *subcarnatus*.

Most of the Mexican specimens included in this study are from the "Biologia" collection of the British Museum, but a few are from other museums in the United States, and two long series and a number of scattered specimens are from the recent David Rockefeller Mexican Expedition of the American Museum of Natural History. Four species are recorded for the first time from Mexico (*arizonensis*, *sayi*, *recta*, *neomexicana*), and two for the first time from the United States (*ima*, *memnonia*).

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I wish to thank Miss Alice Gray for a number of the drawings and Miss Marjorie Statham for technical assistance on the others.

## HISTORY

When the genus *Calendra* was described in 1798 by Clairville and Schellenberg, it included but two species, *granaria* Linnaeus, one of the tiny grain weevils, and *abbreviata* Fabricius, a European billbug, both having been originally described as *Curculio*. No genotype was designated until 1810, when Latreille designated *abbreviata*, but he used *Calandra*, with an "a" for the generic name. This confusion of the "a" and "e" goes back to Clairville and Schellenberg, who used the spelling *Calendra* in the text, but the colored plate was unfortunately labeled *Calandra*, and it was the latter name that persisted. In 1838 Schoenherr erected *Sphenophorus* for all the then known *Calandra* and for the many new species that had been discovered. The name *Sphenophorus* was used for the billbugs for nearly 100 years, until Pierce (1925, p. 113) went into the whole matter exhaustively, and with a page and a half of printed references, which will not be repeated here, showed that *Calendra* had priority over *Calandra* and *Sphenophorus*, and that *Calandra granaria* and the other grain weevils should be in the genus *Sitophilus*. (European authors, I understand, do not recognize this change.) Thus those named before 1838 were *Calandra*; between 1838 and 1925, *Sphenophorus*; and after 1925, *Calendra*. Since the great majority of the species were described before 1925,

nearly every species in this paper bears a parenthesis around its author's name, a fact which therefore has little meaning in this genus.

The eight volumes of Schoenherr's monumental work contain Latin descriptions of hundreds of weevils by Schoenherr, Gyllenhal, Boheman, Mannerheim, and others. Many of those described as *Sphenophorus* were later transferred to other genera: Horn in 1873 set up *Metamasius* for some Central and South American species; LeConte in 1876 separated *Rhodoaenus* and *Cactophagus*, and described *Trichischius*; Chevrolat, 1885, *Cosmopolites*, *Merothricus*, *Homalostylus*, and *Paradiaphorus*; and Champion, 1909, *Metamasioptis*. These are all New World genera. There are an additional six New World genera in the same tribe, Calendrini, which were, however, not taken out of Schoenherr's *Sphenophorus*.

At the time of LeConte and Horn's "Rhynchophora of America north of Mexico" in 1876, there were only about 30 described United States species, a number which grew to 82 by 1936. The great bulk of these new species was the work of one man, F. H. Chittenden, who, in a series of seven papers between 1904 and 1924, described 40 new species and about a dozen varieties. He had intended to write an illustrated, monographic work on the genus, but the "press of other



more imperative duties" never allowed him to accomplish his purpose. His papers, however, treat of a few groups in revisionary form, with keys, descriptions of some older species, and discussions of synonymies and distribution. Before Chittenden, Hart in

1890 and Fall in 1901 each described a species, and between 1916 and 1938 Blatchley, Satterthwait, Buchanan, and Van Dyke described a total of nine species. Champion, in the "Biologia" in 1910 added seven new species to the Mexican fauna.

## DISTRIBUTION

The genus *Calendra* seems to be preëminently a New World genus which had its origin probably in the United States, where there are many more species and fewer closely related genera. In the Old World there are six species recorded from Europe, six from Africa, two from Australia (New South Wales), and 16 from the Indo-Malayan region (Saigon, Sumatra, Java, Borneo, the Philippines, and Ceram). From South America 24 species have been reported; from Mexico, 21 (14 of which occur also in the United States); the West Indies, 12 (three of which occur in the United States); and the United States, 71 (14 of which occur also in Mexico). The species in this country have been more thoroughly studied, so that the disproportionate number of species here may not present a true picture, and the greater number of species recorded for South America than for Central America also probably does not represent the true distributional picture. Most of the South American species were described long ago by Erichson, 1847, Gyllenhal, 1838, Germar, 1824, Blanchard, 1843 and 1851, and others, and they have not been verified since. As in the case of the Mexican species, probably, with further study, some of those from South America will prove to be conspecific with more northern species, or, which is more likely, they will be found to belong in other genera. The only *Calendra* seen or reported from the region between Mexico and South America are the Mexican species *incurrens*, which occurs south from Mexico into Guatemala, Costa Rica, and Panama, and the United States *cariosa*, taken in Guatemala.

*Calendra* is the dominant genus of the subfamily Rhynchophorinae in the United States. Although *Rhodobaenus* also occurs rather widely, it is represented by only two of its many species, whereas farther south, in Mexico and Guatemala, the situation is reversed, *Rhodobaenus* replacing *Calendra* and

consisting of about 45 species. Other related genera in the United States are either introduced, as *Eucactophagus*, or they occur in the southwest only, as *Scyphophorus*, *Cactophagus*, and *Metamasius*, or in the southeast, as *Rhynchophorus* (also California).

According to present records and available material, nearly one-third (24) of the species in the United States have a restricted distribution covering from but one to five states, half this number having been taken in one or two states only. A few of these species are no doubt fairly rare, but the majority probably have a wider distribution than is indicated, an inference that can be proved only by further collecting. Including the above species, the distribution of the 71 species from the United States and Mexico can be grouped as follows:

1. Mexico only: seven species
2. Most of the United States, from coast to coast, including, in a few cases, also southern Canada and Mexico: six species
3. Eastern states only, to the Mississippi River, only one of these being taken from more than four states: eight species
4. Almost every state in the east to beyond the Mississippi Valley region, four occurring in California or Arizona also: 10 species
5. Both east and west of the Mississippi Valley region but not farther west than Colorado, many of these having a spotty and scattered range: 17 species
6. A few states west of the Mississippi River, none occurring in more than three states: six species
7. Western states, Great Basin region, but not to the coast: 11 species
8. Western states, including the Pacific coast: five species
9. Pacific coast only: one species

To summarize, it might be said that, using the beginning of the Great Plains as the western boundary of the eastern species, there are 18 eastern species, 17 western species, 23

doubtful species occurring both east and west but spottily, six covering the country, and seven in Mexico. Of the 14 species common to both countries, half, as might be expected, occur in the Great Basin area of the United States, three are coast to coast species, and the others are eastern species that also occur in Texas or Louisiana. Four of the endemic Mexican species occur in northern Mexico, with two of these continuing farther south, and three occur in southern Mexico only. Distributional records for Mexico, however, are based on very inadequate material.

Published distributional records of all *Calendra* should be accepted with a certain amount of doubt, both because the identification of these weevils is so subject to error and because these weevils, being plant and root breeders, can readily be transported, both by man and by nature. Thus a specimen of *C. australis* from Baltimore was taken in quarantine in California, and both Satterthwait (1932) and Cartwright (1929) speak of *Calendra* floating down streams for many miles and being found in driftwood on overflowed streams.

### BIOLOGY

Satterthwait's excellent pupal study (1931a) deals with 24 species of *Calendra* (22 as now revised) and includes two lists of host plants, one arranged by species and one by plants. Most of the information on biology in this paper except that from collectors or their labels has been taken from this work, and from a number of other papers by Satterthwait, one by Cartwright, and one by Van Dyke. Many of the earlier works on biology cannot be used because of possible misidentification of the species concerned.

Some biological notes are added in this paper for nine species in addition to those treated by Satterthwait, but there still remain 40 species about which little is known in the way of habits or habitats and nothing on the host plants. Many of these are strictly western species that have not proved destructive to important crops, and some are species that are quite rare in occurrence. Of the eastern species Satterthwait (1932) considered *parvula*, *zeae*, *callosa*, and *destructor* (in that order) the species most numerous and most destructive to farm crops.

Those species whose habits are known may be destructive, either as adults or larvae or both, to timothy, blue grass, and other grasses used for hay, pasture, forage, or lawns, also to crops such as maize, rye, barley, oats, and wheat. Many species prefer, however, sedges and grasses of no economic value to man, and feed on cultivated crops only when these are in close proximity to their natural wild habitat. And although they will often lay their eggs in the root stalks or bulbous roots of such crops, their preferred plant for oviposi-

tion is usually some innocuous marsh plant, as cattail, knife flag, tule, or pickerel weed. *C. phoeniciensis*, for instance, cannot even complete its development in its chosen cultivated crops (wheat, barley), but needs the larger wild grasses, as Bermuda grass, for this purpose (Satterthwait, 1932, p. 21).

When marshes or river-bottom lands that have harbored billbug populations in their sedges and bulrushes are turned over to the planting of corn or some other crop, then that crop is liable also to infestation by the adults emerging from the roots and stalks under ground. *Calendra gentilis*, usually a marsh species, has been found developing in corn grown on newly cleared river land in San Joaquin County, California (California Department of Agriculture specimens). Not more than four of the 22 species studied by Satterthwait were found actually breeding in corn (*aequalis*, *callosa*, *maidis*, and *parvula*), but adults of a number of other species (*australis*, *cariosa*, *destructor*, *coesifrons*, *zeae*, *scoparia*, and *costicollis*) are very damaging to corn, puncturing the stems and boring into the stalks below ground as well as feeding on the unopened leaves. Adults normally feed on their host plants, but when these have been cut down or plowed under, the billbugs will seek food to their taste near by, or they will travel, eating as they go, until they find a suitable host plant. Although they possess well-developed wings they seldom use them, but they can crawl along at quite a fast rate.

Eight of the species listed by Satterthwait have only one known host plant; the others have from two to 18, those proving most tol-



erant in taste being *cariosa*, *parvula*, *minima*, and *callosa*. The families and genera of plants chosen include in the Typhaceae (cattails), one genus, *Typha*; in the Sparganiaceae (bur reeds), *Sparganium*; in the Gramineae (grasses), 29 species in the genera *Zea*, *Tripsacum*, *Sorghum*, *Panicum*, *Oryza*, *Zizaniopsis*, *Leersia*, *Phleum*, *Agrostis*, *Avena*, *Spartina*, *Cynodon*, *Dactylus*, *Poa*, *Glyceria*, *Triticum*, *Agropyron*, *Hordeum*, *Secale*, *Elymus*, *Sitanion*, and *Histrix*; in the Cyperaceae (sedges), 20 species in *Cyperus*, *Scirpus*, *Rhynchospora*, and *Carex*; in the Pontederiaceae (pickerel weeds), one genus, *Pontederia*; in the Juncaceae (rushes), *Juncus*.

These plants, as mentioned above, are often the hosts for more than one species of *Calendra*; some, as *Cyperus esculentus* (yellow nut grass), and *Scirpus validus* (American great bulrush) are the preferred host plants for several species. In some cases where two species occur in the same fields, it has been found, as with *parvula* and *minima*, that one species will be dominant in one plant, one in another. Or, as with *callosa* and *destructor*, one species was more abundant in August, the other in September.

Although generally the smaller species breed in smaller plants, this is not always so, as both the larger *australis* and the tiny *minima* develop in the cattail.

There is much of importance yet to be learned, not only on the host plants of the majority of the species, but also on the dates of emergence of the various species, and whether they hibernate as adults or as larvae or pupae, and how readily, if at all, the different species will accept other than their preferred host plant or food.

When a corn plant is no thicker than a lead pencil and but 3 or 4 inches high, it is usually killed at once by the feeding punctures of a large species like *C. maidis* (Cartwright, 1929), which, head facing downward and sharp claws clutching the base of the plant, bores its beak through to the very heart of the plant. The punctures for the egg are made in the same manner, and the growing larva then hollows out the interior of the stem down into the tap root below the surface. Thicker plants, whose inner tissues cannot be reached by the billbug's beak, outgrow their injury, but the perforated

leaves often impede the growth of the leaves to come.

In the smaller grasses, the adults feed also at the base of the plants, dwarfing them but usually not killing them since they do not pierce the central tissues. The larvae, however, in eating out the interior, cause the plants to be weakened and ready to fall in the wind or from their own weight.

The larval stage in *maidis*, under laboratory conditions, was found by Cartwright to be about 49 days (on a three-year average), the length of time varying from 33 to 70 days, depending on conditions. The variability was greater under dry, hot conditions than under wet. In the species studied by Satterthwait there is about the same variation.

The larva molts usually five or six times, then pupates either in its cell or near by in the soil. The time for this period varies from five to 18 days. The adult either emerges and then hibernates in the soil or under stones or debris until the following spring, or it may spend the winter in the host plant in the pupal or adult stage.

The sharp tibial claws of *Calendra* and the instinct to use them in clutching can cause death to poultry which unwarily pick them up and then find them impossible either to swallow or to eject.

Predators of billbugs include a few parasites, and birds, toads, alligators and perhaps other reptiles, which take them for food, and which are perhaps more skillful than the poultry. The six specimens known of *C. bartramiae* were all taken, so far as I understand, from the crops or the excrement of birds (the golden and upland plovers). A list of the birds known to feed on billbugs is given by Satterthwait (1932, p. 20). In 1933 (p. 216) he reports another, the laughing gull, in the stomach of which were found five individuals of *C. pertinax*, usually a coastal species.

An interesting hymenopterous parasite, *Anaphoidea calendrae* Gahan, of the family Mymaridae, was found by Satterthwait (1931b) to destroy 75 per cent of the billbug eggs in white bent grass, or red top (*Agrostis alba*), the preferred host plant of *C. minima* and one of the host plants of *C. parvula*, both tiny species. The eggs of *callosa* and *destructor*

are also known to suffer in the field from this parasite, and at St. Louis, Missouri, where rearings of the parasite were studied under control, the larvae of *Anaphoidea* developed in the eggs of *C. costipennis*, *australis*, *maidis*, *necydaloides*, and *venatus*. The parasite occurs in the Mississippi Valley region, the Gulf region, and on the Atlantic coast, and probably throughout the eastern half of the country, a range which coincides with the above-named *Calendra* hosts. The adults were observed in the laboratory ovipositing on exposed *Calendra* eggs which are destroyed "at the point of oviposition" (*ibid.*, p. 175). How the parasite gets to the egg in the wild is not stated, or perhaps that is what is meant in the above quotation, namely, that the parasite attacks the egg when the female *Calendra* is ovipositing. Otherwise, it seems to me the egg would be hard to reach once the plant tissues closed over it. Usually seven larvae (in the ratio of one male to six females) develop in each parasitized egg, and there are four to seven broods a year, at least around St. Louis. This is "the only recognized inter-

nal insect parasite in the eggs of species of *Calendra*" (*ibid.*, p. 172).

Billbugs, in fact, seem especially well protected from all kinds of injury, not only because all their immature stages are spent under cover within plant stems or roots, but also because they are extremely tough and hard-bodied as adults, and are often camouflaged from enemies by their muddy encrustation. They can withstand long periods of submergence under water, as long as three weeks in an experiment made with *C. maidis* (Cartwright, 1929), and have been found to revive after 24 hours in a cyanide killing bottle. They are also immune from man's efforts at poisoning them, since they feed by driving their beaks into the plant's tissues.

The best method of control (*loc. cit.*) seems to be crop rotation in which corn is planted "at a safe distance from previously infested fields" (over 200 yards), or the planting of other crops, as cotton or potatoes, which are not suitable as billbug food.

Additional notes on biology are given under each species.

## VARIABILITY IN THE GENUS

Taxonomically this is an extremely difficult genus. As Satterthwait, who studied these weevils for many years, says, "distinguishing characters in the adult stage are often obscure, and in the pupa stage are fairly liquid" (1931a, p. 145). Many species, at first glance, seem very similar; on a second, they are seen to differ; and still further investigation shows that they vary so much within the species that it is difficult to decide on the limits of the species. This individual variation accounts in part for the fact that nearly one-half of the names, including "varieties," are synonyms in a genus in which, to the inexperienced eye, the species all look alike.

### INDIVIDUAL VARIATION

Not only does the presence of a pruinose, clayey coating covering parts or all of many species at times obscure the punctuation and sculpture, but the absence of it, caused by the wear or rubbing to which the insect has been subjected, reveals characters that are not normally disclosed. Even those spe-

cies that are more or less glossy and without coating when fresh become opaque with time and wear or accumulate mud in the punctures, and they then present a quite different appearance. Individual variations due to these mechanical factors have been the basis of some of the species synonymized in this paper. Billbugs are also very susceptible to greasing, which obliterates the pattern and causes a coated, velvety species to appear shining and black. Greased specimens of some closely related species are exceedingly troublesome to distinguish.

Another mechanical cause of variation lies in the fact that a number of the diagnostic characters are angles or hairs, both of which may become worn (the outer apical angle of the tibiae, the inner claws on the tibiae, the apex of the beak). Since these weevils do not fly about and rest on flowers, but live a hard life pushing through the ground to get to roots or walking laboriously over rough terrain from field to field, their bodies are readily subject to abrasion. When, however, they are in a fresh, clean, unworn condition,

they still present great individual variation, not only in size, as in all insects that develop within plants, but in color, in punctuation, in the size and shape of certain characters (the beak, antennal club, tarsal segments, thorax, scutellum, mesoepimeron), in the pattern of the pronotum and elytra, and in some cases in the male genitalia.

In some species the pronotal punctuation varies, whereas that of the elytra is fairly constant; in another species the opposite may be true, or both may vary in the same species. The punctuation of the prosternum, of the front femora, and of the front of the head is more reliable and does not show so much individual variation as the punctuation on most of the ventral surface. The shape of the thorax presents considerable intraspecific variation in addition to some sexual variation, sometimes bending inward in the front more abruptly, sometimes being parallel at the base, sometimes with a slighter or greater sinuation of the margins of the pronotum. The width, spacing, and elevation of the pronotal vittae show much variation.

The antennal club in a species that generally has it oval and not dilated in the apical third will be found to be somewhat dilated in some individuals. Likewise, species that normally have the mesoepimeron only one and one-half times longer than broad and with the front margin arched will have it more elongate in some individuals or with the front margin virtually straight. The grooving or channeling of the scutellum varies from individual to individual in presence and in depth.

Although the type of elytral pattern remains the same in a given species, the elytral punctuation, whether of the striae or the intervals, is especially inconstant, and is erratic even on different parts of the same elytron of the same individual. In most species it can be judged only in series, and any statements about elytral punctuation should always be accompanied by the word "usually."

The individual variation found in some male genitalia principally concerns the shape of the apex of the penis which shows the small median sinuation to a greater or lesser extent in different specimens of the same species. The inward slope of the sides of the

penis towards the apex was also found to vary.

The many varietal names in this genus are a clue to the variability of the species. When variation occurs in species that have some recognizable character by which they can be certainly identified, then the individual quality of the variation is usually self evident. When, however, variation occurs in some of those species that are identified only by a combination of sometimes elusive characters then it has, in the past, all too often been mistaken for a mark of specific distinction. There are a number of such instances recorded in this paper of two or three described species which, in my opinion, are no more than individual variants of a variable species: *distichlidis* of *mormon*, *multilineatus* of *robusta*, *sublaevis* of *destructor*, *jugosus* of *callosa*, *blatchleyi* of *zeae*, *eugenia* of *diversa*, *lucedalensis* of *holoserica*, *monterensis* and *subopacus* of *graminis*, *sequoiae* of *phoeniciensis*, *laevigatus* and *medoraensis* of *costipennis*, *ulkei* of *cicatriculata*, and *omissus* of *deficiens*.

#### GEOGRAPHIC VARIATION

In only four of the 71 species is geographical variation so marked that subspecies can be separated: in *venatus* (five subspecies), *aequalis* (four), *australis* (two), and *pertinax* (three). It is possible that more material, particularly from the areas that have been less collected, may show that subspecific differentiation can be recognized in other species. The morphological characters that vary geographically in these species are the thoracic and elytral patterns, the amount and arrangement of the coating or pruinosity, the punctuation, and general size.

The thoracic pattern varies in that the three stripes or vittae on the pronotum may be separated and elevated in one or more subspecies, but merged together and flattened across the disc in another. Some subspecies differ in the punctuation and width of the vittae and in the relative clarity of their demarcation.

Variation in elytral pattern is linked with the amount of coating and the punctuation. In the species *aequalis* and *australis* a general lack of coating on the elytra is found in the northern California area. In *venatus* the two northern subspecies show a lack of

coating on both thorax and elytra; the California populations have an entire coating; and the southeastern subspecies varies considerably in the coating. In *pertinax* the more northern subspecies has more coating than the southern one. The punctuation of the elytra was found to vary markedly only in *aequalis* where the size and shape of the striae punctures differ geographically. The general size was found to grow somewhat smaller from north to south in the eastern subspecies of *venatus*, but larger from north to south in *pertinax*. In *aequalis* and *australis*, western populations range somewhat larger than eastern ones.

#### SEXUAL VARIATION

The sexes are nearly always easily separable both on the shape of the pygidium and the presence or absence of a ventral cavity. It is in only a few species that the differences are so slight as to cause confusion. In the female the pygidium is more attenuate and its apex pointed or rounded; in the male it

is nearly square, with the apex truncate, and broader than in the female. The female has the metasternum and abdomen flat or slightly convex; the male has them concave. Females are in general larger and broader, have a longer or more exaggerated beak, are glabrous below, and have fewer hairs, if any, on the inside of the femora and tibiae. In a few species (*mormon*, *crenata*) the females have certain characters more marked than in the males, but as a rule the secondary sexual characters, if present, are present in the male and lacking in the female. The male characters include a brush of hairs on the second abdominal segment (*pertinax*), a longitudinal row of hairs between the hind coxae (*costipennis*, *striatipennis*), abdominal hairs (*crenata*, *ima*, *angusta*, *aequalis*, *schwarzii*), a patch of thick hairs on the apex of the abdomen (*ima*), the hind tibiae strongly angulate (*scoparia*), and the front third tarsal segment more widely dilated (*arizonensis*, *cicatristriata*, *graminis*).

#### RELATIONSHIP AND CLASSIFICATION OF THE SPECIES

It may be objected that the genus is large and unwieldy, which is true, but forming two or three genera would not be feasible, first, because only a very small number of species could be removed, and, second, because they would not be good genera. One might conceivably separate the four species *cazieri*, *culitellata*, *compressirostris*, and *inaequalis*, because in these the eye is less elongate and is at the same level as the base of the beak, but there is another species, *coesifrons*, in which the eye is almost at the same level, but not quite. Or one might wish to make a genus of the first three species just mentioned, all of which have a short, perfectly straight, strongly compressed beak with a knife-like keel on the upper contour, but the suggestion of such a keel is present in some other *Calendra*. Or one might reduce the above three to the two, *compressirostris* and *culitellata*, that have the already stated characters plus a large tooth near the middle of the tibiae, instead of the smaller subapical tooth of other species. Even this character, however, is not so different as it may appear, as the subapical tooth varies slightly in position

from species to species, being sometimes quite close to the apical tooth, sometimes more distant; in the above two species, it has merely become very distant and much larger.

There is one other species, *schwarzii*, for which Chittenden thought a new genus might be erected because of its somewhat different tarsal structure, but this character is too variable to be used alone and this species is otherwise a *Calendra*. LeConte also erected a monotypic genus, *Trichischius*, for the species *crenata*, but this genus, discussed below, is not considered valid.

The genus has, therefore, been kept as one unit, and the species have been arranged more or less according to the growth and complication of the pattern of the pronotum (figs. 3-14). Those species that seem to be the simplest and most generalized have no pronotal pattern other than a median line; they have been placed first, and the more complex species, with a raised pattern, last. The fact that the pronotal pattern is not static, however, means that half the species fall between the two extremes, showing a more



or a less developed tendency towards a pattern or showing the pattern in some individuals but not in others. The classification of these has not been entirely satisfactory, but in general they have been placed according to what seemed to be the gradual evolution of the pattern, supplemented by other characters discussed below. Of the 71 species, about 20 have no pattern except a narrow median line, about the same number have a definite pattern, and the remainder have either the beginnings of a pattern or a partially complete pattern.

This seems to be an improvement over the former division (Horn, 1873; Blatchley and Leng, 1916) into four groups according to the shape of the outer apical angle of the tibiae and to the dilation and vestiture of the third tarsal segment, a division that not only placed the majority of species in one group (those with the third segment narrow and with less hair below), but separated some otherwise closely related species and left no place for species that did not fit into one of the four categories. In my opinion, any division or grouping of the species must be flexible, and the genus cannot be divided categorically on one or two characters. Although Horn found his categories "the readiest as well as most natural method" of division, Blatchley, already with more species at hand, found that those species grouped under narrow tarsi were "in many instances not closely related and in a natural classification several distinct groups are indicated." With the description of still additional species, this group with narrow tarsi grew out of all proportion to the others. Chittenden, who described most of the new species, attempted to put some order into the arrangement of the early species by forming small groups of species with certain characters in common (the *simplex*, *pertinax*, *aequalis*, and *venatus* groups), but he did not relate these to one another or classify the far larger number of species still outstanding except to place "the simplest forms, based on the tarsal joints" first.

Whether the genus is arranged according to the development of the pronotal pattern or to the tarsal structure, the species still fall into two very general groups. These are (and it must be borne in mind that

each statement should be prefixed by the word "usually," since each one has its exceptions): (A) a larger group composed of species small in size, with the pronotum uniformly punctured and without elevations, the dorsal surface glabrous, no fovea in front of the eye, no callosities near the apex of the elytra, with the antennal club more or less oval, the mesoepimeron much longer than wide and with the front margin straight, the third tarsal segment narrow on at least two pairs of legs and mostly glabrous below; and (B) a smaller group composed of species large in size, with a raised pronotal pattern of three or more stripes, with pruinose coating in the depressed areas of pronotum and elytra, or covering the entire insect, a fovea of depressed punctures in front of the eye, apical callosities on the elytra, the antennal club more or less triangular or wedge shaped, dilated at apical third, the mesoepimeron scarcely longer than wide and with the front margin more or less arched, the third tarsal segment on at least two pairs of legs widely dilated, and with hairy pads covering two-thirds of the surface below.

The first 16 species in the Systematic Section are in group A above. They have no raised pattern and have the pronotum uniformly punctured; further relationships within this group are based on the shape of the beak and its apical angle (the postmentum), the structure of the elytral striae, and certain male characters. The following 22 species agree with A in most characters, but include some with a dilated median vitta on the pronotum, but no lateral vittae, and some with the two lateral vittae barely indicated, either as vague swellings at the base of the pronotum, or as areas with smaller punctures where these vittae would be expected. These are the species in which it has been most difficult to establish relationship. They consist of small groups of two or three species that show certain rather definite affinities within each group in the beak, the elytral callosities, the level of the eye, the large size of the thorax, or tibial characters, and a few single species that possess some character or characters of a number of these small groups, as the beak of one, the elytra of another, the tibiae of another, without any definite relationships being discernible. In these species the pro-

notum varies considerably, and its punctation and feeble vittae are obscured in most cases by clayey coating.

The next 10 species are transitional between A and B. They have the three vittae raised, separated at the base, but not yet separated (though they may be raised) at the apex, the punctures on the vittae being usually smaller than those on the rest of the pronotum, and the median vitta forked at the apex to enclose a depression. The result is a more or less M-like pattern. About half of this group have the pronotum partially covered with coating.

All the species above have narrow tarsi on at least two pairs of legs; the 23 that follow,

with seven exceptions, have the tarsi dilated on at least two pairs of legs and agree with group B. There are some species with a pronotal pattern of narrowly separated, feebly raised areas breaking up into vittae, and some with three strongly raised and clearly separated vittae, usually with two short side branches extending from the laterals to the hind angles of the pronotum. Almost all have some kind of coating. Three of these species have each a subspecies in which the vittae are not separated across the disc, but only at the extreme base and apex, thus, in fact, presenting a simple, unpatterned pronotum as in the groups first discussed.

## DISCUSSION OF CHARACTERS

Although there are 30 or 40 possible characters that could be used in the diagnosis of a species of *Calendra*, most of them are subject to such a wide range of individual variation that many of the characters cannot be used unless series are available or unless the extent of the variation is known. Most characters also do not show any absolute difference between species, but merely a difference in degree or a comparative difference, so are of diagnostic value only in combination with other characters, or in series, or when specimens of both species to be compared are present. Some of these characters have been omitted from the descriptions in the Systematic Section, but they are mentioned below.

### COLOR

Although the majority of *Calendra* are black in ground color, dark red or piceous specimens have been found in nearly every species and probably will be found in all. Reared, and probably therefore teneral, specimens are dark red in two or three species, but I doubt that all such specimens are newly emerged. Three species (*crenata*, *quadrivittata*, *lineata*) are brown with black markings, *crenata* having also a black phase. *C. striatipennis* is the only species with brilliant red stripes on pronotum or elytra or both, but sometimes these stripes are black. Two species, *schwarzii* and *aequalis*, both of which

have the ground color black or dark red, may have a pure white coating, and *aequalis* may also present other hues in its coating, gray, bluish, yellow, ocher, or brown.

### COATING

Some species never have any coating, and some always do, except when abraded, but in others the coat may be present in some populations, but not in others, or in some individuals and not in others. There are three kinds of coat referred to under that general term throughout this paper:

1. There is the smooth, enamel-like, "natural" (Horn, 1873) coating as in *aequalis* and *schwarzii*, which is usually shining and on which the punctures show as mere black dots.

2. There is the opaque, over-all, dusty or muddy-looking coat (*callosa*, *destructor*, *minima*, *parvula*, *bartramiae*, *cazieri*, *hoegbergii*) which usually covers most of the body and appears quite rough and thick, and either obscures or greatly distorts the punctation and sculpture. Newly emerged individuals of this type sometimes have a silky-looking, or velvety, short pile; no doubt earth particles adhere to this surface, forming a solid encrustation that is not removed by carbon tetrachloride. Horn called this an "accidental" coat "composed of argillaceous material hardened, probably, by mixture with some exudation from the surface" (*ibid.*, p. 411); Kelly (1911) also mentions "a waxy

exudation of the elytra, to which the soil adheres."

3. There is a thinner coat, more like the pruinosity of some species of *Rhodobaenus*, which is present in all depressed areas or rather sparsely distributed over the surface. This coat, which may be gray, yellow, or reddish, does not necessarily obscure the punctuation, and it is often worn thin in many places. It occurs in species such as *venatus*, *sayi*, *australis*, *pertinax*, *robusta*, and many others.

#### BEAK

The beak is a significant diagnostic character in most species, but there are a few distinct species that have almost identical beaks, and in two species there seem to be two types of intergrading beaks within the species. In most species the beak is compressed laterally, rather curved, and rather long in proportion to the body, usually nearly as long as the pronotum. It is almost cylindrical in a few species, and is straight in still fewer. It is always at least as long as half the pronotum. The beak is often abraded so that the punctuation is scarcely visible, and for this reason the punctuation has been omitted from the descriptions except where it is noticeably strong. An impressed line, sometimes very faint, or a rather wide depression or canal, is usually present at the base of the beak, extending forward from the puncture between the eyes, but it is lacking in a few species and is rather variable in length and intensity. The shape and angle of the apex of the beak above, though variable in some species, are included in the descriptions because they are in some cases quite characteristic of the species. The angle of the apex below, which is caused by the shape of the postmentum, or peduncle, is constant in most species, variable in some, and subject to wearing down in all.

The majority of the larger species, those with dilated tarsi and three definite vittae, often have a fovea or depression of concentrated punctures laterally at the base of the beak in front of the eye. When filled with mud or coating this depression is very marked. In many species, however, it is not coated and is then seen to consist of either one larger, irregularly shaped puncture, or a

number of confluent punctures that are not always visibly depressed. In any case, the area of the fovea, when the latter is present, has a quite different surface from the same part in those species that do not have it; the punctures in this area, in the latter, are similar to the other punctures at the base of the beak. In some species the fovea seems to be vaguely present in some individuals, but not in others, and in *chittendeni* and *dietrichi*, two very closely related species, the former has a definite fovea, the latter none. The presence or absence of this character is noted in the descriptions

#### EYES

The eyes are elongate oval, very large in comparison with the small head, narrowly separated above. Underneath they generally extend well beyond the lower level of the insertion of the beak, often the lower part of the eye being hidden by the margin of the thorax, but in *cazieri*, *compressirostris*, and *inaequalis* the eye is less elongate, more broadly oval, and in these species and *cultellata*, the lower end does not extend below the insertion of the beak. A few species have a definite, impressed line of punctures around the upper edge of the eye, but since this area is so often covered with coating and since the amount of depression of the punctures is often questionable, this character is mentioned in the descriptions only when definitely present.

#### THORAX

**PRONOTUM:** The importance of the pronotum in the classification has already been discussed above. In a few instances the pattern alone is sufficient for the identification of a species. Only a small proportion of *Calendra* have three clear-cut, bare, elevated stripes or ridges (*australis*, *cariosa*, *costicollis*, *costipennis*, *incongrua*, *latinasas*, *pertinax*, *robusta*, *robustior*, and *villosiventris*). Some, however, have the raised stripes abbreviated, or joined together in front of the middle to form an "M," as in *venatus* and related species; in others the stripes are flattened or confluent across the disc, or are differentiated only by their smaller and finer punctuation, or are covered with coating. In view of the

various forms these stripes can take, it has seemed better in general to employ the vaguer term "vitta" for these areas that correspond to stripes in the more strongly marked species. These vittae in most species have finer punctuation than that in the interspaces, but in some species the reverse is true. The type of pronotal punctuation is generally constant within a species, but not invariably so.

All species have the pronotum, including the apical collar or constriction, longer than wide, but in *bartramiae* and a few others it is very nearly square. In some species the pronotum is markedly large (*cazieri*, *chittendeni*, *compressirostris*, *cultellata*, *dietrichi*, *germari*, *inaequalis*, and *necydalooides*), and in two species (*destructor* and *callosa*) there is a definite median lobe at the base. Otherwise the general shape of the pronotum is very variable within the species, and it has been omitted from the descriptions in the Systematic Section. The median apical depression (actually it is subapical, as it does not trespass on the apical constriction) in *venatus*, *cicatristriata*, and some others, although rarely constant in shape or depth, is a significant character in some groups of species, separating them from other groups that never possess it. This depression is mentioned only where present.

**PROSTERNUM:** The presence or absence of a sinuation or lobe on the apical margin of the sides of the prosternum, behind the eye, although also subject to some variation, is included in the descriptions and is referred to as the thoracic lobe. Also included is the punctuation of the prosternal sides, which is fairly reliable. Since there are no prosternal sutures in weevils, nearly the entire ventral portion of the prothorax is composed of the sides of the prosternum. The center is generally difficult to see because of the usual deflection of the head and the large protruding front coxae.

#### SCUTELLUM

In series the shape of the scutellum may be helpful in comparison of species, but it varies individually. Except for the possible accumulation of mud, it is always bare of coating in all species but three (*aequalis*, *schwarzii*, and *hoegbergii*), and even in these it is often abraded.

#### ELYTRA

Although a number of species have similar elytra and although the elytra are subject to variation and abrasion, they are, with the beak and pronotum, significant, in series, in the identification of species. Their shape is different in a few species, but, as this is a character difficult to visualize, it has been used in only a few instances. The width of the elytra at the base, which Chittenden used to separate some of the small species, was also found to be of little taxonomic value, both because of variation and of the very slight differences involved. The presence or absence of a subapical callosity is definite between some species; in others it is variable or is obscured by coating.

Counting from the suture, which is considered the first interval, the third, fifth, seventh, and ninth intervals are the odd intervals; the second, fourth, etc., the even intervals. The third is usually the broadest, and all intervals are generally far broader than the striae, though in a few species they are very narrow. The striae are of two kinds: the most common type is composed of narrow impressed lines, with the punctures, whether small or large, set along them and well separated by the narrowed stria line (figs. 23-25); the less common type consists of more open, broader, more deeply impressed lines, with the punctures enclosed entirely within the striae in a continuous line (fig. 26). In some of the strongly coated species, of course, this difference in striae is almost impossible to see except where the coating has been rubbed thin.

#### ABDOMEN

In a few species (*incurrens*, *pontederiae*, *lineata*, and *quadrivittata*) the punctuation of the last abdominal segment is diagnostic, but in the majority of species it is not. The prescence of a depression on this segment, sometimes in one sex only, is of importance in certain groups, but in many species it is so feebly marked as to be overlooked. In the last 40 species descriptions it is mentioned only where readily visible. In females of *vomerina*, *championi*, and *memnonia*, and in both sexes of *aequalis*, the lateral apex of the last abdominal segment on both sides was found to have a larger puncture or an elongate



slit from which, in fresh specimens, a small tuft of hairs protrudes. This is an excellent, though minute, character, but all too easily abraded; under high magnification, however, the slit can be discerned even when the hairs are worn. The presence of hairs in this same region, though not in tufts, is the only certain means of distinguishing some populations of *C. striatipennis* from the closely related *costipennis*. A number of specific male characters, also hairs, are found on the abdomen. The first abdominal suture in most species is more or less obliterated at the middle.

#### PYGIDIUM

The shape and punctuation of the pygidium and the arrangement of hairs on it are good characters for the grouping of species, but unfortunately they cannot be used in a key since, in the majority of specimens, the pygidium is either so encrusted that the punctuation is obscured or so rubbed that the hairs cannot be relied on. Most of the species that come first in the classification, the small, uncoated western species, have an apical margin of smaller, denser punctures on the pygidium and lateral tufts of hairs; many of the larger, coated, eastern species, at the end of the classification, have two somewhat oblique rows of stiff hairs extending from the lateral tufts to the center. In some species, the pygidium, seen in profile, is smoothly sloping; in others it bends abruptly downward at an angle; in some it bends under at the apex; there may be hairs distributed generally, or at the apex only. The pygidium is always broader at the apex in the male than in the female, being usually truncate in the former, more rounded or pointed in the latter. But in species where the sexes are nearly alike, as in *parvula*, it is only after considerable practice and the review of many specimens that one can distinguish the sexes by the pygidium. Sometimes there is a median impunctate space or a kind of carina, but this seems to vary quite a bit individually. The male and female pygidial differences are not repeated in the descriptions.

#### LEGS

The femora are clavate, but more strongly in some species than in others. Some species

have more hairs on the inner margin, usually in the male, but because the hairs are so often worn off, this character can only be used in series except in some of the small, uncoated species with very abundant hairs. The size of the punctures on the outside of the front femora is used in a few instances to separate two species. The femora are not mentioned in the systematic descriptions except sometimes in the case of the males.

The tibiae possess some good specific characters which, however, vary slightly from individual to individual. The front tibiae are usually straight on the outer margin, with the outer apical angle rounded or truncate where it bends inward to the apical tooth or claw. In the same species this angle may or may not have a slight projection or tooth, but in some groups of species it is flared outward into a definite lobe, or the outer margin is sinuate or expanded at the apex, and these characters are diagnostic in fresh specimens. The inner margin of the front tibiae is more or less sinuate in all species, varying individually, but strongly sinuate and dentate in a few (*germari*, *holoserica*, and *serratipes*). There is a double row of hairs on the inner side, sometimes more abundant or even tufted at the middle. Many of the smaller, glossy species that have the outer apical angle flared outward also have the front tibiae flatter and more or less excavate or concave on the under side, whereas other species have the front tibiae more tubular. There are all gradations between these types, however, and since the true shape cannot be seen in the coated species, this difference is stated here but not repeated in the descriptions. The apical and subapical claws or teeth on the front tibiae differ both within and between species in their length, thickness, and relative distance from each other; they are not stressed in the systematic descriptions but, presupposing a knowledge of the genus, they could be used as an aid in the separation of some species.

The individual variability in the width and vestiture of the third tarsal segment is not expressed in the descriptions other than in the broadest sense, namely, whether this segment is dilated and with a hairy pad below, or narrow and with lateral hairs below. Actually, the dilated as well as the

narrow segments show many variations. The third segment is considered dilated when it is as wide as long or when its apex is definitely much wider than the apex of the preceding segment (figs. 15, 16). Some individuals with narrow tarsi have the lateral hairs much denser and longer, almost constituting a hairy pad as in species with dilated tarsi.

While all species have a tuft of hairs, often thin and sparse, on the coxae, a few species have this tuft greatly enlarged, often in the male only.

#### ANTENNAE

The general shape of the antennal club (broadly oval or dilated at apical third) seems to correspond to the systematic order of the species, but actual measurements of it showed too much variability for its use as a diagnostic character. There are also occasional but inconstant differences in the relative size of the funicular segments.

#### MESOEPIMERON

The shape of the mesoepimeron should be an important character, and it does, as stated previously, generally separate the smaller, more generalized species from the larger, definitely patterned ones. It is, however, also individually variable in most species, in its relative length, in the shape of the front margin, and in the punctuation. It is not included in the descriptions of species.

#### GENITALIA

The male genitalia have in many instances proved of aid in the separation of species, although they do not seem to show much correlation with the relationship of the species. Some very closely related species, as *cultellata* and *compressirostris*, have genitalia of the same type, but *vomerina* and *graminis*, which are also close, have quite different genitalia. In general, however, more of the larger, well-marked species have similar looking genitalia than do the smaller, unpatterned ones. This can be seen in the drawings (figs. 66-116) which are arranged in the systematic order of the species figured.

The only part of the genitalia used in this study is the penis, or median lobe. The differ-

ences in it were found both in the shape of the apical portion and in the varying widths of the chitinous border at the sides and apex, viewed dorsally. Since this organ is not flat, but usually strongly arched, the shape of the apex may appear somewhat different as the penis is rotated under magnification. Thus in many species there is a sinuation or small knob in the center of the apical border which seems larger and more prominent when seen from above looking directly at the apex, but grows less prominent when viewed from behind the apex. An attempt was made in the outline drawings to show the tip itself, but some distortion is no doubt present in some cases. If four or five of the species figured be discounted, as not showing very definite differences, and the 11 species not figured, because of their similarity to those already shown, and eight species which were not available for dissection, nearly two-thirds of the species show genitalic differences. It is possible also that those genitalia that appear the same may differ in parts other than the gross shape, as in the internal sac or the median struts or the position of the median orifice (Bruhn, 1947).

The genitalic characters mentioned seem constant in most species, but show considerable variation in a few. Sometimes the general shape varies slightly, as do the amount of sinuation at the apex and the chitinization of the border at the middle and base. Specimens of the subspecies of *venatus* were so variable within, as well as between, the subspecies, that it was decided not to figure their genitalia at all; they are of the same general type as those of *phoeniciensis* and *recta* (figs. 102, 104). A dozen specimens of *pertinax*, however, showed no marked variation, and the same number of *australis* differed only in that some individuals had the apical emargination a little less deep.

The species not dissected, either because no males were available or because too few specimens exist, are *holoserica*, *bartramiae*, *serratipes*, *robustior*, *latinasa*, *costicollis*, *schwarzii*, and *multipunctata*.

Secondary sexual characters are discussed above in the section on Variability in the Genus.

The female genitalia have not been used in this study.

## TYPE LOCALITIES

The correct assignment of type localities in this genus would have been impossible without access to the type specimens. Chittenden, who described the large majority of the species, did not specify type localities, although he did select types, most of which are in the United States National Museum. He nearly always gave a locality, but when he had more than one specimen before him at the time of his description, he listed all the various localities without specifying which one corresponded to his type. The type localities for his species have therefore been taken from the label on the type. Horn likewise mentioned all the places from which he had specimens, but he failed to designate types. Most of his original type series is in the Academy

of Natural Sciences of Philadelphia; a smaller part is in the Museum of Comparative Zoölogy at Cambridge. Lectotypes have been chosen from the Philadelphia series from that specimen in each series which bears the name of the species in Horn's handwriting.

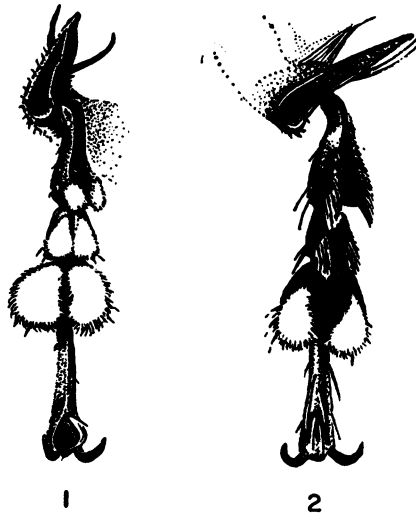
A few of the early species described by Gyllenhal, Olivier, Boheman, and others had only very general localities, such as "America boreali," or "Mexico," and for most of these I have restricted the type locality. Say's localities were also rather comprehensive and since his types no longer exist (LeConte, 1859, p. vi, mentions "the entire destruction of his original specimens"), neotypes and neotype localities are designated in this paper for those species considered valid.

## SPECIES OMITTED

Three of Champion's Mexican species (1910, pp. 156-158, pl. 7, figs. 33, 34) were found, upon examination of the types in the British Museum, to belong in the genus *Rhodobaenus*. They are *Sphenophorus aterrimus*, *octocostatus*, and *mundus*, the first two from southern Mexico and *mundus* from Durango in northern Mexico. Superficially these species are not typical of *Rhodobaenus* because of their large size and black color, and one of them, *octocostatus*, has the alternate elytral intervals raised in stripes as in some *Calendra*. They have, nonetheless, the most reliable diagnostic character of *Rhodobaenus*, a character that was found in the attempt to establish in which genus they belonged: the apex of the claw segment is excavated within, as shown in figure 1, and has a small tooth when seen in profile. In *Calendra* and other Central American genera the apex of this segment is either flat or convex, never concave or excavate (fig. 2). Champion's species also have the other characters usually associated with *Rhodobaenus* but that prove to be often somewhat variable: the round antennal club (but elongate in *mundus*), with the sensitive part larger in proportion to the whole than in most *Calendra*, the widely dilated tarsi, with the third segment spongy-hairy below except for a narrow, glabrous, median line; and the

strongly humped beak over the antennal insertion.

Horn (1873, p. 419) describes, under the species he mistakenly calls *pertinax* Olivier, a form named *pertinax* var. *interstitialis* Say, but Say's *Rhynchophorus interstitialis* (1831, p. 21), from its description, could be neither *pertinax* Olivier nor the other species (*australis*) which Horn confused with *pertinax*. Say states that *interstitialis* has "the thorax nearly as long as the elytra," which is cer-



FIGS. 1, 2. Tarsi, ventral view. 1. *Rhodobaenus pustulosus*. 2. *Calendra aequalis*.

tainly not true of *pertinax* or *australis*, and that the insect is "less than a quarter of an inch" long, which also is not true of either species. This latter statement was omitted by LeConte in his editing of Say's works (1859, p. 288), which probably was the reference used by Horn. Further confusion is caused by Horn's mention, in connection with the elytra, of "a double series of punc-

tures of which Say speaks," whereas Say actually speaks of these punctures in connection with the pronotum. Since Say's types are lost and since it is impossible to tell from the description which species of *Calendra*, if it is a *Calendra*, Say meant, the name *interstitialis* is hereby omitted from all synonymy of the genus.

### KEYS

Two keys are included, one for the species occurring north of Mexico and one for those occurring in Mexico, but each key includes all species known to occur in each region, whether endemic or not. The two areas are not, however, separated in the text, and the Mexican species are placed with the others in what is considered to be their phylogenetic order. Because of the great individual variability in the various species, many of them have been keyed out twice; those couplets where the double entries originate are marked with an asterisk. Thus a starred couplet can be taken as a warning, so to speak, that one is dealing with a variable character or char-

acters and that one or more species will appear twice as a result. It is hoped that these starred couplets will also be useful in referring back in case of error.

Although the species can be distinguished in series, they are so variable individually that it was necessary to make the United States key rather complex. Many species are separated on a combination of characters, and it is therefore essential that both parts of each dichotomy be read before a choice of one is made.

Keys to the subspecies of *venatus*, *pertinax*, and *aequalis* are given under the species, and a key is also given to the *simplex* group.

## SYSTEMATIC SECTION

### GENUS *CALENDRA* CLAIRVILLE AND SCHELLENBERG

*Calendra* CLAIRVILLE AND SCHELLENBERG, 1798, *Entomologie helvétique*, vol. 1, p. 62, pl. 2 [*Calendra* on plate]. LENG, 1918, *Jour. New York Ent. Soc.*, vol. 26, p. 210. PIERCE, 1919, *Proc. Ent. Soc. Washington*, vol. 21, p. 26; 1925, *ibid.*, vol. 27, p. 113. SATTERTHWAIT, 1925, *Ent. News*, vol. 36, p. 269 [footnote]. BLACKWELDER, 1948, Fifth supplement to the Leng catalogue of Coleoptera, p. 48.

*Calandra*, LATREILLE, 1810, *Considérations générales . . . insectes*, pp. 223, 431 [genotype]. CSIKI, 1936, in Junk, *Coleopterorum catalogus*, pt. 149, p. 49.

*Sphenophorus* SCHOENHERR, 1838, *Genera et species curculionidum*, vol. 4, p. 874.

*Trichischius* LECOMTE, 1876, *Proc. Amer. Phil. Soc.*, vol. 15, p. 426.

Size, 5.5 to 20 mm. Color black or deep red, occasionally brown, sometimes covered with a clay-colored coating or with an ocher, white, blue, or gray, enamel-like coating. Beak slender or stout, cylindrical or compressed, straight or curved, half as long as the pronotum or nearly as long, the base with a large or small puncture between the eyes. Labrum lacking, mandibles with three apical teeth, peduncle or postmentum of the labium narrow, elongate, concealing the organs. Eyes on the side of the head, narrowly or broadly oval. Antennae elbowed, inserted at the base of the beak in front of the eyes in a short, deep groove; antennal scape slender, as long as, or longer than, the funicle; first two segments of the six-segmented funicle longer; antennal club more or less wedge shaped, or oval, the outer half, or less, spongy and sensitive. Pronotum longer than wide, constricted at the apex by a narrow collar, either with three elevated stripes or vittae or other elevated areas, or without elevated areas. Scutellum triangular or nearly parallel, flat or concave or narrowly grooved. Elytra as wide as, or wider than, the pronotum, apices separately rounded, exposing the pygidium, with 10 costae or intervals, including the sutural and marginal intervals, separated by nine punctate striae. Front coxae nearly touching, globular; middle coxae separated by about half their diameter, globular; hind coxae widely separated, transverse; all coxae with large or small hairy

tufts; process between middle coxae flat, strongly bisinuate. Mesoepimeron more or less rectangular, truncate on the outer side but with a suggestion of an acute angle in front on the outer side; front margin straight or feebly arched. Metasternum usually hollowed out in male, flat in female, glabrous or hairy; metaepimeron narrow, elongate. Abdomen with five visible segments, first longer than the second, second longer than the third, third and fourth equal, last about equal to the first, glabrous or hairy; suture between first and second segment partially obliterated. Femora feebly clavate, glabrous or hairy within. Tibiae straight, sinuate, angulate, dentate, or with a submedian tooth on inner side, usually hairy within, armed at inner apex with a robust, sharp claw, and a smaller tooth behind the claw; outer apical angle rounded, truncate, minutely toothed, or prolonged outward into a lobe. Tarsi with four visible segments, the third narrow and conical or dilated and flattened, beneath glabrous at middle third, with spongy hairy pads on each side, or nearly entirely glabrous, with sparse hairs at extreme sides; claws simple, divergent, apex of claw segment convex. Pygidium large, exposed beyond elytra, truncate in male, rounded or pointed in female, with or without apical hairs. Male, penis composed of dorsal and ventral plates separated on sides by a narrow membranous strip, the chitinized apex rounded, acute, truncate, or sinuate in outline; median orifice on dorsal side situated in a membranous area behind the apex.

GENOTYPE: *Calendra abbreviata* Fabricius, 1798, Halle, Saxony.

Those of the above characters that distinguish *Calendra* from the other related genera reside in the shape of the antennal club, the relative separation of the coxae, the shape of the mesoepimeron, metaepimeron, and intercoxal processes, the claw segment, and the amount and arrangement of the hairs on the under side of the third tarsal segment. The last character seems a weak one for the separation of the genera in this group. It is variable in *Calendra*; in *Rhodobaenus*; in one species, at least, of *Cactophagus*; and perhaps in other less well-known genera. In *Calendra* in



some species the hairs are of one type on the front and middle tarsi, but of the other type on the hind tarsi, or they may be all of one or all of the other. The dilation of this segment is also variable in *Calendra* and not always constant even in the same species.

One or more species of seven other genera of the subfamily Rhynchophorinae (Blackwelder, 1947, p. 911) have been taken in the United States and Mexico. These genera differ from *Calendra* as follows:

*Rhynchophorus* (South Carolina, Florida, Louisiana, and Mexico), in its much larger size (20 mm. or more), by having a very wide metaepimeron, the mesoepimeron triangular on the outer side, the antennal club strongly transverse, the tarsi with spongy pads below in the apical half.

*Rhodoabaenus* (most of the United States and Mexico), by having the apex of the last tarsal segment deeply excavate within, the apical portion much widened when seen in profile and slightly protuberant, the third tarsal segment usually entirely spongy-hairy below or with only a narrow, median glabrous line from base to near the middle or apex (fig. 1).

*Sitophilus* (cosmopolitan), by being much

smaller (4 to 5 mm.), by having the front coxae widely separated, the mesoepimeron with a long, acute projection at the outer side in front which extends between the base of the prothorax and the base of the elytra.

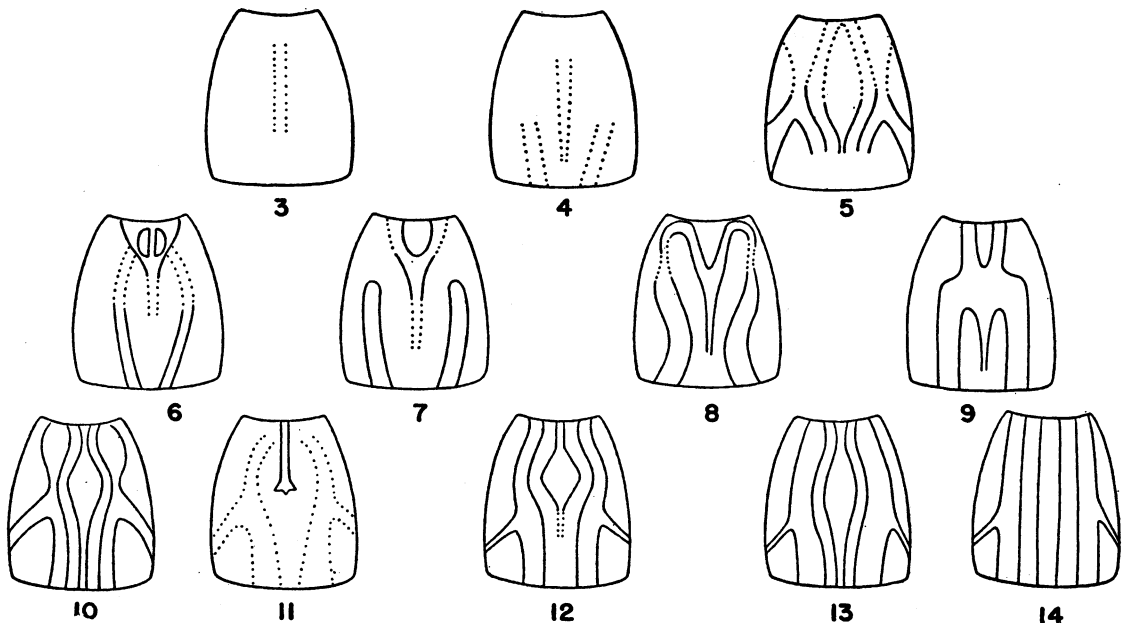
*Scyphophorus* (southern California, Texas, Arizona, Colorado, and Mexico), by having the front coxae more widely separated, the sensitive part of the antennal club retracted and scarcely visible, the tarsi glabrous below except for a ridge of hairs on the apical margin.

*Cactophagus* (southern California, Arizona, and Mexico), by having the front coxae more widely separated and the soles of the tarsi entirely covered with spongy, short, thick hairs (except in *validirostris*).

*Eucactophagus* (New Jersey, Connecticut, introduced; and Mexico), by having the tarsi spongy below except for a narrow, median glabrous line at the base, and by having angular projections between the front and middle coxae.

*Metamasius* (southern California and Mexico), by having the front coxae widely distant, the middle ones even more distant, and the prosternum overlapping the mesosternum with a large process.

The synonymy of *Sphenophorus* is explained under History in the Introduction; of *Trichischius*, under the species *C. crenata*.

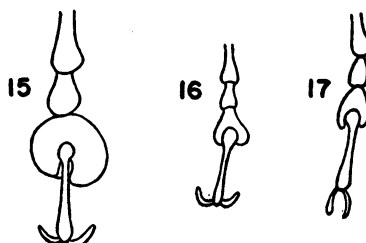


FIGS. 3-14. Types of pronotal pattern. 3. *Calendra simplex* and others. 4. *C. cicatristriata* and others. 5. *C. gagatina*. 6. *C. apicalis*. 7. *C. venatus* and others. 8. *C. recta*. 9. *C. phoeniciensis* and others. 10. *C. zeae* and others. 11. *C. melanocephala*. 12. *C. cariosa*. 13. *C. australis* and others. 14. *C. aequalis* and others. Dotted lines indicate areas not distinctly elevated or areas usually obscured by coating.

KEY<sup>1</sup> TO THE SPECIES OF *Calendra* IN THE UNITED STATES

1. Third tarsal segment on both front and middle legs widely dilated, scarcely, if at all, longer than wide, much wider at apex than preceding segments (figs. 15, 16), below with spongy-hairy pads on sides, leaving glabrous space at middle . . . . . 2
- Third tarsal segment on both front and middle legs not widely dilated (may be dilated on front tarsi only), much longer than wide, scarcely wider at apex than preceding segments (fig. 17), below usually without hairy pads but with sparse, long hairs laterally or near apex, leaving all of middle glabrous . . . . . 19

FIGS. 15-17. Third tarsal segment, front tarsi, dorsal view. 15. *Calendra aequalis*, female. 16. *C. australis*, male. 17. *C. callosa*, male.



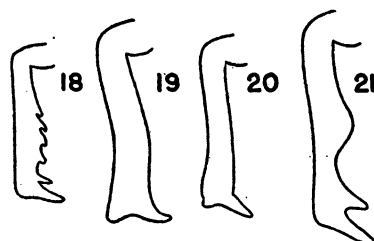
2. Under surface with a yellow or white, enamel-like, glossy coating on which the punctures show as black dots . . . . . 3
- Under surface without yellow or white enamel-like coat . . . . . 4
3. Third tarsal segment below with median glabrous space more or less triangular; abdominal segments glabrous or with hairs in middle of segments only . . . . . *aequalis*†
- Third tarsal segment below with median glabrous space narrow, linear; all abdominal segments in male covered from side to side with thick, long hairs (rare). . . . . *schwarzii*
4. Beak (looking directly into mouth parts from front) with a large, oval portion above formed by enormous dilation of the beak on upper contour (fig. 59, lateral view) (rare) . . . . . *latinasae*
- Beak without any large, oval area above mouth parts . . . . . 5
5. Dorsal surface, except head, uniformly opaque or velvety . . . . . *velutina*
- Dorsal surface not uniformly opaque or velvety . . . . . 6
6. Pronotum with median vitta (or stripe) raised, sharply diamond shaped at middle and not continuing to base (fig. 12); elytra usually rugose, striae with large, widely spaced foveae . . . . . *cariosa*†
- Pronotum with median vitta not or scarcely raised, or, if so, not sharply diamond shaped at middle (may be slightly dilated) and continuing to near base; elytra usually smooth, striae with smaller, closer punctures. . . . . 7
- \*7. Hind legs with third tarsal segment scarcely, if at all, longer than wide and below with two triangular pads of short, thick hair . . . . . 8
- Hind legs with third tarsal segment much longer than wide and below with sparse hair at sides of apex or narrowly on sides (if triangular pads are present below, then no hairs at apex of abdomen on sides) . . . . . 9
8. Elytra with alternate intervals raised and convex from base to near apex; raised parts of pronotum and elytra usually red or red and black . . . . . *striatipennis* (in part)
- Elytra with only suture and base of third interval raised and convex; raised parts of pronotum and elytra black . . . . . *costicollis*
- \*9. Beak (from side) with upper contour bent abruptly downward at apical fourth (figs. 39, 40) . . . . . 10
- Beak (from side) with upper contour nearly straight or evenly curved downward from apical third or fourth (figs. 37, 38, 41-44) . . . . . 11
10. Scutellum concave or grooved, longer than wide; raised stripes on alternate elytral intervals reaching apex or nearly so; male with longitudinal brush of hairs on inside of each hind coxa and apex of abdomen without depression or hairs . . . . . *costipennis* (in part)
- Scutellum flat, nearly as wide as long; raised stripes on alternate elytral intervals usually not reaching apex except on suture; male without brush of hairs on inside of hind coxae, but with

<sup>1</sup> The symbols used have the following significance: \* denotes the occurrence of a variable character in a particular species and that therefore that species will appear twice; † denotes the occurrence also in Mexico. See Keys in the Introduction above.

- fine hairs scattered on abdomen and metasternum and apex of abdomen with fine hairs in subapical depression (hairs often worn) . . . . . *villosiventris*
- \*11. Elytra with some or all intervals definitely convex, or if but feebly convex, with one or more intervals with an impunctate bare stripe in center . . . . . 15
- Elytra with all intervals flat, or, if slightly convex, without any impunctate bare stripe in center of interval . . . . . 12
12. Pronotum with stripes well raised above interspaces, straight, nearly parallel, strongly defined . . . . . *robusta*
- Pronotum with stripes scarcely, if at all, raised above interspaces, sinuous, not parallel, feebly defined, or stripes merged across disc . . . . . 13
13. Pronotum with punctures on disc very fine, scarcely visible. . . . . *australis* (in part)
- Pronotum with definite, strong punctures on disc . . . . . 14
14. Base of beak (from above) without depression leading forward from puncture; male with hind tibiae sharply angulate. . . . . *scoparia*
- Base of beak (from above) with elongate depression, often encrusted, leading forward from puncture; male with hind tibiae straight (rare in the United States) . . . . . *cubensis*
- 15(11). Pronotum with median stripe about same width throughout . . . . . 16
- Pronotum with median stripe fusiform or merged with lateral stripes . . . . . 17
16. Apex of last abdominal segment, laterally, with fine row of minute, short yellow hairs (fig. 36) . . . . . *striatipennis* (in part)
- Apex of last abdominal segment, laterally, without hairs . . . . . *costipennis* (in part)
17. Apex of beak below acute and produced (fig. 41), beak stout . . . . . *maidis*
- Apex of beak below either rounded, obtuse, or right angled, not produced, beak slender . . . . . 18
18. Male with short, transverse brush of hairs in center of second abdominal segment; female, middle femora with coating or pruinosity on inner side or fringe of thick hairs or both; both sexes with elytra regularly striped (stripes may be abbreviated or lacking on some intervals) and third tarsal segment on middle legs as dilated as on front legs, the pads below of equal width . . . . . *pertinax*
- Male without hairs on second abdominal segment; female, middle femora without any coating and with very sparse hair on inner side; both sexes with elytra irregularly mottled and third tarsal segment on middle legs less dilated than on front legs, one pad below much wider than the other. . . . . *australis* (in part)
- 19(1). Pronotum with three entire, bare stripes from base to apex, clearly separated, definitely raised, nearly parallel, and two side branches extending to hind angles of pronotum (fig. 14) . . . . . 20
- Pronotum not as above . . . . . 21
20. Beak with upper contour flattened before apex; hind femora strongly and abruptly clavate; robust . . . . . *robustior*
- Beak with upper contour rounded downward before apex; hind femora scarcely clavate; slender . . . . . *incongrua*
21. Beak (from above) with knife-like carina or keel on upper contour extending from near middle all the way to apex . . . . . 22
- Beak (from above) without knife-like keel on upper contour, or, if slight keel is present, it flattens out or disappears before apex . . . . . 24
22. Front tibiae with long stout spur near middle. . . . . 23
- Front tibiae without spur near middle . . . . . *cazieri*, new species
23. Sides of prosternum sparsely punctured, nearly smooth; front of head and femora finely punctured . . . . . *compressirostris*
- Sides of prosternum, front of head, and femora coarsely, strongly punctured . . . . . *cultellata*
- 24(21). Pronotum with two deep, well-defined, oblong pits near apex, one on each side of median line; small (6 mm.) (fig. 6) . . . . . *apicalis*
- Pronotum with a single deep or shallow median depression near apex, or no depression at all. . . . . 25
- \*25. Beak (from side) not, or scarcely, wider at apex, about the same width throughout, or narrower at apex than at middle; if slightly wider, then apex beneath rounded, or obtuse, not produced (figs. 31, 50–53, 63); beak more cylindrical . . . . . 26
- Beak (from side) wider at extreme apex than at middle; apex beneath usually produced into acute angle, sometimes obtusely angled (figs. 29, 30, 32, 54–58, 61, 62); beak strongly compressed laterally . . . . . 38
26. Pronotum in apical half punctured regularly with approximately the same size and type of puncture, except sometimes for an impunctate median line . . . . . 27

- Pronotum in apical half punctured irregularly with larger and smaller punctures, usually with elevated areas . . . . . 34
- 27. Elytra on disc with large, shallow foveae on striae cutting halfway or more into the intervals; front tibiae with four or five large teeth (fig. 18) on inner side at middle bulge . . . *serratipes*
- Elytra on disc with small, sometimes scarcely visible, punctures within the striae, punctures scarcely cutting into the intervals; front tibiae with no, or very minute, serrations on inner side . . . . . 28
- 28. Sides of prosternum nearly impunctate, or with sparse, fine punctures . . . . . 29
- Sides of prosternum with dense, strong punctures . . . . . 33
- 29. Elytral intervals with coarse, strong punctures . . . . . *vomerina* (in part)†
- Elytral intervals with fine, scarcely visible punctures . . . . . 30
- 30. Front tibiae with outer apical angle definitely flared outward and prolonged into stout lobe; beak on top strongly or feebly keeled medially . . . . . 31
- Front tibiae with outer apical angle scarcely turned outward and with small tooth, no prolonged lobe; beak on top without trace of keel . . . . . 32

FIGS. 18-21. Front tibiae, lateral view. 18. *Calendra serratipes*, female. 19. *C. vomerina*, female. 20. *C. graminis*, male. 21. *C. germari*, female.



- 31. Hind tibiae with sharp, pronounced angulation within in both sexes; beak usually not keeled on side; stria punctures on elytral disc indistinct or not present (impressed striae alone visible); pygidium with two lateral tufts of hair at apex (sometimes worn off) . . . . . *simplex*
- Hind tibiae with at most a slight sinuation within in male; beak usually keeled on side from in front of antennal insertion to top of mouth parts; stria punctures on elytral disc more distinct, more deeply impressed; pygidium with hairs, but not in lateral tufts at apex . . . *mormon*
- 32. Male with ventral cavity and apex of abdomen glabrous; elytral stria punctures on disc oval or round, more distinct, more separated, making sides of intervals more sinuate . . . *subulata*
- Male with short hairs in ventral cavity and large oval patch of white hairs on apical abdominal segment; elytral stria punctures on disc more rectangular, less distinct, merged, leaving sides of intervals nearly straight (rare in the United States) . . . . . *ima*†
- 33(28). Elytral intervals deeply, definitely punctured; first and second striae joined at extreme base and enclosing second interval; beak at base (from above) heavily punctured; male without hair below . . . . . *gentilis*
- Elytral intervals impunctate or faintly punctured; first and second striae separated at base; beak at base (from above) lightly punctured; male with long hairs in center of metasternum and of first two abdominal segments . . . . . *crenata* (in part)
- 34(26). Pronotum without median subapical depression . . . . . 35
- Pronotum with median subapical depression or median subapical concentration of larger punctures . . . . . 37
- 35. Eye without any impressed line along side margin, which is flush with head; base of beak (from side) not depressed in front of eye . . . . . *deficiens*
- Eye with narrow impressed line of punctures along side margin; base of beak (from side) with depression of concentrated punctures in front of eye . . . . . 36
- 36. Elytra with stria punctures small, scarcely cutting into intervals, the stria line more or less open and the punctures merging . . . . . *gagatina* (in part)
- Elytra with stria punctures very large, cutting about halfway into intervals, stria line narrowed between the punctures . . . . . *zeae* (in part)
- 37. Raised areas of pronotum with minute, sometimes scarcely visible punctures; apex of last abdominal segment with depression . . . . . *pontederiae*
- Raised areas of pronotum with large, definitely visible punctures; apex of last abdominal segment without depression . . . . . *missouriensis* (in part)

- 38(25). Pronotum (including apical constriction) scarcely longer than wide, almost completely encrusted with thick coating and with five depressions around margins, including a median subapical one. . . . . *bartramiae*
- Pronotum (including apical constriction) much longer than wide, or, if scarcely longer, then not both coated and with five depressions as above . . . . . 39
- \*39. Elytral intervals on disc in the form of very narrow, straight, elevated lines, due to the near obliteration of the intervals by the large strial foveae . . . . . 40
- Elytral intervals on disc not in the form of very narrow, straight, elevated lines . . . . . 41
40. Sides of prosternum almost impunctate . . . . . *cicatristriata* (in part)†
- Sides of prosternum densely, strongly punctured (rare in the United States) . . . . . *terricola*†
- \*41. Elytra with large foveae seemingly set in pairs along the striae, separated, at least at lower end, by raised edges of striae (fig. 22) . . . . . 42
- Elytra with large or small punctures or foveae, seemingly single, not separated by raised edges of striae . . . . . 44
42. Pronotum with median vitta diamond shaped or dilated . . . . . 43
- Pronotum with median vitta, if present, linear, narrow. . . . . *cicatristriata* (in part)†

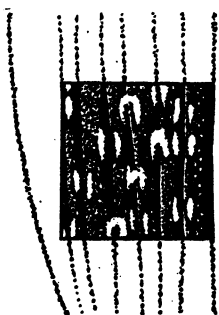


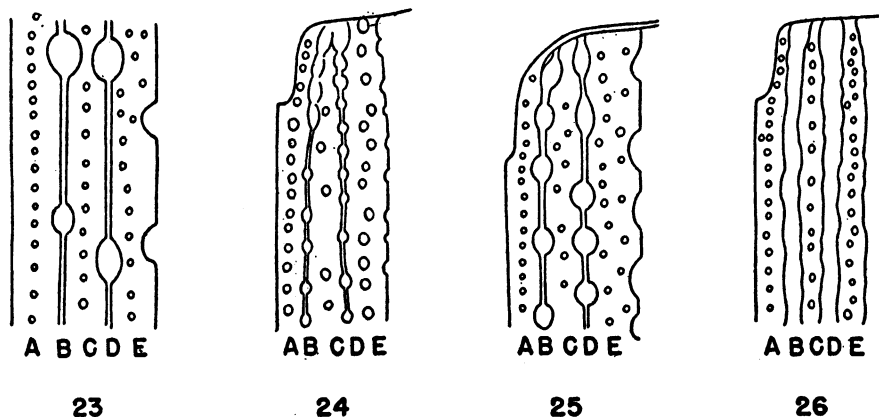
FIG. 22. Foveae on section of elytral disc in  
*Calendra cicatristriata*.

43. Front tibiae with outer apical angle flared outward and produced . . . . . *inaequalis* (in part)
- Front tibiae with outer apical angle not flared outward or produced . . . . . *zeae* (in part)
- \*44. Pronotum, excluding constriction, with punctures of approximately the same diameter throughout and densely or sparsely but regularly placed except where there is a narrow, impunctate, median line. . . . . 45
- Pronotum, excluding constriction, with larger and smaller punctures, often sparsely or irregularly placed, the smaller punctures scattered among the larger ones or, where there are raised areas, on them or on their margins . . . . . 59
45. Beak (from above) without visible angular projection over insertion of antennae, very broad at base, at least half as wide as head (rare) . . . . . *dietrichi*
- Beak (from above) with noticeable angular projection, usually sharp, over insertion of antennae; if angle not evident, then beak narrow at base, not more than one-third as wide as head . . . . . 46
- \*46. Elytra near apex with a prominent callosity or tubercle on each elytron . . . . . 47
- Elytra near apex without evident callosities . . . . . 49
47. Pronotal punctures sparse, irregularly spaced . . . . . *minima* (in part)
- Pronotal punctures dense, almost touching, regularly spaced . . . . . 48
48. Beak strongly arched (fig. 62), almost as long as pronotum; front femora on outside with punctures like those on sides of prosternum, and coated, partially or entirely . . . . . *parvula* (in part)
- Beak scarcely curved, nearly straight on upper contour, shorter; front femora on outside with punctures usually finer than those on sides of prosternum and not coated . . . . . *marina*
- 49(46). Front femora on outside with punctures coated and dense and as large as those on sides of prosternum. . . . . *parvula* (in part)
- Front femora on outside with punctures not both coated and dense and as large as those on sides of prosternum . . . . . 50
50. Male with metasternum and first two abdominal segments with long hairs in center; female with apex of pygidium impunctate, not elevated . . . . . *crenata* (in part)
- Male with no long hairs below; female with apex of pygidium with smaller punctures than on middle, apex usually elevated above the rest . . . . . 51



51. Disc of elytra with strial punctures breaking nearly halfway into the intervals . . . . . 52  
 — Disc of elytra with strial punctures not, or scarcely, breaking into the intervals . . . . . 53
52. Elytral strial punctures invaded, at lower end, by raised edges of striae (fig. 22); pronotum with trace of median subapical depression, also V-shaped basal depression . . . . . *cicatristriata* (in part)†  
 — Elytral strial punctures not invaded by raised edges of striae; pronotum without trace of median subapical depression or V-shaped basal depression . . . . . *arizonensis*†
53. Elytra with outer striae (7-8) with punctures (except at base and apex) regularly placed, distinctly separated; if not well separated, then punctures many times larger than those on neighboring intervals . . . . . 54  
 — Elytra with outer striae (7-8) with punctures (except at base and apex) irregularly placed, indistinct, or merging, or this area covered with coating, punctures usually about same size as on neighboring intervals . . . . . 56
54. Pronotum with punctures large and mostly touching . . . . . *coesifrons* (in part)†  
 — Pronotum with punctures minute, not touching . . . . . 55
55. Prosternum, especially in center, with distinct punctures; male with very deep ventral cavity . . . . . *nevadensis*  
 — Prosternum, especially in center, virtually impunctate; male with shallow ventral cavity . . . . . *memnonia*†
56. Elytral intervals on disc with scarcely visible punctures (surface usually covered with coating), and, when visible, punctures fine, small . . . . . *coesifrons* (in part)†  
 — Elytral intervals on disc with distinctly visible punctures (surface usually shining, bare), punctures coarse, large . . . . . 57
57. Front tibiae with outer apical angle prolonged and flared outward, making apex of tibiae suddenly wider than the rest (fig. 19), this prolonged part often almost as long as the inner apical claw and twice as thick . . . . . *vomerina* (in part)†  
 — Front tibiae with outer apical angle sometimes slightly sinuate but not, or scarcely, prolonged, and not flared outward (fig. 20) . . . . . 58
58. Sutural interval on elytra with single row of punctures on outer side (sometimes the row irregular), occasionally scattered at base; even intervals with single row of large, touching punctures taking up almost entire width of interval; striae often nearly as wide as even intervals . . . . . *tarda*  
 — Sutural interval on elytra with usually triple rows of punctures, occasionally double; even intervals with single row of small punctures not taking up width of interval, or with double rows of tiny punctures; striae never so wide as intervals . . . . . *graminis*
- 59(44). Front tibiae with outer apical angle prolonged and flared outward to an acute angle; eye with lower edge on same level as base of beak below; small, robust (6 mm.) . . . *inaequalis* (in part)  
 — Front tibiae with outer apical angle not prolonged or at least not flared outward to an acute angle; eye with lower edge extending considerably below base of beak . . . . . 60
60. Front and middle tibiae strongly angulate near middle on inner side (fig. 21) . . . . . *germari*  
 — Front and middle tibiae without strong angulation on inner side . . . . . 61
- \*61. Pronotum with median stripe represented by raised, usually shining, undivided keel in apical half, slightly or sharply dilated at middle of pronotum, and not continuing to base (fig. 11). 62  
 — Pronotum with median stripe, if present, not in the form of a raised keel in apical half . . 63
62. Beak abruptly widened before apex, short, not longer than front femora (fig. 58). . . *melanocephala*  
 — Beak gradually widened to apex, long, longer than front femora . . . . . *destructor* (in part)
63. Disc of elytra with strial punctures separated by four or five or more times the diameter of a puncture; only five or six punctures to the striae; intervals flat and lightly punctate (fig. 23) . . . . . *holoserica*  
 — Disc of elytra with strial punctures not separated by four or five times the diameter of a puncture, or, if so, then intervals not both flat and lightly punctate; 10 or more punctures to the striae . . . . . 64
64. Pronotum with five vittae showing in basal fifth, the two inner laterals not reaching the base, vittae merged, partially or completely, in apical half (fig. 5) . . . . . *gagatina* (in part)  
 — Pronotum not as above . . . . . 65
- \*65. Pronotum without lateral raised stripes . . . . . 66  
 — Pronotum with lateral raised stripes, at least in basal half, but sometimes vague in outline, or covered with coating . . . . . 70

66. Beak (from side) with base swollen into hump on upper contour (fig. 55) above projection over antennal insertion and constricted behind; third tarsal segment on front tarsi widely dilated, square . . . . . *sollauui*
- Beak (from side) with base not swollen or constricted; third segment on front tarsi narrow, longer than wide . . . . . 67
67. Pronotal punctures sparse, irregularly spaced; eye with impressed line of punctures dorsally between it and head; elytra with prominent tubercles near apex . . . . . *minima* (in part)
- Pronotal punctures dense, more regularly spaced; eye without impressed line; elytra without tubercles near apex . . . . . 68
68. Front margin of thoracic sides produced towards eye (fig. 27); pronotum without median vitta (rare) . . . . . *blanchardi* (in part)
- Front margin of thoracic sides straight, not produced towards eye; pronotum with wide, fusiform, median vitta . . . . . 69



FIGS. 23-26. Diagram of section of elytral disc. 23. *Calendra holoserica*, Victoria, Texas. 24. *C. neomexicana*, Albuquerque, New Mexico. 25. *C. venatus vestita*, Puerto Rico. 26. *C. championi*, holotype, Santa Barbara, Chihuahua, Mexico. A, C, E, intervals; B, D, striae.

69. Elytra with striae punctures scarcely cutting into the intervals; beak at base with at most a concentration of punctures in front of eye . . . . . *necydaloides*
- Elytra with striae punctures, especially on outer rows, cutting halfway or more into the intervals; beak at base with well-marked, coated depression in front of eye . . . . . *chittendeni*
- \*70(65). Pronotum with no median subapical depression, and median stripe, if present, not forked in front . . . . . 71
- Pronotum with an elongate or round median subapical depression, and median stripe usually more or less forked in front, enclosing the depression (figs. 7-9) . . . . . 78
71. Elytra with striae punctures large, cutting halfway or more into the intervals . . . . . 72
- Elytra with striae punctures not noticeably large, cutting into intervals, if at all, only one-third or less . . . . . 73
72. Pronotum with definite pattern of raised, less punctate areas, median stripe clear cut, dilated at middle; beak usually humped at base on upper contour (fig. 56). . . . . *zeae* (in part)
- Pronotum without definite, raised pattern or median stripe; beak not humped at base (rare) . . . . . *blanchardi* (in part)
73. Pronotum with base strongly sinuate, the middle lobe extending well below the normal base line . . . . . 74
- Pronotum with base not, or only slightly, sinuate, with no lobe extending below the base line . . . . . 75
74. Pronotal stripes with fine, scarcely visible punctures and usually uniformly coated; scutellum deeply concave; front tibiae with outer margin straight from base to apex . . . . . *callosa*
- Pronotal stripes with coarse, large punctures and usually only partially coated or not at all; scutellum flat, or but slightly concave, and with narrow median groove; front tibiae with outer margin abruptly expanded and truncate before apex . . . . . *destructor* (in part)

75. Beak short, extremely stout, broad, compressed laterally (fig. 61); elytral punctuation usually scarcely visible, but, if so, is fine . . . . . *coesifrons* (in part)†
- Beak longer, more slender, not so compressed (fig. 54); elytral punctuation visible even when there is coating present, and is coarser . . . . . 76
76. Pronotum large and robust, almost as broad as elytra and nearly as long . . . *gagalina* (in part)
- Pronotum slender, narrower than elytra and about three-quarters as long . . . . . 77
77. Beak, from side and above, constricted at extreme base, making depression between beak and head; front of head usually distinctly punctured . . . . . *sayi*†
- Beak, from side and above, not constricted at extreme base, beak meeting head in continuous line without depression; front of head scarcely punctured . . . . . *diversa*
- 78(70). Scutellum and entire dorsal surface encrusted with uniform, dense, felt-like coating. *hoegbergii*†
- Scutellum bare of coating, the rest of dorsal surface either bare or with thinner coating . . . 79
79. Front femora on outside with minute punctures, much finer than those on sides of prosternum . . . . . *phoeniciensis*
- Front femora on outside with large punctures, almost as large as those on sides of prosternum . . . . . 80
80. Under surface, including legs, almost completely covered with coating; beak very strongly arched and about same width throughout (fig. 63). . . . . *missouriensis* (in part)
- Under surface, including legs, largely uncoated, bare; beak slightly curved or nearly straight, usually wider at extreme apex, as in figures 61 and 62 . . . . . 81
81. Strial punctures scarcely, if at all, larger than those on intervals (fig. 24) . . . . . *neomexicana*†
- Strial punctures many times larger than those on intervals (fig. 25) . . . . . 82
82. Pronotum with punctures of lateral vittae large or small, but strong, dense, usually some touching . . . . . 83
- Pronotum with punctures of lateral vittae minute, usually faint, rather sparse . . . . . *venatus* (in part)†
83. Pronotum with punctures of lateral vittae much larger than those on median vitta . . . . . *venatus* (in part)†
- Pronotum with punctures of lateral vittae about the same size as those on median vitta . . . 84
84. Pronotum with median subapical depression round or ill defined (fig. 7); apical margin of thorax feebly or strongly produced behind eye; apex of beak below acutely produced; top of beak usually without median keel . . . . . *venatus* (in part)†
- Pronotum with median, subapical depression V-shaped or very narrowly elongate, well defined (fig. 8); apical margin of thorax straight behind eye; apex of beak below obtusely or right angled; top of beak usually with keel medially . . . . . *recta*†

KEY<sup>1</sup> TO THE SPECIES OF *Calendra* IN MEXICO

1. Under surface with a yellowish white, enamel-like coating on which the punctures show as black dots . . . . . *aequalis*†
- Under surface without such a coating . . . . . 2
2. Elytra with third interval (counting from suture as one) in basal half prominently elevated above others and shining black . . . . . *cariosa*†
- Elytra with third interval not elevated in basal half above others . . . . . 3
3. Elytra with large or small punctures on striae, seemingly single, not separated by raised edges of striae, the intervals not obliterated . . . . . 5
- Elytra with large foveae seemingly set in pairs along the striae, separated, at least at lower end, by raised edges of striae (fig. 22), sometimes foveae nearly obliterating the intervals, which appear then as narrow, raised lines . . . . . 4
4. Prosternum impunctate or finely, sparsely punctured . . . . . *cicatristriata*†
- Prosternum with large, dense punctures . . . . . *terricola*†
5. Base of beak below with elongate, hairy depression on each side (fig. 49) . . . . . *multipunctata*
- Base of beak below without hairy depressions . . . . . 6
6. Apical margin of thorax (from side) strongly sinuous behind eye (fig. 27) . . . . . 7
- Apical margin of thorax (from side) straight or only feebly sinuous . . . . . 9
7. Pronotum without median subapical depression; elytral strial punctures usually scarcely visible, small . . . . . *coesifrons*†
- Pronotum with median subapical depression; elytral strial punctures usually visible, large . . 8

<sup>1</sup> The symbol † signifies occurrence also in the United States.

8. Scutellum and entire dorsal surface encrusted with uniform, dense, felt-like coating . . . . . *hoegbergii*†  
 — Scutellum bare of coating, the rest of dorsal surface either bare or coated . . . *venatus* (in part)†  
 9(6). Each elytron with three depressions, one at base of fifth and sixth intervals, one behind middle on side, one behind subapical callosity; pygidium markedly tumid or swollen before apex . . . . . *sulcifrons*  
 — Elytra without depressions; pygidium not tumid before apex . . . . . 10  
 10. Pronotum with median subapical depression or median concentration of larger punctures . . . 11  
 — Pronotum without median subapical depression or median concentration of larger punctures . . . . . 14  
 11. Prosternum, and usually center of abdomen, impunctate or with a few scattered punctures; abdomen with apical depression deeply sunk, surrounded by an impunctate or much less punctured area . . . . . *incurrens*  
 — Entire surface below strongly, densely punctured; abdomen with apical depression, if present, shallow, and entire last segment regularly punctured . . . . . 12  
 12. Punctures on elytral striae on disc the same size as on intervals or only slightly larger (fig. 24) . . . . . *neomexicana*†

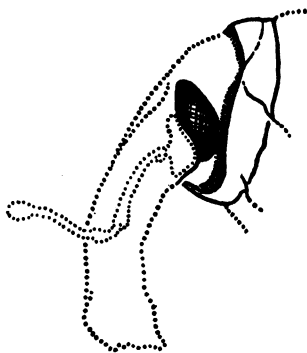


FIG. 27. Thoracic lobe (apical margin of thorax produced towards eye or sinuous behind eye) in *Calendra coesifrons* and others.

- Punctures on elytral striae on disc six to eight or more times larger than those on intervals (fig. 25) . . . . . 13  
 13. Apical margin of thorax (from side) sinuous behind eye (fig. 27); punctures enclosing median subapical depression usually much larger than those on median vitta . . . *venatus* (in part)†  
 — Apical margin of thorax (from side) straight behind eye; punctures enclosing median subapical depression usually same size as those on median vitta . . . . . *recta*†  
 14(10). Pronotum with lateral vittae either raised at base, or not raised but of a different color from rest of pronotum . . . . . 15  
 — Pronotum without lateral vittae of any kind . . . . . 17  
 15. Base of beak and sides of prosternum strongly, densely punctured . . . . . *sayi*†  
 — Base of beak and sides of prosternum nearly impunctate . . . . . 16  
 16. Last abdominal segment scarcely, or very finely, punctured; front femora of male with fringe of long, yellow hairs on inner side extending from base to apical third . . . . . *quadrivittata*  
 — Last abdominal segment coarsely, strongly punctured; front femora of male with few hairs on inner side at base only . . . . . *lineata*  
 17(14). Elytral intervals with coarse punctures, larger than, or as large as, punctures on striae . . . . . *vomerina*†  
 — Elytral intervals with fine punctures, much smaller than those on striae . . . . . 18  
 18. Pygidium at apex without raised margin, all its punctures about the same size . . . . . *angusta*  
 — Pygidium at apex with narrow, usually raised margin composed of much smaller, finer punctures than on rest of pygidium . . . . . 19  
 19. Elytral striae on disc with each puncture round, distinctly separated by its own diameter or more from the next puncture, striae much narrower than striae punctures . . . *arizonensis*†  
 — Elytral striae on disc with punctures more elongate, merging one into the next, striae scarcely, if at all, narrower than striae punctures . . . . . 20  
 20. Beak (from side) not widened at apex, long, slender (fig. 53); front tibiae with subapical tooth minute; last abdominal segment of male with oval patch of dense, whitish hairs . . . *ima*†

- Beak (from side) apically widened, short, stout; front tibiae with subapical tooth stout, larger; last abdominal segment of male hairless . . . . . 21
- 21. Disc of elytra with intervals as wide as striae or not more than twice as wide, intervals usually in great part with single rows of punctures (fig. 26) . . . . . *championi*, new species
- Disc of elytra with intervals four or five times wider than striae, intervals usually with scattered punctures on alternate intervals, single rows on others . . . . . *memnonia*†

#### THE *simplex* GROUP OF SPECIES

Included in the *simplex* group are the first nine species, all of which possess the following characters: a simple, unpatterned pronotum, finely and uniformly punctured, except for a narrow, impunctate median line, sometimes elevated in *gentilis*, the pronotum without raised lateral vittae (in some species the lateral "vittae" are merely stripes of a different color); the elytral intervals not, or scarcely, cut into by the punctures of the striae, these punctures being very close or merging into one another, not separated by a closed strial line; the beak cylindrical, or nearly so, long and slender, scarcely, if at all, widened apically, the apex below rounded; the mesoepimeron narrow, nearly three times longer than wide, with the front margin straight; the third tarsal segment on all legs narrow, longer than wide. In addition, these species have no natural coating, no fovea in front of the eye, no thoracic lobe, no marked subapical callosity on the elytra. They occur in the western United States or in Mexico, none having been taken farther east than

Colorado, except *mormon* from North Dakota.

Although these species appear quite homogeneous in form and size, most of them have distinct and constant characters (sometimes in the male only) that serve to distinguish them more readily than is possible in many other species in the genus, notably the *venatus* group. But their apparent similarity is confusing and, because they do not come together in the same key, a synoptic tabulation is given below to aid in visualizing their differences.

#### *Calendra simplex* AND *Calendra mormon*

These two species are very similar and occupy some of the same areas, although in general, on the basis of present material, *mormon* is more widespread and extends farther north. No *mormon* has been seen from southern California, where *simplex* seems to be most abundant, but both occur in Wyoming and southern Oregon, and have been taken together at Reno, Nevada, and Salt Lake and Provo, Utah. They have the same

#### SYNOPTIC TABLE OF *simplex* GROUP OF SPECIES

- A. Elytral intervals coarsely punctured with large punctures; upper corner of eye with small tuft of hairs . . . . . *gentilis*
- B. Elytral intervals finely punctured or almost impunctate; no hairs at upper corner of eye.
  - 1. Pygidium without apical border of smaller, denser punctures.
    - a. Pronotum nearly impunctate, black; male with short ventral hairs, hairs on trochanters, and pygidium uniformly convex . . . . . *angusta*
    - b. Pronotum with definite punctures, black, or brown with black stripes; male with long ventral hairs, no hairs on trochanters, and pygidium deeply concave at apex . . . . . *crenata*
  - 2. Pygidium with apical border of smaller, denser punctures.
    - a. Outer apical angle of front tibiae prolonged acutely and flared outward into stout lobe.
      - 1. Striae narrower, less punctate . . . . . *simplex*
      - 2. Striae wider, more strongly punctate . . . . . *mormon*
    - b. Outer apical angle of front tibiae with small tooth, but not prolonged acutely or flared outward.
      - 1. Pronotum with three well-marked black stripes on brown background.
        - a. Last abdominal segment scarcely punctured . . . . . *quadrivittata*
        - b. Last abdominal segment coarsely punctured . . . . . *lineata*
      - 2. Pronotum without stripes.
        - a. Pronotum and prosternum scarcely punctured; male with hairs in ventral cavity and in oval patch on last abdominal segment; trochanters and front and middle femora with short, thick, yellow hairs; last abdominal segment without depression . . . . . *ima*
        - b. Pronotum and prosternum more definitely punctured; male without hairs in ventral cavity or on last abdominal segment; trochanters without hairs, front and middle femora with sparse, thin, yellow hairs; last abdominal segment with definite depression . . . . . *subulata*

TABLE 1  
DIFFERENCES BETWEEN *Calendra simplex* AND *Calendra mormon*

<i>C. simplex</i>	<i>C. mormon</i>
Beak less densely punctured; side and top keels less sharp, often scarcely discernible in male	Beak more densely punctured; side and top keels very sharp, even in male
Scutellum parallel; suture and first stria straight at base of elytra	Scutellum more triangular, usually grooved; suture and first stria curved obliquely outward at base of elytra
Elytral striae narrower, punctures less distinct, smaller; intervals with finer, less impressed punctures, more often in single rows on first five intervals	Elytral striae wider, punctures more distinct, larger; intervals with larger, more impressed punctures, more often in double rows on first five intervals
Hind tibiae with sharp, triangular angulation at middle, especially pronounced in male	Hind tibiae with at most a slight sinuation behind the middle, more definite in male
Front tibiae with under side nearly smooth except for center row of punctures	Front tibiae with under side more coarsely punctured, appearing granulate all over
Pygidium with minute tufts of hair on sides at apex (often worn off)	Pygidium with hairs in punctures, but not in tufts on sides at apex
Size generally smaller	Size generally larger

elongate, parallel form and similar pronotal and elytral patterns, the same type of beak, tibiae, pygidium, the same tarsi, and the same male genitalia. They do, however, differ by a combination of characters which are given in table 1.

It must be emphasized that, except for the presence or absence of the tuft of hairs on the pygidium, most of the other characters are more or less relative and are not absolutely constant in either species. Thus in 57 *mormon* the suture and first striae are straight at the base in four, as in *simplex*, and in three of 16 *simplex* they turn outward as in *mormon*. Two *mormon* of 57 have the elytral striae as narrow as in *simplex*, and three of the latter out of 16 have them as wide as in *mormon*. Nine of the 57 *mormon* have single rows of punctures on one or more elytral intervals, two of the 16 *simplex* have them double. Some *mormon* have been seen with the front tibiae below as smooth as in *simplex*. Two females of *simplex*, one from Truckee Meadows, Nevada, one from Baja California, while agreeing with *simplex* in other characters, have the wider elytral striae of *mormon* with more distinct punctures. Chittenden

(1904a, p. 128) remarked that "a few individuals of *simplex*, chiefly from Utah, approach in some few characters a tendency to merge into *mormon* from the same state." This tendency has been shown in the examples cited above, but it is not confined to localities where both species are present, as at least two of my "merging" specimens are from places where only one of the species has been taken (Colorado for *mormon*, Baja California for *simplex*).

For identification purposes, therefore, a combination of characters should be used, the most reliable ones being the sinuation or angulation of the hind tibiae, the sharpness of the keels on the beak in the female, and the punctuation of the beak, except in abraded specimens where no punctuation shows. The keels on the sides of a female *simplex* may be nearly as evident as in a *mormon* male, but they are never sharp, as in a *mormon* female. Neither sex in *mormon* has the tibiae so triangularly angulate as in *simplex*, nor the sinuation so near the middle of the tibiae. Opaque or shining, red or black specimens occur in both species.

*Calendra simplex* and *C. mormon* have the



elytral striae, on the disc, more open and with straighter sides than in most species, the striae usually appearing as deeply cut lines without evident punctures. Punctures are, however, present and when visible they are seen to be wholly enclosed within the striae; they are not round or oval as in many species, but more or less rectangular, following one after the other as in a chain stitch. They do not cut into or scallop the adjacent intervals. Much the same type of striae occurs in *C. ima*, *championi* (fig. 26), and *gentilis*, but in the latter two species the striae are much wider in proportion to the intervals, sometimes being nearly as wide as, or at least half, their width, and the elytra lack the regular, smooth appearance of *simplex* and *mormon* because of their large interval punctures. The striae in *C. tarda*, *graminis*, *subulata*, and *vomerina* also often appear straight sided and open, but in these species the punctures are actually round or oval and usually cut slightly into the intervals. The keel or carina on the side of the beak is also feebly present in some specimens of *C. crenata*, *quadrivittata*, and *angusta*. The sharp angulation of the hind tibiae in *simplex*, both sexes, is found elsewhere in the genus only in the male of *scoparia*, a species far removed. In *mormon* the angulation is expressed by a slight sinuation that is scarcely distinctive.

#### *Calendra simplex* (LeConte)

Figures 3, 66

*Sphenophorus simplex* LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia, vol. 11, p. 79. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 412. CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 130. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 163.

*Calendra simplex*, VAN DYKE, 1938, Pan-Pacific Ent., vol. 14, p. 187.

Small to medium; black or red, no coating, pronotum without raised vittae, elytral intervals flat, striae punctures indistinct and sunken inside of impressed striae.

Beak (from side) long, almost cylindrical, curved, narrower at apex or same width throughout, apex beneath rounded, base slightly swollen where beak meets head, slight keel present on sides near upper contour reaching from in front of eye to apex, no

fovea in front of eye; (from above) apex somewhat flattened, base with depression between head and beak, with impressed line which changes to slight keel beyond eyes, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum very long, without vittae but often with impunctate median space, and finely, evenly punctured, more strongly at base (red specimens often with black, but not raised, stripes on pronotum). Scutellum elongate, nearly parallel. Elytra with intervals flat, nearly equal in width, with scarcely visible punctures, usually even intervals with one row of punctures, but variable; striae on disc open all the way, narrow, sides straight, enclosing indistinct rectangular punctures (often seem impunctate), outer striae (seventh, sometimes eighth) with punctures more distinct, not sunken in striae. Under surface, sides of prosternum almost impunctate, apex of abdomen without depression. Legs, front tibiae with outer apical angle flared outward and prolonged into stout lobe, all tibiae sinuate at middle on inner side and with tuft of yellow hairs at sinuation, hind tibiae sharply angulate, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, in female a keel in center and depression each side of keel, in male, keel and depression less pronounced, both sexes with raised area at apex with finer, denser punctures. Length, 6–11 mm.

MALE CHARACTERS: Hind tibiae more sharply angulate.

TYPE LOCALITY: Tejon, California. Type in Museum of Comparative Zoölogy, Cambridge, examined.

DISTRIBUTION: Southwestern states north to southern Oregon and Wyoming, south to Baja California, Mexico.

SPECIMENS EXAMINED: *California*: 1 ♀; Tejon, 1 ♂ (type, M.C.Z. No. 5204), 1 ♂, 1 ♀ (cotypes), southern California, 2 ♂; Escondido, Jan. 3, 1934, Nov. 27, 1933, 1 ♂, 1 ♀; Lake Elsinore, Mar. 29, 1934 (M. A. Cazier), 1 ♀; Cuyama Ranch, Cuyama Canyon, Mar. 6, 1937 (M. A. Cazier), 1 ♂, 1 ♀; Dillon's Beach, May 6, 1935, 1 ♀; Palm Springs, Feb. 17 (Hubbard and Schwarz), 1 ♂; Hilmar, Merced Co., Apr. 18, 1939 (Fosen-Jones), 1 ♀, "collected from alfalfa"; Monticello, Napa Co.,

Feb. 23, 1947 (A. T. McClay), 1 ♀; Simi, Apr. 1, 1932 (A. T. McClay), 1 ♀. *Nevada*: Reno, May, 1939, Mar. 15, 1941 (La Rivers), 2 ♂; Truckee Meadows, near Reno, Washoe Co., Oct. 16, 1941 (La Rivers), 4 ♀. *Utah*: St. George, 1 ♀; Salt Lake City, Apr. 19 (H. Soltau), 2 ♂, 1 ♀; Callao, June 1, 1922 (T. Spalding), 1 ♂; Salt Lake, June 14, Horn Coll. No. 8980, 1 ♂; Provo (Wickham), Horn Coll. No. 8980, 1 ♂. *Wyoming*: 1 ♀. *Oregon*: Hot Springs, 6 miles south of Alvord Ranch, Harney Co., 4200 ft., June 28, 1947 (F. Ellertson), 1 ♂.

Mexico. *Baja California*: Purissima, Oct., 1923 (W. M. Mann), 1 ♀.

DISCUSSION: Champion (1910, p. 163) placed *simplex* as a synonym of *memnonia* Gyllenhal, which is an error. I have seen the types of both species, and they are quite distinct. I have seen also the specimen of *simplex* at the British Museum (from Los Angeles, California, a female) which Champion identified as *memnonia*; it has the angulate hind tibiae and the cylindrical, apically narrowed beak which are characteristic of *simplex*. Another Mexican species, *C. angusta*, is somewhat similar to *simplex*, but it has different elytral striae, the pronotal punctures scarcely visible except at the base, the outer apical angle of the front tibiae not flared outward into a lobe, and the hind tibiae not angulate.

Six of 14 specimens are red, all but one having some black stripes on the pronotum; the stripes are not elevated. A specimen from Truckee Meadows, Nevada, has the seventh elytral interval broken through in two places near the base by the striae converging from either side, a type of aberration that occurs also in *C. gentilis*, *crenata*, *arizonensis*, *necydaloides*, *quadrivittata*, and possibly others.

This species might be confused with *subulata* (Arizona, New Mexico) or with *gentilis* (Oregon, Idaho, Nevada, California) because of the narrow, almost cylindrical beak, with the apex rounded beneath, and the general form, but it differs from these two by having the intervals of the elytra wider and the striae proportionately much narrower (scarcely more than a thin line), the hind tibiae sharply angulate in both sexes, the outer apical angle of the front tibiae flared outward, and the punctuation all over fine and small.

Differs also from *crenata* (Arizona, Colorado) in the last three characters and further by having the beak narrower, not wider, at the apex; and from *mormon*. (See the discussion under these two species.)

BIOLOGY: Satterthwait did not include *simplex* in his paper on host plants, but Van Dyke (1938, p. 187) has reported it on Bermuda grass lawns (*Cynodon dactylon*) in the San Francisco region, and one of the specimens examined above was collected on alfalfa (*Medicago*). It is usually, however, a marsh species. It was taken by La Rivers in Truckee Meadows, Nevada (near Reno), in salt grass along a wide irrigation ditch in company with *mormon* and *graminis*, under debris. This was in October and possibly, La Rivers suggested, they were congregating for hibernation. There were 50 *mormon* and twice that many *graminis*, but only four *simplex* were taken.

#### *Calendra mormon* (Chittenden)

Figures 50, 66

*Sphenophorus mormon* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 128.

*Calendra mormon*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161.

*Sphenophorus distichlidis* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 130.

Medium to large; black or red, no coating, pronotum without raised vittae, elytral intervals flat, striae punctures rectangular, sunken inside of impressed striae.

Beak (from side) long, keeled, curved, narrower at apex or same width throughout, apex beneath rounded, base slightly swollen where beak meets head, sharp keel present on sides near upper contour and extending from in front of eye to apex, no fovea in front of eye; (from above) apex flattened, base with depression between head and beak, with impressed line which changes to sharp keel beyond eyes, front of head with fine punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum without vittae but with median impunctate space, finely, evenly punctured, more strongly at base (red specimens often with black, not raised areas on pronotum). Scutellum narrower than long, usually grooved. Elytra with intervals flat, nearly equal in width, finely, densely punctured, sometimes even intervals with but one row of punctures but variable; striae on disc

open all the way, narrow, sides straight, enclosing indistinct rectangular punctures (more distinct than in *simplex*), outer striae (seventh, sometimes eighth) with punctures more distinct, not sunken in striae. Under surface, sides of prosternum almost impunctate, at least sparser than on pronotum, apex of abdomen without depression. Legs, front tibiae with outer apical angle flared outward and prolonged into stout lobe, all tibiae tending to sinuation behind the middle on inner side, with tuft of long yellow hairs at sinuation, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium without tufts of hair at sides of apex but with hairs in punctures (usually not visible), in female usually keeled in center and with slight depression each side of keel, in male, keel and depression less pronounced or lacking, both sexes with raised area at apex with finer, denser punctures. Length, 7–13 mm.

**MALE CHARACTERS:** Hind tibiae more visibly sinuate, the hairs longer, denser.

**TYPE LOCALITY:** No locality specified; type from Salt Lake City, Utah. Type in the United States National Museum, examined.

**DISTRIBUTION:** Northwestern states and southern Canada, south to northern California, Nevada, Utah, Colorado, Arizona (Satterthwait, 1931).

**SPECIMENS EXAMINED:** *Washington:* Grand Coulee, Steamboat Rock, July 10, 1902 (C. V. Piper), 1 ♂; Coulee City, Sept. 3, 1920 (R. C. Shannon), 1 ♀; Ritzville, Apr. 23, 1922 (M. C. Lane), 1 ♀; Lake McElroy, Paha, May 12, 1921 (M. C. Lane), 2 ♂; Neppel, Apr. 3, 1919 (M. M. Reeher), 1 ♀; Walla Walla, June 20, 1941 (K. M. and D. M. Fender), 1 ♀; Touchet, Mar. 24, 1939 (H. P. Lanchester), 1 ♂, 1 ♀. *Oregon:* Malin, May 21, 1923 (M. M. Reeher), 1 ♀; Klamath Falls, Oct. 12, 1939 (A. T. McClay), 1 ♀. *Montana:* Helena, May 1 (Hubbard and Schwarz), 1 ♀. *North Dakota:* Pleasant Lake, Aug. 21, 1949 (C. and P. Vaurie), 1 ♀. *Wyoming:* Laramie, Apr. 23, 1888 (Soltau), 1 ♂, July 13–14, 1949 (C. and P. Vaurie), 2[?]; Green River, July 22, 1949 (C. and P. Vaurie), 1[?]. *Colorado:* 1 ♂, 1 ♀. *Utah:* Salt Lake City, Apr. 19 (H. Soltau), 1 ♂, 1 ♀ (cotypes, *mormon*, U.S.N.M. No. 7877), 1 ♀ (paratype, *mormon*), Apr. 10 (H. Soltau), 4 ♀, (F. C. Pratt), 1 ♀; 1 ♂, 1 ♀; Salt Lake (T. H. Parks), 1 ♂; Hooper, Nov. 13–14, 1 ♀; Provo, June (Wickham), 1 ♀, Horn Coll. No. 8980, 1 ♀. *Idaho:* North end of Bear Lake, Aug. 10, 1949

(W. Gertsch), 1 ♂. *Nevada:* Reno, Feb. 4, 23, and March 15, 1941 (La Rivers), 2 ♂, 1 ♀; Truckee Meadows (near Reno), Washoe Co., Oct. 16, 1941 (La Rivers), 22 ♂, 28 ♀; Pyramid Lake, north end, Aug. 16, 1941 (La Rivers), 1 ♀; Humboldt Lake, June 26 (Wickham), 2 ♂; Lovelock, June (Wickham), 1 ♂; Gardnerville, May, 12, 1946 (A. T. McClay), 1 ♂, 1 ♀. *California:* Amedee, July 21–28, 4200 ft. (Wickham), 1 ♂, 2 ♀ (cotypes, *distichlidis*, U.S.N.M. No. 7878), 4 ♂, 6 ♀; Camp Bidwell, 1 ♂.

**DISCUSSION:** Comparison of the cotypes of *distichlidis* from Amedee, California, with the cotypes and topotypes of *mormon* from Salt Lake City, Utah, and with other *mormon* specimens from Utah, Nevada, Oregon, Washington, and Amedee, California, fails to show any specific differences. The characters used by Chittenden for separation either do not hold or prove too variable in *mormon*. Additional characters which were found to differentiate *mormon* from the closely related *simplex* separate *distichlidis* from *simplex* but not from *mormon*. I therefore consider *distichlidis* a synonym of *mormon*.

A specimen from Truckee Meadows, Nevada, has the second interval on one side of the elytra enclosed, at the base, within the first and second striae, as is characteristic of *C. gentilis*. A specimen from Touchet, Washington, has the third interval on one side of the elytra so enclosed.

Eight of 51 specimens are red but with dark suffusions on the pronotum. The rest are black though a number of black specimens have the elytra somewhat reddish. (See above, p. 62, for further discussion of variations.)

Differs from *subulata*, *gentilis*, and *crenata* principally by having the beak keeled on the top and sides and the outer apical angle of the front tibiae flared outward and prolonged into a stout lobe.

This species has been reported from British Columbia and Alberta, Canada.

**BIOLOGY:** The known host plants (Satterthwait, 1931a, p. 161) are *Scirpus occidentalis*, a bulrush of the sedge family (Cyperaceae), and *Distichlidis spicata*, a maritime grass also found in saline spots. The Truckee Meadows, Nevada, specimens were taken in company with many *C. graminis* and a few *C. simplex* under débris "in a saltgrass area along a wide

irrigation ditch" (La Rivers, in letter) in October. La Rivers also says that the weather had turned cold and perhaps these weevils were making ready to hibernate.

The Laramie, Wyoming, specimens, collected in July, were taken on the shores of an alkali lake, in salt grass (?) away from the water, in company with *C. cicatristriata*. The Green River specimen was taken walking on wet sand on the shores of the Green River, Wyoming. The North Dakota specimen was collected from the salt-encrusted surface of a dry alkali lake.

***Calendra subulata* (Chittenden)**

Figures 52, 67

*Sphenophorus subulatus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 173.

Small, slender; black or red, no coating, pronotum without raised vittae, elytra with intervals feebly convex.

Beak (from side) long, cylindrical, curved, narrower at apex, apex beneath rounded, base not swollen over antennal insertion, sides with slight keel, no fovea in front of eye; (from above) apex flattened, base with no impressed line, front of head not visibly punctured. Eye with lower corner below insertion of beak. No thoracic lobe. Pronotum without raised vittae but with median impunctate space finely, evenly punctured, larger punctures at base. Scutellum narrower than long, sometimes grooved. Elytra with intervals feebly convex, nearly equal in width, finely, faintly punctured in single rows, except on suture and third which often have extra punctures; striae on disc deep, narrow, with fairly distinct, closely placed, round punctures cutting slightly into the intervals, outer striae (seventh and eighth) with punctures not impressed. Under surface, sides of prosternum with punctures sparser than on pronotum, apex of abdomen with depression, round in male, more transverse in female. Front tibiae with outer apical angle not prolonged, but with small tooth, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, apex with raised area of finer, denser punctures. Length, 8–10 mm.

TYPE LOCALITY: New Mexico. Type in Carnegie Museum, Pittsburgh.

DISTRIBUTION: Arizona, New Mexico, and on the border of western Texas and northern Mexico.

SPECIMENS EXAMINED: *Arizona*: (Liebeck), 1 ♀. *New Mexico*: 1 ♂, 1 ♀ (paratypes, U.S.N.M. No. 8970); (Pergande), 2 ♂.

*Mexico. Chihuahua*: Paso del Norte (Höge), 1 ♀ [El Paso, Texas].

DISCUSSION: This species, of which so few specimens have been seen, is quite closely related to some Mexican species, a fact mentioned by Chittenden in his description. The combination, in *subulata*, of a very long, narrow, and apically narrowed beak and convex elytral intervals differentiates it from all the species near *simplex* north of Mexico and from all the species in Mexico except *ima* and *angusta*. These two, which occur in Durango, and *ima* also in Arizona, have beaks about as in *subulata*, but *angusta* has the elytral intervals markedly flat, the pygidium without a raised apical margin, and different male characters. In *ima* the elytral intervals are more or less flat but may appear feebly convex, as in *subulata*, but the striae are deeper and wider, with their punctures less distinct, enclosed within, not trespassing on, the intervals. The male of *ima* has a large oval patch of hairs on the last abdominal segment which is lacking in *subulata*. The pronotum in both these species is even more finely punctured than in *subulata*, often appearing nearly impunctate.

The penis in *subulata* (fig. 67) has a narrow chitinous border as in *simplex*, *mormon*, and *ima*, but it is not acutely pointed as in *ima* nor so rounded as in the other two. The female paratype of *subulata* was found to possess the small tufts of hairs on the sides of the apex of the abdomen as in *vomerina*, *memnonia*, and *championi*.

The Chihuahua specimen constitutes the first record for this species in Mexico, but, since Paso del Norte is the former name given by the Mexicans to El Paso, Texas, this record does not indicate a wide Mexican distribution. The above specimen was identified by Champion as *ima* for the "Biologia"; it is quite abraded and therefore has very fine pronotal punctures, but I believe it to be *subulata*, as it has the elytral striae punctures as there and has a definite depression at the apex of the abdomen. Unfortunately, *ima*

females were not examined for this character when they were available, but *subulata* females do have it.

***Calendra ima* (Gyllenhal)**

Figures 53, 68

*Sphenophorus imus* GYLLENHAL, 1838, in Schoenherr, *Genera et species curculionidum*, vol. 4, p. 936. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 166.

Small, slender; black or red, no coating, pronotum without raised vittae, elytral intervals flat.

Beak (from side) long, slightly curved, nearly cylindrical, narrower at apex, apex beneath rounded, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex scarcely flattened, base with no impressed line, front of head not visibly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum without raised vittae but with short median impunctate line, very finely, faintly, sparsely punctured, punctures slightly larger and denser at middle of base. Scutellum nearly parallel, not grooved. Elytra with intervals more or less flat, equal in width, finely, faintly punctured in single rows except on suture or third intervals which have extra punctures; striae on disc open all the way, deep, wide (nearly one-half the width of interval), sides straight, enclosing indistinct, merging punctures, outer striae (seventh and eighth) with punctures more distinct, not impressed. Under surface, sides of prosternum nearly impunctate, apex of abdomen without depression. Front tibiae with outer apical angle not prolonged, but with small tooth, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hairs at sides. Pygidium with tufts of hair at sides at apex, apex with raised area of finer, smaller punctures. Length, 6 mm.

**MALE CHARACTERS:** Metasternum and abdominal segments in center with short, thick hairs, last segment with oval patch of even denser, whitish hairs covering center third; front coxae with large, oval tuft of hairs; all femora and trochanters with fringe of hairs on inner side.

**TYPE LOCALITY:** Mexico; here restricted to Durango City and vicinity. Type in Stockholm museum, examined.

**DISTRIBUTION:** Southern Arizona; Southern Durango south to Mexico City and Puebla. Probably in the highlands.

**SPECIMENS EXAMINED:** Mexico. "Terre froide" (coll. Sallé, coll. Chevrolat), 1 ♂ (type), 1 ♂, 1 ♀; (Truqui), 1 ♂. *Durango*: Tepehuanes (Wickham), 1 ♂, 1 ♀; Durango City (Wickham), 1 ♂, 1 ♀. *Guanajuato*: 1 ♀. *Puebla*: 1 ♂, 1 ♀; Izucar, 1 ♂. *Mexico*: Toluca (Höge), 1 ♂, 1 ♀.

United States. *Arizona*: Pinal Mts., 1 ♂.

**DISCUSSION:** The above description is based on two male specimens, the type and one from Tepehuanes, which were the only ones available at the time of description. The elytral intervals and striae may be more variable than stated. Champion mentions a male from Puebla and a female from Toluca that have four faint narrow vittae on the pronotum and the alternate elytral intervals reddish.

This is the first record of *ima* in the United States. This species and *angusta* and *quadrivittata* have, as far as is known at present, about the same distribution. It is most similar to *angusta* in general appearance and in the narrow beak (fig. 53), but differs from it in the narrower elytral intervals and deeper striae, in the raised apical border and larger, coarser punctures of the pygidium, also in the presence, in the male, of the thick patch of hairs at the apex of the abdomen. It is also close to *subulata* (Arizona, New Mexico, and northern Chihuahua), differing from it also in the male patch of hairs, and further in the more finely punctured pronotum, flatter elytral intervals, and wider striae with merging punctures within. The male genitalia (fig. 68) are acutely pointed as in *angusta*, but have a very narrow chitinous margin.

***Calendra angusta* (Boheman)**

Figure 69

*Sphenophorus angustus* BOHEMAN, 1845, in Schoenherr, *Genera et species curculionidum*, vol. 8, pt. 2, p. 250. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 167, pl. 8, figs. 8, 8a.

Small, slender; black or red, no coating, pronotum without raised vittae, elytral intervals flat.

Beak (from side) short, slightly curved, cylindrical, narrower, or at least not wider at

apex, apex beneath rounded, base slightly swollen over antennal insertion, slight keel present on sides near upper contour, no fovea in front of eye; (from above) apex flattened, base with no impressed line, front of head not visibly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum very finely, faintly, sparsely punctured, punctures slightly larger and denser at middle of base. Scutellum nearly parallel, grooved. Elytra with intervals flat, smooth, equal in width (except third slightly wider), finely punctured, the even intervals in irregular single rows, odd intervals in double rows, or all with more or less double rows, the punctures about the same size as those on pronotum; striae shallow, with small, oval punctures within, usually separated, but sometimes merging. Under surface, sides of prosternum nearly impunctate, apex of abdomen without depression. Legs, front tibiae with outer apical angle slightly prolonged and flared outward, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium uniformly punctured; in female with hairs at sides and often center of apex and slight keel or impunctate line in center, male without hairs or keel. Length, 7–10 mm.

**MALE CHARACTERS:** Hind tibiae slightly sinuate within; center of metasternum and of first two abdominal segments with short, thick hairs; front coxae with large, elongate tuft of hairs; all femora and trochanters with fringe of hairs on inner side, longer and denser than in female, but often scarcely visible on hind legs.

**TYPE LOCALITY:** Mexico; here restricted to Durango City and vicinity. Type in Stockholm museum, examined.

**DISTRIBUTION:** Southern Chihuahua south to Hidalgo. Probably in the highlands.

**SPECIMENS EXAMINED:** Mexico. (Germar), 1 ♀ (type), 1 ♀; (ex. coll. Flohr), 1 ♂. *Chihuahua*: Gaborachic, 8000 ft., June 4, 1948 (G. M. Bradt), 1 ♂. *Durango*: (Wickham), 1 ♀; Otinapa, 8200 ft., Aug. 7, 1947 (Cazier, Gertsch), 11 ♂, 12 ♀; Durango City, 6200 ft., Aug. 14, 1947 (Cazier), 2 ♂. *Hidalgo*: Real del Monte, Pachuca (Richardson), 1 ♀.

**DISCUSSION:** The punctuation of the elytral intervals, as in *graminis*, *vomerina*, and some other species, is quite variable; one in-

dividual has the second interval on one side of the elytra with double rows of punctures, but on the other side with a single, though somewhat irregular row. The punctures in this species, however, are always fine.

Three specimens, including the type, out of 26 have the elytra red or reddish; the others are entirely black. The type has a label written in Champion's handwriting which reads, "*angustatus* var. B," but he makes no reference in the "Biologia" to any variety, and the type does not differ from other specimens.

This species is rather similar in general appearance to a number of other small species, all of which have the pronotum faintly punctured, the elytral intervals flat and minutely punctured, and a nearly cylindrical beak, not widened apically. It is distinguished from them, as well as from three others that have the pronotum more distinctly punctured (*crenata*, *lineata*, and *quadrivittata*), either by the presence of a tuft of yellow hairs on the front and middle trochanters and/or by the absence of a raised apical border on the pygidium, or both. In spite of these differences, *angusta* closely resembles *ima* and *subulata*, and, to a lesser degree, *simplex* and *mormon*. It differs further from the three latter species in its hairy ventral cavity in the male and in the penis, which has a long, acutely pointed apex and a broad chitinous border (fig. 69).

#### *Calendra crenata* (LeConte)

Figure 70

*Trichischius crenatus* LECONTE, 1876, Proc. Amer. Phil. Soc., vol. 15, p. 426.

Small; either entirely black, or brown with black stripes on pronotum, pronotum without raised vittae, but with impunctate median line, elytra with flat, scarcely punctured intervals.

Beak (from side) short, nearly cylindrical, nearly straight, the same width throughout or slightly wider at apex, apex beneath rounded, base not swollen over antennal insertion, slight keel sometimes present on sides near upper contour, no fovea in front of eye; (from above) apex rounded downward, base with definite impressed line extending forward, front of head finely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum uniformly, densely punctured ex-



cept for median impunctate line from near base to front of middle (punctures about the size of those on elytral striae), brown specimens with two wide lateral black stripes, not reaching base or apex, and two oval black spots on sides in front. Scutellum narrower than long, flat. Elytra with all intervals flat and about equal in width, the few fine punctures scarcely visible; striae open, with small, merging, but sometimes separated, round or oval punctures that scarcely cut into the intervals. Under surface, sides of prosternum punctured as on pronotum. Apex of abdomen without depression. Legs, front tibiae with outer apical angle not prolonged but with small tooth, and slightly flared outward, front tibiae, in female markedly sinuate at middle within, other tibiae scarcely sinuate, all tibiae straight in male, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium densely, uniformly punctured except at apex, which is impunctate, without hairs, convex in female, bent sharply downward and concave in male, Length, 7.5–10 mm.

**MALE CHARACTERS:** Ventral cavity from front of metasternum to base of second abdominal segment with an oval patch of long, pale, abundant hairs; apex of abdomen with sparser, finer hairs; all femora and tibiae with fringe of long, pale hairs on inner side; coxae with larger tufts of hair than in female; front tibiae straight.

**TYPE LOCALITY:** Colorado. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Colorado, Arizona, New Mexico.

**SPECIMENS EXAMINED:** *Colorado:* 1 ♂ (type, M.C.Z. No. 5440). *Arizona:* Lake Mary, Coconino Co., Aug. 11, 1948 (C. and P. Vaurie), 6 ♂, 8 ♀; Mormon Lake, Coconino Co., 7000 ft., Aug. 12, 1948, (G. Ball?), 1 ♀ "on ground under log." *New Mexico:* (H. C. Fall), 1 ♀.

**DISCUSSION:** Although LeConte made a monotypic genus for the reception of this species, saying it was close to *Calendra*, I have seen the type and in my opinion it could not be other than *Calendra*. The characters mentioned by LeConte are the projecting pygidium, which is found also in *C. mormon*, *C. simplex*, and others; the concave, declivous pygidium, which is found also in males of

*C. aequalis*; the long hairs in the ventral cavity and on the femora and tibiae, which occur also in males of *aequalis* and of *C. schwarzii*. The fringe of hairs LeConte saw at the apex of the pygidium are actually on the last segment, which is extruded in the type specimen.

This species shows two distinct color phases, 10 (three males, seven females) of the 17 specimens being light brown, with black pronotal stripes, the other seven (four males, three females) being all black, as in the type. The brown specimens are mostly black below except on the front of the prosternal sides and on the legs which, however, are spotted with black. Two of the black specimens have a suggestion of red or brown on the prosternum, and one of these also has the apex of the beak reddish. The type has brown areas on the shoulders of the elytra, on the sides of the apex of the abdomen, and on the center of the pygidium.

The elytral striae punctures are deeper and more distinct in some specimens than in others. Two individuals have the intervals interrupted by the converging of the striae on either side, as has been noticed in other species of the genus. In nine of 15 specimens, the beak is somewhat wider at the apex, but it is never widely dilated as in some species. In the type it is even somewhat narrower at the apex.

This species is unusual in the fact that the front tibiae on the inner side are sinuate, almost angulate, in the female, but not so in the male.

There are six other species that may have the same bicolored pronotal pattern, *quadrivittata*, *lineata*, *gentilis*, *subulata*, *sayi*, and *ima*. *C. crenata* differs from all of these as well as from *simplex*, *mormon*, and *augusta*, in the male characters: the long, abundant ventral hairs and the concave apex of the pygidium. The female can be distinguished from the females of *subulata*, *ima*, and *augusta* by the shorter, broader beak, from females of *gentilis* and *mormon* by the almost impunctate elytral intervals, of *simplex* by the fact that the hind tibiae are only slightly sinuate within and the front tibiae very sinuate, the elytral striae punctures more distinct, from females of *quadrivittata* and *lineata* by the lack of a depression at the

apex of the abdomen and the very sinuate front tibiae, and of *sayi* by the absence of any elevations on the pronotum.

**BIOLOGY:** The Lake Mary specimens were taken at the moist edge of this fresh-water lake among small pebbles and rocks or on very soft mud; some were walking along the shore, some in the water. At a few places along the shore there were low reeds or grasses 5 or 6 feet away in the water and also about 20 feet inland from the shore line.

***Calendra quadrivittata* (Gyllenhal)**

Figure 71

*Sphenophorus quadrivittatus* GYLLENHAL, 1838, in Schoenherr, *Genera et species curculionidum*, vol. 4, p. 962. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 165, pl. 8, figs. 6, 6a.

Medium; mostly black below, mostly red above, pronotum with three black stripes, not raised, sometimes merged, elytra with alternating black and red intervals or mostly red.

Beak (from side) long, curved, scarcely compressed, slightly, or not at all, wider at apex, apex beneath rounded to obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with no, or very slight, impressed line, front of head scarcely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum without raised vittae, but with three black stripes of varying widths, and sometimes merging together, reaching from base to apex, finely punctured; the red interspaces also finely punctured except at middle of base where punctures are larger. Scutellum narrower than long. Elytra with intervals equal in width, flat to feebly convex, finely, faintly punctured, even ones in single rows, odd ones in more or less double irregular rows; striae open, with small merging punctures that scarcely cut into the intervals. Under surface sometimes scarcely punctate anywhere, sometimes definite punctures on sides of metasternum and sides of first two abdominal segments. Apex of abdomen with depression. Front tibiae with outer apical angle not prolonged, but with slight sinuation before apex and minute tooth, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, apex with raised area of smaller,

finer punctures and trace of median keel. Length, 6–9 mm.

**MALE CHARACTERS:** Apical abdominal segment more or less hollowed down the middle from near base to apex; front and middle femora and coxae with long thick hairs.

**TYPE LOCALITY:** Mexico; here restricted to Durango City and vicinity. Type in Stockholm museum, examined.

**DISTRIBUTION:** Southern Durango, south to Mexico City. Probably in the highlands.

**SPECIMENS EXAMINED:** Mexico. "Terre froide," (Chevrolat), 1 ♂ (type); (Truqui), 1 ♀; 1 ♂, 3 ♀. *Durango:* Otinapa, 7500 ft., Aug. 7, 1947 (Cazier, Gertsch), 54 ♂, 22 ♀; 6 miles northeast of El Salto, Durango Dist., 8500 ft., Aug. 10, 1947 (Cazier, Gertsch), 26 ♂, 11 ♀; Durango City, 6200 ft., Aug. 14, 1947 (Cazier, Gertsch), 1 ♂, 2 ♀. *Puebla:* (Sallé coll.), 2 ♀. *Distrito Federal:* Mexico City (Höge), 2 ♀.

**DISCUSSION:** Of 116 specimens, the majority (69) have the pronotum reddish, with three longitudinal black stripes of varying widths but separated from one another, the scutellum black, and the elytra reddish, with black stripes, in full or part way, on the sutural, third, fifth, and seventh intervals, the latter interval being black at the base only (the type has the suture red). The other 47 specimens have either more black on the pronotum and elytra, or less; on the pronotum four specimens have the black stripes touching in the center, one has them merged in front, and four have them almost entirely merged; on the elytra one dark specimen with the pronotal stripes merged has additional black on the eighth interval, and the rest have less black than the typical specimens as follows: 28 have no black on the seventh interval, six have no black on the sutural, third, or seventh intervals, two have no black on the third or seventh, one is all red except on the suture, and one is all red except on the scutellum.

Below the legs are red, sometimes with black areas on the femora; the mesosternum, metasternum, and abdomen are black except the lateral apex of the latter, and the prosternum is mostly black.

On the disc of the elytra on a specimen from Otinapa, Durango, the fourth interval is interrupted by the crossing of the third and fifth intervals, an aberration that has been

noticed in a number of species.

This species is very closely related to *lineata* from Guerrero, differing in the finer punctuation below, especially on the last abdominal segment, in the longer, not transverse depression on that segment in the male; the male differs also in the fringe of thick hairs on the front and middle femora within and the large tuft of hairs on the coxae. The male genitalia also differ (figs. 71, 72).

Differs from *crenata* (Colorado, Arizona), which is often similarly colored, in addition to certain male characters, by having the sides of the prosternum scarcely punctured, the pygidium very coarsely punctured, the apical margin of the pygidium with a raised border.

Differs from *subulata* (New Mexico, Arizona) in the stouter, not apically narrowed beak and the male characters mentioned above.

The penis is more pointed than in *subulata* or *crenata* and has the apical chitinous border broader. It is more like the penis of *nevadensis*.

BIOLOGY: The large series of 76 specimens from Otinapa, Durango, was collected in August in and around a pond. Some of the weevils were found going up and down the stems of reeds in the water, many of them copulating; others were taken under stones or debris on the shores.

#### *Calendra lineata* (Champion)

Figure 72

*Sphenophorus lineatus* CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 166, pl. 8, fig. 7.

Medium; black below, mostly red above, pronotum with three black stripes, not raised, elytra all red or with alternate intervals darkened.

Beak (from side) long, curved, nearly cylindrical, scarcely wider at apex, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with no impressed line, front of head not visibly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum without raised vittae, but with three black stripes extending from base to apex, the median mostly impunctate, the laterals finely punctured; the red interspaces punctured as on the laterals towards

apex, but at middle of base punctures about four times larger and merging. Scutellum narrower than long. Elytra with intervals equal in width and feebly convex, the few fine punctures visible only under high magnification; striae open, with large merging punctures (size of those on base of pronotum) cutting part way into intervals. Under surface, sides of prosternum, mesosternum, and center of metasternum and abdomen nearly impunctate, sides of metasternum and abdomen and all of last abdominal segment strongly punctured. Apex of abdomen slightly transversely depressed. Front tibiae with outer apical angle not prolonged, but with minute tooth, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, apex with raised area of very fine punctures, rest with coarse, deep, dense punctures. Length, 7–9 mm.

TYPE LOCALITY: Amula, Guerrero. Type in British Museum, examined.

DISTRIBUTION: Southern Mexico.

SPECIMENS EXAMINED: Mexico. *Guerrero*: Amula, 6000 ft., Aug. (H. H. Smith), 1 ♂ ? (type, abdomen missing); 2 ♂.

DISCUSSION: This species is exceedingly close to *quadrivittata*, resembling it in size, color pattern, pygidium, tibiae, tarsi, antennae, and beak. The differences are that *lineata* is more strongly punctured on the pygidium, on the elytral striae, sides of the metasternum and abdomen, especially the last abdominal segment; that it has the depression on the last abdominal segment closer to the apex and more transverse, not elongate as in *quadrivittata*; and that the male has no fringe of hairs along the inner side of the femora, but merely a small tuft at the base and a smaller tuft of hairs on the coxae. The apex of the penis is also quite different, the margin being quite rounded in *lineata*, but coming to an acute angle in *quadrivittata* (figs. 71, 72). The latter seems to be generally more northern in distribution, although specimens have been seen from as far south as Puebla and Mexico City; *lineata* is known from central Guerrero only.

None of the other small Mexican species regularly has the red (or brownish) and black pattern of *lineata* and *quadrivittata*. But *cre-*

*nata* from the vicinity of Flagstaff, Arizona, has virtually the same pattern in its brown phase. In addition to some male differences between these two species, *crenata* differs from *lineata* by having strong, dense punctures on the sides of the prosternum and the pygidium, with much finer punctures and no raised border at the apex.

*Calendra lineata* differs from *subulata*, from New Mexico, in its stouter beak which is not distinctly narrowed at the apex.

***Calendra gentilis* (LeConte)**

Figures 28, 73

*Sphenophorus gentilis* LECONTE, 1860, Reports of explorations . . . from Mississippi . . . to . . . Pacific Ocean, vol. 12, pt. 3, p. 58. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 426.

*Calendra gentilis*, VAN DYKE, 1938, Pan-Pacific Ent., vol. 14, p. 187.

Small; red or black, no coating, pronotum with impunctate median line, raised or not, elytra with flat intervals, striae punctures indistinct, sunken inside of impressed striae.

Beak (from side) long, nearly cylindrical, curved, same width throughout, apex beneath rounded, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex not flattened, base with indistinct impressed line, upper corner of eye with small tuft of hairs, front of head nearly impunctate. Eye with lower corner below insertion of beak. No thoracic lobe. Pronotum without vittae, but with impunctate median line from base to apex; usually, but not always, raised (red specimens often with black, but not raised, lateral stripes), pronotum densely, deeply, evenly punctured. Scutellum narrower than long, often nearly parallel. Elytra with intervals raised, but flat, about equal in width, but variable, with single rows of large, usually touching punctures that sometimes nearly fill the interval (often double row at base of third), second interval usually not reaching to base but enclosed within first and second striae; striae deeply cut, often nearly as wide as intervals, their sides usually straight, enclosing indistinct punctures. Under surface, sides of prosternum punctured usually less densely than pronotum, apex of abdomen with hairs protruding from punctures. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow,

longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex (red specimens often with black line down center), evenly punctured throughout. Length, 6–10 mm.

**MALE CHARACTERS:** Slight longitudinal depression on last abdominal segment outlined by tufts of hairs (usually worn off).

**TYPE LOCALITY:** San José, California. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Oregon, Idaho, Nevada, and California.

**SPECIMENS EXAMINED:** *Idaho:* 2 ♂; Pocatello (Wickham), 2 ♂, 1 ♀. *Nevada:* 1 ♂, 1 ♀; Horn Coll. No. 8999, 1 ♂. *Oregon:* Corvallis, June, 1899 (Cordley), 1 ♀; Harper, May 21, 1935 (H. P. Lanchester), 1 ♂; Farewell Bend, Snake R., June 18, 1941 (K. M. and D. M. Fender), 1 ♂, 4 ♀; McMinnville, Apr. 27, June 14, 1942 (K. M. and D. M. Fender), 4 ♀; Bly Mts., June 12, 1945 (K. M. Fender), 1 ♀. *California:* 1 ♀ (type, M.C.Z. No. 5208); 3 ♀; Palo Alto, Stanford Univ., May, 1923, 1 ♀; Yuba City, Sutter Co., May 9, 1932 (L. S. Jones), 1 ♂; Yolo Co., May 31, 1932 (C. Hardy), 1 ♀, "collected from alfalfa"; Woodland, May 13, 1933 (E. C. Zimmerman), 1 ♀; Manteca, San Joaquin Co., June 15, 1929, 1 ♂, "reared from corn," 1 ♀, "collected from corn"; Niles, Mar. 19, 1934 (M. A. Cazier), 4 ♀; Laurel Beach, Lake Co., Mar. 6, 1932 (M. A. Cazier), 1 ♀; Coalinga, May 14, 1938 (M. A. Cazier), 1 ♀; Willits, June 8, 1932 (M. A. Cazier), 1 ♀; Fort Seward, May 28, 1935 (E. W. Baker), 2 ♂, 1 ♀; Sonoma Co., May 20, 1910 (F. W. Nunenmacher), 1 ♀; Forestville, Sonoma Co., May 20, 25, July 14, 1936 (A. T. McClay), 6 ♀, May 17, 1937, May 19, June 6, 1938 (A. T. McClay), 2 ♂, 11 ♀; Clear Lake, June 10, 1936 (A. R. Mead), 1 ♂, lower pond, Apr. 22, 1938 (A. T. McClay), 1 ♀; Sacramento, May 7, 1941, May 6, 1944, May 20, 1946 (A. T. McClay), 2 ♂, 1 ♀; Mar. 16, 1942 (C. C. Wilson), 1 ♂, May 2, 1931 (H. H. Keifer), 1 ♂; Sacramento Co., 1 ♂, 1 ♀; Freeport, May 24, 1941 (A. T. McClay), 1 ♂; Alameda Co., July 30, 1901 (F. W. Nunenmacher), 1 ♀; Glen Ellen, Apr. 28, May 17, 1937, May 19, June 6, 1938 (A. T. McClay), 266; San Antonio Canyon, San Bernardino Co., June 25, 1930, 1 ♀; Davis, Jan., May, 1949, 1 ♂, 1 ♀.

**DISCUSSION:** The presence of a tuft of hair at the top corner of the eye has not been noticed on any other species (fig. 28); it is, of course, sometimes worn off, but of 31

fresh specimens, it is visible in 24. The enclosing of the second elytral interval within the first and second striae at the base also seems unique in *gentilis*, although the tendency is present in some *tarda* where the second interval is very narrow at the base; and two of 106 *mormon* have this interval enclosed on one side of the elytra.

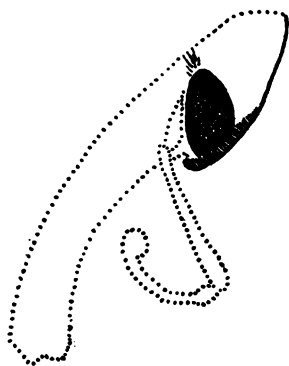


FIG. 28. Tuft of hairs at upper corner of eye in *Calendra gentilis*.

*Calendra gentilis* is more often all red with black markings on the pronotum than it is either all black or with black pronotum and red elytra. Of 51 specimens, 39 have the pronotum red with black. All phases occur in the same locality. A similar color pattern occurs in *C. crenata* (Arizona, New Mexico, Colorado) and *C. sayi* (most of the United States).

There is quite a difference in size in *gentilis*, some females being as small and narrow as many of the males. In the larger specimens, male or female, the elytral intervals and the scutellum are proportionately much broader than in the smaller ones. The latter usually have the striae nearly as wide as the intervals, and the intervals are almost entirely filled from side to side by the large punctures.

A specimen from Harper, Oregon, and two from Forestville, California, have the fourth interval broken through in two places by the striae on either side, leaving a narrow island; other intervals also occasionally are interrupted. This occurs also in *arizonensis*, *crenata*, *simplex*, and *diversa*.

The structure of the elytral striae is very similar to that in *simplex* and *mormon*, but *gentilis* differs from them, as well as from *subulata* and *crenata*, by having the elytral

intervals coarsely punctured, with generally large punctures in single rows, except at base of third interval, and the first and second striae merging across the second interval at the extreme base.

Differs from *tarda*, which it resembles in the punctuation of the intervals and in the male genitalia (figs. 73, 74), and from *graminis* by having the beak narrow throughout and nearly cylindrical, not apically widened and strongly compressed, and the apex of the beak below rounded, not acute.

**BIOLOGY:** Although usually a marsh species *gentilis* was found on Bermuda grass (*Cynodon dactylon*) lawns in the San Francisco region (Van Dyke, 1938, p. 187) and has been reared from corn grown at Manteca, San Joaquin County, California. This corn was growing "on newly cleared river bottom land" (Peter C. Ting, in letter). A specimen from Yolo County, California, was collected on alfalfa.

#### *Calendra tarda* (Fall)

Figure 74

*Sphenophorus tardus* FALL, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 269. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 156.

Small, robust; black, no coating, pronotum with impunctate median line, raised or not, elytra with intervals flat and with single rows of large touching punctures.

Beak (from side) short, compressed, slightly curved, wider at apex, apex beneath acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with indistinct impressed line, front of head scarcely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum nearly as long as elytra, with narrow impunctate median line usually somewhat raised, rest densely, evenly punctured, sometimes vague impressions of lateral vittae at base. Scutellum narrower than long. Elytra with intervals flat, even ones much narrower, with single row of large touching punctures that usually take up most of the width of interval, odd intervals, except suture, with irregular, single, or double rows, suture with single row; striae often nearly as wide as intervals, usually obscured by mud, but more or less open, with punctures round or oval, often merging. Under surface, pro-

sternum similar to pronotum, but punctures less dense, apex of abdomen without depression. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, front with it sometimes dilated but longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, apex with smaller punctures. Length, 6–8 mm.

**MALE CHARACTERS:** Ventral cavity very shallow.

**TYPE LOCALITY:** San Bernadino, California. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Southern California. Wilcox, Arizona (Chittenden).

**SPECIMENS EXAMINED:** *California:* 1 ♀; southern California (Chas. Palm), 1 ♂, 2 ♀, (Andreas Bolter), 1 ♂; Ventura, July 19, 1939 (R. Cecil), 1 ♂; Carpinteria, Feb. 16, 1944 (M. Cravens), 1 ♂; Costa Mesa, Orange Co., Dec. 11, 1942 (Bomgardner), 1 ♀; Los Angeles Co., Aug. 8, 1931 (G. Woodhams), 1 ♀, "collected from lawn"; Montebello, Los Angeles Co., May 30, Sept. 13, Oct. 10, 1932 (A. T. McClay), 15 ♂, 19 ♀, June 1, 1934 (A. T. McClay), 2 ♂, 2 ♀, Aug. 29, 1931, 2 ♂, 1 ♀, "collected from Bermuda grass"; Alhambra, Los Angeles Co., Sept. 11, Oct. 23, 1942 (R. M. Bohart), 2 ♂, 2 ♀, "Bermuda grass"; Whittier, June 8, 1940, 1 ♂, 1 ♀, "reared from larvae collected in soil"; south Pasadena, Apr. 1, 7, 12, Oct. 1, 1932 (A. T. McClay), 2 ♂, 2 ♀; Santa Barbara, Feb. 27, 1932 (A. T. McClay), 1 ♂; San Gabriel, June 23, 1941 (R. M. Bohart), 1 ♂, "Blue grass"; Southgate, Los Angeles Co., Aug. 6, 1941 (R. M. Bohart), 1 ♀, "Bent grass"; Westwood Hills, Los Angeles Co., July, 1941 (R. M. Bohart), 1 ♀, "Blue grass"; San Bernardino Co., July, 1900 (F. W. Nunenmacher), 3 ♂, 3 ♀; San Diego Co., July, 1907 (F. W. Nunenmacher), 1 ♀; Chula Vista, San Diego Co., Nov. 25, 1931 (R. R. McLean), 1 ♀, "coll. from dewberries"; San Bernardino, Dec., 1889, 1 ♀ (type, M.C.Z. No. 25239), 3 (cotypes).

**DISCUSSION:** Except for Chittenden's Arizona record (1924, p. 156), *tarda* is known from southern California only.

In contrast to members of the *simplex* group (except *gentilis*), this species always has the median pronotal line and almost always has it slightly raised. An occasional specimen will also have two small impunctate areas in front of the middle on each side of the median line; these areas have been noted in other species (*gentilis*, *necydalooides*, *gr-*

*minis*, *blanchardi*). In a few individuals there is a suggestion of raised laterals at the base with a small, V-shaped, depressed area between them.

The elytra are quite variable. Although generally it is only the even intervals that have single rows of punctures, in nine of 23 males and one of 27 females, the odd intervals three and five also have but one row, with a few extra punctures here and there. The striae are usually, but not invariably, very wide in proportion to the intervals, and the fact that they are often filled with mud makes them seem even wider. The striae punctures are much smaller than those on the intervals and often can be seen to cut slightly into the intervals.

*Calendra tarda* has much the same type of genitalia (fig. 74) and the same type of elytral and pronotal pattern as *gentilis*, but can always be told from that species by the stout, apically widened, compressed beak. It is also more robust, has the elytra proportionately shorter, and the tibiae stouter.

Differs from *graminis* and *vomerina* in its smaller size, by having one row of punctures on the outer edge of the elytral suture, not two or three rows filling the suture from side to side, by having the elytra more rapidly narrowing to the apex and scarcely longer than the pronotum, the prosternum much more strongly and densely punctured, and the elytral striae usually wider.

**BIOLOGY:** Some of the Los Angeles County specimens were taken on Bermuda grass (*Cynodon dactylon*), blue grass, and bent grass; also on lawns which were probably of Bermuda grass.

#### *Calendra graminis* (Chittenden)

Figures 20, 29, 75

*Sphenophorus graminis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 168. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 164. ESSIG, 1926, Insects of western North America, p. 508.

*Sphenophorus subopacus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 169.

*Sphenophorus monterensis* CHITTENDEN, 1905, *ibid.*, vol. 7, pp. 169–170.

Small, robust; black or red, no coating, pronotum without raised vittae, elytra with flat intervals, striae punctures indistinct, sunken inside of impressed striae.



Beak (from side) short, compressed, curved, wider at apex, apex beneath acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex with cup-like depression, base with impressed line indistinct, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum without vittae but sometimes with impunctate median space, the rest finely, closely, evenly punctured (red specimens may have black M on pronotum, but it is not raised). Scutellum narrower than long. Elytra with alternate intervals usually wider, all intervals flat, even intervals usually with one row of irregular punctures, odd ones with two or three rows, but variable, the punctures about the same size as those on pronotum, outer intervals usually depressed at middle and obscured by mud; striae open all the way, sides slightly sinuous, enclosing small, round, ill-defined punctures within. Under surface, sides of prosternum finely, sparsely punctured, occasionally stronger, rest below strongly punctured, apex of abdomen with depression, but feeble. Legs, front tibiae with outer apical angle minutely prolonged, outer margin sinuate before apex, all tarsi (except of male) with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hairs at sides at apex, and with raised area at apex with finer, denser punctures. Length, 7–10 mm.

**MALE CHARACTERS:** Third tarsal segment on front legs dilated, about as wide as long, but variable, and wider than preceding segments.

**TYPE LOCALITY:** No locality specified; type from The Dalles, Oregon. Type in the United States National Museum, examined.

**DISTRIBUTION:** Throughout California, north to Oregon, Idaho, east into Nevada, Utah, Wyoming, and South Dakota.

**SPECIMENS EXAMINED:** *Idaho:* 1 ♂. *Oregon:* The Dalles, May 18, 1 ♂ (type, *graminis*, U.S.N.M. No. 8966), (Hubbard and Schwarz), 1 ♀ (allotype, *graminis*), 1 ♂, 1 ♀ (paratypes, *graminis*), 3 ♂; Baker, Apr. 18, 1937 (J. H. Baker), 1 ♂, 2 ♀; Harper, May 21, 1935 (H. P. Lancaster), 1 ♂. *California:* (C. V. Riley), 1 ♂; 1 ♂, 2 ♀; Horn Coll. No. 8981, 5 ♂, 1 ♀ [in Horn's type series of *C. vomerina*]; (Ulke), 2 ♀ (cotypes, *subopacus*, U.S.N.M. No. 8967); Monterey Co.,

1 ♂ (type, *monterensis*, U.S.N.M. No. 8969); Long Beach, 2 ♂; Escondido, Jan. 3, 1934 (Cazier), 1 ♂; Carmel, Apr. 20, 1 ♀; Amedee, July 21–28, 4200 ft. (Wickham), 3 ♂, 2 ♀; Owen's Valley, Inyo Co., June 2, 1937, 3 ♂, 4 ♀; Simi, Apr. 1, 1932 (A. T. McClay), 1 ♀; Santa Paula, Mar. 24, 1932 (A. T. McClay), 1 ♂; Coleville, Mono Co., May 28, 1939 (Ting *et al.*), 1 ♀; Rosedale, Kern Co., Mar. 18, 1912 (J. C. Bridwell), 1 ♂; Kern Co., Apr. 13, 1940 (F. W. Nunenmacher), 13 ♂, 9 ♀; Siskiyou Co., June 4, 1941 (F. W. Nunenmacher), 6 ♂, 6 ♀; Antioch, Contra Costa Co., May 27, 1938, 1 ♀, June 15, 1941 (W. F. Barr), 1 ♀; southern Joaquin Co., May 6, 1914 (F. W. Nunenmacher), 1 ♀; Alameda Co., July 30, 1901 (F. W. Nunenmacher), 1 ♀; Bay Farm Island, Alameda Co., May 18, 1940 (W. F. Barr), 1 ♀; Tulare Co., 1 ♂; Sacramento, May 16, 1928 (B. G. Thompson), 1 ♀, June 30, 1930 (H. H. Keifer), 1 ♀, Mar. 16, 1932 (C. C. Wilson), 1 ♀, Swanston Ave., Sacramento R., Apr. 18, 1946 (P. C. Ting), 1 ♀, "collected from *Calendria* on *Artemisia*"; Sacramento Co. (Essig), 1 ♀; Santa Maria, Santa Barbara Co., Aug. 29, 1946, 1 ♂, "collected from lawn"; Fresno (E. A. Schwarz), 1 ♀. *Nevada:* Reno, Feb., Mar., 1941 (La Rivers), 6 ♂, 5 ♀, Mar., Apr., 1941 (La Rivers), 1 ♂, 3 ♀; Reese R., Lander Co., near Austin, May 21, 1949 (La Rivers), 1 ♀; Truckee Meadows (Reno), Washoe Co., Oct. 16, 1941 (La Rivers), 7 ♂, 6 ♀. *Utah:* St. George, 2 ♂; Salt Lake City, Apr. 19, 2 ♂; Dinosaur Natl. Mon., Uintah Co., July 19, 1949 (P. and C. Vaurie), 1 ♀. *Wyoming:* Laramie, May 20, 1893 ("Nisw."), 1 ♂, 2 ♀. *South Dakota:* Volga, 1 ♀.

**DISCUSSION:** This species varies in many ways: it is either reddish or black or a combination of the two, shiny or opaque; the pronotum is sometimes deeply punctured, sometimes shallowly and more finely, the median line may be present or not; the punctuation and the relative widths of the elytral intervals are irregular and erratic; the male front third tarsal segment is more dilated in some specimens, less so in others. Examination of three long series from Reno, Nevada, and Kern and Siskiyou counties in California shows that there are three characters that seem rather more constant than those mentioned above. These are: (1) the shape of the beak, which is short, robust, smoothly curved, apically widened, sometimes to nearly twice the width as at the middle, and with the angle below sharp (fig. 29); (2) the sinuation on the outer side of the front tibiae before the apex and the consequent slight broad-

ening of the apex (fig. 20); and (3) the long, narrow, acute inner claws on all tibiae which are as long as the width of the tibiae at the apex. These are the characters, plus the male genitalia and the somewhat larger, deeper punctures on the prosternum, that differentiate *graminis* from its closer relative, *vomerina*, and it is on the basis of these three characters and the great variability in *graminis* that I have synonymized *monterensis* and *subopacus*.

In the type of *monterensis* (Monterey County, California), the punctuation is somewhat denser than in most *graminis* and the pronotal median space is longer; in the cotypes of *subopacus* ("Cal."), the punctuation is finer than in most *graminis* and the

obscure or make smaller the punctuation. In 16 specimens of *graminis* from Truckee Meadows, Nevada, the 10 specimens with larger punctures on the elytral intervals were all shiny individuals, while the six with smaller punctures had the surface opaque and dull. This may be the explanation of Chittenden's "*subopacus*."

The 16 Truckee Meadows specimens, also six specimens from Owen's Valley, and 14 others from various localities were examined for variations in the pronotum and in the elytral punctuation. It was found that three of these 36 specimens had the second and fourth elytral intervals with but one row of punctures, that one had them with one irregular row, with two or three punctures present

TABLE 2  
VARIATIONS IN THE PRONOTUM IN *Calendra graminis*

	Truckee Meadows, Nevada	Owen's Valley, California	Various Localities
No median space present	10	—	5
Slight median space present	5	6	4
Well-marked median space present	1	—	5

surface is opaque. All these variations, however, can be found in a series of *graminis*, and comparison of the types of the three forms shows no other reliable diagnostic characters. Chittenden described all three in the same paper with long, detailed descriptions, but a careful tabulation, in his own words, of the various characters used still does not differentiate "*monterensis*" and "*subopacus*" from *graminis*. Thus "*monterensis*" was said to have the third tarsal segment on the front legs "more than one-third wider than first," whereas in *graminis* it was "less than one-third wider" but with "considerable variation." In a small sample of the specimens examined, one male each from Kern and Siskiyou counties and one from Owen's Valley, Inyo County, California, and several males from Truckee Meadows, near Reno, Nevada, have this segment as wide as in the type of "*monterensis*."

The opaque surface in some *graminis*, as well as in members of the *simplex* group, especially *simplex* and *mormon*, may be due to wear or abrasion. It seems, at any rate, to

outside the row, and that the other 32 had all variations between the latter and scattered punctures nearly filling the intervals, at base only or all the way. The odd intervals three and five usually had more than a single row of punctures, at least at the base. In width the intervals were sometimes nearly equal, sometimes the third was much wider, sometimes the third and fifth were both wider than the others.

It can be seen from table 2 that only a few specimens have the median impunctate space well marked as a definite line. The "slight median space" does not appear as a line and must be searched for.

The outer apical angle of the front tibiae is longer in some specimens than in others, but it is never, as in *vomerina*, as long as the inner claw. One of the Laramie, Wyoming, specimens has the elytra, pronotum, and front of the head more distinctly punctured than in most specimens. Most *graminis*, even the black ones, have red or reddish legs, and seven of the 29 Nevada specimens are red all over except for dark suffusions on the pronotum.

Six specimens from California are in Horn's type series of *vomerina* in the Horn collection. *C. graminis* closely resembles *vomerina* in form, size, coloration, general pronotal and elytral pattern, but differs from it as follows: in the slightly sinuous, but not lobed, outer apical angle of the tibiae, in the shorter, more curved, more apically widened beak, in the proportionately longer, narrower inner tibial claw, in the stronger punctuation of the prosternum, in the somewhat finer and shallower elytral punctuation, in the greater dilation of the front third tarsal segment in the male, in the broader, more square-sided pygidium, and in the truncate, not pointed, male genitalia (fig. 75). The female also lacks the hairs at the sides of the apex of the abdomen. According to present records these two species have not been taken in the same localities and, although *graminis* has been examined from as far east as Volga, South Dakota, it has never been reported from the southwestern region where *vomerina* occurs, except in southern California, *graminis* having been taken at Owen's Valley and Escondido and *vomerina* at Needles, Blythe, and in Imperial County.

Differs from *memnonia* (Mexico and Tucson, Arizona) in the beak, the genitalia, the lack of apical abdominal hairs in the female, and in the generally stronger, coarser pronotal and elytral punctuation. Differs from *tarda* by having smaller punctures on the elytral intervals, especially on the even intervals, more than one row of punctures filling the sutural interval, the pronotum more finely punctured and with the median space, if present, not raised, and the prosternum more finely punctured.

**BIOLOGY:** Many specimens were collected by La Rivers in Truckee Meadows, near Reno, Nevada, in company with *mormon* and *simplex*, in a salt-grass area along an irrigation ditch, in October, under débris. The larvae have been reported as feeding on the roots of grasses (Essig, 1926, p. 508).

***Calendra vomerina* (LeConte)**

Figures 19, 30–33, 76

*Sphenophorus vomerinus* LECONTE, 1858, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 81. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p.

412. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 164.

*Sphenophorus vomerinus* var. *baridioides* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 413.

Small to medium, robust; black or red, not coated, pronotum without raised vittae, elytra with flat intervals, striae punctures indistinct, sunken inside impressed striae.

Beak (from side) short or long, compressed, scarcely curved, slightly wider at apex or nearly same width throughout, apex beneath obtuse or acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex concave or convex, base usually with no definite impressed line, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum without vittae but with impunctate median space from base to apex, finely, densely, evenly punctured. Scutellum narrower than long, often grooved or channeled. Elytra with odd intervals scarcely wider than even ones, all intervals flat, with strong, nearly touching punctures (larger than those at base of pronotum), sometimes all but suture with single row except for confusion at base, sometimes only even intervals with single row and others with two or three rows of punctures; striae open all the way, sides slightly sinuous, enclosing ill-defined, merging punctures within. Under surface, prosternum with fine, sparse punctures, no depression at apex of abdomen. Legs, front tibiae with outer apical angle flared outward and prolonged into stout lobe, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at sides of apex, with raised area at apex of smaller, denser punctures, and suggestion of median keel. Length, 8.5–10 mm.

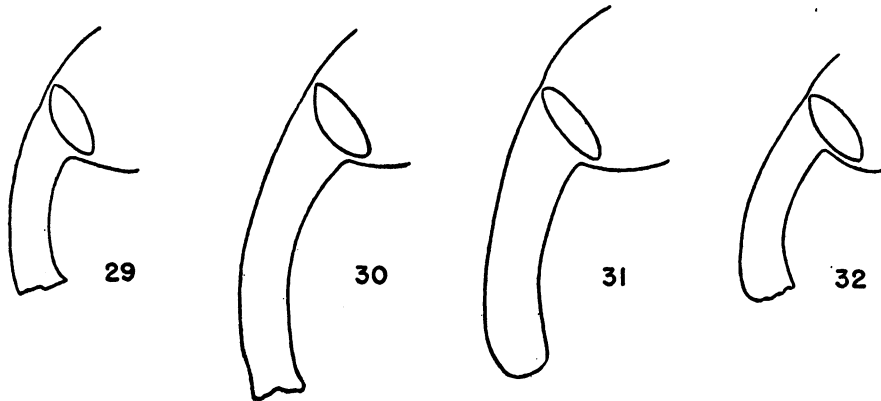
**TYPE LOCALITY:** Sonora, Mexico. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Northern Mexico, south-eastern California, Arizona, New Mexico, Texas north into Colorado, Kansas, Nebraska, eastern Montana into Alberta, Canada.

**SPECIMENS EXAMINED:** *California:* Horn Coll. No. 8981, 2 ♀ (cotypes, var. *baridioides*); Needles (Horn Coll. No. 8981), 1 ♂ (cotype, var. *bari-*

*dioides*); Blythe, Riverside Co., June 9, 1949 (Harper, Platt), 1 ♂ "coll. from honeydew melon"; Bard, Imperial Co., Nov. 13, 1945 (G. Beever), 1 ♂ "coll. from cotton field." *Arizona*: 3 ♀; (M. L. Linell), 2 ♀; Joseph City, Navajo Co., Aug. 15, 1948 (C. and P. Vaurie), 1 ♀; Winslow, July 31 (Barber and Schwarz), 3 ♂, 1 ♀; Holbrook, 2 ♀, Sept. 15 (H. C. Fall), 1 ♂, (Roberts), 1 ♀, (F. H. Chittenden), 1 ♂; Tucson, 3 ♂. *New Mexico*: 1 ♂; Roswell (A. Nicolay), 1 ♀; Aug., 1 ♂, 3 ♀, Sept. (F. W. Nunenmacher), 1 ♂, 1 ♀, Mar., 1 ♂; Gallup (Wickham), 1 ♀; Estancia, 1925 (J. R. Douglass), 1 ♂. *Texas*: Pecos, 1 ♀. *Colorado*: Crook, Aug. 12, 1921, 2 ♀; (Sandhurst),

punctures." In the above series of 19 specimens there is no specimen that answers accurately to the description of *baridioides*, since the sutural interval in all specimens has double or triple rows of punctures, and the third and/or the fifth intervals on all but one (Blythe, California) have double or at least confused punctures at the base. Some do have the intervals about equal, but some also have the third and fifth slightly wider, and some have the punctures more noticeably in two rows and for a farther extent on the interval. There seems, therefore, to be no



FIGS. 29-32. Diagram of beaks. 29. *Calendra graminis*, male. 30. *C. vomerina*, female, northeastern Arizona. 31. *C. vomerina*, male, Kansas. 32. *C. vomerina*, female.

1 ♀. *Kansas*: Western Kansas (Popenoe), 2 ♂, 1 ♀; Russell Co. (Popenoe), 1 ♀; Reno Co., Oct. 14 (J. Warren), 2 ♂, 1 ♀. *Nebraska*: 1 ♂ (cotype, var. *baridioides*, M.C.Z. No. 8438); Alliance, Aug. (Wickham), 1 ♂, 9 ♀. *Montana*: 20 miles south of Scobey, in Roosevelt Co., Aug. 17, 1949 (P. and C. Vaurie), 1 ♂.

Canada. *Alberta*: Medicine Hat, Chappice Lake, Aug. 22, 1927 (P. J. Darlington), 1 ♂.

Mexico. *Sonora*: (Webb), 1 ♀ (type, *vomerina*, M.C.Z. No. 5209), 1 ♂ (paratype, *vomerina*).

**DISCUSSION:** Horn's distinction between *vomerina* (type locality, Sonora, Mexico) and his variety *baridioides* (Colorado, Arizona, California east of the Sierras) for which no type was designated, does not hold true for 11 specimens from northern Arizona, two from southeastern California, three from Colorado, one from Montana, and two from southeastern New Mexico. He said that in *baridioides* the elytral intervals were "equal, and uniseriately punctulate with coarser

essential difference in the elytra, and the punctuation of the intervals in *vomerina* is no more erratic than it is in the closely related *graminis*, or in others of this group of western species. As Horn himself adds, "every necessary link between the two forms exists."

A marked difference in the beaks (figs. 30-32) of some populations of *vomerina* was, however, noted. It seemed at first to coincide with the supposed distribution of *baridioides* and to denote subspecific distinction, but this difference was found later to be not consistent with the geographic distribution, and *baridioides* is therefore considered a synonym of *vomerina*. It seems, however, worth while to record the distribution of this difference in case subsequent collecting or additional knowledge of the species should alter the picture. The northeastern Arizona and northwestern New Mexico specimens have the beak proportionately, though not statistically significantly, longer, and narrower,

not broadened on the top before the apex, and in a few specimens the upper contour near the apex is flattened, almost concave, not rounding downward towards the apex. The specimen figured (fig. 30) is a very large female, which has the apex below more acute and prolonged than in most specimens. Individuals from northeastern Montana, Kansas, Nebraska, Texas, and southeastern New Mexico have the beak shorter, stouter, slightly broadened before the apex on top and with the upper contour at the apex rounded downward. Although the beaks in these two groups of populations fall into two recognizable types, the beaks in specimens from the following localities are not at all constant. Of three specimens from Crook in northeastern Colorado, two have the short beak as just described, but the third has the beak longer, though still stout. The two specimens from southeastern California (Bard, Blythe) have the beak rather long and narrow, but one has it also apically widened. A specimen from Texas (seen at the United States National Museum) and three from Tucson, Arizona, have long beaks similar to those of northern Arizona and northern New Mexico specimens, but another specimen, from Pecos, Texas, has a short beak. Of Horn's California specimens ("*baridioides*") at the Academy of Natural Sciences in Philadelphia, the one with his *vomerina baridioides* label has the beak long, not widened, and the other two (California, and Needles, California) have the beak shorter and broader and slightly widened apically.

In an attempt to find some concrete basis for the apparent difference in the beak lengths, the beaks were compared, by measurement, with the front femora (the beak from the apex on top to the back of the antennal scrobe; the femora to but not including the trochanters). Males and females of the northern Arizona and northwestern New Mexico populations (10 specimens) had the beak longer than the front femora, but in the other group, although four males (Montana, Alberta, southern New Mexico, and Bard, California) had the beak the same length as the front femora, four females (Crook, Colorado and southern New Mexico), and one male (Blythe, California) had it longer.

The male genitalia were compared on

specimens from Scobey, Montana; Roswell, New Mexico; Winslow and Holbrook, Arizona; and Blythe, California, but no significant differences could be discerned.

The outer apical angle on the front tibiae is worn down in eight of 19 specimens so that the flared lobe is only suggested; two specimens have the claw broken short but the outer lobe intact, and the other nine have the lobe or outer angle prolonged and flared outward as is usual (fig. 19).

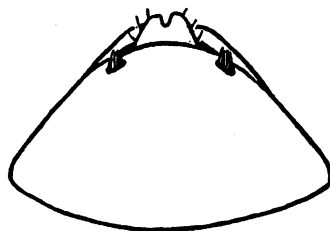


FIG. 33. Last abdominal segment in female of *Calendra memnonia*, ventral view, showing hairs at sides of apex. Hairs also present in females of *C. vomerina*, and *C. championi*, and in both sexes of *C. aequalis*.

This species is very close to *graminis* and seems generally to replace it in the southwest and in the Great Plains states. The two species have not yet been taken together but come close in extreme southeastern Wyoming (*graminis*) and extreme northeastern Colorado and western Nebraska (*vomerina*). In southern California, *graminis* occurs on the west coast at Escondido and *vomerina* in the east in Imperial County.

For differences between this species and *graminis*, see under *graminis*.

The presence in the female of a tuft of hairs at the sides of the apex of the abdomen in *vomerina*, which is not present in *graminis*, was found to occur in *memnonia* (fig. 33) and *championi*. When the hairs are worn off, the slit or oval depression can none the less be seen under high magnification. *C. memnonia* is a Mexican species, three specimens of which have been seen from Tucson, Arizona. *C. vomerina* differs from it and from *championi* (central and northern Mexico), by having the punctures on the elytral intervals larger and closer together, larger than, or the same size as, the basal pronotal punctures, not smaller than the latter as in the other two species;

differs further from *championi* in the much narrower elytral striae. Otherwise these three species are exceedingly similar. The distribution of *memnonia* is, except for the Tucson record, confined to southern Mexico, and *championi* has not yet been taken in the United States.

Differs from *nevadensis* by having much coarser, deeper elytral interval punctures and different male genitalia (figs. 76, 79).

***Calendra memnonia* (Gyllenhal)**

Figures 33, 77

*Sphenophorus memnonius* GYLLENHAL, 1838, in Schoenherr, *Genera et species curculionidum*, vol. 4, p. 935. *CHAMPION*, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 163.

Small to medium, robust; black or red, not coated, pronotum without raised vittae, elytra with flat intervals, striae punctures indistinct, sunken inside impressed striae.

Beak (from side) short, compressed, scarcely curved, slightly wider at apex, apex beneath rounded or obtuse, base swollen over antennal insertion, no fovea in front of eye; (from above) apex rather convex, base sometimes with a fine impressed line, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum without vittae, but with impunctate median space from base to near apex, finely, densely, evenly punctured. Scutellum narrower than long, usually grooved. Elytra with intervals about equal in width (third occasionally wider), all intervals flat, with fine punctures (smaller than those at base of pronotum), well separated when in single rows (usually on even intervals), more closely set when in double or confused rows (usually on odd intervals); striae open all the way, sides slightly sinuous, enclosing ill-defined, merging punctures within. Under surface, sides of prosternum more finely, sparsely punctured than pronotum, rest below slightly more strongly punctured, apex of abdomen without depression. Legs, front tibiae with outer apical angle slightly flared outward, sometimes slightly prolonged, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at sides of apex, apex with raised area of smaller, denser punctures, and sometimes with suggestion of

median keel. Length, 7–11 mm.

TYPE LOCALITY: Mexico; here restricted to Mexico City and vicinity. Type in Stockholm museum, examined.

DISTRIBUTION: Southern Mexico as far north as Guanajuato. Also Tucson, Arizona. Probably in the highlands.

SPECIMENS EXAMINED: Mexico. (Coll. Chevrolat), 1 ♂ (cotype); "Terre froide" (coll. Sallé, coll. Chevrolat), 1 ♀ (type), (Truqui), 3 ♂, 2 ♀. *Distrito Federal*: Mexico City, 3 ♂, 1 ♀, (J. H. Mohrs), 1 ♂; Guadalupe, 1 ♂, Sept. 7, 1903 (W. L. Tower), 1 ♂, (Wickham), 8 ♂, 4 ♀; San Angel (Wickham), 1 ♀. *Guanajuato*: 1 ♀. *Yucatan*: 2 ♀.

*Arizona*: Tucson, Pima Co., Sept. 3, 1906 (F. W. Nunenmacher), 2 ♂, 1 ♀.

DISCUSSION: The occurrence of this species in Tucson is probably an accident, since the only other records are from Guanajuato, Mexico, and southward. The three Arizona specimens do not differ in any noticeable way from the type or from those of southern Mexico except that one of them, which is the smallest of all the specimens, has only one row of punctures on the third elytral interval, whereas the others have confused double rows.

Four of nine specimens have a faint, narrow, impressed line at the base of the beak on top, but so faint as to be scarcely visible. The type and cotype have no impressed line. Five of the nine have the elytra deep reddish.

The females of this species, as also the females of *vomerina* and *championi*, have a slit or elongate depression on the sides of the apex of the abdomen (fig. 33), from which, when it is not worn off, a tuft of hairs protrudes. *C. memnonia* is very closely related to the above two species and very difficult to distinguish from them. It differs from *vomerina* in the finer, smaller punctures on the pronotum and elytral intervals, in the usually less prominent outer apical angle of the front tibiae, and in the broader chitinous margin at the apex of the penis (fig. 77). In *memnonia* the elytral interval punctures are smaller than those at the base of the pronotum, whereas in *vomerina* they are larger. The elytral striae punctures, on the other hand, are larger than those on the intervals in *memnonia*, but smaller or the same size in *vomerina*.

It differs from *graminis* also by having the pronotal punctures finer and smaller and the penis not truncate, and differs from *championi* by having the elytral striae much narrower than the intervals, instead of almost as wide as, or wider than, the intervals. The striae are not so deeply sunk as in the latter species.

Differs from *nevadensis* in the nearly impunctate prosternum, especially in the center in front of the coxae, and in the male genitalia.

The Los Angeles specimen of *simplex* which caused Champion (1910, p. 163) erroneously to synonymize that species with *memnonia* has been examined in the British Museum (it carries his label). The specimen is *simplex*, as can be seen by the angulate hind tibiae and the keeled beak.

***Calendra championi*, new species**

Figures 26, 33, 34, 78

Small, robust; black or red, pronotum without raised vittae, elytra with flat, narrow intervals and wide, deep striae.

**DESCRIPTION OF TYPE, MALE:** Beak (from side) short, compressed, top contour nearly straight, lower contour curved, slightly wider at apex, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex convex, base with fine impressed line, punctures dense, distinct, front of head scarcely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum without trace of lateral vittae, uniformly punctured except for narrow impunctate median line from base to apex, punctures the same size as on elytral intervals. Scutellum narrow, parallel. Elytra with intervals about equal in width, all intervals flat, with single rows of punctures the size of those on pronotum, the punctures separated, on odd intervals, by about their own width, on even intervals by at least twice their width; striae deeply cut, nearly as wide as the intervals on the disc, wider than the intervals at extreme base, striae open all the way, sides slightly sinuous, enclosing ill-defined, merging punctures within. Under surface, sides of prosternum very finely, sparsely punctured, the rest below, except mesosternum, strongly, coarsely punctured, apex of abdomen without depression. Legs, front tibiae with outer apical angle slightly flared

outward, but not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides; front and middle coxae with tufts of golden hairs, front and middle femora with similar tufts at base and a few scattered hairs within; all tibiae fringed with hairs within. Pygidium with tufts of hairs at sides of apex, apex with raised area of smaller, denser punctures, rest of pygidium with coarse, merging punctures. Length, 8 mm.

**TYPE:** Holotype male, Santa Barbara, Chihuahua, Mexico, 6200 feet, August 17, 1947 (G. M. Bradt); allotype female, Durango City, Durango, Mexico (Wickham). Five paratypes: Durango: Durango City (Wickham), one male; Chihuahua: Santa Barbara, 6200 feet, August 17, 1947 (G. M. Bradt), one female, May 2, 1947, one female, 6300 feet, July 18, 1947 (Schramel), one female; Aguascalientes: Aguascalientes (Wickham), one male. Holotype and three paratypes in the American Museum of Natural History, allotype and one paratype in the collection of the British Museum (Natural History), one paratype in the Museum of Comparative Zoölogy, Cambridge.

**DISTRIBUTION:** Aguascalientes in central Mexico north to southern Chihuahua.

**DISCUSSION:** Champion (1910, p. 163) described this species as a variety of *memnonia* but did not give it a name. He mentioned the "distinctly sulcate" beak at the base, the broader, more coarsely punctured elytral striae, the more or less uniseriate punctures of the intervals, and the more coarsely punctured under surface, especially the last segment of the abdomen. Two additional characters found in the male serve further to differentiate *championi* from *memnonia* and to indicate its specific distinctness. These are the penis (fig. 78) which in two males of *championi* is broader as a whole but has a narrower chitinous margin at the apex, whereas in three males of *memnonia* this margin is about three times broader at the apex than at the sides; and the apex of the male pygidium. The latter in *championi* bulges out over the actual apical margin and is separated from it by a narrow, transverse depression (fig. 34). The apex in *memnonia* has no depression.



Otherwise *championi* is very close to *memnonia* and seems to replace it in the northern half of Mexico, except for the Arizona records of *memnonia* which may possibly, of course, be fortuitous. A trace of the sulcate beak of *championi* is present in a few *memnonia*; in both species the apex of the beak is wider in some specimens than in others; the apex below is more acute in the allotype and four paratypes of *championi* than it is in the type and one paratype; it is

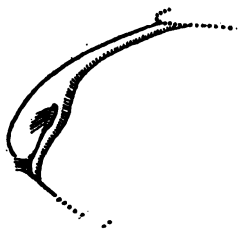


FIG. 34. Apex of pygidium in *Calendra championi*, male, showing bulge over apex and transverse depression; ventro-lateral view.

not acute in any of the *memnonia* specimens. In both species the female has a slit on the sides of the apex of the abdomen (fig. 33) from which protrudes a tuft of hairs, but the hairs are worn off in all the *championi* females except in the allotype. The elytral differences serve readily to distinguish the two species; the wide, deeply cut striae, which are nearly as wide as the intervals, give a quite different appearance to *championi* (fig. 26).

Three additional specimens of this species have been examined at the British Museum, two males and a female from Aguascalientes City (Höge) in the state of that name, which is just north of Jalisco and Guanajuato. These, as also the two paratypes from Durango, were the specimens on which Champion based his "variety."

***Calendra nevadensis* (Chittenden)**

Figure 79

*Sphenophorus nevadensis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 172.

Small, robust; black or red; not coated, pronotum without raised vittae, elytra with flat intervals and distinct stria punctures sunken inside impressed striae.

Beak (from side) short, compressed,

curved, wider at apex, apex beneath obtuse or acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened or concave, base with distinct impressed line, front of head without visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum without vittae but often with impunctate median space, the rest finely, evenly punctured. Scutellum narrower than long. Elytra with intervals flat, about equal in width, sparsely, finely punctured in single rows, sometimes third and fifth intervals with two irregular rows; striae on disc open all the way, sides slightly sinuous, enclosing definite round punctures, some touching, but usually separated by their diameter or more, outer striae unimpressed, with round punctures. Under surface, sides of prosternum with larger, deeper, but sparser punctures than on pronotum, apex of abdomen with depression. Legs, front tibiae with outer apical angle not prolonged, front tarsi with third segment somewhat dilated, other tarsi with it narrow, longer than wide, all below mostly smooth, with sparse hair at sides. Pygidium with triangular area at apex of finer, denser punctures. Length, 8-10 mm.

**MALE CHARACTERS:** Long, deep ventral cavity with short hairs.

**TYPE LOCALITY:** No locality specified; type from Nevada. Type in the United States National Museum, examined.

**DISTRIBUTION:** Nevada, California.

**SPECIMENS EXAMINED:** *Nevada:* (Liebeck), 1 ♀; 1 ♀ (type, U.S.N.M. No. 8975), 1 ♂ (allotype); (Roberts), 1 ♂, 1 ♀. *California:* 1 ♂; (T. Pergande), 1 ♂.

**DISCUSSION:** Even these few specimens show variation in the punctuation of the elytral intervals, a variation common in *C. graminis* and *C. vomerina* also. This punctuation was not analyzed on three of the above specimens, but the type, a female, has the punctures on the sutural, third, and fifth intervals in two irregular rows, on the other intervals in single rows; the allotype, a male, has two rows on the third only, the rest of the intervals in single rows; and one of the California males has all the intervals with single rows of punctures.

This species is more finely and faintly punctured all over than any *vomerina* and

than most *graminis*, but about as in the Mexican *memnonia*, which has been taken at Tucson, Arizona. It might be thought a variant of *graminis*, with which it agrees in many respects, but for two important characters: the male has a noticeably deep ventral cavity with short hairs in it, whereas *graminis* males have a shallow, hairless depression; and the male genitalia (fig. 79) have the penis quite pointed at the apex, not truncated as in *graminis*. *C. nevadensis* also has the outer elytral striae (seventh and eighth, sometimes sixth) with distinct, separated, round punctures that are not impressed, but this character may not be diagnostic and will no doubt be found to vary upon examination of additional specimens; it occurs to some extent also in *mormon*, *simplex*, and *memnonia*.

I was unable to compare directly any females of *nevadensis* with females of *memnonia*, but the males are similar in general shape and size and in the pronotum, elytra, and tarsi, differing in the presence, in *nevadensis*, of long yellow hairs on the front and middle femora within, of a deep ventral cavity, and of a slight prolongation at the apex of the penis. The base of the beak has no impressed line in four of seven *memnonia*, but a trace of it in three; in *nevadensis* this line is distinct. The outer apical angle of the front tibiae is slightly flared outward and prolonged in *memnonia*, but not so in *nevadensis*. The latter has a depression at the apex of the abdomen which is lacking in *memnonia*.

Differs from *arizonensis* principally in the different type of strial structure; in that species the well-separated punctures are set along a narrow, closed strial line, and they cut nearly halfway into the intervals.

#### *Calendra arizonensis* (Horn)

Figure 80

*Sphenophorus arizonensis* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 428.

*Sphenophorus fallii* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 172, fig. 19.

Small, robust; black or red, not coated, pronotum without vittae, elytra with intervals flat, with large, round, strial punctures encroaching almost halfway onto the intervals.

Beak (from side) short, compressed, almost straight on upper contour, wider at apex,

apex beneath obtuse to acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex somewhat flattened, base with distinct impressed line, front of head with scarcely visible punctures. Eye with lower corner below insertion of beak. No thoracic lobe. Pronotum without vittae but with a narrow, impunctate, median line, the rest finely, evenly punctured. Scutellum narrower than long. Elytra with intervals flat, about equal in width, sparsely and finely punctured in single rows except on third and sutural intervals where rows are double; striae with large oval or round punctures (as wide as about half an elytral interval), separated by their own diameter or twice their diameter, and breaking into the intervals, making their sides sinuous. Under surface, sides of prosternum almost impunctate, apex of abdomen with depression. Front tibiae with the outer apical angle not prolonged, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides (except front tarsi in male). Pygidium with tufts of hair on sides at apex, with median keel and with shiny raised part at apex with finer, denser punctures. Length, 8–9 mm.

**MALE CHARACTERS:** Front third tarsal segment dilated to twice or three times the width of the preceding segments, and with hairy pads below.

**TYPE LOCALITY:** No locality specified; here designated as Colorado from original label on lectotype, male, new designation, Horn Collection No. 9003, Academy of Natural Sciences of Philadelphia, examined.

**DISTRIBUTION:** Arizona, Colorado, New Mexico, and Mexico.

**SPECIMENS EXAMINED:** *Arizona:* 2♂, 2♀; McNary, Aug. 12, 1939 (F. H. Parker), 1♂, 1♀; 8 miles south of Flagstaff, Coconino Co., 6800 ft., Aug. 11, 1948 (G. E. Ball), 1♂; White Mts., Apache Co., Sept., 1930 (Duncan), 5♂, 1♀. *Colorado:* 4♂, 1♀; Horn Coll. No. 9003, 3♂ (lectotype and paratypes, *arizonensis*); Fort Garland, Mt. Home Lake, 8300 ft., July 20–25, 1932, 1♀. *New Mexico:* 1♀; Santa Fe Canyon, 7000 ft., Aug., 1880 (F. H. S.), 3♂; Santa Fe, Aug., 1897 (H. C. Fall), 1♂ (type, *fallii*, U.S.N.M. No. 9726).

*Mexico. Distrito Federal:* Guadalupe, Apr. 21 (Wickham), 1♀.

**DISCUSSION:** Chittenden, who had only the

male of *fallii* and had seen only the female of *arizonensis*, described the former on the basis of the widely dilated third tarsal segment on the front legs of the male, remarking that otherwise the two were remarkably alike. Horn's type series of *arizonensis*, all males, also have the dilated tarsi, and the type of *fallii* is indistinguishable from, and synonymous with, *arizonensis*.

The fact that the fifth and sixth elytral striae in *fallii* nearly touch across the interval, as shown in Chittenden's drawing, is not unique or diagnostic; a number of individuals in a series of *C. crenata* show these wandering striae, as do also specimens of *gentilis*, *simplex*, and *diversa*.

It is barely possible that the specimen listed above from southern Mexico is not this species, but *cicatristriata*. Unfortunately this specimen is no longer available for examination. At the time, I noted that the elytral stria punctures were larger than in other *arizonensis*, but I had not seen those southern Mexican *cicatristriata* which might well be confused with *arizonensis* and therefore did not especially note whether or not there was any slight separation by the raised stria line at the back end of the stria foveae. Most *cicatristriata* have this separation of the foveae so well marked that there seem to be two foveae on each side of the stria, the whole appearing horseshoe shaped. But some southern Mexican *cicatristriata*, including the type, have the foveae scarcely separated and about the size of the foveae in *arizonensis*, and they also have the pronotal depressions so vague that at first glance they might be considered *arizonensis*.

Differs from the *simplex* group of species in the type of elytra, with the stria punctures large, clearly separated by a closed stria line, and cutting nearly halfway into the intervals, and in the greatly enlarged front tarsi of the male.

Differs from *holoserica* and *deficiens*, which have somewhat similar elytra, by having the pronotum evenly punctured with small, fine punctures of the same size, and by having a narrow, linear, median, impunctate line.

***Calendra cicatristriata* (Fahraeus)**

Figures 4, 22, 81

*Sphenophorus cicatristriatus* FAHRAEUS, 1838,

in Schoenherr, *Genera et species curculionidum*, vol. 4, p. 958. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 159, pl. 8, fig. 3. CHITTENDEN, 1924, *Proc. Ent. Soc. Washington*, vol. 26, p. 150.

*Sphenophorus cicatrispensis* FAHRAEUS, 1845, in Schoenherr, *Genera et species curculionidum*, vol. 8, pt. 2, p. 262. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 159. CHITTENDEN, 1924, *Proc. Ent. Soc. Washington*, vol. 26, p. 150.

*Sphenophorus ulkei* HORN, 1873, *Proc. Amer. Phil. Soc.*, vol. 13, p. 413. CHAMPION, 1910, *Biologia Centrali-Americana*, vol. 4, pt. 7, p. 159, pl. 8, fig. 3.

*Sphenophorus variolosus* LECONTE, 1876, *Proc. Amer. Phil. Soc.*, vol. 15, p. 424.

Small to medium, robust; black or red, coating in punctures, pronotum with median line and suggestion of lateral vittae at base or with M-shaped pattern more distinct, elytra with large foveae set in pairs, often obliterating the intervals.

Beak (from side) short, compressed, slightly curved, wider at apex, apex beneath an obtuse or right angle, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened or concave, base with impressed line or canal, front of head finely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with apical concentration of punctures at middle either feebly or strongly depressed, with median impunctate line extending to near base where it is sometimes raised, and two lateral vittae raised, if at all, at base only, vittae merging in apical half, but not always markedly so, lateral vittae with finer punctures than the rest of pronotum; interspaces at base with larger, often merging, punctures. Scutellum more or less triangular. Elytra transversely wrinkled or nearly smooth, intervals on disc sometimes flat, but often so cut into by large stria foveae that they are merely raised crooked lines, even intervals with single rows of minute punctures, odd intervals with double rows; striae with wide, usually shallow, horseshoe-shaped foveae, their diameter as wide as the sutural interval, the foveae virtually composed of two elongate foveae divided at one end by the raised edges of the striae, foveae either well separated or run together longitudinally. Under surface, sides of prosternum nearly

impunctate or with finer, sparser punctures than on pronotum, rest below strongly punctured, apex of abdomen with small depression of concentrated, larger punctures. Front tibiae sinuate on outer side before apex, outer apical angle slightly prolonged, front tarsi with third segment sometimes widely dilated and with hairy pads below, usually with it and other tarsi but slightly dilated, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex and with raised apical area of denser, smaller punctures. Length, 7.5–11 mm.

**TYPE LOCALITY:** Mexico; here restricted to Mexico City and vicinity. Type in Stockholm museum, examined.

**DISTRIBUTION:** From Alberta, Canada, through North Dakota and Montana south to Mexico City, Vera Cruz, and Yucatan.

**SPECIMENS EXAMINED:** Canada. *Alberta*: Chap-pice Lake, Aug. 24, 1927 (Darlington), 3 ♂, 5 ♀; Medicine Hat, Aug. 9, 1924 (F. S. Carr), 1 ♂, 1 ♀.

United States. *North Dakota*: 23 miles south of Towner, McHenry Co., Aug. 20, 1949 (P. and C. Vaurie), 1 ♂, 5 ♀; Pleasant Lake, Benson Co., Aug. 21, 1949 (P. and C. Vaurie), 1 ♀. *Nebraska*: Horn Coll. No. 8982, 1 ♂ (cotype, *ulkei*). *Wyoming*: (Deitz), 2 ♂; Cheyenne, Mar. 5 ("Blanch."), 1 ♂, June 11, 1920, 6000 ft., 1 ♀; Laramie, Mar. 31, 1894, 1 [abdomen missing], Apr. 28, 1888, 1 ♀, July 13, 1949 (P. and C. Vaurie), 17; Teton Mts., Jackson Lake, 7000 ft., Aug. 14 (F. R. Mason), 2. *Colorado*: 3 ♂, 1 ♀; Horn Coll. No. 8982, 1 ♂ (cotype, *ulkei*); 1 ♀ (type, *variolosus*, M.C.Z. No. 5205); Sterling (Sandhurst), 1 ♀; Jim Creek near Boulder, 6400 ft., July 21, 1923, 1 ♀; Univ. of Colorado campus (Cockerell), 1 ♀; Greeley (Dietz), 1 ♂, Apr. 22 ("Blanch."), 1 ♂, (C. Palm), 1 ♂; Denver, 3 ♂, 1 ♀, June 22, 1 ♂, 1 ♀; Oslar (Dietz), 1 ♂. *Utah*: Horn Coll. No. 8982, 1 ♂. *New Mexico*: 3 ♂, 2 ♀, (Dietz), 2 ♀; Grant Co. [label says Texas, but no such county in Texas], June 16 (Kellogg), 2 ♀; Albuquerque (Chittenden), 1 ♂, Feb. 3 (H. Soltau), 2 ♂; Las Vegas, Aug. 14 (Barber and Schwarz), 1 ♂; Coolidge (Wickham), 1 ♂.

Mexico. "Terre froide" (coll. Sallé), 1 ♂ (type, *cicatristriata*); (Sturm), 1 ♀ (type, *cicatripennis*); (Truqui), 1 ♂ (specimen figured in the "Biologia"). *Chihuahua*: Santa Barbara, 6200 ft., Aug. 25, Sept. 15, Oct. 3, 1947 (G. M. Bradt), 1 ♂, 3 ♀, 6300 ft., July 17, 1947 (Gertsch), 1 ♀; 63 miles west of Santa Barbara, 5500 ft., July 20, 1947 (Gertsch), 1 ♀. *Durango*: Nombre de Dios, 5900 ft., Aug. 13, 1947 (Gertsch), 1 ♂; Otinapa, 8200

ft., Aug. 11, 1947 (Gertsch, Cazier), 1 ♂, 3 ♀, 7500 ft., Aug. 7, 1947 (Cazier), 1 ♂, 1 ♀; Durango City, 6200 ft., Aug. 4, 1947 (Cazier), 1 ♀. *Aguascalientes*: (Wickham), 1 ♀. *Distrito Federal*: San Jeronimo, May 4, July 11, 1946 (J. and D. Pallister), 1 ♂, 1 ♀; Contreras, May 30, 1946 (J. and D. Pallister), 1 ♂; Guadalupe (Wickham), 1 ♂. *Mexico*: Toluca (Wickham), 1 ♂, 1 ♀, near Toluca, Nov. 7, 1945 (B. Rotger), 3 ♂, 1 ♀. *Jalisco*: Tuxpan, Sept. 6, 1903 (J. F. McClendon), 1 ♂. *Guanajuato*: (Sallé coll.), 1 ♀; Irapuato (Höge), 1 ♂. *Michoacan*: Morelia (Höge), 1 ♂. *Puebla*: 1 ♀ (paratype, *cicatristriata*). *Hidalgo*: San Miguel (W. M. Mann), 2 ♀; Guerrero Mills (W. M. Mann), 2 ♂, 4 ♀. *Yucatan*: 2 ♀.

Other specimens from Mexico seen at the British Museum, sex or collector not noted: Mexico City, 6; Mixcoac, 1; Cholula, 1; Salazar, 2; Cerro de Plumas, 1; Morelia, 1; Puebla, 1; Jalapa, 1; Tuxpan, 1.

**DISCUSSION:** Comparison of Horn's type series of two males of *ulkei* (Nebraska, Colorado) and Fahraeus' type of *cicatripennis* (Mexico) with the type and two paratypes of Fahraeus' *cicatristriata* (Mexico) shows that they are similar in all essential characters, and I agree with Champion that the first two are synonymous with the last. LeConte's *variolosus* from Colorado, the type of which has also been seen, is likewise a synonym of *cicatristriata*.

The pronotum, the elytra, and the third front tarsal segment on the male are all variable in this species, and some of these variations are represented in the types. Thus one cotype of *ulkei* and the type and paratypes of *cicatristriata* have the pronotum without evident vittae because the median apical depression and the V-shaped basal depression are barely indicated by means of slightly larger punctures, and are not, or scarcely, depressed. On the other hand, the other cotype of *ulkei* has the apical depression more marked, so does the type of *cicatripennis*; the latter has the basal V-shaped area also more depressed and with larger punctures, the pronotum thus appearing more trivittate. The elytra in the type of *cicatripennis* have larger and more widely spaced foveae along the striae, those of *cicatristriata* have smaller and more numerous foveae; the foveae are found to vary greatly within populations from the same locality, even varying on each elytron or on different striae.

The type and the male paratype of *cicatristriata* have the third front tarsal segment very greatly enlarged and dilated to about four times the size of the preceding segment, whereas in the cotypes of *ulkei* it is only feebly dilated; it is enlarged to the same degree in a male collected by Truqui from "Mexico" and in two males from Guadalupe, Distrito Federal. It was this difference, and also a difference in the punctuation of the head which was not confirmed by my examination of long series, that caused Chittenden (1924, p. 150) to insist on the distinctness of *ulkei* from *cicatristriata*. There are, however, all gradations in the width of this segment, some other males from the Distrito Federal, as well as from Hidalgo, Jalisco, and Durango, having it more dilated than in the United States specimens, but less dilated than in the five Mexican specimens mentioned above. None of the many United States males examined, however, has it so widely dilated as in the

type and four other specimens. These five specimens cannot be found to differ in any constant character from other males. They have the pronotum and elytra quite smooth, without marked depressions on the pronotum or transverse rugosities on the elytra; they resemble in these characters the majority of individuals of *cicatristriata* from the Great Basin region of the United States and some from southern Mexico. Two of them have somewhat smaller, rounder foveae on the elytral striae, but so have two other males from Colorado and one from New Mexico. The male genitalia of the Truqui specimen seem not to differ from those of four other specimens from Colorado, North Dakota, Chihuahua, and Mexico City (fig. 81). The tarsal dilation in *Calendra* is often individually variable, but this is the most striking example of it, unless, of course, it is not a variation and indicates specific distinction.

The most northern populations (North Dakota south to New Mexico and Sonora)

TABLE 3  
GEOGRAPHIC VARIATION IN POPULATIONS OF *Calendra cicatristriata*

	Pronotum						Elytra	
	Median Apical Punctures			Median Basal V-shaped Area			Intervals 1-3 on Disc	
	Not De-pressed N	Scarcely De-pressed N	De-pressed N	Not De-pressed N	Scarcely De-pressed N	De-pressed N	Broad, Flat N	Narrow, Raised N
Alberta, Canada	5	2	—	—	5	2	7	—
Colorado, Wyoming,								
North Dakota,								
New Mexico	33	22	—	2	43	11	47	8
Sonora	1	—	—	1	—	—	1	—
Chihuahua, Durango,								
Aguascalientes	—	8	7	—	—	15	3	12
Jalisco and Guanajuato	2	1	—	—	1	2	—	3
Morelia, Michoacan	—	—	1	—	—	1	1	—
Toluca, Mexico	1	3	2	—	1	5	4	2
Distrito Federal	2 <sup>a</sup>	—	3	1 <sup>a</sup>	1 <sup>a</sup>	3	2 <sup>a</sup>	3
Hidalgo	—	6	1	—	—	7	5	2
Yucatan	1	—	—	—	1	—	1	—
"Mexico" <sup>a,b</sup>	3	—	—	3	—	—	3	—
"Mexico" <sup>c</sup>	—	—	1	—	—	1	1	—

<sup>a</sup> Widely dilated tarsi.

<sup>b</sup> Includes type and paratype, *cicatristriata*, both with widely dilated tarsi.

<sup>c</sup> Type of *cicatripennis*.

and the most southern populations (Mexico City region to Vera Cruz and Yucatan) resemble each other more closely than do the geographically intervening populations (Durango and southern Chihuahua). In the latter (14 specimens), some individuals have the pronotum and/or the elytra as in the United States and southern Mexico populations, but most of them have both the pronotum and elytra more deeply impressed, more closely punctured, and with more coating in the depressed areas. These differences, however, are merely exaggerations of the characters already present in the other populations, and they are all, therefore, here considered to be one variable species, *cicatristriata*. In order to show that there is no definite geographic pattern in their variation, a table of their variations is presented, the localities being listed from north to south (table 3). Unfortunately, many southern Mexico specimens seen at the British Museum are not now available for further examination.

First it must be explained that all specimens have a few concentrated and larger punctures at the base and apex of the pronotum, but the degree to which they are depressed varies. The depression of the basal V-shaped area results in more prominent vittae on either side; the punctures on the lateral vittae at base are usually finer and smaller than those in front, but sometimes they are nearly the same size. Where the intervals on the elytra are broad and flat, the striae foveae on each side of them are either very shallow, or so small as not to cut into them. Conversely, where the intervals are narrow and raised, the foveae are more deeply cut, or so wide as nearly to obliterate the intervals.

Differs from all other species except *serratifipes*, *terricola*, and *zeae* in the double, or paired, elytral foveae which usually are connected in front but never contiguous at the other end, being always slightly or markedly separated by the raised striae line, thus causing the horseshoe shape mentioned by most authors (fig. 22).

Differs from *serratifipes* in the shorter, broader, apically widened beak and in the absence of strong dentations on the inner side of the front tibiae. Differs from *terricola* by having the sides of the prosternum scarcely

punctured and the pronotum, in general, with smaller punctures. It is very different from *zeae* which has the median vitta dilated at the middle and no apical depression or median apical punctures; and the striae foveae in *zeae* are only occasionally weakly horseshoe shaped.

**BIOLOGY:** The North Dakota and Wyoming specimens taken by the author were collected, with a few *C. mormon*, in short grass near alkali lakes and on the surface of a dry saline lake.

#### *Calendra terricola* (Champion)

##### Figure 81

*Sphenophorus terricola* CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 161.

*Sphenophorus reticulatus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 154.

Medium, robust; black, coating in punctures, pronotum with median line and suggestion of lateral vittae at base, elytral foveae so large that they obliterate most of the intervals.

Beak (from side) short, compressed, slightly curved, wider at apex, apex beneath an obtuse or right angle, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with impressed line, front of head finely punctured. Eye below insertion of beak. No thoracic lobe. Pronotum with apical concentration of larger punctures at middle not, or but slightly, depressed, with median impunctate line somewhat raised at base, as also lateral vittae; V-shaped interspace with confluent punctures not much larger than those on vittae, rest of pronotum densely, strongly punctured. Scutellum triangular, flat. Elytra transversely wrinkled, intervals so cut into by large striae foveae that they are merely raised crooked lines, intervals with small punctures in single, irregular rows; striae with elongate, double foveae divided by the raised edges of the striae, usually run together longitudinally. Under surface, sides of prosternum with dense, strong punctures as on sides of pronotum, apex of abdomen with despression. Front tibiae with outer apical angle not prolonged, but sinuate on outer side before apex, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides.

Pygidium with tufts of hair at sides at apex and with raised area at apex of denser, smaller punctures. Length, 9–10 mm.

MALE CHARACTERS: Depression at apex of abdomen with short, fine hairs.

TYPE LOCALITY: Northern Sonora, Mexico. Type in British Museum, examined.

DISTRIBUTION: Northern Sonora and Arizona.

SPECIMENS EXAMINED: *Arizona*: (Liebeck), 2 ♂; 1 ♀ (type, *reticulatus*, U.S.N.M. No. 26897), 1 ♂ (allotype, *reticulatus*).

Mexico. *Northern Sonora*: (Morrison), 1 ♂ (type, *terricola*), 4 ♂, 1 ♀.

DISCUSSION: The type and allotype of *reticulatus* cannot be found to differ from the type and five other specimens of *terricola* and is considered synonymous with that species.

If additional information on either the habits or distributional limits of *cicatristriata* should ever clarify the problem that species presents, then this species, *terricola*, may be found to be synonymous with it or one of its forms. At present, *terricola* is separable from all *cicatristriata* only by the dense, large punctures on the prosternum. The punctures in this area in *cicatristriata* can scarcely be seen in the great majority of specimens, the sides of the prosternum being usually glabrous and appearing impunctate; those that can be seen, in some specimens, are very small and fine, not coarse as in *terricola*. *C. terricola* can be separated from the *cicatristriata* in the United States by the larger, coarser, denser punctures on the pronotum, but it is similar in this respect to some *cicatristriata* from Mexico.

#### *Calendra serratipes* (Chittenden)

Figure 18

*Sphenophorus serratipes* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 149, pl. 6, fig. 4.

Small, robust; black, no coating, pronotum with median line, elytra with large shallow pits. Front tibiae dentate within.

Beak (from side) long, scarcely compressed, straight, same width at apex as at middle, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with no impressed line, front of head with hardly

visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum with no depression at apex, without vittae, but with median impunctate line and slight suggestion of lateral vittae at base, closely, finely punctured. Scutellum narrower than long. Elytra with intervals more or less convex, transversely wrinkled, with one or two rows of punctures; striae with wide, shallow, horseshoe-shaped pits, their diameter as wide as the sutural interval, cutting halfway or more into intervals. Under surface, sides of prosternum nearly smooth, with fine, sparse punctures, apex of abdomen without depression. Legs, front tibiae with outer apical angle flared outward into a lobe, serrate within (four or five distinct teeth), all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex, female with keel in center and round depression each side of keel, at apex raised area of denser punctures. Length, 8–9 mm.

TYPE LOCALITY: No locality specified; type from Fort Collins, Colorado. Type in the United States National Museum, examined.

DISTRIBUTION: Colorado, Kansas, and Alberta, Canada.

SPECIMENS EXAMINED: *Colorado*: Fort Collins, May 22, 1898 (Wickham), 1 ♂ (type, U.S.N.M. No. 26896). *Kansas*: Grove Co., 2500 ft. (F. H. Snow), 1 ♀.

Canada: *Alberta*: Medicine Hat, Apr. 28, 1923 (F. S. Carr), 1 ♀ (allotype); 1 ♀; May 2, 1920, 1 ♀; May 10 (F. S. Carr), 1 ♂.

DISCUSSION: The long, straight, scarcely compressed beak, of about the same width throughout, and the definitely serrate front tibiae distinguish *serratipes* from all other species (fig. 18).

It seems quite close to *cicatristriata* and *terricola*, and the elytra in all three are similar, but it differs from both these species in the beak and tibiae as mentioned above, in the absence of either a canal or impressed line at the base of the beak above, and in the presence of a keel on the female pygidium, with a depression on each side. It further differs from *terricola* in the nearly impunctate prosternum and the generally finer punctuation above.



***Calendra holoserica* (Chittenden)**

## Figure 23

*Sphenophorus holosericus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 153, pl. 6, fig. 2.

*Calendra lucedalensis* SATTERTHWAIT, 1933, Ent. News, vol. 44, p. 212.

Medium; black, no coating, pronotum without raised vittae but with median impunctate space, elytra with flat intervals and large, round, stria punctures encroaching halfway onto intervals.

Beak (from side) very long, compressed, slightly curved, wider at apex, apex beneath acute, base swollen into hump over insertion of antennae, then distinctly flattened behind, almost concave, no fovea in front of eye; (from above) apex concave, base with no impressed line but a mass of dense punctures, and a median keel from near base but not reaching apex, front of head finely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum without true vittae (not raised) but with median impunctate line and a suggestion of lateral vittae at base in the finer sparser punctures where these vittae would be, rest of pronotum with small punctures in apical half, larger ones at middle of base and sides. Scutellum narrower than long, flat or slightly convex. Elytra with intervals flat, about equal in width, sparsely and finely punctured in single rows (third interval often confused); striae with large oval or round punctures (size of those at base of pronotum), separated by twice to five times their own diameter, resulting in only six or seven to a stria, the punctures breaking into the intervals nearly halfway. Under surface, sides of prosternum with small, fine punctures as on lateral "vittae," but sparser, apex of abdomen no depression. Legs, front tibiae with outer apical angle somewhat flared outward and slightly prolonged, front tibiae very sinuate, almost serrate within, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with median keel in female and two deep depressions on each side of keel. Length, 7–11 mm.

TYPE LOCALITY: No locality specified; type from Willis, Texas. Type in the United States National Museum, examined.

DISTRIBUTION: Arizona, Texas, Mississippi, Louisiana.

SPECIMENS EXAMINED: *Arizona*: 1 ♂; (Morrison, Hubbard, Schwarz), 1 ♂; 1 ♂ (paratype, *holoserica*). *Texas*: Dallas, 1 ♀; Willis (Bridwell), 1 ♂ (type, *holoserica*, U.S.N.M. No. 26893); Longview, Aug. 24, 1 ♂ (allotype, *holoserica*); Victoria, June 1, 1903 (W. E. Hinds), 1 ♀, (J. D. Mitchell), 1 ♀. *Mississippi*: Lucedale, June 22, 1932 (H. Dietrich), 1 ♀ (type, *lucedalensis*, U.S.N.M. No. 44808).

DISCUSSION: The type and only specimen of *lucedalensis* (Lucedale, Mississippi) was examined and found to agree in all particulars except its larger size (11 mm.) with the type of *holoserica* and is therefore synonymous with it.

This species is not very different from *deficiens* (Florida, North Carolina, New York), with which it agrees in the pronotal pattern, the silky texture, and more or less in the beak and elytra. In *holoserica*, however, the pronotum is broader, the beak is longer, apically widened, its base from the side is more concave, the punctures above are larger and denser, and the apex beneath is acute, not rounded. In *holoserica* also the elytra are smooth, not transversely wrinkled, and the stria punctures are more widely spaced (fig. 23). The front tibiae have the outer apical angle dilated in *holoserica*, but not so in *deficiens*, although on both they are sinuate and slightly dentate within.

Differs from *arizonensis* and *cicatristriata* in the silky surface, the basal hump and median keel on the beak, the more widely spaced stria punctures, and the suture with but one row of punctures.

The Texas localities and Lucedale, Mississippi, are all well inland except Victoria, Texas, which is 20 or 30 miles from the Gulf coast.

***Calendra deficiens* (Chittenden)**

## Figure 82

*Sphenophorus deficiens* CHITTENDEN, 1920, Jour. Washington Acad. Sci., vol. 10, p. 313. BLATCHLEY, 1920, Jour. New York Ent. Soc., vol. 28, p. 176.

*Sphenophorus omissus* BLATCHLEY, 1920, loc. cit.

Small; black, no coating, pronotum without raised vittae, but with median impunctate space, elytra with transversely wrinkled in-

tervals and large oval stria punctures encroaching on intervals.

Beak (from side) short, scarcely compressed, nearly straight, not wider at apex, apex beneath rounded to obtuse, base slightly swollen over antennal insertion, no fovea in front of eye; (from above) apex concave, base usually with no impressed line, front of head finely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum very long, without true vittae, but with median impunctate space and a suggestion of lateral vittae at base in the slightly smaller punctures where these vittae would be, rest of pronotum with small punctures in apical half, larger ones at middle of base and sides. Scutellum narrower than long, slightly grooved. Elytra with intervals transversely wrinkled, about equal in width, so sparsely and finely punctured in single rows as to be scarcely visible; striae with large oval punctures (size of those at base of pronotum) separated by twice to three times their own diameter, the punctures breaking into the intervals nearly halfway. Under surface, sides of prosternum strongly punctured about as on sides of pronotum, apex of abdomen without depression. Legs, front tibiae with outer apical angle not prolonged or flared outward, front tibiae very sinuate, almost serrate within, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium (five specimens) without hairs or tufts. Length, 6–9 mm.

TYPE LOCALITY: Crescent City, Florida. Type in the United States National Museum, examined.

DISTRIBUTION: Florida, North Carolina, New York.

SPECIMENS EXAMINED: *Florida*: Jacksonville, 1 ♂; Crescent City (Hubbard and Schwarz), 1 ♀ (type, *deficiens*, U.S.N.M. No. 23076); Volusia Co., Nov. 25, 1929 (W. A. Hiers), 1 ♂; Fort Barrancas, Mar. 4, 1919 (G. L. Harrington), 1 ♂; Dunedin, Mar. 31, 1913 (W. S. B.), 1 ♀ (type, *omissus*). *North Carolina*: New River, Sept. 20, 1944 (G. E. Bohart), 1 ♂. *New York*: Fire Island, July 9, 1941 (B. D. Valentine), 1 ♂.

DISCUSSION: Blatchley's *omissus* (type locality, Dunedin, Florida), the type of which was kindly lent for examination by Dr. J. J. Davis of Purdue University, is a synonym of *deficiens* Chittenden. The type, a male, was

compared with a male of *deficiens* from Fort Barrancas, Florida, a specimen that I had previously compared with the type of *deficiens*. The two specimens agree in all characters, except that the *omissus* type is smaller, has the punctures at the base of the lateral pronotal vittae sparser and somewhat smaller. It has also a more shining surface, but in this respect it matches the type of *deficiens*. The type of *omissus* is rather greased and has some mud or other obstruction at the very apex of the beak. The descriptions of both species appeared in the June numbers of their respective publications (June 4 for *deficiens*) and in the same year. Since the *deficiens* description is more detailed and the name is better known and since the type in Washington is perhaps more readily available to future workers, this name is here given priority.

It is curious that Blatchley had collected a specimen of *deficiens* just two weeks before he collected the specimen he described as "*omissus*" and had had it identified by Chittenden. This notation (1920, p. 176) appears on the same page as his description of "*omissus*."

Very close to *holoserica*, but differs from it by having a narrower, longer pronotum, a shorter beak, with the apex not widened and not acute below, the base of the beak from the side not so swollen, the punctures above smaller, the elytral intervals transversely wrinkled, the stria punctures less widely spaced, and the punctuation below larger, denser. The penis has the chitinized border very broad at the apex (fig. 82), much as in *cicatristriata*, *necydaloides*, and a few others, but the apex is slightly emarginate, with no lobe or knob whatsoever, and the lateral corners are more square than in the above species. Unfortunately, no dissection was made on any males of *holoserica*.

Differs from *arizonensis* and *cicatristriata* by having the beak of the same width throughout, not apically widened, the elytral suture with but one row of punctures, and a longer, narrower pronotum.

The localities listed are all on the Atlantic or Gulf coasts (New River, North Carolina, was not found).

BIOLOGY: Three specimens were collected under logs, two near a pond and one on a beach.

***Calendra blanchardi* (Chittenden)**

## Figure 83

*Sphenophorus blanchardi* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 179.

Medium, robust; black, coated in interspaces, pronotum without evident vittae, elytra with very large, deep punctures on intervals and striae, intervals flat, smooth.

Beak (from side) long, compressed, curved, wider at apex, apex beneath prolonged and obtusely or acutely angled, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex concave, base with deep canal, front of head finely punctured. Eye with lower corner below insertion of beak. Strong thoracic lobe present behind eye. Pronotum without true vittae, but with them indicated by having smaller punctures than rest of pronotum, the median "vitta" a round area, the laterals oblique at the base, apex of pronotum with four or five confluent punctures, interspace punctures dense, deep, and large (size of elytral stria punctures). Scutellum narrower than long, broadly grooved. Elytra with intervals flat, of about equal width, the even ones with single rows of large punctures (almost as large as stria), the odd ones, including suture, with confused double rows of touching punctures; striae narrow, with widely spaced large punctures (like those on pronotal interspaces) that cut about halfway or more into the intervals. Sides of prosternum with strong, dense punctures as on pronotum. Legs, front tibiae with outer apical angle not prolonged, but sinuate before apex, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides, at apex. Length, 10.5–12.5 mm.

TYPE LOCALITY: Texas. Type in the United States National Museum, examined.

DISTRIBUTION: Texas.

SPECIMENS EXAMINED: *Texas*: (Blanchard), 1 ♀ (type, U.S.N.M. No. 8974), 1 ♂ (allotype), 1 ♂ (paratype).

DISCUSSION: Although Chittenden states in his description that his type is a male, it has been examined and is a female.

On one of the specimens the head is more strongly punctured than on the others, and

the female (type) has the apex of the beak beneath very acute and prolonged. The center of the pronotum is more convex in the paratype and has denser punctures. Chittenden said that this species did "not suggest any other in our fauna," and he also emphasized as being unique the strong constriction of the extreme apical margin of the sides of the thorax which, when seen from above, had "the lower portion projecting beyond the upper," forming an acute angle behind the eye. This is, however, caused merely by the strongly sinuous thoracic lobe behind the eye and occurs, though less markedly, in species such as *callosa* and *destructor* which also have a lobe.

The very large, dense, elytral punctures are similar to those of *germari*, which is, however, a quite different insect. In general appearance, *blanchardi* is somewhat similar to *cicatristriata*, *serratipes*, and *terricola*, but it differs from them by having a thoracic lobe, larger punctures on the pronotum and elytral intervals, the pygidium rapidly narrowing to the apex, the elytral stria punctures round, not horseshoe shaped, and more widely separated.

***Calendra necydaloides* (Fabricius)**

## Figure 84

*Calandra necydaloides* FABRICIUS, 1801, Systema eleutheratorum, vol. 2, p. 435. OLIVIER, 1807, Entomologie, vol. 5, p. 94, pl. 28, fig. 420.

*Sphenophorus necydaloides*, CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 155.

*Sphenophorus retusus* GYLLENHAL, 1838, Genera et species curculionidum, vol. 4, p. 949. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 427. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 565.

*Calandra retusa*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 162. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 441.

Medium, robust; black or reddish, usually not coated, pronotum very large, with spindle-shaped, bare, median vitta, elytra presenting smooth, neat appearance, punctures not large.

Beak (from side) long, compressed, curved, wider at apex, apex beneath acute, base not swollen over antennal insertion, fovea of a few larger, confluent punctures in front of eye; (from above) apex flattened or concave, base with wide, deep canal, front of head im-

punctate or finely punctured. Eye extending below insertion of beak. Apex of thorax behind eye with weak lobe. Pronotum large, nearly as wide as widest part of elytra but appears even wider, median vitta spindle shaped, usually taking up a third of pronotum in width but sometimes narrower, with fine sparse punctures in center (not always visible), rest of pronotum evenly, moderately punctured (some punctures smaller than others), at middle to each side of median vitta usually a round or oval impunctate area, at base a suggestion of where laterals would be expected. Scutellum narrower than long. Elytra scarcely longer than pronotum, intervals about equal in width and elevation, feebly convex, with single row of small punctures (third interval irregularly punctured); striae with larger punctures, regularly spaced. Under surface, sides of prosternum with finer, sparser punctures than on pronotum, rest below more strongly punctured. Abdomen depressed before apex. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex. Length, 8–11 mm.

**MALE CHARACTERS:** All femora and tibiae, base of metasternum, all first abdominal segment, and apex of abdomen with short yellow hairs.

**TYPE LOCALITY:** "Carolina, America borealis"; here restricted to South Carolina. Type in Paris museum, examined.

**DISTRIBUTION:** Atlantic and Gulf coast states. Iowa (Bleasdel).

**SPECIMENS EXAMINED:** *Massachusetts:* "Sconset," Aug. 20, 1902 (J. L. Zabriskie), 2 ♂, 2 ♀, *Rhode Island:* Watch Hill, July 11, 26, 1945 (S. C. Harriot), 2 ♂, 3 ♀, Aug. 12, 1909 (W. Robinson), 1 ♀. *New York:* (C. Palm), 1 ♀; Massach., 1 ♀; Rockaway Beach, Aug. 3, 1891 (J. L. Zabriskie), 5 ♂, 1 ♀; Fire Island, July 27, 1941, 1 ♂; Nyack, 1883 (J. L. Z.), 1 ♂. *South Carolina:* 1 ♀; "Caroline, coll. Bosc, 1828," 1 ♀ (type, *necydaloidea*). *Florida:* Coral Gables, Nov.–Jan., 1927 (H. B. Bailey), 1 ♂, 2 ♀; Indian River (Hubbard and Schwarz), 1 ♀; Miami, Nov. 26, 1912 (F. Knab), 1 ♀. *Alabama:* Sept. 14, 1922 (Satterthwait), 1 ♀. *Texas:* Victoria, April 24 (J. D. Mitchell), 1 ♀; Alligator Head, Calhoun Co. (J. D. Mitchell), 1 ♀. "America borealis," 1 ♂ (type, *retusus*).

**DISCUSSION:** The pronotum in this species is quite uniform, the median vitta, or impunctate area (actually there are a few minute scattered punctures) being always large, broad at the middle, and narrowing towards both ends, feebly convex. It usually covers in width the middle third of the pronotum, but occasionally, as in one specimen from South Carolina and three from Coral Gables, Florida, it is quite a bit narrower. In 27 specimens, all but one have a small impunctate area on each side of the median vitta just in front of the center.

One specimen (Nyack, New York) has the fourth interval of the elytra on both sides, near the base, interrupted by the fourth and fifth striae which meet across the interval. The seventh interval on a Watch Hill, Rhode Island, specimen is similarly interrupted but on one elytron only. The antennal club varies somewhat in shape but is generally definitely oval, with the sensory part at the tip very small.

The beak is much longer than in *coesifrons*, from which it differs further by having the median space on the pronotum wide and fusiform, the apex of the thorax behind the eye scarcely, if at all, sinuous, the abdomen depressed before the apex, the male with noticeable hairs in the ventral cavity, the elytral intervals with visible punctures, not coated. The genitalia are rather similar (figs. 84, 85).

The types of both *necydaloidea* (1801) and *retusus* (1838) have been examined, the former in Paris, the latter in Stockholm. They are the same species, as Chittenden (1924, p. 155) had already deduced from his examination of Olivier's drawings, and *necydaloidea* must replace the name that has been used for many years. The *retusus* type is a small male (7 mm.), with shiny surface; the *necydaloidea* type, a female, is larger (9 mm.) and is somewhat opaque.

Additional specimens of this species have been seen from Connecticut, New Jersey, and Mississippi, and have been reported from North Carolina, Pennsylvania, and Iowa.

**BIOLOGY:** Satterthwait (1931a, p. 162) records *Panicum repens*, creeping panic grass, as the only host plant. This grass grows in sand along the sea shore; it has long, stout root stalks.

***Calendra coesifrons* (Gyllenhal)**

Figures 27, 61, 85

*Sphenophorus coesifrons* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 959. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 161.

*Sphenophorus oblitus* LECONTE, 1876, Proc. Amer. Phil. Soc., vol. 15, p. 425. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 156.

*Calendra oblita*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161; 1932, U. S. Dept. Agr. Farmers' Bull., no. 1003, p. 18.

*Sphenophorus lutulentus* CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 162.

Medium to large; robust; black or red, coated, pronotum without raised vittae, elytra smooth, coated, no punctures usually visible.

Beak (from side) short, stout, strongly compressed, slightly curved, wider at apex, apex beneath prolonged into acute point, base not swollen over antennal insertion, no fovea in front of eye, but a fold or ridge; (from above) apex definitely concave, base deeply concave, front of head finely or strongly punctured. Eye with lower edge almost level with insertion of beak, but slightly below. Thoracic lobe behind eye strongly sinuous. Pronotum without apical depression, usually quite convex in center, with sometimes a slightly raised, impunctate median line, the lateral vittae vaguely traced, oblique, slightly elevated or merely outlined by coating, entire pronotum with large, round, shallow, sometimes touching punctures, usually filled with coating or mud. Scutellum narrower than long, virtually parallel. Elytra with intervals about equal in width and elevation, with single rows of fine, regular punctures, usually scarcely visible; striae fine, with small, distant punctures. Under surface, sides of prosternum evenly, densely punctured, but usually obscured by coating. Front tibiae with outer apical angle not prolonged, but with minute tooth, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with thick hairs at apex in male, small tufts at sides only in female. Length, 8–12 mm.

TYPE LOCALITY: Mexico. Type in Stockholm museum, examined.

DISTRIBUTION: Probably most of southeastern, south central, and southwestern United States, also Mexico (probably northern Mexico only).

SPECIMENS EXAMINED: *North Carolina*: 1 ♀; Southern Pines, Aug. 31, 1909 (A. H. Manee), 1 ♂, 3 ♀. *Alabama*: Montgomery, Oct. 26, 1892 (H. Soltan), 1 ♂. *Louisiana*: Shreveport (J. O. Anthony), 1 ♂. *Texas*: 1 ♀ (type, *oblitus*, M.C.Z. No. 5439); 1 ♂, 1 ♀; Horn Coll. No. 9009, 1 ♂, 1 ♀; Victoria, May 26, June 8, 1917, June 6, 1919 (J. D. Mitchell), 3 ♂, 1 ♀; Bay City, May 10, 1918 (A. H. Hollinger), 2 ♂, June, 1917 (J. D. Mitchell), 1 ♀; Marathon, June 18, 1934 (O. Schwab, M. Cazier), 1 ♀; Leon Co., May 27, 1939 (R. E. Maxwell), 1 ♂; Van Horn, Culberson Co., June 24, 1942 (H. A. Scullen), 2 ♀; Dallas Co., Mar. Apr., 3 ♀; 6–10 miles west of Fort Davis, on Texas 166, 5000 ft., July 15, 1948, 1 ♀. *Oklahoma*: Duncan, June 19, 1909 (T. D. Urbahns), 1 ♀. *Kansas*: Rook Co., July 1, 1885, 1 ♀. *New Mexico*: Cienaga Ranch, near Rodeo, Hidalgo Co., July 12, 1948 (P. and C. Vaurie), 1 ♀; Roswell, 4 [sex not noted]; Las Cruces, June 18, 1942 (H. A. Scullen), 1 ♂. *Arizona*: Douglas, July 21, 1941 (W. W. Jones), 2 ♂, 2 ♀. [State?]: Floral Park, July 13, 1913, 1 ♀.

Mexico. 1 ♂, 1 ♂ (type, *coesifrons*), 1 ♀ (paratype, *coesifrons*). *Durango*: Lerdo, June 3, 1918 (McKinney and Loftin), 1 ♀. *Chihuahua*: Paso del Norte (Höge), 1 ♀ (type, *lutulentus*). *Coahuila*: Saltillo, July (Wickham), 1 ♂. "Vera Cruz," 1 (paratype, *coesifrons*).

DISCUSSION: Champion (1910, pp. 161–162) considered his *lutulentus* (northern Mexico) allied to *oblitus* LeConte (Texas) and the latter "extremely like" *coesifrons* Gyllenhal (Mexico). Comparison of the types of the two Mexican species with the type and many specimens of *oblitus* from the United States shows the three forms to be conspecific, with Gyllenhal's *coesifrons* having priority. There is quite a disparity in size between the type of *lutulentus* (a female, 12 mm.) and that of *coesifrons* (a male, 8 mm.), but the same size range has been found among United States specimens, a New Mexico specimen agreeing in size with *lutulentus* and many Texan specimens being as small as *coesifrons*. The type of *oblitus* measures 10 mm. Other differences mentioned by Champion in his comparisons of the three forms seem to be due to wear or to individual variation.

Specimens of *coesifrons*, in addition to those examined, have been reported in the literature by Chittenden (1924, p. 156) from Colorado, and by Satterthwait (1932, p. 18) from Wisconsin to New Mexico, also Maryland and Mississippi. One of the paratypes

of *coesifrons* is labeled Vera Cruz, Mexico, which seems too far south for this species, but it may have found its way south along the Gulf coast. Or, since it is an old specimen, it may have been labeled Vera Cruz because it was shipped out from that port to Europe, but may have come from the interior or northern Mexico.

Of 13 specimens, 10 have the coating on the pronotum fairly thick in the interspaces and distributed in such a way that the median space and the lateral vittae are recognizable as such; in the other three specimens, the coating is present within the punctures only, which results in the pronotum's appearing rather evenly punctured and without evident vittae. The fine elytral punctures are visible under low magnification in only half the above specimens.

This species resembles *chittendeni* and *dietrichi* in the stout, heavy beak and general pronotal pattern but differs from them in the more acute prolongation of the apex of the beak below (fig. 61), in the fact that the beak, seen from above, is much narrower at the middle, and in the fine punctuation of the elytral striae. It is more similar in pronotal pattern to *compressirostris* and *cultellata*, but it lacks the straight, keeled beak and submedian tibial teeth of the latter two species, and it has no raised elytral intervals. The subapical tooth is large and stout as in *germari*.

Differs from *necydalooides* by having a shorter, broader beak, a sinuous thoracic lobe behind the eye, and the male cavity without hairs. Both species have been seen from Victoria, Texas, a locality from which we have also *germari*, *aequalis*, *bartramiae*, *holoserica*, and *pertinax*.

**BIOLOGY:** This species has been reared from timothy (Satterthwait, 1932, p. 18), but this is evidently not its natural host, which is unknown. The adults can do much damage also to corn, and Chittenden (1924, p. 156) reported it as injurious to rice. It is one of the species taken by the upland plover (*ibid.*, p. 155).

***Calendra chittendeni* (Blatchley)**

Figure 86

*Sphenophorus chittendeni* BLATCHLEY, 1916, in Blatchley and Leng, Rhynchophora of north-

eastern America, p. 565; 1920, Jour. New York Ent. Soc., vol. 28, p. 176. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 155.

Medium, robust; black, coated in interspaces, large pronotum covered with big shallow punctures except on dilated bare median vitta, elytra with large punctures on striae, small ones on intervals, usually transversely wrinkled.

Beak (from side) short, very stout, compressed, slightly curved, wider at apex, apex beneath acute, base not swollen over antennal insertion, large, deep fovea in front of eye; (from above) apex slightly concave, base unusually broad, with deep long canal, front of head scarcely punctured. Eye extending slightly below insertion of beak. Thoracic lobe weak. Pronotum very large, with median vitta spindle shaped, impunctate in center, finely, sparsely punctured at edges, rest of pronotum covered with large, round, shallow punctures, some touching, some separated by their own width (separated punctures are where lateral vittae would be expected), punctures as wide as elytral intervals, filled with coating and each with a stiff hair arising from it, at sides near base four or five confluent depressed punctures, making round depressions. Scutellum narrower than long, flat. Elytra scarcely longer than pronotum, intervals of about equal width, slightly wider than largest pronotal punctures, their punctures visible only under high magnification; striae with large deep punctures of size of pronotal punctures, cutting into the intervals, making their sides sinuous. Under surface, sides of prosternum punctured as on pronotum or somewhat smaller, rest below strongly punctured except femora which are finely punctured. Abdomen before apex slightly depressed. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium coated, some hairs at apex. Length, 8.5–9 mm.

**TYPE LOCALITY:** Dunedin, Florida. Type in the United States National Museum, examined.

**DISTRIBUTION:** Florida, Alabama, Mississippi, Georgia (Blatchley, Buchanan).

**SPECIMENS EXAMINED:** *Florida:* 1 ♂; Sebastian, 1 ♂; Dunedin, Jan. 11, 1913 (W.S.B.), 1 ♀ (type, U.S.N.M. No. 19652); *Eau Gallie*, Jan. 8, 1910,

1 ♀, "from stomach of *Sturnella granelle*"; Tampa, 1 ♀; Naples, Feb. 1, 1946 (S. Rounds), 1 ♀. *Alabama*: Mobile, Feb. 5, 1915 (H. P. Loding), 1 ♀, Apr. 2, 1903 (H. P. Loding), 1?; Mobile Co., Dec. 6, 1931 (H. P. Loding), 1 ♀. *Mississippi*: Lucedale, June 25, 1930 (H. Dietrich), 1 ♂.

DISCUSSION: *Calendra chittendeni* is very closely related to *C. dietrichi*. They occupy the same geographical range, and neither appears to be very common. They are both robust, of about the same size, with the same over-sized pronotum with large punctures, the same beak, the same type of genitalia (figs. 86, 87), and the same tarsal structure. They have the pronotal punctures larger than on most other species and are the only species except *cultellata* with such a broad space between the eyes.

Differs from *dietrichi* by having a large, deep fovea (usually encrusted) in front of the eye, the median pronotal vitta dilated and fusiform instead of a narrow line, much finer punctuation on the femora, at the base of the beak above, and on the front of the head, the elytra with larger stria pits but smaller, minute interval punctures, including the suture.

Blatchley found *chittendeni* allied to *necydaloides* which also has a large pronotum and similar median vitta; the latter has the punctuation above and below smaller and finer, the beak longer and narrower, and no deep fovea in front of the eye. Two very old *chittendeni* specimens without locality were found at the British Museum labeled *retusus*, which is a synonym of *necydaloides*.

Differs from *coesifrons* in the large stria punctures on the elytra and in the presence of the fovea in front of the eye.

BIOLOGY: There have been no reports on what this species feeds on, only reports on what feeds on it. A Florida specimen was found in the stomach of a lark, and a Georgia specimen, reported by L. L. Buchanan, in the stomach of a toad (Chittenden, 1924). Specimens have been taken on the edge of an inland pond and under seaweed on the Gulf coast beaches (Blatchley and Leng, 1916).

#### *Calendra dietrichi* Satterthwait

Figure 87

*Calendra dietrichi* SATTERTHWAIT, 1933, Ent. News, vol. 44, p. 210; 1936, *ibid.*, vol. 47, p. 38.

Medium, robust; black, coated in interspaces, large pronotum covered with big, shallow punctures and with narrow bare line for median vitta, elytra with large punctures on intervals and striae.

Beak (from side) short, very stout, compressed, slightly curved, wider at apex, apex beneath acute, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex slightly concave, base unusually broad, with wide canal between eyes surrounded by large, confluent punctures, front of head distinctly punctured. Eye extending below insertion of beak. Thoracic lobe weak. Pronotum very large, without vittae but with raised, impunctate, median line from near base to near apex (variable), about as wide as third elytral interval, rest of pronotum covered with large, round, shallow punctures, almost touching, as wide as narrower elytral intervals, punctures filled with coating and each with a stiff hair arising from it. Scutellum narrower than long, flat. Elytra scarcely longer than pronotum, third interval raised and wider than others, others hardly wider than largest pronotal punctures, with one row of close-set punctures except third, which has two rows at base, punctures about size of smallest pronotal punctures; striae wide, deep, with large punctures at base, becoming confluent towards apex. Under surface, sides of prosternum punctured same as above, rest below strongly punctured, including femora. Abdomen before apex slightly depressed and with stiff yellow hairs. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with stiff hairs at apex. Length, 8–10 mm.

TYPE LOCALITY: Wiggins, Mississippi. Type in the United States National Museum, examined.

DISTRIBUTION: Mississippi, Alabama, Florida.

SPECIMENS EXAMINED: *Mississippi*: Wiggins, Mar. 4, 1932, Webster Groves, No. 32002, 1 ♀ (type, U.S.N.M. No. 44807). *Alabama*: Mobile (H. P. Loding), 1 ♀, Feb., 1909 (H. P. Loding), 1 ♂.

DISCUSSION: This species is listed in Blackwelder's fourth supplement (1939, p.



69) under *Sitophilus*, which is an error; it is a *Calendra*.

Although only three specimens have been seen, at least two others exist, a female from Delchamps, Alabama, collected by Henry Dietrich, December 13, 1931, which Satterthwait had at the time of his description of the species, also a male described by Satterthwait from Florida (W. G. Dietz collection) which he found in the collection of the Museum of Comparative Zoölogy at Cambridge.

Looked at from above, this species could be mistaken for *chittendeni* except for the narrower, not dilated, median pronotal line. It differs further from that species in the absence of the deep fovea in front of the eye and in the much stronger punctuation on the femora, at the base of the beak above, and on the front of the head. The two species are, however, closely related.

This marked difference in punctuation of the femora, beak, and head in these two sympatric species is the same type of difference that occurs between *cultellata* and *compressirostris*, two other sympatric species which are perhaps as closely related to each other as are *dietrichi* and *chittendeni*. *C. cultellata* and *compressirostris* have sharp keels along the top of the beak and large, submedian teeth on the front tibiae, both of which are lacking in the other two species.

Satterthwait said that *dietrichi* more resembled *germari* than it did *chittendeni*, but I find it closer to the latter. It differs from *germari* in the shape of the beak, in the lack of a strong constriction at the base of the beak on top in front of the eye, in the lack of angulation on the inner side of the front tibiae, and in the fact that the pronotal punctures are of more uniform size. The penis is very different from that of *germari* which is long and pointed. In *dietrichi* there is a large, wedge-shaped projection connected to the apex of the penis by a strong constriction; this projection is also present on the penis of *chittendeni*, but there it is not constricted and is longer, not wedge shaped. No other genitalia examined have quite this type of projection (figs. 86, 87).

**BIOLOGY:** The type was taken as a larva from rice stubble on March 4, the adult issuing April 6.

### *Calendra cultellata* (Horn)

Figures 64, 88

*Sphenophorus cultellatus* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 429.

Medium, robust; black, coated in interspaces, large pronotum with large touching punctures all over except for narrow median line, elytra with intervals showing as narrow raised lines.

Beak (from side) very short, stout, strongly compressed, straight, about same width throughout, upper and lower contours with knife-like keels from near base to apex, apex beneath acute and with slight sinuation before apex, base not swollen over antennal insertion, no fovea in front of eye, but a fold or ridge; (from above) apex with sharp keel, base unusually broad, with long, deep canal, front of head with strong, dense punctures. Eye with lower edge at same level as insertion of beak. No thoracic lobe. Pronotum large, with large, round, often touching punctures, each with an erect hair visible in the center against the coating and a very narrow median impunctate line; where lateral vittae would be expected there is more space between the punctures. Scutellum nearly as wide as long, variable. Elytra scarcely longer than pronotum, with odd intervals raised, bare, strongly punctured, even intervals less raised, bare, narrower than the coated striae space on each side; striae usually entirely obscured by coating. Under surface, sides of prosternum with same large punctures as on pronotum, the rest below strongly punctured, including femora. Legs, front tibiae with outer apical angle not prolonged, front tibiae with subapical tooth moved to near middle, stouter than apical tooth and nearly as long, middle and hind tibiae with subapical tooth smaller and closer to apical, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium at apex with smaller punctures and hairs. Length, 8.5–10 mm.

**TYPE LOCALITY:** No locality specified; here designated as Texas from original label on lectotype, female, new designation, Horn Collection No. 9005, in the Academy of Natural Sciences of Philadelphia, examined.

**DISTRIBUTION:** Coast of Texas north to Nebraska and Iowa.

**SPECIMENS EXAMINED:** *Texas:* Horn Coll. No. 9005, 1 ♀ (lectotype); Tivoli, Apr. 29, 1909 (J. D. Mitchell), 1 ♂. *Oklahoma:* Lawton (J. R. Horton), 1 ♂. *Kansas:* (F. H. Snow), 1 ♂; Horn Coll. No. 9005, 2 ♀ (cotypes); Ellsworth, Apr. 18, 1 ♂, 1 ♀; Wallace Co., Aug. 31, 1 ♀, July 8, 1 ♂; Greenwood Co. (J. C. Bridwell), 1 ♂; Sylvia, Reno Co., Dec. 2 (J. C. Warren), 1 ♂. *Nebraska:* Horn Coll. No. 9005, 1 ♀ (cotype); (Liebeck), 1 ♀. No locality: 5 cotypes, M.C.Z. No. 1035.

**DISCUSSION:** This species and *compressirostris* are the only two in the genus in which the subapical tooth on the front tibiae is moved back to near the middle of the tibiae and in which this tooth is stouter than the apical tooth. They are further characterized, as is also *cazieri*, by having a short, broad, perfectly straight beak, so compressed above that it has a knife-like keel on the upper contour. They are still further characterized, as are also *cazieri* and *inaequalis*, by the fact that the bottom of the eye does not extend below the insertion of the beak as in other species, but is on the same level (fig. 64).

Differs from the closely related *compressirostris* by having a knife-like keel also on the under side of the beak, by the deeper, denser punctuation on the front of the head, on the femora, and on the prosternum, by the broader, larger pronotum, and the narrow, not dilated or fusiform, median line on the pronotum.

All four of the above species occur in Texas: *cazieri*, only one specimen, on the coast; *inaequalis* probably on the coast (it has been reported from Texas); *compressirostris* at Brownsville as well as in inland Texas; and *cultellata* on the coast. Other species fairly close to these (*necydaloidea*, *germari*, *coesifrons*) have also been taken in Texas.

The elytra and genitalia (fig. 88) are almost identical with those of *compressirostris*.

This species is far more abundant than would appear from the list of specimens examined; many more specimens have been seen but not examined closely, at the Museum of Comparative Zoölogy, mostly from Kansas and Texas. A specimen from Iowa was seen at the United States National Museum.

The median impunctate line on the pronotum is not always distinct.

### *Calendra compressirostris* (Say)

Figures 65, 88

*Calendra compressirostra* SAY, 1823, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 319.

*Sphenophorus compressirostris*, SCHOENHERR, 1838, Genera et species curculionidum, vol. 4, p. 952. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 429.

*Sphenophorus cultirostris* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 951. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 429.

*Sphenophorus compressirostris* var. *obscuripennis* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 156.

Small to medium, robust; black, coated in interspaces, large pronotum with spindle-shaped, bare, median vitta, merging with vague laterals in apical half, elytra with intervals showing as narrow raised lines.

**DESCRIPTION OF NEOTYPE, MALE:** Beak (from side) very short, stout, strongly compressed, straight, upper contour with knife-like keel from near base to apex and especially marked at apex, beak wider at apex, apex beneath acute, base not swollen over antennal insertion, no fovea in front of eye, but a fold or ridge; (from above) apex with sharp keel, base with slight keel leading forward, front of head with fine, distinct punctures. Antennal club more or less oval. Eye with lower edge at same level as insertion of beak. No thoracic lobe behind eye. Pronotum nearly as long as elytra, with spindle-shaped median vitta, feebly raised, somewhat dilated at middle, and two indistinct laterals merging with median in apical half, median vitta impunctate at middle, but with small scattered punctures at margins, lateral vittae differing from interspaces and rest of pronotum only by being slightly raised and less coated and by punctures' being somewhat smaller and sparser; interspaces obscured by coating, punctures large, round, shallow, practically touching, some merging at base. Scutellum narrower than long. Elytra scarcely longer than pronotum, with odd intervals raised and bare in their center, strongly punctured in single rows, even intervals more or less flat, coated; striae with well-separated punctures as large as those at base of pronotum. Under surface, sides of prosternum

sparsely, finely punctured, the rest below strongly punctured except femora, which are finely punctured. Front tibiae with outer apical angle not prolonged, subapical tooth moved to near middle, stouter than apical tooth and nearly as long, middle and hind tibiae with subapical tooth smaller and somewhat closer to apical, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium at apex with shiny raised area of smaller, closer punctures and lateral tufts of hairs. Length, 7.5 mm.

TYPE LOCALITY: "Arkansas, near the Mountains." Type destroyed.

NEOTYPE LOCALITY: Gatesville, Coryell County, Texas, September 15 to 30, 1942 (Mrs. E. L. Bell, Jr.). Neotype, male, new designation, in the American Museum of Natural History.

DISTRIBUTION: Texas and neighboring states, also Kentucky, Tennessee, Wisconsin, and New York.

SPECIMENS EXAMINED: *Texas*: (C. Palm), 2 ♂, 2 ♀, (C. V. Riley), 1 ♂; Horn Coll. No. 9006, 1 ♂, 1 ♀; Edinburg (Chittenden), 1 ♀ (type, var. *obscuripennis*, U.S.N.M. No. 26903), 1 ♂ (allotype, var. *obscuripennis*); Kerr Co., Apr. 9, 1939 (D. Millspaugh), 4 ♂; Bandera, Apr. 7 (Rowe), 1 ♀; Gurley, May 23, 1905 (A. C. Morgan), 1 ♀; Gatesville, Coryell Co., Sept. 15-30, 1942 (Mrs. E. L. Bell, Jr.), 1 ♂ (neotype, *compressirostris*), 1 ♂, 2 ♀. *New Mexico*: Maxwell, Sept. 11, 1916 (Caffrey), 1 ♀. *Tennessee*: Dickson, Feb. 29, 1932 (H. Ruckes), 1 ♀. *New York*: Kinderhook, July, 1936 (B. D. Valentine), 1 ♂. "America borealis," 1 ♂ (type, *cultirostris*).

DISCUSSION: The type and allotype of the variety *obscuripennis*, described from Edinburg, Texas, and also from Brownsville, Texas, and Koehler, New Mexico, do not seem to differ from *compressirostris*. The type of Gyllenhal's *cultirostris*, examined in Stockholm, also agrees with *compressirostris*.

This species appears to be more abundant than its close relative, *cultellata*, and also more widespread. In addition to the above, specimens have been seen from Wisconsin, Kansas, and Colorado, and they have been reported from Kentucky and Oklahoma. This makes a rather spotty distribution, but the records are probably correct, as it is an easily recognized species.

As in *cultellata* and *coesifrons*, the lateral vittae would scarcely be recognized as vittae were it not for the coating or mud in the punctures of the depressed interspaces, this coating making the vittae more noticeable by contrast. In this species, however, the punctures on the vittae are usually smaller and sparser than those in the interspaces, and this helps to make the pronotal M stand out.

The elytra are of the same type as in *cultellata*. The striae, stria punctures, and the even intervals are usually hidden under heavy coating; sometimes the even intervals have a raised line as on the odd intervals, but the line is narrower. The single rows of punctures on the sutural and third intervals are double rows in some specimens.

The apex of the beak below is usually more acute than in the neotype specimen and often has a slight sinuation below just before the apex. The size range seen in other specimens of this species is from 6.5 to 8.5 mm.

The characters separating this species from *cultellata* are the lack of a keel on the under side of the beak in *compressirostris*, the finer, sparser punctuation on the front of the head, the base of the beak, the femora, and prosternum, and the presence of a dilated median vitta on the pronotum instead of merely a narrow line as in *cultellata*. It is interesting to note that two other closely related species, *chittendeni* and *dietrichi*, differ from each other in the same characters by which *compressirostris* differs from *cultellata* (with the exception of the keel on the beak, which the former two species do not possess). Differs from all other species except *cultellata* in the large submedian tooth on the front tibiae.

BIOLOGY: Chittenden (1924, p. 155) reports the upland plover, *Bartramia longicauda*, as feeding on this species, among others.

#### *Calendra cazieri*, new species

Figure 89

Small, robust; covered with thick grayish coat, pronotum large, without visible vittae, elytra with alternate intervals raised.

DESCRIPTION OF TYPE, MALE: Beak (from side) very short, stout, strongly compressed, straight, upper contour with knife-like keel from near base to apex, beak wider at apex, apical half impunctate or nearly so, apex beneath acute, base not swollen over antennal

insertion, densely, deeply punctured, no fovea in front of eye but a fold or ridge; (from above) apex with sharp keel, base and front of head encrusted, with small distinct punctures on head behind encrustation. Bottom of eye at same level as insertion of beak, eye not quite twice as long as wide. Apex of thorax behind eye with very slight indication of lobe. Antennal scape about three-quarters of the length of beak, funicle with second segment slightly longer than third, club elongate-oval, the sensitive part only one-fifth of the whole. Pronotum large, square in appearance, actually very nearly as wide as long, including the apical constriction, entirely encrusted except for rubbed spot in center showing three punctures and part of a median impunctate line, no vittae discernible, small, evenly placed punctures just visible under coating, basal margin slightly sinuate but not lobed. Scutellum more or less triangular. Elytra wider than pronotum, only slightly longer, entirely encrusted, odd intervals raised under coating, no punctures visible. Under surface coated except hind angles of prosternum, most of legs, part of mesosternum, and last abdominal segment; sides of prosternum finely, sparsely punctured, also legs and mesosternum, the abdomen more strongly. Legs, front tibiae with outer apical angle flared outward and prolonged into lobe which is thicker than inner apical claw and about half as long, other tibiae with angle not prolonged, all tibiae sinuate within, especially the front; all femora with a few sparse hairs on inner side; subapical tooth small; under side of front tibiae excavated, the surface smooth except for raised line near outer edge and row of small punctures on inner side of raised line; all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Femora with fine, sparse punctures. Pygidium entirely coated, almost square, apical area hairy. Ventral and metasternal cavity shallow. Length, 8 mm.

TYPE: Male, Corpus Christi, Nueces County, Texas, June 5, 1948, collected by Mont A. Cazier, after whom the writer takes pleasure in naming this species; deposited in the collection of the American Museum of Natural History.

DISCUSSION: In a genus of such variability as *Calendra* it is usually inadvisable to describe a new species from a single specimen, but in this case all the usually variable characters are entirely covered with a thick gray coating so that they cannot in any case be used for discrimination. The position of the eye (at the same level as the insertion of the beak) and the large pronotum link *cazieri* with *compressirostris*, *cultellata*, and *inaequalis*; the beak is of exactly the same type (short, stubby, straight, sharply keeled above) as in *compressirostris* and *cultellata* (figs. 64, 65), without the keel on the under side as in *cultellata*, but *cazieri* differs by not having the large submedian tooth on the inner side of the front tibiae as in those species, the eye is more broadly oval, not so elongate, the pronotum is less elongate, and the outer apical angle of the front tibiae is flared outward into a lobe. In the four latter characters it agrees with *inaequalis*, which it resembles also in general shape, in size, and in the very small sensitive area at the apex of the antennal club, but the beak in *inaequalis* is not so short, nor so compressed, nor so straight, nor does it have any keel. The male genitalia are also quite different, and *inaequalis* has a raised pronotal pattern which seems to be lacking in *cazieri*. The penis in *cazieri* is somewhat the same shape as in *cultellata* and *compressirostris*, but the apex has a small rounded knob not present in the others (fig. 89). All four species occur in Texas.

A second specimen of this species was found in the collection of the Museum of Comparative Zoölogy at Cambridge. It has, unfortunately, no locality label. It is also a male and matches the type except that it is a little smaller (7 mm.), the apex of the beak below is worn, so is less acute, and the coating on the pronotum is denuded enough to show more of the median impunctate line and also to reveal what may be the lateral vittae at base, with punctures the size of those in the center of the pronotum. These exposed punctures are much larger than they appear when covered with the coating. The elytra are partially denuded and a few very widely spaced, small striae punctures can be seen. No doubt more specimens of this heavily encrusted species exist, unidentified, in collections.

***Calendra inaequalis* (Say)**

Figure 90

*Rhynchophorus inaequalis* SAY, 1831, Description of new species of Curculionites of North America, p. 23.

*Sphenophorus inaequalis*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 414. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 552.

*Calendra inaequalis*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 19.

*Sphenophorus contractus* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 953.

Small, robust; black or reddish, partially coated, pronotum large, with five, sometimes seven, raised bare areas corresponding to vittae, the median always distinct; elytra with equal intervals, sinuous at sides, or transversely rugose.

DESCRIPTION OF NEOTYPE, FEMALE: Beak (from side) short, compressed laterally, nearly straight on top contour, slightly curved on lower contour, wider at apex, apex beneath acute, base not swollen over antennal insertion, no fovea in front of eye, but slight fold or ridge on upper front edge of eye; (from above) apex flattened, base with narrow impressed line leading forward from puncture, front of head finely punctured. Antennal club oval, elongate, the sensitive portion very small. Eye with lower margin at same level as insertion of beak. No trace of thoracic lobe behind eye. Pronotum nearly as long as elytra and about as wide, with three feebly raised, shining vittae, minutely punctured, the median vitta dilated into a diamond in center and with a narrow line extending to apex and base, the laterals partly broken and interrupted by invading punctures of the interspaces, with two additional, ill-defined, raised areas where side branches of laterals would be expected; interspaces with large punctures, some as wide as an elytral interval, and often confluent. Scutellum narrower than long, depressed at base. Elytra scarcely longer than pronotum, intervals about equal in width and elevation, somewhat obscured by coating, transversely wrinkled, with large round punctures in single rows about a third of the width of intervals; striae with larger punctures than on intervals and breaking

into them, making their sides sinuous. Under surface, sides of prosternum almost impunctate, the rest below, except the femora which are finely punctured, strongly punctured. Front tibiae with outer apical angle flared outward and prolonged into a lobe, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium obscured by heavy coating, fringe of short hairs at apex. Length, 5.5 mm.

TYPE LOCALITY: "United States." Type destroyed.

NEOTYPE LOCALITY: MacDill Field, Tampa, Florida, April 1 to 10, 1943 (B. Malkin). Neotype, female, new designation, in the American Museum of Natural History.

DISTRIBUTION: Atlantic and Gulf coastal states, also Nebraska. Indiana (Blatchley and Leng), Minnesota (Satterthwait).

SPECIMENS EXAMINED: *Rhode Island*: Watch Hill, July 5, 1909 (W. Robinson), 1 ♀. *New York*: 2 ♀; Rockaway Beach, June 26, 1910, 1 ♂; Babylon, June 30, 1892 (G. D. Bradford), 4 ♀; Brooklyn, Apr. 30, 1911, 1 ♀. *New Jersey*: Lakewood, 1 ♀; Manasquan, June 16, 1935, 3 ♀; Hopatcong, 2 ♂. *South Carolina*: Beaufort, Apr. 3, 1892 (W. D. Bradford), 2 ♀; Charleston, June 15, 1943 (B. Malkin), 1 ♂, 1 ♀. *Delaware*: 1 ♂. *Florida*: Ch. Hbr. [Charles Harbor], 1 ♂; Miami Beach, Apr. 9, 1918 (T. E. Snyder), 1 ♀; Clearwater, Pinellas Co., Mar. 15, 1943 (B. Malkin), 1 ♀; Tampa, Mar., 1905 (F. H. Shoemaker), 1 ♂, 1 ♀; MacDill Field, Tampa, Feb., Mar., Apr., June, 1943 (B. Malkin), 14 ♂, 15 ♀, Apr. 1-10, 1943, 1 ♀ (neotype, *inaequalis*). *Nebraska*: 1. "America borealis," 2 (type and paratype, *contractus*).

DISCUSSION: Gyllenhal's *contractus*, the type of which was examined in Stockholm, is a synonym of *inaequalis*.

There is not much variation in the pronotum in this species; the median vitta is always well marked, dilated, and diamond shaped, reaching the apex and base by a raised impunctate line which is occasionally confused at the base by invading punctures from the interspaces. The interrupted lateral vittae, often represented by four raised shiny areas, either impunctate or with smaller punctures than in the interspaces, are usually more distinct at the base than at the apex. On one Florida specimen, the laterals are not recognizable, being a mass of punctures with only a trace of raised areas.

Specimens with less coating on the elytra present a more uneven appearance, the intervals then showing they are unequally raised and their sides sinuous; those with heavier coating appear smoother.

The antennal club is distinctly oval, scarcely narrower at the base than at the apex, with the sensitive part at the apex so small that it is just visible, as in *cazieri* and, to some extent, in *necydaloidea*. The scutellum is occasionally nearly as wide as long; the depressed base is not always evident.

The male pygidium is exceedingly broad for so small an insect and nearly twice as broad at the apex as in the female. When the female pygidium is not too coated, it is seen to possess a median keel and a depression on each side. The size range seen in this species is from 5.5 to 8 mm.

Although this appears to be mainly a coastal species, the Nebraska, Indiana, and Minnesota records show that it may occasionally occur inland. It has also been recorded from Alabama, Texas, and Pennsylvania.

The former grouping of *inaequalis* with those other species (*mormon*, *simplex*, *vomerina*) with the outer apical angle of the front tibiae dilated or prolonged did not at all show its relationship. It seems closer to *cultellata*, *compressirostris*, and *cazieri*, all robust, compact species with the lower edge of the eye at the same level as the insertion of the beak. These four species also have a kind of fold or ridge in front of the eye, on top; they have the pronotum broad, nearly as long as the elytra, and all the tarsi narrow. *C. inaequalis* differs from the three others by having a narrower, longer beak without any keel on top, and a definite pronotal pattern. It most resembles *cazieri* in general shape and size and in the flared outer apical angle of the front tibiae, both it and *cazieri* lacking the submedian tooth on the tibiae present in *cultellata* and *compressirostris*. The genitalia of the male, however, are different from those of all the species above mentioned (fig. 90). The penis is elongate and pointed, as in *germari*, and *germari* has a pronotal pattern somewhat similar to that of *inaequalis*, but the latter differs from *germari* in its much smaller size, longer, narrower beak, and the position of the eye.

**BIOLOGY:** Bermuda grass (*Cynodon dactylon*) has been recorded by Satterthwait (1931a, p. 160; 1932, p. 19) as a host plant for this species.

### *Calendra germari* (Horn)

Figures 21, 57, 91

*Calandra compressirostris* GERMAR, 1824, Insectorum species novae, vol. 1, p. 300.

*Sphenophorus compressirostris*, BOHEMAN, 1845, in Schoenherr, Genera et species curculionidum, vol. 8, pt. 2, p. 258. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 430.

*Sphenophorus germari* HORN, 1873, loc. cit. (new name for *S. compressirostris* Germar, nec Say). BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 572.

*Sphenophorus germari* var. *pinguis* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 156.

Medium to large, robust; black, coated in interspaces, pronotum large, with five vague raised bare spaces for vittae, elytral intervals sinuous from the large striae punctures.

Beak (from side) short, stout, strongly compressed, straight on upper contour until apex where bent downward and rounded off, beak wider at apex, apex beneath rounded to obtuse, base slightly swollen over antennal insertion, fovea of larger, concentrated punctures present in front of eye; (from above) apex flattened and distinctly turned downward, rest of upper contour with somewhat of a keel, base flattened between eyes and filled with mass of close, large punctures, front of head distinctly punctured. Eye extending below insertion of beak. Weak thoracic lobe. Pronotum large, with three feebly raised, indistinctly outlined vittae, with large and small punctures intermingled, the median somewhat dilated, the laterals broken up and appearing as four raised areas; interspaces with large, oval, round, or elongate punctures, usually confluent. Scutellum flat or broadly grooved. Elytra scarcely longer than pronotum, intervals about equal in width and elevation, transversely wrinkled, uneven, with large, shallow, usually touching punctures that take up most of the interval (on suture and third, two rows; on others, one); striae with large oval punctures (as large as on pronotal interspaces) that break into or interrupt the intervals, making them sinuous. Under surface entirely with large dense punctures, especially large on the

metasternum. Legs, front tibiae with outer apical angle not prolonged but slightly sinuate before apex, front and middle tibiae noticeably strongly sinuate near middle on inside, hind tibiae somewhat sinuate on inner and outer sides, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with apical hairs. Length, 10–11.5 mm.

TYPE LOCALITY: No locality specified; here designated as Texas from original label on lectotype, female, new designation, Horn Collection No. 9007, in the Academy of Natural Sciences of Philadelphia, examined.

DISTRIBUTION: Gulf States, North Carolina, eastern central states.

SPECIMENS EXAMINED: *Texas*: Horn Coll. No. 9007, 1 ♀ (lectotype, *germari*); 1 ♀ (cotype, *germari*); (C. V. Riley), 1 ♂, 2 ♀; "Pilate, 1841," 1 ♀; Victoria, June, 1917 (J. D. Mitchell), 1 ♂; Alligator Head, Calhoun Co., Apr., 1902 (J. D. Mitchell), 1 ♂. *Florida*: 1 ♂ (type, var. *pinguis*, U.S.N.M. No. 26906); Tampa, Apr. 15 (Hubbard and Schwarz), 1 ♂ (paratype, var. *pinguis*). *Missouri*: Willard, Greene Co., June 16, 1 ♂. *Indian Territory*: Horn Coll. No. 9007, 1 ♀ (cotype, *germari*). No locality: 2 cotypes, *germari*, M.C.Z. No. 1036.

DISCUSSION: Horn found Germar's *compressirostris*, described from Kentucky in 1824, to be preoccupied by Say's species of that name, 1823, and he redescribed it as *germari*.

The type and paratype of the variety *pinguis* (Florida and Tampa, Florida) have the elytra more irregular and seemingly more deeply punctured than *germari*, but this is probably due to the fact that the usual coating is somewhat worn off and does not fill in the punctures, because near the apex, where the coating is normal, *pinguis* presents the same aspect as *germari*, and I consider it a synonym of *germari*.

In addition to the specimens listed above, others have been seen (but exact data not taken) from Kansas, Indiana, Louisiana, Mississippi, and North Carolina and have been reported from Kentucky.

The situation on the inner side of the front tibiae is larger and stronger in *germari* than in any other species seen (fig. 21). It also has both the apical and subapical teeth very

large and stout, the subapical being about half the size of the apical and almost as thick.

This species is close to *cultellata*, *compressirostris*, and *cazieri* in the nearly straight, heavy beak which in some specimens has a trace on the top contour of the sharp keel of that group, and it is close to them also in having a stout subapical tooth on the front tibiae, but in *germari* the tooth is not in the middle of the tibiae though it is not so close to the apical tooth as in most other species. The male genitalia, however, are very different from those of the *cultellata* group, the penis being long, narrow, and pointed, not stout and rounded off at the apex (fig. 91).

In the genitalia, as also in the pronotal pattern, *germari* approaches *inaequalis*, which is also close to the *cultellata* group, but it differs from *inaequalis* in its much larger size, by having a shorter, stouter beak, the eye extending below the insertion of the beak, the front tibiae strongly sinuate within, the punctures below large and dense. Both species have been taken in Tampa, Florida.

Differs from *chittendeni* and *dietrichi*, with which it might be confused because of the large pronotum and heavy build, by having the front tibiae abruptly sinuate and the base of the beak (seen from above) strongly constricted in front of the eye.

BIOLOGY: This is one of the species reported by Chittenden (1924, p. 155) as being fed upon by the upland plover (*Bartramia longicauda*).

#### *Calendra soltauui* (Chittenden)

Figures 55, 92

*Sphenophorus soltauui* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 178. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 559.

Small, robust; black or reddish, scarcely coated, pronotum with median line and sometimes vague lateral vittae, evenly punctured all over, elytra with alternate intervals feebly raised, bare.

Beak (from side) long, compressed, nearly straight, much wider at apex, apex beneath forming obtuse or right angle, base strongly and abruptly swollen over antennal insertion and coarsely punctured, a mass of large punctures in front of eye; (from above), apex somewhat flattened, base with dense,



confluent punctures between eyes, no impressed line, front of head strongly punctured. Eye extending below insertion of beak and with a noticeable trench of impressed punctures around border. No thoracic lobe. Pronotum without vittae, but with impunctate median line of varying length which is often invaded by punctures, slight suggestion of lateral vittae and side branches present in the grouping and smaller size of the punctures in those regions, punctuation dense, uneven, with larger and smaller punctures. Scutellum narrower than long. Elytra with intervals about equal in width, odd ones somewhat feebly raised, bare, their punctures usually in single rows except on third, even intervals flat, usually coated, punctures as on odd, when visible; striae with round deep punctures, sometimes separated, sometimes touching, cutting deeply into the intervals and often nearly as wide as the intervals they interrupt. Under surface, sides of prosternum and the rest below punctured as on pronotum, including the femora. Legs, front tibiae with outer apical angle not prolonged, front tarsi with third segment widely dilated, middle tarsi with it less dilated, hind tarsi with it narrow, longer than wide, below on all mostly smooth with sparse hair at sides, on front tarsi hair is sometimes quite dense but does not form hairy pads. Pygidium with lateral tufts of hair at apex, impunctate line in center in some. Length, 6–8 mm.

**MALE CHARACTERS:** Abdomen with yellow hairs down center except on third and fourth segments.

**TYPE LOCALITY:** No locality specified, type from Greeley, [Colorado]. Type in the United States National Museum, examined.

**DISTRIBUTION:** Colorado, Iowa, Kansas, Illinois, Pennsylvania. Texas (Chittenden).

**SPECIMENS EXAMINED:** *Colorado:* Greeley, Apr. 22, 1889, 1 ♀ (type, U.S.N.M. No. 8973), (Wickham), 2 ♀ (paratypes). *Iowa:* Ames, Aug. 1, 1932 (F. Andre), 1 ♀; Iowa City, July 21, 1902 (Wickham), 1 ♀ (paratype), July 20 (Wickham), 1 ♀; Lake Okoboji, June 20, 1917 (L. L. Buchanan), 1 ♂. *Kansas:* Medora, June 6, 1913 (Warren Knaus), 1 ♂; McPherson, Sept. 12, 1914 (W. Knaus), 1 ♂. *Illinois:* Northern Illinois, (C. H. Roberts), 1 ♂. *Pennsylvania:* Pittsburgh, Aug., 1 ♀.

**DISCUSSION:** In four out of five specimens

(two from Iowa; one, Pennsylvania; one, Illinois; one, no locality) the median line of the pronotum is raised and noticeable, but not the laterals; in one of the Iowa specimens the median line is also raised but broader, somewhat dilated at the middle, and the laterals and side branches can be seen.

This is the only tiny species with a combination of the following characters: front third tarsal segment widely dilated, virtually square, the beak nearly straight, strongly widened at the apex, abruptly humped and coarsely punctured at the base, strongly constricted between the beak and the head (fig. 55), the male with short hairs in the ventral cavity, and the penis with the apex truncate, almost concave in outline (fig. 92). *C. zeae* has somewhat the same basally humped beak, but it is larger, has all the tarsi narrow, a more definite pronotal pattern, and the elytra with large foveae.

**BIOLOGY:** Blatchley and Leng (1916, p. 560) quote Knaus who found many specimens in the Reno County, Kansas, sand hills, apparently dead from the heat.

#### *Calendra gagatina* (Gyllenhal)

Figures 5, 54, 93

*Sphenophorus gagatinus* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 952. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 428. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 566.

Small, robust; black, scarcely any coating, pronotal vittae bare, indistinctly indicated and partially confluent, elytra with striae almost as wide as intervals.

Beak (from side) long, scarcely compressed, curved, about same width throughout, or slightly wider at apex, apex beneath rounded, base slightly swollen over antennal insertion, fovea of concentrated, deeper punctures in front of eye; (from above) apex flattened, base with no impressed line or canal, front of head scarcely punctured. Eye extending below insertion of beak, and noticeable, deep trench around hind margin of eye filled with deep, touching punctures. No trace of thoracic lobe behind eye. Pronotum with three indistinct, sometimes confluent vittae and two side branches, vittae usually not reaching base and giving appearance of five vittae radiating from apex; median vitta, when not

confluent, dilated at middle, lateral vittae indicated by being more finely punctured than interspaces but sometimes raised; interspaces narrow, sometimes obliterated, with larger punctures than on vittae. Scutellum narrower than long, slightly grooved. Elytra scarcely longer than pronotum, with intervals fairly equal in width and elevation, with usually one row of punctures; striae wide, their punctures cutting into and interrupting intervals, punctures larger than on intervals, often merging. Under surface with large dense punctures as on pronotal interspaces. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment rather narrow, but front and middle legs with it less narrow and slightly wider than preceding segments, hind tarsi with third segment narrower, longer than wide, all tarsi below mostly smooth, with sparse hair at sides. Pygidium with tufts of hairs laterally at apex. Length, 6-7 mm.

**MALE CHARACTERS:** Front tibiae more sinuate within; tibiae and femora with long yellow hairs.

**TYPE LOCALITY:** "America septentrionalis," here restricted to the region of Newark, New Jersey. Type in Stockholm museum, examined.

**DISTRIBUTION:** New York, New Jersey, Georgia, Louisiana, and Mississippi.

**SPECIMENS EXAMINED:** *New York:* Tuxedo, May 30, 1921 (L. B. Woodruff), 1 ♂. *New Jersey:* Snake Hill, 1 ♂; Newark, 1 ♀. *Georgia:* St. Simons Island, Aug. 20, 1931 (Quirfeld), 1 ♂, 3 ♀. *Louisiana:* Southern Louisiana, June 5, 1892 (H. Soltau), 1 ♂. *Mississippi:* Bay St. Louis, May 15, 1945 (Rau), 1 ♂, 1 ♀ "on carpet grass roots." "America borealis," 1 ♂ (type).

**DISCUSSION:** In a male from New York the five vittate areas on the pronotum are definitely raised; in a male from New Jersey the pronotum is much broader and the vittae are scarcely raised and are poorly differentiated; in the male and female from Mississippi the pronotum is also broad, but smoother, with fewer, finer punctures, the vittae not raised, but merged except at the base. Most of the vittae in these specimens fail to reach the base of the pronotum. The elytra appear quite uniform.

Differs from *parvula*, *minima*, and *marina* in the pronotal pattern (fig. 5) which, even

when indistinct, shows three traceable vittae and two side branches, in the median vitta, which is not in the form of a narrow line, in the lack of subapical callosities on the elytra, and in the apex of the beak below, which is rounded, not acute.

This species is perhaps closest to *soltavii*, from which it differs in the dilated median vitta or, when this is merged, in the smaller, sparser pronotal punctures, and wide smooth areas, the narrower first tarsal segment on the front legs, the longer, narrower, less apically widened beak (fig. 54), and in the lack of a hump at the base of the beak. The male genitalia (fig. 93) are truncate, as in *soltavii*, but not concave; they are quite unlike those of *marina*, which are pointed.

**BIOLOGY:** The Mississippi specimens were taken on the roots of carpet grass.

#### ***Calendra marina* (Chittenden)**

Figure 94

*Sphenophorus marinus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 166. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 564.

Small, robust; black or reddish, scarcely coated, pronotum densely, confluent punctured except for median line, elytra with equal intervals, eighth interval at middle with bare, shiny spot.

Beak (from side) long, compressed, slightly curved, upper contour nearly straight, lower curved, beak wider at apex, apex beneath acute, and sinuate just before the point, base slightly swollen over antennal insertion, no fovea in front of eye; (from above) apex concave, base with impressed line between eyes, front of head strongly punctured. Eye extending below insertion of beak, entire margin of eye with definite impressed trench. Thoracic lobe behind eye sinuous. Pronotum without vittae, but with a narrow, raised, impunctate, usually sinuous, median line of varying length and sometimes a suggestion of lateral vittae, pronotum covered with large, dense, often confluent punctures of about the same size throughout, and each with a stiff hair arising from it. Scutellum much narrower than long, often deeply grooved. Elytra with sharp tubercles near apex, intervals not coated, flat, but raised above striae, about equal in width, with single row of large

punctures that almost fill the width of interval; striae with closely placed large punctures as large as those on intervals; eighth interval at middle with bare, shiny spot of varying length; striae cut deep and sometimes almost as wide as intervals. Under surface densely punctured as above, but punctures smaller. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex in male, in tufts in female. Length, 5.5–6 mm.

TYPE LOCALITY: Sea Isle City, New Jersey. Type in the United States National Museum, examined.

DISTRIBUTION: New Jersey.

SPECIMENS EXAMINED: *New Jersey*: Sea Isle City, June 10 (Ch. Boerner), 1 ♂ (type, U.S.N.M. No. 9449), 1 ♀ (allotype), June 11 (Ch. Boerner), 1 ♀; Sea Isle, 2 ♂; Whitesbog, July 16, 1914 (H. B. Scammell), 1 ♂, 1 ♀; Lakehurst, May 31, 1925 (A. Nicolay), 1 ♂.

DISCUSSION: The pronotal punctures, when not too filled with coating, are seen to be very deep and are separated from one another by very thin walls. In three specimens before me there is a small, impunctate, shiny spot on each side of the median line a little in front of the middle. There is also a bare shiny spot on the eighth interval of the elytra near the middle.

Although Chittenden grouped *marina* with *parvula* and *minima* because of the same trench around the eye and the same tarsi and tibiae, the penis in *marina* is not so elongate as in those species nor does it have a broad chitinous border at the apex (fig. 94). *C. marina* is also more robust and compact and with the beak not strongly arched. I am placing it near *soltaii* and *gagatina*, which also have an orbital trench, but from both of which *marina* differs in the male genitalia, in the sharp apical tubercles on the elytra, and the large striae punctures in single rows. The pronotum in *marina* is more as in *soltaii* than as in *gagatina*. All three species have unusual distribution, so far as is now known, *marina* occurring in New Jersey only, *gagatina* in New Jersey, New York, Georgia, Mississippi, and Louisiana, *soltaii* in Pennsylvania, Texas, and three middle western states.

### *Calendra bartramiae* (Chittenden)

*Sphenophorus bartramiae* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 154, pl. 6, fig. 3.

Small, robust; reddish (?), coated with thick tan or brown crust, pronotum without visible vittae, but with five small, round depressions, elytra uneven, encrusted.

Beak (from side) long, compressed, upper contour nearly straight or slightly curved, lower strongly curved, beak wider at apex, sometimes twice as wide as at middle, apex beneath acute or right angle, base slightly swollen over antennal insertion, no fovea visible in front of eye; (from above) apex concave, base with impressed line, coated, front of head strongly punctured, coated. Eye extending below insertion of beak, top margin of eye with definite impressed trench. Thoracic lobe strongly sinuous. Pronotum without vittae, nearly square, including the apical collar or constriction, with five small, round depressions visible under the coating, one at apex behind the collar, and one at each corner of pronotum, punctures minute and sparse. Scutellum narrower than long. Elytra rough and uneven, with thick encrustation that hides the punctuation, with deep depression near shoulder, third interval at base much raised, huge apical bumps (almost tubercles); striae deep-set with large punctures. Under surface so encrusted as to obscure punctuation. Legs, front tibiae with apical angle not prolonged but minutely toothed, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex. Length, 7–8.5 mm.

TYPE LOCALITY: Victoria, Texas. Type in the United States National Museum, examined.

DISTRIBUTION: Texas, Arkansas.

SPECIMENS EXAMINED: *Texas*: 1 ♀; Lee Co., June, 1 ♀; Victoria, Mar. 28, 1907, 1 ♀ (type, U.S.N.M. No. 26904), 1 ♂ (allotype); 1 ♀; Mar. 30, 1907, 1 (paratype, all in pieces), Mar. 25, 1907, 1 ♀ "in crop of *Bartramia*, Golden Plover." *Arkansas*: Stuttgart, Sept. 12, 1910 (C. E. Hood), 1 ♂ "in bird excrement"; Hope, May 5, June 11, 1925, 1 ♂, 2 ♀.

DISCUSSION: All the specimens seen of this species, excepting the allotype, are as densely

encrusted with coating all over as *hoegbergii*, *cazieri*, or *callosa*. The dismembered parts of the paratype are mounted on cards. Chittenden states that his specimens were taken from the crop of *Bartramia longicauda*, the upland plover. The golden plover, a name that appears on one of the paratype labels, is not *Bartramia* but *Pluvialis*.

The pronotum in the allotype has a thick crust as in the other specimens, but the elytra is smooth, without the characteristic apical tubercles or other roughness. When it was found that the scutellum did not match that of *bartramiae*, that the middle and hind legs were free from coating while the front ones were roughly coated, and that the elytra were not rapidly narrowing as in *bartramiae*, the matter was further investigated. The conclusion is that the allotype is composed of the thorax of *bartramiae* and the glued-on elytra of a small *coesifrons*, a species that also occurs in Victoria, Texas. Chittenden evidently found more than one species in his plovers.

The pronotum in *bartramiae* is somewhat as in *minima*, but larger in proportion, and almost square (by measurement, including the apical constriction), and with much finer punctures. The rapidly narrowing elytra, with the prominent apical tubercles, and the trench at the upper corner of the eye are also the same as in *minima*, but *bartramiae* differs by having the beak much stouter and more widely dilated at the apex, the coating thicker, yellow-brown, not gray, the elytra rough and transversely rugose, the pronotum with fine, scarcely visible punctures. The only irregularities that show on the pronotum in *bartramiae* are the five small, round depressions; if the crust were removed, there might also appear three vittae, because there are vague elevations under the crust. Four of the 11 specimens seen are greased, and their coating, instead of being yellow, is a dirty grayish black.

**BIOLOGY:** This species probably breeds in some kind of grass or grain in open fields, since it has been taken in the spring from the crop or excrement of plovers.

***Calendra parvula* (Gyllenhal)**

Figure 62, 95

*Sphenophorus parvulus* GYLLENHAL, 1838, in

Schoenherr, Genera et species curculionidum, vol. 4, p. 961. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 427. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 167. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 563, fig. 123.

*Calendra parvula*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159; 1931, Jour. New York Ent. Soc., vol. 39, p. 171; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 6, figs. 4, 10; 1942, Ent. News, vol. 53, p. 41.

*Calendra parvulus*, BRUHN, 1947, Great Basin Nat., vol. 8, p. 19, pl. 5, fig. 40.

*Sphenophorus pumilis* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 960.

Small, slender; black but usually coated with opaque gray, pronotum evenly, densely punctured all over except sometimes for median line of varying length, elytra with sinuous intervals.

Beak (from side) long, compressed, strongly curved, upper contour usually slightly sinuate just before apex, beak wider at apex, apex beneath acute, base swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened or concave, base with coarse, dense punctures between eyes, sometimes depressed in long canal, front of head strongly punctured. Eye extending below insertion of beak, entire margin of eye with definite impressed trench. Slight thoracic lobe behind eye. Pronotum without vittae but with a narrow, slightly raised, impunctate median line of varying length, occasionally lacking, and a suggestion of lateral vittae at base, pronotum covered with dense, moderately large (about width of narrower elytral intervals) punctures of nearly same diameter throughout, punctures with coating in their depths and each with stiff hair arising from it (not always visible), some specimens have slightly depressed area near apex. Scutellum narrower than long, nearly parallel. Elytra usually with noticeable apical callosities, intervals coated, more or less flat, of about equal width, the even ones slightly depressed, and all with single rows of punctures that take up most of the width of the interval (though quite small in some specimens) and a little smaller than pronotal punctures; striae with large round punctures that cut into the intervals, making their sides sinuous (when the coating is worn off,

the punctures are seen to be smaller). Under surface, sides of prosternum about the same punctuation as the pronotum, also the rest below, including the outside of the femora. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex and in tufts at sides of apex. Length, 6–8 mm.

**TYPE LOCALITY:** "America septentrionalis"; here restricted to Babylon, Long Island, New York. Location of type unknown to author.

**DISTRIBUTION:** Eastern states west to Colorado and Texas, also Ontario, Canada.

**SPECIMENS EXAMINED:** (Sex not noted in most specimens.) *Rhode Island:* Watch Hill, June 28, 1909 (W. Robinson), 3. *Connecticut:* Stamford, 1. *New York:* Ithaca, Sept. 4, 1947 (G. E. Ball), 5; Ocean Beach, Fire Island, Aug., 1941 (B. D. Valentine), 1; Babylon (G. D. Bradford), 22, June, 1918 (G. D. Bradford), 36; Flatbush, May–Nov., 1890–1900 (J. L. Zabriskie), 6; West Point, Sept. 12, 1908, Sept. 15, 1916 (W. Robinson), 3; Southampton, 2; Rockaway, 2; Rockaway Beach, May 23, 1912 (C. L. Pollard), 1; New York City, Nov. 17, 1900, 4; Cold Spring Harbor, Aug. 25, 1900, 1; Nyack, 1883 (J. L. Zabriskie), 1; Pocantico Hills, June 12, 1921, 1; Newark, Wayne Co., May 30, June 21, 1947 (G. E. Ball), 2. *New Jersey:* (G. D. Bradford), 3; Newark (J. A. Grossbeck), 1; Chester, Sept. 7, 1; Hopatcong (C. Palm), 1. *Pennsylvania:* Milford, Pike Co., May 30, 1941 (B. Malkin), 1 ♂. *Kentucky:* Fort Knox, May 1, 1944 (B. Malkin), 1 ♀. *Georgia:* Horn Coll. No. 9000, 1. *Florida:* 1. *Ohio:* Elyria, Oct. 23, 1927 (B. Benesh), 1. *Illinois:* Lake Co., May 17, 1933, 1; Lake Co., North Chicago, May 29, 1933, 1; Urbana, Oct. 15, 1933 (M. D. Farrar), 1, May 5, 1939, 1; Putnam Co., Feb. 26, Nov. 6, 1933 (M. C. Glenn), 2; Chicago, 1; Peoria, Aug. 26, 1938 (F. F. Hasbrouck), 1; Apple River Canyon State Park, June 4, 1940 (Mohr, Burks), 1; Hillview, June 11, 1927 (A. T. McClay), 1. *Minnesota:* Rapidan, June 24, 1942 (C. O. Mohr), 1; Fridley Sand Dunes, May 7, 1939 (H. Knutson), 1. *Iowa:* Ames, June 22, 1932 (H. M. Beck), 1, Apr. 27, 1932 (F. Andre), 2; Leon, Aug. 1, 1932 (F. Andre), 1; Iowa City, Apr., ("M. M. McG."), 1 ♂. *Missouri:* Knox Co., Jan., 1938, 1; Columbia, Apr. 18, May 10, 1937, 2, July, 1939 (R. I. Wakeman), 1, Feb. 26, 1940, Dec. 18, 1937 (R. C. Froeschner), 2; Glencoe, May 16, 1943 (R. C. Froeschner), 1; Marionville, Oct. 9, 1939 (R. I.

Wakeman), 1. *Arkansas:* Washington Co., July 12, 1940, 1 "collected as grub," Apr. 17, 1938 (M. W. Sanderson), 1. *Texas:* Dallas Co., 1941, 1, June 1, Dec. 24, 1938 (R. E. Maxwell), 2, Mar.–Apr., 4; Leon Co., May 27, 1939, 1. *Kansas:* Horn Coll. No. 9000, 1. *Colorado:* Julesburg, June 7, 1920, about 3460 ft., 1. "America septentrionalis," 2 (type, *pumilis*, and paratype, *parvula*).

*Canada. Ontario:* Prince Edward Co., July 7, 1943 (Brimley), 4.

**DISCUSSION:** The type of Gyllenhal's *parvula* was not found in the Stockholm museum where most of his types are, but a paratype was seen there. The type of another of his species, *pumilis*, the status of which has never been certain, was examined in Stockholm and proved to be *parvula*. The description of *pumilis* appears on the page before the description of *parvula* in the same publication, but there is no point in changing a long-established name because of a page difference.

Specimens have been seen or reported from all the eastern states except Maine, Vermont, West Virginia, Tennessee, and Louisiana, in each of which it no doubt occurs.

A large series from Babylon, New York, and other specimens from the same vicinity have the median line on the pronotum clearly marked, generally raised, and extending from near base to near apex, though sometimes abbreviated. Scattered specimens from other areas, however, do not have the line present as such; instead they have the median area slightly raised and the line either an impunctate space or obliterated by invading punctures. These specimens are from Ontario (four), Illinois (two), Ames, Iowa (two), and one each from Dallas, Texas, and Julesburg, Colorado. The pronotum further varies in sometimes having lateral "vittae" which can be seen as slight swellings at the base with depressions between them and the median area or line, but in some specimens the depressions and the swellings are more marked. This seems to be true of the 10 specimens listed above, but it is also true of quite a few New York specimens. A slight depression near the apex of the pronotum, medially, follows the same pattern, being generally less marked in specimens from the New York area and deeper in those from scattered localities elsewhere.

A reared specimen from Washington County, Arkansas, is deep velvety red without any coating in the punctures above or below; the inequalities of the elytra, which are usually not evident in coated specimens, can be readily seen here, both the scalloping of the third interval by the adjacent stria punctures and the elevation of the third and fifth intervals.

This species has the same distribution as *minima* (except California, where the latter has recently been discovered), and it closely resembles *minima* in most characters, including the male genitalia (fig. 95), but differs by having the pronotal punctures dense, not widely separated, the front angles of the pronotum more rounded off, not so square, and no complete opaque coat covering the raised areas and punctures.

Chittenden (1905b, p. 167) grouped *parvula*, *minima*, and *marina* together, adding that all three were related to the *venatus* group. With the exception of *marina*, this seems correct, as *parvula* and *minima* (especially *parvula*) show a tendency, in some specimens at least, towards the raised lateral vittae and median subapical depression on the pronotum, and they have the same type of strongly arched beak, acutely angled at the apex below, as in members of the *venatus* group (fig. 62).

Differs from *marina* in the more elongate, less robust form, more strongly curved beak, less prominent elytral callosities at the apex, and by having the stria punctures on the elytra larger than the interval punctures. Differs from *bartramiae* by having the pronotum definitely longer than wide and with larger, denser punctures.

**BIOLOGY:** *Calendra parvula* develops in more plants than any other species. The preferred host is Kentucky blue grass, *Poa pratensis*, in which it does much damage by cutting the bulbs and rootlets. The larvae feed in the prop-roots of corn, and in the roots of wheat, barley, rye, timothy (*Phleum pratense*), white bent grass or red top (*Agrostis alba*), and other grasses and some sedges (see Satterthwait, 1931a, p. 164, for full list). The adults will attack corn, and they also feed on the above-named plants. *C. zae*, which has about the same range as *parvula*, also feeds on timothy and Kentucky blue grass, and

Satterthwait (1932, p. 8) has found them in the same clusters of timothy, but he says that generally *parvula* prefers the higher and *zae* the lower portions of a field. He says also that *parvula* "probably ranks first in numbers and in destructiveness to farm-crop values" of all the *Calendra*. Its enemies include the upland plover (Chittenden, 1924, p. 155) and *Anaphoidea calendrae* Gahan, a small hymenopterous parasite of the family Mymaridae that lays in billbug eggs (Satterthwait, 1931b, p. 171).

#### *Calendra minima* (Hart)

Figure 96

*Sphenophorus minimus* HART, 1890, in Forbes, Sixteenth Rept. State Ent. Illinois, p. 65, pl. 3, fig. 2. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 167. BLATCHELEY AND LENG, 1916, Rhynchophora of northeastern America, p. 564, fig. 124.

*Calendra minima*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 162; 1931, Jour. New York Ent. Soc., vol. 39, p. 171; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 18. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., vol. 11, p. 441. VAN DYKE, 1938, Pan-Pacific Ent., vol. 14, p. 187.

Small, slender; black, coated with opaque gray, pronotum unevenly, sparsely punctured all over except for raised, usually shiny spot in front of center; elytra with sinuous intervals.

Beak (from side) long, compressed, strongly curved, wider at apex, apex beneath acute, base slightly swollen over antennal insertion, no fovea in front of eye; (from above) apex concave, base with long, wide canal, usually coated, front of head strongly punctured. Eye extending below insertion of beak, top margin of eye with definite impressed trench, though usually coated. Thoracic lobe behind eye sinuous. Pronotum without vittae, but with raised impunctate spot in front of center and sometimes vague oblique laterals from middle to base, pronotum with sparse, large, deep punctures scattered irregularly, those where the lateral vittae would be expected often smaller in diameter, punctures with stiff hair arising from within (usually not visible). Scutellum narrower than long, nearly parallel. Elytra with definite, well-marked tubercles near apex which, when seen from side, are quite sharp, intervals coated, about equal in width, more or

less flat, with single rows of fine punctures that are usually obscured by coating; striae with round, widely separated, deep, large punctures (large as, or larger than, those on pronotum) that cut deeply into the intervals, making their sides sinuous. Under surface, sides of prosternum with denser punctures than on pronotum, rest below deep and dense including outside of femora, but often obscured by coating. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex and in tufts at sides of apex. Length, 5–7 mm.

**TYPE LOCALITY:** No locality specified; type from Urbana, Illinois. Type in State Natural History Survey Division, Urbana, Illinois.

**DISTRIBUTION:** All the eastern states as far west as Nebraska and Kansas, also Berkeley, California, and Ontario, Canada.

**SPECIMENS EXAMINED:** *Connecticut:* East Hartford, June 11, 1947 (H. E. Evans), 1. *New York:* New York, June, 1942 (B. D. Valentine), 1; Yonkers, Aug. 18, 1929 (C. L. Ragot), 1 ♀; Flushing, May 15, 1931, 2 ♂; Rockaway, July 28, 1940, 2 ♀; Willowbrook, Staten Island, Sept. 15, 1929 (C. L. Ragot), 3 ♀; Kinderhook, Aug., 1937 (B. D. Valentine), 1; Ithaca, June 22, 1947, 1; Jones Beach, Mar., 1938, 6; Fire Island, June 23, July 10, Aug. 1, 1941 (B. D. Valentine), 8. *New Jersey:* Summit, Apr. 27, 1947 (P. Vaurie), 1 ♀; Manasquan, June 13, Nov. 16, 1935, 1 ♂, 3 ♀. *Pennsylvania:* Allegheny, 1 ♂; Wyoming, Nov. 30, 1904, 1 ♂. *Tennessee:* Monteagle, June 10, 1930 (A. G. Richards), 2000 ft., 1. *Florida:* Marineland, Apr. 5, 1941 (L. W. Clausen), 1 ♂; Enterprise, May 25 (Hubbard and Schwarz), 1 ♂. *Alabama:* Mobile, June, 1923, 1 ♂, 1 ♀; Tuscaloosa, Jan. 4, 1950 (B. D. Valentine), 1. *Missouri:* Webster Groves, June 9, 1928 (A. F. Bucholtz), 1 ♀; California, Jan., 1938, 1 ♂ "*Agrostis alba*." *Illinois:* Urbana, May, 1929, June 2, 1930, 2. *Indiana:* Michigan City, June 9, 1934 (C. H. Seevers), 1 ♀; Lafayette, Nov. 25, 1915, 2 "reared from timothy." *Michigan:* Dearborn, Aug. 23, 1937, 1; Oakland Co., May 30, 1927 (A. W. Andrews), 1. *Nebraska:* Horn Coll. No. 215, 1 ♂. *California:* Berkeley, Oct. 1, 1938, 31, Oct. 1, 1938 (J. J. du Bois), 7.

Canada. *Ontario:* Prince Edward Co., Brimley, June, 1939, July, 1937, June, 1941, 4.

**DISCUSSION:** Except for the locality in California, where it has no doubt been in-

troduced, *minima* occurs in the same states as *parvula*, to which it is closely related.

The characteristic pronotum, as shown by the long series from Berkeley, California, is covered with gray or tan coating and has all the punctures plugged with coating or mud. Traces of the lateral vittae can be seen in some specimens either as gentle swellings or as slightly darkened areas. A black spot is usually visible in front of the middle, if the coating is not too dense. The elytral punctures are only vaguely discernible under the coating.

A reared specimen (Webster Groves, Missouri) has an opaque, waxy-like, red-brown coating on the upper surface to which, no doubt, in later life both mud and debris adhere, but the deeply set punctures of pronotum and elytra are not filled with any extraneous material in this specimen. The median black spot on the pronotum is present, and the lateral vittae can be traced.

Differs from *parvula*, as well as from *marina* and *bartramiae*, in the larger, more widely separated, irregularly placed pronotal punctures and in the raised impunctate spot in front of center. *C. minima* resembles *parvula* in many characters and seems closest to it, but a specimen from Marineland, Florida, which has a dark, not light, gray coat, is very similar (from above) to a specimen of *apicalis*, also from Florida. It differs, however, from the latter in the lack of a double median depression at the apex of the pronotum and in the more strongly curved beak.

The type was collected by Marten and Hart on June 30, 1888, from driftwood in a creek. It was labeled a male, but later designated a female (lectotype) by Hart. Information on the type was kindly supplied by Dr. M. W. Sanderson.

**BIOLOGY:** Terrell grass or Virginia wild rye (*Elymus virginicus*) and *Agrostis alba*, or red top, are the most common and the preferred host plants for this species. Its other hosts include the common cattail, rice, rice cut grass, timothy, wheat, and a few wild grasses (Satterthwait, 1931a, p. 165). The eggs of *minima*, as well as those of *parvula* and *callosa*, are parasitized by a member of the hymenopterous family Mymaridae, *Anaphoidea calendrae* Gahan. This parasite

has "been found to destroy seventy-five per cent of the billbug eggs in *Agrostis alba*," in which *minima* commonly breeds (Satterthwait, 1931b, p. 171).

***Calendra apicalis* (LeConte)**

Figures 6, 97

*Sphenophorus apicalis* LECONTE, 1878, Proc. Amer. Phil. Soc., vol. 17, p. 432. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 570.

Small, slender; black, coated with opaque gray, pronotum at apex with two elongate, deep depressions or pits, elytra with large punctures filled with opaque coating.

Beak (from side) long, slightly compressed, scarcely curved, hardly wider at apex, apex beneath obtusely angled, slightly swollen at base over antennal insertion, fovea, if present in front of eye, encrusted; (from above) apex somewhat flattened, base with deep channel between eyes, front of head finely punctured. Eye extending below insertion of beak. Slight thoracic lobe behind eye. Pronotum with two elongate, deep depressions near apex, almost as long as one-third of the pronotum, and enclosed by fork of narrow, faintly marked median vitta, with two narrow, faint, lateral vittae, vittae finely punctured and forming a vague M on pronotum, sometimes vittae obliterated; interspaces with large, round, nearly touching punctures, larger than on elytral striae. Scutellum narrower than long. Elytra with prominent apical tubercles, intervals scarcely raised, punctuation not visible; striae obscured by coating, with large, round punctures nearly as large as on pronotal interspaces, punctures separated by more than their diameter and filled with coating. Under surface, sides of prosternum with small, fine punctures, rest below strongly punctured but obscured by coating. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with hairs at apex. Length, 6-7 mm.

TYPE LOCALITY: Enterprise, Florida. Type in Museum of Comparative Zoölogy, Cambridge, examined.

DISTRIBUTION: Gulf states. New Jersey (Blatchley).

SPECIMENS EXAMINED: *Florida*: 1 ♂; Orange Co. (Hubbard and Schwarz), 1 ♂; Atlantic Beach, 1 ♂; Ch. Harbor, 1 ♀; Enterprise, May 25, 1 ♂ (type). *Alabama*: Mobile, Mar. 25, 1911 (H. P. Loding), 1 ♀; (H. P. Loding), 1 ♂, 1 ♀. *Mississippi*: Gulf View, Mar. 20, 1892, 3 ♂. *Texas*: Horn Coll. No. 8998, 1 ♀.

DISCUSSION: This small species is the only one in the genus with a definite double depression behind the apex of the pronotum (fig. 6). The male genitalia also set it apart, at least from the species it seems closest to, *parvula*, *minima*, and members of the *venatus* group. The apex of the penis (fig. 97) is prolonged more or less acutely, and in a side view the prolongation is long, thin, and recurved. The elytra have prominent tubercles near the apex as in *parvula*, *minima*, *marina*, and *bartramiae*.

In addition to the double pronotal depression in which it differs from all other species, *apicalis* differs further from *minima* by having the beak nearly straight, scarcely wider at the apex, and the elytra not rapidly narrowing to the apex.

The rather restricted range of this species occurs within the ranges of both *parvula* and *minima*, which are far more widespread. Blatchley's report (1916, p. 570) of *apicalis* from New Jersey was based on records in Smith's "Insects of New Jersey"; the localities given were Gloucester (Wenzel) and Avalon (Boerner). Although these are far removed from the Gulf states, it is quite possible that a stray *apicalis* might appear on northern beaches.

***Calendra sayi* (Gyllenhal)**

Figure 98

*Sphenophorus sayi* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 943. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 425. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 569.

*Sphenophorus subcarinatus* MANNERHEIM, 1843, Bull. Soc. Imp. Nat. Moscou, vol. 16, p. 294; 1845, in Schoenherr, Genera et species curculionidum, vol. 8, pt. 2, p. 255. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 425. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 570.

Small, narrow; red or black, sometimes with coating, pronotum with three indistinct



raised vittae, laterals raised at base only, elytra with intervals feebly convex and with fine rows of single punctures.

Beak (from side) long, slightly compressed, curved, slightly wider at apex, apex beneath obtuse, base slightly to strongly swollen over antennal insertion, no fovea in front of eye but larger concentrated punctures and base of beak at this point constricted; (from above) apex flattened, base with transverse depression between eyes and deep, well-defined canal, front of head distinctly punctured. Eye extending below insertion of beak. Slight thoracic lobe usually present behind eye. Pronotum with three slightly raised but not very distinct vittae (occasionally merged in front), sparsely and finely punctured, median somewhat dilated at middle and reaching base and apex in narrow line, laterals usually raised in basal half only, but often continuing as black bands, not raised, to apex, laterals sinuous, oblique, or straight; interspaces with punctures larger than on vittae, those at middle of base larger than on elytral striae and often confluent. Scutellum narrower than long, nearly parallel. Elytra with intervals about equal in width and elevation, or odd intervals slightly raised, all feebly convex, with single, somewhat irregular, rows of small, fine punctures (as fine as, or finer than, those on pronotal vittae), suture always raised and shiny, even intervals sometimes coated; striae fine, with round punctures (smaller than on pronotal interspaces) separated by their own width or more. Under surface, sides of prosternum with dense punctures as on sides of pronotum. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with large, yellow tufts of hair at sides at apex, apical border with smaller, denser punctures, but usually obscured by coating. Length, 6-9 mm.

TYPE LOCALITY: "America borealis, N. Orleans." Type in Stockholm museum, examined.

DISTRIBUTION: Most of the United States, also British Columbia, Canada, and Chihuahua, Mexico.

SPECIMENS EXAMINED: *Indiana*: Pine, May 6 (Wickham), 1 ♀; Mineral Springs, 1 ♂. *Illinois*:

Cook Co. (Blackwelder), 1 ♂. *Iowa*: Iowa City (Wickham), 1 ♂; Horn Coll. No. 8996, 1 ♀. *Nebraska*: Lincoln (H. Soltau), 1 ♂; Fillmore, 1 ♀. *Texas*: Dallas Co., May 1, 1940, 1 ♂. *Louisiana*: Horn Coll. No. 8996, 1 ♂; New Orleans, 1 ♂ (type, *sayi*). *New Mexico*: Albuquerque, Dec. or Febr.? (H. Soltau), 1 ♂. *Utah*: Aug. 31, 1937, 1 ♂. *Nevada*: Reno, Mar. 5, 1941, July 4, 1940 (La Rivers), 1 ♂, 2 ♀. *California*: Southern California, 3 ♂, 1 ♀; Fort Seward, May 23, 1935 (F. R. Platt), 2 ♂, 2 ♀; Los Angeles, Nov., 1936, 1 ♀; Carrville, Trinity Co., May 23, 1934 (F. R. Platt), 1 ♀; Wendel, June 21, 1931 (A. T. McClay), 1 ♂; Dunsmuir (Wickham), 1 ♂. *Oregon*: Corvallis, Apr. 6, 1936 (G. Ferguson), 1 ♂, 1 ♀, June 12, 1898, Apr. 28, 1925, 2 ♂, 1 ♀; Forest Grove, May 14, 1921 (L. P. Rockwood), 1 ♀; Ashland, Apr. 26, 1941 (L. G. Gentner), 2 ♂, 3 ♀, (A. T. McClay), 17 ♂, 8 ♀; Pacific City, July 23, 1942 (K. M. and D. M. Fender), 1 ♂; McMinnville, Apr. 21, 1939, July 2, 1944, May 17, 1947, Mar. 29, 1942 (K. M. and D. M. Fender), 3 ♂, 3 ♀, June 28, 1942 (B. Malkin and K. M. Fender), 1 ♂, 2 ♀. *Washington*: Wallula, May 28, 1924 (M. C. Lane), 1 ♀; Olympia, 2 ♂.

Canada. *British Columbia*: Vancouver, 1 ♂.

Mexico. *Chihuahua*: Delicias, July 11, 1947, 4150 ft. (Cazier), 1 ♂.

DISCUSSION: The type of *sayi* (New Orleans) has a rather battered beak which is very swollen at the base. The type is black, with a yellowish gray coating in all depressed areas. The lateral vittae on the pronotum are rather sinuous. Unfortunately, the type of *subcarinatus* could not be examined; it is reported to be at the Zoological Museum in Helsinki, Finland.

The Chihuahua specimen represents the first published record of *sayi* in Mexico.

The differences given by Blatchley and Leng (1916, p. 569) between what they called *sayi* ("New Jersey to Illinois, south to Georgia") and *subcarinatus* ("California, Aleutian Islands, Indiana 'rare' ") appear to be but individual variations, and I agree with Horn (1873) that they are conspecific. It is possible that these two forms might be considered subspecies, since there is a slight difference in the beak, but sufficient specimens have not been examined from the eastern area for a fair comparison. Those examined from Indiana, Illinois, and Iowa have the base of the beak more abruptly swollen or humped over the antennal insertion than specimens from farther west, but the type,

from New Orleans, also has the same swollen beak, and there is considerable variation among western specimens. For instance, two males, one from Pacific City, Oregon, and one from Lincoln, Nebraska, have the base of the beak as swollen as does a male from Mineral Springs, Indiana. The genitalia of a male from Iowa City, Iowa, and of two males from Fort Seward, California, seem identical (fig. 98). A parallel case, in reverse, occurs in the species *zeae* where the few Florida specimens seen have the base of the beak less swollen, and the many *zeae* specimens seen outside Florida have it variable, but on the whole more swollen.

The pronotum in *sayi* varies in its proportions without relation to sex, sometimes appearing longer and narrower, sometimes broader and shorter. It varies also in color: one specimen out of 47 has it all red except for a small median black area, 28 have it red with the three vittae black, 18 have it mostly black. The lateral vittae may be nearly parallel, or somewhat oblique, or sinuous within. Although the black color of the lateral vittae may continue to the apex, in no case are these vittae actually raised in the apical half. Towards the apex, where the lateral vittae would be if prolonged that far, the punctures are no longer fine as on the raised portions of the vittae, but they are larger, as those on the sides and interspaces of the pronotum. In two of the four specimens from Fort Seward, California, the vittae are scarcely evident, being merged across the apical half, the median vitta separated from the laterals at the base only, a type of obliteration that occurs also in *C. diversa*.

The long, thick, pygidial tufts of hair cause the female pygidium to seem more square at the apex than it actually is.

Very close to *diversa* (Washington, Oregon, California), differing from it in the swollen base of the beak, in the constriction around the base of the beak, in the longer, narrower, less clavate femora. Differs from *venatus* and the species associated with it in the absence of the median apical depression on the pronotum.

***Calendra diversa* (Chittenden)**

Figure 99

*Sphenophorus diversus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 170.

*Calendra eugenia* SATTERTHWAIT, 1943, Ent. News, vol. 54, p. 52.

Small, slender; black or red, no coating (usually), pronotum with three incomplete vittae, raised or not, elytra with intervals feebly convex and fine rows of single punctures.

Beak (from side) short, slightly compressed, curved, wider at apex, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye, no constriction around base of beak; (from above) apex flattened, base with slight impressed line, front of head finely, sometimes more strongly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with median impunctate space near apex, surrounded by a few larger punctures (depressed in one specimen), with three incomplete vittae raised at base only and merged in front, sparsely and finely punctured, median vitta wider at middle, laterals disappearing apically, usually with suggestion of two side branches; interspaces with larger punctures than on vittae, often merging. Scutellum narrower than long. Elytra with intervals about equal in width and elevation, but variable, with widely separated, small, fine punctures in single rows except on suture where there are extra punctures; striae fine, with small punctures scarcely cutting into intervals. Under surface, sides of prosternum, and the rest below finely, sparsely punctured. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at sides at apex (often worn) and depressions, often very shallow, on each side of median line, apex with raised area of smaller, denser punctures. Length, 6–9 mm.

TYPE LOCALITY: No locality specified, but either California or Washington. Location of type not known to author.

DISTRIBUTION: California, Oregon, Washington.

SPECIMENS EXAMINED: *California*: 1 ♀ (paratype, *diversa*); Lake Co., 1 ♂. *Oregon*: Eugene, June 26, 1941 (B. Malkin), 1 ♂ (type, *eugenia*, U.S.N.M. No. 56366), 3 ♂, 3 ♀ (paratypes, *eugenia*), Apr. 19, 1942, 1 ♀, June 26, 1942 (B. Malkin), 1 ♀; Corvallis, June 2, 1925 (G. Ferguson), 1 ♀; Spencer's Butte (Eugene), June 16, 1946 (B. Malkin), 1 ♀. *Washington*: Pullman

(H. C. Fall), 1 ♂ (cotype, *diversa*, U.S.N.M. No. 8968).

DISCUSSION: Chittenden reported but two specimens in connection with his original description of *diversa*, a female from California and a male from Pullman, Washington. Without designating which was which, he said that the type was in the Carnegie Museum at Pittsburgh and the cotype at the United States National Museum. With the kind help of Dr. George Wallace of the Carnegie Museum I find that there is no specimen of *diversa* there. There are, however, two specimens at the National Museum, instead of one as stated by Chittenden, but the female from California has a paratype label, and the male from Pullman, Washington, has a cotype label, both having the same United States National Museum number. It is thus impossible to say with certainty which is the type, and, in view of the lack of importance formerly given to type designations, it is even possible that there is a type in existence somewhere, perhaps with one of the same localities as on the two specimens examined.

Comparison of the type and paratypes of *eugenia* with a cotype and paratype of *diversa* seems to prove these two forms conspecific, with *eugenia* a synonym. Both series present variations, especially in the pygidium and pronotum, which might lead one to think they were distinct species, but the pronotal differences are individual and the pygidial differences are due to wear and to the accumulation of grease or debris. The male genitalia of the Lake County, California, *diversa* are the same as those of one of the paratypes of *eugenia*.

Satterthwait said his *eugenia* was similar to *venatus* but without the pronotal apical depression, which is true in a general way, but he evidently had not seen *diversa* and probably could not, from Chittenden's description of that species, see that they were the same species for two reasons. First, Chittenden said that *diversa* had tufts of hair on the pygidium and also a median keel in the female, two characters that Satterthwait thought *eugenia* lacked; second, Chittenden said that *diversa* was very different from other species and that the "punctuation of the elytral striae, as well as . . . intervals . . . was . . . without a parallel." In view of the

similarity between *diversa* and another species, *sayi*, which occurs in the same area, this last statement seems exaggerated.

As to the pygidium in the female, one of the topotypes of *eugenia* has large tufts of long hairs at the sides of the apex, as in the paratype of *diversa*; on another topotype, as well as on a specimen from Corvallis, Oregon, tufts of hair are present, though minute; in the type and paratypes no tufts are visible. Thus the tufts do exist but, as in many specimens of *simplex*, for instance, they are worn off on a great number of individuals, or hidden under grease or dirt (no attempt, at the time of examination, was made to clean the "hairless" type or paratypes).

In regard to the median keel and the depression on each side of it on the female pygidium, both of which are very evident on the *diversa* paratype, they were found, after cleaning, to be also present in one topotype of *eugenia* and to be suggested, at least, in the other topotypes and a paratype. In *striatipennis* and *costipennis* and in some other species, a similar keel and depressions are not by any means constant in all specimens, so that these characters alone cannot be used for differentiation of species.

Another pygidial character, which was found in all the above females discussed but which also varies in prominence and is not unique with this species, is a raised bulbous area at the apex, punctured more densely and with smaller punctures than the rest of the pygidium. In profile, this area occasionally looks like a little knob.

Of nine specimens of *diversa* (six from Eugene, one from Corvallis, Oregon, and two from California) two are black, two have the pronotum black and the elytra mostly red, five are entirely red. All have the vittae merged and flat in the apical half of the pronotum; three specimens have the median vitta not noticeably raised except at the extreme base; in the others it is raised above the interspaces. Except in the paratype of *diversa*, an incomplete side branch can be discerned, starting obliquely from the middle of each lateral vitta in the direction of the hind angles of the pronotum.

Although neither Chittenden nor Satterthwait mentioned *sayi* in his description, that species is very difficult to separate from *diversa*. It also occurs in Oregon, and both

species have been collected from Corvallis. In general, the pronotal vittae in *sayi* are much narrower, but its variations approach very closely those of *diversa*. The principal difference between the two species lies in the beak; *diversa* lacks the constriction around the base of the beak and consequently lacks the transverse depression between the beak and the head caused by the constriction. Thus in *diversa*, seen from the side, the upper contour of the beak meets the head without any hump over the antennal insertion or without any depression behind it. It further differs from *sayi* by having the base of the beak and the front of the head more finely, less coarsely and densely punctured, the female pygidium narrower at the apex and usually with visible keel and depressions, and the male genitalia more sharply pointed (fig. 99). It is also somewhat more robust, less elongate, than *sayi*, and generally with less coating.

Somewhat similar in pronotal pattern to *cicatristriata*, but that species is much broader and heavier and has an entirely different elytral pattern of large, horseshoe-shaped, stria punctures cutting almost completely through the intervals.

Differs from *venatus* and the species associated with *venatus* in the absence of the median apical depression on the pronotum.

#### ***Calendra venatus***

Figures 7, 25, 35

#### DESCRIPTION OF THE SPECIES

Small to medium; black or red, bare or coated; pronotum with three bare vittae, the median enclosing an apical depression, the laterals not reaching the apex; elytra variable, but stria punctures much larger than interval punctures.

Beak (from side) long, compressed, curved, wider at apex, apex beneath prolonged into acute angle, base not or only slightly swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened to concave, base with puncture between eyes often appearing as double puncture, and depression or canal of concentrated punctures, front of head lightly or distinctly punctured. Eye extending below insertion of beak. Thoracic lobe present. Pronotum with three

feebly or strongly raised, not well-defined, bare vittae, the median more or less Y-shaped, humped in center, often disappearing towards base, enclosing an ill- or well-defined, round or elongate, subapical depression of dense or merging punctures, the lateral vittae narrow or broad, straight or oblique or evenly emarginate, raised in basal one-half or two-thirds only, punctures on median vitta in center fine, small, on apical forks of median vitta somewhat or very much larger, punctures on laterals either as on median in center or larger, sparse or dense; interspaces with larger, often merging punctures. Scutellum narrower than long, almost parallel, sometimes grooved. Elytra variable, bare or coated, in all or in part, smooth or rugose, third and fifth intervals usually somewhat raised and somewhat wider than other intervals, punctures on intervals in irregular single rows, often double at base; striae with large round or oval punctures six to eight times larger than interval punctures and cutting into intervals, making their sides sinuous (fig. 25). Under surface finely or coarsely punctured. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides. Length, 8-11 mm.

MALE CHARACTERS: Ventral cavity and apex of abdomen with short, very fine hairs (usually worn and not visible).

DIAGNOSIS: The species *venatus* is similar in general pattern to *C. sayi* and *C. diversa*, but differs from them in the presence of a median subapical depression on the pronotum; the depression is sometimes suggested in some specimens of these species, but it is always bisected by the median vitta, which is not true in *venatus*. Differs from *C. hoegbergii* and *missouriensis* in the broader pygidium; from *C. recta*, *neomexicana*, and *phoeniciensis* in the generally larger size and by having the lateral pronotal vittae seemingly stopping short in front of the middle of the pronotum, not continuing to the apex in a rather undulating line as in *recta*, nor merging with the median vitta as in the other two species. Differs further from *neomexicana* in the greater disparity of size between the interval and stria punctures on the elytra.

## DISTRIBUTION

Probably all of the United States, also Mexico, and the Bahamas and Greater Antilles in the West Indies.

## DISCUSSION

The name *venatus*, meaning "the chase, hunting," is a noun and therefore has not been changed to agree with *Calendra*.

The species *venatus*, at the time of Horn, 1873, included all *Calendra* with a median apical depression on the pronotum and already had an imposing list of six synonyms. Chittenden, in 1904, described five new species with an apical depression (*vestita*, *confluens*, *neomexicana*, *phoeniciensis*, and *coactorum*), calling them the *venatus* group; in 1905 and 1919 he described two more, *glyceriae* and a variety, *missouriensis*, and *pontederiae*, thus creating seven species out of Horn's one. In 1924 he put *vestita* into synonymy with *venatus*. Van Dyke, 1938, added yet another, *sequoiae*, to this group.

After examination of the type or paratype of all these species (except of *venatus*, the type of which is lost), I agree with Chittenden that *pontederiae*, *hoegbergii* ("*coactorum*"), *phoeniciensis*, *neomexicana*, and *venatus* are distinct species and that *vestita* is synonymous with the latter. I believe, in addition, that *confluens*, *reticulaticollis*, and *glyceriae* should also be considered conspecific with *venatus* and that they and *vestita* are subspecies of *venatus*; that there is another species in this group which I am calling *recta* (Say); that *missouriensis* is not a variety of "*glyceriae*" but a separate species, and that *sequoiae* is a synonym of *phoeniciensis*. These forms certainly cannot, as Horn thought, all be the same species; on the other hand they are so closely related and possess so many similar characters that their limits are extremely difficult to define, as Champion discovered in attempting to classify them in the "Biologia." Only further collecting and the examination of more specimens will show whether or not I am wrong in considering *glyceriae*, *confluens*, and *reticulaticollis* as subspecies instead of species; or perhaps some of those I consider as species may prove to be subspecies of some other member of the group. With a few exceptions, the differences between the species in the *venatus* group are not much more

distinct than are the differences between the subspecies of *venatus*.

The five subspecies of *venatus*, as can be seen from the key that follows, are not separable on any basic diagnostic characters. In the beak, pygidium, tibiae, and male genitalia they appear to be similar, and they differ only in the coating, punctuation, and somewhat in the size and shape. The only male characters, except the usual more truncate pygidium and the slightly concave ventral cavity, are some very short fine hairs in the ventral cavity and at the apex of the abdomen, these being present in all the subspecies. The male genitalia were examined in a number of specimens of each form; no two, even in the same subspecies, are exactly alike, but all show the same type of variation. The variation is in the size of a small median lobe at the apex of the penis which, in the same subspecies, is scarcely visible and sometimes definitely visible.

The following are the subspecies recognized: *venatus* (neotype locality, Watch Hill, Rhode Island) which occurs in the northeastern states south to New Jersey and west to Ohio, possibly to Iowa; *vestita* (type locality, Sebastian, Florida), ranging from the District of Columbia south along the Atlantic coast to Florida and west to eastern Texas, southern Kansas (Sedgwick County) and southern Missouri (Manley), also the West Indies; *glyceriae* (lectotype locality, Palm Springs, California) which extends from southwestern Texas (Del Rio) westward through New Mexico and northern Chihuahua to California, thence up the Pacific coast to southern Oregon; *confluens* (type locality, Portland, Oregon), occurring in Oregon, Washington, Montana, and possibly northern California; and *reticulaticollis* (type locality, Mexico City and vicinity), which has been examined from south central Mexico (Guadalajara to Mexico City). This last-named subspecies has no doubt a wider distribution than is here indicated.

There is a large western area from which none of these subspecies has been seen (fig. 35); also specimens have been lacking from many other states and from the greater part of Mexico. The species probably occurs more widely than is shown on the map, since there are many records of it in the literature,

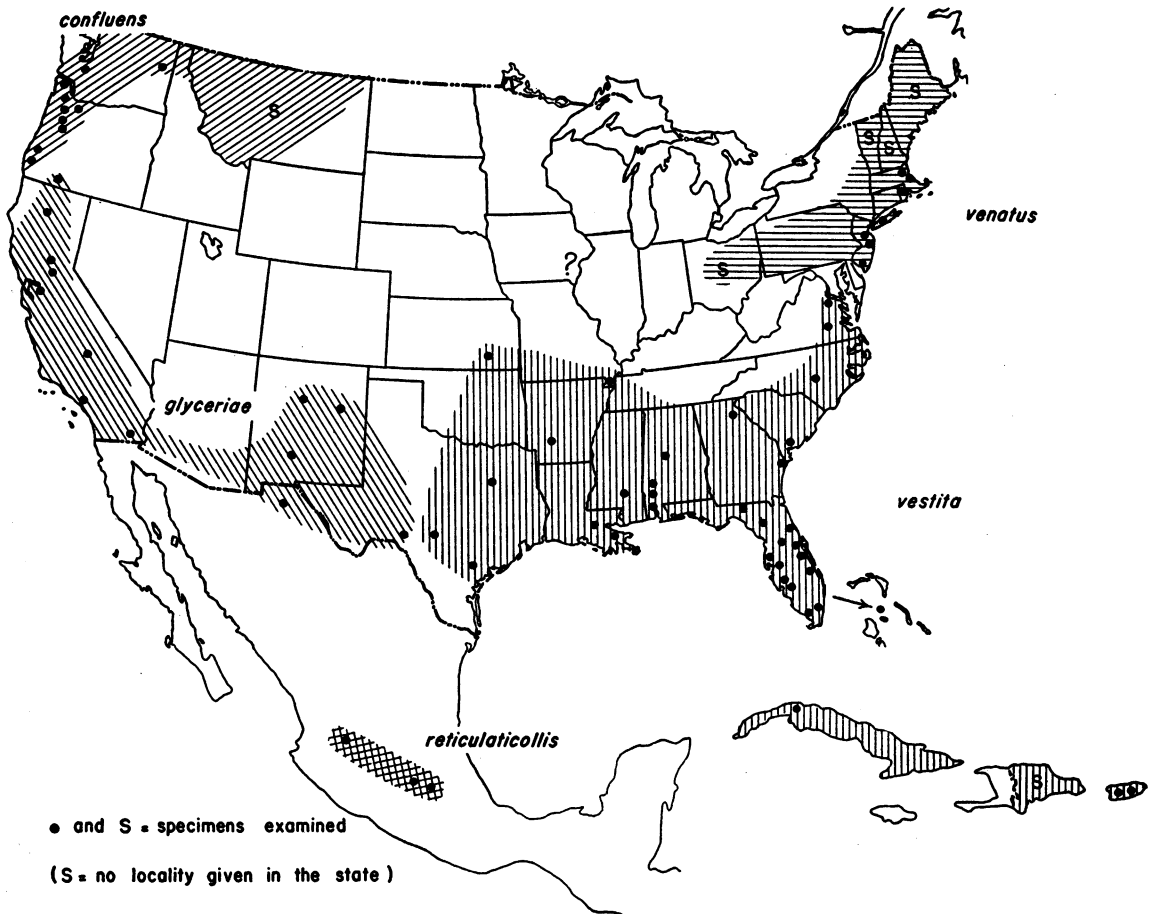


FIG. 35. Distribution of *Calendra venatus*. For explanation of ?, see text.

but the difficulty of distinguishing *venatus* from other closely related species makes me unwilling to accept these records. Satterthwait (1931a, p. 162), for instance, reports "*venatus*" from the following additional states: Arizona, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nebraska, Oklahoma, Pennsylvania, Wisconsin, Wyoming, and Ontario, Canada. It is true that some of these records may well be one of the subspecies of *venatus*, but some might also be either *C. recta* or *C. neomexicana*. Bleasdel (1937, pp. 441-442) reports both "*C. venatus*" and "*C. vestita*" from Henry County in southeastern Iowa. This locality appears as a question mark on figure 35. Probably the *venatus* record is nominate *venatus*, but I am inclined to believe that the *vestita* record is *C. recta*, a species which has been considered

until now as a variety or synonym of *venatus* and/or *vestita*; it might be confused with the latter, not with the former.

The worn or rubbed condition of the majority of specimens, the often erratic presence of coating, and the accumulation of caked mud either over the coating or within the punctures make the diagnosis of individuals difficult, but in series in fair condition, southern populations of *vestita*, for example, would never be mistaken for the northern populations of nominate *venatus*. Nor would series of *glyceriae* and *confluens* be confused, yet a single greased or abraded specimen might be hard to place. Abrasion in *Calendra* often makes the punctures much smaller and finer, sometimes nearly obliterating them; an excess of coating, if solid, also makes the punctures seem finer by plugging up the punctures, but, on the other hand, mud within the

punctures, but not on the spaces between them, tends to make the punctures appear larger.

#### GEOGRAPHIC VARIATION

The northeastern subspecies (*venatus*) is a large, shining, not coated insect with neither the apical depression nor the median vitta very clearly indicated, but with the lateral vittae clearly marked by their minute punctures, these laterals usually oblique in position and their sides either straight or curving slightly. *C. venatus vestita* (southeast) is similar to nominate *venatus* in the pattern of the pronotum, but is more robust, with shorter, stouter elytra, the elytra and the under side usually with a partial or entire, opaque, yellowish coating, the prosternum on the sides more deeply, coarsely, and densely punctured than in nominate *venatus*. The beak is also shorter, wider, and more arched in the southern populations, and the size is smaller. In fresh specimens there is no doubt of whether the coating or bloom is present, but grease may cause nominate *venatus* to appear coated or may hide the coat in *vestita*.

Although the ratios of the length to the width of the pronotum and of the length of the elytra to the length of the pronotum show too small a difference in the two subspecies to be of taxonomic value, they do show that 20 specimens of nominate *venatus* (10 males, 10 females) have the pronotum proportionately a little longer than the same number of *vestita*, not so square, and that 26 specimens of *venatus* (11 males, 15 females) have the elytra proportionately a little longer than the pronotum than is true in the same number of *vestita*.

The southwestern populations (*glyceriae*) are of the same shape and size as most *vestita*, but have the pronotum as well as the elytra and under side coated, and the lateral vittae showing through the coat as a narrow, denuded line of irregular, dense, large punctures. These punctures are always larger, usually far larger than those on the median vitta (the punctures on the latter may even be lacking), and are generally nearly as large as those in the interspaces, facts that do not apply to either nominate *venatus* or *vestita* but that do apply to a few *confluens*. In *glyceriae*, as in *confluens*, the vittae are not so clearly differentiated from the rest

of the pronotum as in the other two subspecies. The coating in the southwestern populations is thicker and denser than in all forms except in certain individuals from the southeast.

The northwestern populations (*confluens*) recall nominate *venatus* in the lack of natural coating above and below and in the elongate form, but the size is about as in *glyceriae* and *vestita*. The upper surface is more deeply, confluent punctured, and the elytra are more rugose than in all the other subspecies except in some *reticulaticollis*. The punctures on the lateral vittae are not always of uniform size, because larger punctures from the interspaces often invade the vittae. In general, however, they are not so minute as in nominate *venatus* and *vestita*, although not so large as in *glyceriae*; they are usually smaller than the punctures at the apex of the pronotum, but not always much smaller. The lateral vittae are straighter than in nominate *venatus*, *vestita*, and *reticulaticollis*, not so oblique, and broader, more as in *glyceriae* when the latter is abraded.

The south central Mexican populations (*reticulaticollis*) have not been seen in series; the few specimens examined show a great deal of individual variation and seem to possess some characters of all the other subspecies except nominate *venatus*.

Although seven specimens of this subspecies have been examined, I have only three males before me at the present writing: the type, a specimen from Guadalupe, and one from Toluca, the last being one of Champion's specimens used for the "Biologia." In these specimens the lateral vittae are about as in *vestita* except for the larger, denser punctures; the elytra are rugose as in *confluens*, the type, however, having them also partially coated as in some *glyceriae*. Another specimen seen at the British Museum, from Guadalupe, has the elytra almost entirely coated as in most *glyceriae*. The type and the Guadalupe specimen are red in ground color, the latter less so, and have two and three rows of punctures in the lateral vittae. The Toluca specimen is black and has the vittae narrower, but both pronotum and elytra have been scratched as if with a pin, so that their true sculpture is difficult to see. The median vitta is humped in the center in the type and

the Guadalupe specimen, but is somewhat flatter in the Toluca specimen. The Guadalupe specimen is not too different from a few small *vestita* in a series from the West Indies, and *reticulaticollis* may, in fact, be closer to *vestita* than to the other subspecies. Or perhaps it is only because *vestita* is more variable, and therefore some of its variations are bound to be repeated elsewhere in the range of the species.

#### BIOLOGY OF THE SPECIES

Since the species *recta* has not before been separated from *C. venatus* and since Chittenden in 1924 returned *vestita* into synonymy with *venatus*, it is now impossible to tell to which species, *venatus* or *recta*, or to which subspecies (nominate *venatus* or *vestita*) the recorded host plants refer, because Satterthwait's publications on this subject were written after the merging of *venatus* and *vestita* and before the separation of *recta*.

The "*venatus*" records, as given by Satterthwait (1931a, 1932, 1942) include the sedge *Cyperus esculentus*, or yellow nut grass, as the preferred host plant, and wheat, Bermuda grass (*Cynodon dactylon*), timothy, and the sedge *Scirpus validus*, or tule, as other host plants. The adults are said to be destructive to corn as well as to these host plants. Other billbugs that prefer nut grass as host plants are *cariosa*, *parvula*, *destructor*, and *callosa*, all species with wide ranges covering most of the eastern states west to the Mississippi Valley region, an area that would include *recta*, nominate *venatus*, and *vestita*. Missouri is twice mentioned by Satterthwait in connection with the biology of "*venatus*," and eggs were taken in nut grass at Webster Groves and Charleston, Missouri, and at Chalmers, Indiana (1942, p. 42). I suspect that these records apply to the species *recta*, specimens of which I have seen from Kansas, Missouri, Iowa, Illinois, Indiana, Ohio, and New York. But I have also seen two specimens of *vestita* from Missouri and, of course, the host plant records given by Satterthwait are not confined to Missouri or Indiana, but cover the known range of the species with which he deals.

No host plant records have been published for *confluens*, and the only one for *glyceriae* is that it was ovipositing on *Glyceria sep-*

*tentrionalis* at Woodrow, Missouri (Chittenden, 1919, p. 270). (For the identification of this as *glyceriae*, see discussion under that subspecies.) A specimen of *confluens* has been seen with the notation "with rye grass," and a specimen of *glyceriae* was "collected from *Lauristenus*," which is arrow wood or viburnum. These insects were not said to be feeding on these plants.

#### KEY TO THE SUBSPECIES OF *Calendra venatus*

1. Sides of prosternum with small, fine, often scarcely visible punctures; dorsal and ventral surface bare, shining; usually larger (northeast) . . . . . *venatus*
- Sides of prosternum with larger, coarser, denser punctures; dorsal and ventral surface either bare or coated; usually smaller. 2
2. Pronotum with an opaque, yellow or gray coating between the punctures as well as within them, except on the exposed bare summits of the median and lateral vittae. 3
- Pronotum without coating except within the punctures, vittae entirely bare and visible. 4
3. Punctures on lateral vittae always larger than those on median vitta (usually but one or two rows) and not much smaller than those in interspaces; ground color of pronotum and elytra usually red (southwest, and northern Mexico) . . . . . *glyceriae*
- Punctures on lateral vittae the same size as those on median vitta and minute in comparison with those in interspaces; ground color of pronotum and elytra either black or red (southeast, and West Indies) . . . . . *vestita* (in part)
4. Lateral vittae nearly straight and parallel, broad, their limits not well defined (northwest) . . . . . *confluens*
- Lateral vittae oblique, narrow, their limits well defined . . . . . 5
5. Pronotum flatter, surface smoother, median vitta not usually humped in center, punctures on vittae minute . . . . . *vestita* (in part)
- Pronotum more convex, surface more irregular, median vitta usually humped in center, punctures on vittae smaller than those in interspaces, but not minute (central and southern Mexico) . . . . . *reticulaticollis*

#### *Calendra venatus venatus* (Say)

*Rhynchophorus venatus* SAY, 1831, Description of new species of Curculionites of North America, p. 22.

*Sphenophorus venatus*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 426. CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 133.



BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 571, fig. 128.

*Calendra venatus*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 162; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, pp. 16, 17, figs. 9, 25. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 442. SATTERTHWAIT, 1942, Ent. News, vol. 53, p. 42.

*Rhynchophorus immunis* SAY, 1831, Description of new species of Curculionites of North America, p. 23.

*Rhynchophorus placidus* SAY, 1831, loc. cit.

*Sphenophorus placidus*, GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 947.

*Sphenophorus confusus* GYLLENHAL, 1838, in Schoenherr, op. cit., vol. 4, p. 944.

*Sphenophorus fallax* BOHEMAN, 1845, in Schoenherr, op. cit., vol. 8, pt. 2, p. 256.

TYPE LOCALITY: "United States." Type destroyed.

NEOTYPE LOCALITY: Watch Hill, Rhode Island, July 11, 1909 (W. Robinson). Neotype, male, new designation, in the American Museum of Natural History.

DISTRIBUTION: Northeastern states south to New Jersey, west to Ohio. Possibly Iowa (Bleasdel). Probably intergrades with *vestita* on the coast of southern New Jersey.

DESCRIPTION OF NEOTYPE, MALE: Beak (from side) long, compressed, curved, only slightly wider at apex, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex slightly concave, base with short depression, front of head scarcely punctured. Eye extending below insertion of beak. Thorax behind eye feebly sinuous. Pronotum bare, with three raised, bare vittae, the median scarcely raised, more or less Y-shaped, enclosing in front an elongate, ill-defined, shallow depression of eight larger punctures, the lateral vittae broad, oblique, raised in basal two-thirds, then disappearing, punctures on vittae sparse, minute; interspaces with very large, touching punctures (size of those on elytral striae). Scutellum nearly parallel. Elytra bare, third and fifth intervals more convex, wider, more elevated, intervals with irregular, single rows of punctures, double at base of third; striae with large, round punctures about eight times larger than those on intervals and cutting into the intervals. Under surface, sides of prosternum with sparser, smaller

punctures than on sides of pronotum, the rest below, except the mesosternum, strongly punctured, apex of abdomen with shallow, transverse depression and fine hairs, hairs of ventral cavity apparently worn. Tibiae, tarsi, pygidium as in the species. Length, 10 mm.

DIAGNOSIS: Differs from the other subspecies by the finer punctuation of the under side, especially on the sides of the prosternum. Differs further from *glyceriae* (southwest, California, Mexico) and *vestita* (south central and southeast) by being longer, less robust, by having no natural coating above or below, by having the lateral vittae punctures much smaller than in *glyceriae* and about the same as in *vestita*. Differs further from *confluens* (northwest) by having the elytra generally smooth, not transversely rugose, and the pronotal punctures not so deep and irregular.

SPECIMENS EXAMINED: *Massachusetts*: Newburyport, Aug. 23, 1 ♀; Ipswich, July (J. W. Angell), 1 ♂. *Rhode Island*: Watch Hill, Aug. 22, 1945 (S. C. Harriot), 1 ♀; July 11, 31, 1909 (W. Robinson), 1 ♂ (neotype, *v. venatus*); 1 ♂. *New York*: 3 ♂, 9 ♀; Rockaway, Long Island, 1 ♂, 2 ♀; Rockaway Beach, May 24, 1914, June 2, 1918, 2 ♂, 3 ♀, July 6, 1912 (C. L. Pollard), 1 ♂; Long Beach, 1 ♂, June 11, 1926 (A. Nicolay), 1 ♂, 1 ♀, Aug. 9, 1925 (Quirsfeld), 1 ♂; Cold Spring Harbor, Aug. 22, 1900, 1 ♀, June 25, 1931 (C. H. Curran), 1 ♂, 1 ♀; Pelham Bay, June 12, 1940, 2 ♂; Willowbrook, Staten Island, Apr. 1, 14, 1927 (C. L. Ragot), 1 ♂, 2 ♀; Fire Island, June 25, 1941, July 30, 1946 (B. Valentine), 2 ♀; Montauk Point, Long Island, July 25, 1925, 1 ♀; Long Island, 1 ♀, "on shore between tides." *New Jersey*: Morgan, May 25 (Weiss, Wist), 1 ♀; Lakehurst, 1 ♂; South Amboy, June 30, 1 ♀; Wildwood Crest, May 29, 1949 (C. and P. Vaurie), 1 ♀. *Ohio*: 1 ♀. "America borealis," 1 ♂ (type, *confusus*), 1 ♀ (type, *fallax*).

DISCUSSION: Examination of the types of *confusus* Gyllenhal and *fallax* Boheman shows that the former is definitely the subspecies *venatus*, but that *fallax* might possibly be *vestita*, over which it would have priority. However, since this specimen is not in perfect condition, and it has no locality other than "America borealis," it was thought best to synonymize *fallax* with nominate *venatus*.

As to Say's types, which are no longer in existence, it was decided, after the descriptions of them were studied, that Horn's

placing of *immunis* and *placidus* in synonymy with the now long-used *venatus* should be accepted.

As can be seen from the list of specimens, no long series have been examined; the majority of specimens come from sea beaches in the vicinity of New York. This subspecies has, however, been reported as far west as Iowa (Bleasdel, 1937), and I have seen a few specimens from Clay County in southern Kansas, but these latter were from the Psota collection which has been known to contain errors in labeling. It also occurs as far north as Maine, New Hampshire, and Vermont (specimens seen at the United States National Museum).

All the New Jersey specimens of nominate *venatus* are from central or northern New Jersey, except one from Wildwood Crest, which is in the extreme south near Cape May. This specimen is in perfect condition; it has the elytra covered with waxy, yellow coating, and a darker coating below on the mesoepimeron and sides of the body, all as in *vestita*, but the sides of the prosternum are not so densely or deeply punctured as in *vestita* and the beak is more slender as in nominate *venatus*. One specimen is scarcely sufficient, but this one seems to show intergradation between the two subspecies, and it was taken in a locality where transitional forms often occur. However, there is also an individual from Lakehurst, in the pine barrens of central New Jersey, which has the elytra partially coated as in the majority of *vestita* specimens, and a very large individual from Long Island, New York, which is similar to the Wildwood Crest specimen. A specimen labeled Louisiana in the United States National Museum, and which should be *vestita* if the locality is correct, has the punctures sparse below as in nominate *venatus* and seems also to be like that subspecies in having no coating (the specimen is greased). Another isolated specimen has been seen at the Museum of Comparative Zoölogy from "Mex."; it is a typical specimen of the northern subspecies and must either be incorrectly labeled or have been transported.

The punctuation of the elytral intervals varies; usually all intervals except the third have one row of punctures; the third sometimes also has one row, sometimes two, and

sometimes the suture has two. The elytra in nominate *venatus* appear smoother in some specimens than in others, and an occasional specimen has them transversely rugose, as in most specimens of *confluens*.

#### *Calendra venatus vestita* (Chittenden)

*Sphenophorus vestitus* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 134. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 160. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 571. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 152. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 442.

TYPE LOCALITY: Sebastian River, Sebastian, Florida. Type in the United States National Museum, examined.

DISTRIBUTION: Southeastern states from the District of Columbia to Florida and west to eastern Texas and southern Kansas. Also the West Indies (Bahamas and Greater Antilles).

DIAGNOSIS: Differs from *glyceriae* (southwest, California, northern Mexico) by having sparse, minute, not large and dense punctures on the lateral pronotal vittae and these vittae more raised and more clearly marked; from *confluens* (northwest) and *reticulaticollis* (south central Mexico) also in the finer vittae punctures and in the less rugose elytra. Differs from nominate *venatus* (northeast) in the larger, denser punctures on the sides of the prosternum and in the usually coated mesoepimeron.

SPECIMENS EXAMINED: *District of Columbia*: 1 ♀. *Virginia*: Richmond, 1 ♀; East Falls Church, May 21, 2 ♀. *North Carolina*: Southern Pines, Feb. 27, 1918, 1 ♂, 1 ♀, July 14 (A. H. Manee), 1 ♂. *South Carolina*: 1 ♂; Beaufort, Mar. 29, 1892, 1 ♀; Clemson, Mar. 20, 1940, 1 ♂. *Georgia*: Savannah (Harper), 1 ♀; Feb. 8, 1926, 1 ♂. Clarke Co., June 19, 1928 (Richards), 1 ♀. *Florida*: MacDill Field, Tampa (B. Malkin), Apr., 7 ♂, 8 ♀, May, 2 ♂, 2 ♀, June, 3 ♂, 4 ♀; Miami Beach, 1921 (H. B. Barley), 1 ♀; Miami, Feb. 18, 1940, 1 ♂; Ortega, 5 ♂, 5 ♀; Enterprise, May 9, 19 (Hubbard and Schwarz), 2 ♂; Capron, Apr. 3, 20 (Hubbard and Schwarz), 1 ♂, 1 ♀; Indian River, 1 ♀; Punta Gorda, Nov. 16, 1911, 4 ♂; Kissimmee, 1 ♀; Ormond, 2 ♀; Biscayne Bay, 1 ♂, 1 ♀; Ch. Hbr. [Charles Harbor], 1 ♀; Belleair, 1 ♂; Everglade, Apr. 11, 1912, 1 ♂; Gainesville, Agricultural Experiment Station ("J. R. W."), 1 ♀; Valparaiso, fall, 1943 (G. A.

Edwards), 1 ♂, 2 ♀; Clara, Taylor Co., May 26, 1948 (M. Cazier), 2 ♂, 1 ♀. Sebastian River, July 4 (Hubbard and Schwarz), 1 ♂ (type, U.S.N.M. No. 7903). *Alabama*: 1 ♀; Jackson, Clarke Co., June 11, 1917, 1 ♀; Spring Hill (H. P. Loding), 1 ♂, 1 ♀; Mobile, Mar., 3 ♂, 2 ♀; Tuscaloosa, Dec. 14, 1949, Jan. 24–28, 1950 (B. D. Valentine), 2 ♂, 8 ♀, Oct. 16, 1949 (B. E. Williams), 1 ♀. *Mississippi*: Camp Shelby, near Hattiesburg, Aug. 31, 1943 (C. D. Michener), 1 ♀. *Louisiana*: Horn Coll. No. 8998, 1 ♂, 2 ♀; Sept. 28, 1916 (O. von Geldern), 3 ♀; Baton Rouge, Mar. 11, 1916, Mar. 2, 1917 (T. H. Jones), 2 ♂, 1 ♀, Apr. 11, 26, 1915 (T. H. Jones), 2 ♀; New Orleans, Oct. (H. Soltan), 1 ♀. *Texas*: (Chittenden), 1 ♀, (Roberts), 1 ♀ (paratypes); Horn Coll. No. 8998, 1 ♂, 1 ♀; Dallas Co., Apr. 21, 1948 (F. W.), 3 ♀; Bandera, Apr. 7 (Rowe), 1 ♂; Eagle Lake, Oct. 16, 1943 (Johnston), 1 ♂, 1 ♀ "in rice tap roots." *Arkansas*: Hope, Mar. 19, 1922, 4 ♂, 1 ♀. *Kansas*: Sedgwick Co., June 14, 1911 (Blaisdell), 1 ♀. *Missouri*: Manley, Aug. 13, 1939 (R. C. Froeschner), 1 ♂; Tyler, May 10, 1942 (R. C. Froeschner), 1 ♀.

*Cuba*: Havana, University Hill, Oct. 9, 1915, 1 ♂, 5 ♀; Havana, Oct. 5, 1915, 1 ♂, 3 ♀.

*Puerto Rico*: Rio Grande, Feb. 11, 1931, 2 ♂, 1 ♀; Cataño, Finca El Pantage, Nov. 28, 1930, 10 ♂, 4 ♀; Boqueron, Feb. 18, 7 ♂, 3 ♀; Cartagena Lagoon, 12.

*Dominican Republic*: July, 1938 (Darlington), 8.

*Bahamas*: New Providence Island, July, 1904 (Barber), 1 ♂. North Bimini Island, May, 1951 (Gertsch), 1 ♀.

**DISCUSSION:** This subspecies is probably the most abundant and has the widest range of all the five subspecies (fig. 35). It occurs in the Atlantic coastal states from Virginia to Florida, and along the Gulf to perhaps as far as Brownsville. In Texas it has been taken inland at Eagle Lake and Bandera, both near San Antonio, and at Dallas. There is some question about its reported occurrence in Indiana, Illinois, and Iowa (these records probably are of the species *recta*), but I have seen specimens of *vestita* from southeastern Missouri and from southern Kansas. No specimens have been seen from western Texas, where *v. glyceriae* has been found along the Rio Grande at Del Rio, Texas.

The coating in *vestita* is yellowish when fresh, but usually a dirty gray. The pronotum is usually not coated, but it has mud within the punctures. In 49 specimens from Virginia, North and South Carolina, Georgia, Florida,

Mississippi, and Alabama, the coating was present as follows:

	COATED	UNCOATED	PARTLY COATED
Pronotum	16	33	—
Elytra	34	12	3

The pronotum and elytra were tallied separately so that the coated pronotum does not necessarily go with the coated elytra. Some of the 12 specimens without coating on the elytra were abraded or greased.

In a series of 11 specimens (two males, nine females) from Tuscaloosa, Alabama, five specimens are red (two of these with the vittae black) and two have only the elytra red; three specimens have the first, third, and fifth elytral intervals slightly elevated; six have the median apical fossa on the pronotum depressed, the others have it scarcely depressed; four of the females have the beak less arched than in the other specimens; all are strongly punctured below on the sides of the prosternum and on the front femora.

The populations from Cuba, the Dominican Republic, and Puerto Rico show the same range of variation as does a series from Tampa, Florida, and two specimens from the Bahamas are not separable from them.

The types of *C. neomexicana* and *vestita* and the allotype of *glyceriae* are very similar, the elytra in the latter two being identical, but the punctures on the pronotal vittae are about the same size as those on the rest of the pronotum in *neomexicana* and *glyceriae*, whereas in *vestita* they are minute and much smaller than on the rest of the pronotum.

For discussion and comparison with nominate *venatus*, see under the species.

#### *Calendra venatus glyceriae* (Chittenden)

*Sphenophorus reticulaticollis*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 426 (in part). CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 136. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 161. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 572. VAN DYKE, 1938, Pan-Pacific Ent., vol. 14, p. 187.

*Sphenophorus glyceriae* CHITTENDEN, 1919, Proc. Biol. Soc. Washington, vol. 32, p. 270 (new name for *reticulaticollis*, nec Boheman).

**TYPE LOCALITY:** No locality specified; here designated as Palm Springs, California,

from original label on lectotype, male, new designation, in the United States National Museum, examined. Allotype from Albuquerque, New Mexico, in the United States National Museum, examined. Location of type, if ever designated, unknown to author.

**DISTRIBUTION:** Southern Oregon, California, New Mexico, southwestern Texas, and northern Mexico.

**DIAGNOSIS:** Differs from the other subspecies by having larger, denser punctures on the lateral pronotal vittae and these vittae usually much narrower, often accommodating but one row of punctures. Differs further from nominate *venatus* (northeast), *confluens* (northwest), and *reticulaticollis* (southern Mexico) by being generally coated above and below, only the center hump of the median vitta and the narrow lines of the lateral vittae showing through the dorsal coat.

**SPECIMENS EXAMINED:** (Sex not noted in some.) *Oregon:* Medford, Jackson Co., Mar., June, July, 1944 (A. T. McClay), 1 ♀, 3. *California:* Los Angeles Co. (Coquillett), 1 ♂ (paratype), 1 ♂, 1 ♀ (cotypes); Montebello, Los Angeles Co., Aug.–Oct., 1932, 1934 (A. T. McClay), 21; Hollywood, Los Angeles Co., Feb., June, Sept., Oct., 1928, 1934 (A. T. McClay), 4; Westwood Hills, Los Angeles Co., Feb. 20, 1941 (A. T. McClay), 1; Palm Springs, July 2 (Hubbard and Schwarz), 1 ♂ (lectotype, U.S.N.M. No. 60918); Holtville, June 15, 1934 (O. Schwab, M. Cazier), 2 ♂, 1 ♀; Berkeley, Mar., June, 1934 (M. Cazier), 1 ♂, 1 ♀; Sept. 27, 1934, 2 ♂, 1 ♀; Lone Pine, June, 1937, 1 ♂; Red Bluff, Nov. 18, 1949, 2 ♂; Yuba Co., 2 ♂; Marysville, Yuba Co., Oct. 18, 1930, 1 ♂ "collected from *Lauristenus*"; Sacramento, Aug., 1913 (Essig), 2 ♂, Oct. 4, 1932 (S. Lockwood), 1 ♂, Oct. 30 (E. Gammon), 1 ♂, Mar. 27, 1935 (H. Hunt), 1 ♂, Aug.–Sept., 1931–1936 (H. H. Keifer), 2 ♂, 3 ♀; Mar.–Oct., 1941–1946 (A. T. McClay), 24. *New Mexico:* Albuquerque, Feb. 16 (H. Soltan), 2 ♂ (allotype and paratype, U.S.N.M. No. 7907); 1 ♂, 2 ♀ (cotypes); Merillas [Mesilla], June 28, 1897 (A. P. Morse), 1 ♂; Santa Rosa, 5200 ft. (W. Knaus), 1 ♂. *Texas:* Del Rio, 955 ft., July 23–24 (Wickham), 1 ♂ (cotype), 1 ♀, 1.

*Mexico. Chihuahua:* Villa Ahumada, June 28, 1947 (Spieth), 2 ♀.

**DISCUSSION:** The confusion between *reticulaticollis* and *glyceriae* was caused by Chittenden in 1904 who redescribed some insects he had from California and New

Mexico as *reticulaticollis* Boheman, a name that had been synonymized by Horn with *venatus*. When Chittenden sent this supposed *reticulaticollis* to Champion for comparison with Mexican *Calendra* for the "Biologia," the latter, who had seen the type, wrote back that the two were not the same. Some years later, in 1919, Chittenden renamed his "*reticulaticollis*" as *glyceriae*.

Chittenden failed, however, to designate a holotype for *glyceriae*, and none has been found at the United States National Museum where most of his types, including the allotype of *glyceriae*, were deposited. Since another example exists, with *C. diversa*, of Chittenden's confusing, apparently, a type and a paratype, it seems very likely that in this case he meant to label one of his specimens as holotype, but for one reason or another did not do so. It is on this assumption that I have designated a lectotype, but there is always the possibility that a type exists.

There are two questionable records of this subspecies outside its range. One is from the District of Columbia, reported by Chittenden when he redescribed *reticulaticollis*, and repeated by Blatchley and Leng; this specimen must be either wrongly labeled or a misidentification of *vestita*. The other record, also reported by Chittenden (1919, p. 270), is from Woodrow, Missouri, where *glyceriae* was supposedly collected with the species *missouriensis* on *Glyceria septentrionalis* by Satterthwait, who had observed it ovipositing on this plant. Both these localities fall within the distribution of *vestita* and the quite similar *C. recta*, but are far from the distribution of *glyceriae* (fig. 35). If these specimens should prove to be undoubted *glyceriae* and if more such should be found, then the consideration of this form as a subspecies of *venatus* would have to be revised, and it would be returned to its original species status.

The Texas locality, Del Rio, is in western Texas on the Rio Grande; Texas records of *vestita* are in the eastern part of the state. Villa Ahumada is in northeastern Chihuahua, and the two specimens seen from that place are typical of the majority of specimens of this subspecies.

The raised line of the lateral vittae accommodates in width from one to three rows of

punctures. Of 29 specimens from California, southern Oregon, and northern Mexico, 13 have one irregular row of punctures, 10 have two rows, and only six have three. Actually, however, these vittae are not always so narrow as they appear, the raised bare line being only the inner edge of the vittae which is exposed in the proportion just given. In specimens where the coat is abraded or where the normally exposed line is covered over with grease, the vittae seem to be much broader at the base, although, since they are not sharply raised, their limits are not easy to define.

***Calendra venatus confluens* (Chittenden)**

*Sphenophorus confluens* CHITTENDEN, 1904<sup>1</sup>  
Proc. Ent. Soc. Washington, vol. 6, p. 133.

TYPE LOCALITY: No locality specified; type from Portland, Oregon. Type in the United States National Museum, examined.

DISTRIBUTION: Montana, Washington, Oregon. ?Northern California.

DIAGNOSIS: Differs from the other subspecies by having the dorsal surface more deeply and irregularly punctured and the elytra heavily rugose transversely. Differs further from *glyceriae* (southwest, California, Mexico) and most *vestita* (south central and southeast) by having no natural coating on the elytra (abraded examples occur in both these subspecies). Differs further from nominate *venatus* (northeast) in its generally smaller size and in the larger, coarser punctation below, and from *reticulaticollis* in the straighter, broader, lateral pronotal vittae.

SPECIMENS EXAMINED: *Washington*: Spokane Falls, May, 1890, 2 ♀; Rochester, Apr. 19, 1930 (W. W. Baker), 1 ♀, Marys River [?], Apr. 1, 1911 (Brundage), 1 ♂. *Oregon*: Portland (Wickham), 1 ♂ (type, U.S.N.M. No. 7908), Apr. 21, 1945 (Anderson), 1 ♀ "with rye grass," June 12, 1920 (A. C. Burrill), 2 ♀, June 25, 1927 (Van Dyke), 3 ♂, 3 ♀, Mar. 28, 1929 (G. Heid), 1 ♂; Corvallis (Cordley), 1 ♂ (paratype), May 3, Apr. 20, 1924 (J. Wilcox), 2 ♂, May, 1935, Aug., 1934 (N. P. Larson), 1 ♂, 3 ♀, Apr. 26, 1935 (J. Schuh), 1 ♀, Mar. 29, 1935 (H. W. Brown), 1 ♀, Apr., May, 1930 (M. F. Canova), 2 ♂, May 1, 1941 (R. A. Nicholson), 1 ♀, (A. Moore), 1 ♂, Feb. 29, 1939 (R. L. Pos), 1 ♂, Mar. 22, 1946 (L. G. Gentner), 1 ♀, May 5, 1914 (W. J. Chamberlin), 1 ♂, June 9, 1897, 2 ♂, 4 ♀, May 18, 1915 (E. Dunn), 1 ♂, May 2, 1910 (Cordley), 1 ♂;

Forest Grove, Apr. 27, 1919 (A. C. Burrill), 1 ♀; Rainier, June 18, 1945 (Anderson), 1 ♂ "on grass"; McMinnville, Apr., 1939, 1940 (K. M. and D. M. Fender), 5 ♂, 3 ♀; Eugene, Apr. 8, 1932, 1 ♀, Oct. 26, 1941 (B. Malkin), 6 ♂, 6 ♀, July 4, 1941, Apr. 6, 1942, June-July, 1946 (B. Malkin), 1 ♂, 5 ♀, Mar., Nov., 1942, 2 ♂; Baker Creek Valley, Oct. 23, 1938, 1 ♀; Vida, Lane Co., June 28, 1941, 1 ♀; Coburg, Lane Co., Mar. 22, 1942, 1 ♂; Cannon Beach, June, 1927 (E. C. Van Dyke), 1 ♂, 2 ♀; Florence, Lane Co., June 12, 1936, 1 ♀; Roseburg, Sept. 22, 1946 (B. Malkin), 1 ♀. *California*: (Blanchard), 1 ♂, 1 ♀.

DISCUSSION: The two specimens from "California," if they represent an actual population, probably come from northern California, but in any case they would seem to come into the range of the subspecies *glyceriae* which occurs in northern California and extends into southern Oregon (fig. 35). These specimens are typically *confluens* and show no intergradation with *glyceriae*.

In some specimens the lateral pronotal vittae are only feebly raised above the interspaces; in most, however, they are definitely raised. In about a third of the specimens, the center of the median vitta is impunctate; in the others the punctures cover the entire area. Some specimens have the elytra rather smoother, although all have some amount of transverse wrinkling. Twenty-three out of 25 specimens before me have the elytra shining and rugose; the other two have them opaque and not so rugose. A specimen from Eugene, Oregon, has scarcely any apical depression on the pronotum.

***Calendra venatus reticulaticollis* (Boheman)**

*Sphenophorus reticulaticollis* BOHEMAN, 1845, in Schoenherr, Genera et species curculionidum vol. 8, pt. 2, p. 257. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 160, pl. 8, fig. 4.

TYPE LOCALITY: "California"; here restricted to Mexico City and vicinity. Type in Stockholm museum, examined.

DISTRIBUTION: Central and southern Mexico.

DIAGNOSIS: Differs from *glyceriae* by having coating within the punctures of the pronotum but no natural covering coating (seven specimens) and by having the punctures on the lateral vittae sometimes the

same size as those on the median vitta (type and one other specimen); from *vestita* in the more rugose elytra (six specimens), more convex pronotum (type and one other specimen), and larger punctures on the lateral vittae (type and two other specimens); from *confluens* in the narrow, oblique, not broad and straight, lateral vittae (type and two other specimens) and in the deeper median apical depression (type and two other specimens); from nominate *venatus* in the larger, coarser, denser punctures on the sides of the prosternum (seven specimens) and much smaller size.

**SPECIMENS EXAMINED:** "California; Mexico," 1 ♂ (type), Mexico. 1 ♂, 1 ♀. *Jalisco:* Guadalajara (Höge), 1 ♀. *Mexico:* Toluca, Aug. (Wickham), 1 ♂, 1 ♀. *Distrito Federal:* Guadalupe (Wickham), 1 ♂.

**DISCUSSION:** Although Boheman in his description gave California as the locality for this species, the type specimen has also, in addition to three California labels, a label reading "Mexico Chevrolat 743." Since in 1845 the term "California" is ambiguous, and since at least 70 specimens of the subspecies *glyceriae* have been seen from present-day California and none of them matches the type of *reticulaticollis*, and since no other examples of the latter subspecies have been seen from California (all the records of *reticulaticollis* in modern literature applying to *glyceriae*), I accept, as first reviser, Mexico as the type locality, further restricting it to the area around Mexico City. It is possible, of course, that *reticulaticollis* occurs farther north in Mexico than available records indicate.

For further discussion, see under the species.

***Calendra hoebergii* (Boheman)**

Figure 100

*Sphenophorus hoebergii* BOHEMAN, 1845, in Schoenherr, Genera et species curculionidum, vol. 8, pt. 2, p. 254. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 160.

*Sphenophorus coactorum* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 136. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 161.

Small to medium; black but densely encrusted with tan coating, pronotum with three raised vittae under coat, median enclos-

ing an apical depression, elytra with odd intervals elevated.

Beak (from side) long, compressed, curved, wider at apex, apex beneath prolonged into acute angle, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flat to concave, base with depression between eyes usually visible under coating, front of head distinctly punctured. Eye extending below insertion of beak. Thoracic lobe sinuous behind eye. Pronotum coated, with three raised, coated vittae, median Y-shaped, enclosing deep apical depression, and with small area in center sometimes bare, laterals broad, oblique, raised in basal half only, all vittae with smaller punctures than interspaces, interspaces with punctures about size of elytral striae punctures. Scutellum coated, narrower than long, almost parallel. Elytra entirely coated, odd intervals raised, but not always the suture, all intervals with a more or less single row of punctures, often obscured by coating; striae fine, with deep punctures, often obscured, that cut into the intervals. Under surface, sides of prosternum about the same as pronotum. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex and at sides of apex. Length, 8–10.5 mm.

**TYPE LOCALITY:** Vera Cruz, Mexico.

**DISTRIBUTION:** Texas and southern Mexico. Type in Stockholm museum, examined.

**SPECIMENS EXAMINED:** *Texas:* 3 ♀; Horn Coll. No. 8998, 2 ♀, (Wickham), 1 ♀, (C. H. Roberts), 2 ♀; Edinburg (Chittenden), 1 ♂ (type, *coactorum*, U.S.N.M. No. 7906), 2 ♂, 1 ♀; Brownsville, June (Wickham), 1 ♂, July, 1912 (E. G. Smyth), 1 ♂, Mar. 26, 1916 (McMillan), 1 ♂; Hueco Mts., 30 miles northeast of El Paso, Aug. 17, 1947 (B. D. Valentine), 1 ♀ "at light."

*Mexico. Vera Cruz:* (Högeberg), 1 ♀ (type, *hoebergii*); Cordoba (Höge), 1 ♂, 1 ♀.

**DISCUSSION:** Comparison of the type of *coactorum* (Edinburg, Texas) and other Texas specimens with the type of *hoebergii* (Vera Cruz, Mexico) shows them to be the same species, with *coactorum* a synonym.

This species, as in the unrelated *cazieri*, *bartramiae*, and *minima*, has an exceedingly dense, thick, over-all encrustation; unlike them it has the scutellum also encrusted (one

of 15 has it bare, and the type has it only partially encrusted). Short hairs are visible protruding from the coated punctures of the pronotum, elytra, and pygidium, and from the coated areas ventrally. When the full coating is present, this species could not be confused with the more thinly coated *venatus* and *recta*, which occur also in Texas and which have the same apical depression on the pronotum and a similar pronotal and elytral pattern. In these species the lateral vittae are always at least partially bare.

*Calendra hoegbergii* differs further from these closely related species in the narrower pygidium in both the male and female and in the proportionately shorter, stouter front tibiae. A male from Texas, compared with a male of *C. venatus reticulaticollis* of similar size from Toluca, Mexico, and with an even smaller male of *recta* from New York, has the pygidium at the apex at least a third narrower and the tibiae broader and shorter. It agrees with *missouriensis* (Missouri) in the narrow pygidium, but has a shorter, broader, less strongly arched beak than that species, with the apex of the beak wider and more acutely produced below. The odd elytral intervals in *hoegbergii*, perhaps due to the thick coating, seem more strongly elevated than in any of the above species.

When almost entirely abraded, as in the El Paso female, *hoegbergii* might be mistaken for *C. venatus vestita*, but that form, in addition to the pygidial and tibial differences, has the punctures on the pronotal vittae minute and the lateral vittae more clearly differentiated from the rest of the pronotum.

Two specimens in the British Museum, a male from Cordoba and a female from Vera Cruz, which Champion included in the "Biologia" as *hoegbergii*, are not this species, but seem to be *recta*. These specimens are discussed under the latter species.

#### ***Calendra missouriensis* (Chittenden)**

Figures 63, 101

*Sphenophorus glyceriae* var. *missouriensis* CHITTENDEN, 1919, Proc. Biol. Soc. Washington, vol. 32, p. 270.

Small; black or red, coated, pronotum with three bare vittae, vaguely M-shaped, the median enclosing a shallow apical depression, elytral stria punctures larger than interval punctures.

Beak (from side) very long, slightly compressed, very strongly arched, about the same width throughout, apex beneath an obtuse or right angle, no fovea in front of eye, base not swollen over antennal insertion; (from above) apex flattened to concave, base with no evident canal (heavily coated), front of head distinctly, densely punctured. Eye extending below insertion of beak. Thoracic lobe present. Pronotum with three raised, usually well-defined, bare, narrow vittae, the median enclosing a shallow, ill-defined apical depression, the laterals raised from base to apex, slightly curved outward at middle, punctures on vittae smaller than in interspaces, not dense, larger at apex than at base and in center; interspaces with larger, sometimes merging punctures. Scutellum flat or concave, virtually parallel. Elytra coated except where worn, intervals flat, of about same width and elevation, their punctures in single rows, but often obscured; striae with much larger punctures that cut into intervals, making their sides sinuous. Under surface, sides of prosternum punctured as on sides of pronotum. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides. Length, 6.5–8 mm.

TYPE LOCALITY: Woodrow, Missouri. Type in the United States National Museum, examined.

DISTRIBUTION: Woodrow, Missouri.

SPECIMENS EXAMINED: *Missouri*: Woodrow, May 23, 1919 (Satterthwait), 1 ♀ (type, U.S.N.M. No. 22777), 2 ♂, 2 ♀, all "on *Glyceria septentrionalis*," May 20, 1921 (Satterthwait), 1 ♂.

DISCUSSION: This species is known so far from Woodrow, Missouri, only. In Chittenden's paper it was described as a variety, following his renaming of *reticulaticollis* as *glyceriae*, but it was not stated as being a variety of *glyceriae*, although no doubt that was meant. I consider it to be distinct from *glyceriae*, from which it differs, as Chittenden stated, "markedly in its more slender form" and "different shaped rostrum." The beak is more arched, more slender, and longer than in any of the other closely related species and seems, in fact, to be the only certain distinguishing character (fig. 63). Chittenden also mentions that it is "finely carinate

at middle," but this is not diagnostic since there is a trace of this carina in other species, notably in *recta*.

Differs further from related species in that the lateral vittae reach the apex in a continuous raised line of punctures, not as in *venatus* and *hoegbergii* where they fade out at the middle, nor as in *neomexicana* and *phoeniciensis* where they join the median vitta before the apex, but more as in *recta*, although in that species the vittae are generally sinuous and are more densely punctured. The attenuate elytra in *missouriensis*, the flat pronotum, and narrow pygidium are different from those of all the species mentioned except *hoegbergii*, but that species has a thick, clay-like encrustation not present in *missouriensis*, and a different beak. The beak in *hoegbergii* as well as in *C. venatus glyceriae* is similar to that of *coesifrons* (fig. 61) but a little less stout.

**BIOLOGY:** This species was collected on *Glyceria septentrionalis*, a grass that grows in shallow water.

#### *Calendra recta* (Say)

Figures 8, 102

*Rhynchophorus rectus* SAY, 1831, Description of new species of Curculionites of North America, p. 22.

*Sphenophorus rectus*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 426. CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 133.

Small; black or red, coated, pronotum with M-shaped, sinuous, bare vittae, the median enclosing an apical depression, elytral stria punctures larger than interval punctures.

**DESCRIPTION OF NEOTYPE, MALE:** Beak (from side) long, compressed, curved, wider at apex, apex beneath obtuse, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex damaged, base with dense, confluent punctures, also a slight median keel extending forward, front of head densely and strongly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three raised, bare vittae, the median Y-shaped, humped in center, enclosing a well-defined, elongated apical depression of dense punctures, the laterals about the same width as the median in center, undulating, curving outward at middle and joining median at apex, laterals with two

vague side branches, punctures on all vittae and apex of pronotum small, dense, of about the same size; interspaces coated, punctures larger, some merging. Scutellum nearly parallel, concave at base. Elytra partially coated, mostly on outer intervals, intervals flat, with single rows of punctures (size of punctures on vittae) except at base of third where they are double; striae with larger punctures than on intervals and cutting into intervals, making their sides sinuous. Under surface, sides of prosternum with dense punctures about the size of those on pronotal interspaces, rest below strongly, densely punctured. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides and raised apical area of smaller, denser punctures. Length, 8 mm.

**TYPE LOCALITY:** "United States." Type destroyed.

**NEOTYPE LOCALITY:** Pine Island, New York, June 17, 1911 (C. L. Pollard). Neotype, male, new designation, in the American Museum of Natural History.

**DISTRIBUTION:** New York and Rhode Island west to Kansas, also Texas, Arizona, and southern Mexico.

**SPECIMENS EXAMINED:** *New York:* Rochester, May 12, 1 ♂; Esopus, Aug., 1893, 1 ♀; Rockaway Beach, Long Island, June 10, 1923 (A. Nicolay), 2 ♂; Rockaway, 2 ♀; Far Rockaway, June 4, 1904, 1 ♀; Pine Island, June 17, 1911 (C. L. Pollard), 1 ♂ (neotype), 3 ♂; Fire Island, July 5 and 11, 1941 (B. Valentine), 3 ♀. *Rhode Island:* Watch Hill, June 22, July 2, 1909 (W. Robinson), 3 ♀. *Ohio:* East of Fairport, Lake Co., July 21, 1918 (E. R. Kalmbach), 1 ♀. *Indiana:* Michigan City, June 9, 1934 (C. H. Seevers), 1 ♂. *Illinois:* 1 ♀; Havana, Aug. 19, 1907 (Hart and Hood), 2 ♀; Galena, June 6, 1876, 1 ♀. *Michigan:* Caseville, June 16, 1910, 1 ♀. *Iowa:* Iowa City, July 15 (Wickham), 1 ♀. *Missouri:* Charleston, June 12, 1918 (H. R. Painter), 1 ♂; Carthage, May 18, 1941 (R. C. Froeschner), 1 ♀. *Texas:* 1 ♀. *Kansas:* (Snow), 1 ♀; Reno Co., May 20 (J. Warren), 1 ♀. *Arizona:* Douglas, Aug., 1905 (E. G. Smyth), 1 ♂, 1 ♀; Patagonia, Aug. 21, 1940 (F. W. Nunenmacher), 1 ♂, 1 ♀.

*Mexico. Vera Cruz:* 1 ♀; Cordoba (Hoegel), 1 ♂.

**DISCUSSION:** Since Say's types no longer exist and cannot be verified, his names for the various forms with the apical depression



on the pronotum must either be applied rather arbitrarily (the descriptions are poor), or new names must be given. It was thought best to follow the first course and to designate a neotype. Only two (*venatus* or *recta*) of Say's four names (all 1831) can serve for the present insect. Since Horn in 1873 decided on *venatus* for the form long known under that name, I have chosen *recta* for this species, even though Say's description might also fit *venatus*. He said that *recta* was covered with a dull cinereous deposit and had the pronotum more densely punctured than *venatus* which is true, but he said the lateral vittae were not undulating as in *venatus*, which is not true.

One cannot be certain of the distributional records of this species since it has been confused with *vestita*, when that form was considered a species by Chittenden, and with *venatus*, when Chittenden synonymized *vestita* with *venatus*. Blatchley's illustration (1916, p. 571) for *venatus* seems to be a typical *recta*. I consider nominate *venatus* and *vestita* northern and southern subspecies of *venatus*, and *recta* a distinct, though closely related, species which occurs with nominate *venatus* in Rhode Island, New York, Ohio, and possibly Iowa (Bleasdel, 1937, p. 442) and with *vestita* in Missouri, Kansas, and Texas.

No specimens have been examined from the large intervening area between Arizona and Texas and the southeastern coast of Mexico. This may be owing to lack of collecting or it may be that the two specimens from Mexico had been transported there. Champion had identified these specimens as *hoegbergii* (his label has, however, a question mark after the identification and the word "abraded"). The male from Cordoba cannot be *hoegbergii*: it is small (7 mm.), but has the pygidium broader at the apex than a slightly larger *hoegbergii*; it has no trace of the typical encrustation of *hoegbergii*, no trace of a thoracic lobe behind the eye, no elevated elytral intervals, and a rather slender beak. It could not be *C. venatus*, since the vittae are definitely raised in front, nor *neomexicana* because of the fine vittae punctures and the slightly undulating laterals, nor *missouriensis* because of the broad pygidium and the less arched beak. It is most similar to *phoenicenis*, which in itself is very variable, except that

there are side branches to the lateral vittae, the lateral vittae are somewhat undulating, and the penis has a broader chitinous margin (fig. 102). It differs from most other *recta* by completely lacking any coating except within the pronotal punctures (the other Mexican specimen and a specimen from Havana, Illinois, also lack coating), and by having the vittae, beak, head, and front femora with much finer punctures than is usual. The worn, opaque condition of the specimen might possibly account for these differences.

This species is about the same size as *neomexicana* and *phoenicenis* and is consistently smaller than nominate *venatus* or *vestita* (none more than 8 or 9 mm.). Some *vestita* are as small, but these are nearly always males. *C. recta*, seen in series, has a consistent pronotal pattern, with the lateral vittae undulating (not oblique or rectilinear as in nominate *venatus* and *vestita*), looping outward just in front of the middle, and curving around the median vitta and the sides of the apical depression in a narrow band (fig. 8), this apical portion, as well as the base of the lateral vittae, having punctures of approximately the same size and density. Individuals present some variations in pattern. The punctures on the vittae are much smaller than those in the coated interspaces, as in the species *venatus*, but they are much denser and somewhat larger and deeper than in most specimens of this species. The coating in the interspaces is generally not merely within the punctures, as in *vestita*, but it obliterates them in great part. The base of the beak on top and the front of the head are strongly, often confluent punctured, the punctures deep and coarse; there is no wide canal but often a narrow, sunken line. After passing the antennal scrobes, this sunken line changes into a slight keel or carina which is present in 22 of 25 specimens examined. The keel does not appear to be present in *vestita* although it occurs sporadically in other close forms. The middle third of the beak, seen from above, is much more densely and deeply punctured in *recta* than in *vestita*. The beak in *recta* is less curved, especially on the upper contour, and its apex beneath usually forms a right or obtuse angle, but in two specimens out of 25 (one from Charleston, Missouri, and one, Havana, Illinois) the apex is produced into an acute angle

as in most *vestita*. The margin of the thorax behind the eye is straight, not lobed as in *vestita*, but there is a very slight sinuation visible in four of 25 specimens (three from New York, one from Indiana). The elytra vary as much and in about the same way as in *vestita*, although in general the disparity of size between the stria and interval punctures in *recta* is not so great. The penis seems more truncate, not so pointed as in *vestita*, and with a broader chitinous border at the apex, but the male genitalia in this whole group of species do not seem to be very constant.

Not much has been said in the above comparison about nominate *venatus* because it is easily separable from *recta*, being very much larger, entirely without coating above or below, and with much finer, sparser punctures below.

The three specimens from southern Arizona (Patagonia and Douglas) have the punctures above and below even deeper and denser than in other *recta* and have less difference in size between the vittae and interspace punctures on the pronotum and between the stria and interval punctures on the elytra. The pronotum and elytra are so densely pitted as to leave scarcely any exposed smooth surface. In other characters, including the penis, these specimens agree with other *recta*. More specimens from Arizona may show this to be a subspecies of *recta*, but for the present there is enough confusion in this group without adding yet another name on so few examples.

Differs from *neomexicana* by having the vittae punctures denser, smaller, and proportionately much smaller than the interspace punctures, not slightly smaller, the thorax behind the eye straight, not sinuous, the apex of the beak less acute, and the penis with a stronger sinuation at the apex. Differs from *venatus*, *hoebergii*, *neomexicana*, and *phoeniciensis* in the more undulating lateral vittae, and from *missouriensis* in the less arched beak and lack of thoracic lobe behind the eye.

**BIOLOGY:** Since this species has long been regarded as a variant of *venatus* and *vestita*, it would be difficult now to disentangle the host plant records and to decide which ones might apply to *recta*. (See discussion of biology under *Calendra venatus*.)

### *Calendra neomexicana* (Chittenden)

Figures 24, 103

*Sphenophorus neomexicanus* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 134.

Small; black or red, partially coated; pronotum with M-shaped bare vittae, the median enclosing a round or oblong apical depression; elytral stria punctures about the same size as interval punctures.

Beak (from side) long, compressed, curved, wider at apex, apex beneath prolonged into acute angle, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened to concave, base with usually a narrow depression of sunken punctures, front of head densely and distinctly punctured. Eye extending below insertion of beak. Slight thoracic lobe behind eye. Pronotum with three raised, broad, bare vittae with small, not fine, dense punctures, the median Y-shaped, the fork enclosing a deep or shallow, elongate or round, apical depression of sunken large punctures, the depression usually extending about one-quarter back from the apex, lateral vittae straight or slightly oblique, merging with median at about middle; interspaces with larger punctures than on vittae, shallow, usually not merging. Scutellum narrower than long, virtually parallel, sometimes with slight groove. Elytra with intervals more or less flat, third and fifth often raised, and slightly, if at all, wider; intervals with single rows of punctures, very close on suture, more widely separated on other intervals, the punctures the same size as those on striae or scarcely smaller; striae with fairly distant punctures scarcely cutting into the intervals, and about the size of those at base of lateral pronotal vittae. Under surface, sides of prosternum strongly punctured, as on pronotum, punctures about size of those on lateral vittae or slightly larger; front femora with outside as strongly punctured as prosternum. Front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides. Length, 7–9 mm.

**TYPE LOCALITY:** Albuquerque, New Mexico. Type in the United States National Museum, examined.

**DISTRIBUTION:** New Mexico, Colorado, Nebraska, also northern Mexico.

**SPECIMENS EXAMINED:** *New Mexico:* Albuquerque, Feb. 3 (H. Soltau), 1 ♂ (type, U.S.N.M. No. 7904), Feb. 12 (H. Soltau), 1 ♂, 1 ♀ (paratypes), 4 ♂, 4 ♀; Jemez Mts., Aug., 1909, 1 ♀. *Colorado:* (Roberts), 1 ♀; Denver, June, 1897 (Wickham), 1 ♀. *Nebraska:* Lincoln, Salt Basin, May 14, 1905 (F. H. Shoemaker), 2 ♂.

*Mexico. Chihuahua:* Ojos del Diablo, Mar. 25, 1902, 2 ♂, Los Ojos del Diablo, 30 miles northwest of Villa Ahumada, Mar. 25, 1913 (Townsend), 1 ♂, 1 ♀ "under rocks."

**DISCUSSION:** The two Townsend specimens were incorrectly labeled as coming from "Santo Domingo Republic Chihuahua" and "30 Mi. N. W. of Villa Abremada." Another label reading "*Sphenophorus*, probably new species, coll. Townsend, data on cover" makes it evident that someone else besides Townsend wrote the locality label, mistaking "Abremada" for Ahumada and placing Los Ojos del Diablo in the wrong country. There is no Chihuahua, which is a Mexican Indian name, in Santo Domingo, nor any Abremada, but the names Chihuahua, Los Ojos del Diablo, Santo Domingo, and the town Villa Ahumada all occur in the northern province of Ahumada in the State of Chihuahua, Mexico. This is the first record of this species in Mexico.

The elytra in eight specimens (two each from Nebraska, Colorado, New Mexico, Mexico) have the discal intervals entirely coated in one, shiny and bare of coating in three, and only the odd intervals at the base bare of coating in the other four. When the coating in the interspaces of the pronotum covers the whole surface, as in four specimens, then the M of the vittae is as marked as in *phoeniciensis* (fig. 9), but when the coating is present within the punctures only, as in the other four, then the vittae are defined only by the slightly larger punctures between them, except when the vittae are strongly elevated.

The Denver specimen, although typical *neomexicana* in the punctuation of the front of the head, the base of the beak, and the front femora, is, from above, scarcely distinguishable from some specimens of *phoeniciensis*, because some of the vittae punctures in this specimen are smaller than usual and

the third elytral interval has two rows of punctures at the base instead of one. *C. neomexicana* is, in fact, very close to *phoeniciensis* and has the same shape, pronotal pattern, and is the same size. It differs from the latter by having the vittae punctures almost as large as the other punctures, and stronger punctures on the front femora, base of the beak, and front of the head. The penis is more truncate in *neomexicana* (fig. 103). The punctures on the femora are nearly as large as those on the prosternum, whereas in *phoeniciensis* they are minute in comparison with those on the prosternum.

Differs from other close species in this group by having the punctures on the elytral intervals almost as large as those on the striae (fig. 24) and the third interval with but one row of punctures (the latter varies somewhat in all the group). Differs further from *recta* by having the vittae punctures sparser, larger, and nearly as large as those on the interspaces, the thoracic margin behind the eye with a slight sinuation, and the apex of the beak below acute.

#### *Calendra phoeniciensis* (Chittenden)

Figures 9, 104

*Sphenophorus phoeniciensis* CHITTENDEN, 1904, Proc. Ent. Soc. Washington, vol. 6, p. 135.

*Calendra phoeniciensis*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 17, figs. 5-6.

*Calendra sequoiae* VAN DYKE, 1930, Pan-Pacific Ent., vol. 6, p. 165; 1938, *ibid.*, vol. 14, p. 187.

Small; black or red, usually coated, pronotum with wide, M-shaped, raised, bare vittae, the median enclosing an oblong apical depression; elytra smooth and coated, or transversely rugose and mostly uncoated.

Beak (from side) long, compressed, curved, wider at apex, apex beneath prolonged into acute angle, base not swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with usually no impressed line but puncture may be elongated, front of head finely punctured. Eyt extending below insertion of beak. Slighe thoracic lobe behind eye. Pronotum with three raised, broad, bare vittae, sparsely or densely, but finely, punctured, the median

Y-shaped, the fork enclosing a long, deep, apical depression of sunken large punctures (often filled with coating), the depression usually extending about one-third down from apex, lateral vittae straight or slightly oblique, merging with median at about middle; interspaces with larger punctures than on vittae, shallow, often merging at base (punctures larger than those on elytral striae). Scutellum narrower than long, often parallel, sometimes with slight groove. Elytra with intervals flat, the odd ones raised and bare or all intervals coated and none seemingly raised, the third and fifth intervals sometimes nearly twice as wide as the others, finely punctured in single rows except on third which usually has two rows; striae finely or coarsely punctured (depending on amount of coating), the punctures larger than on intervals and separated by more than their diameter, cutting into the intervals and making their sides scalloped. Under surface, sides of prosternum with sparser punctures than on sides of pronotum and at least twice as large as on lateral vittae. Front femora punctures very fine compared with those on prosternum. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides. Length, 7–9 mm.

**TYPE LOCALITY:** No locality specified; type from Phoenix, Arizona. Type in the United States National Museum, examined.

**DISTRIBUTION:** Arizona, and California as far north as San Francisco.

**SPECIMENS EXAMINED:** *Arizona:* Phoenix (H. C. Fall), 1 ♀ (type, *phoeniciensis*, U.S.N.M. No. 7905), (Ch. Palm), 1 ♀ (paratype, *phoeniciensis*); Globe, May (D. K. Duncan), 4 ♂ "in wheat-fields"; Patagonia, July 6, 1936 (M. Cazier), 1 ♀, June 14, 1947 (A. T. McClay), 4 ♂, 2 ♀; base of Pinal Mts., 4000 ft., July (M. Cazier), 1 ♂; Grand Canyon, Supai (Havas Canyon), 3500 ft., Aug. 2, 1934 (F. E. Lutz), 1 ♂; Gila Center, Mar. 31, 1944 (G. M. Hess), 1 ♂, 1 ♀ "collected from flax"; San Luis, June 16, 1940 (W. F. Barr), 2 ♀; Tucson, Apr. 6, 1938 (Nunenmacher), 3 ♂, 3 ♀; "Arizona," June 1, 1911 (Rev. J. Warren), 2 ♂. *California:* Sequoia National Park, Camp Potwisha, 2000–5000 ft., May 24, June 13, 1929 (Van Dyke), 1 ♂, 2 ♀ (paratypes, *sequoiae*), 2000–3000 ft., June 2, 13, 1929 (A. T. McClay),

1 ♂, 5 ♀; Stockton, San Joaquin Co., June 16, 1949 (Hutchinson), 2 ♂, 2 ♀ "collected from lawn," July 1, 1936 (P. F. Wright), 2 ♂ "collected from bent grass"; Elliott dist., San Joaquin Co., July 20, 1933, 2 ♂, 1 ♀ "collected from blue grass lawn"; Ione, Amador, July 29, 1949 (Wilson), 1 ♂, 2 ♀ "lawn"; Bakersfield, Kern Co., June 30, 1941 (R. M. Bohart), 1 ♀ "in blue grass," Nov. 10, 1942 (C. S. Morley), 1 ♂; Kernville, June 7, 1940 (W. F. Barr), 1 ♂; Holtville, June 15, July 15, 1934 (O. Schwab, M. Cazier), 6 ♂, 3 ♀; Riverside Co.: Arlington, Oct., 1942, 1 ♂ "in Bermuda grass," Nov. 13, 1942 (F. R. Platt), 1 ♂, 1 ♀ "collected from Bermuda grass"; Riverside, May 8, Aug. 10, 1941 (M. Bohart), 2 ♂, 1 ♀ "in clover lawn"; Indio, Mar. 21, 1945 (Anderson), 1 ♂ "collected from *Echinochloa*"; Palo Verde, Mar. 15, 1938 (A. Bottel), 1 ♀; Blythe, Mar. 15, 1944 (G. M. Hess), 1 ♂, 1 ♀ "collected from alfalfa," June 9, 1949 (Harper, Platt), 1 ♀ "collected from honeydew melon"; Los Angeles Co.: Westwood Hills, Oct. 24, 1941 (A. Mallis), 2 ♀ "in St. Augustine grass"; Alhambra, Sept. 11, 1942 (R. M. Swift), 1 ♂, 1 ♀, Oct. 6, 1942 (H. Wilcomb), 2 ♂, 1 ♀ "collected from Bermuda grass."

**DISCUSSION:** Except for the fact that it generally has less coating, especially on the elytra, *sequoiae* (Sequoia National Park, California) seems inseparable from *phoeniciensis* (Phoenix, Arizona) and is therefore synonymous with it. This lack of heavy coat on the elytra reveals "the elevation of the alternate intervals and coarse stria punctures," which Van Dyke states are characteristic of "*sequoiae*." These characters of "*sequoiae*," however, are also seen to be present in certain specimens of *phoeniciensis* which have the coating rubbed or worn off, and a number of such specimens occur with typically thick-coated *phoeniciensis* from Patagonia, Arizona. A specimen from Ione, Amador, California (*sequoiae*?), shows both extremes on the same elytra, as the outer rows and the apex of the elytra are coated and therefore appear smooth and with smaller punctures, whereas the disc is bare and shiny, with larger punctures, and the odd intervals are elevated and transversely rugose. Other characters, including the male genitalia (fig. 104), seem to be the same in both forms. The length and width of both pronotum and elytra were taken, but the proportions prove almost identical between the two. Both breed in the roots of various grasses. Both have a certain number

of red or reddish individuals. Both have a slight tooth on the outer apical angle of the front tibiae and the apex of the beak beneath prolonged into an acute point. These latter characters are often worn, but they can be checked with fair accuracy; thus in seven populations of 31 individuals (four populations of "*sequoiae*," northern California, and three of *phoeniciensis*, southern California and Arizona) where the point was worn off the beak, the angle of the tibiae was also worn, except in one specimen which had the tibia worn but the beak apex sharp. The worn specimens occurred equally in "*sequoiae*" and in *phoeniciensis*. The females of both forms have the apex of the abdomen characteristically pinched and depressed in the same manner.

There seems, therefore, to be no structural differences between these two forms, but there does seem to be a difference in the amount of coating, northern specimens generally having less, southern specimens generally more. This lesser or greater amount of coating and its occurrence in both forms in varying percentages might indicate that these were subspecies, except that "*sequoiae*" and *phoeniciensis* both have been taken around the San Francisco Bay region, the former on the lawns of the University of California (Van Dyke, 1938, p. 187) and the latter from Piedmont near by (many specimens seen at the Chicago Natural History Museum). In addition, Chittenden in his description of *phoeniciensis* reported it from Fresno, which is close to Sequoia National Park, the type locality of "*sequoiae*," and between it and San Francisco.

Partially coated individuals appear in other species, notably in *parvula* and *destructor*. In these, as in the present case, the inequalities of the elytra and the true size of the punctures are obscured in the majority of specimens, which are well and smoothly coated, but revealed in less coated individuals or in reared specimens. The coating does not disappear in carbon tetrachloride but it can be scraped off with a sharp instrument, as was done on a *phoeniciensis* from Holtville, California.

Not only the elytra but also the punctuation of the pronotal vittae and interspaces, the width of the vittae, and the color are

variable in *phoeniciensis*. In some specimens the fork of the median vitta is more densely punctured than the laterals, or the punctures are larger. The lateral vittae are usually broader than the interspace between them and the median vitta at base, but they are sometimes narrower (fig. 9). The most common coloration is a light gray-yellow coat offset by black shining vittae, but the coat is often dull reddish or a very dark gray and often the vittae or other uncoated parts are red. A specimen from Sequoia National Park has a dark gray coat on the pronotum, but the elytra red and with red coating; another from the same locality is all red, without evident coating. The vittae are red in five of 12 specimens from Stockton, Elliott District, and Ione (northern California), and the pronotum has no coat in three of the five red specimens (two from Stockton, one from Ione); the other seven are black, with the pronotum coated and the elytra partially coated. The vittae are red and the pronotum uncoated also in two specimens from "Arizona."

Differs from the related *venatus* in smaller size, by having the three vittae well marked, distinctly raised above the interspaces, the laterals distinctly joining the median in front of the middle (two specimens have been seen in which they did not join), the apical depression more elongate, deeper, more clearly marked, and the base of the beak on top with smaller, more uniform punctures. Differs not so markedly in these characters from *neomexicana*, but differing further by having the punctures of the vittae very much smaller than those of the interspaces, not scarcely smaller as in *neomexicana*, the front of the head and the front femora more finely punctured. In *neomexicana* the third elytral interval usually has but one row of well-separated punctures which are almost as large as the stria punctures.

**BIOLOGY:** This species develops (Satterthwait, 1931a, p. 159) in Johnson grass, oats, Bermuda grass, wheat, and barley; *Cynodon dactylon*, Bermuda grass, is the preferred host. It has also been taken on bent grass, blue grass, St. Augustine grass, alfalfa, flax (see list of specimens examined) and seems to have a predilection for Cali-

fornia lawns. It also causes much damage to wheat and barley in the Salt River Valley of Arizona where these crops have been planted "on or near infested sod of old Bermuda grass" (Satterthwait, 1932, p. 17). Bermuda grass, or other larger grasses, are needed for *phoeniciensis* to complete its life cycle (*ibid.*, p. 21). A San Diego, California, specimen was taken from *Echinochloa*, a genus of the grass family that is common on moist rich soil on river banks, ditches, or low ground.

***Calendra pontederiae* (Chittenden)**

Figures 51, 105

*Sphenophorus pontederiae* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 63. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 165. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 570.

*Calendra pontederiae*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159.

Medium to large; black or red, not coated, pronotum with three raised, M-shaped vittae enclosing a median apical depression, elytra with flat intervals with single rows of fine punctures.

Beak (from side) long, cylindrical, curved, narrower at apex, apex beneath rounded to obtuse, base not swollen over antennal insertion, no true fovea in front of eye, but concentrated punctures; (from above) apex flattened, base with impressed line, front of head almost impunctate. Eye extending below insertion of beak. No thoracic lobe. Pronotum with median apical depression of six or seven punctures, with three broad, raised, M-shaped vittae, the median enclosing the depression, vittae sparsely and finely punctured, the laterals with ill-defined side branches, laterals merging with median in front of middle; interspaces with large, often merging punctures (as large as, or larger than, striae punctures). Scutellum narrower than long, usually grooved. Elytra with intervals flat to feebly convex, all with more or less single rows of very fine punctures, often double row at base of third and suture; striae narrow, with large, distinct, usually separated, round punctures (size of those on pronotal interspaces) that cut less than halfway into intervals. Under surface, sides of prosternum strongly punctured, as

on sides of pronotum, but sparser, rest below strongly punctured, apex of abdomen with depression. Front tibiae with outer apical angle not prolonged but sinuate before apex, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with lateral tufts of hair at apex and hairs in punctures. Length, 9–11 mm.

**MALE CHARACTERS:** Depression at apex of abdomen not transverse as in female, but oval, and shallower than in female.

**TYPE LOCALITY:** No locality specified; type from New Orleans, Louisiana. Type in the United States National Museum, examined.

**DISTRIBUTION:** Probably most of the states east of the Mississippi River, also Missouri, Louisiana, and Texas.

**SPECIMENS EXAMINED:** *Georgia:* Savannah (Harper), 1 ♀. *Florida:* Atlantic Beach (Mrs. A. T. Slosson), 1 ♀; Kissimmee (C. Palm), 1 ♀; Dune-din, Apr. 6, 1924 (W. S. B.), 2 ♀. *Louisiana:* Horn Coll. No. 8998, 1 ♀; New Orleans, Oct. 26 (H. Soltau), 1 ♀ (type, U.S.N.M. No. 7907), 1 ♂, 2 ♀ (paratypes), Mar. 11, 1 ♂ (paratype); Baton Rouge, Apr., 1949, 1 ♂, 1 ♀. *Illinois:* Horn Coll. No. 8998, 2 ♂, 1 ♀.

**DISCUSSION:** Additional specimens have been seen at the United States National Museum from Texas, South Carolina, Virginia, Massachusetts, Michigan, and Missouri. It has also been reported in the literature from Alabama, Maryland, New Jersey, and Rhode Island. The wide range of this species no doubt follows the distribution of its food plant, the pickerel weed. Although Champion mentioned the occurrence of this plant "throughout our region" (1910, p. 153), I have not seen any specimens of *pontederiae* from Mexico, nor did he include it among his species.

There is some doubt as to the proper position of this species in the classification. I have placed it near the *venatus* group of related species because of the pronotum, even though it differs radically from them in the structure of the beak. The apical depression on the pronotum in *pontederiae* is not always very evidently depressed, but the area is always distinctly marked by two short rows of larger punctures. In the presence of this depression and also in the broad M of the pronotal vittae, it resembles *venatus*,

*phoeniciensis*, *neomexicana*, etc. The beak, however, is cylindrical, not laterally compressed as in the others, narrower at the apex instead of wider, and with the apex beneath rounded, not acute (fig. 51). The *venatus* group also has no deep apical depression on the abdomen. Other species with somewhat similarly shaped beaks are *subulata* (New Mexico), and four Mexican species (*ima*, *lineata*, *quadrivittata*, and *angusta*), but these species have a different pronotum of a generalized type without any raised pattern or any apical depression, but with rather evenly placed punctures of the same size.

The species to which *pontederiae* is most closely related is the more southern *incurrens*, as Champion stated (1910, p. 165) in his discussion of the latter. The elytral and pronotal patterns in the two species are similar, and the male genitalia are of the same truncated type (fig. 105). The antennal club seems unusually large in both. A tabulation of their differences is given under *incurrens*.

**BIOLOGY:** The only known host plant (Satterthwait, 1931a, p. 159) is *Pontederia cordata*, the pickerel weed, an aquatic herb occurring in fresh water from Texas eastward and northward and also, according to Champion, throughout Mexico. The type series was reared from larvae found on the roots of this plant.

#### *Calendra incurrens* (Gyllenhal)

##### Figure 105

*Sphenophorus incurrens* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 957. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 164, pl. 8, figs. 5, 5a.

*Sphenophorus monilis* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 946. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 164.

*Sphenophorus glabripes* CHEVROLAT, 1885, Ann. Soc. Ent. France, vol. 5, p. 110. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 164.

Small to medium, black or red, sometimes coated, pronotum with three raised, M-shaped vittae enclosing a median apical depression, elytra with flat intervals with single rows of fine punctures.

Beak (from side) long, curved, slightly compressed, slightly wider at apex, apex beneath a right or acute angle, base slightly

swollen over antennal insertion, no fovea in front of eye; (from above) apex flattened, base with impressed line, front of head almost impunctate. Eye extending below insertion of beak. Slight thoracic lobe. Pronotum with median apical depression of six or more round punctures, with three broad, raised, M-shaped vittae, the median enclosing the depression, sparsely and finely punctured, the laterals with ill-defined side branches, laterals merging with median in front of middle; interspaces with large, often merging punctures (as large as, or larger than, stria punctures). Scutellum narrower than long. Elytra with intervals flat to feebly convex, all with more or less single rows of very fine punctures (usually not visible); striae narrow, with distinct, usually separated, round punctures (same size as of those at base of pronotum, occasionally smaller) that cut less than halfway into intervals. Under surface, sides of prosternum nearly impunctate or with punctures shallow and sparse, rest below strongly punctured except mesosternum, apex of abdomen with oval, deep depression, larger in female. Legs, front tibiae with outer apical angle not prolonged, but sinuate before apex, tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with lateral tufts of hair at apex and hairs in punctures, punctures very large, confluent, but usually obscured by coating. Length, 8–9 mm.

**TYPE LOCALITY:** Mexico. Type in Stockholm museum, examined.

**DISTRIBUTION:** Southern Chihuahua in Mexico south to Panama.

**SPECIMENS EXAMINED:** Mexico. "Terre froide," Aug. (coll. Sallé, coll. Chevrolat), 1 ♀ (type, *incurrens*); (D. Cristofori), 1 ♂ (type, *glabripes*); "Calif." [?], 1 ♂ (type, *monilis*); Toulpec (Chevrolat), 1 ♂ (paratype, *monilis*). *Chihuahua*: Catarinas, 5800 ft., July 26, 1947 (Cazier), 1 ♂. *Vera Cruz*: Jalapa (W. Schaus), 1 ♂. *Hidalgo*: Guerrero Mills (W. M. Mann), 4 ♂, 4 ♀.

Guatemala. 1905 (Sharp coll.), 2 ♂, 1 ♀; (Patten) (Dietz) (Scudder), 3 ♂, 2 ♀; Chichicastenango, 6000 ft., Aug. 7, 1947 (C. and P. Vaurie), 1 ♀.

Panama. El Volcan, Lake Davis and vicinity, Feb. 28, 1936 (Gertsch), 1 ♀.

In addition to the above, specimens were seen from the following localities, but the number and

TABLE 4  
DIFFERENCES BETWEEN *Calendra incurrens* AND *Calendra pontederiae*

	<i>incurrens</i>	<i>pontederiae</i>
Mesosternum and sides of prosternum	Nearly impunctate	With large, coarse punctures
Mesoepimeron	Very narrow, front margin straight	Broader, front margin arched on outer side
Beak	Wider at apex or same width throughout; apex below acute	Narrower at apex; apex below rounded
Last abdominal segment	With a distinctly less punctured area surrounding apical depression	Entire segment with same large punctures
Apical depression on abdomen	Deeply sunk, round, never transverse	Shallower, only deeply sunk in female where it is transverse, smaller
Size	Generally smaller	Generally larger
Range	Panama north to southern Chihuahua, Mexico	Texas, Louisiana, and eastern United States

sex were not noted: Mexico: *Durango*: Sierra de Durango. *Guerrero*: Omilteme. *Puebla*: Puebla; Matamoros Izucar. *Mexico*: Toluca. *Distrito Federal*: Mexico City. *Vera Cruz*: Jalapa; Misantla. *Tabasco*: Teapa. *Chiapas*. Guatemala: Dueñas, Guatemala City, San Jeronimo, Tepan. Costa Rica.

DISCUSSION: As far as is known from present records, this is the only United States or Mexican species of *Calendra* that occurs in Guatemala, Panama, and Costa Rica, although *C. cariosa* occurs as far south as Guatemala.

Champion (1910, p. 164) synonymized both *monilis* and *glabripes* (type locality, Mexico) with *incurrens*. I have seen the types of all three forms and agree with Champion. Although *monilis* has page priority over *incurrens*, both species were described by the same author in the same publication, and there seems no point in changing the already established name of *incurrens*. The type of *monilis* bears a handwritten label that appears to read "Calif.," but in his original description Gyllenhal gives the locality as Toulcepec, Mexico, which is the name that appears also on the paratype of *monilis*.

In view of the diverse localities from which

*incurrens* has been taken and the lack of knowledge as to where it might be most abundant, no attempt has been made to restrict the type locality further at this time.

The series of eight specimens from Hidalgo are entirely red and have the V-shaped interspaces at the base of the pronotum well marked by two or three rows of depressed punctures extending forward to the middle of the pronotum, as also in the Chihuahua specimen and the one from Panama (the latter, however, is black and opaque). The Guatemala specimens and one from Jalapa, Mexico, are entirely black and either have the V-shaped interspaces not extending so far forward or have them with but one line of scarcely depressed punctures. In these latter specimens, therefore, the vittae seem more merged than in the others; they resemble the type of *incurrens*, whereas the others resemble the types of *monilis* and *glabripes*. Champion said that in his long series he had all the connecting links between these forms. Not only the vittae, but also the shape and punctuation of the apical depression, and the extent of the depression at the apex of the abdomen vary.

This far-ranging species is exceedingly close to *pontederiae* (eastern United States, Louisi-



ana, and Texas) and seems to be a southern representative of that species. The male genitalia (fig. 105) are almost identical and the two species differ only in the combination of characters given in table 4.

A specimen from Catarinas, Chihuahua, has the punctures on the sides of the prosternum and on the center of the metasternum more noticeable than in most other *incurrens*.

**BIOLOGY:** No data are available, but it would be interesting to know whether or not this species also breeds in pickerel weed as does *pontederiae*.

***Calendra scoparia* (Horn)**

Figure 106

*Sphenophorus scoparius* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 424. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 567.

*Calendra scoparia*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 19.

Small to large, robust; black or partially dull red, scarcely any coating, pronotum with three scarcely raised bare vittae, elytral intervals flat.

Beak (from side) long, slightly compressed, slightly curved, wider at apex, apex beneath forming obtuse or right angle, base somewhat swollen (more so in male) over antennal insertion, fovea of larger concentrated punctures present in front of eye; (from above) apex flattened, base with the puncture not always visible, no canal, front of head finely or distinctly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three feebly raised, moderately and sparsely punctured, broad vittae, and two broad side branches; lateral vittae sinuous on inner side, median vitta dilated at the middle; interspaces not coated, very narrow, often composed of but one or two rows of punctures which are about the size of punctures on elytral striae and very dense. Scutellum narrower than long, grooved but not always noticeably. Elytra with all intervals flat, only partially or lightly coated, even ones with single row of small, regularly spaced punctures (size of those on pronotal vittae), odd ones with two or three rows of small punctures; striae with more or less regularly placed punctures, the size of those

on pronotal interspaces. Under surface, sides of prosternum punctured same as pronotum but sparser, the rest below strongly, densely punctured, Legs, front tibiae with outer apical angle not prolonged, but with minute tooth; outside of hind tibiae, male and female, slightly curved inward; front and middle tarsi with third segment widely dilated (slightly less so on middle), flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of yellow hairs at apex (often worn). Length, 9–13 mm.

**MALE CHARACTERS:** Hind tibiae with large angulation on inner side from which rises a tuft of long yellow hairs; apex of abdomen with depression, in front of which is oval patch of short, thick, yellow hairs, almost spongy in texture:

**TYPE LOCALITY:** No locality specified; here designated as Kansas from original label on lectotype female, new designation, Horn Collection No. 8994, in the Academy of Natural Sciences of Philadelphia, examined.

**DISTRIBUTION:** Central states from Wisconsin, Iowa, and Nebraska south to the Gulf. Maryland (Satterthwait).

**SPECIMENS EXAMINED:** *Wisconsin:* 1 ♂ (co-type, M.C.Z. No. 1038). *Illinois:* Mitchell, May 22, 1922, 1 ♀, "U.S.D.A. traps." *Nebraska:* Lincoln (Wickham), 1 ♂; Fillmore, 1 ♂. *Kansas:* 1 ♀ (lectotype, Horn Coll. No. 8994), 1 ♀ (co-type, M.C.Z. No. 1038). *Missouri:* Cliff Cave, July 6, 1923 (H. E. Roberts), 1 ♀; St. Louis, Aug. 1, 1938, 1 ♀, "U.S.D.A. traps"; Labaddie, June 8, 1931 (Satterthwait), 1 ♂, 1 ♀, "corn." *Texas:* 1 ♀. *Louisiana:* Jefferson Parish, Apr. 10, 1931 (W. E. Haley, T. E. Holloway), 1 ♀ "on drift wood in Miss. River." [No state]: Greeley, Apr. 22, 1919, 1 ♂.

**DISCUSSION:** In addition to the above, Satterthwait (1931a) gives the localities Maryland, Arkansas, and Alabama.

Horn made an error in placing this species in the group with narrow third tarsal segments, as his type and all other specimens seen have this segment dilated on the front and middle legs and with hairy pads below.

In seven specimens the pronotal pattern is quite uniform, the only variations being that in two the interspaces on each side of the median vitta are slightly wider, with

more punctures, and the vittae are not quite so flat; in two the lateral vittae are less sinuous within; one specimen has the interspace punctures filled with mud which causes the vittae to stand out.

Differs from other related species (*cubensis*, *maidis*, *zeae*) in its male characters: the strong hind tibial angulation with its tuft of hairs, the patch of thick hairs on the last abdominal segment, the pointed, not truncated, penis which is proportionately very large (fig. 106). The three other species have, as in *scoparia*, no coating on the pronotum, and the same type of pronotal pattern in which, however, the vittae tend to merge in *maidis* and to be interrupted and more elevated in *zeae*. It seems most closely related to *cubensis* (Florida, Cuba), from which it differs further by having the third elytral interval not convex (it is only feebly so in *cubensis*), the suture with more than one row of punctures, the base of the beak above without any depression in front of the puncture.

Differs further from *zeae* by having the front and middle tarsi dilated and much smaller punctures on the elytral striae. It is more like *maidis* in its large size, but differs from it by having no depression at the base of the beak, less distinct fovea in front of the eye, and the elytra flat without raised convex intervals.

**BIOLOGY:** This species and *costicollis* have the same preferred host plant, which is the lake-bank sedge (*Carex riparia*), and the adults of both species have been found feeding on corn planted near this sedge. Other plants in which *scoparia* develops are *Scirpus atrovirens*, the dark green bulrush, probably *Cyperus*, a sedge, and *Spartina michauxiana*, tall marsh grass (Satterthwait, 1931a, 1932).

***Calendra cubensis* Buchanan**

Figure 107

*Calendra cubensis* BUCHANAN, 1936, Mem. Soc. Cubana Hist. Nat., vol. 10, p. 150.

Small to medium, robust; black or reddish, usually coated in punctures, pronotum with three feebly raised bare vittae, elytral intervals flat except third which is feebly convex at base.

Beak (from side) long, slightly compressed, strongly curved, usually wider at apex, apex beneath forming a right or obtuse angle, base

not swollen over antennal insertion, fovea of concentrated punctures present in front of eye; (from above) apex flattened, base with canal, often coated, front of head distinctly punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three raised (sometimes feebly) bare vittae, moderately and sparsely punctured, and two side branches, lateral vittae usually sinuous on inner side, median dilated at middle; interspaces not coated but may be so within the punctures, composed of one or two rows of punctures about size of stria punctures. Scutellum narrower than long, usually concave. Elytra with third interval at base usually feebly convex, other intervals flat, usually partially coated, all, except third which has double row, with single row of small punctures like those on pronotal vittae; striae with more or less regularly spaced punctures, a trifle smaller than those on pronotal interspaces. Under surface, sides of prosternum punctured as pronotum, but sparser, rest below strongly punctured. Apex of abdomen with feeble depression. Legs, front tibiae with outer apical angle not prolonged but minutely toothed; front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of yellow hairs at apex. Length, 8–10 mm.

**TYPE LOCALITY:** Havana, Cuba. Type in the United States National Museum.

**DISTRIBUTION:** Cuba, Jamaica, southern Florida.

**SPECIMENS EXAMINED:** *Florida:* Miami, June 22, 1942 ("H. J. T."), 1 ♂, "weeds"; Homestead, Apr. 27, 1944 (Griswold), 1 ♂, 2 ♀ "with celery." *Cuba:* Soledad, Cienfuegos, June, 1929 (Darlington), 1 ♂ (paratype), Nov. 4, 1926 (Darlington), 1 ♀ (paratype). *Jamaica:* Kingston, Aug. 27, 1934 (Darlington), 1 ♂.

**DISCUSSION:** The Florida specimens, kindly sent to me by Dr. L. L. Buchanan, constitute the first record of this Cuban species in the United States. It occurs in various localities in Cuba, also on the island of Jamaica.

The lateral vittae are nearly parallel in the Miami specimen and are less sinuous in one of the Homestead specimens than in the other two. In the Miami specimen also the

third elytral interval is less convex, but this specimen is rather worn.

Similar to *scoparia* and closer to it than to *zeae* or *maidis*, differing from it mainly in the absence of the male hind tibial angulation and of the patch of thick hairs on the last abdominal segment, in the truncated, not pointed, penis (fig. 107), and in the presence of a canal or depression at the base of the beak. It is also smaller in size and without the disparity of size between male and female so often seen in *scoparia*.

*Calendra zeae*, which is about the same size, has all the third tarsal segments narrow and the elytra with larger stria punctures. *C. maidis* is usually at least twice the size of *cubensis*, has the third, and usually the fifth, elytral interval markedly convex, and the apex of the beak below long drawn out and acutely prolonged. The genitalia of the male, however, are not very different from those of *zeae* and *maidis*.

**BIOLOGY:** A notation on one of the Cuban specimens in Buchanan's type series, from Arroyo Naranjo, Havana Province, reads "Breeding in *Cyperus rotundus*." This is a sedge, commonly called nut grass or coco grass, and is the host plant also for *C. callosa*, *cariosa*, and perhaps *C. scoparia* (Satterthwait, 1931a, p. 167).

#### ***Calendra maidis* (Chittenden)**

Figures 41, 108

*Sphenophorus maidis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 59, fig. 10. KELLY, 1911, U. S. Dept. Agr. Bur. Ent. Bull., no. 95, pp. 11-22, figs. 5-10, pls. 2-3. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 558.

*Calendra maidis*, CARTWRIGHT, 1929, Clemson Agr. Coll. Bull., no. 257, pp. 3-35, figs. 1-13. SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 10, figs. 3, 8.

Large, robust; black or red, usually with coating in elytral interspaces; three bare pronotal stripes merging in front or nearly so; elytra with third and fifth intervals raised and bare in basal third.

Beak (from side) long, compressed, evenly, strongly curved, wider at apex, apex beneath prolonged into acute point, base not swollen over antennal insertion, distinct fovea pres-

ent in front of eye; (from above) apex usually strongly concave, base usually with deep, wide canal, front of head finely punctured. Eye extending below insertion of beak. Weak thoracic lobe. Pronotum with three scarcely raised vittae, sparsely and finely punctured, usually merging in apical half, or nearly so, and two side branches; lateral vittae sinuous on inner side, median vitta dilated in front of middle and extending to base; interspaces narrow, one-fifth of median vitta at middle, or represented by one row of larger punctures, punctures sometimes merging at base. Scutellum narrower than long, sometimes concave. Elytra with odd intervals three and five, sometimes seven, raised, convex, and bare in basal half or third, third interval especially convex, odd intervals with scattered fine punctures; even intervals flat, usually coated, with single row of punctures (often not visible); striae with regularly spaced round punctures, larger than those on intervals and set close together. Under surface, sides of prosternum often almost impunctate or with shallow sparse punctures, the rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged; front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides, apical and subapical teeth longer, stouter than usual. Pygidium at apex with tufts of hair, sometimes with raised median line. Length, 12-16 mm.

**TYPE LOCALITY:** No locality specified; type from Augusta, Kansas. Type in the United States National Museum, examined.

**DISTRIBUTION:** Southern states, including Texas, north to Kansas and Missouri. Massachusetts (?), Michigan (?), Washington (?), (Satterthwait).

**SPECIMENS EXAMINED:** *Kentucky:* Louisville, Apr. 7, 1899, 1 ♀. *North Carolina:* Maxton, Sept. 17, 1943 (A. B. Klots), 1 ♀. *South Carolina:* Meredith, June 25, 1930 (O. L. Cartwright), 1 ♀; Ballentine, Apr. 7, 1899, 1 ♀ (paratype), 1 ♂; Columbia (Blum), 2 ♀. *Georgia:* Blakely, Early Co., Apr. 15, 1939, 1 ♂. *Alabama:* Wetumka, 1 ♀ (paratype) "on corn," 1 ♂; Dadeville, May, 1880 (S. M. Robertson), 1 ♂ (paratype). *Texas:* Plano, July 27, 1909, 1 ♂. *Oklahoma:* Pryor (W. H. Graham), 2 ♂, 2 ♀; Choteau (J. F. Schultz), 1 ♂. *Kansas:* Augusta, 1 ♂ (type,

U.S.N.M. No. 8226); Butler Co., 1 ♂; Wellington (E. G. Kelly), 1 ♂; south central, July 21, 3 ♀.

**DISCUSSION:** The pronotal interspaces between the vittae are always narrow, at least in the apical half of the pronotum, and consist of but one or two rows of punctures. In nine of 19 specimens, the interspaces at the apex are not depressed and are recognizable only as interspaces because the punctures are larger than those on the vittae they separate. At the base the vittae are more distinct, being slightly raised, and are more clearly separated by the large punctures of the interspaces.

The third elytral interval in one specimen is scarcely raised and is only feebly convex, but in 15 specimens the suture, third and fifth intervals are all bare, raised, and more convex in the basal half, the suture being often raised throughout. In the type and in a specimen from Oklahoma the fifth interval is raised as far as the apical callosity, and the seventh is also raised in a narrow line.

Many of the depredations on corn by this species were attributed, in the early economic literature, to *robusta* and "*pertinax*" (now *australis*), from both of which it differs by having the three vittae scarcely raised, virtually merged, and without coating in the interspaces. It also has the apex of the beak below more attenuate and acutely angled (fig. 41). Chittenden (1905a, p. 60) considered this character, which produces "the appearance of a greater curvature of the inner surface" as "unique in this group," the group of species with the front and middle third tarsal segment widely dilated. It is not unique, since other species, notably *pertinax*, also have it, but not to such an exaggerated degree. In my opinion, *maidis* is closer to *scoparia*, *cubensis*, and *zeae* than it is to the group mentioned by Chittenden, and it can be distinguished from these three species by the beak, also by the presence of a distinct, deep fovea in front of the eye, the fact that the mesoepimeron is more arched in front, and an exceptionally heavy, long apical claw on the front tibiae.

**BIOLOGY:** Although this species prefers gama or sesame grass (*Tripsacum dactyloides*), a perennial of the grass family with thick, creeping root stocks, in which to place its eggs and in which the larvae develop, it also

utilizes corn for this purpose and seems to prefer corn as food in the adult stage. Its damage to corn can be so severe as to cause complete destruction of fields and their abandonment. Adults feed also on other plants, millet, oats, crab grass, Johnson grass, and other grasses.

Another type of injury accredited to *maidis*, as also to *C. pertinax ludoviciana* and *C. aequalis*, is death to chickens and turkeys that try to swallow live adults which thereupon cling with their sharp tibial teeth to the fowl's mouth or tongue or throat.

Some enemies of *maidis* are a small hymenopteron of the Mymaridae, *Anaphoidea calendrae* Gahan, which parasitizes the eggs of a number of *Calendra*; a wasp, *Cerceris bicornuta*, which was found taking adult *maidis* to its nest; and fungus growths which destroyed it in any stage. (Data from Satterthwait, 1931a, 1931b, 1932; and Cartwright, 1929.)

Cartwright (1929, p. 9) records a drowning experiment on *maidis* which showed that these billbugs can revive after complete submergence under water of from seven days to three weeks.

#### *Calendra zeae* (Walsh)

Figures 10, 56, 109

*Sphenophorus zeae* WALSH, 1867, Pract. Ent., vol. 2, p. 117. RILEY, 1871, Third Ann. Rept. of . . . Insects . . . of Missouri, p. 59, fig. 22. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 423. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 178. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 566, fig. 125.

*Calendra zeae*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159; 1932, U. S. Dept. Agr. Farmers' Bull., no. 1003, p. 7, fig. 11. BRUHN, 1947, Great Basin Nat., vol. 8, p. 20, pl. 5.

*Sphenophorus blatchleyi* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 149.

Small, slender; black or red, no coating except in punctures, three raised, bare vittae on pronotum, the laterals broken in front of middle, elytra with large pits.

Beak (from side) long, slightly compressed, nearly straight to strongly curved, wider at apex, apex beneath an obtuse or right angle, base usually, but not always, markedly swollen over antennal insertion, fovea of concentrated or merging punctures in front of

eye; (from above) apex flattened, base with usually no impressed line, never a canal, front of head finely punctured. Eye extending below insertion of beak and with noticeable trench of impressed punctures around border. No thoracic lobe. Pronotum with three raised, broad vittae, finely and sparsely punctured, and two broad side branches, lateral vittae sinuous and more or less broken or interrupted, and depressed in front of middle, median vitta dilated at middle; interspaces not coated, narrow, sinuous, their punctures much larger than those on vittae. Scutellum narrower than long, often concave. Elytra with all intervals more or less flat, but usually raised above striae, often transversely wrinkled, punctures usually in single rows, usually double on suture and third intervals; striae with large, deep or shallow, round or oval, fairly regularly spaced punctures or pits that cut halfway or more into the intervals, sometimes nearly all the way through, in size at least twice as large as the largest pronotal punctures. Under surface, sides of prosternum strongly punctured, but more sparsely than above, rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged but often with minute tooth visible, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of yellow hairs at apex. Length, 7–9 mm. (one specimen, 11.5 mm.).

**MALE CHARACTERS:** Pygidium (from side) markedly truncate, last abdominal segment with a few hairs (can be seen in profile).

**TYPE LOCALITY:** No locality specified; type from Rock Island, Illinois. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Eastern states west to Colorado, also eastern Canada. California (Satterthwait).

**SPECIMENS EXAMINED:** *New Hampshire:* Franconia, 1 ♀. *Massachusetts:* Lenox, June 18, 1891 (Bradford), 1 ♂; Ipswich, July 1 (J. W. Angell), 1 ♀. *Rhode Island:* Watch Hill, June 24–30, 1909, 1 ♂, 2 ♀. *Connecticut:* 1 ♀, Sept. 30, 1936 (K. Sommerman), 1 ♂. *New York:* 3 ♀; Rockaway Beach, 1 ♂, 4 ♀, May, June, 1918 (L. B. Woodruff), 2 ♂, 7 ♀, June 1, 1912 (C. L. Pollard), 3 ♀; Far Rockaway, June 4, 1904, 1 ♂, 1 ♀; Fire Island, June 25, 1941, 2 ♂, 1 ♀, July, 1941,

1946 (B. D. Valentine), 1 ♂, 3 ♀, Sept. 4, 1941 (B. D. V.), 2 ♂; Yaphank, May 29, 1911, 1 ♀; Jones Beach, May, 1938, 2 ♀; Long Beach, 1 ♀; Babylon, June 18 (G. D. Bradford), 1 ♀; Naragansett, Sept. 4, 1939, 1 ♀; Southampton, Sept. 25, 1891, 1 ♂, 1 ♀; Bronx, Apr. 17, 1904, 1 ♂, 3 ♀; Flatbush, Long Island, 1888 (J. L. Zabriskie), 1 ♀, May, 1890 (J. L. Zabriskie), 7 ♂, 12 ♀; New Baltimore, 1880 (J. L. Zabriskie), 1 ♀; West Point, June 8, 1911 (W. Robinson), 1 ♂; Ames, Sept. 6, 1939, 1 ♀; Ithaca, May 19, 1947 (S. Roback), 1 ♂, June 20, 1947 (H. E. Evans), 1 ♀. *New Jersey:* Huntington Co., June 15 (J. A. Grossbeck), 4 ♂, 4 ♀; Ship Bottom, May 24, 1936, 1 ♂; Morris Co. (E. L. Dickerson), 1 ♂; Arlington, Apr. 10 (E. L. Dickerson), 1 ♂; Hopatcong (C. Palm), 1 ♂, 1 ♀; Trenton, June 10 (J. A. Grossbeck), 1 ♂, 1 ♀. *Pennsylvania:* Delaware Water Gap (Slosson), 2 ♀; Allentown, Apr. 14, 1925 (C. L. Ragot), 2 ♀. *Florida:* Marineland, Apr. 5, 1941 (L. W. Clausen), 1 ♂, 2 ♀; Lake Placid, Jan. 23, 1943 (M. Cazier), 1 ♂; Ch. Hbr. [Charles Harbor], (Slosson), 1 ♂; Biscayne Bay, (Slosson), 1 ♀; Lashby (Hubbard and Schwarz), 1 ♀; Ormond, Apr. 3, 1911 (W. S. B.), 1 ♀ (type, *blatchleyi*, U.S.N.M. No. 26894). *Ohio:* 1 ♂. *Indiana:* 1 ♂, 3 ♀; Michigan City, June 9, 1934 (C. H. Seevers), 4 ♀; Dune Park, July 7, 1934 (C. H. Seevers), 2 ♀. *Illinois:* Cookville, June 8, 1928 (C. Barker), 1 ♀, "corn," Mayfield, May 21, 1928 (A. T. McClay), 1 ♀, [?] Budd Lake, Sept., 1913, 1 ♂. *Michigan:* South Haven, July 1, 1914, 2 ♂. *Texas:* San Marcos, Aug. 10, 1949 ("E. E. G."), 1 ♀. *Colorado:* Lamar, June 4–11, 1919, about latitude 38° 06' N., longitude 102° 37' W., 3600 ft., 1 ♀.

Canada. *Ontario:* Prince Edward Co., June 15, 1938 (Brimley), 2 ♂, 6 ♀.

**DISCUSSION:** The type and only specimen of *blatchleyi* from Ormond, Florida, seems inseparable from *zeae*. It is true, as Chittenden pointed out, that the base of the beak is not so swollen as in most *zeae*, but this character shows variation in *zeae*. The "coarser and shallower elytral punctures" are caused, I believe, by the greater amount of mud in the punctures in this specimen. The "obsoletely punctate" head and base of the beak may well be due to the fact that the head in this specimen is opaque and the punctures therefore obscured.

Although the pronotum and elytra vary a good deal, this species is always recognizable by the large, usually round, elytral stria punctures, twice to four times larger than any punctures on the pronotum and cutting at

least halfway, if not more, into the narrower elytral intervals. The characteristic pronotal pattern (fig. 10) has the three finely punctured vittae and the two side branches all raised, or at least clearly separated from the rest of the pronotum by larger, usually depressed punctures, the lateral vittae narrower or cut off in front of the middle because interrupted there by invading punctures from the sides. There are all gradations in the extent of this breaking in two of the lateral vittae, some specimens having these vittae continuous, though narrow at the middle, others having the basal and apical portions definitely separated from each other. This variation occurs in specimens from the same locality.

The hump at the base of the beak is usually quite marked (fig. 56), as is also the constriction behind it, but quite a few specimens from various localities have the hump much reduced (Florida, New York, Colorado). *C. sayi*, which also has this hump, also shows the same variation in its prominence.

This species has been reported from every state east of the Mississippi River except Maine; also from Minnesota, Iowa, Missouri, Kansas, and Nebraska, states which are not in the list of specimens examined.

Differs from *maidis*, *scoparia*, and *cubensis*, which have a rather similar pronotal pattern, by having the third tarsal segments narrow on all legs. Differs from *destructor*, which has the same tarsal structure, by having no sinuous thoracic lobe behind the eye, the pronotum more elongate and about the same width at the base as the elytra at the base, the vittae with smaller, finer punctures, and no actual coating, only mud within the punctures.

**BIOLOGY:** Next to *parvula*, this is the second most destructive billbug and the second in numbers of individuals. It develops in two of the same plants as *parvula*, Kentucky blue grass (*Poa pratensis*) and timothy (*Phleum pratense*), the latter being its preferred host plant. Both larvae and adults cause injury to timothy, and the adults also feed on and damage corn (Satterthwait, 1932, p. 8).

***Calendra sulcifrons* (Chevrolat)**

Figure 110

*Sphenophorus sulcifrons* CHEVROLAT, 1885,

Ann. Soc. Ent. France, vol. 5, p. 110. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 162.

Medium, robust; red or black, coated or bare, pronotum with median line and vague lateral vittae, elytra with two depressions at base, two on sides and two apically.

Beak (from side) long, robust, curved, compressed, wider at apex, apex beneath acute, base swollen over antennal insertion, fovea in front of eye; (from above) apex flattened, base with deep impressed line, front of head finely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with median impunctate line and ill-defined lateral vittae, more noticeable at base, punctures smaller than in interspaces, often obscured by coating, interspace punctures as large as, or larger than, those on elytral striae, irregularly spaced, pronotum with four round depressions, two on each side of median line at middle, two nearer base. Scutellum narrower than long, slightly grooved. Elytra with intervals punctured as on pronotal vittae, in single rows except on third which may have single or double rows and is broader, elytra with large rugosities when coated, each elytron with a depression at base in region of fifth and sixth intervals, one on sides of elytra (seventh and eighth intervals) in front of prominent apical callosity, and one behind the callosity; striae with large round punctures cutting slightly into intervals but often obscured by coating. Under surface, sides of prosternum punctured as sides of pronotum, the rest strongly punctured. Apex of abdomen with depression. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with raised, median, impunctate line, forming tubercle in male, and a deep, strongly punctured depression on each side of line at apex, tufts of hair at apex on sides. Length, 8–12 mm.

**MALE CHARACTERS:** Pygidium with tubercle near apex; ventral cavity with short hairs; all femora with hairs on inner side.

**TYPE LOCALITY:** Mexico; here restricted to the state of Vera Cruz. Type in Stockholm museum, examined.

DISTRIBUTION: Southern Mexico, chiefly near the Gulf coast.

SPECIMENS EXAMINED: Mexico: 1 ♂ (type). *Vera Cruz*: 3 ♂, 3 ♀; *Jalapa*, 3 ♂; *Tuxpam*, 1 ♂; *Cordoba*, 1 ♀. *Oaxaca*: 1 ♂.

DISCUSSION: The depression between the front of the head and the base of the beak, which no doubt gives *sulcifrons* its name, can be seen in profile as well as from above; it is quite rugose and distinctly punctured.

In this species, as in *destructor*, some specimens are heavily coated and some virtually bare. In the coated specimens the pronotal and elytral depressions appear larger and deeper, the elytra more uneven and rugose, the punctures larger. The type is such a specimen and is further encrusted with dirt.

The pronotal vittae, as seen in a bare and somewhat abraded male from *Vera Cruz*, form a vaguely defined M, as in smooth specimens of *C. cicatristriata*; this specimen also has at the middle of the apex a circle of eight round punctures which almost constitute a median apical depression.

The pygidium has not been seen elsewhere in the genus so markedly tumid, although some species have it somewhat swollen.

Differs from *destructor*, which it resembles

in form and in the various surface depressions, in the lack of a thoracic lobe behind the eye, in the stouter beak without a hump at the base, and in the apical margin of the penis which is long and pointed, not rounded as in *destructor* (fig. 110).

#### *Calendra destructor* AND *Calendra callosa*

These two widely ranging species are very often confused in collections because of their similar shape and size and because they are both usually encrusted with mud or with a yellow or gray over-all coating that obscures the details. They both have narrow tarsi and a distinct lobe at the base of the pronotum; the beak, pronotum, and elytra seem, at first glance, rather similar. They occur together over most the eastern states and are often found on the same host plants, even in the same fields. The two are, however, distinct, and can be readily separated, not only by the male genitalia, but by other characters, which are given in table 5.

The front of the head and the sides of the prosternum are more strongly punctured in *destructor* than in *callosa*, but these parts are generally obscured by mud or coating. More specimens of *destructor* are found with the coating worn thin and the black showing

TABLE 5  
DIFFERENCES BETWEEN *Calendra destructor* AND *Calendra callosa*

<i>destructor</i>	<i>callosa</i>
Beak slightly, but evenly, curved throughout	Beak bent slightly downward at apical fourth
Antennal club narrower, more oval	Antennal club wider, more dilated
Mesoepimeron usually straight in front	Mesoepimeron usually arched in front
Thoracic lobe behind eye strongly sinuous	Thoracic lobe scarcely sinuous
Pronotal vittae coarsely, strongly punctured	Pronotal vittae with small, scarcely visible punctures
Median vitta usually with black elevated line, or partially coated	Median vitta without black elevated line, entirely coated
Scutellum not deep, usually grooved	Scutellum exceedingly concave, deep
Fifth elytral interval at base on level with third, not depressed	Fifth elytral interval at base strongly depressed
Subapical callosities on elytra not prominent	Subapical callosities very prominent
Front tibiae expanded and truncate on outer side just before apex. Subapical tooth nearly half the size of apical, distant from it	Front tibiae straight on outer side to apex. Subapical tooth small, close to apical
Pygidium with small tufts of hairs at sides of apex	Pygidium with two oblique rows of long hairs at apex
Penis with chitinous border twice as wide in apical area as at sides; sides obliquely rounded to apex (fig. 111)	Penis with chitinous border of equal width throughout; apex truncate, square at sides (fig. 109)

through than is true of *callosa*, which is more often entirely covered with a thicker coat.

These two species, and also *melanocephala*, which seems to be related to them, form a group that is close to *cubensis*, *scoparia*, *maidis*, and *zeae*.

***Calendra destructor* (Chittenden)**

Figure 111

*Sphenophorus destructor* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 174. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 566. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 152, pl. 5.

*Calendra destructor*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 162; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 16, fig. 24; 1942, Ent. News, vol. 53, p. 39. BRUHN, 1947, Great Basin Nat., vol. 8, p. 19, pl. 5.

*Sphenophorus sublaevis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 176; 1924, *ibid.*, vol. 26, p. 152, pl. 5.

*Sphenophorus callosus* var. *sublaevis*, BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 568. BLATCHLEY, 1920, Jour. New York Ent. Soc., vol. 28, p. 177.

Medium, robust; coated, pronotum with three narrow, raised vittae, usually partly bare, elytra without marked callosities.

Beak (from side) long, compressed, upper contour almost straight to slightly curved, beak wider at apex, apex beneath obtusely angulate or a right angle, base strongly swollen over antennal insertion, no true fovea, but concentrated punctures in front of eye; (from above) apex flattened, base encrusted with coating, front of head distinctly punctured. Eye extending below insertion of beak. Thorax behind eye strongly sinuous. Pronotum with three raised, usually bare vittae, coarsely and strongly punctured, and two side branches, median vitta usually a raised, uncoated, irregular line superimposed on broader, dilated, but coated true vitta, lateral vittae usually seen as bare, raised, sinuous lines of large punctures; interspaces with punctures larger, coarser than on vittae, base of pronotum sinuate, with median lobe extending backward. Scutellum narrower than long, seemingly flat or somewhat concave or grooved. Elytra usually coated, transversely wrinkled, intervals about equal in width and elevation, with punctures smaller than on pronotal vittae, in more or

less single rows, usually punctuation obscured by coating, fourth and sixth intervals, at base, often with oblong depressions; striae fine, with large punctures (size of those in pronotal interspaces), well separated, cutting less than halfway into intervals, apical callosities not prominent. Under surface, sides of prosternum with large punctures as above, but sparser. Legs, front tibiae with outer apical angle not prolonged, but with outer side expanded and truncate before apex, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with small tufts of hair at extreme sides of apex. Length, 8–11 mm.

TYPE LOCALITY: No locality specified; type from Atoka, Missouri. Type in the United States National Museum, examined.

DISTRIBUTION: Eastern states as far west as Nebraska, Kansas, Oklahoma, and Texas.

SPECIMENS EXAMINED: *New Jersey*: Anglesea, May 31, 1 ♀ (allotype, *destructor*), 1 ♂ (paratype, *destructor*), June 15 (C. Boerner), 1 ♂ (paratype, *destructor*). *Indiana*: 1 ♀ (type, *sublaevis*, U.S.N.M. No. 8972); Dune Park, July 7, 1934 (C. H. Seevers), 2 ♀; Michigan City, June 9, 1934 (C. H. Seevers), 2 ♀. *Illinois*: (Hart), 1 ♀ (cotype, *sublaevis*); (C. H. Popenoe), 1 ♀; Waukegan, June 27, 1929 (Satterthwait), 1 ♀ "on beach, dead." *Wisconsin*: (Wickham), 1 ♀ (cotype, *sublaevis*). *Missouri*: Horn Coll. No. 8995, 1 ♀; Atoka, June, 1903, 1 ♂ (type, *destructor*, U.S.N.M. No. 8971), 1 ♂, 3 ♀ (paratypes, *destructor*); Columbia, Apr., May, 1937, 2 ♂, 2 ♀, June 2, 1941 (R. C. Froeschner), 3 ♂, 1 ♀, May 20, 1940 (R. I. Wakeman), 1 ♀; Carthage, May 18, 1941 (R. C. Froeschner), 3 ♂; Eldan, Mar. 17, 1940 (E. Herbold), 1 ♀; Pacific, May 30, 1946, 1 ♂; Willard, Greene Co., July 17, 1 ♀; Charleston, Oct. 18, 1919, 1 ♂, 1 ♀ "*Andropogon*"; Dudley, Mar. 26, 1920 (H. R. Painter), 1 ♂ "*Andropogon*." *Kentucky*: 1 ♀. *Arkansas*: Wabbaseka, Feb. 23, 1911, 1 ♀; Mt. Magazine, 2800 ft., Ouachita Mts., June 10, 1947, 1 ♀. *Oklahoma*: 1 ♂, 1 ♀. *Texas*: (C. V. Riley), 1 ♂; Plano, Aug. 5, 1909 (T. D. Urbahns), 1 ♂; Moody, Mar. 25, 1904, 1 ♀; Dallas Co., Apr., 1945, 1947, 4 ♀.

DISCUSSION: Chittenden's *sublaevis* (Indiana, Illinois, Wisconsin) was based on individuals with less coating on the pronotal vittae and on the elytral intervals, but *destructor* in these areas shows all gradations from a full coat to a partial one. Chittenden's



statement (1905b, p. 176) that in *sublaevis* the "elevated portions of the thoracic vittae are much wider [than in *destructor*] without elevated lines" is only partly true. The elevated portions of the pronotum seem wider only because they are so denuded; in *destructor* the raised vittae are actually just as broad, but they are usually denuded along a narrow line only. The second part of the above statement is belied by one of Chittenden's cotypes which has the elevated line. In eight specimens of *destructor*, two have the vittae not or scarcely denuded, four have them partially denuded and the median one with the black elevated line, two have them broadly denuded and lack the median black elevated line. These latter (Dune Park, Indiana) are what Chittenden would have called "*sublaevis*."

The "deeper, coarsely foveate punctures" in the type of *sublaevis* are the same as in *destructor* whenever enough of the coating is worn off to show them. Four of my specimens which appeared of a "uniform dull black" as in "*sublaevis*" revealed, after a degreasing in carbon tetrachloride, that they did possess a gray or yellowish coating in varying degree; one specimen had nearly the entire elytra coated. I therefore consider *sublaevis* a synonym of *destructor*.

Blatchley placed *sublaevis* as a variety of *callosa*, a species which, despite its similar general appearance, is very different from *destructor*. The characters he gave, the coarse vittae punctures and the larger subapical tooth, are diagnostic for *destructor*.

Differs from *zeae* by having a strong thoracic lobe behind the eye, the pronotum less elongate, definitely narrower at the base than the base of the elytra, the vittae with large, coarse punctures, the elytra usually coated and with smaller stria punctures. Differs from *melanocephala*, which it occasionally resembles in the median keel on the pronotum, by having a longer, gradually widened beak and a more prominent thoracic lobe.

Additional specimens have been seen from South Carolina, Kansas, Tennessee, and reported from Pennsylvania, Ohio, Michigan, Nebraska, Alabama, and Mississippi.

**BIOLOGY:** Chufa or yellow nut grass (*Cyperus esculentus*), which grows as a weed

in cornfields and is used for hog feed, is the preferred host plant for this species as well as for *callosa*. The two species breed also in *Juncus torreyi* and in wheat, and *destructor* ranks fourth after *parvula*, *zeae*, and *callosa* in abundance and in destruction to crops. It develops also in timothy and in another sedge, *Juncus acuminatus*. The adults are very destructive to corn, especially in Missouri. (Above data from Satterthwait, 1931a, 1932, 1942.) This is one of the species reported by Satterthwait (1931b, p. 173) as being parasitized in the egg stage by *Anaphoidea calendrae*, a small, hymenopterous insect.

The specimens from Charleston and Dudley, Missouri, were taken on *Andropogon*, a tall perennial grass.

#### *Calendra callosa* (Olivier)

Figure 17, 109

*Calendra callosa* OLIVIER, 1807, Entomologie, vol. 5, p. 92, pl. 28.

*Sphenophorus callosus*, GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 942. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 424. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 176, fig. 20. WEBSTER, 1912, U. S. Dept. Agr. Bur. Ent. Bull., no. 95, pp. 53-71, figs. 16-21, pls. 6-9. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 567, fig. 126. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 152, pl. 5.

*Calendra callosa*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160; 1931, Jour. New York Ent. Soc., vol. 39, p. 171; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 13, figs. 7, 19-22; 1942, Ent. News, vol. 53, p. 37.

*Sphenophorus jugosus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 151, pl. 6.

Medium to large, robust; coated, pronotum with three broad, raised vittae under coating, elytra with prominent shoulder and apical callosities.

Beak (from side) long, compressed, upper contour nearly straight until apical fourth where beak bent down towards apex, beak wider at apex, apex beneath obtusely angulate, or a right angle, base swollen over antennal insertion, no true fovea in front of eye but some concentrated punctures, all coated; (from above) apex flattened or convex, base between eyes completely coated, front

of head finely punctured. Eye extending below insertion of beak. Thoracic lobe behind eye slightly sinuous. Pronotum with three broad, raised vittae under coating, finely and sparsely punctured, and two side branches (often indistinct), lateral vittae sinuous on inner side, median dilated at middle, interspaces narrow, separating the vittae with one, sometimes two, irregular rows of large, round punctures, base of pronotum sinuate, with median lobe extending backward. Scutellum narrower than long, deeply concave. Elytra coated, rough and uneven, sometimes smoother, depending on coating, intervals about equal in width, third usually definitely raised at base, with irregular rows of fine punctures (as on pronotal vittae), other intervals with one row of punctures, fifth and sixth intervals, at base, strongly depressed; striae fine, with well-separated, deep, large, round punctures about the size of those on pronotal interspaces and cutting less than halfway into intervals, apical callosities very prominent. Under surface, sides of prosternum usually obscured by coating, but fairly smooth, with a few scattered punctures, sometimes denser. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with long hairs at apex, in two oblique rows. Length, 7.5–13 mm.

TYPE LOCALITY: "Caroline"; here restricted to South Carolina. Type in Paris museum, examined.

DISTRIBUTION: Eastern states west to Nebraska, Kansas, Oklahoma, and Texas. New Mexico, Arizona (Satterthwait). Mexico (Webster).

SPECIMENS EXAMINED: *New Jersey*: Chester, 1 ♂. *New York*: Pine Island, June 17, 1911 (C. L. Pollard), 1 ♀; Fire Island, July 11, 1941 (B. Valentine), 1 ♂. *South Carolina*: Blenheim, Marlboro Co., July 13, 1928 (O. L. Cartwright), 1 ♂; Meredith, May 25, 1926 (O. L. Cartwright), 1 ♂; Florence, July 19, 1928 (O. L. Cartwright), 1 ♀; Hampton, Apr. 21, 1927 (J. O. Pepper), 1 ♀. "Caroline, coll. Bosc, 1828," 1 ♀ (type, *callosa*). *Georgia*: Horn Coll. No. 8990, 1 ♂; Atlanta, 1 ♂. *Florida*: Gainesville, Agricultural Experiment Station ("J. R. W."), 1 ♂ "on corn"; Biscayne Bay, 2 ♂; Kissimmee, 1 ♀. *Indiana*: Dune Park, July 7, 1934 (C. H. Seevers), 1 ♀. *Illinois*:

Florence, July 6, 1946 (A. T. McClay), 1 ♀. *Iowa*: (Wickham), 1 ♀ (type, *jugosus*, U.S.N.M. No. 26892); Ames, June 24, 1949 (P. and C. Vaurie), 1 ♀. *Missouri*: Canton, Sept. 19, 1942 (R. C. Froeschner), 1 ♂. *Kansas*: (F. H. Snow), 1 ♂. *Oklahoma*: 1 ♂.

DISCUSSION: The type and only specimen of *jugosus* (Iowa) seems to be but a smaller and denuded specimen of *callosa*, with which it agrees in all essential characters. The beak and legs may be more slender, as Chittenden pointed out, but this is the smallest specimen seen (7.5 mm.), and the absence of coating would naturally make the legs look smaller. It is true that the front of the head in *jugosus* has larger punctures than in the few *callosa* seen with this area bare of coating, but since this area is usually coated, the variation in *callosa* cannot be judged. *C. callosa* also has more than one row of punctures on the third elytral interval, not a single row as in *jugosus*, but this also might prove variable if the punctures could be seen on all individuals. In view of the variability of *callosa* it seems best to consider this somewhat different, but essentially similar, single specimen as synonymous with *callosa*.

In only one of 10 specimens of *callosa* is the median vitta, at the base, raised as much as the laterals at base. Of the remaining nine, four have this basal area between the laterals invaded by the interspace punctures, thus seemingly obliterating the median vitta, as in *cariosa*. But in the latter species this obliteration is much more marked, since the raised vittae are bare, black and shining, not covered with coating. In many *callosa* specimens the vittae punctures on the pronotum and the interval punctures on the elytra are scarcely visible; the larger punctures on the pronotal interspaces and on the elytral striae are often plugged up with coating or mud. The scutellum in 10 specimens is invariably deeply and cavernously concave.

For comparison with *destructor*, see discussion of the two species above. Differs from *melanocephala* in the longer, more compressed, less bulky beak, the entirely coated pronotum, the median vitta which is not in the form of a prominent keel, the strongly depressed fifth and sixth elytral intervals at base. Differs from *cariosa* as mentioned above, also in the narrow, not dilated, front

and middle third tarsal segment (fig. 17), and the third elytral interval which is not bare and shining at base.

Newly emerged or reared specimens that have not accumulated a muddy coat have a velvety yellow coat with golden glints in it that is quite beautiful.

**BIOLOGY:** The preferred host plant of this species is *Cyperus esculentus*, yellow nut grass, the same host preferred by its close relative, *destructor*. The two species, however, were found to have different feeding periods on this plant, at least near St. Louis, Missouri, *callosa* being dominant in August, *destructor* in September. Fourteen other host plants are recorded: 11 sedges (two of the genus *Carex*, seven of *Cyperus*, one *Rhynchospora*, one *Juncus*) and three grasses (wheat, corn, and corn grass, i.e., *Panicum clandestinum*). Only four other billbugs, *aequalis*, *maidis*, *parvula*, and, recently, *gentilis*, actually develop in corn, although many of them feed on corn.

The larvae and adults are especially destructive to corn in the southern states, and the adults also do great damage to rice and peanut crops. After *parvula* and *zeae*, this species was ranked third by Satterthwait in its destructiveness to agricultural crops and in abundance, although both these factors vary in different states. One female has been recorded as having deposited 447 eggs. (Above data from Satterthwait, 1931a, 1932, 1942.)

The eggs of this species were found by Satterthwait (1931b, p. 171) to be often parasitized by the hymenopterous parasite *Anaphoidea calendrae* Gahan.

#### ***Calendra melanocephala* (Fabricius)**

Figures 11, 58, 108

*Calandra melanocephala* FABRICIUS, 1801, Systema eleutheratorum, vol. 2, p. 435. OLIVIER, 1807, Entomologie, vol. 5, p. 93, pl. 28, fig. 419.

*Sphenophorus melanocephalus*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 425. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 569, fig. 127.

*Calendra melanocephala*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 19.

*Sphenophorus nubilus* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol.

4, p. 938. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 425.

Medium, robust; black, covered with gray or tan coating, pronotum with shining keel ending at middle of pronotum in angular dilation, elytral intervals more or less flat.

Beak (from side) short, stout, slightly compressed, much wider at apex, upper contour straight to before apex where bent downward at an angle, apex beneath obtuse, base strongly swollen over antennal insertion, large, concentrated punctures in front of eye; (from above) apex bent down and flattened, base coated between eyes and with coarse, confluent punctures, front of head with a few sparse punctures. Eye extending below insertion of beak. Thoracic lobe weak. Pronotum with median vitta represented by raised bare keel from near apex to middle where it widens into a small triangle and does not continue to base, punctured with three to seven small punctures, usually on extreme border, lateral vittae vaguely traced as basal swellings under coating, sometimes reaching to apex, and two side branches which are usually obscured by coating, punctures on laterals small and sparse, often not visible because of coating, rest of pronotum with larger, well-separated punctures as large as, or larger than, striae punctures. Scutellum definitely concave. Elytra with intervals broad, flat, coated, equal in elevation, with single, irregular rows of small punctures (size of those on pronotal vittae) usually not visible; striae with deep but small punctures as on pronotal interspaces, but often obscured by coating, scarcely cutting into intervals; elytra appear transversely wrinkled when coating worn off. Under surface, sides of prosternum as above but sparser, rest below strongly punctured, front femora especially coarsely. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of hairs. Length, 8.5–11 mm.

**TYPE LOCALITY:** "Carolina"; here restricted to North Carolina. Type in Europe; its present location unknown to author.

**DISTRIBUTION:** Eastern states west to Nebraska, Kansas, Oklahoma, and Texas, also Ontario, Canada.

**SPECIMENS EXAMINED:** *Massachusetts:* 1 ♀. *Rhode Island:* Watch Hill, June 22, 1909 (W. Robinson), 1 ♀. *New York:* Pine Island, June 17, 1911 (C. L. Pollard), 4 ♂, 2 ♀; Bear Mountain, June 2, 1940, 1 ♂; Brooklyn, July 8, 1912, 1 ♀; Rockaway Beach, 2 ♀; Varna, May 1, 1948, 1 ♂. *Pennsylvania:* Horn Coll. No. 8995, 1 ♂. *New Jersey:* 1 ♀; Horn Coll. No. 8995, 1 ♀; Arlington, 3 ♂. *District of Columbia:* 1 ♀. *Virginia:* Camp Peary, May, 1943, 1 ♀. *North Carolina:* 1 ♀. *Kentucky:* 1 ♂, 1 ♀. *Indiana:* 1 ♀; Michigan City, June 9, 1934 (C. H. Seevers), 2 ♂, 4 ♀; Dune Park, July 7, 1934 (C. H. Seevers), 2 ♀. *Illinois:* 1 ♀; Putnam Co., June 10, 1915 (M. C. Glenn), 1 ♀. *Wisconsin:* Milwaukee, Aug., 1935 (H. Jungmann), 1 ♀. *Missouri:* Columbia, May 10, 1937, 1 ♀; Everton, Apr. 27, 1939 (R. Froeschner), 1 ♂. *Nebraska:* Dodge, 1 ♀. *Texas:* 1 ♀. "America borealis," 1 ♂ (type, *nubilus*).

Canada. Horn Coll. No. 8995, 1 ♂, 2 ♀.

**DISCUSSION:** The keel on the pronotum (fig. 11) is usually angularly dilated at its base to a greater or less degree, but in seven specimens out of 27 it is merely somewhat broader at this point. Actually this keel is the median vitta itself which, as in *cariosa*, does not extend to the base. In *cariosa*, however, the median vitta is twice to four times broader than in *melanocephala*, and the lateral vittae are distinct and raised. Most specimens of *melanocephala* are so thickly coated that the lateral vittae are not at all evident. In one denuded specimen it can be seen that all the punctures of the pronotum and elytra are larger than in coated specimens.

The beak in this species is short and stout and, viewed from the side, is usually nearly twice as wide at the apical third as at the middle, and it is also widened at the base over the antennal insertion, thus being narrow at the middle and broad at both ends (fig. 58). The upper contour, after widening in the apical third, bends sharply downward just before the apex. This beak, in addition to the shining median keel of the pronotum and the thick coating elsewhere, should be sufficient to separate *melanocephala* from all other species. The male genitalia are very similar to those of *callosa* and *cariosa* (fig. 108).

Although another of Fabricius' types, that of *necydaloides*, was found at the Paris museum, the type of *melanocephala* was not

found there, nor at the British Museum. The type of *nubilus* Gyllenhal, synonymized by Horn in 1873, was examined in Stockholm and found to be *melanocephala*.

In addition to the localities listed above, this species has been seen from Connecticut, Maryland, Michigan, Iowa, and Kansas, but exact data were not taken. It has also been recorded in the literature from New Hampshire, West Virginia, South Carolina, Georgia, Ohio, Minnesota, Oklahoma, and Ontario, Canada.

**BIOLOGY:** *Leersia oryzoides*, or cut grass, is the only host plant recorded by Satterthwait (1931a), and he adds (1932) that *melanocephala* is generally restricted to places where this grass grows. It has, however, been found in the adult stage on both timothy and corn.

#### *Calandra cariosa* (Olivier)

Figures 12, 109

*Calandra cariosa* OLIVIER, 1807, Entomologie, vol. 5, p. 91, pl. 28.

*Sphenophorus cariosus*, SCHOENHERR, 1838, Genera et species curculionidum, vol. 4, p. 941. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 420. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 177. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 158, pl. 8, fig. 2. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 560.

*Calandra cariosa*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 19; 1942, Ent. News, vol. 53, p. 41.

*Calandra larvalis* GERMAR, 1824, Insectorum species novae, vol. 1, p. 301.

*Sphenophorus larvalis*, SCHOENHERR, 1838, Genera et species curculionidum, vol. 4, p. 941. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 420.

*Rhynchophorus cicatricosus* SAY, 1831, Description of new species of Curculionites of North America, p. 22.

*Sphenophorus cicatricosus*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 420.

*Sphenophorus flexuosus* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 940. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 420.

*Sphenophorus sculptilis* UHLER, 1855, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 416. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 424. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 177.

Medium, robust; black, with gray or yel-

low coating in interspaces, median vitta diamond shaped at middle and not continuing to base; third elytral interval at base convex and shining.

Beak (from side) long, compressed, top contour not always evenly curved throughout but bending downward at apical third, wider at apex, apex beneath obtuse, base slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex flattened, base with no canal or a short one, front of head finely punctured. Eye extending below insertion of beak. Slight thoracic lobe. Pronotum with three raised, bare vittae, sparsely and finely punctured, and two side branches; lateral vittae usually markedly sinuous on inner side, median vitta dilated into diamond at middle and not extending to base except sometimes by narrow, attenuated line; interspaces usually coated, punctures very large, irregular. Scutellum narrower than long, concave. Elytra with third interval, basal half, very convex, bare, with very fine punctures as on pronotal vittae, other intervals more or less flat, punctures in single row, but often not visible under coating; striae with large, round, deep punctures cutting less than halfway into intervals and usually set wide apart (two or three times the diameter of the puncture or more), punctures often surrounded by circle of tan color. Under surface, sides of prosternum nearly smooth, rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged, front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of yellow hairs at apex. Length, 8–13 mm.

TYPE LOCALITY: "Amérique septentrionale"; here restricted to Tuscaloosa, Alabama. Location of type in Europe unknown to author.

DISTRIBUTION: Eastern states west to Nebraska, Kansas, Oklahoma, and Texas. Also Mexico and Guatemala.

SPECIMENS EXAMINED: *Massachusetts*: Harwichport, July 20, 1933 (L. Lacey), 1 ♀. *Rhode Island*: Watch Hill, July 20, 1945 (S. C. Harriot), 2 ♂, 2 ♀, June 25, 1909 (W. Robinson), 1 ♀. *New York*: 2 ♀; New York City, May 5, 1940, 1 ♂;

Watermill, July 5, 1903, 1 ♀ "dead on beach"; Brooklyn, May 1, 1911, 1 ♂; Fire Island, June 25, 1941, 1 ♀; Montauk, May 18, 1941, 1 ♀; Yonkers, May 10, 1941, 1 ♂. *New Jersey*: Atlantic City, 1 ♂. *Georgia*: Athens, Oct. 20, 1923, 2 ♀. *Florida*: Biscayne Bay, 2 ♀; Gainesville, Sept. 26–Oct. 2, 1914, 1 ♀; Marineland, Apr. 4, 1941 (L. W. Clausen), 1 ♀; Kissimmee (C. Palm), 3 ♀; Tampa, MacDill Field, Mar. 5, 1943 (B. Malkin), 1 ♀. *Alabama*: Tuscaloosa, Nov.–Dec., 1949, Jan., 1950 (B. D. Valentine), 16 ♂, 23 ♀. *Mississippi*: Agricultural College, 1 ♂. *Louisiana*: New Orleans (Guérin), 1 ♂ (type, *flexuosus*), 1 [abdomen missing] (paratype, *flexuosus*). *Texas*: Dallas Co., Mar. 10, 1948 (M. Z.), 1 ♂. *Oklahoma*: (C. Palm), 1 ♂. *Nebraska*: Dodge, 1 ♀.

Mexico. *Vera Cruz*: Cordoba and Jalapa, 2 ♂, 1 ♀.

Guatemala. 2 ♂.

DISCUSSION: The type of *cariosa*, purported to be, with other types of Olivier, at the Paris museum, was not found there or at the museums in Stockholm or London. The type and paratype of *flexuosus* Gyllenhal (New Orleans) were examined at Stockholm, with specimens of *larvalis* Germar ("America septentrionali"), and Horn was correct in synonymizing these two species with *cariosa*. The description of *cicatricosus* Say (Louisiana) agrees with that of *cariosa*. *C. sculptilis* Uhler (Baltimore) was synonymized by Chittenden who thought it was based on an unusually large specimen of *cariosa*. The location of the type of *sculptilis* is unknown (Chittenden, 1905b).

In general the inner margin of the lateral vittae is markedly sinuous, but in two specimens out of 60 it is nearly straight except for a slight break at the middle, and these lateral vittae are virtually parallel.

The diamond-shaped, median vitta (fig. 12) and the characteristic shining, very convex basal stripe on the third elytral interval separate *cariosa* from all other species with the front and middle tarsi widely dilated except possibly some *maidis*, but the latter has the third interval much less convex and has the fifth interval also somewhat raised basally, and the pronotal vittae are flat, not elevated, and usually merged in the apical half. *C. callosa*, which has often been confused with *cariosa*, actually has the same pronotal and elytral pattern, but there the entire insect is encrusted; it has the same male

genitalia as *cariosa* (fig. 109), but it differs notably by having all the tarsi narrow. *C. cariosa* differs from *melanocephala* also by the dilated front and middle tarsi.

Champion's figure shows a typical *cariosa* of which he had four specimens from the state of Vera Cruz. Further collecting should produce others between southern Mexico and Texas. This species and *incurrens* are the only two that have been seen from Guatemala.

**BIOLOGY:** Although this species generally feeds on rushes and sedges, it has proved destructive to corn in Missouri. The horned or beaked rush (*Rhynchospora corniculata*) is the preferred host plant, and nine others of the genera *Cyperus* and *Scirpus* of the sedge family have been recorded also as hosts (Satterthwait, 1931a, 1932, 1942).

#### *Calendra robusta* (Horn)

Figure 108

*Sphenophorus robustus* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 419. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 57. BLATCHLEY AND LENG, 1916, Rhynchophora of north-eastern America, p. 557, fig. 122.

*Calendra robusta*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160.

*Sphenophorus robustus* var. *rectistriatus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 148.

*Calendra multilineatus* SATTERTHWAIT, 1925, Ent. News, vol. 36, p. 269.

Large, robust; black or partially dull red, with yellow or gray coating in depressed areas; pronotum with three raised bare vittae; elytra with intervals flat.

Beak (from side) long, compressed, top contour evenly curved or occasionally with slight hump at apical third, beak wider at apex, apex beneath forming right angle, with tendency to acute point, at base slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex flattened, sometimes concave, base with canal, front of head finely punctured. Eye extending below insertion of beak. Very slight thoracic lobe. Pronotum with three strongly raised, nearly parallel, nearly equal vittae, finely and sparsely punctured, and two side branches; lateral vittae sometimes slightly sinuous on inner side; median vitta usually not dilated at middle; interspaces about same width

as vittae, usually coated and with the punctures small and sparse (when coating worn, punctures are larger and often touching). Scutellum narrower than long, either flat or channeled. Elytra with all intervals flat, usually covered with gray or tan coating, with single row of fine punctures (size of those on pronotal vittae), often double on odd intervals (punctures often not visible), erratic uncoated areas along striae punctures on edges of intervals or in center of third and fifth intervals resulting in small, bare, shiny patches or ill-defined stripes; if coating heavy, bare areas smaller; striae with more or less regularly spaced round punctures, larger than those on intervals and set close together. Under surface, sides of prosternum with sparse shallow punctures, rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged; front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium sometimes with impunctate median line, at apex with two oblique rows of yellow hairs. Length, 11–15 mm.

**TYPE LOCALITY:** No locality specified; here designated as Illinois from original label on lectotype, female, new designation, Horn Collection No. 8988, Academy of Natural Sciences of Philadelphia, examined.

**DISTRIBUTION:** Middle western and western states, also Texas, western Canada. New Jersey (Satterthwait).

**SPECIMENS EXAMINED:** *Michigan:* New Buffalo, June, 1920 (M. H. Hatch), 1 ♂. *Indiana:* 3 ♀; (J. B. Smith), 1 ♂ (type, var. *rectistriatus*, U.S.N.M. No. 26908); (Chittenden), 1 ♂ (paratype, var. *rectistriatus*); Dune Park, June 9, July 7, 1934 (C. H. Seevers), 2 ♂, 1 ♀; Vigo Co., May 30, 1894 (W. S. Blatchley), 1 ♀; Chesterton, July 10, 1934 (T. Craig), 1 ♀. *Illinois:* 2 ♂, 1 ♀; 1 ♀ (lectotype, *robusta*, Horn Coll. No. 8988); 2 ♂, 2 ♀ (cotypes, *robusta*, Horn Coll. No. 8988); Ravinia Park, June 21, 1914 (R. Hopping), 2 ♂, 4 ♀; Chicago, May 22, 1912, 1 ♂, 1 ♀. *Minnesota:* 1 ♀ (type, *multilineatus*, U.S.N.M. No. 27826). *Iowa:* Lake Okoboji, June 20, 1917 (L. L. Buchanan), 1 ♀. *South Dakota:* Volga (Truman), 1 ♂. *Texas:* Houston, June 14, 1 ♀. *Utah:* Provo, 2 ♀ (cotypes, *robusta*); (Wickham), 1 ♂, 1 ♀; Utah Lake, June 19, 1 ♀ (cotype, *robusta*). *California:* 1 (cotype, *robusta*, M.C.Z. No. 1041); (C. H. Roberts), 1 ♀; Lake Co.,

Lower Lake, May 13, 1922 (E. P. Van Duzee), 1 ♀; Soda Bay, Clear Lake, Sept. 29, 1940 (Van Dyke), 1 ♀.

Canada. *British Columbia*: Vasceaux Lake, Apr. 25, 1925 (R. Hopping), 1 ♀.

**DISCUSSION:** The variety *rectistriatus* (type specimen from Indiana) and the species *multilineatus* (type locality, Minnesota) both fall within the range of variation of *robusta* and are here considered synonymous with it. As is shown below, the elytra in this species are very variable, depending on how much of the coating is present, and many specimens that do not at first glance show a division of the intervals as explained by Satterthwait for *multilineatus*, do, in fact, have this division. Examination of the type of *multilineatus* and also the two males and one female from Illinois in the Horn Collection which Satterthwait said were *multilineatus* does not substantiate any essential difference between them and other *robusta*, including Horn's type series of *robusta*. Specimens of *pertinax* and *australis* vary as much as, if not more than, *robusta* in the relative amount of coating and raised uncoated areas on the elytral intervals. The difference in the color of the coat, gray in *multilineatus* and yellowish in *robusta*, as mentioned by Satterthwait, does not seem diagnostic, as it occurs throughout the genus in many species.

The pronotum presents a rather uniform appearance in *robusta* except when the coating is rubbed or worn. In two females (Provo, Utah, and Vigo County, Indiana) where the coating is gone from the interspaces, the vittae seem to be less distinctly separated, since the black connecting portions between them are revealed.

A comparison of the elytra in 12 eastern specimens (Indiana, Illinois) and eight western specimens (South Dakota, Utah, Texas, California) shows certain variations that are not correlated, however, with geographical distribution. Seven of the 20 specimens have bare (uncoated) spots discontinuously placed on the sides of the first two intervals, and 13 have these spots in a continuous line, at least on the discal intervals, eastern and western individuals falling in about equal numbers into these two categories. The third interval in nine specimens is entirely coated. In the other 11, some have a bare, attenuated,

but not convex stripe in the center in the basal half, or basal three-quarters, or all the way; some have also the fourth and fifth intervals with the bare stripe. This stripe seems to be merely the barring of the center row of punctures.

The occurrence of this species has been recorded in the literature from Wisconsin, Ohio, Colorado, Nebraska, and Kansas, and I have seen a specimen from the state of Washington.

Differs from other species with the dilated front and middle and the narrow hind tarsi (except *scoparia* and *cubensis*) by having the elytral intervals mostly flat, at least without any definite convex stripes in their centers. It differs from *scoparia* and *cubensis* principally by having the vittae on the pronotum raised, well separated, parallel, and the punctuation of the prosternum sparser and shallower. Differs from *robustior* by having dilated tarsi on the front and middle legs, and the elytra much longer and narrower.

**BIOLOGY:** *Scirpus validus*, the bulrush, or tule, is recorded by Satterthwait (1931a, p. 160) as one of the host plants, also *Scirpus occidentalis* for "*multilineatus*" (communication by Satterthwait). Blatchley and Leng (1916, p. 557) reported *robusta* hibernating with *C. aequalis* in February. Many of the older reports of *robusta* injuring corn were "due to a distinct species . . . *maidis*" (Chittenden, 1905a, p. 57).

#### *Calendra robustior* (Chittenden)

*Sphenophorus robustior* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 62. BLATCHLEY AND LENG, 1916, Rhynchophora of north-eastern America, p. 573.

*Sphenophorus robustior* var. *costifer* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 152.

Large, robust; black, but mostly coated with yellowish coating, three raised, bare vittae on pronotum, elytra with part of third, and sometimes the other odd intervals raised, convex, bare.

Beak (from side) long, compressed, top contour straight until apical third where it is bent downward to apex, beak wider at apex, apex beneath forming acute angle, base swollen over antennal insertion, fovea present in front of eye; (from above) apex concave and

with long flattened area at apical fourth, base with deep, long, impressed line, front of head with small, distinct punctures. Eye extending below insertion of beak. Thoracic lobe present, but weak. Pronotum with three nearly parallel, raised, nearly equal vittae (occasionally vittae almost confluent), moderately and rather densely punctured, and two side branches, median vitta often dilated at middle; interspaces either narrower or broader than vittae, coated, their punctures same size as, or larger than, those on vittae. Scutellum narrower than long, concave. Elytra with all of suture, part of third, and sometimes part of fifth and seventh, intervals raised, feebly convex, bare, other intervals flat and coated except for shoulder and apical spots, their punctures in single rows on even, in double or triple rows on odd, intervals, punctures the same size as those on pronotal vittae; striae with punctures of approximately same size as intervals, but more distantly placed. Under surface, sides of prosternum with larger, sparser punctures than above, the rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at apex at sides. Length, 11–13 mm.

**TYPE LOCALITY:** No locality specified; type from Cook County, Illinois. Type in the United States National Museum, examined.

**DISTRIBUTION:** Illinois, Iowa, Nebraska, South Dakota, and central Canada.

**SPECIMENS EXAMINED:** *Illinois:* Cook Co. (Forbes, Hart), 1 ♂ (type, *robustior*, U.S.N.M. No. 8229), 2 ♀ (paratypes, *robustior*); "I" or Ill., 3 ♂, 1 ♀ (paratypes, *robustior*); "I" (C. H. Popenoe) (Wickham), 1 ♂, 2 ♀; Brach, May 14, 1938 (B. Benesh), 1 ♀. *Iowa:* Lake Okoboji, June 21, 26, 1917 (L. L. Buchanan), 1 ♂, 1 ♀ (paratypes, var. *costifer*). *Nebraska:* Dodge (Wickham), 1 ♂. *South Dakota:* (Aldrich), 1 ♀ (type, var. *costifer*, U.S.N.M. No. 26895).

*Canada. Manitoba:* Strong Mountain, June 8, 1924, 1 ♂.

**DISCUSSION:** The variety *costifer* is synonymous with *robustior*. The type and paratypes have the raised shiny parts of the elytral intervals longer and on more inter-

vals, but this falls within the range of individual variation of *robustior*.

Differs from *robusta* and other species with the front and middle tarsi dilated by having all tarsi narrow, not dilated. The punctures on the vittae are also larger and denser than is usual in *robusta*, and the elytra are very short and robust, not elongate as in *robusta*.

Differs from *incongrua*, which has the same tarsal structure, in being nearly twice as broad, and heavier, in the dense pronotal vittae punctures, and in the stouter beak with a long flattened area at the apex above.

### ***Calendra incongrua* (Chittenden)**

Figure 108

*Sphenophorus incongruus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 61. BLATCHLEY AND LENG, 1916, Rhynchophora of north-eastern America, p. 572.

*Calendra incongrua*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 159.

*Sphenophorus incongruus* var. *elephantulus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 151.

Medium, very slender; black or reddish, coated in depressed areas, three nearly parallel, raised vittae on pronotum, elytra with alternate intervals slightly raised and convex, bare.

Beak (from side) long, compressed, evenly curved, wider at apex, upper contour rounded downward and lower contour slightly sinuate before apex, apex beneath obtusely angled, base not swollen over antennal insertion, fovea present in front of eye (absent in one specimen); (from above), apex slightly flattened, base with impressed line or canal, front of head finely punctured. Eye extending below insertion of beak. Thoracic lobe present but weak. Pronotum with three nearly parallel, raised, nearly equal vittae, finely and sparsely punctured, and two side branches, median vitta sometimes slightly dilated at middle; interspaces of same width as vittae, coated, with much larger, deeper, denser punctures than on vittae. Scutellum narrower than long, deeply concave. Elytra with odd intervals slightly raised, bare, with one row (often irregular) of fine punctures, even intervals flat, coated, sometimes showing black bare patches, with one row



of punctures, more widely spaced and larger than on odd intervals; striae with regularly placed round punctures, larger than those on intervals. Under surface, sides of prosternum punctured as interspaces of pronotum but sparser, rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of yellow hairs at apex. Length, 8-10 mm.

TYPE LOCALITY: No locality specified; type from Wisconsin. Type in the United States National Museum, examined.

DISTRIBUTION: Kansas, Indiana, Iowa, Wisconsin, Michigan, Maryland. Illinois (Satterthwait).

SPECIMENS EXAMINED: *Kansas*: Western Kansas (Popenoe), 1 ♀ (type, var. *elephantulus*, U.S.N.M. No. 26905). *Wisconsin*: (Roberts), 1 ♂ (type, *incongrua*, U.S.N.M. No. 8228); Madison, Apr. 25 (L. G. Gentner), 1 ♂, Oct. 14 (student coll.), 1 ♀. *Indiana*: Miller, May 30, 1906 (Wickham), 1 ♀. *Iowa*: Iowa City, May 23 (Wickham), 1 ♂. *Maryland*: 1 ♂ (paratype, *incongrua*). *Michigan*: "Gd. Ledge" (Hubbard and Schwarz), 1 ♂ (paratype, *incongrua*).

DISCUSSION: The type of the variety *elephantulus* is the same as that of *incongrua* except that it is somewhat more robust, with the pronotum broader, more convex, and the punctures at the base in the interspaces larger. The elytra has less coating in the even intervals, exposing a few black shiny areas. These variations do not indicate specific distinctness, so *elephantulus* is a synonym of *incongrua*.

This is a very slender species, with the elytra almost parallel, not markedly broader at the base. Superficially it looks like *costipennis* from above but with the pronotal and elytral stripes much less raised and less prominent. Although similar in general markings, in the fovea in front of the eye, and in the wider antennal club to the other larger species, *incongrua* has the front tarsi narrow and without pads below, as in most of the smaller species. In this respect it parallels *robustior* which also is large but has all the tarsi narrow.

Differs from *robustior* in being about half its width, by having a more slender beak,

with the apex on top rounded downward, by having more and longer bare stripes on the elytral intervals, and the hind femora scarcely clavate.

BIOLOGY: Satterthwait (1931a, p. 159) gives *Scirpus validus*, the American great bulrush, or tule, as the host plant of this species.

*Calendra striatipennis* AND *Calendra costipennis*

Although these two species can readily be differentiated over most of their joint range, in one locality they are virtually indistinguishable except for one small character which so far has proved constant. They have the same pronotal and elytral pattern and punctuation, the same elongate, somewhat grooved scutellum, pygidium and front tibiae of the same shape, the same male characters, including genitalia (fig. 112), and the same punctuation and coloration below. In typical *striatipennis*, however, the third tarsal segment on the hind legs is as wide as long, as widely dilated as in *C. aequalis*, and has the same spongy-hairy pads below as there. The beak is somewhat bent downward before the apex (fig. 37) but not conspicuously so and not humped or dilated before the apex. The pronotum has the lateral vittae partly or entirely bright red and the elytra with bright red stripes; the pronotum appears broad and robust. The allotype is such a specimen, although the type has the pronotum definitely less robust. This species has been seen from Ohio, Indiana, Illinois, Wisconsin, Michigan, Iowa, North Dakota, Texas, and Alberta, Canada, and was reported by Chittenden in his description from Nevada and California.

Typical specimens of *costipennis*, on the other hand, have the hind third tarsal segment narrow, hardly wider than the preceding segments, longer than wide, and with long sparse hairs below at the sides, sometimes appearing as pads, the beak usually definitely humped and dilated at apical fourth (fig. 39) and bent suddenly downward, the pronotum not especially robust, pronotum and elytra always with black stripes. This species has been seen or reported from most of the United States and Canada, including the 11 states mentioned for *striatipennis* (in Jenner, Alberta, and Lake Oko-

boji, Iowa, both *striatipennis* and *costipennis* have been taken together).

The red stripes of *striatipennis*, however, are often black, and sometimes the beak is bent slightly downward at apical fourth, as in certain *costipennis* in which this character is less pronounced (fig. 38). *C. costipennis* never has red stripes above, but is usually red and black below as in *striatipennis*. Both may have the coating in the depressed areas gray,

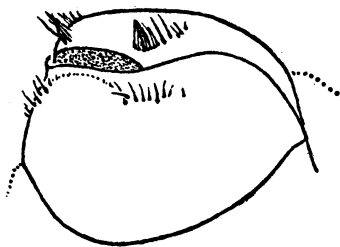


FIG. 36. Hairs at apex of last abdominal segment in *Calendra striatipennis*, ventro-lateral view.

yellow, or red. The proportions of the pronotum in both species, although appearing different, prove to be nearly the same and vary in both. A median glabrous line on the pygidium in *costipennis* was found also to be present, though less evident, in some specimens of *striatipennis*. Thus color, proportions, beak, and pygidium are variable. Concerning the tarsi, in the great majority of cases the dilation of the third segment of the hind tarsi in *striatipennis* is strikingly different from the narrow elongate tarsi of *costipennis*, but in a mixed series of eight specimens from Jenner, Alberta, even this character breaks down. These are all smaller specimens than is usual for either species (8–10 mm.), and they are all similar in coloration (stripes black, coating dull red). Two of the five *striatipennis* specimens have the third segment somewhat dilated and wider than the preceding tarsal segments, but not so wide as long, thus approaching *costipennis*, and one of the latter has the third segment about as wide as long, thus approaching *striatipennis*. It happens that these specimens can be separated by the beak, but this has been shown to be often variable. Another character, however, has been found which has proved constant in 125 male and female specimens of both species examined for

this character. This is the presence, in *striatipennis*, of a line of short yellow hairs on the sides of the apex of the last abdominal segment, near the ridge where this segment turns towards the apex, sometimes only a tuft of hairs at the angle being evident (fig. 36). This small hairy area is lacking in *costipennis*. Both species have tufts of hair at the apex of the pygidium itself, but the hairs described above are on the last abdominal segment.

The other locality where both species were taken together is Lake Okoboji, Iowa. Here all specimens are readily separable by the tarsal character (and also the line of hairs at the apex of the abdomen), but the *striatipennis* are mixed in color, most being mainly black and some with varying amounts of bright red invading the black stripes.

It may be possible that these two species hybridize, but why the tarsi should be affected at one time (Alberta) and the color at another (Iowa), I do not know. More specimens of both species from the same localities might help to clear this problem.

From the study of these species, it seems, at any rate, that the width or dilation of the tarsal segments in *Calendra* is not so important in classification as was formerly thought and that it certainly does not necessarily indicate relationship or lack of relationship. It is true that most of the larger, well-marked species have dilated tarsi and the small generalized ones narrow tarsi, but many species do not fit into this division.

#### *Calendra striatipennis* (Chittenden)

Figures 36, 37, 112

*Sphenophorus striatipennis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 180. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 554.

Medium to large; black or red, coated in depressed areas, pronotum with three raised, bare vittae; elytra with alternate intervals raised, convex, bare to apex. Lateral vittae and elytral stripes often bright red.

Beak (from side) long, compressed, upper contour quite evenly curved throughout, but slightly bent downward before apex, apex beneath a right or obtuse angle, base slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex concave,

base with deep long canal, puncture sometimes appearing double, front of head finely punctured. Eye with lower corner below insertion of beak. No thoracic lobe. Pronotum with three raised, nearly parallel, equal vittae, finely and sparsely punctured, and two side branches, median vitta occasionally somewhat dilated at middle; interspaces less than, or equal to, width of vittae, heavily coated, usually obscuring the sparse punctures which are larger than those on vittae. Scutellum longer than wide, usually concave or grooved. Elytra with odd intervals raised, their strongly convex bare stripes filling the intervals and reaching to apex, with punctures fine (as on pronotal vittae) and in two or three rows, even intervals flat and coated, with one row of fine or slightly larger punctures; striae with regularly placed punctures, larger than those on intervals. Under surface, sides of prosternum with punctures of same size as in pronotal interspaces, but usually sparser, rest below strongly punctured. Ridge on sides at apex of last abdominal segment with short yellow hairs. Front tibiae with outer apical angle not prolonged, all tarsi with third segment widely dilated, flattened, below with hairy pads (rarely third segment on hind tarsi longer than wide). Pygidium with tufts of hair at and before apex. Length, 8–13 mm.

**MALE CHARACTERS:** First abdominal segment, between coxae, with longitudinal patch of hairs on each side.

**TYPE LOCALITY:** No locality specified; type from Chicago, Illinois. Type in the United States National Museum, examined.

**DISTRIBUTION:** Region south of the Great Lakes, also Iowa, North Dakota, Texas, and Alberta, Canada. Nevada, California (Chittenden).

**SPECIMENS EXAMINED:** *Ohio:* 2 ♀. *Indiana:* (Chittenden), 1 ♂ (allotype); Michigan City, June 9, 1934 (C. H. Seevers), 1 ♂. *Illinois:* Glencoe, June 1, 1916, 2 ♀, July 11, 1911 (Blaisdell), 2 ♂, 2 ♀; Vilmete, June 14, 1914 (R. Hoppling), 3 ♂, 4 ♀; Chicago (Chittenden), 1 ♂ (type, U.S.N.M. No. 9727). *Iowa:* Lake Okoboji, June 19, 20, 23 and July 28, 1917 (L. L. Buchanan), 3 ♂, 9 ♀, July 1, 1916 (Stoner), 1 ♀. *Wisconsin:* 1 ♀ (paratype). *North Dakota:* Tower Co., July (?) 5, 1906, 1 ♂. *Texas:* 1 ♂.

Canada. *Alberta:* Jenner, Aug. 5, 1925 (F. S. Carr), 5 ♂; Pot Hill, May 30, 1930, 2 ♂.

**DISCUSSION:** Chittenden, in his description, states that the bright red, raised stripes in *striatipennis* are occasionally black, in "1 to 300." This is not at all the proportion in the present 41 specimens examined, where 13 have black stripes and six others have some black and some red stripes, which would be one in three black, not counting the bicolored ones. However, my black specimens come from but three out of 12 localities, from North Dakota, Alberta, and Lake Okoboji, Iowa. In the first two localities all the specimens are black as in *costipennis*; in the Lake Okoboji series they are black, or red and black, the color being as follows: seven specimens have no red stripes on the pronotum but have some red on the edges of the stripes; on the elytra they have the humeral callosity and the outer marginal stripe red; one specimen has the pronotal side branches red and the elytral stripes red at the base only; five specimens have the lateral pronotal stripes one-half or three-quarters red, the rest black.

The coating may be gray, or yellow, or deep red.

Differs from *costipennis* and *villosiventris* by having hairs on the sides of the apex of the last abdominal segment, the third tarsal segment on the hind tarsi widely dilated, nearly as wide as long (occasionally not so; see discussion of *striatipennis* and *costipennis*); the beak not conspicuously widened at apical fourth or bent suddenly downward, though it is slightly bent, the pronotum and elytra, or either, often with bright red stripes.

#### *Calendra costipennis* (Horn)

Figures 38, 39, 112

*Sphenophorus costipennis* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 420. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 57. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 558.

*Calendra costipennis*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161; 1931, Jour. New York Ent. Soc., vol. 39, p. 180.

*Sphenophorus laevigatus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, pp. 58, 59; 1924, *ibid.*, vol. 26, p. 148.

*Calendra medoraensis* SATTERTHWAIT, 1925, Ent. News, vol. 36, p. 270.

Medium to large; black or red, coated in depressed areas, pronotum with three raised,

bare vittae; elytra with alternate intervals raised, convex, bare to apex.

Beak (from side) long, compressed, upper contour straight until apical fourth, where it is suddenly humped or dilated, then bent abruptly downward to apex, apex beneath a right or obtuse angle, base not or slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex flattened or concave, base with deep, long canal, puncture sometimes appearing double, front of head finely punctured. Eye with lower corner below insertion of beak. Thorax without apical lobe. Pronotum with three raised, nearly parallel, equal vittae, finely and sparsely punctured, and two side branches, median vitta occasionally somewhat dilated at middle; interspaces less than, or equal to, width of vittae, heavily coated, usually obscuring the sparse punctures which are larger than those on vittae. Scutellum longer than wide, usually concave or grooved. Elytra with odd intervals raised, their strongly convex (sometimes feebly convex) bare stripes filling the intervals and reaching to apex, with punctures fine (as on pronotal vittae) and in two or three rows, even intervals flat and coated, sometimes not coated, with one row of fine or slightly larger punctures; striae with regularly placed punctures, larger than those on intervals. Under surface, sides of prosternum with punctures of same size as in pronotal interspaces but usually sparser, rest below strongly punctured. Ridge on sides at apex of last abdominal segment without hairs. Front tibiae with outer apical angle not prolonged, front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it longer than wide, below mostly smooth, with sparse hair at sides (rarely hind third tarsal segment like the front and middle tarsi). Pygidium with tufts of hair at and before apex, sometimes a median glabrous line. Length, 8–13 mm.

**MALE CHARACTERS:** First abdominal segment, between coxae, with longitudinal patch of hairs on each side.

**TYPE LOCALITY:** No locality specified; here designated as Nevada from original label on lectotype, male, new designation, Horn Collection No. 8989, in Academy of Natural Sciences of Philadelphia, examined.

**DISTRIBUTION:** All the United States and most of Canada.

**SPECIMENS EXAMINED:** *Massachusetts:* Framingham, June 4, 1940 (C. A. Frost), 1 ♀. *New Hampshire:* Franconia, 1 ♂. *Connecticut:* Cornwall, Sept. 30, 1920 (K. F. Chamberlain), 5 ♂, 1 ♀. *New York:* 1 ♀; Long Island, 1 ♀; New York City and vicinity, 1 ♀; Manhattan, June 8, 1940, 1 ♂; Ithaca, May, 1928 (Chittenden), 1 ♀; Buffalo, 1 ♀; Rockaway, July 14, 1917, 1 ♀; Flatbush, June 6, 1893 (J. L. Zabriskie), 1 ♀. *New Jersey:* 1 ♀; Snake Hill, 2 ♂; Arlington, 1 ♂; Woodcliff Lake, May 20, 1934, 1 ♂, 1 ♀. *South Carolina:* Myrtle Beach, Horry Co., Apr. 22, 1919 (E. R. Kalmbach), 1 ♂. *Indiana:* 2 ♂, 3 ♀; Chesterton, July 10, 1934 (T. Craig), 1 ♂, 1 ♀; Michigan City, June 9, 1934 (C. H. Seevers), 1 ♀; Dune Park, July 7, 1934 (C. H. Seevers), 3 ♀; Hammond, July 11, 1918, 1 ♀. *Illinois:* 1 ♂, 5 ♀; Chicago (F. H. Chittenden), 1 ♀; Spring Grove, May 30, 1938 (Mohr and Burke), 1 ♂; Winnetka, June 18, 1911, 1 ♂, 1 ♀; Willow-spring, June 11, 1921, 3 ♂; northern Illinois, June, 1901 (W. Bebb), 1 ♂, 1 ♀. *Michigan:* Agricultural College, Oct. 27, 1922 (L. A. Gentner), 1 ♂; Houghton Lake, June 15–18, 1935 (T. H. Frison), 1 ♀; Washtenaw Co., July 5, 1921 (E. Herbold), 1 ♀. *Wisconsin:* Beaver Dam, May 7, 1911 (W. E. Snyder), 1 ♂, 2 ♀. *Minnesota:* Park Point, Duluth, June 15, 1940 (Gertsch and Hook), 1 ♂. *Iowa:* Lake Okoboji, June 24, 1916, June 20, 29, 1917, June 22, 1946 (L. L. Buchanan), 2 ♂, 2 ♀; Elma, 1 ♀. *Kansas:* Western Kansas (Popenoe), 1 ♀; Medora, May 12, 1893, 1 ♂, 1 ♀ (holotype and allotype, *medoraensis*, U.S.N.M. No. 27827). *Missouri:* St. Louis, 1 ♀, (E. Fischer), 1 ♂, 3 ♀. *Texas:* Brownsville, 1 ♂. *Colorado:* 2 ♂ (cotypes, *costipennis*, Horn Coll. No. 8989). *Utah:* Salt Lake, June 14, 2 ♂ (cotypes, *costipennis*, Horn Coll. No. 8989), June 3 (Hubbard and Schwarz), 1 ♂ (type, *laevigatus*, U.S.N.M. No. 8230), 1 ♂, 2 ♀ (paratypes, *laevigatus*), June 4 (Hubbard and Schwarz), 1 ♂, 1 ♀; 1 ♀. *Nevada:* 1 ♂ (lectotype, *costipennis*, Horn Coll. No. 8989). *Idaho:* Priest River, June 21 (Wickham), 1 ♂; Coolin, Priest Lake, July 22, 1927 (E. C. Van Dyke), 1 ♀; Clarks Fork, lower Kootenay R., 1 ♀. *California:* 1 ♂; Branscomb, July 1, 1941, 1 ♀; Feather R., Butte Co., Highway 24, June 14, 1940 (M. Cazier, T. Aitken), 1 ♀; Big Pine, June, 1 ♂; Fort Seward, May 31, 1935 (E. W. Baker), 1 ♂, June 1–6, 1935 (H. J. Rayner), 4 ♂, 2 ♀, June 1–14, 1935 (E. O. Essig), 2 ♂, 7 ♀. *Oregon:* Cannon Beach, June 9–15, 1927 (E. C. Van Dyke), 2 ♂, 2 ♀; Multnomah Falls, July 4, 1942 (B. Malkin), 1 ♀; Multnomah Co., Sauries (?) Island, May 5, 1931 (R. L. West), 1 ♂; Granite, Lake Creek, July 5,

8, 1942, 4400 ft. (J. H. Baker), 1 ♂, 1 ♀; Pacific City, July 23, 1942 (K. M. and D. M. Fender), 2 ♀. *Washington*: Newman Lake, Spokane Co., July 9, 1927 (E. C. Van Dyke), 1 ♂, June 11, 1922 (M. C. Lane), 1 ♂.

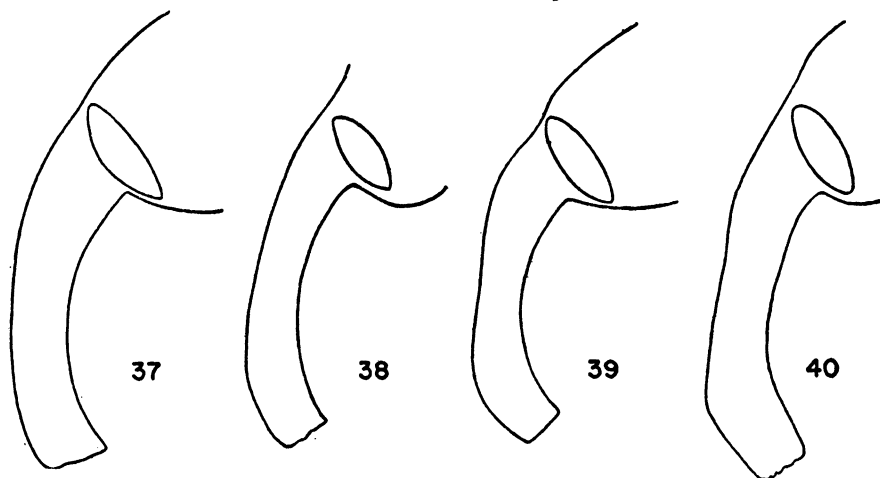
Canada. 1 ♀. *Quebec*, June 17, 1938 (G. Stace Smith), 1 ♂. *Ontario*: Prince Edward Co., June 28, July 1, 1933 (Brimley), 1 ♂, 1 ♀; Lannon [?] Co., June 16, 1935 (Brimley), 1 ♀. *Manitoba*: Winnipeg (Wickham), 1 ♂. *Saskatchewan*: Earl Grey, May 31, 1925 (J. Ritchie), 1 ♀. *Alberta*: Jenner, May 8, 1915, 2 ♂, 1 ♀; Medicine Hat, May 8 (F. S. Carr), 2 ♂, 2 ♀; Edmonton, Apr. 21, 1919 (F. S. Carr), 1 ♀. *British Columbia*: Enderby, May 29, 1941 (B. Malkin), 2 ♂, 1 ♀; Salmon Arm, May 1, 1930, May 16, 1932 (H. B. Leech), 3 ♂, 2 ♀.

**DISCUSSION:** The type and paratypes of Chittenden's *laevigatus*, described from Salt Lake, Utah, and subsequently taken in New York City, New Jersey, Long Island (the latter determined as *laevigatus* by its author), Winnipeg, Manitoba, and Big Pine, California, are separable from *costipennis* only by the lack of coating on the even intervals of the elytra and the somewhat lesser amount of coating on the pronotal interspaces. This variability in the amount of coating occurs also in other species, such as *venatus*, *phoeniciensis*, *destructor*, and *parvula*, and is not a diagnostic character unless supported by other characters. In this instance, also, the same even interval may be uncoated part of the way and coated the rest. This species is therefore considered synonymous with *costipennis*.

*Calendra medoraensis* Satterthwait is also synonymous with *costipennis*. It was described from two specimens from Medora, Kansas, both of which have been examined and which match *costipennis* in all characters.

Like some of the other wide-ranging species (*aequalis*, *australis*, *destructor*, and *robusta*), *costipennis* varies greatly in a number of respects. Especially variable are the third tarsal segment on the hind legs and the contour of the beak. In most specimens there is no doubt about the narrowness of the tarsal segment, which is almost twice as long as wide and scarcely wider at the apex than the preceding segments. However, there are many gradations in the width of the apex of this segment. Thus a male and female from Medicine Hat, Alberta, have the third tarsal segment longer than wide, but proportionately wider than in two other specimens from the same locality. This segment is nearly always at least a little longer than wide except in a specimen from Jenner, Alberta, where it is equally as wide as long (see discussion of *costipennis* and *striatipennis* above). This segment further varies in sometimes having the sparse hairs below forming a thick hairy pad as on the front and middle legs. An otherwise typical individual from Spring Grove, Illinois, has such a pad.

The beak is occasionally as exaggeratedly humped and bent down before the apex as in *villosiventris* (fig. 40) and sometimes not at all, as in *striatipennis* (fig. 37). In a series of nine specimens from Fort Seward, Califor-



FIGS. 37-40. Diagram of beaks. 37. *Calendra striatipennis*, male. 38. *C. costipennis*, female. 39. *C. costipennis*, male. 40. *C. villosiventris*, female.

nia, all of which have the hind third tarsal segment definitely narrow, some of the beaks are bent abruptly at apical fourth, some are as in *striatipennis*; two of the three Enderby, British Columbia, specimens have the beak more as in *striatipennis*. The width and convexity of the elytral intervals, the color of the coating, the shape of the pronotum, and the size also vary greatly.

The combination of characters given in the key to the species (p. 53) usually separates this species from *villosiventris*, to which it is closely related, but the beak, scutellum, and the extent of the elytral stripes may vary in both species, and, if they vary in a female specimen, then separation may be difficult. Differs from *striatipennis* by having no hairs on the sides of the apex of the last abdominal segment, the third tarsal segment on the hind tarsi narrower, the beak bent suddenly downward at apical fourth.

**BIOLOGY:** This species develops in two members of the sedge family (Cyperaceae), *Scirpus validus*, the tule, and *Carex comosa*, the bristly sedge. According to Satterthwait (1931a, p. 164) the former is the preferred host. One of the enemies of this species, according to Chittenden (1924, p. 155), is the upland plover (*Bartramia longicauda*) which feeds on a number of other billbugs. Another enemy is *Anaphoidea calendrae* Gahan, a small, hymenopterous insect which was found by Satterthwait (1931b, p. 180) to parasitize the eggs of a number of species of *Calendra*.

***Calendra villosiventris* (Chittenden)**

Figures 40, 113

*Sphenophorus villosiventris* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 58, fig. 10. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 558.

Large, robust; black or partially red, coated in depressed areas, pronotum with three raised, bare vittae, elytra with alternate intervals raised, convex, bare, but abbreviated before apex.

Beak (from side) long, compressed, upper contour straight until apical fourth, where it is suddenly humped or dilated, then bent sharply down to apex, apex beneath a right or obtuse angle, base slightly swollen over

antennal insertion, fovea present in front of eye; (from above) apex variable, base with deep, long canal, front of head scarcely punctured. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three raised, nearly parallel, equal vittae, finely and sparsely punctured, and two oblique side branches, median vitta occasionally somewhat dilated at middle; interspaces less than, or equal to, width of vittae, heavily coated, usually obscuring the sparse punctures which are larger than on vittae. Scutellum usually nearly as wide as long, flat. Elytra with odd intervals raised, their feebly convex bare stripes not quite filling the intervals and tapering off before the apex, with punctures fine (as on pronotal vittae) and in two or three rows, even intervals flat and coated, with one row of fine or slightly larger punctures; striae with regularly placed punctures, larger than those on intervals. Under surface, sides of prosternum with punctures of same size as in pronotal interspaces but usually sparser, rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged, front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with tufts of hair at and before apex. Length, 11–12 mm.

**MALE CHARACTERS:** Last abdominal segment with fine hairs in center (seen best in profile), also some hairs on other segments and on metasternum, but usually worn off.

**TYPE LOCALITY:** No locality specified; type from Buffalo, New York. Type in the United States National Museum, examined.

**DISTRIBUTION:** Northeastern states south to Virginia, west to Wisconsin and Illinois.

**SPECIMENS EXAMINED:** *New York:* Buffalo, 1 ♂ (type, U.S.N.M. No. 8225); Westport, May 20, 1921, 1 ♂; Fire Island, June 25, 1941 (B. D. Valentine), 1 ♀; Pine Island, June 17, 1911 (C. L. Pollard), 1 ♀; Long Beach, Long Island, 2 ♂, 1 ♀; Yonkers, May 30, 1940, 1 ♀. *New Jersey:* Green Village, June 19, 1 ♀; Snake Hill, 2 ♂. *Rhode Island:* Watch Hill, June 28, 1909 (W. Robinson), 1 ♀. *Connecticut:* Litchfield, Sept. 3, 1901 (L. B. Woodruff), 1 ♀. *New Hampshire:* Franconia, 1 ♂. *Indiana:* Hessville, May 30, 1915 (F. J. Psota), 1 ♂. *Illinois:* Volo, July 1, 1942 (Ross and Mohr), 1 ♀, "in pitcher plant." *Wisconsin:* Cranmoor, Wood Co., Aug. 20, 1907 (C. B. Hardenberg), 1 ♂.

**DISCUSSION:** This species is closely related to both *costipennis* and *striatipennis* and occurs in some of the same areas. The beak and third tarsal segment do not vary as in the other two species, but there are other variations. In two of 11 specimens each interspace on the pronotum is as wide as the median vitta; in the others all the vittae are wider than the interspaces. The raised stripe on the elytral suture reaches all the way to the apex in all, but in five of the 11 specimens the stripe on the third interval fails to reach the apex except as a series of broken dots. The fifth interval stripe is narrower than the third and about the same length or shorter; the seventh interval has a still narrower stripe, often interrupted, but usually reaching to the bare shiny spot on the apical callosity. The specimen from Yonkers, New York, has the elytral stripes entire and filling the interval, as in *costipennis*, but the beak and scutellum are as in *villosiventris*.

Differs from *costipennis* and *striatipennis* in the broader, flatter, not grooved scutellum, by having the elytral stripes generally shorter, less convex, and narrower, the elytral callosities usually less prominent because of more coating in that region, the upper contour of the beak near the apex with a more exaggerated hump (fig. 40), the male with the ventral cavity sparsely hairy but not with hairs in a longitudinal patch between the coxae, the apex of the penis not concave (fig. 113). Differs further from *striatipennis* by having the third tarsal segment on the hind legs much narrower and by lacking the row of hairs at the sides of the apex of the last abdominal segment.

In addition to the specimens examined, this species has been reported from Maryland, Virginia, and the District of Columbia.

#### ***Calendra latinasa* (Horn)**

##### Figure 59

*Sphenophorus latinusus* HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 421. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 554.

Large, robust; black, coated in interspaces, pronotum with three raised, bare vittae; elytra with basal two-thirds of third interval raised, convex, bare.

Beak (from side) rather short, compressed,

top contour straight part way, then dilated to two and one-half times the width at middle and bent sharply downward towards apex, apex beneath obtusely angled, base not swollen over antennal insertion, fovea present in front of eye; (from above) base with deep canal. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three strongly raised, nearly parallel, finely and sparsely punctured vittae, and two side branches; lateral vittae sometimes slightly sinuous, median slightly wider at middle; interspaces about same width as vittae, heavily coated with grayish yellow, punctures larger than on vittae. Scutellum narrower than long. Elytra with third interval raised, convex, bare for two-thirds of its length, very finely punctured, fifth and seventh often with raised, narrow, black stripe in middle portion, even intervals flat and heavily coated; striae with small punctures. Under surface with large dense punctures, obscured by coating. Legs, front tibiae with outer apical angle not prolonged, all tarsi with third segment widely dilated, flattened, below with hairy pads. Pygidium with hairs in apical punctures and tufts of hairs at sides of apex. Length, 10–13 mm.

**TYPE LOCALITY:** Georgia. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Georgia, Alabama, Mississippi.

**SPECIMENS EXAMINED:** *Alabama:* Springhill, Apr. 7, 1923, 1 ♀. *Mississippi:* Fontainebleau, 7 miles east of Ocean Springs, May 10, 1931 (H. Dietrich), 1 ♂ "under log on beach." *Georgia:* 1 ♂ (type, M.C.Z. No. 1039).

**DISCUSSION:** This rather rare species is distinct from all others of the genus in the enormous widening of the apex of the beak (fig. 59). The elytra most resemble those of *costicollis*, but *latinasa* seems closer to *villosiventris*, the beak being an extreme form of the already extreme beak of *villosiventris*. It differs further from *villosiventris* by having the third tarsal segment widely dilated on all tarsi and with hairy pads below.

#### ***Calendra costicollis* (Chittenden)**

##### Figure 42

*Sphenophorus costicollis* CHITTENDEN, 1919, Proc. Biol. Soc. Washington, vol. 32, p. 269.

*Sphenophorus costicollis* var. *callosipennis* CHITTENDEN, 1919, *loc. cit.*

*Calendra costicollis* var. *callosipennis*, SATTERTHWAIT, 1931, *Ann. Ent. Soc. Amer.*, vol. 24, p. 159.

Large, robust; black or red, coated, three raised, bare stripes on pronotum, elytra with suture and basal half of third interval raised, convex, bare.

Beak (from side) very long, compressed, top contour evenly curved throughout or somewhat bent downward at apical third, beak somewhat wider just before apex, apex beneath forming right angle, base slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex flattened, base with wide canal (often encrusted), front of head with scarcely visible punctures. Eye extending below insertion of beak. Weak thoracic lobe. Pronotum with three strongly raised, parallel, equal vittae, sparsely and finely punctured, and two nearly obsolete side branches, interspaces one and one-half to twice as wide as vittae, so coated as to obscure punctuation. Scutellum narrower than long. Elytra with suture and basal half of third interval raised, convex, bare (occasionally entire elytra coated), their punctures fine and sparse, as on pronotal vittae; other intervals flat and heavily coated; striae with small round punctures usually separated by at least twice the diameter of the puncture. Under surface, sides of prosternum with very large punctures. Legs, front tibiae with outer apical angle not prolonged; all tarsi with third segment widely dilated (hind tarsi with it sometimes less dilated than on front and middle), flattened, below with hairy pads. Pygidium at apex with two oblique rows of yellow hairs, sometimes with impunctate median line. Length, 10.5–14 mm.

MALE CHARACTERS: Pygidial hairs extending beyond apex.

TYPE LOCALITY: New Orleans, Louisiana. Type in the United States National Museum, examined.

DISTRIBUTION: South central states north to Illinois.

SPECIMENS EXAMINED: *Louisiana*: New Orleans, Apr. 26, 1918 (T. H. Jones), 1 ♀ (type, *costicollis*, U.S.N.M. No. 22775). *Missouri*: St. Charles, Sept. 1, 1922 (R. A. Blanchard), 1 ♂, "*Carex lacustris*," (H. E. Roberts and Blanchard),

1 ♀, "*Carex lacustris*"; Dudley, Mar. 29, 1919 (Satterthwait), 2 ♂ (type and allotype, var. *callosipennis*, U.S.N.M. No. 26776), 1 ♀ (paratype, var. *callosipennis*); Cliff Cave, Apr. 11, 1928 (R. C. Lange), 1 ♂ "from *Elymus* clump." *Illinois*: Mitchell, Aug. 30, 1922 (R. C. Lange), 1 ♀, "*Carex lacustris*."

DISCUSSION: The type and six other specimens of the variety *callosipennis* seem to be inseparable in all essential characters from the type and only specimen of *costicollis*. According to Chittenden, the apical and basal callosities on the elytra in the type of *costicollis* and the base of the third elytral interval are not exposed and shining black as they are in the variety, nor are they elevated. It seemed to me, however, that they were elevated, although obscured by the coating. Subsequent to my examination of the type of *costicollis*, Dr. L. L. Buchanan was kind enough to decrease it, and reported that, although no shining black areas were exposed, the apical and basal callosities were, in his opinion, "essentially the same as in *callosipennis* except that they are covered with that peculiar sericeous coating . . ." To test the extent to which this coating could be rubbed or worn off, a specimen of "*callosipennis*" at the American Museum of Natural History was brushed with a creolin solution. This treatment resulted in the further uncovering of the bare basal stripe on the third elytral interval so that it extended nearly to the apical callosity instead of just halfway to it. In a number of species, such as *C. venatus*, *robusta*, *australis*, *pertinax*, and others, individuals occur with more or with less coating which alternately covers or uncovers the elevations or irregularities of the elytral sculpture.

Chittenden said that his variety ("*callosipennis*") might be considered a "geographical race," but, in addition to the fact that there is but one known specimen of *costicollis*, the "variety" occurs up and down the Mississippi Valley and seems to include New Orleans (type locality of *costicollis*) in its distribution.

Dorsally, *costicollis* is quite similar to *latinasa*, but differs from it in the much longer, not apically dilated, beak. Differs from *villosiventris* by having the third tarsal segment on the hind tarsi widely dilated, the pronotal



vittae more widely separated, the beak more curved and not strongly bent downward before the apex. Differs from *pertinax* and *australis* also in the dilated hind tarsi. Chittenden compared it with *robusta*, which differs principally by having the elytral intervals flat and the prosternum less densely punctured.

Additional specimens have been reported in the literature from Kansas, Arkansas, and Mississippi.

**BIOLOGY:** Sedges are the host plants for this species, especially the lake-bank sedge (*Carex riparia*) which is also the preferred host plant for *C. scoparia*. The others are *Rhynchospora corniculata*, the preferred host plant of *C. cariosa*, and four other sedges of the genus *Carex*, *crus-corvi*, *lupuliformis*, *lupulina*, and *vesicaria* (Satterthwait, 1931a). The St. Charles, Missouri, and the Mitchell, Illinois, specimens were taken from still another sedge, *Carex lacustris*.

In the adult stage this species has been found to feed on corn planted near sedges. The Cliff Cave, Missouri, specimen was taken from *Elymus*, or wild rye, a grass.

#### *Calendra pertinax* AND *Calendra australis*

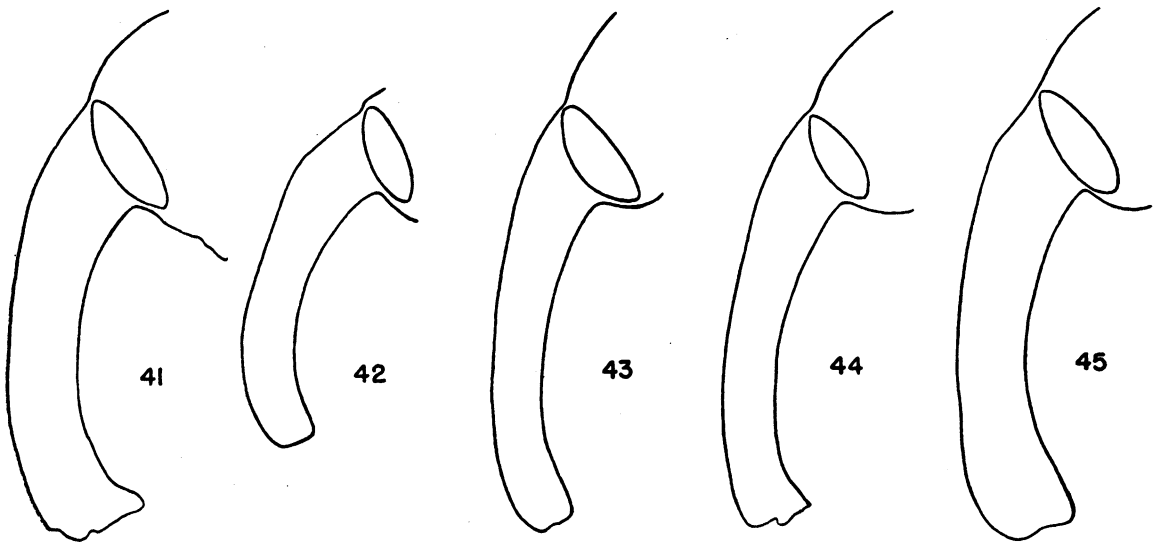
Examination of the type of *pertinax* Olivier, 1807, showed it to be not the widespread cattail-breeding and corn-damaging species assumed to be *pertinax* by Horn, Blatchley, Chittenden, Satterthwait, and others, but the species breeding in salt reed grass (*Spartina*), of more restricted and more coastal distribution, described by Chittenden in 1905 as *setiger*, which has been found to be a synonym of *pertinax*. Since *pertinax* and *setiger* are the same species, a name is therefore needed for the other species, which is so well known for its injuries to corn. The first name available is Chittenden's *australis*, 1905, a species he described as a variety of "*pertinax*," but which is not the *pertinax* of Olivier.

From a rereading of the descriptions of Olivier's *pertinax* by subsequent writers, it can be seen that both Say (1831) and Gyllenhal (1838) had before them specimens similar to the type. But Horn (1873), whose series from which he wrote his redescriptions I have seen, had not only the true *pertinax*,

but also specimens of *maidis*, *australis*, and *abrasa*, all of which he misidentified as the same species. His statements, that the intervals of the elytra were "eroded so that an aspect of catenulation is produced," that the species was "injurious to corn," and "occurs in California," apply to one or both of the other species, but not at all to *pertinax*. Thus he started the error in identification that has persisted to date. *C. pertinax* and *australis* are superficially very similar, and they are both extremely variable in elytral pattern, so that the early descriptions could be construed as applying to either one, depending on which species one had in mind. Thus Olivier and Gyllenhal say the elytral intervals are elevated, bare, and shining. This is true of both species concerning the odd intervals (1-3-5), and is true of some *pertinax* and of some *australis* as regards the even intervals (2-4-6). But the important difference between the two species in respect to the even intervals is not whether or not they are elevated, but in what way they are elevated (as irregular patches in *australis*, as attenuated lines in *pertinax*).

There are three other characters by which the two species can be separated. One is the shape of the beak and its apical angle, not mentioned by Olivier, Gyllenhal, or Say, and the two others appear in the male only: the genitalia (figs. 114, 115), which are distinctly different, and the presence in *pertinax* of a transverse brush of hair on the second abdominal segment. These characters are not mentioned in the early literature and therefore Chittenden, who had no opportunity of seeing the type of *pertinax*, thought he was describing a new species in *setiger*. The type of *setiger*, however, agrees perfectly with the type of *pertinax* except that the latter is a female and so lacks the abdominal brush of hair. Unfortunately, since 1905 and the description of "*setiger*," there has been published much economic literature on the habits, food plants, and biology of the billbugs, and in all this literature modern readers must remember that references to "*setiger*" should read *pertinax* and references to "*pertinax*" should read *australis*.

**DISTRIBUTION AND DIFFERENCES BETWEEN SPECIES:** *Calendra australis* is the more widespread species, occurring through-



FIGS. 41-45. Diagram of beaks. 41. *Calendra maidis*, female. 42. *C. costicollis*, male. 43. *C. australis*, female. 44. *C. pertinax*, female. 45. *C. aequalis*, female.

out the United States and southeastern Canada, and in Puerto Rico. The range of *C. pertinax* includes the northeastern states west to South Dakota and the southeastern states west to eastern Texas. *C. pertinax* differs from *australis* by having the beak laterally compressed, not almost cylindrical as in *australis*, not narrower at the apex but usually slightly wider, and the apex beneath a sharp angle, not rounded (figs. 43, 44). The slight depression of concentrated punctures in front of the eye in *australis* is not nearly so marked as in *pertinax*. The elytra in *australis* have irregular black patches on the even intervals or they are solidly black, but they have not the raised, attenuated black stripes, sometimes nearly obsolete, that characterize *pertinax*. The third tarsal segment on the middle legs in *australis* is less dilated than on the front legs, and one of the hairy pads below is wider than the other; in *pertinax* the hairy pads are of the same width, and the middle tarsi are about as dilated as the front ones. The male of *australis* has no transverse brush of hairs on the second abdominal segment as in the male of *pertinax*, nor a narrow row of thick hairs on the sides of the metasternum, outlining the deep ventral cavity, and the apex of the penis is truncate, slightly concave, not prolonged into an acute point. There are some hairs on the inside of the front and mid-

dle femora in *australis* (male and female), and tufts on the coxae, but these hairs are sparse and fine, whereas in *pertinax* they are thick and dense, especially so in the male; in addition, *pertinax* males and females have hairs on the front and middle trochanters and on the hind femora within.

In spite of these many differences, these two species, when seen from above and especially when the pattern is obscured through greasing, appear remarkably alike. They differ from *C. costicollis* by having the third tarsal segment on the hind legs much narrower, longer than wide, with only sparse hairs, not hairy pads, below.

#### *Calendra pertinax*

Figures 44, 46, 114

#### DESCRIPTION OF THE SPECIES

Medium to large; black or red, coated in depressed areas, pronotum with three raised, bare vittae, sometimes touching; elytra with raised, bare, attenuated stripes reaching part or all the way to apical callosity, often lacking or much abbreviated on even intervals.

Beak (from side) long, compressed, curved, wider at apex, apex beneath forming right angle, base slightly swollen over antennal insertion, fovea present in front of eye; (from above) apex more or less concave, base with

distinct, sometimes indistinct, impressed line extending forward, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three raised, bare vittae of variable widths, sparsely and finely punctured, and two side branches, sometimes vittae touching in one or two or more spots; lateral vittae usually sinuous on inner side, median gradually dilated towards middle; interspaces very narrow to very broad, coated, punctures large, round, irregularly placed, sometimes merging at base, often obscured by coating. Scutellum narrower than long, somewhat concave. Elytra variable, odd intervals raised, convex, and bare either about halfway to apex or nearly to apex, even intervals either raised, convex, and bare, or partially coated, showing only abbreviated, narrow, bare stripes, or almost entirely coated and without evident bare stripes; interval punctures fine, sparse; striae with small round punctures. Under surface, sides of prosternum nearly impunctate, the rest strongly punctured. Legs, front tibiae with outer apical angle not prolonged, but outer side sinuous before apex, front and middle tarsi with third segment

widely dilated, flattened, below with hairy pads, hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of hairs at apex. Length, 10.5–17 mm.

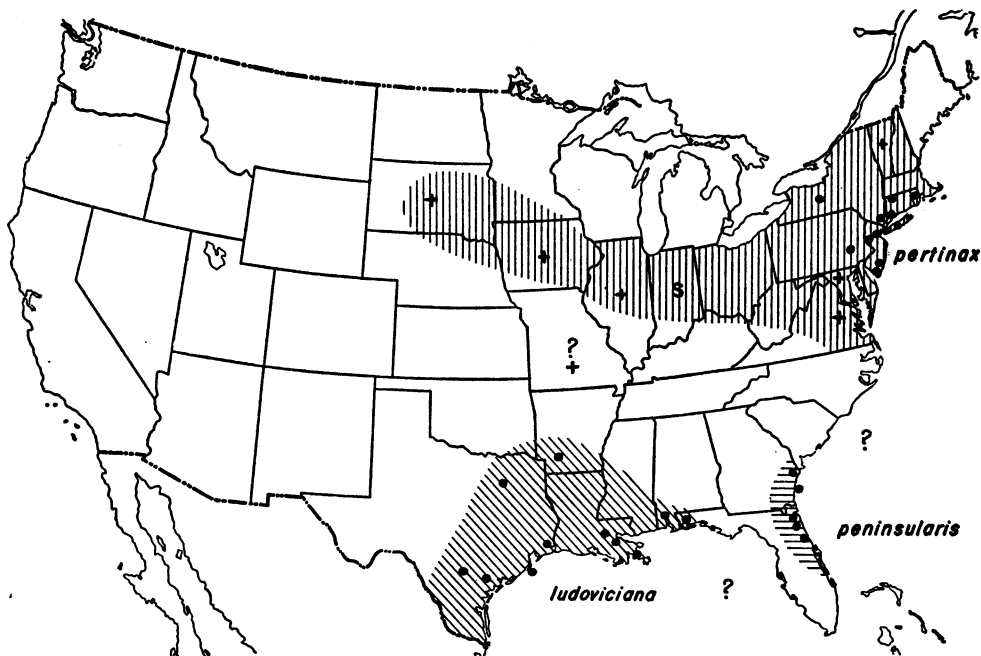
**MALE CHARACTERS:** Second abdominal segment with a transverse brush of stiff hairs at middle; first abdominal segment and metasternum at sides with a narrow, longitudinal band of short hairs; apex of abdomen with depression.

#### DISTRIBUTION

Eastern states west to the Mississippi River, also Iowa, South Dakota, Texas, Arkansas, and Missouri.

#### DISCUSSION

This species is divisible into three subspecies: nominate *pertinax* in the northeast, south to Virginia and west to the Dakotas; *peninsularis* in Georgia and eastern Florida; and *ludoviciana* in western Florida, the Gulf states, and Arkansas. These forms, in addition to structural similarities (shape of beak, tibiae, pygidium, tarsi), all possess the same striking male characters, which are: a short



● and S = specimens examined (S = no locality given in state), + = from the literature

FIG. 46. Distribution of *Calendra pertinax*. For explanation of ?, see text.

TABLE 6  
COMPARISON OF THE SUBSPECIES OF *Calendra pertinax*

<i>ludoviciana</i>	<i>pertinax</i>	<i>peninsularis</i>
Larger; range, total length, 17 specimens, 12–16 mm., average, 14.3 mm.	Smaller; range, total length, 17 specimens, 10.5–14 mm., average, 12 mm.	Larger; range, total length, five specimens, 13.5–17 mm., average, 14.5 mm.
Pronotal vittae scarcely separated, almost always touching at one or more spots (33 of 34 specimens)	Pronotal vittae usually distinctly separated, but in 7 of 45 specimens they touch at one or more spots	Pronotal vittae always widely separated
Bare elytral stripes longer, present on all intervals, first six from suture reaching middle of apical callosity in 15 of 22 specimens	Bare elytral stripes shorter, often narrowed or nearly obsolete on even intervals and reaching middle of apical callosity in only five of 63 specimens	Bare elytral stripes shorter, usually lacking on even intervals, present but often nearly obsolete at basal half of odd intervals (four specimens)
Beak usually same length as pronotum or, in female, longer	Beak usually either shorter than pronotum or same length	Beak, three males, same length as pronotum in two, longer in one
Not coated on sides below	Not coated on sides below	Coated on sides below
Recorded host plant, <i>Zizaniopsis miliacea</i> (Michaux) Döll and Ascherson	Recorded host plant, <i>Spartina cynosuroides</i> (Linnaeus) Roth	No host plant recorded

transverse brush of hairs on the second abdominal segment; a markedly deep metasternal cavity, with a longitudinal line of hairs on the ridge on each side of the cavity; a depression at the apex of the abdomen; an acute, prolonged, triangular apex to the penis unlike any other in the genus; the apical margin of the segment that encloses the penis definitely bilobed, causing a V-shaped emargination in the middle. (Certain genitalic differences between these forms, given by Satterthwait, 1933, p. 216, are not confirmed by my examination.) The above evidence of similarity and the examination of 239 specimens for these and other characters make it impossible to consider these any longer as separate species.

There are no records of nominate *pertinax* south of Virginia and none of *peninsularis* north of Georgia, nor have any specimens been seen from the area between the range of the latter subspecies and that of *ludoviciana*. I have seen *ludoviciana* from Arkansas, and it has been reported as far north as Missouri (Satterthwait, 1932, p. 19), but this latter record might possibly be nominate *pertinax*, and for this reason it has not been included on the map (fig. 46) with either subspecies. *C. p. pertinax* has been recorded as far west as Iowa (Bleasdel, 1937, p. 441) and from Il-

linois and South Dakota (Chittenden, Blatchley), and these records have been accepted. The reports of some of these inland specimens of *pertinax* were questioned by Satterthwait (1933, p. 213, as "*setiger*"), who doubted their proper labeling. I have not seen specimens from these states, but I have seen a specimen from Indiana, one from Allentown, Pennsylvania, and one from Ithaca, New York, the latter being one of the paratypes of "*setiger*." Including those given by Satterthwait and the Bleasdel record, this makes quite a few inland records, and I believe that, even though the center of nominate *pertinax* distribution is undoubtedly the coastal areas around New York and New Jersey, these isolated inland records must be accepted. In support of this conclusion Lamson-Scribner, in "American grasses" (1900, p. 179), says that the genus *Spartina* is represented in the saline regions of the Great Plains and that *S. cynosuroides* (the host plant of nominate *pertinax*) occurs on river banks and lake shores as well as on the coast from "Maine and Nova Scotia to Assiniboia and Oregon, south to New Jersey, western Tennessee, Texas, and Colorado."

REMARKS ON TABLE 6: The stripes, or vittae, never actually merge across the disc as in some other species (*australis*, *aequalis*),

but they touch when the black of the vittae crosses the coated interspace. This may happen at any point along the median vitta.

The beaks were measured on the top contour from the apex to the top of the eye. Whether the beak is as long as, shorter than, or longer than, the pronotum can be tested by measurement with an eye-piece micrometer; judgment by the eye alone is deceiving and unreliable, since the difference between beak and pronotum in all subspecies is never more than 1 mm., usually much less than that.

Only one of 122 specimens of *pertinax* had no visible trace of a stripe on any of the even intervals, which were covered with coating throughout, but a number of specimens lacked the stripe on the first even interval.

#### BIOLOGY OF THE SPECIES

Only two host plants have been recorded, both in the Gramineae, or grass family: *Spartina cynosuroides*, or salt reed grass, for nominate *pertinax*, and *Zizaniopsis miliacea*, or knife flag, for *ludoviciana*. No data have been recorded for *peninsularis*.

Satterthwait (1933, p. 215) reared this species in the laboratory in cornstalk pith, which shows its adaptability and its potential destructiveness to corn. He also reported that five individuals were found in the stomach of a laughing gull at Cedar Island, Virginia. Numerous cases of injury to poultry have been recorded from Texas (Satterthwait, 1932, p. 5). The injury occurs when the fowl cannot rid itself of the stubbornly clinging beetle it has taken into its mouth. Damage to the tongue or mouth membranes or even death may result.

#### KEY TO THE SUBSPECIES OF *Calendra pertinax*

1. Pronotal vittae separated by at least twice their own width; coating present ventrally (Georgia, eastern Florida) . . . *peninsularis*
- Pronotal vittae separated by their own width or less; no coating ventrally . . . . . 2
2. Vittae usually distinctly separated; all elytral intervals with shorter raised stripes, the first six not reaching the middle of the apical callosity; stripes on even intervals much narrower than on odd and often broken into dots, sometimes lacking (northeast) . . . . . *pertinax*
- Vittae always touching at one or more places; all elytral intervals with long raised stripes,

the first six usually reaching middle of apical callosity or beyond; stripes on even intervals never lacking (western Florida, Gulf states, Arkansas) . . . . . *ludoviciana*

#### *Calendra pertinax pertinax* (Olivier)

*Calendra pertinax* OLIVIER, 1807, Entomologie, vol. 5, p. 90, pl. 28, fig. 417.

*Sphenophorus pertinax*, GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 938.

*Rhynchophorus truncatus* SAY, 1831, Description of new species of Curculionites of North America, p. 22.

*Sphenophorus canaliculatus* BOHEMAN, 1845, in Schoenherr, Genera et species curculionidum, vol. 8, pt. 2, p. 253.

*Sphenophorus setiger* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 55. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 557.

*Calendra setiger*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161; 1933, Jour. Econ. Ent., vol. 26, pp. 210-217. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 441.

*Sphenophorus setiger* var. *intervallatus* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 148.

*Sphenophorus peninsularis* var. *nasutus* CHITTENDEN, 1924, loc. cit.

TYPE LOCALITY: "Amérique septentrionale"; here restricted to New Jersey. Type in Stockholm museum, examined.

DISTRIBUTION: Northeastern states south to Virginia and west to Iowa and South Dakota.

For description, see table 6 under the species.

SPECIMENS EXAMINED: *Massachusetts*: Beverly, May 27, 1868, 1 ♂. *Rhode Island*: Watch Hill, June 30, 1909 (W. Robinson), 1 ♀. *Connecticut*: Stamford, May 30, 1938, 1 ♂; Lakeville (A. T. Gaul), 1 ♀. *New York*: 1 ♂, 1 ♀; (Schaeffer), 1 ♀ (paratype, *peninsularis* var. *nasutus*); New York City and vicinity, 1 ♂ (allotype, *setiger*), May 30, 1893, 1 ♀ (type, *peninsularis* var. *nasutus*, U.S.N.M. No. 26907); Yonkers, Aug. 18, 1929 (C. L. Ragot), 1 ♀. *New Rochelle*, May 1, 1941, 2 ♂; Pelham Bay Park, June 12, 1940, 1 ♀; Ithaca (Chittenden), 1 ♀ (paratype, *setiger*); *Long Island*: Astoria, Apr. 14, 1927 (C. L. Ragot), 2 ♂, 1 ♀; Fire Island, June 6, 25, and Sept. 4, 1941 (B. D. Valentine), 3 ♂, 1 ♀; Jones Beach, May 7, 1941 (Wm. Spector), 34 ♂, 17 ♀, May 30, 1945 (P. Vaurie), 1 ♀; Long Beach, May 31, 1948 (P. Vaurie), 1 ♀, June 20, 1926 (A. Nicolay), 4 ♂, 2 ♀; Far Rockaway, June 4, 1904, 1 ♂,

2 ♀; Rockaway Beach, 2 ♂, 6 ♀; June 1, 1912 (C. L. Pollard), 2 ♂, May 19, 1918, July 14, 1917 (L. B. Woodruff), 1 ♂, 1 ♀, June 14, 1941 (Spector), 3 ♂, 2 ♀, July 10, 1932 (C. L. Ragot), 9 ♂, 8 ♀, (A. Nicolay), 2 ♀; Montauk, June 16, May 18, Sept. 5, 1941, 4 ♀; Ravenswood, 1 ♀; Staten Island: south shore, Aug. 4, 1912 (H. H. Cleaves), 1 ♂, July 24, 1911, 1 ♀; Willowbrook, Apr. 1, 1927 (C. L. Ragot), 3 ♂, 1 ♀. *New Jersey*: (Chittenden), 1 ♂ (type, *setiger*, U.S.N.M. No. 8223); Ship Bottom, May 24, July 5, 1936, 3 ♂, 2 ♀; Anglesea, Mar. 28 (Chittenden), 1 ♀ (type, *setiger* var. *intervallatus*, U.S.N.M. No. 26909), June 25, 1 ♀ (paratype, *setiger* var. *intervallatus*), 1 ♂ (allotype, *setiger* var. *intervallatus*); Mount Pleasant, May 25, 1921 (E. G. Smyth), 1 ♀; Elizabethport, Sept. 16-17, 1907 (H. L. Zabriskie), 29 ♂, 20 ♀; Newark, 1 ♂; Snake Hill, 1 ♀; Passaic Junction, July 9, 1911, 1 ♂; Atlantic City, 2 ♂, 2 ♀; South Amboy, 1 ♂; Manasquan, June 13, 1932, 1 ♀. *Pennsylvania*: Allentown, Apr. 14, 1927 (C. L. Ragot), 1 ♂. "America boreali": 1 ♀ (type, *pertinax*).

**DISCUSSION:** Say's *truncatus* (Missouri) was described as being much like *pertinax* but larger, with broader vittae, and more numerous striae on the elytra. Say may have had *pertinax* (var. "*intervallatus*") or *ludoviciana*, but since I have not seen any Missouri specimens of either subspecies and Say's types cannot be verified, I have put *truncatus* into synonymy with nominate *pertinax*.

On the same reasoning, *canaliculatus* ("America septentrionalis") has also been synonymized with this subspecies. The location of the type is unknown to me; it was not found with Boheman's other types in Sweden, or in Paris or London. The type of *setiger* (type specimen from New Jersey) has been examined, and *setiger* is a synonym of nominate *pertinax*. The variety *intervallatus* (type locality, Anglesea, New Jersey) represents those specimens of nominate *pertinax* that have somewhat broader and longer stripes on the even elytral intervals, and it is no more than a variety, since all gradations from a stripe of broken dots and dashes to a moderately broad stripe occur in the same population, as in the series from Jones Beach, New York.

The type and paratype of the variety *nasutus* from New York City and vicinity and another specimen Chittenden mentioned in his description from Mount Pleasant, New Jersey, are indistinguishable from those *per-*

*tinax* with obsolete stripes on the even intervals.

**INDIVIDUAL VARIATION:** Of a series of 45 specimens from Jones Beach, New York, 27 have the stripes on the even elytral intervals nearly obsolete or with but a narrow, often broken, raised attenuated line; 14 have the stripes definitely marked, though short, broader than in the preceding, and not interrupted or broken; four specimens are so greased that the stripes can scarcely be seen.

#### *Calendra pertinax ludoviciana* (Chittenden)

*Sphenophorus ludovicianus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 55, fig. 10.

*Calendra ludoviciana*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 161; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 19; 1933, Jour. Econ. Ent., vol. 26, p. 210.

**TYPE LOCALITY:** No locality specified; type from New Orleans, Louisiana. Type in the United States National Museum, examined.

**DISTRIBUTION:** Western Florida and the Gulf states, also Arkansas. Missouri (Satterthwait).

For description, see table 6 under the species.

**SPECIMENS EXAMINED:** *Florida*: Pensacola, 1 ♀. *Alabama*: Mobile, Oct. 20, 1922 (H. P. Loding), 2 ♂. *Louisiana*: New Orleans, 5 ♂, 3 ♀; Oct. 26, 1891 (H. Soltau), 1 ♀ (type, U.S.N.M. No. 8224); 1 ♂, 1 ♀ (paratypes); 1 ♂, 1 ♀; Nov. 4, 1891, 1 ♂; Nairn, Nov., 1909, 1 ♀; Jefferson Parish, Apr. 10, 1931 (W. E. Haley and T. E. Holloway), 1 ♂; Baton Rouge, May 11, 1949 (A. Delaune), 1 ♂. *Texas*: (C. V. Riley), 1 ♀; Sequin ("A. and M."), 1 ♂; Victoria, Mar. 26-28, 1901 (C. R. Jones), 6 ♀, Mar. 30, 1908 (J. D. Mitchell), 1 ♀; Galveston, Oct. 19, 1948 (O. Bryant), 2 ♂; Port Arthur, Oct. 18, 1948 (O. Bryant), 1 ♂, 1 ♀; Dallas Co., Apr. 8, 1947 ("F. H. W."), 1 ♀. *Arkansas*: Hope, May 21, 1925, 1 ♀.

**DISCUSSION:** One of the specimens from Mobile, Alabama, is more like nominate *pertinax* in that the vittae are more separated and the elytral stripes shorter, those on the even intervals being also narrower. This is a male, and the beak is the same length as the pronotum. The specimen from Pensacola, Florida, has been so worn that it is opaque black all over, and no coating was revealed even after a night of soaking in carbon tetrachloride.

The localities are all on the coast except for

the following localities: Sequin, near San Antonio; Victoria, about 26 miles inland up the Guadalupe River; and Dallas, all in Texas, and Hope, Arkansas.

***Calendra pertinax peninsularis* (Chittenden)**

*Sphenophorus peninsularis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 56. BLATCHLEY AND LENG, 1916, Rhynchophora of north-eastern America, p. 557.

TYPE LOCALITY: Jacksonville, Florida. Type in the United States National Museum, examined.

DISTRIBUTION: Georgia, eastern Florida.

For description, see table 6 under the species.

SPECIMENS EXAMINED: *Georgia*: Savannah, Apr. 30, 1926, 1 ♀; St. Simons Island, July 21, 1931 (Quirsfeld), 1 ♂. *Florida*: Atlantic Beach, 1 ♂; St. Augustine (Wickham), 1 ♀; Ormond, 1 ♂; Jacksonville (Ashmead), 1 ♀ (type, U.S.N.M. No. 8227).

DISCUSSION: The number and extent of the bare elytral stripes vary as much in this subspecies as in nominate *pertinax*. In the three male specimens mentioned above, all have the sutural and third intervals partially striped (in two the stripes extend one-third to the apex; in one, one-half to three-quarters). The St. Simons Island male has no other stripes except a very narrow one on the ninth interval; the Atlantic Beach male has a thin line of broken dots on the fifth and ninth intervals at the base; the Ormond male has a very short, narrow line at the base of the fourth interval and a similar line, somewhat broken into dots, in the basal half of the fifth and ninth intervals. The type, a female, has the sutural and third intervals with a stripe at the base. The female from Savannah has all the suture and the base of the third interval with a raised stripe.

***Calendra australis***

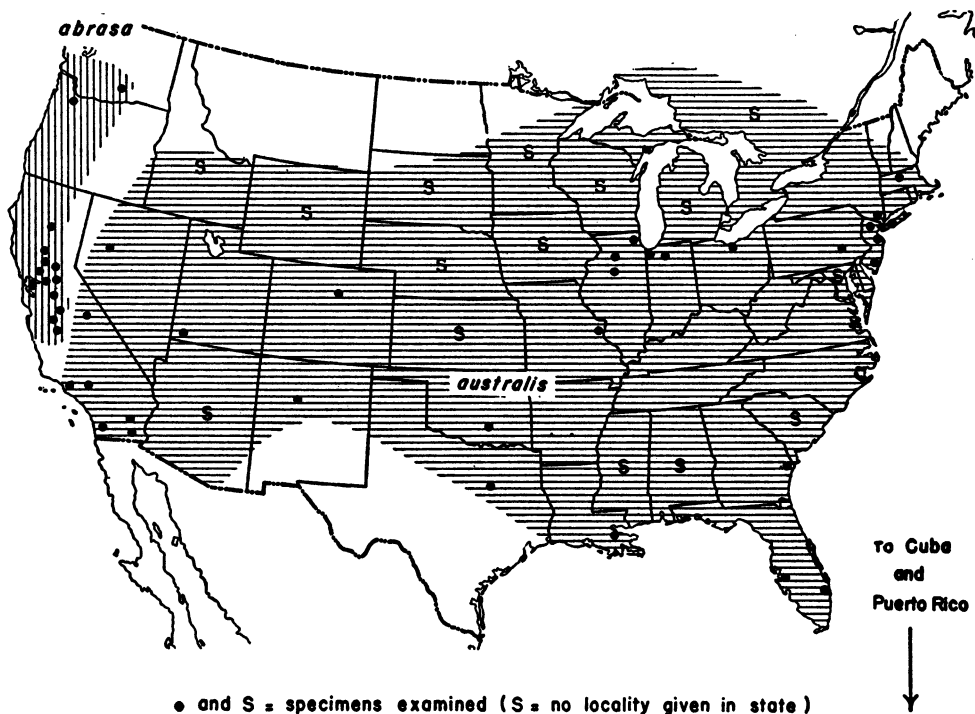
Figures 13, 16, 43, 47, 115

**DESCRIPTION OF THE SPECIES**

Medium to large; black or red, coated in depressed areas, pronotum with three raised, bare vittae, sometimes merged across disc; elytra with alternate intervals usually raised, convex, bare, even ones with shiny irregular patches, sometimes nearly absent, sometimes entirely covering the intervals.

Beak (from side) long, almost cylindrical, evenly curved, not wider at apex, apex beneath rounded, occasionally obtuse, base slightly swollen over antennal insertion, no true fovea in front of eye, but sometimes a suggestion of it; (from above) apex more or less convex, base with fine impressed line extending forward, front of head with scarcely visible punctures. Eye extending below insertion of beak. No thoracic lobe. Pronotum with three raised, bare vittae of variable widths, sparsely and finely punctured, and two side branches, sometimes vittae confluent across most of the pronotum, their separation evident at extreme base and apex only; lateral vittae usually sinuous on inner side, median gradually dilated towards middle, sometimes vittae touching in one or two places across the coated interspaces; interspaces narrow to quite broad, coated, punctures fine and small, usually obscured by coating, at base much larger and touching. Scutellum narrower than long, usually concave. Elytra variable, with odd intervals one to five, sometimes also the seventh, raised, convex, bare at least in basal half, often interrupted at sides and towards apex by invading irregular patches of coating, punctures fine, as on pronotal vittae and in irregular rows, even intervals flat and usually mostly coated, but with irregular, raised, shiny patches at the sides or center, sometimes second and fourth (even) intervals almost completely devoid of coating and thus bare like the odd intervals, punctures fine as on odd intervals, but in single rows; striae with small round punctures. Under surface, sides of prosternum with small, sparse, shallow punctures, the rest below strongly punctured. Legs, front tibiae with outer apical angle not prolonged, but outer side sinuous before apex, front and middle tarsi with third segment dilated, flattened, below with hairy pads (middle tarsi less dilated and with one of the pads below usually wider than the other), hind tarsi with it narrow, longer than wide, below mostly smooth, with sparse hair at sides. Pygidium with two oblique rows of hairs at apex. Length, 10–14 mm.

MALE CHARACTERS: First abdominal segment and metasternum at sides with broad, longitudinal band of short hairs (usually rubbed off); apex of abdomen with slight depression.

FIG. 47. Distribution of *Calendra australis*.

## DISTRIBUTION

Probably all of the United States, south-eastern Canada, also Puerto Rico. Cuba (Satterthwait).

## DISCUSSION

This species is divisible into two subspecies, nominate *australis* (type locality, New Orleans) and *abrsa* (type locality, Sacramento, California), both described by Chittenden. I do not recognize *typhae* Chittenden (type locality, Los Angeles County, California) which, although intermediate between *australis* and *abrsa*, is closer to *australis*. Over 100 specimens of *australis* and about 60 of *abrsa* have been examined.

Although *abrsa* has heretofore been considered a distinct species, it is, with the exception of the dorsal pattern, identical with nominate *australis* in all characters, including the male genitalia. It differs from the latter by having the three bare pronotal vittae merged across the disc in 88 per cent of the specimens, whereas in nominate *australis* the vittae are clearly separated and raised in 79 per cent of the specimens; *abrsa* has the elytra almost entirely shining black and bare

and nominate *australis* has them partially black and bare, but mostly coated.

## GEOGRAPHIC VARIATION

In specimens from northern and central California, also in southern Washington and western Oregon (*abrsa*), the vittae are not separated across the greater part of the pronotum but at the base and apex only; they are occasionally partially separated but always touch somewhere. (I have examined but one specimen each from Washington and Oregon; the Washington specimen is typically *abrsa*, that from Oregon has the vittae touching in two places rather broadly but not merged.) In those from the rest of the United States, in eastern Canada, and in Puerto Rico (nominate *australis*), the vittae are distinctly though narrowly separated; some specimens have them touching at one or two spots, but only one out of 119 has them merged as in *abrsa*. Since the depressed areas between the vittae are coated in this species, it can be said that in those from the northwest and northern and central California, where the vittae are merged, there is virtually no coating on



the pronotum, whereas in those from the east, west, and southwest there is more coating.

The elytral pattern presents a similar variation. In specimens from the northwest and northern and central California there is scarcely any coating, both odd and even intervals (except the outermost ones) being almost completely bare and none noticeably elevated; in the other populations the odd intervals are bare for only one-half to three-quarters of their length and usually

*abrasa* populations, but the majority are inseparable from nominate *australis*.

Although only 20 scattered specimens have been examined from the Great Basin area and Colorado, they seem on the whole to be more similar to the southern California populations than they are to the more eastern ones, but they are still closer to them than they are to *abrasa* in the northwest. Six of seven specimens from western Nevada have the pronotum as in specimens from southern California (the vittae touching in a few places),

TABLE 7  
GEOGRAPHIC VARIATION IN THE PRONOTAL VITTAE IN *Calendra australis*

Form	Total N	Entirely Separated	Partially Separated	Not Separated, Merged
<i>australis</i>				
East, Middle West	52	47	5	0
West (southern California, Great Basin)	67	48	18	1
<i>abrasa</i>				
Northwest (northern and central California, Washington, Oregon)	54	0	6	48

elevated, and the even intervals are mostly coated and depressed, with only isolated bare patches at the sides or center of the intervals. These elytral markings must be seen in series, as they are not only often greased over or caked with mud, but there is also quite a considerable range of individual variation, more so than in the pronotum.

Nominate *australis* populations, which range over most of the country, are not so uniform as those of *abrasa*, and a number of intermediate populations occur, none of which, however, is distinct enough to be separated nomenclatorially from nominate *australis*. The populations of southern California which Chittenden called "*typhae*" have the vittae somewhat closer than those from the east and middle west and touching more often, but the difference is slight. On the elytra the odd intervals are usually bare for at least three-quarters of their length and the even ones usually have more bare patches than they have coating. Nearly all of these populations could be distinguished from

but the elytra as in eastern specimens (more coating), and one specimen has both pronotum and elytra as in the specimens of *abrasa* from northern California. Four specimens from Utah and one from Colorado show the reverse, the pronotum in all being as in more eastern populations, the elytra as in those from southern California. As far east as Las Lunas, New Mexico, eight specimens are more like those of southern California, the vittae in only two being distinctly separated, while they are touching or virtually touching in six, the elytra in five of the eight having a greater amount of bare, elevated patches and in three being as in populations farther east. Additional material from this extensive western region and also from the middle western states may in the future help to decide the status and the limits of these intergrading populations. They, and a single specimen from Sequoia National Park, California, have been included on the map (fig. 47) with nominate *australis*.

It can be seen from table 7 that the south-

ern California and Great Basin populations are closer in pronotal pattern to the eastern and middle western than they are to the northwestern populations.

Another character that seems to vary geographically is the presence of short, sparse hairs on the sides of the center of the metasternum and first abdominal segment of the male. These were found to occur in some nominate *australis* (they are often worn), but were not visible in a dozen *abrassa* examined for this character. This evidence, however, is not conclusive, since these ventral hairs are readily abraded and do not seem to be abundant or very evident in any specimens.

In summary, the species *australis*, as it spreads eastward and southeastward from the northwestern coastal area, where it is virtually devoid of coating, develops more and more coating on both pronotum and elytra and the vittae pull apart to become three well-marked, elevated, separated stripes. A parallel trend exists in the species *aequalis* where the eastern subspecies is also more coated and has the vittae separated, whereas the three western subspecies are less coated and have the vittae closer or merged. In both species the subspecies with the merged vittae occur in the same region of northern California.

#### BIOLOGY OF THE SPECIES

The common cattail, *Typha latifolia*, is the preferred host plant, according to Satterthwait (1931a, p. 164, writing of "*pertinax*"), but nominate *australis* develops also in *Sparganium eurycarpum*, the broad-fruited bur reed. The adult "has long been considered among the most important of the billbugs attacking corn" (Satterthwait, 1932, p. 15), since it burrows into the ground to feed on the stalks. The eggs, however, are placed in the other two plants mentioned above. When reared on corn in the laboratory, this species "fails to adapt itself to cornstalk diet for the first generation" (Satterthwait, 1933).

A California Department of Agriculture specimen from Curlew, California, was collected from *Echinochloa*, a grass that is found in rich, wet soil.

This is one of the seven or eight species that is parasitized in the egg stage by a small member of the hymenopterous family My-

maridae, *Anaphoidea calendrae* Gahan (Satterthwait, 1931b, p. 180).

All the above remarks refer to the subspecies *australis* as there are no published data on *abrassa*. Three specimens of the latter subspecies from Kings County, California, were "collected from sugar beets," and others were taken in traps for Japanese beetles.

#### *Calendra australis australis* (Chittenden)

*Sphenophorus pertinax*, HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 418 (in part). CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 54, fig. 10. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 556, fig. 121.

*Calendra pertinax*, SATTERTHWAIT, 1920, Jour. Econ. Ent., vol. 13, pp. 280-295, pls. 4-5; 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160; 1931, Jour. New York Ent. Soc., vol. 39, p. 180; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 15, fig. 23. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 441.

*Sphenophorus pertinax* var. *australis* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 53.

*Sphenophorus pertinax* var. *typhae* CHITTENDEN, 1905, loc. cit.

TYPE LOCALITY: No locality specified; type from New Orleans, Louisiana. Type in the United States National Museum, examined.

DISTRIBUTION: The United States westward to the Sierras, also Ontario, Canada, and Puerto Rico. Cuba (Satterthwait).

DIAGNOSIS: Differs from *abrassa* by having the pronotal vittae clearly separated and the elytral intervals with more coating, the elytra presenting a mottled appearance.

SPECIMENS EXAMINED: *Massachusetts*: Amherst, May 23, 1938 (F. R. Shaw), 2 ♂. *New York*: 1 ♂, 1 ♀; Rockaway, Long Island, 1 ♂, 1 ♀; New York, July 26, 1945 (Dr. Hill), 1 ♀; Fort Hamilton, Brooklyn, May 25, 1918, 1 ♀; Fire Island, June 23-24, July 27, 1941 (B. Valentine), 1 ♂, 2 ♀. *New Jersey*: Cape May, May 30, 1949 (P. Vaurie), 2 ♀; Troy Meadows, near Boonton, May 11, 1946 (P. Vaurie), 1 ♀; Snake Hill, Mar., 1918 (Grossbeck), 2 ♀; Hopatcong (C. Palm), 2 ♀; Passaic Junction, June 10, 1911, 1 ♂; Paterson, May 3 (Grossbeck), 1 ♀; Arlington, Apr. 10, 5 ♂, 5 ♀, (E. Bischof), 2 ♂; Green Village, Aug. 30, Sept. 5, 4 ♂; Hamburg Place, Apr. 11, 1903,

1 ♀; Ship Bottom, May 24, 1936, 1 ♂. *Georgia*: Savannah (Harper), 1 ♀. *Florida*: Lake Worth, 1 ♀; Ch. Hrbr. [Charles Harbor], 3 ♂. *Pennsylvania*: Harrisburg, Nov. 27, 1909, 2 ♂, 2 ♀. *Ohio*: Cedar Point, Sandusky, June, 1912, 1 ♂, 1 ♀. *Indiana*: 3 ♀; Dune Park, July 7, 1934 (C. H. Seevers), 3 ♂, 2 ♀; Hammond, July 11, 1918, 2 ♀; Chesterton, July 10, 1934 (Thos. Craig), 5 ♂, 5 ♀. *Illinois*: 2 ♀; Horn Coll. No. 8987, 1 ♀; Glencoe, July 11, 1911, 1 ♂; Millers Landing, May 25, 1912, 1 ♂; Peoria, June 20, 1938 (F. F. Hasbrouck), 1 ♂; Volo, July 1, 1912 (Ross and Mohr), 1 ♀ "in pitcher plant"; Spring Bay, June 21, 1942 (F. F. Hasbrouck), 1 ♀; Putnam Co., Apr. 27, 1933 (M. C. Glenn), 1 ♂. *Missouri*: St. Louis, June 1, 1937, June 16, 1938, July 6, 1946 (R. C. Froeschner), 3 ♀, June 21, 1935 (R. C. F.), 1 ♀; Aug. 6, 1931, 1 ♂, 2 ♀; Dardene Prairie, May 29, 1938 (R. C. Froeschner), 1 ♂. *Oklahoma*: McClain Co., Apr. 17, 1931 (W. Fisher), 1 ♂, 2 ♀. *Texas*: Dallas Co., Mar. 15, 1937 (E. P. C.), 1 ♀, Apr. 27, 1940, Sept. 20, 1939 (R. E. Maxwell), 3 ♀. *Louisiana*: Horn Coll. No. 8987, 1 ♂; New Orleans, 1 ♂, 2 ♀ (paratypes, *pertinax* var. *australis*), Oct. 26 (H. Soltau), 1 ♂ (type, *pertinax* var. *australis*, U.S.N.M. No. 8220); Sioux City [La.?], July 8 (H. Soltau), 2 ♂ (paratypes, *pertinax* var. *australis*). *New Mexico*: Las Lunas, June 10, 1935 (Van Dyke), 4 ♂, 4 ♀. *Colorado*: Campus, Univ. Colo. (Cockerell), 1912, 1 [sex not noted]. *Utah*: Horn Coll. No. 8987, 1 ♂, 1 ♀; St. George, 2 ♀. *Nevada*: 1 ♂; Lovelock, June (Wickham), 2 ♂, 4 ♀. *California*: Horn Coll. No. 8987, 3 ♂, 4 ♀; Sand Dune, June 15, 1934 (O. Schwab, M. Cazier), 21 ♂, 18 ♀; Salton Sea, Imperial Co., Aug. 7, 1948 (C. and P. Vaurie), 3 ♂, 9 ♀, north end, Salton Sea, June 22, 1940 (W. F. Barr), 1 ♂; San Diego Co., Apr. 6, May 15, 1930, 3 ♂, 3 ♀; San Diego, June (Field), 1 ♂; Sequoia National Park, June 13, 1929, 2000–3000 ft., 1 ♂; Los Angeles Co., 1 ♂ (type, *pertinax* var. *typhae*, U.S.N.M. No. 8221), June 28, 1911, 5 ♀ (paratypes, *pertinax* var. *typhae*), (Coquillett), 1 ♂ (paratype, *pertinax* var. *typhae*); (Van Dyke) (Gordon Grant), 1 ♂, 3 ♀; Los Angeles, 2 ♂; Holtville, Imperial Co., June 20, 1939 (E. S. Ross), 1 ♂; Seeley, Nov. 2, 1921, 1 ♀; Potholes, Imperial Co., Apr. 12, 1923 (E. P. Van Duzee), 1 ♂; Riverside, Mar. 1, 1927, 1 ♂; Palm Springs, Riverside Co., Apr. 3, 1925 (F. H. Wymore), 2 ♂, 1 ♀; Curlew, Mar. 15, 1945 (Osborn), 1 ♂, 2 ♀ "ex *Echinochloa*," Mar. 8, 1945 (C. G. Anderson), 1 ♀; Parker, June 22, 1947, 1 ♀ "in quarantine from Baltimore, Md."

Canada. Horn Coll. No. 8987, 1 ♂; *Ontario*: Godenid, July 4, 1898, 1 ♀.

Puerto Rico. Rio Grande, Feb. 11, 1931, 1 ♂.

**DISCUSSION:** For the incorrect use of the name *pertinax* for this species, see general discussion above under the two species *C. pertinax* and *australis* (p. 159).

**INDIVIDUAL VARIATION:** The pronotum and elytra in five specimens of nominate *australis* from Dune Park, Indiana, and 11 from Arlington, New Jersey, were compared for individual variation. The vittae touched in only one specimen, but were narrower in some than in others. The median vitta was regularly fusiform in 10, more irregular on one side than the other in two, rather sharply dilated at the middle in three, wider in the entire apical half than in the basal half in two. The lateral vittae were parallel in one, slightly sinuous on the inner side in seven, strongly sinuous in eight.

The even elytral intervals (2–4–6) were virtually entirely coated in 11 specimens of the 16, and the second and sixth were coated (the fourth noticeably less so) in five. The odd intervals (3–5) were bare in the basal half, then interrupted by patches of coating in six specimens; they were bare in the basal three-quarters before being interrupted by the coating in nine specimens, with the seventh interval also mostly bare; one specimen had the third, fifth, and seventh intervals bare most of the way to the apex.

A single specimen from St. Louis, Missouri, has so much coating on the elytra that it resembles *pertinax* Olivier, there being but two black, bare, attenuated stripes on the third and fifth intervals, with most of the rest coated. There are, however, a few characteristic bare black patches along the striae, which are never present in *pertinax*.

#### *Calendra australis abrasa* (Chittenden)

*Sphenophorus abrasus* CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 54.

**TYPE LOCALITY:** California; here restricted to Sacramento, California. Type in the United States National Museum, examined.

**DISTRIBUTION:** Southern Washington, western Oregon, northern California south to Kings County (excluding Sequoia National Park).

**DIAGNOSIS:** Differs from nominate *australis* by having the pronotal vittae merged across the disc and the elytra nearly devoid of

coating, the dorsal surface almost entirely shining and uniform.

**SPECIMENS EXAMINED:** *Washington:* Toppenish, June 28, 1925 (Van Dyke), 1 ♀. *Oregon:* McMinnville, June 16, 1925 (F. W. Wymore), 1 ♂. *California:* (Roberts), 1 ♂ (type, U.S.N.M. No. 8222), 1 ♀ (allotype); (Wickham), 1 ♂; Gridley, Sept. 5, 1941 (La Rivers), 1 ♂, 4 ♀; Lincoln, Placer Co., Feb. 24, 1945 (A. T. McClay), 1 ♂; Davis, Mar. 11, May 13, 1948 (A. T. McClay), 3 ♂, 1 ♀, Oct., 1942, 1 ♀, June, 1933 (E. C. Zimmerman), 1 ♀; Pollock Pines, June 23, July 8, 1939 (A. T. McClay), 1 ♂, 1 ♀; Woodland, Yolo Co., May 10, 1939 (Hardy), 1 ♀ "from barley field," June 1, 1948, 1 ♀; Antioch, June 15, 1941 (W. F. Barr), 1 ♂, May 27, 1939, 1 ♂, Sept. 16, 1934 (F. R. Platt), 1 ♂, Apr. 24, Sept. 18, 1938 (Van Dyke), 2 ♂, 2 ♀, May 26, 1933 (R. M. and G. E. Bohart), 1 ♀; San Joaquin Co., May 6, 1914 (Nunenmacher), 2 ♀; Manteca, San Joaquin Co., Oct. 12, 1938 (K. S. Hagen), 1 ♂; Kings Co., June 23 (Hall), 1 ♀; Tulare Lake, Kings Co., May 31, Oct. 31, 1937 (L. D. Leach), 3 ♂ "collected from sugar beets"; Contra Costa Co., June 2, 1940 (Nunenmacher), 1 ♂; Alameda, July 24, 1919 (Nunenmacher), 1 ♂; Sacramento, Mar. 3, 1920, May 27, 1918 (E. P. Van Duzee), 2 ♀, May 2, 1933, 1 ♀, Apr. 21, 1931, July 3, 1930, Aug. 16, 1936 (H. H. Keifer), 4 ♂, 1 ♀, June 13, 1914 (Childs), 1 ♀; Panoche Canyon, Fresno Co., Apr. 24, 1946 (Van Dyke), 1 ♀; Cro Loma, Fresno Co., June 4, 1945 (L. Atkinson), 1 ♂, "Jap beetle trap"; Modesto, 1921 (C. D. Duncan), 1 ♀; Oakland, July, 1935 (E. S. Ross), 1 ♀; Butte Creek Co., near Chico, Apr. 23, 1922 (E. P. Van Duzee), 1 ♀; Chico, July 7, 1945 (P. Fawnc), 1 ♂, 1 ♀ "in Jap beetle trap"; Yolo Co., June 16, 1913 (E. J. Branigan), 1 ♂, 1 ♀.

### *Calendra aequalis*

Figures 2, 14, 15, 33, 45, 48, 116

#### DESCRIPTION OF THE SPECIES

Large, robust; black or red, with buff, ocher, gray, white, or bluish coating, partial or entire; pronotum with three vittae, raised or flat, coated or bare, sometimes merged; elytral intervals flat or feebly convex.

Beak (from side) long, compressed, curved, wider at apex, upper contour rounded downward just before apex, apex beneath a right or obtuse angle, base slightly swollen over antennal insertion, no fovea in front of eye; (from above) apex concave, base with narrow impressed line, front of head finely, distinctly punctured. Eye extending below

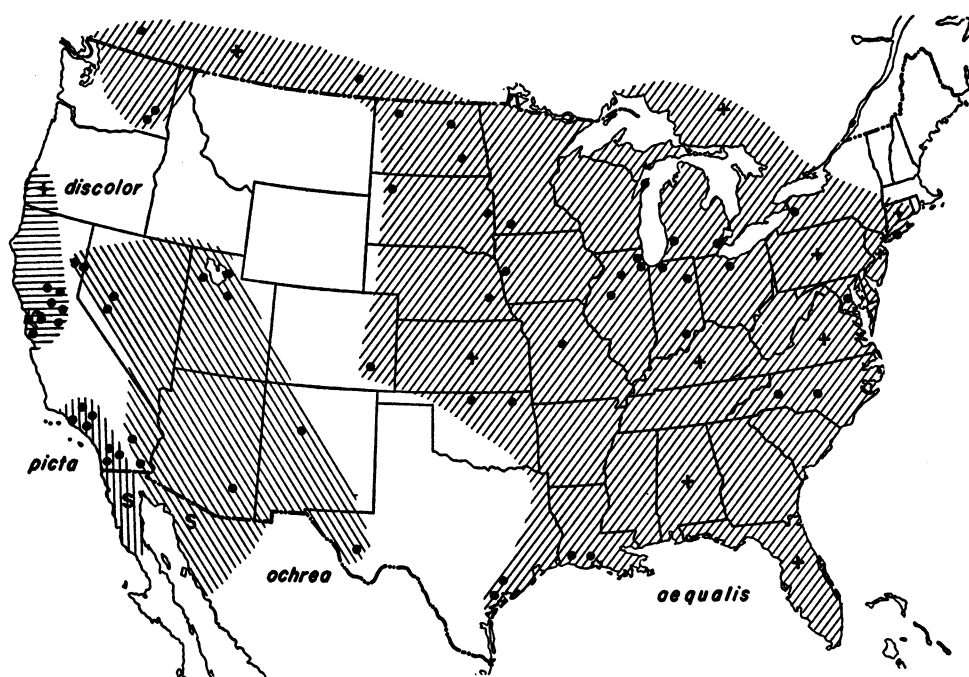
insertion of beak. No thoracic lobe behind eye. Pronotum either flat and with vittae merged across disc or with three broad or narrow, separated vittae, feebly or strongly raised, bare or coated or partially coated, sparsely and finely punctured, with side branches not actually present but sometimes indicated by darker color, median vitta often with impunctate line in center; interspaces with punctures somewhat larger than on vittae, especially at base. Scutellum narrower than long, coated or not, sometimes with slight depression. Elytra with intervals flat to feebly convex, the third and fifth widest and often more convex, with fine sparse punctures filling the odd intervals and in a single row on even intervals; striae with punctures varying from round and deep to oval and shallow, either well separated by fine striae line or close and merging together. Under surface uniformly finely, sparsely punctured, apex of abdomen with depression, and hairs at sides of apex. Legs, front tibiae with outer apical angle not prolonged but with minute tooth, all tarsi with third segment widely dilated, flattened, below with hairy pads. Pygidium with two oblique rows of hairs at apex and with tufts of hair at sides of apex. Length, 9–21 mm.

**MALE CHARACTERS:** Depression on last abdominal segment filled with fine, single hairs, rest of abdomen in center, and metasternal cavity with coarser double hairs, either so short as to be scarcely visible or quite long (hairs on third and fourth segments usually sparser and often worn off); pygidium turned down abruptly at apex and more or less concave, almost vertical when seen from the side.

**DIAGNOSIS:** Differs from all other species except *schwarzii* in the presence of an enamel-like, whitish yellow, glabrous coating below. Differs from *schwarzii* by having the V-shaped glabrous space on the under surface of the tarsi broader, not a narrow line, and the abdominal hairs in the male situated in the center of the ventral cavity, not reaching the sides.

#### DISTRIBUTION

Probably all of the United States, also southern Canada, east and west, and northern Mexico (Sonora and Baja California).



● and S = specimens examined (S = no locality given in state); from the literature = +

FIG. 48. Distribution of *Calendra aequalis*.

#### DISCUSSION

After examination of about 300 specimens from most of the United States and southern Canada, the conclusion seems inevitable that all the described species of *Calendra* with the shining white or yellow, enamel-like coating below (except *schwarzii*) are one species, *aequalis*, which can be divided into four subspecies: nominate *aequalis* (type locality, Missouri) from the Atlantic to the Dakotas and eastern Colorado, north into southeastern and southwestern Canada, and the state of Washington (fig. 48); *ochrea* (type locality, Sonora, Mexico) in the Great Basin area, including New Mexico, Arizona, Utah, Nevada, western Texas, Sonora, and southeastern California; *picta* (type locality, Vallecito, San Diego County, California) in southwestern California and Baja California; and *discolor* (type locality, Sacramento, California) in northern California and southern Oregon. The varieties *univitta* and *scirpi* of nominate *aequalis* and the variety *atrivittata* of *ochrea* seem, for the present at least, to be only individual variants of their respective subspecies.

Although these four subspecies have been considered separate species, there seem to be no structural differences to warrant their separation. They are the same, or at least show the same kind of individual variation, in all the following characters: the beak (fig. 45), the eyes, the shape of the pronotum and pygidium, the shape of the tibiae, the apical and subapical teeth, and outer apical angle of the tibiae, the width of the tarsi, the depression and hairs in the center at the apex of the last abdominal segment in the male, the elongate slit with protruding hairs on the sides of the apex of the last abdominal segment in both sexes (fig. 33), the arrangement of the hairs at the apex of the pygidium, and the male genitalia (fig. 116). They all vary in size, but are generally large.

They do, however, differ in other characters that are shown in table 8. First it must be explained that this species possesses what Horn (1873, p. 411) called "a natural coat . . . of dense structure, and of smooth, shining surface, always allowing the punctures, even the most minute, to be visible." This coat is present below in all *aequalis*, although it is

TABLE 8  
COMPARATIVE CHARACTERS IN THE SUBSPECIES OF *Calendra aequalis*

	<i>aequalis</i> (East, Central, and Northwest)	<i>ochrea</i> (Great Basin)	<i>picta</i> (Southwestern California)	<i>discolor</i> (Northern California, Oregon)
Male ventral cavity	With long yellow hairs; somewhat shallow	With shorter hairs	As in <i>ochrea</i>	With very short hairs, usually none visible; deep
Elytral striae punctures	Rounder, larger, deeper	Oval, smaller, shallower	As in <i>ochrea</i> , but shallow <sup>a</sup>	Round, sometimes oval, deeper <sup>a</sup>
General appearance	Unicolored; ocher, gray, or bluish <sup>b</sup>	Bicolored; mostly white with black stripes <sup>c</sup>	Bicolored; mostly black with white stripes <sup>d</sup>	Unicolored, black or dark red <sup>e</sup>
Amount of coat	Usually entire	Partial	Very little	Less than in <i>picta</i>
Pronotal vittae	Separated, coated <sup>f</sup>	Separated, not coated <sup>g</sup>	Separated more narrowly, not coated <sup>h</sup>	Not separated, not coated <sup>i</sup>

<sup>a</sup> Because of lack of contrasting coat, punctures are difficult to see on all black surfaces.

<sup>b</sup> Of 126 specimens, 14 have either black stripes as in *ochrea* or partial black stripes.

<sup>c</sup> Of 29 specimens, two are mostly ocher as in *aequalis*, one is mostly black as in *picta*, and one is all black as in *discolor*.

<sup>d</sup> Of 23 specimens, four are nearly all black as in *discolor*.

<sup>e</sup> Of 69 specimens, 18 have more white: two as in *ochrea*, 16 as in *picta*.

<sup>f</sup> Of 126 specimens, 14 have vittae either not coated as in *ochrea*, or partially coated.

<sup>g</sup> Of 29 specimens, two have vittae not entirely separated as in *picta*, two have lateral vittae partially coated as in northwestern *aequalis*, and one has vittae merged as in *discolor*.

<sup>h</sup> Of 23 specimens, four have vittae merged as in *discolor*.

<sup>i</sup> Of 69 specimens, five have vittae separated as in *ochrea*, and eight have them partially separated as in *picta*.

more extensive in nominate *aequalis*, for instance, than in *discolor*, and it is always white or whitish yellow; on the dorsal surface it is present also in varying degree, but here it may be of different colors and is often opaque. Where the coating is not present or has been worn or scratched off, the ground color is seen to be black or dark red. In fresh specimens of the eastern populations (nominate *aequalis*), which are entirely coated, the three pronotal vittae and the odd elytral intervals are always a shade darker in color than the rest, and these are the same parts that are black and not coated in the Great Basin form (*ochrea*) and in the extreme northwest populations of nominate *aequalis*. In some specimens of *aequalis* from Texas ("*scirpi*") these parts are a very dark brown, but this color is merely an intensification of the color of the coat. The coating in this species has no velvety bloom or pruinose quality to which debris adheres; it is always smooth, whether shining or opaque.

As shown in the footnotes to table 8, there is considerable variation within the subspecies in the color pattern, that is, the amount of coating, and in the degree of separation of the pronotal vittae, *aequalis* and *ochrea* varying somewhat less than *discolor* and *picta*. In all four subspecies, however, over 75 per cent of the specimens are separable in these two characters.

Considerable geographic as well as individual variation occurs also in the other characters in the table. The elytral striae punctures are usually as stated in the table, but all the subspecies vary in the degree of separation of the punctures which are sometimes distinct and well spaced and separated from one another by a fine stria line, and at other times indistinct, the punctures opening up at either end and merging together, thus virtually obliterating the fine stria line. The degree of separation may vary on each elytron, on each stria, or even within each stria.

The most important diagnostic character

is probably the secondary sexual character of the hairs on the metasternum and basal abdominal segments of the male. (All the subspecies have fine hairs on the apical abdominal segment and very few, if any, on the two preapical segments.) Unfortunately these hairs are often worn off or worn down, but in specimens in good condition the difference in the length and thickness of the hairs is noticeable. The difference is best seen between nominate *aequalis* and *discolor*, the former being definitely very hairy below and the latter appearing hairless (though hairs are actually present). Males of *discolor* can always be told from males of the other subspecies by this character. The difference in hairiness between *ochrea* and *picta* is not so striking, and some *ochrea* appear as hairy as some *aequalis*. The depth of the ventral cavity mentioned by some authors breaks down in many specimens and it is, in any case, a difficult character to assess.

#### GEOGRAPHIC VARIATION

If one were to contrast a population of nominate *aequalis* from Washington, D. C., with a population of *discolor* from San Francisco, California, one would find in the east pale individuals completely covered above with a solid ochreous coating, with three separated pronotal vittae swelling under the coat and the male with long yellow hairs below; in the west, dark individuals almost completely without coating (and black or deep red) above, with the three vittae flat and merged across the disc, and no visible hairs in the male cavity below. But between these two extremes one would find many gradations in the above and in other characters. *C. a. ochrea* from the Great Basin area is partially coated as in nominate *aequalis* and partially uncoated and black as in *discolor*, but more pale than dark; the vittae are clearly separated as in nominate *aequalis*, but uncoated as in *discolor*, and the male hairs below are generally shorter, less abundant than in nominate *aequalis*, but distinctly longer than in *discolor*. *C. a. picta* from southern California shows some intergradation between *ochrea* and *discolor*, having the dark color of *discolor* though with somewhat more white coating, but the male hairs more as in *ochrea*; the vittae are intermediate, being

less separated than in *ochrea*, but more so than in *discolor*. The same general pattern of variation is found also in another species, *australis*, in which the vittae are also separated in eastern specimens, partially merged in those from southern California, and entirely merged in those from northern California, the eastern specimens having more coating and less black, the western ones less coating and more black.

#### BIOLOGY OF THE SPECIES

This species breeds in corn as well as in its natural food plants, the river rushes. *Scirpus fluviatilis*, the river bulrush, and *S. validus*, the tule or great bulrush, are its favorite host plants. Both nominate *aequalis* and *discolor* have been taken from the roots of the latter, but no data have been seen on *picta* or *ochrea*. The adults feed on the above plants, also on millet, foxtail, bristly nut grass, common reed grass, and on sedges. They will also attack crops such as barley, oats, or wheat if these are planted near or on newly reclaimed swamp land. (Data from Satterthwait, 1931a, p. 163; 1932, pp. 9, 14.)

Specimens collected by me in western Canada, North Dakota, and Nebraska were walking on the encrusted edges of dry, saline lakes, in the vicinity of reeds or rushes.

An interesting fact given by Satterthwait (1932, p. 5) is that some billbugs, notably nominate *aequalis* and *C. pertinax ludoviciana*, are the cause of death to poultry. When picked up by a chicken or turkey, a billbug attempts to cling to something with its strongly spined legs; often it catches hold of the tongue or mouth membranes, and, since it does not let go, the fowl often dies in the struggle.

#### KEY TO THE SUBSPECIES OF *Calendra aequalis*

1. Usually black above except for white edges of pronotum: male with scarcely visible hairs in ventral cavity (northern California, Oregon) . . . . . *discolor*
- Usually not all black above; male with short or long hairs in ventral cavity . . . . . 2
2. Elytra mostly black, with only one or two complete white stripes, or white stripes incomplete; striae punctures scarcely visible, shallow, small (southwestern and Baja California) . . . . . *picta*
- Elytra mostly white, ocher, bluish, or gray,

sometimes with alternate black stripes; stria punctures readily visible, oval or round, deeper, larger . . . . . 3

3. Punctures on elytral striae (especially two inner ones) round, large, deep, often merging, sometimes well separated; pronotum without denuded stripes, or, if so, they are usually abbreviated (eastern, central, north-western states, southern Canada). *aequalis*
- Punctures on elytral striae fusiform or oval, smaller, shallower, usually separated by fine stria line, not merging; pronotum with three broad, black, denuded stripes (Great Basin, southeastern California, Sonora) . . . . . *ochrea*

***Calendra aequalis aequalis* (Gyllenhal)**

*Sphenophorus aequalis* GYLLENHAL, 1838, in Schoenherr, Genera et species curculionidum, vol. 4, p. 941. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 416. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 181. BLATCHELY AND LENG, 1916, Rhynchophora of northeastern America, p. 553. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 147.

*Calendra aequalis*, SATTERTHWAIT, 1931, Ann. Ent. Soc. Amer., vol. 24, p. 160; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 9, figs. 12-15. BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 441.

*Sphenophorus aequalis* var. *univitta* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 146.

*Sphenophorus aequalis* var. *scirpi* CHITTENDEN, 1924, *ibid.*, vol. 26, p. 147.

TYPE LOCALITY: "America borealis, Missouri." Type in Stockholm museum, examined.

DISTRIBUTION: Eastern states west to the Dakotas, Colorado, and Texas, also Washington, and most of southern Canada.

DIAGNOSIS: Differs from the other subspecies as shown in table 8.

SPECIMENS EXAMINED: 1 ♀ [?] (type, *aequalis*). New York: Fire Island, June 25, 1941, 1 ♂; Rockaway Beach, July 3, 1909, 1 ♂, 1 ♀; Buffalo (C. Palm), 1 ♂. New Jersey: Arlington, 1 ♂. District of Columbia: June 19, 1923 (E. D. Quirsfeld), 3 ♂, 2 ♀, June 22, 1911 (E. Shoemaker, W. T. Davis), 6 ♂, 6 ♀. North Carolina: Asheville, May 20, 3 ♂, 3 ♀; Southern Pines, Jan. 6, 1909, 1 ♀. Louisiana: Abbeville, Aug. 30, 1918 (Mrs. L. H. Gordy), 1 ♀; Cameron Parish, May 10, 1919, 1 ♂. Texas: Gulf of Texas (Wickham), 1 ♂; Aransas Co., June, 1940 (R. P. Allen), 1 ♀; Traylor's Lake (J. D. Mitchell), 1 ♀ (type, var. *scirpi*, U.S.N.M. No. 26898), 1 ♂, Aug. 24, 1913 (J. D. Mitchell), 5 "reared from roots of

*Scirpus*, sp."; Victoria, Mar., Aug. 13-28, 1913 (J. D. Mitchell), 2 ♂, 4 ♀; Victoria Co., Aug. 28, 1913 (J. D. Mitchell), 1 ♂ (allotype, var. *scirpi*), "bred from corn." Missouri: Dardene Prairie, May 29, 1930 (R. C. Froeschner), 2 ♂, 4 ♀; Arrow Rock, June 27, 1932, 3 ♀; Waverly, June 16, 1932, 1 ♂, 1 ♀, Ohio: 2 ♂, 2 ♀; Sandusky, July 20, 1903 (C. D. Dodds), 1 ♂. Indiana: 2 ♂, 3 ♀; Miller, July 16, 1922, 3 ♀; Charleston, July 10, 1934 (Thos. Craig), 2 ♂, 5 ♀. Michigan City, June 9, 1934 (C. H. Seevers), 1 ♀; Bluffton, June 16, 1901 (C. C. Deam), 1 ♀. Illinois: 2 ♀; Putnam Co., June, 1915, July, 1932, June, 1933 (M. C. Glenn), 3 ♂, 1 ♀; Peoria, June 20, 1938 (F. F. Hasbrouck), 3 ♂, 3 ♀; Winnetka, June 18, 1911, 1 ♂, 4 ♀; (Brues), 3 ♂, 1 ♀; Chicago, July 16, 18, 1922, 2 ♂, 5 ♀; (M. L. Linell), 1 ♂. Michigan: Monroe Co., June 10, 1912, 1 ♂; S. Haven (Hubbard and Schwarz), 1 ♀. Wisconsin: 3 ♂, 3 ♀; Egg Harbor, July 3, 1923 (H. R. Painter), 1 ♂. Minnesota: Jackson, May 6, 1 ♀. Iowa: Pisgah, June 23, 1917 (D. H. Seabury), 1 ♀. North Dakota: Devil's Lake, Benson Co., June 6 (Wickham), 1 ♂, Aug. 22, 1949 (P. and C. Vaurie), 1 ♂; Stanley, Mountrail Co., Aug. 19, 1949 (P. and C. Vaurie), 1 ♀; Fox Lake, Eckelson, Barnes Co., Aug. 23, 1949 (P. and C. Vaurie), 1 ♂, 1 ♀; Horseshoe Lake, Sept. 7, 1922 (R. A. Blanchard), 1 ♀ "on *Scirpus fluviatilis*." South Dakota: 1 ♀; Volga, 1 ♂, 1 ♀. Nebraska: 1 ♂; Lincoln (Salt Basin), June 26, 1949 (P. and C. Vaurie), 1 ♂. Kansas: 1 ♀. Oklahoma: Cherokee, Salt Plains, June 11, 1930 (R. D. Bird), 1 ♂; Choteau, May, 1930 (J. F. Schultz), 1 ♀. Colorado: La Junta, July 23, 1919 (R. and H.), 2 ♀. Washington: Sprague, May 8, 1921 (M. C. Lane), 2 ♀ (type and cotype, var. *univitta*, U.S.N.M. No. 26899); Sprague Lake, July 10, 1937 (E. C. Van Dyke), 2 ♂, 2 ♀; Perry North, June 17, 1933 (M. C. Lane), 1 ♂ (allotype, var. *univitta*); Ritzville, June 8, 1923 (M. C. Lane), 1 ♀ (paratype, var. *univitta*), May 8, 1921 (M. C. Lane), 1 ♀; Paha, Lake McElroy, May, June, 1920-1922 (M. C. Lane), 2 ♂, 2 ♀.

Canada. Horn Coll. No. 8984, 1 ♂. British Columbia: Vernon, May 20, 1931 (R. Hopping), 3 ♂, Apr. 30, 1939 (H. B. Leech), 1 ♀, May, 7 ♂, 4 ♀; Osoyoos, May 21, 1924 (K. F. Auden), 1 ♂, 1 ♀. Saskatchewan: Ceylon, Aug. 17, 1949 (P. and C. Vaurie), 6 ♀.

DISCUSSION: Missouri does not appear on the type label of *aequalis*, although Gyllenhal gives it in his description. The type seems to be a female, but the pygidium is caved in and the abdominal cavity covered so that it is not possible to be certain of the sex. The specimen is in poor condition; it is



a dirty gray and the lateral vittae have been rubbed bare of coating in the apical half. The elytral striae have definitely round punctures.

The type and paratypes of the variety *univitta* (type from Sprague, Washington) agree with most nominate *aequalis* except for the fact that they have the median vitta black and denuded for a short way at the base. A number of other specimens from Washington and British Columbia have not only the median vitta thus partially denuded, but also part or all of the lateral vittae, and sometimes the odd intervals of the elytra, as in some *ochrea*, but these bare black stripes are not so distinct as in the latter subspecies, appearing uneven, as if worn, on the edges. This population might be treated as a separate subspecies, but the partial denuding of the vittae is not constant enough to warrant nomenclatorial recognition. Nor is this character confined to the northwest area, as specimens of "*univitta*" have been examined from widely scattered localities, Lincoln, Nebraska, Washington, D. C., Devil's Lake, North Dakota, La Junta, Colorado, and Cherokee, Oklahoma. Furthermore, many eastern nominate *aequalis* have bare black spots, not at the base, but at the apex of the median vitta, and it may be that this happens whenever a more elevated part of the thorax comes in contact with too much rubbing. The elytral stria punctures are round in the variety *univitta* and in some specimens are even deeper and closer together than in other populations of nominate *aequalis*, but this character has been shown to be exceedingly variable in the species. This variety is considered synonymous with nominate *aequalis*.

The variety *scirpi* (type locality, Traylor's Lake, Texas) seems likewise inseparable from nominate *aequalis* and no more than a variant of the latter. It is true that in 12 specimens (10 from Texas, including the type and allotype, two from Louisiana), 10 have the punctures on the pronotal interspaces at the base larger than those on the elytral striae, whereas in most nominate *aequalis* populations they are about the same size or smaller, and in six specimens they tend to coalesce as described by Chittenden. But the punctures of the pronotum are so variable in many ways that even though these southern specimens have larger

punctures, this character alone seems insufficient to warrant recognition, especially since Chittenden in his description reports "*scirpi*" also from Kansas, and other nominate *aequalis* occur between Kansas and Texas. The vittae in seven specimens are more noticeably of a deeper tan color than the rest of the pronotum, but six of these are reared specimens and other fresh nominate *aequalis* also usually have the vittae darker. The two Louisiana specimens (Abbeville and Cameron Parish) were described by Chittenden (1924, p. 147) as "aberration *a*" of *aequalis*, with wider vittae "dark brown to subopaque black." But this dark brown, or black, greasy color, which is also present on two of the "*scirpi*" from Texas, came out light brown after a soaking in carbon tetrachloride, and the vittae were then no longer any wider than in most other nominate *aequalis*.

The color of the coat in this subspecies is usually some ochreous shade. In 91 specimens from various localities, 15 are so worn or greased that the color can scarcely be judged. One of these has the enamel coat below worn off, perhaps a dozen are gray-white or gray-blue, one is virtually white, and the remaining are ocher or light brown.

Although generally the pronotal vittae are definitely elevated, especially the lateral ones, some specimens have them nearly flat as in *C. a. discolor*. The size and placement of the punctures, as mentioned above, are quite variable.

The coating above is never so shiny or enamel-like as the coating below; in fact often it is more or less opaque, especially in specimens that have seen much wear.

#### *Calendra aequalis ochrea* (LeConte)

*Sphenophorus ochreus* LECONTE, 1858, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 80. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 416. CHITTENDEN, 1905, Proc. Ent. Soc. Washington, vol. 7, p. 181. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 157, pl. 8. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 554. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 147.

*Calendra ochrea*, BLEASDELL, 1937, Iowa State Coll. Jour. Sci., no. 11, p. 441. BRUHN, 1947, Great Basin Nat., vol. 8, p. 19, pl. 5 (genitalia).

*Sphenophorus ochreus* var. *atrivittata* CHITTEN-

DEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 147.

**TYPE LOCALITY:** Sonora, Mexico. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Great Basin area (Utah, Nevada, Arizona, New Mexico), also western Texas, California east of the Sierras, southeastern California, and northern Mexico (Sonora).

**DIAGNOSIS:** Differs from the other subspecies as shown in table 8.

**SPECIMENS EXAMINED:** [Mexico. Sonora:] (Webb), 1 ♂ (type, *ochrea*, M.C.Z. No. 5201). *Utah:* (Roberts), 1 ♂ (type, var. *atrivittata*, U.S.N.M. No. 26901); Horn Coll. No. 8986, 1 ♀; Provo, June (Wickham), 4 ♂, 4 ♀; Salt Lake, June 25 (Hubbard and Schwarz), 2 ♂, Horn Coll. No. 8986, Apr. 7, 2 ♂, Apr. 19 (H. Soltan), 1 ♂, 1 ♀; Saltair, May 21, 26 (Van Duzee), 1 ♂; Kaysville, June 29, 1912 (E. R. Lalmbach), 1 ♂, 1 ♀. *Nevada:* 1 ♂, 2 ♀; Walker Lake, south end, July 7, 1941 (La Rivers), 2 ♀; Sand Springs, July 5, 1941 (La Rivers), 1 ♂, 2 ♀. *Arizona:* (Hardy), 1 ♀; Cochise Co., 1 ♀. *New Mexico:* Las Lunas, June 10, 1935 (Van Dyke), 1 ♂. *California:* Amedee, 4200 ft., July 21–28 (Wickham), 1 ♂, 3 [sex not noted]; Wendel, June 21, 1931 (A. T. McClay), 1 ♀; Calexico, May 23, 1940, 1 ♀; Salton Sea, June 27, 1936 (E. S. Ross), 1 ♂. *Texas:* Alpine, Oct. 1, 1926, 1 ♀.

**DISCUSSION:** The type of LeConte's *ochrea* is yellowish white, with the vittae exposed and black, but not completely so; the striae punctures on the elytra are typically oval. Horn (1873), in his redescription of *ochrea*, cited "*? aequalis*" as a synonym. He must have had specimens of the latter as well as the type of *ochrea*, since he stated "the type specimen [*ochrea*] does not differ notably from the specimens from this side of the Mississippi except that the summits of the thoracic vittae have become denuded."

The variety *atrivittata*, the type of which I have seen, is, as Chittenden said, merely a color variant of *ochrea*, with alternating black and white intervals on the elytra. Such specimens occur with typical *ochrea*.

The Salton Sea, California, specimen is more yellow than white, but in this respect matches an otherwise typically marked *ochrea* from St. George, Utah. It has the black of the vittae very narrowly exposed, and not

exposed at all in the basal three-quarters of the lateral vittae. The elytral striae punctures and the hairs below are as in other *ochrea*.

One specimen from Provo, Utah, has the pronotal stripes broader than usual and the laterals touching the median vitta at one place, as in some *picta*, but the elytra are characteristically white. The female from Cochise County, Arizona, has both pronotum and elytra black, with the vittae merged as in *discolor*, and another female, from Alpine, Texas, has them nearly all black as in typical specimens of *picta*.

The reports of *ochrea* in the literature from South Dakota and Iowa and Chittenden's records (1924, p. 147) from Paha, Washington, and Saskatoon, Saskatchewan, I am inclined to believe must be nominate *aequalis*, which I have seen from these areas.

The subspecies *ochrea* probably occurs in Idaho and southeastern Oregon, possibly Wyoming; it may come into contact with nominate *aequalis* somewhere in this northwestern area, since the latter occurs in the Dakotas, in Washington, and western Canada.

#### *Calendra aequalis picta* (LeConte)

*Sphenophorus pictus* LECONTE, 1858, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 80. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 417. CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 157, pl. 8. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 146.

**TYPE LOCALITY:** Vallecito, San Diego County, California. Type in Museum of Comparative Zoölogy, Cambridge, examined.

**DISTRIBUTION:** Southwestern California, Baja California.

**DIAGNOSIS:** Differs from the other subspecies as shown in table 8.

**SPECIMENS EXAMINED:** *California:* 1 ♀ (type, M.C.Z. No. 5202); (F. E. Blaisdell), 1 ♂; Horn Coll. No. 8986, 1 ♂, 1 ♀; 2 ♂; San Diego, 6 ♂, 1 ♀, (F. C. Pratt), 1 ♂, (Blaisdell), 2 ♂, May 9, 1931 (R. R. McLean), 1 ♀ "collected from head of chicken"; Los Angeles Co., 1 ♀, (M. Albright), 1 ♀, (Van Dyke), 2 ♂; Downey, July 3, 1933 (E. Herald), 1 ♂; Redondo, Apr., 1 ♂, Sept., 1 ♀; Laguna Beach, Orange Co., 1 ♂, 1 ♀, May 1, July 2, 1921, July 25, 1926, 1 ♂, 2 ♀, Dec. 26 (Gehring), 1 ♀; Pasadena, May, 1 ♀; Lakeside, May 15, 1927, 1 ♂.

Mexico. *Baja California:* Aug. 1, 1903, 1 ♂.

DISCUSSION: The elytra on the type are black except for the second and eighth intervals which are mostly white and the fourth and sixth which are white at the base. The pronotum has three wide black stripes that touch in two places.

This subspecies was synonymized with *ochrea* by Champion (1910, p. 157) without comment, but Chittenden (1924, p. 146) still considered it a separate species. It seems to me to be rather closer to *discolor* than to *ochrea*, although it combines some of the characters of each. This is especially noticeable in the pronotal vittae, which are more separated than in *discolor* but not so widely separated as in *ochrea*, and in the amount of black on the elytra, which is not so extensive as in *discolor* but more so than in *ochrea*. It is therefore closer to the former in coloration, but the abdominal hairs are more like those of *ochrea*. The elytral stria punctures are less pronounced than in either of the other two subspecies, seeming to be little more than a stria line, with scarcely impressed, shallow punctures. In *discolor* these punctures are usually deeper and rounder, in *ochrea* they are rather shallow but oval and distinctly impressed.

None of the *picta* specimens examined could be mistaken for *ochrea*, but four specimens (Redondo, Laguna Beach, and Los Angeles County) resemble *discolor* in coloration and in the merging of the pronotal vittae. These four, however, have the elytral punctures as in other *picta*, and the male has short hairs below. Another entirely black individual, a male, without further locality than "Cal." cannot be assigned to either subspecies, since it has the hairs below as in *picta* but both the elytral punctuation and the coloring of *discolor*.

For explanation of the notation "collected from head of chicken" on the San Diego specimen, see biology note under *C. aequalis*.

***Calendra aequalis discolor* (Mannerheim)**

*Sphenophorus discolor* MANNERHEIM, 1843, Bull. Soc. Imp. Nat. Moscou, vol. 16, p. 293; 1845, in Schoenherr, Genera et species curculionidum, vol. 8, pt. 2, p. 246. HORN, 1873, Proc. Amer. Phil. Soc., vol. 13, p. 417. CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 146.

*Calendra discolor*, SATTERTHWAIT, 1931, Ann.

Ent. Soc. Amer., vol. 24, p. 160; 1932, U. S. Dept. Agr., Farmers' Bull., no. 1003, p. 14.

TYPE LOCALITY: California; here restricted to Sacramento, California. Location of type in Europe unknown to author.

DISTRIBUTION: Northern California in San Francisco area, San Joaquin and Sacramento valleys. Oregon (Satterthwait).

DIAGNOSIS: Differs from the other subspecies as shown in table 8.

SPECIMENS EXAMINED: *California*: 1 ♂, 4 ♀; Horn Coll. Nos. 8985, 8986, 1 ♂, 5 ♀; San Francisco, June 8, 2 ♀, Aug. 3, 1908, May 21, 1911, 1 ♂, 3 ♀, Aug., 1916 (F. E. Blaisdell), 1 ♀, (Van Dyke), 1 ♀; San Francisco Co., May-June, 1910-1912 (Van Dyke), 2 ♂, 6 ♀; Davies, May 13, 1948 (A. T. McClay), 2 ♀, Nov. 2, 1946, 1 ♂, May 27, 1936, June 10, 1938 (M. A. Embury), 2 ♂, 3 ♀, June 10, 1936 (J. J. du Bois), 2 ♀, June 17, 1929, Apr. 9, 1927 (F. H. Wymore), 1 ♂, 1 ♀; Rio Vista, 1 ♂, 2 ♀, May 11, 1921, 1 ♂, 1 ♀, Apr. 25, 1926 (F. H. Wymore), 1 ♀; Woodland, May 30, 1933 (M. A. Cazier), 2 ♂; Clarksburg, June 4, 1931 (M. A. Cazier), 2 ♀; Antioch, May 30, 1933, Sept. 5, 1936 (M. A. Cazier), 2 ♂, June 8, 1933 (R. M. and G. E. Bohart), 2 ♀, Apr. 24, 1938, Sept. 5, 1941 (Van Dyke), 1 ♂, 4 ♀; Sacramento, Apr. 26, 1936 (M. A. Cazier), 1 ♂, June 3, 1920 (E. P. Van Duzee), 1 ♂, 2 ♀, Apr. 26, 1936 (E. S. Ross), 1 ♂, 1 ♀; Mokel Hill, May 10 (Blaisdell), 1 ♀; Oakland, Aug. 25, 1921 (F. H. Wymore), 1 ♀; Berkeley, June 24, 1915 (R. Hoppling), 1 ♂, June 3, 1919 (Van Dyke), 1 ♂; Dipsea, Marin Co., June 8 (F. E. Blaisdell), 1 ♂; Avon, July 25 (F. H. Wymore), 1 ♂; southeast of Stockton, June 9, 1919 (Van Dyke), 1 ♂; Alameda, 1915, 2 ♂; Alameda Co., June 4, 1903, 1 ♀, (W. G. Dietz), 1 ♂; Vine Hill, Alhambra Valley, Contra Costa Co., June 20, 1919 (F. E. Blaisdell), 1 ♂; Piedmont, May 24, 1917, 1 ♀.

DISCUSSION: Of 64 specimens, 10 have the pronotal vittae not entirely merged, but either separated as in *ochrea* (five) or partially separated as in *picta* (five). There are some white stripes on the elytra in 16 of the 64 specimens, the white being usually correlated with the specimens with more white on the pronotum, but in five the pronotum is black and the vittae merged. Of all the above specimens that might be confused with *ochrea* or *picta* because of the extent of white on the pronotum and/or the elytra, the males can be distinguished by the lack of visible hair below, which leaves 10 females, or 15 per

cent, that are colored as in *ochrea* or *picta*. These can be identified with a fair amount of accuracy by the elytral stria punctures which are usually deeper and more evident than in *picta*, not so oval as in *ochrea*, but somewhat variable and difficult to judge. *C. a. discolor* seems closer to *picta* than to *ochrea*.

Although all but one or two of the males examined showed no hairs in the ventral cavity, the hairs are actually present, though minute.

Satterthwait's report of *discolor* (1931a, p. 160) from Oregon is probably correct, and it has therefore been included in the distributional map (fig. 48).

***Calendra schwarzii* (Chittenden)**

*Sphenophorus schwarzii* CHITTENDEN, 1924, Proc. Ent. Soc. Washington, vol. 26, p. 145, pl. 5, fig. 1.

Large, slender; pronotum black on disc, white on borders, with three narrow bare lines for vittae, the laterals raised; elytra entirely white, opaque.

Beak (from side) long, scarcely compressed, straight, wider at apex, apex beneath obtusely angled; base not swollen over antennal insertion, no fovea present in front of eye; (from above) apex slightly flattened, base with impressed line, front of head finely punctured. Top of beak and front of head coated with white. Eye extending below insertion of beak. No thoracic lobe behind eye. Pronotum with two narrow, raised, lateral vittae, finely punctured, and a narrow impunctate line for the median vitta, no side branches, disc of pronotum black, opaque, with no visible punctures, outer side of laterals edged with white, then black, then white again at border of pronotum. Scutellum narrower than long, coated. Elytra with all intervals flat, covered with white, opaque coating, with one row of small punctures except on third interval which has two irregular rows of smaller punctures; striae with punctures slightly larger than on second interval, outer striae not impressed. Under surface, sides of prosternum white, opaque, with large black spots almost too shallow for punctures, sides of metasternum black, with recumbent golden hairs, center of metasternum, every abdominal segment, and inside of all femora and tibiae

covered with long golden hairs. Front tibiae with outer apical angle not prolonged, all tarsi with third segment widely dilated, below with two thick spongy-hairy pads, leaving a narrow smooth line in center. Pygidium without hairs (unless worn), and covered with white opaque coating. Length, 12 mm.

**MALE CHARACTERS:** Probably the hairy covering below and on the legs is present in the male only.

**TYPE LOCALITY:** Fort Monroe, Virginia. Type in the United States National Museum, examined.

**DISTRIBUTION:** Fort Monroe, Virginia.

**SPECIMENS EXAMINED:** *Virginia:* Fort Monroe, May 29 (Hubbard and Schwarz), 1 ♂ (type, U.S.N.M. No. 26900). "Ind or ?," 1 ♂.

**DISCUSSION:** This beautiful and striking species, of which only the type is known in this country, is undoubtedly an importation, though from what part of the world is uncertain. A worn specimen of Dupont's (about 1840), with an unpublished manuscript name in his handwriting, was found in the collection of the British Museum with the label "Ind or?," which might mean India or even the Indies, East or West. Except for the somewhat rubbed pronotum and the dirty condition of the white coating, this specimen agrees with the type of *schwarzii*.

It is possible that this species does not belong in *Calendra*, although the only character that is not represented elsewhere in the genus is the sole of the third tarsal segment, which is spongy rather than hairy and has a linear narrow smooth space in the center instead of the usual triangular space. Most species in the genus *Rhodoabaenus* have this type of tarsi except that the linear smooth space extends usually only halfway to the apex of the segment, not all the way, as in *schwarzii*. Too much reliance cannot be placed on this tarsal character, however, since other genera close to *Calendra* show some variation in this respect, as also does *Calendra* itself.

The coating in *schwarzii* is like that of white specimens of *aequalis ochrea*; the hairs in the ventral cavity are more abundant than in *aequalis aequalis* and are not confined to the center of the abdomen but reach from side to side. It is otherwise, except for the tarsal difference and the differently colored

and punctuated pronotum, very similar to the above forms of *aequalis*.

***Calendra velutina* (LeConte)**

Figures 60, 109

*Sphenophorus velutinus* LECONTE, 1876, Proc. Amer. Phil. Soc., vol. 15, p. 424. BLATCHLEY AND LENG, 1916, Rhynchophora of northeastern America, p. 559.

Large, slender; entirely covered above with opaque, velvety brown or black coating, pronotum without evident vittae.

Beak (from side) long, strongly compressed, curved throughout; wider at apex, apex beneath forming right angle with acute point, base not swollen over antennal insertion, no fovea present in front of eye; (from above) apex strongly concave, base with no canal, front of head finely punctured. Eye extending below insertion of beak. Thoracic lobe present behind eye. Pronotum nearly as long as elytra, without true vittae, but with feebly raised laterals showing at base, entire pronotum covered with thin velvety coat, finely punctured except for narrow, impunctate, median space (not always present), at base on sides two round depressions; interspaces with larger punctures. Scutellum narrower than long. Elytra with third and fourth intervals, especially the fourth, raised at extreme base, but more or less flat at middle, other intervals more or less flat, with scattered fine punctures on all but second and sixth intervals which have but one row of punctures (usually punctuation obscured by opaqueness); striae with distant fine round puncture separated, in places, by as much as the width of an interval, third, sometimes also fourth, stria turned obliquely towards suture at extreme base. Apical callosities sharp. Under surface with fine, sparse punctures. Legs, front tibiae with outer apical angle not prolonged, but with sharp minute tooth, front and middle tarsi with third segment widely dilated, flattened, below with hairy pads, hind tarsi with it less dilated but still almost as wide as long, below with hairy pads. Pygidium with hairs at apex. Length, 11–12 mm.

TYPE LOCALITY: Florida. Type in Museum of Comparative Zoölogy, Cambridge, examined.

DISTRIBUTION: Gulf states.

SPECIMENS EXAMINED: *Florida*: 1 ♀ (type, M.C.Z. No. 5203); Buena Vista (C. A. Mosier), 1 ♀; Homestead, Feb. 15 (Mozenette), 1 ♂; Atlantic Beach, 1 ♀; Pensacola, Oct. 11, 1914, 1 ♂; Paradise Key, Apr. 9, 1919 (C. A. Mosier), 1 ♀; Upper Metacumbe Key, Mar. (Brooks), 1 ♂. *Alabama*: Delchamps, Oct. 21, 1911, Nov. 18, 1916 (H. P. Loding), 1 (?), 1 ♀, Aug. 30 (H. P. Loding), 1 ♂; Mobile, July 1, 1923, Nov. 20, 1924 (A. Nicolay), 2 ♂, 1 ♀. *Texas*: Victoria, Apr. 24 (J. D. Mitchell), 1 ♂. *Louisiana*: Horn Coll. No. 8992 ?, 1 ♀.

DISCUSSION: It is possible that *velutina*, like *schwarzii*, is an importation. It is thinner through the body than most of our *Calendra*, and the elytra, when seen from the side, are flatter and do not bend downward and round off as in most of our species. The front tibiae seem very short in proportion to the size of the insect, and the femora are also shorter than in other species of equal size. The elytra narrow rapidly to the apex and are scarcely longer than the pronotum. The width of the hind third tarsal segment is somewhat variable.

Differs from all other species in the United States in its uniform, velvety, opaque, dark coating which is more similar to the pruinosity of many members of the genus *Rhodaenus* than of *Calendra*.

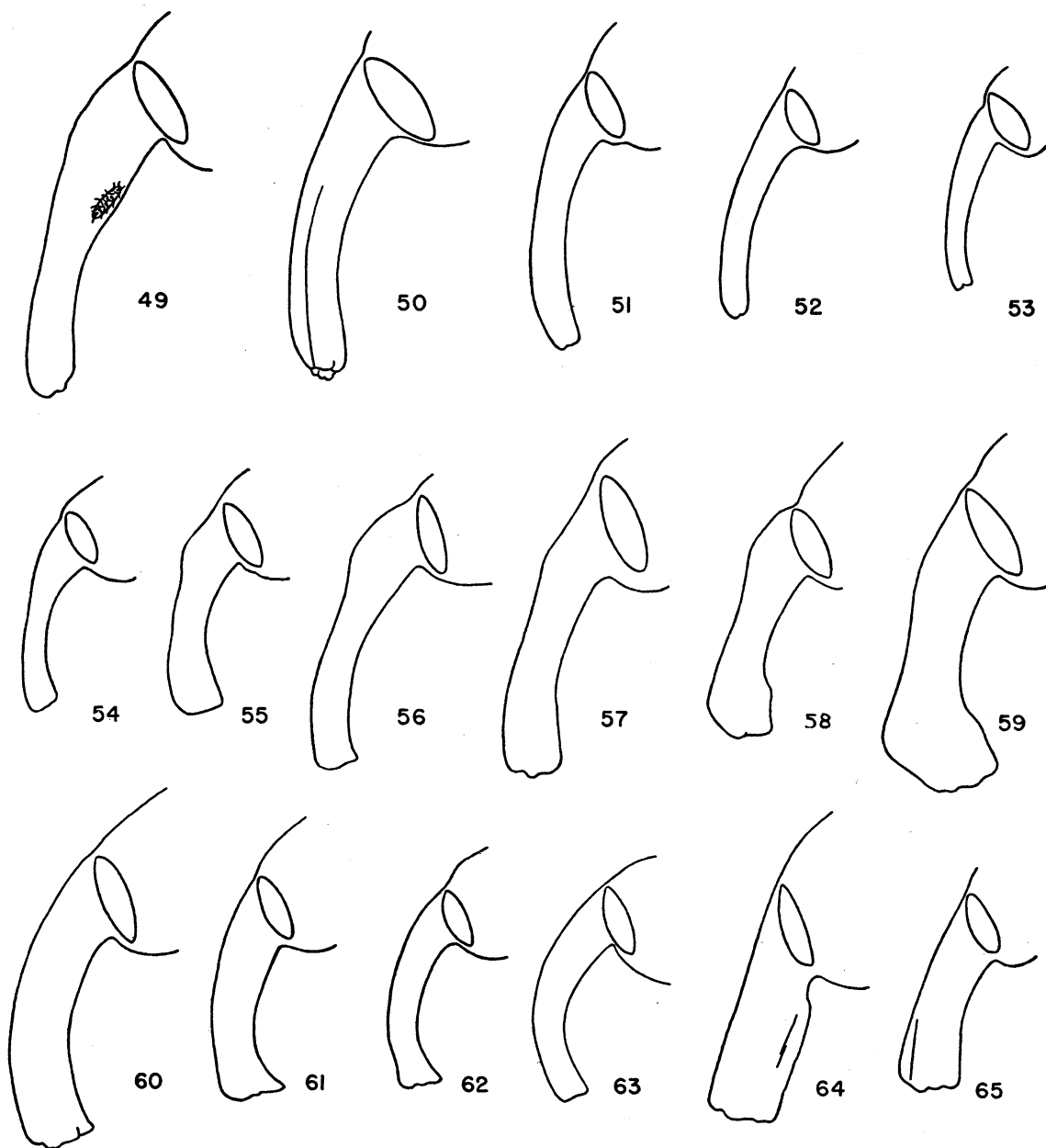
***Calendra multipunctata* (Champion)**

Figure 49

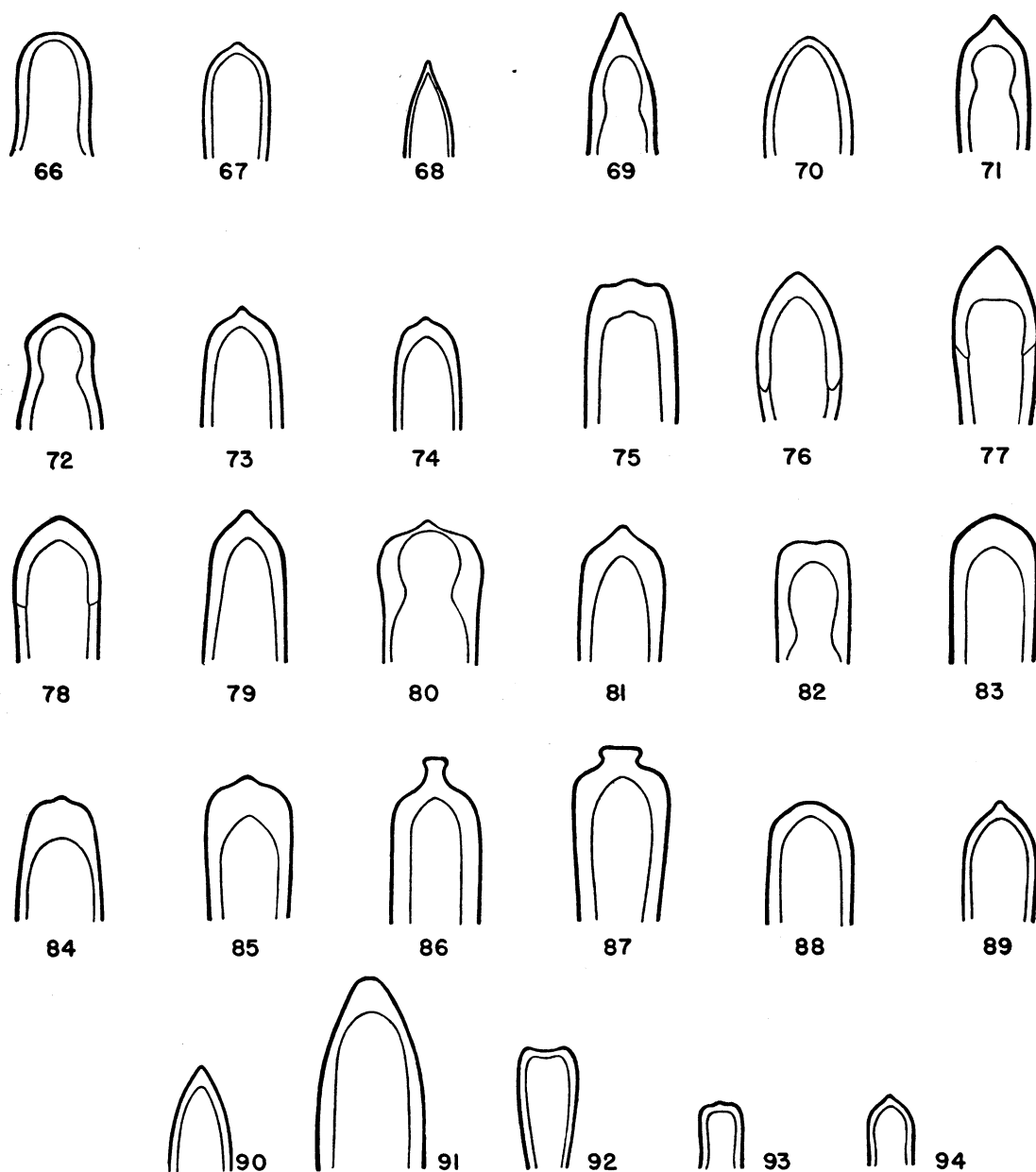
*Sphenophorus multipunctatus* CHAMPION, 1910, Biologia Centrali-Americana, vol. 4, pt. 7, p. 158, pl. 7, figs. 34, 34a.

Large, robust; black, no coating, pronotum without vittae but with median impunctate line, elytra with intervals flat and equal, uniformly densely punctured.

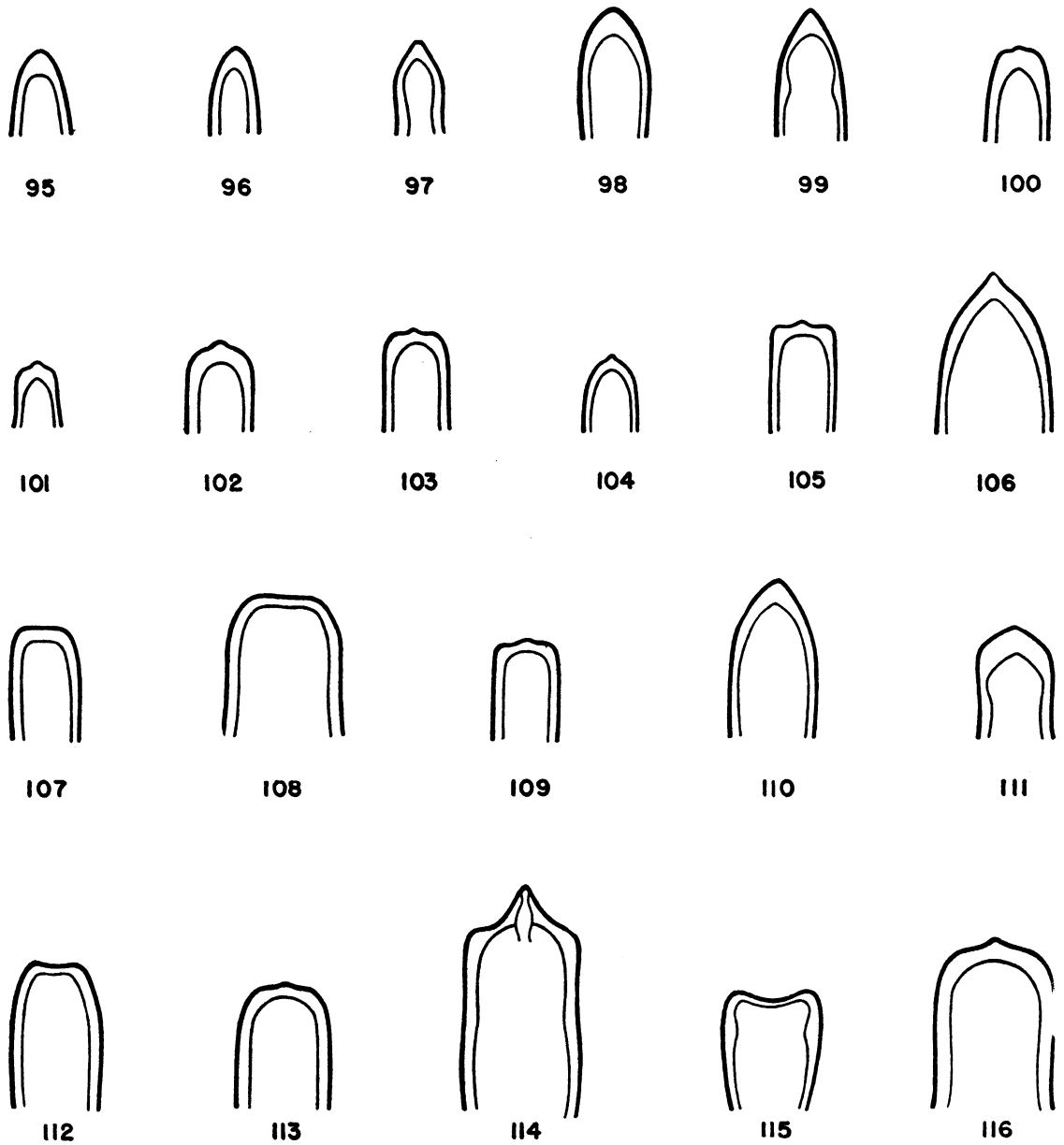
Beak (from side) long, nearly straight, nearly cylindrical, not dilated at apex but slightly wider at apex, apex beneath rounded, base very swollen over antennal insertion, no true fovea in front of eye, near base on each side a hairy depression; (from above) apex flattened, base with depression, and punctures extending forward, front of head strongly punctured. Eye extending below insertion of beak. Slight thoracic lobe. Pronotum without vittae, but with swellings at base where lateral vittae would be expected and short impunctate line in center; punc-



FIGS. 49-65. Diagram of beaks. 49. *Calendra multipunctata*. 50. *C. mormon*. 51. *C. pontederiae*. 52. *C. subulata*. 53. *C. ima*. 54. *C. gagatina*. 55. *C. soltauui*. 56. *C. zae*. 57. *C. germari*. 58. *C. melanocephala*. 59. *C. latinasa*. 60. *C. velutina*. 61. *C. coesifrons*. 62. *C. parvula*. 63. *C. missouriensis*. 64. *C. culiellata*. 65. *C. compressirostris*. All are females except 52, 53, and 60.



FIGS. 66-94. Apices of penis, dorsal view. 66. *C. simplex* (also *mormon*). 67. *C. subulata*. 68. *C. ima*. 69. *C. angusta*. 70. *C. crenata*. 71. *C. quadrivittata*. 72. *C. lineata*. 73. *C. gentilis*. 74. *C. tarda*. 75. *C. graminis*. 76. *C. vomerina*. 77. *C. memnonia*. 78. *C. championi*. 79. *C. nevadensis*. 80. *C. arizonensis*. 81. *C. cicatristriata* (also *terricola*). 82. *C. deficiens*. 83. *C. blanchardi*. 84. *C. necydaloides*. 85. *C. coesifrons*. 86. *C. chittendeni*. 87. *C. dietrichi*. 88. *C. cultellata* (also *compressirostris*). 89. *C. cazieri*. 90. *C. inaequalis*. 91. *C. germari*. 92. *C. soltauui*. 93. *C. gagatina*. 94. *C. marina*.



FIGS. 95-116. Apices of penis, dorsal view. 95. *C. parvula*. 96. *C. minima*. 97. *C. apicalis*. 98. *C. sayi*. 99. *C. diversa*. 100. *C. hoegbergii*. 101. *C. missouriensis*. 102. *C. recta*. 103. *C. neomexicana*. 104. *C. phoeniciensis*. 105. *C. pontederiae* (also *incurrens*). 106. *C. scoparia*. 107. *C. cubensis*. 108. *C. maidis* (also *melanocephala*, *incongrua*, *robusta*). 109. *C. zeae* (also *callosa*, *cariosa*, *velutina*). 110. *C. sulcifrons*. 111. *C. destructor*. 112. *C. striatipennis* (also *costipennis*). 113. *C. villosiventris*. 114. *C. pertinax*. 115. *C. australis*. 116. *C. aequalis*.



tures on laterals smaller than those on sides of pronotum, at base punctures denser, punctures generally fine and sparse. Scutellum nearly parallel. Elytra smooth or transversely rugose, with intervals about equal in width, flat or feebly convex, with single (sometimes irregular) rows of large punctures, larger than those at base of pronotum and nearly as large as those on striae; striae with large, usually touching punctures. Apical callosities broad, prominent. Under surface, sides of prosternum with large punctures as on border of pronotum, but sparser. Apex of abdomen with depression. Legs, front tibiae with outer apical angle not prolonged, but with small tooth, all femora and tibiae with sparse hairs on inner side, tibiae curved, all tarsi with third segment widely dilated, flattened, below with hairy pads. Pygidium with large punctures, as those on striae, apex with fringe of hairs. Length, 13–14 mm.

**MALE CHARACTERS:** Apex of abdomen with deep, large cavity bordered by a crenate ridge on each side, the cavity and rest of abdomen with fine, scattered hairs.

**TYPE LOCALITY:** Tepenistlahuaca in the state of Oaxaca, Mexico. Type in British Museum, examined.

**DISTRIBUTION:** Southern Mexico.

**SPECIMENS EXAMINED:** Mexico. 1 ♀. *Oaxaca*: Tepenistlahuaca, (Sallé coll.), 1 ♂ (type).

**DISCUSSION:** This southern species differs from other Mexican and United States species in four characters: at the base of the beak on each side below in front of the antennal insertion there is an elongate depression from which hairs protrude (fig. 49); at the apex of the abdomen in the male there is a deep

excavation, also with hairs, which takes up the entire center of the apical segment and is bordered on the sides by a crenate ridge; the middle and hind tibiae are definitely curved; and no subapical tooth can be discerned in the hairs of the tibiae. These characters might make one wonder if this species belonged in *Calendra*, but the generic characters are all present, and it could not be *Rhodobaenus* because of the lack of an excavation at the inner apex of the last tarsal segment.

The type, a male, has the beak and pronotum longer and narrower than in the female specimen examined, and the elytra broadly rugose with the interval punctures larger, taking up most of the interval, not a third of it, as in the female. This female specimen has a label in Champion's writing, "*Sphenophorus multipunctatus* var. G. C."; he did not include it in his discussion of *multipunctata*. It agrees in other characters with the type except that the apex of the abdomen is merely deeply and transversely depressed, not excavated as in the male.

This species does not bear much resemblance to others in the United States and Mexican fauna, and it is difficult to decide where to place it. If it were to be put near the species with simpler pronotal patterns, it would not correspond to them either in size or in tarsal dilation. And if it were put near the large species with dilated tarsi, it would not correspond in the pronotum or in the cylindrical beak. It has therefore been placed at the end, after *C. velutina*, with which it agrees only by having widened tarsi, no pronotal pattern, rapidly narrowing elytra, and by being probably also subtropical in origin.

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