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(COLEOPTERA, SCARABAEIDAE)

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INTRODUCTION

THE DUSTY-LOOKING MEMBERS of this unattractive but interesting genus of beetles are found in many parts of the world. *Trox* is from the Greek *trog*, to gnaw, and these beetles gnaw on dried carcasses and carrion of all sorts, or on feathers, or on the animal debris in the nests of birds or small mammals.

Except for a few of the smaller species, the majority of *Trox* have a crusty tomentose indument on the body, especially on the head and pronotum, often supplemented by layers or particles of mud. When these dull-looking scarabs appear on a collecting sheet at night or when they are surprised while investigating a corpse, they pull in the legs, drop the head downward out of sight and remain motionless, looking very much like pieces of a stick or of earth or of excrement. The majority of the species in North and Central America are oblong in shape, somewhat convex, parallel-sided, but a few of the largest species, some of which are wingless, are ovate in shape and very convex. In size they range from about 4 to 19 mm. in length.

The present paper is based on material collected on two David Rockefeller expeditions (1947, 1953) to Mexico and the southwestern United States, and on collections from 23 in-

stitutions or individuals. The material examined totals nearly 8000 specimens, representing 41 species (three of which are described as new in this paper), from Canada and the United States south to Nicaragua, including some of the West Indies. Twelve species are recorded for the first time from Mexico. Five species are synonymized; the monotypic genus *Pseudotrox* is considered to be congeneric; three forms described as species are considered to be subspecies. The types or lectotypes of 17 of LeConte's forms and of 14 described by Robinson have been examined, as have the cotypes of a species of Horn's and of Harold's.

The cooperation of Mr. Mark Robinson who has been working for many years on the taxonomy and biology of North American *Trox* has been of great aid in the writing of this paper. Owing to the pressure of other work, Mr. Robinson was unable to continue his revisionary studies in the genus, but he was very generous in his offer to help with the present work, and he has made available not only his type material and some other specimens, but also all his notes and unfinished manuscript.

DISTRIBUTION

The genus *Trox* is world wide in distribution, occurring in the temperate and subtropical regions, chiefly in the drier parts. A few species extend rather far to the north, occurring in Siberia and in Canada. In Junk's catalogue (Arrow, 1912), approximately 14 species are listed in Europe, 14 in Asia, six in India and the Pacific islands, five in Central America, 19 in South America, 31 in Australia, 36 in Africa, and 19 in the United States. These figures, of course, have been increased since that time. One tiny species (*scaber*) is virtually cosmopolitan, and in the New World *suberosus* extends all the way from Canada to Patagonia, including the West Indies, the Bahamas, and the Galapagos Islands. With the exception of these wide-ranging species, and a new species (Mexico and Argentina), the fauna of each continent is distinct.

Nineteen of the 41 American species occur in the United States or Canada but not in Mexico; only three occur in Mexico but not in the United States; 18 species occur in both the United States and Mexico; one species is endemic to Cuba (*insularis*). Two species (*tytus* and *suberosus*) occur both in Cuba and the United States. Eleven species have been taken in Canada. Only three species extend their ranges south of Mexico, *fuliginosus* into Guatemala, *rubricans* into Guatemala and Nicaragua, and a new species to Argentina.

In the United States more species are restricted to the western drier areas than to the eastern wetter ones. Only three of the 13 western species, *atrox*, *sonorae*, and *punctatus*, have been taken east of the Mississippi River, whereas all the 16 eastern species except *terrestris* (eastern and Gulf coasts only), *striatus*, and *laticollis* occur also west of the

TABLE 1
OCCURRENCE OF THE GENUS *Trox* IN MEXICO^a

	Baja California	Sonora	Sinaloa	Nayarit	Chihuahua	Durango	Coahuila	Nuevo Leon	Tamaulipas	Zacatecas	San Luis Potosi	Aguascalientes	Jalisco	Guanajuato	Michoacan	Hidalgo	Puebla	Distrito Federal	Morelos	Guerrero	Oaxaca	Veracruz	Tabasco	Yucatan
<i>aequalis</i> ^b	—	—	—	—	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>atrox</i> ^b	—	—	—	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>spinulosus</i> ^b	x	—	—	—	x	x	x	—	—	—	—	—	—	—	x	—	—	—	x	—	—	—	—	—
<i>sonorae</i>	—	x	—	—	x	x	—	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>gemmulatus</i> ^b	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>acanthinus</i> ^c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	—	—
<i>plicatus</i> ^b	—	x	—	—	x	x	—	—	—	x	—	—	—	—	x	x	x	x	—	—	—	x	—	—
<i>loxus</i> ^c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>suberosus</i>	x	x	—	—	x	x	x	—	x	—	x	—	x	—	x	—	—	x	x	x	x	x	x	x
<i>rubricans</i> ^d	—	—	x	—	?	?	—	x	x	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>tomentosus</i> ^c	—	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	—	—	—
<i>carinatus</i> ^b	—	—	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>fuliginosus</i> ^b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	—	x
<i>asper</i>	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>punctatus</i>	x	x	—	—	x	x	—	x	—	—	—	x	—	x	—	—	—	—	—	—	—	—	—	—
<i>inflatus</i> ^b	—	—	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>tesselatus</i>	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	—	—	—	—
<i>nodosus</i> ^b	—	—	—	—	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>texanus</i> ^b	—	—	—	—	—	—	—	x	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>umbonatus</i> ^b	—	—	—	—	x	—	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>scutellaris</i>	—	x	—	—	x	x	x	—	—	—	—	—	—	—	—	—	x	x	x	—	—	—	—	—

^a The states are listed from north to south.

^b First published records from Mexico.

^c Not known to occur north of Mexico.

^d ? The locality "Presidio" may be in Chihuahua or Durango.

Mississippi, at least as far as Kansas and eastern Texas. Only six of these eastern species, however, reach farther westward to scattered localities in Colorado, Utah, Wyoming, New Mexico, Arizona, Washington, or California (*scaber*, *aequalis*, *tuberculatus*, *capillaris*, *unistriatus*, and *asper*). The other eastern species are *affinis*, *hamatus*, *foveicollis*, *variolatus*, *sordidus*, *monachus*, and *scabrosus*. The western species, except for the three mentioned above and *scutellaris* and *fascifer*, are restricted to the largely semi-arid southwestern states of Arizona, New Mexico, Texas, and sometimes Utah or southern California, many of them continuing south into Mexico (*gemmulatus*, *plicatus*, *carinatus*, *inflatus*, *tesselatus*, *nodosus*, *texanus*, and *umbonatus*). *Trox scutellaris* occurs also in

Kansas, and *fascifer* is exclusively northwestern in distribution.

Of the species not yet mentioned (United States only), five are neither eastern nor western, *robinsoni* being in the central plains from Canada south to Texas, and *frontera*, *contractus*, *rubricans*, and *fuliginosus* all restricted to the state of Texas. Of these, *frontera* and *rubricans* are each known from but one locality in the southern part of the state. It is interesting to note that 31 of the 41 species in North America occur in Texas, the only ones not yet taken there being *fascifer*, *striatus*, *laticollis*, *terrestris*, *gemmulatus*, *tytus*, the Cuban species (*insularis*), and the three species endemic to Mexico. One species (*suberosus*) is virtually country wide in distribution; *spinulosus* has two sub-

species in the east and one in the southwest and Mexico; and *tytus* has a scattered range in the states of Pennsylvania and Georgia in the east, Oklahoma in the central plains, and Arizona in the southwest, as well as in the island of Cuba. In all these localities this last-named species was found living in the nests of barn owls, a habitat that is not often investigated. Specialized habitats may also explain the discontinuous distribution of two of the eastern species mentioned above: *striatus*, in owls' nests in Pennsylvania, New Jersey, and Arkansas, and *laticollis*, found in the dens of foxes in three northeastern states, also in Iowa and Arkansas. Some typical patterns of distribution are illustrated in the

maps (figs. 7, 8, 11, 13-16, 18, 19, 21, and 24).

The distribution of the 21 species occurring in Mexico, only three of which are endemic, is given in table 1. It will be noted that the species are more numerous in the north than in the south of Mexico, principally in the semi-arid states of Sonora, Chihuahua, Durango, and Coahuila, and in the peninsula of Baja California. Only two species occur exclusively south of about latitude 20° N. (Michoacan southward); eight others with northern distribution continue south of that latitude. The last 15 species on the list are all in the *suberosus* group.

BIOLOGY

Adult *Trox* are found in a variety of habitats. They are the last visitors to dry carcasses after the Diptera and other Coleoptera have taken their fill and when only skin, bones, and hair remain. They feed also in other situations where feathers or animal hairs abound, either in the nests of birds, chiefly hole-nesting birds such as owls, woodpeckers, and starlings, or in the nests or burrows of small mammals, such as foxes, gophers, squirrels, mice, rats, rabbits, and badgers. Owl pellets are a good source of supply for some of the smaller species. Occasionally *Trox* are found at dung, decayed fish, and fungi. Some species are attracted to a bait of chicken feathers or malt, and many species come to light.

If conditions are suitable, *Trox* apparently lay their eggs near their food supply. Xamheu (1892) in Europe put out a dead chicken as a lure in March, and at the end of July found 300 larvae, pupae, and adults of *T. scaber*, some still feeding on the tendons of the victim. He says the larvae enter the ground beneath the body to a depth of from 2 to 10 cm., depending on the freshness and friability of the soil, and that the pupal stage lasts about a month. The larva (Robinson, *in litt.*) "forms an oblong cell the walls of which are strengthened with small fibres or debris," and "the cocoons of *Trox scaber* taken from crows' nests are suggestive of certain short but well built caddis cases found in brooks."

In this country Mark Robinson found that a number of small species that were consid-

ered quite rare could be taken in large quantities once their habitat was known, and he and Sim and Bottimer collected hundreds of specimens of *aequalis*, *affinis*, *spinulosus*, and *striatus* in the nests or pellets of birds. He says (1941, p. 227): "in the case of such birds as crows, titmice and other Passerines, the *Trox* are feeding on the feathers used to line the nest or the hairs which crows will intertwine through their nests; hawks' and owls' nests will always have scattered through them hair and feathers from the mammals and birds with which the Raptores had fed their young. In order for the *Trox* to be able to subsist in these nests, the nests must be very thick, or be in the cavity of a tree, in order to preserve the moisture which the larvae must have in order to mature." Heim de Balsac (1952) who studied the contents of a huge stork nest in Lorraine, France, found that *T. scaber*, one of the 32 species of beetles found in the nest, was a strict commensal and sought mainly the humidity of the nest for its young. Paulian (1943) found *T. perisi* Fairmaire, of Europe, to be an exclusive *nidicole* in hollow trees inhabited by birds of prey, wood pigeons, or woodpeckers, although most *nidicolous* beetles, he said, were not so particular and would take any sort of cavities on the ground or in trees. Although some American *Trox* occur in the nests of many different birds, a few species, Robinson believes, are endemic to the nests of particular birds, such as *tytus* in the nests of barn owls, *affinis* in the nests of crows, and *striatus*

"in the nests or nesting cavities of our species of owls." All the species in the United States known to be associated with birds (except *tytus* and *monachus*) are not more than about 10 mm. long. All specimens of the tiny *laticollis* have been taken exclusively in the burrows of foxes.

Some unusual habits of *Trox* have been reported. Berg (1898) records *T. suberosus* contributing to the destruction of the eggs of the locust *Schistocerca paranensis* in Argentina by eating the protective substance around the egg, after which the egg decomposes. Gardner (1946) says that *T. procerus* in India is "suspected of feeding on eggs of the locust *Schistocerca gregaria*." Perris (1877) received larvae of *T. hispidus* Laicharteg from Corsica that had been found in March feeding on a dirty piece of woolen material below

the ground. Robinson (1941) also has found species feeding on an old carpet, an old felt hat, and (*in litt.*) on a wool sweater and the horsehair cushion of an automobile seat. Paulian (1943) cites a species of *Trox* in the guano caves of Celebes that feeds on the ejections of the bats.

Péringuey (1901) mentions that *Trox* stridulate feebly when captured. The stridulating organ (Blatchley, 1910) is "in the form of an elliptical plate with pearly reflections, located on the upper part of the outer face of the first ventral segment and covered by the elytra. A small oval polished space on the inner surface of the elytra near the margin and about opposite the plate serves as an aid in producing the sound."

Further notes on habits and habitats appear under the species.

HISTORY

The earliest recorded species of *Trox* from the North American fauna are *scaber* Linnaeus, 1767, a nearly cosmopolitan species, and *tuberculatus* De Geer, 1774, from Pennsylvania. These species were not included by Fabricius, however, when he described the genus *Trox* in 1775, with three species, *sabulosus* Linnaeus, *suberosus* Fabricius, and *spinicornis* Fabricius. The first of these was designated as type of the genus by Latreille (1810).

The first review of *Trox* was by Herbst (1790), who included 13 species, of which three are now known to occur in North America (*suberosus*, *tuberculatus*, and *monachus*). Later the genus was reviewed in a general way by Fabricius (1792), Erichson (1848), and Lacordaire (1856), but the first important work on a world-wide basis was Harold's monograph of 1872, in which he described about 30 new species and recognized about 100, 26 of which occur in North America. Harold not only discussed the morphological characters in detail, but gave a key to the species in Latin, described each species at length in both Latin and German, and made comparisons with other species. Burmeister (1876) discussed the Argentine *Trox*, also mentioning some species from the United States. Péringuey, in his review of South African *Trox* (1901), was the first

author to describe and illustrate the male genitalia, which have since proved of such importance in classification. In 1936 Balthasar wrote a monograph of the subfamily Troginae of the Palearctic region only. Dr. E. Haaf of the Museum G. Frey in Munich is at present working on revisions of the genus outside of North America, and his paper on some of the African species has already been published (1953).

The only revisions of the species in the United States and Mexico are those of LeConte (1854), who described 15 new species out of a total of 25, and of Horn (1874). The latter revision, written to clarify the American species not known to Harold two years previously, included but 21 species because Horn synonymized a number of LeConte's names and added only one new species. Since 1874 there has been no further revision of North American species, although Blatchley (1910) reviewed 15 of the species occurring in Indiana and the eastern states, and Robinson (1940, 1941, 1946) described 15 new species, with notes on some of the older forms. Loomis (1922) described four species. Other authors of valid species occurring in North America are Beauvois, Chevrolat, Fabricius, Germar, Harold, Herbst, Melsheimer, and Say; also De Geer and Linnaeus, mentioned above.

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Mr. H. B. Leech, California Academy of Sciences; Mr. A. T. McClay, University of California at Davis; Dr. P. D. Hurd, Jr., University of California at Berkeley; and Mr. F. S. Truxal, Los Angeles County Museum. The following individuals have kindly lent specimens from their collections: Messrs. O. Bryant, R. C. Casselberry, E. R. Leach, L. J. Bottimer, B. Malkin, F. M. Parker, and Dr. H. Howden. Specimens were studied also in the natural history museums of Copenhagen and London.

Dr. Mont A. Cazier of the American Museum of Natural History was kind enough to check the key and to give some helpful suggestions. Miss Marjorie Statham made the drawings of the genitalia and of the new species. I thank the British Museum for a male of *acanthinus*.

GENERAL REMARKS AND TREATMENT

The type localities of LeConte's species have been accepted from his writings, because his type specimens rarely have exact locality but are labeled with colored discs indicating regions only. The specimen in his cotype series that bears his original handwritten name label is accepted by most authors as the type and I so consider it, but Robinson (1940) has already designated some of these "number one" specimens as lectotypes (*erinaeus*, *integer*, *texanus*, *suturalis*, and *umbonatus*).

A complete synonymy of each species is given, but additional references to the literature are omitted, as most of these are listed

in Junk's catalogue (Arrow, 1912) and involve the same papers, namely, those of Harold, LeConte, Horn, Blatchley, and Robinson.

The formal descriptions of the species are relatively short because the characters common to each of the five groups of species are given in the text before the key to the species and are not repeated. The length is measured from the front of the pronotum to the apex of the elytra; the wings are measured from the basal attachment to the apex. Variations of a millimeter or so are to be expected, especially in the smaller species which are more difficult to measure.

CLASSIFICATION AND MORPHOLOGY

The 41 species of *Trox* are here divided into five groups of species which are discussed below in the systematic section: four small groups of small species (*scaber*, *terrestris*, *tuberculatus*, and *unistriatus* groups) totaling 24 species, and one large group of 17 large species (*suberosus* group). The latter have the scutellum hastate or lance-shaped; the other groups have it elongate oval. There are many more differences separating the *suberosus* group from the other groups than there

are separating the smaller groups from one another (see table 2).

The species, with one or two exceptions, readily fall into groups not only by external characters but by the male genitalia as well (the groups and their characters are described below under the genus in the Systematic Section). In general the species seem to progress from those small in size and with undifferentiated or simple sculpture and pattern to larger species with definite sculpture of ridges,

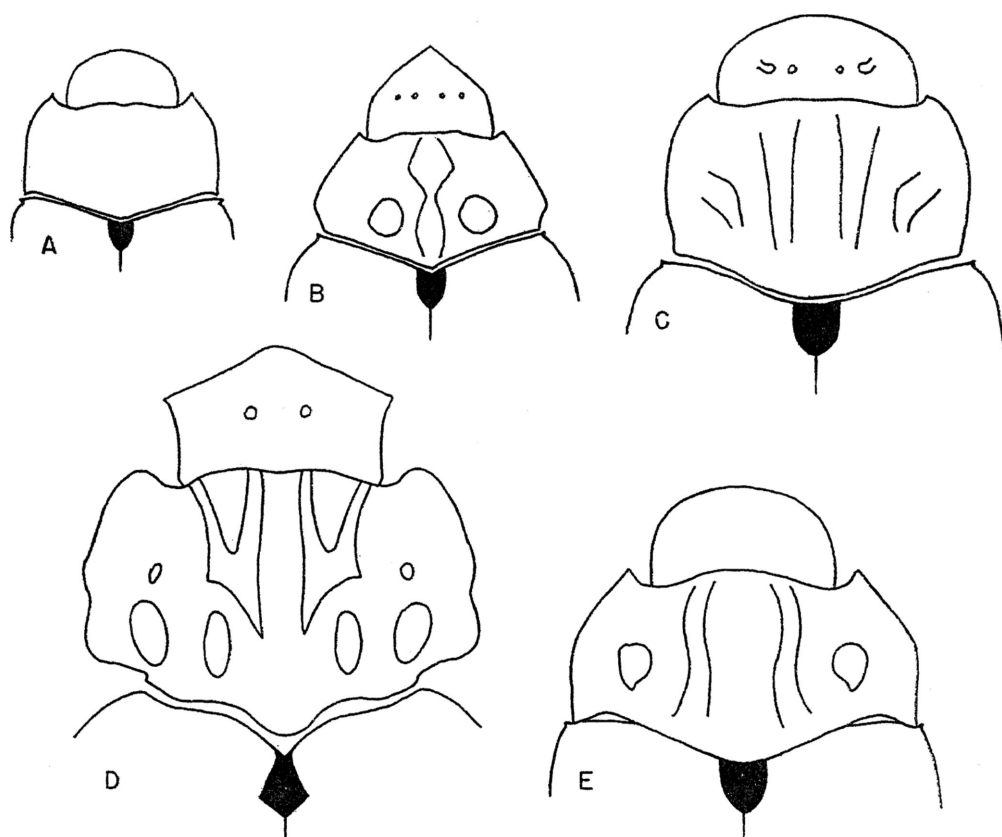


FIG. 1. Diagrams of the pronotum and scutellum in *Trox*, by groups. A. *T. aequalis* (*scaber* group). B. *T. terrestris* (*terrestris* group). C. *T. unistriatus* (*unistriatus* group). D. *T. punctatus* (*suberosus* group). E. *T. sonorae* (*tuberculatus* group). The lines and circles on the pronota represent raised areas except in B, where they represent depressions.

tubercles, and callosities. The smaller species have the basal pieces of the male genitalia proportionately much larger than in the larger species, a more primitive characteristic according to Wood (1952, p. 616), but they also have them fused dorsally, a less primitive characteristic. In the larger species, the basal pieces, although reduced in size, are open, not fused dorsally.

It is interesting to note that those species of the *suberosus* group that are found principally in the more arid desert regions of the western United States and northern Mexico (*carinatus*, *punctatus*, *inflatus*, *tesselatus*, *nodosus*, *texanus*, *umbonatus*, and *scutellaris*) have the least tomentosity and their elytra are furnished with large glabrous tubercles (sometimes alternating with tomentose tubercles). In speaking of desert insects, Paul-

ian (1943, p. 271) remarks on the fact that their sculpture is often exaggerated and characterized either by spines and abundant pubescence or, as in *Trox*, by large tubercles and callosities. Van Dyke (1933, p. 475) states that one of the results of a desert environment is a tendency to a wingless condition, as in four of the above species, with a resultant increase in size and a general excessive development "of all parts, resulting in a much grosser type of insect." Some of the *Trox* of the Australian deserts are even larger (up to 31 mm.) than ours and have an even more exaggerated sculpture of bristling spines and sharp tubercles. The foregoing observations, however, evidently do not apply to some of the small western species of the other groups that occur in the same regions with the *suberosus* group.

Following is a discussion of the diagnostic characters that are used in this paper to distinguish either groups of species or the species themselves. The characters separating species vary from group to group (see discussion of groups below in Systematic Section); the elytral pattern, for example, is sufficient in itself for identification of members of the *unistriatus* group, but relatively useless without other characters for most species of the *terrestris* and *tuberculatus* groups. Most parts of the external anatomy serve to distinguish some of the species, with the exception of the mouth parts, mesosternum, abdomen, front and middle legs, and hind femora.

COLOR AND VESTITURE

All species are black, piceous, or occasionally deep red in ground color, the majority being partially or entirely overlain by a dirty brown indument or tomentosity which is often greased and then appears black. This indument is often light brown or buffy (*suberosus*, *fuliginosus*, *asper*), light reddish (*monachus*), or dark red (*capillaris*). The seven species of the *scaber* group are generally lacking in tomentosity; those of the *terrestris* group have it on the pronotum, but it is present on the elytra under the setose patches only; it is variable in the *unistriatus* and *tuberculatus* groups, and in the *suberosus* group it is always present on the pronotum and either covers the beetle entirely (*tytus*, *loxus*, *suberosus*, *fuliginosus*, *monachus*) or appears in scattered patches on the intervals of the elytra.

The length, density, arrangement, and abundance of setae on different parts of the body are often good specific characters. The setae on the outside of the hind tibiae in those species with the tibiae serrate are very stiff and are called spines in this paper. The color of the various hairs and setae (black, piceous, bronze, fulvous, and yellow) is usually significant but varies within some species. The setae on the margins of the pronotum and elytra are pale in all species with oval scutellum except in *acanthinus* and some *laticollis* in which they are black. The setae on the dorsum of the elytra are generally yellow, but bronze to black in *acanthinus*, *variolatus*, *capillaris*, and in most *tuberculatus*.

The long hairs on the antennal scape and around the labrum and mandibles are either black or fulvous or both in *sonorae*, mostly black in *scabrosus*, black in *acanthinus*, *nodosus*, *texanus*, and *scutellaris*, and fulvous in all other species. The color of the antennal club is usually fulvous like the hairs on the scape, but it is often gray-brown or darker even in species with fulvous hairs on the scape.

HEAD AND CLYPEUS

In our species of *Trox* the differences to be found on the head and clypeus serve to separate groups of species rather than single species. All members of the hastate scutellum group have the clypeus obtusely triangular, acutely angular at the sides (fig. 1D), strongly reflexed, slightly bent down in front; the head is bituberculate except in one species (*tytus*); in the oval scutellum groups more than half of the species have the clypeus broadly rounded (*scaber* and *tuberculatus* groups, also *sordidus*, *capillaris*, and *unistriatus*; fig. 1A, C, E), and eight have it triangular (fig. 1B) but not at all bent down (*terrestris* group and *variolatus*). In the *scaber* group there is some variation in the front margin of the clypeus, the apex being almost angulate and often slightly turned upward in four of the species. The head in these smaller species may be bituberculate or quadrituberculate, or flat but with a transverse or sometimes irregular row of setae between the eyes. These setae are very often worn off or obscured by tomentosity and are therefore not of much practical use for identification. The punctures on the head in the small species, when visible, are seen to be dense in all, with variable impunctate areas, usually behind the row of setae; the punctures of the clypeus are also dense except in *atrox* of the *scaber* group, in which species they are virtually lacking.

ANTENNAE

Several group characters and a few that separate species are found in the antennae, which unfortunately are not visible unless the head or the opposing front femora have been pried apart. In the first four groups of species (those with the scutellum oval) the funicle is attached to the apex of the scape and the scape is more or less round, at least scarcely

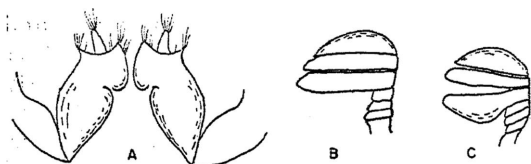


FIG. 2. Female genitalia and antennal club in *Trox*. A. Genitalia of *T. scutellaris*, ventral view. B. Club in oval scutellum group. C. Club in hastate scutellum group.

longer than wide; the first segment of the club, viewed from the side, is flat and the same width throughout (fig. 2B), and the club is proportionately longer than in the last group of species. Among the species of these four groups the scape has fulvous hairs in all but two (black in *acanthinus* and some *sonorae*), and the club is also fulvous in all but *laticollis*, *acanthinus*, some *sonorae*, some *gemmulatus*, and some *sordidus*, species in which it is gray-brown to black. In the last group of species (those with the scutellum hastate) the funicle is attached before the apex of the scape and underneath it so that the insertion is not visible from above, and the scape is elongate, two or three times longer than wide; the first segment of the club, when viewed from the side, is arcuate below, wider in the middle (fig. 2C), and the club is proportionately smaller. Among the species of this group there are the same differences in the color of the hairs on the scape and the club as above, fulvous in most species, black in *scabrosus*, *nodosus*, *texanus*, and *scutellaris*, the club alone darker in some other species, but variable. The apex of the scape is truncate in *umbonatus* and *scutellaris*, less so in *nodosus* and *texanus*, and pointed and elongated in the other large species. Neither this character nor the color of the scape has been used in the descriptions of the species.

SCUTELLUM

All workers on *Trox* have found the scutellum a convenient and readily visible character to separate large groups of species. In the two types of scutellum that serve to divide the North American species (hastate or oval) there is little further difference among species, aside from some individual variation, except that the scutellum is proportionately smaller in two of the hastate-

scutellum species (*umbonatus* and *scutellaris*) than it is in the others of that group. The hastate scutellum is feebly or strongly concave at the base, but the depression is often filled in with tomentosity; the oval scutellum is flat.

THORAX

PRONOTUM: Any species can be placed in its proper group of species according to the pronotum, and a few species can be identified by it alone (*atrox*, *variolatus*, *unistriatus*, *suberosus*, *tytus*, *loxus*, *carinatus*). The shape, sculpture, and amount of tomentosity vary somewhat within the species. The pronotum is always wider than long (scarcely so in *sordidus*, *capillaris*, and *unistriatus*), usually definitely transverse, and margined with abundant yellow setae in the species with oval scutellum, scarcely setose in the others. It may be glabrous and virtually without depressions (*scaber* group, fig. 1A); tomentose and with four round foveae that are feebly or strongly depressed (*terrestris* group, fig. 1B); furnished with two median ridges from base to apex with a depression between them (*tuberculatus* and *unistriatus* groups, fig. 1C, E); with two median ridges forked in front and four large tubercles posteriorly (*suberosus* group, fig. 1D); or the ridges and tubercles are virtually obsolete (*tytus*, *loxus*, and *suberosus* of the *suberosus* group).

In the first four groups with oval scutellum the base of the pronotum laterally is applied closely to the elytra, the sides are regularly rounded, never incised (although they are slightly sinuate before the hind angles in the *terrestris* group, fig. 1B), and the hind angles are more or less angulate. In the last group with hastate scutellum the base of the pronotum is constricted laterally so that it is distant from the humerus of the elytra, the sides are usually irregular and sinuate, often deeply emarginate or incised near the base (figs. 1D, 4A-G), and the hind angles are rounded, sometimes angulate. The presence and depth of the basal lateral incision and the extent or angle of the basal constriction in this group are inconstant within most of the species and are valuable for identification in only a few cases (*tytus*, *loxus*, *suberosus*, and *carinatus*).

PROSTERNUM: Posteriorly the prosternum

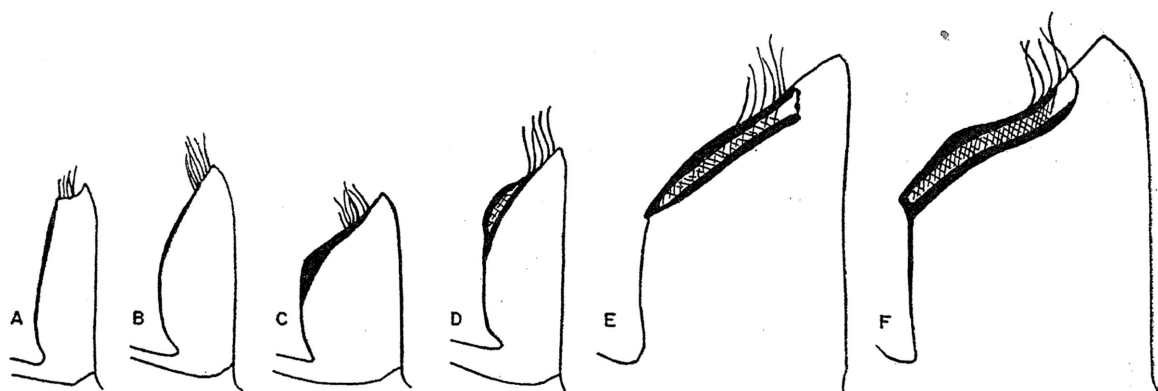


FIG. 3. The proepisternum in *Trox*. A. *T. laticollis*. B. *T. scaber*. C. *T. hamatus*. D. *T. capillaris*. E. *T. suberosus*. F. *T. tytus*. See discussion of characters in text.

(prosternal process) behind the front coxae of the *suberosus* group differs from that of all the other groups. The distinction is, however, often difficult to make, because this part may be worn or it may be covered with tomentosity. In the *suberosus* group this "processus prosternalis" is flat or slightly swollen and more or less triangular in outline; in the groups with oval scutellum it is usually longitudinally so sharply carinate between the coxae that it forms a bending tooth projecting backward, but in *variolatus* it is bituberculate. Harold (1872) found that the difference in shape of this process separated some otherwise closely related species, but in our fauna it appears not to do so, *variolatus*, which is quite distinct, being the only aberrant species in this respect.

PROEPISTERNA: Unless the bulky front femora are pushed away from their close position against the proepisterna, the deeply cut inner margins of this sclerite cannot be seen. These margins vary in outline among some species and groups, converging in front in all species of the *scaber* group (fig. 3B) except *laticollis* in which they are nearly parallel (fig. 3A), forming an obtuse angle at the middle in the *terrestris*, *tuberculatus*, and *suberosus* groups, also in *variolatus* and *unistriatus* of the *unistriatus* group (fig. 3C, E, F), and having the angle more rounded and placed farther front in *sordidus* and *capillaris* (fig. 3D). The sinuation of the margin varies individually and may be stronger or feebler than shown in the figures. The front part of the inner margins is furnished with a black,

shining, slightly elevated area which is often grooved in the center and into which the front femora evidently fit when closed. This area appears to be virtually obsolete in the *scaber* group, but the margin is raised and sometimes thickened and probably serves the same purpose. The proepisterna are usually strongly tomentose, but when denuded they show, in some species, a number of raised sinuate lines and a depression.

METASTERNUM

The front of the metasternum between and behind the middle coxae is somewhat swollen and raised in the *suberosus* and *scaber* groups and carinate to tuberculate in the other groups, especially tuberculate in the *terrestris* and *tuberculatus* groups. The center third of the metasternum has a round or more or less hexagonal depression which is about as long as wide except in those species with the wings reduced in which it is nearly twice as wide as long and in which the metasternum is much shorter. Posteriorly the metasternum between the median depression and the sides is swollen, sometimes tuberculate or angulate. The side pieces of the metasternum are truncate in front in the *suberosus* group, oval in the others.

ELYTRA AND ABDOMEN

Harold's remark made 82 years ago that one could determine the species of *Trox* by the elytra is quite true for some of our species (*striatus*, *atrox*, *frontera*, *gemmulatus*, *plicatus*, *sordidus*, *capillaris*, *variolatus*, *unistriatus*,

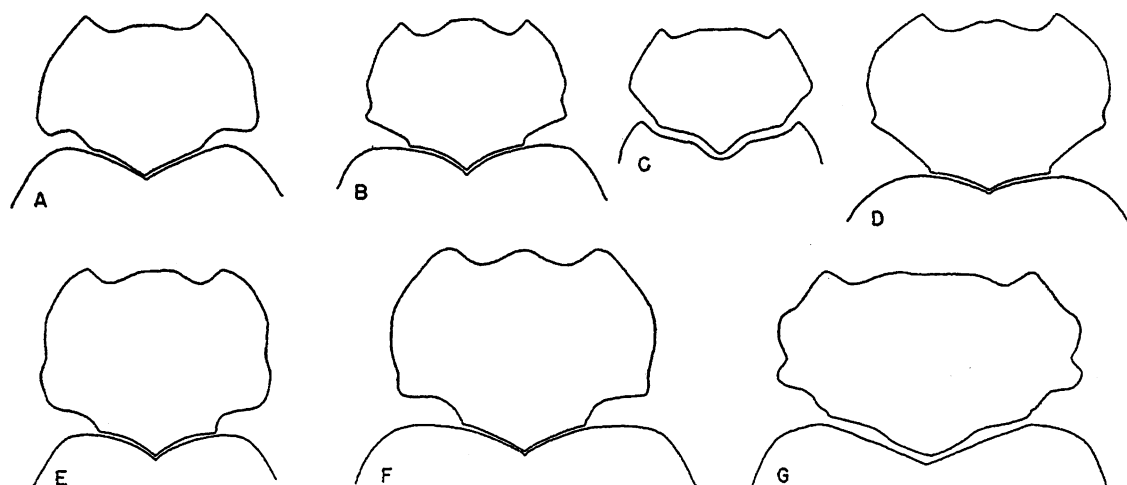


FIG. 4. Pronotal outlines of *Trox* in the *suberosus* group. A. *T. tytus*. B. *T. suberosus*. C. *T. loxus*. D. *T. carinatus*. E. *T. punctatus* and others. F. *T. tessellatus*. G. *T. monachus* and others.

carinatus, *scabrosus*, *asper*, *umbonatus*, and *scutellaris*), but there are some pairs or groups of species with the elytra very similar, as *suberosus* and *rubricans*, *monachus* and *fuliginosus*, *punctatus* and *tessellatus*, *texanus* and *nodosus*, five species of the *scaber* group, five species of the *terrestris* group, and five of the *tuberculatus* group. The differences between these pairs or among the species of these groups either are individually so variable or are so relative that identification is difficult or impossible without reference to other characters in addition to the elytra. In general, although details of the elytra, as the size and shape of the tubercles and the amount of tomentosity or setae, often vary greatly within a species, the general pattern of a species remains constant, so that, once this is known and allowance is made for variations, greasing, and wear, the species can be recognized.

The elytra have 10 rows or intervals and a broad marginal interval (called the reflexed elytral margin in this paper), and 10 narrow punctate striae. In most of the large species of the *suberosus* group the striae punctures tend to become irregular and are often obscured by the coalescence of the large elytral tubercles, and in many tomentose species of course they are obscured by the tomentose coating. The intervals are as a rule alternating in height, tuberculation, and vestiture,

the odd ones (3-5-7-9) being higher, more tuberculate, or more setose. In the *scaber* group, however, the intervals are all rather flat, not tuberculate, about equal in vestiture; in *tytus*, *loxus*, and *suberosus* of the *suberosus* group there is little difference among the intervals; and in the last six species (*inflatus*, *tessellatus*, *nodosus*, *texanus*, *umbonatus*, and *scutellaris*) all the intervals are about equally covered with large shining tubercles of the same height. In the last four species named the elytra are more convex and more ovate in shape; in most species the elytra are flatter on top, and the sides are nearly parallel or only slightly wider behind the middle. In all species the elytra are strongly declivous posteriorly, most of the larger species having a prominent subapical umbone at the top of the declivity (all the *suberosus* group except *tytus*, *loxus*, *suberosus*, and the last four species of this group). The humeral umbone is a large prominent tubercular swelling in all the fully winged species; it is partially obsolete in *nodosus* and *texanus* (wings reduced) and no larger than other tubercles on the elytra in *umbonatus* and *scutellaris* (wings vestigial). Species with the pronotum applied closely to the elytra have a tiny tubercle or ledge at the humeral angle (fig. 1A-C, E) which is usually hidden under the pronotal angles. These species also have capillary lines connecting the striae punctures, very evident

and strong in *capillaris*, and tiny granules on each side within each puncture, but these details are generally not visible and may not be present on all individuals.

The elytral margins are tomentose in the *suberosus* group and have a few hairs, but they are not truly or regularly setose or ciliate as in the other groups. In the latter the length and spacing of the marginal setae are different among some species and constitute a good character. The presence of small tubercles or patches of setae on the reflexed margins of the elytra is also a good character in some sections of the genus but appears to be individually quite variable in others (*terrestris* group).

No specific or group differences were found on the abdomen.

WINGS

Normal wings are at least as long as, usually 4 or 5 mm. longer than, the pronotum and elytra combined, and the opaque cell called the pterostigma is situated at or near the middle of the costal margin of the wing. Reduced wings (*nodosus*, *texanus*) are shorter than the total length of the beetle, often shorter than the elytra, and the pterostigma occurs near the apex of the costal margin (fig. 22A-D). Vestigial wings (*umbonatus*, *scutellaris*) are only about one-half of the length of the elytra and are only about 1 or 2 mm. wide, the pterostigma usually being lacking entirely (fig. 22E-F). The majority of the smaller species have the veins and pterostigma of the wing, often the entire wing, darker than does the *suberosus* group. The shape and venation appear to be similar in all species with normal wings. Robinson (*in litt.*) recorded the length and breadth of the wings of most the North American species. I have recorded the length in all the species of the *suberosus* group and in a few of the others.

LEGS

The serrations of the front tibiae, as already noticed by previous authors, are usually too variable to be relied upon in classification. The apex is bidentate in all species, although often worn so as to appear unidentate. Between the apical teeth and the base of the tibiae there is generally another tooth on

the outer margin, sometimes two additional teeth, and sometimes, as in some specimens in the groups with oval scutellum, basal serrations. These teeth are not only readily worn down, but in series they prove to be extremely variable individually and for this reason have not been used in the present paper. Other characters on the legs which should be mentioned but which have not been employed are the outer apical angle of the hind tibiae which is more produced in the *scaber* group, the heavy scales on the trochanters and femora in the *terrestris* group, and the tiny teeth on the hind margin of the hind femora in the *tuberculatus* group and in some specimens of other groups. These characters were found to be either too inconstant, too subject to wear, or too difficult of observation to be usable. The enlarged bulbous front femora and the narrow middle and hind femora appear not to differ significantly among species.

The diagnostic group or specific characters are found in the hind tibiae and in the middle and hind tarsi. The tibiae are about the same length as the femora and somewhat narrower. They are more or less straight, but in some species are slightly arcuate internally or emarginate externally near the apex. Apically they are feebly or strongly widened. The surface is shining or tomentose, clothed with longitudinal lines of setae. The *suberosus* group differs from all the other groups by having the hind tibiae not at all serrate or toothed externally, differing among species only in relative width or length and in one species (*texanus*) in the concave, slightly curved inner margin in the male (fig. 23B).

In the groups of species with oval scutellum the external serrations and emargination of the hind tibiae, although variable and relative and difficult to define, are sometimes the only clue, with the exception of the male genitalia, to the identity of some species (*fascifer*, *hamatus*, *robinsoni*). Externally, the hind tibiae have two edges or margins, an inner and an outer one, either or both of which are spinose, serrate, or dentate. The outer edge has a series of true teeth in the *scaber* group but only one feeble or strong tooth or spine at or behind the middle in the other groups. The inner edge is serrate or spinose either to or behind the middle or all the way to the

apex. Behind the middle a more prominent spine or a projection containing a group of spines is evident in most species but is virtually obsolete in a few. The hind tibiae are more emarginate externally before the apex in some species (*fascifer*, *frontera*; figs. 5A, 9), wider in others (*hamatus*, fig. 6A-B), have longer setae (*atrox*), and in one species (*hamatus*) the male has the tibiae flattened, greatly enlarged on the outer side, and a large, inward-bending hook subapically on the inner margin.

The longest of the two spurs on the hind tibiae is proportionately shorter in the *suberosus* group (no longer than the first tarsal segment), whereas in the other groups it is usually as long as or longer than the first two segments combined.

The middle and hind tarsi in all species are a little more than half of the length of the tibiae; the first segment is a little longer than the following segment, but is very much longer in *laticollis*. The tarsi in the *suberosus* group have dense or at least numerous setae posteriorly on the ventral side of the first four segments and two or more setae in the center of the claw segment; in the other groups the setae are very sparse—usually only five or six on a segment and one on the claw segment. The claw segment appears proportionately shorter in the *suberosus* group. The tarsal segments are feebly eroded or depressed at the base in the *tuberculatus* group and also in about half of the species of the *suberosus* group. In the latter, in addition, the segments are not so cylindrical, and the surface is often ridged with many little lines, the erosion and striation being very marked on the tarsi in *carinatus*. This is a useful character in the separation of some of the large species (as *tesselatus* from *punctatus* and *inflatus*), but the presence of too heavy a tomentose coating may cause the eroded tarsi to appear smooth.

GENITALIA

Nearly every species of North American *Trox* has specifically distinct male genitalia, and many species cannot be separated with certainty except by these organs. Péringuey, in 1901, was the first author to use and figure the genitalia, and Loomis (1922) was the first to use them in the United States.

Balthasar (1936) mentions but does not use them in his revision of the Palearctic species, but Robinson (1940 to 1948) employed them extensively for North American species, and Haaf (1953) for the African species of the *luridus* group. The female genitalia, which are shown for one species in figure 2A, are too similar and too generalized for differentiating species.

The terminology employed in this paper for the parts of the genitalia is based on Sharp and Muir (1912). For *Trox* this includes the median lobe, two lateral lobes, a basal piece or basal pieces, and an internal sac. The internal sac has not been used by previous authors except by Sharp and Muir, who mention it in their descriptions of the genitalia of six species of *Trox* (p. 577). I have examined it only in the larger species with hastate scutellum; in many of these it is soft and undifferentiated, being rather elongate, somewhat hairy, and of the same color as the median lobe, but in other species (*carinatus*, *fuliginosus*, *monachus*, *asper*, *punctatus*, *inflatus*, and *tesselatus*) it is partially or entirely sclerotized, dark in color, and of various distinctive shapes (see fig. 27). In these large species the sac can be extracted by inserting a pin into the apex of the median lobe (in relaxed genitalia) and forcing apart the dorsal and ventral pieces of the lobe. In *inflatus*, where the armature of the sac is a long hard piece, the apex reaches the apex of the median lobe; in some others the sac and armature are very short.

The basal piece is fused dorsally in all but the *suberosus* group of species, in which it appears to be fused only partially on the dorsal side by a membrane that connects the seemingly separate basal lobes. This basal piece is about twice as long as the median and lateral lobes in some species (*scaber* group except *atrox* and *laticollis*), only a little longer to about the same length in others (*atrox*, *laticollis*, and *terrestris* group), the same length or a trifle shorter in the *tuberculatus* group, from one-third to one-fourth shorter in the *unistriatus* group, and finally from one-fourth to one-sixth or one-seventh shorter in the *suberosus* group. The position of the lateral lobes in respect to the median lobe and the relative width and length of the lobes are also important. The three lobes are more

or less of the same length in the majority of species, but the laterals extend greatly beyond the median lobe in most of the species of the *terrestris* group. Another characteristic of this group is that the lateral lobes are separated from the median lobe for most of their length (except in *hamatus*) and are much narrower than the median lobe. The lateral lobes are also much narrower in the *unistriatus* group.

The diagnostic characters of the genitalia in the *suberosus* group of larger species are mostly in the shape of the lateral lobes (in *inflatus*, however, the large inflated median lobe is clearly diagnostic of the species), and in the shape of the internal sac when it has sclerotized armatures. Three species of this group (*scabrosus*, *nodosus*, and *texanus*) have virtually identical genitalia. In the other groups the median lobe may be more diagnostic than the lateral lobes (*unistriatus* and *tuberculatus* groups), or both may be equally important (*terrestris* and *scaber* groups). In the *tuberculatus* group all the genitalia are quite similar, the shape of the median lobe varying considerably within some species (*sonorae*, *tuberculatus*).

The large species can be dissected dry if handled with care. The hind legs should first be pushed back with a pin to leave the abdomen free, then if the pin can be inserted at the tip of the abdomen, the latter can be

flipped out and the genitalia extracted. If the abdomen is sunk too far within the enclosing elytra, then it can be pierced by a pin and severed along the first or second suture and the apical segments pulled out with the genitalia attached. A pin slipped from behind between the sclerotized and membranous parts of the abdominal segments will detach the membranous mass enclosing the genitalia. The genitalia can then be freed of surrounding membranes by careful chipping with the pin.

SECONDARY SEXUAL CHARACTERS

Neither Balthasar (1936) nor Haaf (1953) could find any external characters to differentiate the sexes, not even size. Robinson (1940) used the tiny spur on the front tibiae, but I could not verify his observations. He found this spur declinate, or straight, truncate or acute, slender or thick, shorter or longer in one or the other sex, the attributes changing with the species. I find that in the larger species the longest of the spurs on the hind tibiae are generally less acuminate, more rounded in the females, but this is not a very reliable character. The only definite secondary sexual character is found in two species; *hamatus*, which has enlarged hind tibiae in the male, and *texanus*, which has the hind tibiae excavated in the male.

SYSTEMATIC SECTION

GENUS *TROX* FABRICIUS

Trox FABRICIUS, 1775, *Systema entomologiae*, p. 31. Type: *Trox sabulosus* Linnaeus.

Omorgus ERICHSON, 1847, *Arch. Naturgesch.*, vol. 13, no. 1, p. 111. Type: *Trox suberosus* Fabricius.

Pseudotrox ROBINSON, 1948, *Notulae Nat.*, no. 211, p. 1, figs. 1-2. Type: *Trox laticollis* LeConte. New synonymy.

Eyes not divided by the genae which form a ridge above them; mandibles vertical, robust; labrum vertical; antennae 10-segmented, basal segment robust, club three-segmented, free; front femora enlarged, connate with head in repose; elytra striate, convex, declivous behind, either tuberculate or setose or both, epipleurae distinct; abdomen covered by elytra, ventral segments five, fused; coxae virtually contiguous; tarsal claws simple; size, 4-19 mm.

The other genera in the Troginae differ from *Trox* as follows: *Glaresis* Erichson (eight species in North America) are consistently smaller (from 3 to 5 mm.) and light buffy in color; they have the eyes half divided, the antennae nine-segmented, the metasternum very long, and the hind femora and tibiae so enlarged that they hide the abdomen. *Cryptogenius* Westwood I have not seen. There are but two species, both from South America. Their author says "in its dull color and tuberculated setose appearance, the large size of the exerted labrum, horny mandibles, 10-jointed antennae, with the joints of the club free, and concealed labium, it agrees with the Trogidae," but differs in its "notched anterior tibiae, membranous lobes of the maxillae, mandibles not toothed. . . and singularly formed mentum."

In 1847 Erichson proposed the generic name *Omorgus* (type, *suberosus*) for some of the species of *Trox*, and he was followed in this division by LeConte (1854) who placed 14 of the North American species in *Trox* and 11 in *Omorgus*. Other authors, however, have considered *Omorgus* either as synonymous with *Trox* (Lacordaire, Harold, Horn, Loomis) or as a subgenus (Burmeister, Péringuey, Arrow, Balthasar, Robinson). I am not recognizing it as a subgenus because, even though there are many differences separating

the *Omorgus* species in North America, all these characters do not necessarily apply to the *Omorgus* species in South America, Australia, Africa, and Asia. The South American *brevicollis*, for example, has the general appearance, pronotum, and front of the metasternum as in "*Omorgus*," but the scutellum, antennae, eyes, and hind tibiae of "*Trox*." In order to determine the limits of *Omorgus* as a subgenus, material from other parts of the world must be examined and evaluated, and this is beyond the scope of the present paper. If Haaf in his study of the *Trox* of the world excluding North America should recognize *Omorgus* as a subgenus, then the North American *suberosus* group would probably be placed in it. Other subgeneric names proposed for species outside North America include *Phoberus* MacLeay (1819), *Chesas*, *Polynoncus*, *Lagopelus* Burmeister (1876), and *Megalotrox* Borre (1886).

Robinson's *Pseudotrox* is based on two characters present in its one species (*laticollis* LeConte): the genitalia, which differ "radically from the type found in other members of the genus," and the middle coxae, which separate "the mesosternum and metasternum, therefore the middle coxae reach the mesosternal epimera," or are open exteriorly. It is true that the male genitalia are quite different in some respects, but the difference, I believe, is no greater than that found among some of the other species in North America, and in the African species of the *luridus* group (Haaf, 1953) the genitalic differences among species are even more striking. As for the ventral character, although the separation of the mesosternum and the metasternum by the middle coxae is of great importance in some groups, as in the Cerambycidae, in *Trox* there seems to be some variation in this character, and it therefore does not provide sufficient basis on which to erect a new genus. Thus in *atrox*, a species close to *laticollis*, some individuals have the coxal cavity partially open exteriorly, with the mesoepimeron extending inward as in *laticollis*. In other members of the groups with oval scutellum the mesoepimeron often penetrates quite far towards the coxae, almost separating the mesosternum from the nar-

TABLE 2
DIFFERENCES BETWEEN SPECIES GROUPS IN *Trox*

<i>scaber, terrestris, tuberculatus,</i> and <i>unistriatus</i> Groups	<i>suberosus</i> Group
Scutellum oval, not narrowed at base	Scutellum hastate, narrowed at base
Antennal funicle attached at apex of scape; scape round; antennal club proportionately larger; first segment of club flat, same width throughout	Antennal funicle attached before apex of scape; scape elongate; antennal club proportionately smaller; first segment of club arched, wider at middle
Pronotum not constricted, its base applied closely to elytra; margins strongly setose	Pronotum constricted at base, sides of base distant from elytra; margins scarcely, if at all, setose
Eyes definitely reticulate	Eyes virtually smooth
Sides of metasternum in front more or less rounded, narrow	Sides of metasternum in front broadly truncate
Elytral humerus with tiny projecting ledge (often hidden by base of pronotum)	Elytral humerus without projecting ledge
Hind tibiae with one or more teeth or spines externally	Hind tibiae unarmed externally
Hind tarsal segments ventrally with only scattered setae, claw with but one seta	Hind tarsal segments ventrally with dense setae, claw with two or three setae
Longest spur on hind tibiae longer than first two tarsal segments	Longest spur on hind tibiae not or scarcely longer than first tarsal segment
Size usually smaller (4 to 12 mm.)	Size usually larger (up to 19 mm.)

rowed front margin of the metasternum. In the *suberosus* group this is not so, the front of the metasternum being broadly in close contact with the mesosternum. For the above reasons, it is my opinion that *laticollis* is better left in the genus *Trox*.

The groups of *Trox* are discussed below in their presumed phylogenetic order. In these

discussions the groups are compared as to taxonomy, distribution, habits, and genitalia, and the characters common to the species of each group are not repeated later in the formal descriptions. The differences to be found between the four groups of small *Trox* on one hand and the large *suberosus* group on the other are listed in table 2.

GROUPS WITH OVAL SCUTELLUM

The *scaber, terrestris, tuberculatus,* and *unistriatus* groups probably correspond to Haaf's *perlatus* group of small Palearctic and American species with oval scutellum and the head without ridges (1953, p. 312, fig. 1d). With the exception of the *unistriatus* group, the groups with oval scutellum contain the most difficult and confused species of North American *Trox*, and the females of many species are generally unidentifiable.

THE *SCABER* GROUP OF SPECIES

This group of seven small species (5 to 8.5 mm.) is differentiated from the three other

groups with oval scutellum by the smoothness of the pronotum which is mostly glabrous, not tomentose or noticeably setose nor ridged nor tuberculate, by the general smoothness of the elytra which have all the intervals of about the same width and elevation, not alternating in height (in *scaber* there is slight alternation of the intervals), and by the less angulate inner margins of the propisterna (fig. 3A, B). The species differ principally in the number, length, and arrangement of the setae, in the sculpture, and in the male genitalia; *affinis, fascifer,* and *laticollis* differ also in other characters. Four of the species have quite limited geographical

distribution and are never numerous in collections (*affinis*, *fascifer*, *striatus*, and *laticollis*); only two (*aequalis* and *atrox*) extend into Mexico, the former occurring in most of the eastern states and a few western ones, the latter in most of the western states and a few eastern ones. With the exception of *laticollis* (so far known only from fox burrows) and *fascifer* (no biological data available), the species occur in the nests of birds as well as in other situations usual to *Trox*.

The genitalia in this group have the basal piece proportionately longer than in any of the following groups, but in *atrox* and *laticollis* it is about the same length as the lateral lobes. Each species has distinct genitalia; those of *aequalis*, *affinis*, and *fascifer* are strongly recurved and superficially similar.

CHARACTERS OF *scaber* GROUP

Following is a short description of the characters common to all seven species and therefore not repeated under each species:

Head densely punctured, with a row of transverse setae (often rubbed off). Clypeus broadly rounded. Antennal scape with fulvous hairs. Pronotum almost twice as wide as long, not tomentose, relatively densely punctured, with tiny setae, usually not visible, emerging from punctures; surface depressions when present very feeble, consisting of shallow median longitudinal furrow from base to apex, at base usually in form of round fovea in center, and two foveae laterally. Elytra not tomentose, margins not crenulate, marginal setae contiguous or nearly so; intervals feebly rugose or with horizontal or diagonal scratches, not strongly alternating in height. Prosternum behind front coxae with sharp projecting tooth, often worn. Proepisterna with inner margins arcuate or straight, not angulate, their border thickened in front. Hind tibiae externally with double row of serrations to below middle, the inner of these more or less spinose, the outer truly dentate; tarsal segments apparently smooth. Wings probably normal in all, being 1 or 2 mm. longer than the pronotum and elytra combined in those measured (*scaber*, *fascifer*, *striatus*, *laticollis*).

THE *TERRESTRIS* GROUP OF SPECIES

This has been called the *insularis* group by Robinson (1940), but I am using the oldest names in each group. In contrast to the preceding (*scaber*) group, the six small species (5 to 7.5 mm.) of the *terrestris* group are usually strongly tomentose, especially on the pronotum; they have the head tuberculate, not smooth, the pronotum roughly sculptured with four round foveae enclosed by setose ridges (fig. 1B), the elytra with the odd intervals elevated, either in costae or in tubercles, the clypeus triangular and acuminate, not broadly rounded, and the proepisternal inner margins angulate at middle (fig. 3C). As in the *scaber* group, these species also are very similar to one another in general appearance, differing in the setae, the sculpture, the male genitalia, and in some species in the shape of the hind tibiae. Within the group, three of the species (*hamatus*, *spinulosus*, and some *foveicollis*) have the elytral setae long and the pronotal depressions deep and distinct, and four (some *foveicollis*, *terrestris*, *insularis*, and *frontera*) have the setae short and the pronotal depressions usually feeble. Because these characters are relative, a number of the species cannot be differentiated with certainty externally, but dissected males can be identified in all cases.

Four of the species (*hamatus*, *spinulosus*, *foveicollis*, *terrestris*) inhabit the eastern or eastern and central United States, with *spinulosus* continuing into the southwest and Mexico, *frontera* occurs in Texas only, and *insularis* in Cuba only.

The genitalia are quite different from those of the *scaber* group, except those of *hamatus* which are similar to those of *atrox*. The lateral lobes are long and thin, narrower than the median lobe and not closely applied to it, the median lobe having the apex widened at both sides. The genitalia are specifically distinct.

CHARACTERS OF *terrestris* GROUP

The following characters are not repeated under the species, being similar in all:

Head quadrituberculate, the two outer tubercles often nearly obsolete. Clypeus tri-

angular, acuminate. Antennal scape with hairs fulvous, club fulvous. Pronotum almost twice as wide as long, heavily tomentose, with four large round foveae, two in the center between the median longitudinal ridges, and two at base (one fovea on either side of center). Elytra with odd intervals elevated or tuberculate, the tubercles tomentose and setose; striae with the large punctures and the granulations in front of them usually obscured; reflexed margins often with small setose granules. Prosternum behind front coxae with sharp projecting tooth. Proepisterna with inner margins angulate at middle and with a raised black area across the angle. Outer margins of hind tibiae externally with a tooth at or below the middle, internally with a spinose projection. Tarsal segments apparently smooth. Wings probably normal.

THE *TUBERCULATUS* GROUP OF SPECIES

The best known and most widespread species of this group is *sonorae* LeConte. The seven species are very homogeneous; they are generally larger in size (8 to 11 mm.) than those of the preceding groups. The pronotum is not smooth as in the *scaber* group, nor furnished with four foveae as in the *terrestris* group, but it has two prominent median longitudinal ridges from base to apex, the depression between them not divided into foveae but sometimes ridged transversely at middle (fig. 1E). The pronotum somewhat resembles that of the following (*unistriatus*) group of species, but the hind margins are deeply sinuate near the hind angles, which is not true of the latter group, and the angles are acute and extend backward. Three of the species (*gemmulatus*, *plicatus*, and *sonorae*) are definitely western in their range, all three crossing the border into northern Mexico (southern Mexico also in the case of *plicatus*); *tuberculatus* is definitely eastern; *robinsoni* occurs in the north and south central United States, *contractus* in Texas only, and *acanthinus* in southeastern Mexico. The western *sonorae*, however, extends eastward to Missouri, the eastern *tuberculatus* has been taken in scattered western states, and all species except *gemmulatus* and *acanthinus* occur in Texas, so that the only areas where only one

of these outwardly similar species occurs, at least according to present knowledge, are Montana, Idaho, and Utah (*sonorae*), Minnesota, Michigan, Wisconsin, and Manitoba (*robinsoni*), and east of the Mississippi River and south of the Great Lakes region (*tuberculatus*).

The genitalia of the males have the lateral lobes of about the same width as the median lobe and longer than the basal piece. The median lobe extends just to the apex of the lateral lobes; it varies slightly in shape and convexity between, sometimes within, the species. The genitalia in this group are much more similar than are those in the other groups.

The species of this group are so similar and so variable that individual specimens, especially females, are difficult to identify. Sometimes even the male genitalia are not conclusive because they, like the external characters, vary somewhat within some species. However, after having examined over 2200 specimens of this group, I would say that, with the exception of *contractus*, which seems to differ from *sonorae* only in the male genitalia, typical specimens of the five other species are sufficiently distinct from one another and could not be confused. Unfortunately, many specimens deviate from the typical in the relative degree of elevation of the elytral intervals, in the size of the setae patches on the intervals, in the length of all setae, and in the amount of tomentosity.

CHARACTERS OF *tuberculatus* GROUP

The following characters are not repeated under the species, being similar in all:

Head with row of transverse setae between eyes (often obscured). Clypeus broadly rounded and densely punctured. Pronotum very transverse, almost twice as wide as long, with a very wide median depression from base to apex, strongly ridged on either side and sometimes faintly so in the middle, and two lateral swellings or tubercles; punctures on raised areas large and dense, but when pronotum is tomentose, the punctures are usually not visible and the median ridges, front margins, and lateral tubercles are then setose; sides of pronotum feebly arcuate, wider behind, slightly convergent in front; marginal setae short, contiguous, hind angles

acute; base emarginate near hind angles. Elytra with odd intervals elevated or tuberculate, tubercles tomentose and setose, reflexed elytral margins with a row of setae apically. Prosternum behind front coxae with sharp projecting tooth. Proepisterna with inner margins angulate at middle and a raised black area across angle. Outer margins of hind tibiae externally with a small tooth or spine at or below middle, internally with basal serrations ending in a spinose projection. Hind femora with tiny teeth on hind margin (usually worn off). Tarsal segments on middle and hind tarsi eroded or depressed at base. Wings normal.

THE UNISTRIATUS GROUP OF SPECIES

The pronotum in the four species of this group is rather similar to that found in the *tuberculatus* group except that the hind angles do not extend backward and the basal margin near the angles is therefore straight at the sides, not sinuate (fig. 1C). The median ridges are closer together than in the *tuberculatus* group and less elevated. In *sordidus*, *capillaris*, and *unistriatus* the pronotum appears less transverse and the sides more parallel than is usual in these *Trox* with oval scutellum; *variolatus* seems to belong partly to the *tuberculatus* group and partly to the present group. In shape, elytral pattern, and male genitalia, the species of this group differ more distinctly than do the species of the

preceding groups; in fact *capillaris* and *unistriatus* can be identified quite readily at a glance. The species are not uniform in size, *variolatus* and *sordidus* being small (6 to 8 mm.), *capillaris* 8 to 10 mm., and *unistriatus* 9 to 12 mm. They occur in the eastern and central states, *unistriatus* extending north into Canada as far west as Alberta. None of the species has been reported from Mexico. The genitalia have the lateral lobes narrower than the median lobe and both parts longer than the basal piece; they are specifically distinct.

CHARACTERS OF *unistriatus* GROUP

Following is a short description of the common characters of the group that are not repeated under the species:

Antennal scape with fulvous hairs. Pronotum with a narrow median depression from base to apex that is feebly or strongly ridged on either side, and with either a tubercle or a short ridge laterally; hind angles rectangular; base of pronotum straight near hind angles; sides nearly parallel; marginal setae contiguous. Elytra with odd intervals elevated, tuberculate, or setose. Proepisterna with inner margins angulate and with raised black area. Outer margins of hind tibiae externally with a tooth at or below middle, internally with a spinose projection. Tarsal segments on middle and hind tarsi smooth, cylindrical, not depressed. Wings normal.

GROUP WITH HASTATE SCUTELLUM

THE SUBEROSUS GROUP OF SPECIES

The 17 large species (12 to 19 mm.; one species, 8.5 mm.) of this group differ from the species of all the other groups in North America in the hastate scutellum and in the other characters given in table 2 above. Haaf (1953) recognized this group, which is considered by some authors as part of the subgenus *Omorgus*, in his key to world groups of *Trox*, differentiating it from the Australian species (*candidus* group) by the raised but not keeled median ridges on the pronotum. This large group is not so readily separable into distinct groups as are the preceding

species with oval scutellum. Because the relationships of some of the species are not very clear to me, I have kept them in one group, rather than closely affiliate species which may not be related. Four of the largest species, however (*nodosus*, *texanus*, *umbonatus*, and *scutellaris*), may form a group apart because they have the wings reduced in varying degree, therefore the humeral umbone is absent or virtually so, the metasternum is very short, and the elytra are exceedingly convex; they also have the apex of the antennal scape more truncate than in the other species. I have placed these species at the end.

The species of the *suberosus* group differ among themselves in sculpture, extent and arrangement of tomentosity, color of the antennal hairs, shape of the pronotum, details of tarsi and tibiae, male genitalia, and other characters. They are predominantly western species extending south into Mexico; only three are eastern (*monachus*, *scabrosus*, *asper*), and two occur both in east and west, *suberosus* over virtually all North America, and *tytus* in five isolated and distant localities. All but *tytus*, *monachus*, and *scabrosus* occur in Mexico, only two (*tomentosus* and *loxus*) being apparently endemic to that country. A number of the species appear to have quite a restricted geographical distribution: *nodosus* and *texanus* in New Mexico, Texas, and northern Mexico, *loxus* in Veracruz, and *carinatus* and *inflatus* in Arizona, New Mexico, western Texas, and Chihuahua.

The male genitalia are specifically distinct except for those of *nodosus*, *texanus*, and *scabrosus* where there is little observable difference. All the genitalia have the lateral and median lobes very much longer than the tiny basal piece; the basal piece is not fused dorsally as it is in the preceding groups, and the lateral lobes are applied closely to the median lobe, as is true of most of the species of the *tuberculatus* group. Seven species not only show external differences in the genitalia, but internal ones as well (*carinatus*, *fuliginosus*, *monachus*, *asper*, *punctatus*, *inflatus*, and *tesselatus*). These species have part of the internal sac within the median lobe sclerotized, and these armatures are of a different shape in each species (fig. 27). The sac apparently is not sclerotized in the other species. The median lobe was not dissected in *rubricans*, *loxus*, and *tomentosus* because of the lack of a sufficient number of males.

No data are available on the habits of four of the species; of the others only two (*monachus* and *tytus*) have been reported from the nests of birds (buzzard and barn owl, re-

spectively). Many species come to light.

A number of the species of this group were described by LeConte in 1854, synonymized by Horn in 1874, then recognized again as distinct species by Robinson in 1940. Horn placed *tesselatus* in synonymy with *punctatus*, but Robinson found the male genitalia to be quite different and *tesselatus* a separate species. LeConte's *umbonatus*, *texanus*, and *suturalis*, which Horn considered as varieties of *scutellaris*, were also found by Robinson to be distinct species, although the latter, I find, is a synonym of *texanus*, as shown by the bent hind tibiae of the male lectotype. Horn's synonymy of *morsus* and *integer* with *punctatus*, however, still stands, as these species have the same male genitalia, their external appearance representing but extremes of variations of *punctatus*.

CHARACTERS OF *suberosus* GROUP

Characters common to all species are given below and are not repeated under each description:

Clypeus triangular or V-shaped, acutely angled laterally, the apex somewhat bent downward, front margin reflexed, depressed behind. Pronotum medially at apex with two elevated V-shaped ridges, each extending backward towards the base, base with four large oblong tubercles, and in front of each outer basal tubercle another tubercle that is slightly smaller in size (in *tytus*, *loxus*, and *suberosus* these elevations are obsolete or nearly so, especially apically). Elytra with the large deep stria punctures between the tubercles usually obscured by either tomentosity or the coalescence of the tubercles; marginal setae virtually absent; margins not crenulate. Prosternum behind front coxae flat or swollen, not toothed. Proepisterna with inner margins angulate at middle and with broad shining grooved edge very evident on front margin. Hind tibiae not serrate or toothed externally.

KEY TO THE SPECIES OF *TROX* IN NORTH AMERICA

The intervals, rows, ridges, or costae of the elytra are here considered to be the longitudinal spaces between the stria punctures, although the latter are not always visible.

These intervals are counted from the sutural interval outward to the margins, with the suture understood as the first odd interval, then 3-5-7-9 as the other odd intervals, and

2-4-6-8-10 as the even ones.

Some species can be identified definitely only by the male genitalia which are therefore given first in the dichotomy; other characters, however, are mentioned that may help to identify a specimen if it is in good condition and is typical. The range, where it is thought to be definitive, is given in the key.

1. Scutellum hastate, its sides constricted at base; base of pronotum at sides not touching elytral humeri; pronotal and elytral margins not fringed with setae; antennal funicle attached below apex of scape; larger species (up to 19 mm.) (*suberosus* group) 2

Scutellum more or less oval, its sides not constricted at base; base of pronotum applied closely to elytra; pronotal and elytral margins fringed with setae; antennal funicle attached to apex of scape; small species (4 to 12 mm.) 20

2. Metasternum with median depression twice as wide as long; elytral margins (seen from above) always visible at base because humeral umbone lacking or obsolete (wings reduced or vestigial) 3

Metasternum with median depression about equally as wide as long; elytral margins (seen from above) often hidden at base by prominent humeral umbone (wings normally developed) 6

3. Scutellum very small, sunk within two prominent bulbous tubercles; humeral umbone completely lacking; genitalia (fig. 26F-G) with lateral lobes strongly constricted before apex 4

Scutellum larger, scarcely depressed between two flattish tubercles; humeral umbone faintly indicated; genitalia (fig. 26C) with lateral lobes not at all constricted before apex 5

4. Elytral tubercles mostly rounded in shape, about equal in size on all intervals; ground color of antennal club and hairs on scape and in mouth region black *scutellaris*

Elytral tubercles irregular in shape, those on alternating intervals much larger; ground color of antennal club red, occasionally brown, all hairs fulvous *umbonatus*

5. Male with inner face of hind tibiae flat, narrow, the inner edge straight and with sparse black setae (western Texas, New Mexico, northern Chihuahua) *nodosus*

Male with inner face of hind tibiae con-

cave or excavate before apex, broader, the inner edge slightly curved and bristling with dense black coarse setae (fig. 23) (extreme southern Texas, New Mexico, Nuevo Leon, Tamaulipas) *texasus*

- 6(2). Front of head convex but without trace of tubercles; elytra entirely tomentose and smooth *tytus*

Front of head usually with two definite tubercles, but if tubercles indistinct or partly fused in center, then elytra bare and tuberculate. 7

7. Pronotum quite smoothly convex, at least in front, scarcely depressed or tuberculate except slightly at base; elytra scarcely costate. 8

Pronotum strongly sculptured, with ridges, tubercles, and deep depressions; elytra costate, carinate, or tuberculate (scarcely costate in some *rubricans*) 9

8. Pronotal margins incised in front of base as in figure 4B and with fine long hairs protruding (about one-half of length of hairs on antennal scape) (all of Western Hemisphere) *suberosus*

Pronotal margins angulate at middle, not at all incised, without hairs (fig. 4C) (Veracruz, Mexico; Argentina?). *loxus*

9. Each elytron with four sharply keeled, uninterrupted carinae extending from base to apical declivity; pronotal hind angles widely separated from humeri (fig. 4D) (New Mexico, Arizona, Texas, Chihuahua) *carinatus*

Each elytron with intervals either feebly or strongly elevated or tuberculate, but without four sharply keeled, uninterrupted carinae; pronotal hind angles less widely separated from humeri 10

10. Third elytral interval in basal third or fourth sharply elevated, confluent, and entirely tomentose 11

Third elytral interval in basal third or fourth either not sharply elevated, not confluent, or not entirely tomentose 12

11. Pacific coast of Mexico; non-elevated elytral intervals without tubercles. *tomentosus*

Eastern United States west to Nebraska-Texas, also Utah; non-elevated elytral intervals with row of small tubercles *asper* (in part)

12. Each elytron, not counting suture, with at least three rows of tubercles that stand out from the other rows either because of their greater elevation or be-

- cause of their larger or wider tubercles; elytra usually mostly tomentose . . . 13
- Each elytron with all the rows (except sometimes third from suture) nearly uniformly tuberculate; elytra usually mostly shining, bare. 18
13. Tarsal segments on middle and hind tarsi ridged and eroded at base, sometimes but feebly; elytral disc with tubercles mostly black and shining, with small, narrower tomentose areas attached behind . . . *punctatus* (in part)
- Tarsal segments on middle and hind tarsi apparently entirely smooth; elytral disc with each isolated tubercle either entirely or at least more than half encrusted with heavy tomentose coating 14
14. Antennal and mandibular hairs mostly dark or black, club grayish; hind tibiae with the longest spur nearly as broad at middle as the base of the first tarsal segment *scabrosus*
- Antennal and mandibular hairs fulvous, club fulvous; hind tibiae with longest spur narrower at middle than base of first tarsal segment 15
15. Elytral tubercles (at least on third interval) not entirely tomentose, but with black shining areas of varying size at their front ends; most of the tubercles more or less elongate 16
- Elytral tubercles entirely tomentose and opaque, most of them round 17
16. Reflexed elytral sides with submarginal row of small setose tubercles in apical third or half; genitalia (fig. 27G) with lateral lobes contiguous before apex *asper* (in part)
- Reflexed elytral sides with at most minute patches of setae; genitalia (fig. 26D) with lateral lobes not contiguous (Mexico, Guatemala, Nicaragua; rare in United States except southern Texas) *rubricans*
17. Genitalia with inner margins of lateral lobes not parallel at base (fig. 27C); reflexed elytral margins with large and/or small, but definite tubercles (eastern and central states in the United States) *monachus*
- Genitalia with inner margins of lateral lobes narrowly parallel at base (fig. 27B); reflexed elytral margins with very small patches of setae, if any at all (only southern Texas in the United States; Mexico; Guatemala) *fuliginosus*
- 18(12). Tarsal segments on middle and hind legs smooth, cylindrical; front of head with tubercles more or less fused at middle; genitalia as shown in figure 27E *tesselatus*
- Tarsal segments on middle and hind legs ridged, rugose, or excavate, sometimes at base only; front of head with tubercles distinctly separated; genitalia as shown in figure 27D, F 19
19. Genitalia with median lobe flattened (fig. 27F); pronotum with two inner basal tubercles usually almost reaching base, basal margin usually with small knob or tiny tubercle behind each one. *punctatus* (in part)
- Genitalia with median lobe bulbous, inflated (fig. 27D); pronotum with two inner basal tubercles usually separated from basal margin by half their length or more, the base behind each tubercle usually without knob or tubercle *inflatus*
- 20(1). Pronotum virtually glabrous, quite uniformly smooth, without pronounced ridges or depressions (*scaber* has feeble depressions); elytra with all intervals about equal in width and elevation; proepisterna (fig. 3A-B) with inner margin arcuate or straight, not angulate at middle (*scaber* group) 21
- Pronotum usually tomentose, irregularly sculptured with pronounced ridges or tubercles and depressions; elytra with alternate intervals noticeably more elevated or more setose or more tuberculate than other intervals; proepisterna (fig. 3C-D) with inner margin forming obtuse or right angle near middle 27
21. Lateral margins of pronotum with setae as long as or longer than the elytral intervals are wide; elytral intervals with a single row of equidistant setae in center *atrox*
- Lateral margins of pronotum with setae short; elytral intervals with setae, if visible, in double rows or in isolated patches 22
22. Elytra convex, glossy, the fine setae scarcely visible; intervals slightly convex; capillary lines of striae not evident *striatus*
- Elytra flat, more opaque, the setae in patches or clumps; intervals flat; raised capillary lines of striae evident between punctures 23
23. Antennal club black; first segment of

- hind tarsi as long as claw segment (without claw); pronotal margins strongly arcuate; reflexed elytral margins with row of setae next to tenth stria; middle coxae reaching mesoepimera *laticollis*
- Antennal club fulvous or dark red; first segment of hind tarsi shorter than claw segment; pronotal margins nearly parallel except in front; reflexed elytral margins without setae; middle coxae not reaching mesoepimera 24
24. Pronotal depressions evident; elytral setae more noticeable or in longer patches on alternate intervals; male genitalia straight (fig. 25A) *scaber*
- Pronotal depressions absent or feeble; elytral setae in patches of about same size on all intervals (except sometimes the third); male genitalia strongly curved (fig. 25B-D) 25
25. Hind tibiae strongly emarginate before apex (fig. 5A); genitalia with apex of median lobe gently rounded (fig. 25D). (Pacific northwest only, including northern California) *fascifer*
- Hind tibiae feebly emarginate before apex (fig. 5B); genitalia with apex of median lobe truncate (fig. 25B-C) 26
26. Male genitalia with apices of lateral lobes so needle-like as to appear a single line (fig. 25B); size smaller (5 to 6 mm.) *aequalis*
- Male genitalia with apices of lateral lobes needle-like but broader at base (fig. 25C); size larger (6 to 8 mm.) *affinis*
- 27(20). Pronotum (fig. 1B) with four large round foveae, two in median longitudinal depression (these may be less distinct and only feebly depressed), and one each near base between median depression and sides of pronotum (*terrestris* group) 28
- Pronotum (fig. 1C, E) without large round foveae but with a median longitudinal depression that is sometimes feebly humped at middle; tubercle or swelling present between median depression and sides of pronotum (*unistriatus* and *tuberculatus* groups) 37
28. Clypeus broadly rounded *sordidus* (in part)
- Clypeus triangular, acuminate (*terrestris* group) 29
29. Setae on elytral margins three or four times longer than those on dorsum and as long as those on sides of pronotum; hind tibiae slightly curved within, strongly emarginate on outer margin before apex (fig. 9) *frontera*
- Setae on elytral margins shorter than other setae; hind tibiae straight within, less strongly, if at all, emarginate on outer margin (fig. 6A-D) 30
30. Elytral setae on intervals hair-like, longer than tubercles are high, usually meeting over tubercles; pronotal foveae deep, distinct, the surrounding elevated ridges sharp 31
- Elytral setae on intervals scale-like, so short as scarcely to top the tubercles, never meeting over them; pronotal foveae shallow, feeble, the surrounding ridges broadly rounded 35
31. Hind tibiae of male greatly enlarged at middle, with large tooth within near apex (fig. 6A), of female keeled narrowly on outer margin from base to external tooth (fig. 6B) *hamatus*
- Hind tibiae not enlarged or toothed within in either sex, outer margin not keeled (fig. 6C-D) 32
32. Fifth elytral interval from base to subapical declivity with not more than eight setose tubercles. *spinulosus spinulosus* (in part) and *spinulosus simi*
- Fifth elytral interval from base to subapical declivity with from nine to 15 setose tubercles. 33
33. Male genitalia with median lobe short, its apex large (fig. 25J) *foveicollis* (in part)
- Male genitalia with median lobe elongate, about as long as basal piece, its apex small (fig. 25I) 34
34. Hind tibiae at emergence of large external tooth almost one-third as wide as long; setae on elytral intervals scarcely longer than marginal setae; intervals costate (southwestern states and Mexico) (fig. 6C) *spinulosus dentibius*
- Hind tibiae about one-fifth or one-sixth as wide as long (fig. 6D); setae on elytral intervals much longer than marginal setae; intervals scarcely, if at all, costate (eastern states west to Kansas and Oklahoma) *spinulosus spinulosus* (in part)
- 35(30). Male genitalia with lateral lobes nearly straight, median lobe elongate, narrow (fig. 25K) (Atlantic coast) *terrestris*
- Male genitalia with lateral lobes strongly sinuous before apex, median lobe short,

- stout (fig. 25J, L). 36
36. Cuba only; median lobe of male genitalia with basal angles of apical portion acute (fig. 25L). *insularis*
Eastern United States to Kansas and Texas; median lobe with basal angles of apical portion round or rectangular, not acute (fig. 25J)
 *foveicollis* (in part)
- 37(27). Reflexed elytral margins with submarginal row of small setose tubercles in center, especially prominent towards apex where they are nearly as large as tubercles on last interval . . . *variolatus*
 Reflexed elytral margins either without tubercles or with very minute ones at base or at apex only. 38
38. Base of pronotum nearly straight before the rectangular hind angles (fig. 1C), sides of pronotum nearly parallel, median depression rugose or punctate within, narrower, less clearly marked (*unistriatus* group) 39
 Base of pronotum emarginate just before the more acute hind angles (fig. 1E), sides of pronotum more convergent to apex, median depression smooth, opaque within, apparently impunctate, sharply, clearly marked (*tuberculatus* group). 41
39. Elytra with odd intervals not elevated above even ones except sometimes third at extreme base, and not elevated between the well-separated clumps of shining dark setae *capillaris*
 Elytra with odd intervals feebly or strongly elevated above even ones, setae yellow 40
40. Elytral margins with dense, contiguous setae, margins not at all crenulate; size large, 9 to 12 mm. . . . *unistriatus*
 Elytral margins with sparse setae separated by their own lengths, margins slightly crenulate; size small, 7 to 8 mm. *sordidus* (in part)
41. Elytral margins at middle with setae not equidistant but in contiguous dense groups or clumps 42
 Elytral margins at middle with setae equidistant, sparse, separated by about their own lengths (occasionally two setae emerge together). 43
42. Head bituberculate, sometimes only faintly so; setae on elytral intervals always yellow, paler than those at base of pronotum; genitalia as shown in figure 25P (southwestern United States, Mexico) *plicatus*
 Head not tuberculate, but with four tufts of dark setae; setae on elytral intervals usually bronze or piceous, darker than those at base of pronotum; genitalia shown in figure 25R (eastern states, occasional in west)
 *tuberculatus* (in part)
43. Setae on odd elytral intervals, including suture, in long bushy tufts nearly as long as setae at base of pronotum, usually bronze to piceous; pronotum heavily tomentose, with punctures usually obscured. . . . *tuberculatus* (in part)
 Setae on odd elytral intervals short, scarcely longer than the tubercles are high, yellow; pronotum usually with punctures visible even when tomentose 44
44. Each elytron with the alternate intervals strongly, sharply elevated and cristiform all the way to posterior declivity; humeral umbone crossed longitudinally by tubercles of seventh interval (California and Baja California, rare elsewhere). *gemmulatus*
 Each elytron with only one or two intervals elevated, but none cristiform, the elevation decreasing towards posterior declivity; humeral umbone with tubercles lacking or obsolete (only one record from California) 45
45. All elytral setae dark; third elytral interval with the spaces between the setae-bearing tubercles flat, not elevated (southeastern Mexico). . . *acanthinus*
 All elytral setae pale; third elytral interval with the spaces between the setae-bearing tubercles elevated, costate (United States or northern and central Mexico) 46
46. Antennal scape with black or dark hairs *sonorae* (in part)
 Antennal scape with fulvous hairs. 47
47. Male genitalia with median lobe abruptly constricted before apex (fig. 25O) (central and southern Texas only)
 *contractus*
 Male genitalia with median lobe not constricted before apex (fig. 25N, P) (Texas and elsewhere) 48
48. Male genitalia as shown in figure 25N; hind tibiae more markedly serrate on inner edge of outer margin and with strong tooth on outer edge; odd elytral intervals broader, less elevated, their setose patches usually well separated,

narrower than the width of the interval, and depressed; hairs on antennal scape often dark . . . *sonorae* (in part)
Male genitalia as shown in figure 25P;
hind tibiae scarcely serrate on inner edge of outer margin and with spine,

not a tooth, on outer edge; odd elytral intervals narrower, more elevated, their setose patches often confluent, usually as wide as the interval, and not depressed; hairs on antennal scape always fulvous *robinsoni*

THE SCABER GROUP

For a discussion of the group, see page 19.

Trox scaber (Linnaeus)

Figures 3B, 25A

Silpha scabra LINNAEUS, 1767, *Systema naturae*, ed. 12, p. 573 (type, Europe).

Trox barbosus LAICHARTEG, 1781, *Verzeichniss und Beschreibung der Tyroler Insecten*, vol. 1, p. 31.

Trox arenarius FABRICIUS, 1787, *Mantissa insectorum*, vol. 1, p. 18 (type "Halae, Saxonum").

Trox arenosus GMELIN, 1789, in Linnaeus, *Systema naturae*, ed. 13, vol. 1, pt. 4, p. 1586 (type, "Halae, Saxonum").

Trox hispidus PAYKULL, 1798, *Fauna Suecica*, vol. 1, p. 81 (type, southern Sweden).

Trox trisulcatus CURTIS, 1845, *Trans. Linnean Soc. London*, vol. 19, p. 446 (type, Valparaiso, Chile).

Trox niponensis LEWIS, 1895, *Ann. Mag. Nat. Hist.*, ser. 6, vol. 16, p. 387 (type, Hakodate, Japan).

DIAGNOSIS: Differs from the other species of the *scaber* group by having both the median longitudinal depression on the pronotum and the lateral round depressions deeper, more clearly marked, and the third and fifth elytral intervals (often at base only) usually slightly elevated, not flat, under the discontinuous patches of setae. For comparison with *aequalis*, see below.

DESCRIPTION: (See also characters of group). Length, 5 to 7 mm. Clypeus with small angulation in front which is often slightly reflexed; densely punctured. Antennal club fulvous. Pronotum with median depression and three foveae well indicated, sides feebly arcuate, hind angles rectangular, marginal setae short. Elytra with third interval, sometimes fifth, feebly elevated and convex at base or entirely, clothed with tufts of yellow setae, those on odd intervals, at least on disc, usually denser and in more elongate patches than those on even intervals and suture where the patches are small

(four or five setae) and round; reflexed elytral sides without setae. Hind tarsi with first segment shorter than claw segment (without claw). Hind tibiae with serrations interrupted before apex. Proepisterna with inner margins converging in front.

DISTRIBUTION: In the United States from Maine south to Virginia and west to Iowa, also South Carolina, Florida, Texas, North Dakota (Robinson), Colorado, Utah, northern California, and Washington (Robinson). In Canada in Ontario in the east, and Alberta and British Columbia in the west.

SPECIMENS EXAMINED: A total of 651 specimens from 96 localities in the above region except for New Hampshire and Kentucky; only 43 specimens from the western states. All localities include dissected males except for a female from Texas.

DISCUSSION: According to its present known geographical range, this abundant species appears to be more northern in its distribution in the United States, only one specimen having been seen from as far south as Texas and none from Central America. It occurs, however, in Chile and Argentina. Balthasar (1936) calls it a nearly cosmopolitan species, giving its range as Europe, Siberia, north Africa, Canary Islands, North America, Australia, and Chile.

Externally *scaber* is exceedingly similar to *aequalis* and *fascifer*, but the male genitalia are very different (fig. 25A, B, D), resembling the straight genitalia of *atrox* and *hamatus* rather than the arcuate genitalia of *aequalis*, *fascifer*, and *striatus*. It occurs with *fascifer* in the Pacific northwest and around San Francisco, but the hind tibiae are not abruptly and deeply cut out before the apex as in that species, and in *fascifer* the elytral setae are much sparser, and the pronotum is virtually without depressions.

As to *scaber* and *aequalis*, these two species not only have approximately the same geo-

graphical range but they have been taken in the same bird's nest at the same time. They are often confused, but the following remarks may serve to separate the majority of specimens. In *scaber* the patches of setae on the elytral intervals are definitely contrasting, those on the odd intervals being more elongate in shape, closer together, the setae longer and more numerous, while those on the even intervals are much smaller, wider apart, placed in round tufts of from five to six setae, the setae shorter; often the even intervals appear to be lacking in setae. In *aequalis* the elytral patches of setae are usually quite uniform on all intervals (in size, spacing, and number of setae), less elongate, more round than in *scaber*, the setae sparser and shorter. However, in *aequalis* on the third interval, also at times on other intervals, the setae often occur in elongate, scarcely separated patches, and specimens of this sort are often mistaken for *scaber*. In addition to the setae, three other characters can be used in identification: the alternate (odd) intervals especially at base are usually, although not always, somewhat convex or elevated in *scaber*, they are always flat in *aequalis*; the pronotal depressions are generally well marked in *scaber* and always present, whereas in *aequalis* they are feebly indicated, sometimes absent; the punctuation on the pronotum is denser and larger in *scaber* than in *aequalis*. Although all these differences are relative, they can be used with fair accuracy for discrimination of the species when series are available; in doubtful cases, where the setae are worn or the pronotum is encrusted, the genitalia should be dissected. Harold (1872) separated *scaber* from *aequalis* by stating in his key that the front tibiae in *scaber* were serrulate between the apical teeth and base, and not so in *aequalis*. This character is very variable, and I find serrations present or absent in both species.

The apex of the median lobe is truncate as in *aequalis* and *affinis*, not rounded as in *fascifer* and *striatus*, but the lateral lobes differ from those of the other species by being straight, not strongly recurved and by lacking the elongate needle-like apices (fig. 25A).

The synonymy given above is from Harold (1872) and Arrow (1912). The types of these forms have not been examined.

HABITS: Robinson (*in litt.*) found this species feeding on various objects including "hoof parings, chicken feathers, owl pellets, bone meal, and a wool coat." Blatchley (1910) found it "frequent beneath dead fish and other carrion and rubbish." Heim de Balsac (1952), in a study of a stork's nest (*Ciconia ciconia*) in Lorraine, France, found *scaber* and 31 other species of beetles as "strict commensals" in the nest. A specimen from Massachusetts was taken in a squirrel's nest. Paulian (1943) reports *scaber* from the nests of a woodpecker, sparrow, screech owl, and jackdaw, from the holes of rabbits and badgers, and from the galleries of moles.

***Trox aequalis* Say**

Figures 1A, 5B, 25B

Trox aequalis SAY, 1831, New species of . . . insects found . . . chiefly in Louisiana, p. 5 (type, United States).

DIAGNOSIS: Differs from *affinis* only in smaller size and male genitalia. Very similar also to *scaber* and *fascifer*, differing from the latter in the less emarginate apex of the hind tibiae (fig. 5B) and by usually having some of the patches of elytral setae longer than wide. Differs from *striatus* by having more abundant elytral setae (setae scarcely visible in *striatus*), and flat, not convex pronotum, elytra, and elytral intervals. Differs from *scaber* as stated under that species.

DESCRIPTION: (See also characters of group). Length, 5 to 6 mm. Clypeus with small angulation in front which is often slightly reflexed, densely punctured. Antennal club fulvous. Pronotum with median depression and basal median fovea often obsolete, the lateral foveae usually present but not deep, sides feebly arcuate, hind angles rectangular, marginal setae short. Elytra with all intervals flat, not elevated (except sometimes the extreme base of third), clothed with small, round, equidistant tufts of yellow setae, these tufts sometimes elongated or run together on some intervals; reflexed elytral sides without setae. Hind tarsi with first segment shorter than claw segment (without claw); hind tibiae with serrations interrupted before apex. Proepisterna with inner margins converging in front.

DISTRIBUTION: Quebec, Canada, and eastern United States south to South Carolina,

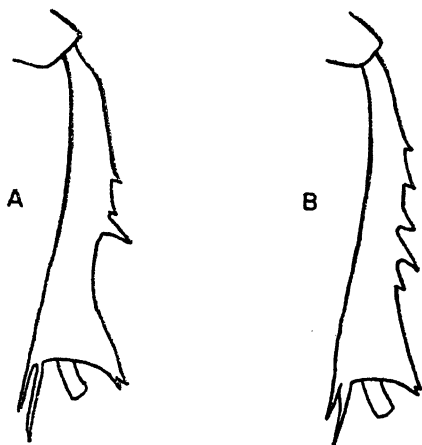


FIG. 5. Hind tibiae of *Trox*. A. *T. fascifer* (British Columbia). B. *T. aequalis* (Chihuahua, Mexico).

west to Texas and North Dakota, also Colorado and Arizona; the states of Coahuila, Chihuahua, and Durango in northern Mexico.

SPECIMENS EXAMINED: A total of 235 from 68 localities in the above region except for the New England states, Wisconsin, South Dakota, Nebraska, and Delaware. Only 12 specimens come from as far west as Colorado and Arizona, and 11 from Mexico.

DISCUSSION: The specimens from northern Mexico constitute the first records of *aequalis* from south of the border. This species occurs, but evidently less abundantly, in many of the same localities as *scaber*, though it ranges farther south than *scaber* in North America and has not been taken in the Pacific northwest. It is similar to *scaber* (see discussion under that species), but is even more similar externally to *fascifer*, from which it differs as stated in the diagnosis and, further, in the male genitalia (fig. 25B). The lateral lobes in *aequalis* are not quite so sinuate on the outer sides, and the apex of the median lobe is truncate with almost rectangular sides, not broadly rounded and with sloping sides as in *fascifer*. The shape of the apex can sometimes be seen through the enclosing lateral lobes, but is best seen by spreading apart at least one lobe. For the small but apparently constant difference in genitalia between *aequalis* and *affinis*, see discussion under *affinis*.

HABITS: Robinson (1941) found this species in a variety of nests of mammals and birds, such as nests of crows, screech owls,

barn owls, great horned owls, buteos, turkey vultures, starlings, and tufted tits. I have seen specimens reared from the nests of crows and starlings. A specimen from Quebec was taken under bark in April, and Blatchley (1910) reports *aequalis* "often distant from carrion beneath bark and about the roots of trees." He also found it hibernating under fence corners in accumulations of dead leaves.

Trox affinis Robinson

Figure 25C

Trox (Trox) aequalis affinis ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 158, pl. 4, fig. 9 (type, male, Moorestown, Burlington County, New Jersey, in collection of Mark Robinson).

DIAGNOSIS: Differs from *aequalis* only in larger size and in the male genitalia. Differs from the other species of the *scaber* group in the same way as stated for *aequalis*.

DESCRIPTION: Length, 6 to 8 mm. Otherwise exactly as in *aequalis*.

DISTRIBUTION: Some northeastern states, also Iowa (Robinson, 1940), Kansas (?), Louisiana (?), Texas, and California (Robinson, 1941).

SPECIMENS EXAMINED: A total of 31 from nine localities (see Appendix). Identification of the 16 females is based either on their large size or on their association with another female of large size or a dissected male from the same locality.

DISCUSSION: Although Robinson described *affinis* as a subspecies of *aequalis*, later when he found it occurring throughout the range of *aequalis*, he changed its status to that of a species. He believes it to be endemic in crows' nests or nests used formerly by crows, but *aequalis* likewise is found in the same situations. However, as Robinson states, the small difference between the male genitalia of *affinis* and those of *aequalis* appears to be constant (fig. 25B-C). I have examined the genitalia of the type and eight paratypes of *affinis* and of six other males and find that the apices of the lateral lobes are always broader and shorter than in males of *aequalis*. In *affinis* the prolonged apices are more or less in the form of an isosceles triangle, whereas in *aequalis* they are needle-like and narrowed throughout. The apices in *aequalis* are actually longer than in the much larger genitalia of *affinis*. This difference I

believe is more readily discerned and more reliable than the sinuation of the sides of the lateral lobes, the sides being less sinuate in *affinis*. The fact that all these male *affinis* are larger (and Robinson states that this is true of his type series of 59 males and females) is supporting evidence for the distinctness of *affinis*, but would not be sufficient alone, as the size range in the two species overlaps in some instances (a few of the male *aequalis* from Mexico are as large as some male *affinis* and one of the females of *affinis* from Cupola, Pennsylvania, and one from Plummer's Island, Maryland, are as small as some *aequalis*).

HABITS: All the type material was collected in the nests of crows in four localities in New Jersey. Robinson (1941) reports 24 additional specimens from four crows' nests in May of 1941 in Chester County, Pennsylvania, and 52 specimens from a great horned owl's nest in Cupola, Pennsylvania, in June, 1951. He says (p. 231) that the owl was using a crow's former nest, and that the *Trox* were feeding "on the hair of rabbits and feathers of pheasant and grouse, which remains were found in the nest."

***Trox fascifer* LeConte**

Figures 5A, 25D

Trox fascifer LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 213 (type, San Francisco [California], in Museum of Comparative Zoology).

DIAGNOSIS: Differs from the other species of the *scaber* group in the stronger emargination in front of the outer angle on the hind tibiae (tibial serrations broadly interrupted), and differs further from *aequalis* by having the elytral setae always in tiny round, not elongate, tufts.

DESCRIPTION: Length, 5.5 to 7 mm. All characters as in *aequalis* except as stated above.

DISTRIBUTION: Pacific northwest from San Francisco region in California, north to British Columbia, Canada.

SPECIMENS EXAMINED: A total of 14 from eight localities (see Appendix).

DISCUSSION: Although the stronger emargination of the hind tibiae in this species is a relative character and not always readily recognized unless comparative material is

available, *fascifer* can be distinguished with certainty from the other members in the group by a more definite character, the male genitalia. These are of the same general shape as in *aequalis*, *affinis*, and *striatus*, but the lateral lobes are more sinuate on the outer margins and more abruptly narrowed to the apex than in all three of the other species. The shape of the median lobe differs distinctly from that of *aequalis* and *affinis*, the two species that approach *fascifer* most closely in the sinuation of the lateral lobes. When the latter are spread open, the sides of the median lobe are seen to be gently sloping to a rounded apex in *fascifer* (fig. 25D), but angulate in *aequalis* and *affinis*, with apices truncate and slightly sinuate. In *striatus* the median lobe is about the same as in *fascifer*, but the lateral lobes are not sinuate or abruptly narrowed. Externally *striatus* differs from *fascifer* only in its very convex, not flat, elytra and pronotum, less abundant setae (often not visible at all), and larger, more round stria punctures.

The hind tarsal segments 2, 3, and 4, said by Horn (1874) to be not longer than wide in *fascifer*, do appear longer than wide in some specimens, although not proportionately so long as in *aequalis* or *affinis*. Neither LeConte nor Horn mentions the emargination of the hind tibiae, which was first noticed by Robinson (*in litt.*). As shown in figure 5A, the difference in emargination between *fascifer* and *aequalis* is not very striking, but most United States specimens of *aequalis* have the tibiae even less cut out than in the Mexican specimen figured.

The type of this species has been examined.

HABITS: No information.

***Trox striatus* Melsheimer**

Figure 25E

Trox striatus MELSHEIMER, 1846, Proc. Acad. Nat. Sci. Philadelphia, vol. 2, p. 137 (type, Pennsylvania).

DIAGNOSIS: Differs from all species with oval scutellum by appearing very glossy and virtually without setae although fine setae are actually present. The elytra and elytral intervals are more convex than in other species of the *scaber* group, the elytral punctures apparently lacking the usual capillary lines.

DESCRIPTION: (See also characters of the group). Length, 5.5 to 6.5 mm. Clypeus densely punctured. Antennal club fulvous to dark red. Pronotum with median depression and foveae faintly indicated, sides feebly arcuate, hind angles rectangular, marginal setae short. Elytra with all intervals slightly and equally convex, clothed with scarcely visible tiny equidistant clumps of from two to five yellow setae; reflexed elytral margins without setae. Hind tarsi with first segment shorter than claw segment (without claw). Hind tibiae with serrations interrupted before apex. Proepisterna with inner margins converging in front.

DISTRIBUTION: New Jersey, Pennsylvania, and Arkansas.

SPECIMENS EXAMINED: New Jersey: Moorestown, May to July, 18. Pennsylvania: Broomall, May, 218. Arkansas: Hope, June, one.

DISCUSSION: This species was so rare in collections at the time of its description that Harold in 1872 thought it might possibly be the European species *eversmanni* accidental in the United States. In 1941, however, Robinson found it occurred in the nest or nesting cavities of owls, and he collected several hundred specimens in a barn owl's nest in Broomall, Pennsylvania.

Melshiemer thought *striatus* had no pubescence, and it is true that none is evident in the majority of specimens. Except for its glossy brilliance and general convexity, this species is very similar to *fascifer*, which, however, occurs at the opposite extreme of the country. The second, third, and fourth hind tarsal segments are scarcely longer than wide, as in *fascifer*, and the hind tibiae are sometimes nearly as strongly emarginate as in that species. The median lobe of the genitalia is also of about the same shape, but the lateral lobes in *striatus* are not abruptly sinuate before the apex (fig. 25E).

The type was not found in the Melsheimer collection at the Museum of Comparative Zoölogy.

HABITS: In addition to the barn owl's nest mentioned above, this species has been collected in owl pellets and in the nests of the great horned owl and the screech owl in Cupola, Chester Heights, and Lyndell, Pennsylvania (Robinson, 1941).

Trox laticollis LeConte

Figures 3A, 25F

Trox laticollis LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 213 (type, New York, in Museum of Comparative Zoölogy).

DIAGNOSIS: Differs from all species in the genus by having the middle coxae reaching the mesoepimera. Differs further from other species in the *scaber* group by having the antennal club black, the lateral margins of the pronotum more strongly rounded, the first segment of the hind tarsi longer than the last, the proepisterna with the inner margins not converging in front, and the reflexed sides of the elytra with a row of setae next to the tenth stria.

DESCRIPTION: (See also characters of the group). Length, 5.5 to 6 mm. Clypeus densely punctured. Antennal club black. Pronotum with median depression and basal median fovea sometimes absent, or replaced by impunctate line, lateral foveae usually present but not deep, sides strongly arcuate, hind angles obtuse, marginal setae short. Elytra with all intervals flat, not elevated (except sometimes base of third), clothed with tiny, round, equidistant clumps of from two to four yellow or bronze setae; reflexed elytral margins with single row of setae next to tenth stria. Hind tarsi with first segment longer than claw segment (without claw). Hind tibiae with serrations continuous to apex. Proepisterna with inner margins nearly parallel in front.

DISTRIBUTION: Massachusetts, New York, Pennsylvania, and Iowa; Arkansas (Robinson, 1941).

SPECIMENS EXAMINED: A total of 28 from six localities (see Appendix).

DISCUSSION: This species, as well as the following (*atrox*), possesses a number of distinct differences from the other species of the *scaber* group as noted above. The prolonged section of the mesoepimeron that extends inward to the middle coxae, thus separating slightly the mesosternum from the sides of the metasternum, is the character that, along with the different male genitalia, led Robinson (1948) to erect the genus *Pseudotrox* for this species. (The reasons for synonymizing *Pseudotrox* are given above under the discussion of the genus *Trox*.) The male

genitalia are indeed of a somewhat different type; each lateral lobe has a soft membranous area apically; the median lobe is not flattened dorsally, but is laterally compressed, its apex sickle shaped, the hook coming forward through the tips of the lobes (fig. 25F).

The type of this species has been examined.

HABITS: Except for a specimen found at the entrance of a woodchuck burrow, all the specimens of this species for which data were kept are associated with foxes. Robinson (1941) reports 25 specimens collected in a fox den in Natick, Massachusetts, in May, one from the den of a gray fox in Pennsylvania in July, and four feeding on a dead fox in a cave of Washington County, Arkansas, in November. Specimens from Framingham, Massachusetts, were also taken in a fox's hole.

***Trox atrox* LeConte**

Figure 25G

Trox atrox LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 214 (type, Long's Peak [Colorado], in the Museum of Comparative Zoölogy).

DIAGNOSIS: Differs from all species in North America in two characters: the longer fringe of setae on the lateral pronotal margins (longer than elytral intervals are wide), and the single continuous row of equidistant setae on each elytral interval.

DESCRIPTION: (See also characters of the group). Length, 6 to 8.5 mm. Clypeus finely punctured or nearly impunctate. Antennal club fulvous. Pronotum with median depression usually absent, but foveae present, sides feebly arcuate, with a slight bend at the middle, hind angles acute; marginal setae long. Elytra with all intervals equally flat, with single yellow setae in an uninterrupted row in center of each interval, setae separated by about their own lengths; reflexed elytral margins without setae. Hind tarsi with first segment shorter than claw segment (without claw). Hind tibiae with serrations continuous to apex. Proepisterna with inner margins converging in front.

DISTRIBUTION: Alberta, Canada, and western United States east to the Mississippi River, also Illinois (*Blatchley*), Michigan (Robinson, *in litt.*), and Indiana. Durango City, Durango, Mexico.

SPECIMENS EXAMINED: A total of 100 from

83 localities in the above regions except for the states of Oregon, North Dakota, Iowa, Missouri, Arkansas, and Louisiana. Most of the localities are in California, Arizona, Utah, and Kansas. Only two specimens were seen from Indiana, one from Minnesota, three from Texas, and one from Durango.

DISCUSSION: The specimen from Durango City, Durango, is the first record from Mexico, although I have seen specimens from as far south in the United States as Dimmit County in southeastern Texas, Wilcox and Tucson in southern Arizona, Hope and Malaga in Eddy County, New Mexico, and from San Diego in southern California. This species differs further from other members of the *scaber* group by having the clypeus very finely, not densely punctured and the hind angles of the pronotum acute; it differs from all but *laticollis* in the apparently not emarginate hind tibiae and in their less produced apical angle. In *atrox* and *laticollis* the hind tibiae appear straight on the outer margin (except for a slight apical flare) because the double rows of serrations extend all the way to the apex, whereas in the other species the serrations disappear subapically, leaving an emarginate gap. The hind tarsal segments are longer and narrower in *atrox* than in the other species, and the setae on the hind tibiae are longer. On the third elytral interval, sometimes also on the fifth, there are often one or two extra setae, or a few setae are placed out of line.

I have seen a female specimen of the European and Asiatic species (*eversmanni* Krynicki), identified as such by R. Paulian, which is externally exceedingly similar to *atrox*. The clypeus in this specimen, however, is densely punctured, not nearly impunctate, and has a slight angulation in front; the pronotum appears somewhat more convex and less transverse than in *atrox*, and the three middle hind tarsal segments are scarcely longer than wide. It would be rather startling if these were to prove to be the same species, but they cannot be said to be so without more material of *eversmanni* in order to ascertain the individual variations of this form, and without a comparison of the male genitalia.

In *atrox* and in *laticollis* the basal piece on the male genitalia is not notably longer than the lateral lobes as in the other species of the

scaber group, but of about the same length. In the *terrestris* group of species, which follows, the basal piece is shorter than the lateral lobes except in the case of *hamatus*. The genitalia of *atrox* (fig. 25G) are nearly the same as those of *hamatus*; they are also very large, actually larger than the genitalia of a much larger specimen of *tuberculatus* in the *sonorae* group.

The type specimen has been examined.

HABITS: The only record Robinson (*in litt.*) had of the habits of this species was that a specimen was found in the nest of a ground squirrel. Additional material with ecologic notations shows that *atrox* has occurred in the nest of a burrowing owl (*Speotyto*) and in a gopher hole, as well as at light and under a dead cow.

THE *TERRESTRIS* GROUP

For a discussion of the group, see page 20.

Trox hamatus Robinson

Figures 3C, 6A-B, 25H

Trox (Trox) hamatus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 153, pl. 4, figs. 7, 13 (type, male, Mount Misery, Burlington County, New Jersey, in collection of Mark Robinson).

DIAGNOSIS: The male differs from both sexes of all species of the genus in North America in the enlarged and flattened hind tibiae but is otherwise, except in the male genitalia, similar to those members of the *terrestris* group that have long elytral setae and deep pronotal foveae. The females also have the hind tibiae wider (nearly a third as wide as long) than in other species, but not enlarged (fig. 6A-B).

DESCRIPTION: (See also characters of the group). Length, 5 to 6 mm. Pronotum with foveae deep, ridges sharply elevated, narrow; sides scarcely, if at all, sinuate before hind angles which are rectangular or obtuse; marginal setae dense, contiguous. Elytra with surface of tubercles usually covered by dense long setae that are so long they meet over the tubercles and are three or more times longer than marginal setae; marginal setae not contiguous. Hind tibiae in male flattened, somewhat concave dorsally, half as wide as long, externally with a keel expanding in a large blunt tooth at apical third, internally with a large inward-curving tooth or hook subapically, hidden among abundant hairs; in female, just perceptibly concave dorsally, nearly one-third as wide as long, keel on outer margin scarcely expanded to tooth at apical third, internally without subapical tooth, hind tibiae not emarginate at apex on outer side; submarginal row of dorsal setae

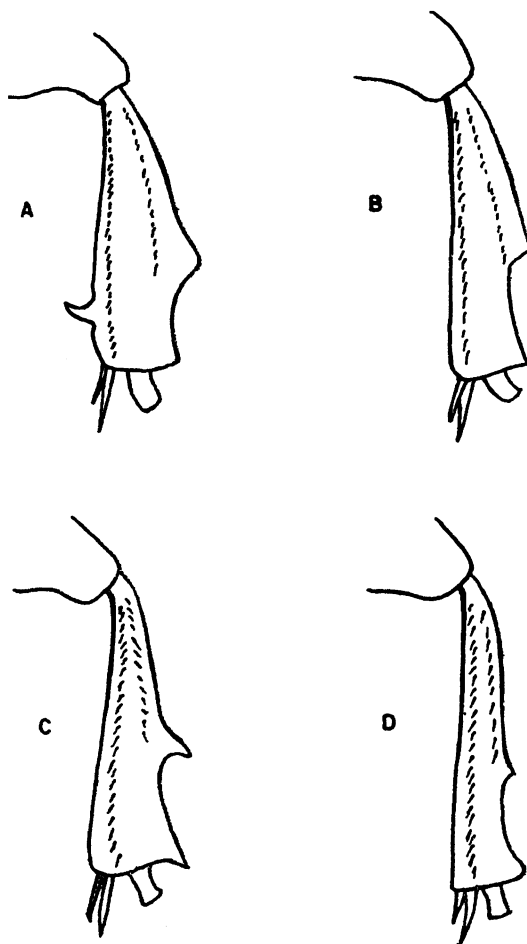


FIG. 6. Hind tibiae of *Trox*. A. *T. hamatus*, male. B. *T. hamatus*, female. C. *T. spinulosus dentibius*, male (type). D. *T. s. spinulosus*, female (paratype).

near inner margin not turning away from margin at apex.

DISTRIBUTION: Eastern states south to Georgia and Tennessee, west to Nebraska,

Kansas, also Oklahoma and Texas.

SPECIMENS EXAMINED: A total of 258 from 77 localities in the above region except for Maine, New Hampshire, Vermont, West Virginia, Indiana, Wisconsin, and Minnesota. Most abundant in numbers and localities in New York, New Jersey, Pennsylvania, and North Carolina.

DISCUSSION: I have examined the type and about 35 of the 932 paratypes and find that the pattern of the elytral tufts of setae varies somewhat as is usual in most *Trox*. In the paratype series some individuals have the setose tubercles round, equidistant, and close together, whereas others have them round or elongate, and either narrowly or widely separated (sometimes by twice their diameter), the shape and spacing of the tufts varying on different intervals.

Robinson (*in litt.*) has seen the species from "Texas," but I have examined but one specimen from that state, a worn female from Brownsville, Cameron County.

The other species with long elytral setae (*spinulosus* and some *foveicollis*) are very similar dorsally, and females of these species can be distinguished from females of *hamatus* only by their narrower, unkeeled hind tibiae, a character which is actually difficult to evaluate without comparative material. The male genitalia, however, are very different from those of other species in the group, closely resembling those of *atrox* of the preceding (*scaber*) group of species (fig. 25H). These two species appear to have no other characters in common and are not at all similar externally. In comparison with other species of the *terrestris* group, *hamatus* has the basal piece of the genitalia as long as or longer than the lateral lobes, not shorter, the lateral lobes nearly as wide as the median lobe, not narrow ribbons, and the median lobe simply rounded apically, not emarginate or with ear-like projections.

HABITS: Specimens have been collected under chicken feathers, squirrel carrion, at light, and from a fox's burrow.

Trox spinulosus

Figures 6C-D, 7, 25I

DIAGNOSIS: Distinguished from the other two species of the group that also have long elytral setae as follows: from *hamatus* by the

narrower hind tibiae and from *foveicollis* only by the male genitalia which have the median lobe elongate, not short, its broadened apex only one-fourth or one-fifth of the entire length, not one-half to one-third.

DESCRIPTION: (See also characters of the group). Length, 5 to 7 mm. Details of pronotum and elytra as in *hamatus*, except that the setae on the elytral tubercles are sometimes sparse, not dense (*s. dentibius*). Hind tibiae feebly or strongly toothed, scarcely emarginate before apex on outer side; submarginal row of dorsal setae variable.

DISTRIBUTION OF THE SPECIES: Eastern states from New Jersey south to Virginia, west to Arizona and northern Mexico; *spinulosus* and *dentibius* intergrading in Texas (see map, fig. 7).

DISCUSSION: This species is divisible into three subspecies: nominate *spinulosus* Robinson (type locality, La Salle, Michigan), *simi* Robinson (type locality, Moorestown, New Jersey), and *dentibius* Robinson (type locality, Palmerlee, Arizona). These forms were described as separate species, but the male genitalia appear to be identical, and intermediate individuals occur. The subspecies *simi* has a restricted range along the Atlantic coast from Pennsylvania to Virginia and is far less numerous than the other two subspecies; nominate *spinulosus* is an inland form extending to Nebraska, Oklahoma, and northern and central Texas; and *dentibius* occurs at high altitudes in extreme western Texas, in New Mexico, Arizona, Mexico, and southern Baja California (see fig. 7). The characters distinguishing the subspecies include the number, size, and vestiture of the tubercles composing the odd elytral intervals, the elevation of these intervals, the number of isolated setae, if any, on the reflexed elytral margins, and the relative width of the hind tibiae. Populations of *simi* (Atlantic coast) differ from the other subspecies by having larger and fewer setose tubercles on the elytral intervals, each tubercle well separated by flat, shiny spaces, and by having a row of small setae along the reflexed elytral margins. Populations of nominate *spinulosus* have the setose tubercles more numerous, closer together, and slightly smaller than in *simi*, with the spaces between the tubercles sometimes slightly elevated, and the setae on

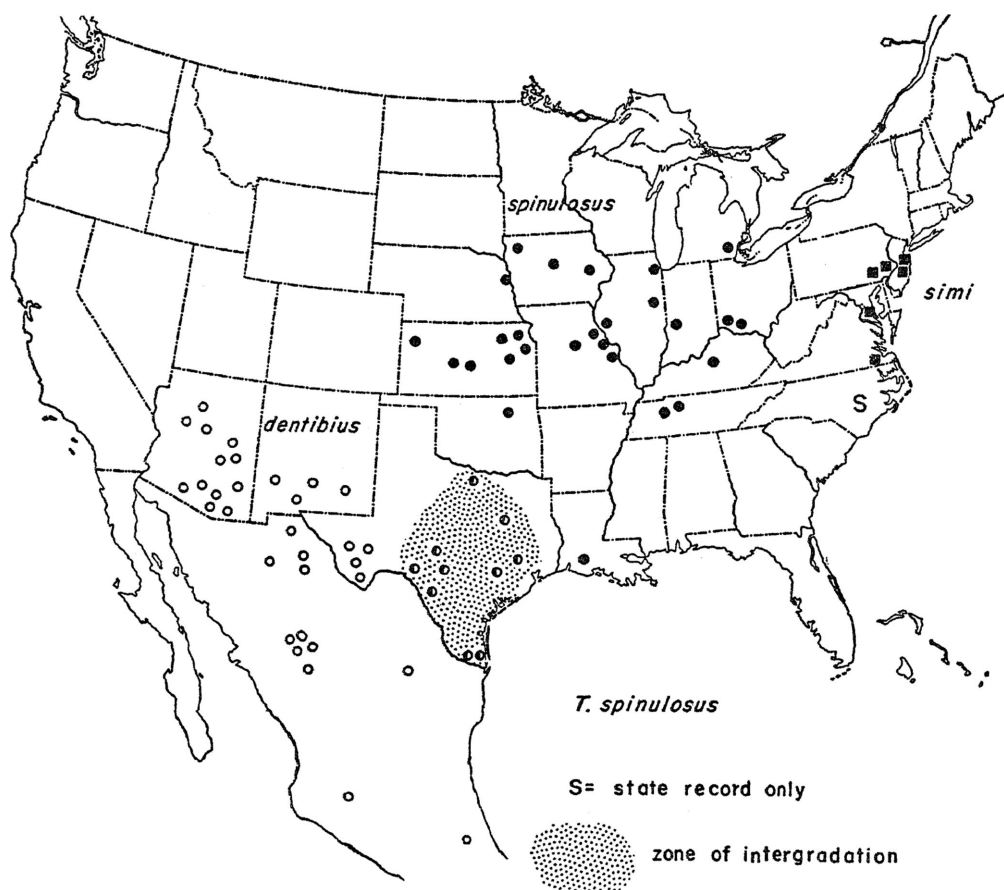


FIG. 7. Distribution of the subspecies of *Trox spinulosus*.

the reflexed margins fewer, sometimes lacking. Both these subspecies have narrow hind tibiae. Populations of *dentibius*, on the other hand, have the hind tibiae proportionately wider than in either of the preceding subspecies, with a larger tooth on the outer margin; they are slightly larger in general size; they have the elytral setae in yet smaller, less shaggy tufts which are spaced more closely along the intervals; the intervals are more elevated or costate throughout; the reflexed margins have no setae.

It was thought at first that *dentibius* represented a distinct species, but the fact that the genitalia are the same as in *spinulosus* and *simi* (Robinson's figures of the genitalia are not correct, see below) and specimens from Texas show some of the characters of *dentibius* and some of *spinulosus* has led me to consider them as conspecific. These inter-

mediate populations consist of a series (mostly males) from Kerr and Menard counties in central Texas, and from Archer County near the Oklahoma boundary. In these series the hind tibiae are generally narrow as in nominate *spinulosus* but often have a large tooth as in *dentibius*, the setae on the elytral intervals approach *dentibius* in being sparser and less shaggy, and the intervals themselves are more costate as in *dentibius*. The setose tubercles on some individuals are as numerous as in most *dentibius*, but on other individuals they are less numerous, as in the nominate subspecies. I believe the tibial character has more weight than the elytra and therefore consider these populations closer to *spinulosus* than to *dentibius*. A few isolated males from other parts of Texas might be placed with either subspecies, or they might be considered as intermediates,

but only further series from these localities can define the zone of intergradation (see Appendix).

A few corrections should be made in the figures of the genitalia of *dentibius* and *spinulosus* as given by Robinson (1940, pl. 4). The rectangular piece at the apex of the median lobe in *dentibius* is present also in *spinulosus*, although it is not shown in Robinson's drawing of the latter. This piece is the apex of the ventral part of the lobe, and it sometimes shows slightly in a dorsal view, depending on whether the genitalia have been pressed forward or backward; it can always be seen in a ventral view. A small, median, finger-like projection shown by Robinson at the apex of the ventral piece in *spinulosus* is a part of the dorsal, not the ventral, portion of the median lobe, and it is present also in *dentibius*. The hind angles of the widened apex of the median lobe are actually the same in both subspecies, that is, at right angles, but sometimes they are reflexed ventrally in such a way as to seem to be more oblique and to form obtuse angles, as shown by Robinson for *spinulosus* only. The above remarks are true also of the genitalia of *simi*.

In the eastern part of its range the species occurs with two exceedingly similar species, *hamatus* and *foveicollis*. Males of these two species can be distinguished from *spinulosus* by the different genitalia (fig. 25H-J) and in the case of *hamatus* also by the hind tibiae (fig. 6A) which are enlarged and flattened and possess an inner subapical tooth, but females can be recognized by only a few relative characters. Thus the hind tibiae are narrow and not keeled on the outer margin, whereas in *hamatus* females they are nearly one-third as wide as long and have a kind of keel on the outer margin (fig. 6B); the hind tibiae of *s. dentibius* are often almost as wide as in *hamatus*, but this subspecies does not occur in the eastern area. The setae on the elytral intervals are much longer and more shaggy in *spinulosus* than in most *foveicollis*, but the setae are often worn down, and some specimens of *foveicollis* also have long setae. Some females of *spinulosus* (subspecies *simi*) could not be confused with either *hamatus* or *foveicollis*, because they have a row of setae on the reflexed elytral margins and very few tubercles on the dorsum (from five to

eight on the fifth elytral interval from base to subapical umbone as against nine to 13 in *hamatus* and *foveicollis*). The number of tubercles on any interval is variable in most *Trox* and even varies on each elytron, so that numbers given must not be considered as definitive.

There is a third species of the *terrestris* group restricted to Texas (*frontera*) which differs from *spinulosus* principally in the male genitalia and in the very long setae on the elytral margins (longer than the setae on the intervals). Both this species and *terrestris* itself have short, not long, setae on the elytral intervals. Farther west than Texas there are no other species of this group, and *spinulosus* also is the only species of the group yet found in Mexico.

HABITS: Robinson's food records for the subspecies *simi* (1940, 1941) include hen feathers, mouse hair, dead crow, mole, old carpet, and owl pellets. He took the type and 92 specimens from Pennsylvania in the pellets of the barn owl (*Tyto alba pratincola* Bonaparte) on the ground beneath the roosting tree. For nominate *spinulosus* and *s. dentibius* no data are available except that they come to light, but the intermediate series from Archer County, Texas, were collected from a mouse's nest under a stone, and those from Kerr and Menard counties, Texas, at sheep, goat, and rabbit carrion.

Trox spinulosus simi Robinson

Trox (Trox) simi ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 157, pl. 4, fig. 5 (type, male, Moorestown, Burlington County, New Jersey, in collection of Mark Robinson).

DIAGNOSIS: Differs from the other two subspecies in the presence of a complete row of closely placed setae in the center of the reflexed elytral margins, occasionally incomplete, and in the larger, higher, and fewer setose tubercles on the odd elytral intervals, these tubercles being separated longitudinally by flat, shiny areas that are often twice as long as the tubercles.

DISTRIBUTION: Atlantic coast from Pennsylvania and New Jersey south to Virginia (see map, fig. 7).

SPECIMENS EXAMINED: A total of 42 from nine localities (see Appendix).

DISCUSSION: This form was described as a

distinct species from 15 specimens from New Jersey, Pennsylvania, and Virginia. I have examined the type (Moorestown, New Jersey), and three paratypes (Stow Creek and Jericho, New Jersey; Delaware County, Pennsylvania), all of which agree with the diagnostic characters as stated above except the paratype from Stow Creek which has only one seta on the reflexed elytral margin. The number of elytral tubercles on the third and fifth intervals ranges from six to nine (from base to the subapical declivity) in most populations of this subspecies. Of 26 specimens from Broomall, Pennsylvania, part of a series of 92 taken in Delaware County, only one specimen has more than eight tubercles on the fifth interval. Of five specimens from Sparrows Point, Maryland, however, only three are typically *simi* in this respect, the others having more tubercles, thus approaching nominate *spinulosus*. I have not seen any specimens from Virginia, but Robinson had a paratype from the Dismal Swamp in that state.

For genitalia (fig. 25I) and habits, see under the species.

***Trox spinulosus spinulosus* Robinson**

Trox (Trox) spinulosus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 156, pl. 4, figs. 5, 15 (type, male, La Salle, Monroe County, Michigan, in the collection of Mark Robinson).

DIAGNOSIS: Differs from *spinulosus simi* by having no setae or only one to five widely separated ones in the center of the reflexed elytral margins, and by having smaller, more numerous setose tubercles on the odd elytral intervals, the spaces between the tubercles longitudinally being slightly elevated, not completely flat. Differs from *s. dentibius* by having narrower hind tibiae, larger, more bushy, less numerous setose tubercles on the elytra, and less elevated intervals.

DISTRIBUTION: From Michigan to Tennessee and west to Nebraska, south to northern and central Texas where it intergrades with *s. dentibius* (see map, fig. 7), also Louisiana.

SPECIMENS EXAMINED: A total of 103 from 30 localities (see Appendix).

DISCUSSION: When Robinson described this form he had specimens from the type locality only, of which I have examined the type and

20 of the 258 paratypes. The present extension of the range brings *spinulosus* in contact with another subspecies, *dentibius*, in Texas (for discussion of the intermediate populations, see under the species above). There is a blank area in the distribution of nominate *spinulosus* between Tennessee and southern Louisiana, although the species no doubt occurs in this region. Scattered specimens of *spinulosus* approach *simi* populations in some characters. Thus one specimen each seen from Louisiana, Iowa, Missouri, and Tennessee have only from seven to nine tubercles on the third and fifth elytral intervals, as in *simi*, but they have the longitudinal spaces elevated as in other specimens of *spinulosus*, and the reflexed elytral margins not setose. Occasionally the longitudinal spaces are as flat as in *simi*, as in a specimen from Lake Okoboji, Iowa. In general, populations of nominate *spinulosus* have approximately 11 to 13 tubercles on the third and fifth intervals (from base to subapical declivity), *dentibius* from 13 to 15, and *simi* from six to nine. The type of *spinulosus* (a very small specimen of 5 mm.) has 11 tubercles on the third interval, 10 on the fifth, and on the reflexed elytral margins has five setae on one side, two on the other. For genitalia (fig. 25I) and habits, see above under the species.

***Trox spinulosus dentibius* Robinson**

Trox (Trox) dentibius ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 156, pl. 4, figs. 4, 14 (type, male, Palmerlee, Cochise County, Arizona, in collection of Mark Robinson).

DIAGNOSIS: Differs from the other subspecies in the wider, stouter hind tibiae, which have also a larger external tooth, the more costate elytral intervals, and the less distinctly separated tubercles. The tubercles usually have fewer setae in each tuft, thus appearing less shaggy than in nominate *spinulosus* or in *simi*.

DISTRIBUTION: Arizona, New Mexico, western Texas; the states of Coahuila, Chihuahua, Durango, Baja California, Morelos and Michoacan in Mexico (see map, fig. 7).

SPECIMENS EXAMINED: A total of 300 specimens from 59 localities—about a sixth of these from 17 localities in Mexico (see Appendix).

DISCUSSION: Robinson in his description

states that the hind tibiae of this form are "two-sevenths as wide as long" as opposed to the hind tibiae of nominate *spinulosus* which are "two-ninths as wide as long." I do not know whether or not my drawings (fig. 6C, D) of the type of the former and paratype of the latter represent this difference, but in any case the hind tibiae of the two forms are not always so definitely different as is shown in the figures. Wear makes the tibiae appear narrower and the often present coating of grease or mud makes them appear wider. In general the sparser setae on the elytra, more numerous tufts (about 13 to 15 on the third interval), and wider hind tibiae will separate this subspecies from nominate *spinulosus*.

For genitalia (fig. 25I) and habits, see above under the species.

Trox foveicollis Harold

Figure 25J

Trox foveicollis HAROLD, 1872, Coleopterologische Hefte, vol. 9, p. 181 (type locality not designated, "Tennessee, Illinois, New Orleans, Texas.")

Trox (Trox) aciculeatus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 156, pl. 4, fig. 3 (type, male, Hope, Arkansas, in collection of Mark Robinson). New synonymy.

DIAGNOSIS: Resembles externally all the other species of the *terrestris* group except *frontera*, which is larger and has the setae on the elytral margins very long, and males of *hamatus*, which have the hind tibiae flattened and enlarged, but differs from all in the male genitalia.

DESCRIPTION: (See also characters of group). Length, 5 to 6.5 mm. Pronotum with foveae usually deep, sometimes front fovea indistinct, ridges sharply elevated, narrow; sides sinuate before hind angles which are obtuse or rounded; marginal setae neither contiguous nor widely separated. Elytra with surface of tubercles either not covered over by the short sparse setae or with longer setae that meet over the tubercles, setae as long as or longer than marginal setae; marginal setae not contiguous. Hind tibiae feebly toothed, not or but slightly emarginate before apex on outer margin; submarginal row of dorsal setae near inner margin turning away from margin at apex.

DISTRIBUTION: Eastern states west to Kansas, Oklahoma, and Texas.

SPECIMENS EXAMINED: A total of 206 from 56 localities (see Appendix).

DISCUSSION: This species has been often misidentified in the United States as *insularis* Chevrolat, a Cuban species (see discussion under *insularis*). The reason for its resemblance to other species in the group is that the elytral setae vary from short to long and the pronotal depressions from feeble to strong. Individuals with the setae short and the depressions either worn or feeble might be mistaken for *terrestris* or *insularis*, although the latter occurs in Cuba only and *terrestris* has as yet not been taken in the inland areas occupied by *foveicollis*, but only on the coast (see *terrestris* for further differences). Those individuals with longer setae and the pronotum more deeply depressed are difficult to distinguish from *spinulosus* or female *hamatus* which have about the same geographical range. In series it is evident that the pronotal foveae are deeper than in *terrestris* or *insularis*, but not so deep as in *hamatus* or *spinulosus*, and that the elytral setae are longer than in the first two species, but shorter, less shaggy, than in the last two.

Robinson's *aciculeatus* (type locality, Hope, Arkansas), of which I have examined the type (male), a paratype (female), and three other specimens from Arkansas, seems to me to be not separable from *foveicollis* Harold. Although I have not seen the type of the latter, Harold states that it has "upright bristles" on the elytra in contrast to the "very short scales" of *terrestris*, and in this respect it does not differ from Robinson's form. Unfortunately Robinson compares his *aciculeatus* not with *foveicollis* but with *dentibius*, to which he finds it similar in the head, pronotum, and elytra, but the hind tibiae are wider in *dentibius*.

As regards the male genitalia, which are depicted by Robinson as differing in the shape of the ear-like projections of the median lobe, I have compared them on two specimens identified by Robinson, one from St. Louis, Missouri (*aciculeatus*), and one from Delaware County, Pennsylvania (*foveicollis*), and can find no observable difference. In other males from various localities with either long or short elytral setae, the apices of the ear-like projections are neither smoothly rounded (as shown for *foveicollis*)



T. terrestris

FIG. 8. Distribution of *Trox terrestris*.

nor sharply pointed (as shown for *aciculeatus*), but somewhere in between. In fact a specimen from Raleigh, North Carolina, has the "ears" more or less rounded on one side, but more pointed on the other. The hind angles of the projection also do not seem to me to correspond with Robinson's figures, having always an even sharper angle than shown for *aciculeatus*.

The genitalia of *foveicollis* have the median lobe short as in *insularis*, not long as in *terrestris*, *spinulosus*, and *frontera* (fig. 25J).

HABITS: All references to habits have been taken from labels on specimens. This species has occurred on mouse hair under an osprey's nest, on hair of a dead meadow mouse, on hen feathers, in owl pellets, dog dung, and squirrel carrion.

Trox terrestris Say

Figures 1B, 8, 25K

Trox terrestris SAY, 1825, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 192 (type, United States).

DIAGNOSIS: Differs from other species with short elytral setae in the *terrestris* group (except *frontera*) in the generally shallower

pronotal foveae, especially in front, but many specimens cannot be distinguished from *foveicollis* or *insularis* except by the different type of male genitalia. Differs from *frontera* by having the setae on elytral margins shorter than those on pronotal side margins.

DESCRIPTION: (See also characters of group). Length, 5 to 6.5 mm. Pronotum with foveae either distinct but shallow, or indistinct and shallow, ridges broadly rounded, not sharp; sides strongly sinuate before hind angles which are obtuse, but often with a minute acute angle; marginal setae neither contiguous nor widely separated. Elytra with surface of tubercles not covered by the sparse short setae, setae no longer than marginal setae; marginal setae not contiguous. Hind tibiae strongly toothed, slightly emarginate before apex on outer side; submarginal row of dorsal setae near inner margin turning away from margin at apex.

DISTRIBUTION: Pennsylvania and Atlantic coastal states from Massachusetts to Mississippi, including Florida (see map, fig. 8).

SPECIMENS EXAMINED: A total of 158 specimens from 41 localities (see Appendix).

DISCUSSION: This species and *foveicollis* are the only ones of the group that had been seen by Harold (1872), who said that they differed in that *terrestris* had the pronotum broader behind with the foveae weaker, that the elytral tubercles had only short scaly hairs, not upright bristles, and that the elytral declivity was more abrupt and straight in *terrestris*, not gently curving. These differences, with the exception of the last which I cannot see, are usually discernible, but sometimes the "upright bristles" of *foveicollis* are not long enough to meet over the tubercles and are therefore like those of *terrestris*, and the depth of the pronotal foveae varies in both species. Thus in a series of nine specimens taken in March and April in Punta Gorda, Florida, all with the elytral setae short as in *terrestris* and the foveae neither very deep nor very shallow, only two of the six males proved after dissection to be *terrestris*, the rest being *foveicollis*. The majority of *terrestris* do, however, have the pronotal foveae very shallow and the pronotum uniformly tomentose without contrasting sharp setose ridges as in most *foveicollis*. In areas where both species occur (along the coast) there seems to be more

blending and confusion of characters than elsewhere, but the male genitalia are always uncompromisingly distinct.

The genitalia of *terrestris* (fig. 25K) differ from all others in the group by having the lateral lobes nearly straight, not sinuous, and scarcely longer than the median lobe; they differ further from those of *foveicollis* and *insularis* in the elongate, not short and squat, median lobe, and from those of *spinulosus* in the acute backward angle at the base of the ear-like projections of the apex of the lobe.

HABITS: Blatchley (1928) found this species "common throughout the winter at carrion traps and beneath dried carcasses of dead animals" and (1910) hibernating, with *aequalis*, "beneath rails and chunks in fence corners." Some specimens from North Carolina were collected under chicken feathers and carrion, on a dead swan, and at malt.

***Trox insularis* Chevrolat**

Figure 25L

Trox insularis CHEVROLAT, 1864, Ann. Soc. Ent. France, vol. 4, p. 416 (type, Cuba).

DIAGNOSIS: The sparse and very short elytral setae that scarcely extend beyond the top of the tomentose tubercles distinguish this species from *hamatus* and *spinulosus*, and the short marginal setae distinguish it from *frontera*. Very similar to *terrestris* and *foveicollis*, differing from them only in the sparser marginal setae, the male genitalia, and in locality.

DESCRIPTION: (See also characters of group). Length, 6 mm. Pronotum with foveae distinct but shallow, ridges broadly rounded, not sharp, sides sinuate before hind angles which are acute; marginal setae separated by half of their length or more. Elytra with surface of tubercles heavily tomentose, not covered by the sparse, just visible setae, setae no longer than marginal setae; marginal setae separated by twice their length. Hind tibiae feebly toothed, not emarginate on outer side before apex; submarginal row of dorsal setae near inner margin turning away from margin at apex.

DISTRIBUTION: Cuba.

SPECIMENS EXAMINED: Cuba: one male; Baragua, June, one; Central Soledad, July, one; Soledad (Cienfuegos), April, May, August, three males.

DISCUSSION: Although Blatchley (1928) reported this species from Pensacola and Haulover, Florida, I believe that his specimens were *foveicollis*, not *insularis*, because he mentions the erect brown elytral setae (*insularis* has very short yellow setae), and because *foveicollis* does occur in Florida. It is possible that Blatchley confused the names. According to a discussion by Robinson (1940, p. 152), the name *insularis* has been mistakenly given to specimens from the United States that are in reality *foveicollis*. Robinson unfortunately headed his discussion of this in such a way that he appears to be placing *insularis* as a synonym of *foveicollis*, an error which was copied in the Blackwelder catalogue (1948, p. 31). Robinson did not intend to synonymize *insularis*, because he lists and illustrates both forms as distinct species in his plates.

Robinson (*loc. cit.*) said that he could not find the type of *insularis* in the Poey collection from which the three original specimens came, but he found Cuban specimens agreeing with the original description and in the male genitalia. The latter are of the broad squat type of *foveicollis*, with the median lobe shorter than the basal piece, and they resemble the genitalia of *foveicollis* except for the basal angle of the ear-like projection on the median lobe; this angle is acute and bent backward as in *terrestris*, not obtuse or rectangular or rounded as in *foveicollis*. The lateral lobes are long and sinuous in both *insularis* and *foveicollis*, shorter and nearly straight in *terrestris* (fig. 25J-L).

HABITS: No information.

***Trox frontera*, new species**

Figures 9, 10, 25M

DIAGNOSIS: Differs from all species of the *terrestris* group in the distinctive male genitalia, in the much longer and finer setae on the elytral margins, and in the more emarginate hind tibiae which are also slightly curved inward, not straight (fig. 9). The setae on the non-elevated elytral intervals are more conspicuous than in other species of the group; the average size is larger.

DESCRIPTION OF HOLOTYPE, MALE: (See also characters of group). Length, 7.5 mm. Head, clypeus and antennae as in group. Pronotum with apical fovea shallow, indis-



FIG. 9. Hind tibiae of *Trox frontera*, type.

tinct, basal foveae deep, distinct, ridges broadly rounded, sides not sinuate before hind angles which are rectangular; marginal setae long, dense, contiguous. Elytra with alternate intervals elevated and tuberculate, surface of tubercles not covered over with the sparse, short, yellow, erect setae, tubercles more or less elongate, tomentose, flat; setae less than one-quarter of the length of the marginal setae; marginal setae fine, hair-like, nearly contiguous, as long as the setae on lateral margins of pronotum; reflexed elytral margins with row of small equidistant setae in apical half. Hind tibiae with inner margin slightly curved; outer margin strongly emarginate before apex between the large outer tooth and the outer apical angle, the inner edge of the outer margin obliquely spinose below the outer tooth, and furnished with four spines; submarginal row of dorsal setae near inner margin not turning away to center of tibiae towards apex. Tarsal segments on middle and hind legs scarcely longer than wide.

Allotype, female, same as male, but marginal setae on elytra a little longer than those on pronotum.

TYPES: Holotype, male, Dimmit County, Texas, February, 1933; allotype, female,

April 1, 1934, and four male paratypes (February and March, 1933), S. E. Jones, collector, all from Dimmit County, Texas. Holotype, allotype, and two paratypes in collection of Agricultural and Mechanical College, College Station, Texas; two paratypes in the American Museum of Natural History.

DISTRIBUTION: Known at present only from the type locality, which is near the Mexican frontier in southern Texas, north of Laredo.

DISCUSSION: This species is most similar to *terrestris*, especially in the shallow apical pronotal fovea, but the sides of the pronotum show no evidence, at least in the six specimens examined, of the sinuation before the hind angles characteristic of *terrestris*. The setae on the odd elytral intervals are longer than in *terrestris*, *insularis*, and in some *foveicollis*, but shorter than in other members of the group (*spinulosus*, *hamatus*).

The hind tibiae resemble those of *spinulosus dentibius* more than of any other form in the group, the large spinose projection on the inner edge of the outer margin and the external tooth being quite similar, but in *frontera* the tibiae are feebly curved within, not straight, the outer emargination is much deeper, and the apex wider (figs. 6C, 9). Both *s. dentibius* and *terrestris* approach, in some individuals, the larger size of *frontera*,

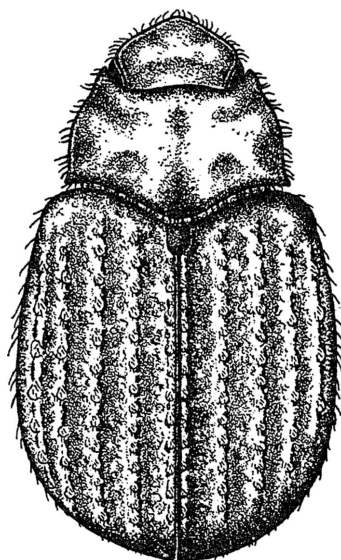


FIG. 10. *Trox frontera*, type.

whereas all others of the group are consistently smaller. The marginal setae on the elytra (viewed from the side) are inserted not in the center of the margin, but on the lower edge. In two of the paratypes they are not visible from above because they recline one on top of the other on the under side of the elytral margin.

The lateral lobes of the male genitalia are more or less straight as in *terrestris* and the hind angles of the head of the median lobe are acute and bent backward, also as in that species, but the angles are much more acute and the apex itself is quite different in shape (fig. 25M). In addition the median lobe is strongly narrowed at the middle, a characteristic not found in any other species of the group.

VARIATIONS: The size range of the speci-

mens in the type series is from 6.5 to 7.5 mm. Two of the specimens have the pronotal foveae shallower than the others. The elytra vary, as in other small *Trox*, in the spacing of the setose tubercles, some being closer together, some farther apart. In the allotype two of the tubercles on the third interval on one side of the elytra are run together. The front tibiae in one of the paratypes has a sharp and distinct tooth between the subapical tooth and the base, this tooth being represented by a feeble swelling in the holotype, allotype, and two of the paratypes; in one paratype it is more evident on one tibia than on the other. The spinose projection on the hind tibiae contains five spines in one of the paratypes, four in the holotype and allotype, and three in the others.

HABITS: No data.

THE *TUBERCULATUS* GROUP

For a discussion of the group, see page 21.

Trox sonorae LeConte

Figures 1E, 11, 12, 25N

Trox sonorae LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 211 (type, "Tucson, Sonora" [Arizona], in Museum of Comparative Zoölogy).

Trox alternans LECONTE, 1854, *ibid.*, vol. 7, p. 211 (type, "Kansas Territory and New Mexico," in Museum of Comparative Zoölogy).

Trox lecontei HAROLD, 1872, Coleopterologische Hefte, vol. 9, p. 156 (new name for *alternans* LeConte, preoccupied by *alternans* MacLeay, 1827).

DIAGNOSIS: Differs from *robinsoni* by having the hind tibiae more serrate and with a strong external tooth, the odd elytral intervals broader, less elevated, their setose patches narrower and less elevated than the shining areas between. Differs from *contractus* only in the male genitalia. This is the only species of the group except *acanthinus* from southeastern Mexico that ever has black or dark hairs on the antennal scape and around the mandibles, but sometimes these hairs are fulvous as in the other species.

DESCRIPTION: (See also characters of group). Length, 8 to 11 mm. Wing, 14 mm. on specimen of 10 mm. Head not tuberculate, setae inconspicuous. Antennal scape either with dark, often black hairs and the club

gray-brown, or with fulvous hairs and club fulvous, sometimes the hairs mixed dark and fulvous. Pronotum either shining or tomentose, lateral tubercles present as gentle swellings. Elytra mostly shining, third and fifth intervals feebly, broadly, and continuously elevated, sometimes more sharply, rounded on top, all odd intervals set with round or elongate patches of short yellow setae, shorter than the intervals are high and about one-third of the length of the setae at base of pronotum, the shining non-setose areas of third interval usually either wider, more elevated, or more noticeable than the setose patches; marginal setae separated by their own lengths, the setae single; margins feebly crenulate. Hind tibiae strongly serrate and spinose externally on inner side, with a small but definite tooth on outer side near middle.

DISTRIBUTION: Alberta, Canada, south to Sonora, Chihuahua, Zacatecas, and Durango, Mexico; east in the United States to South Dakota, Nebraska, Kansas, Texas, also Louisiana (Harold), and Missouri (see map, fig. 11).

SPECIMENS EXAMINED: A total of about 800 from 164 localities in the above region with the exception of Washington, Oregon, Nevada, North Dakota, and Oklahoma. Thirty-three specimens are from Mexico. A male from Buffalo, New York, and a female

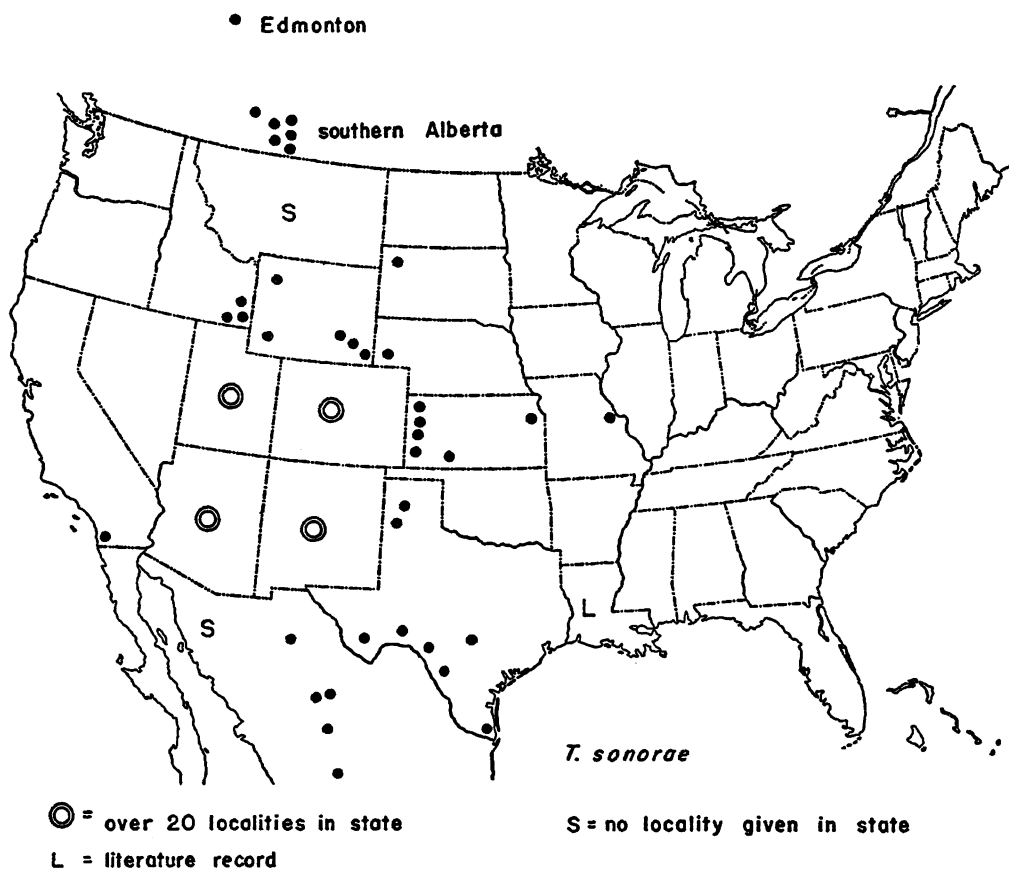


FIG. 11. Distribution of *Trox sonoreae*. *Trox atrox* and *T. punctatus* have the same general type of distribution.

from Steinhatchee, Florida, have been examined but are no doubt labeled in error.

DISCUSSION: This is perhaps the most variable and difficult of the species of the *tuberculatus* group. As in *punctatus* of the *suberosus* group, some forms appear to be different in certain geographical areas, but they are not confined to those areas and cannot actually be distinguished by any definite characters. Although the specimens from the type locality (Tucson) and other places in southern Arizona, also most of those from Texas and northern Mexico, have the antennal hairs usually fulvous, other specimens from these areas resemble the majority of northern *sonorae* in having dark antennal hairs. Some variants from southern localities have more elevated and narrower elytral intervals, as in *robinsoni*, or have the marginal setae of the elytra emerging close together and the setae

on the disc somewhat longer, as in *tuberculatus*, but other southern individuals cannot be distinguished from *sonorae* from the north. Therefore, these forms are considered conspecific and not separable into subspecies. A comparison by states of the prevalence of dark and fulvous hairs on the antennal scape is given in table 3.

Table 3 shows that of 591 specimens more than half (or 64%) have the antennal hairs completely dark and that individuals with such hairs appear to be more common everywhere except in southern Arizona, Texas, and northern Mexico. These populations might possibly be considered a subspecies, but in view of the fact that other characters, including the male genitalia, do not seem to vary geographically and that ranges would be difficult to define, there seems to be insufficient basis to warrant recognition of subspecies in

TABLE 3
HAIR COLOR ON ANTENNAL SCAPE IN 591 SPECIMENS OF *Trox sonorae*

	Dark Hairs	Fulvous Hairs	Mixed Hairs (Dark and Fulvous)
Canada			
Alberta	51	1	5
United States			
Montana	2	—	—
Idaho	1	1	—
Wyoming	41	1	3
South Dakota	1	—	—
Utah	34	4	11
Colorado	59	1	6
New Mexico	69	8	10
Kansas	4	1	4
Nebraska	6	—	2
Missouri	1	—	—
Northern Arizona	93	6	20
Southern Arizona	—	90	2
California	1	—	—
Texas	6	12	9
Northern Mexico	7	13	5
Total	376	138	77

this species. There is also quite a high percentage of individuals with dark hairs in the southwest and Mexico.

This species is as widespread as *tuberculatus* but much more numerous—as numerous as *plicatus*, which has a more restricted range. It differs externally from these two species by having the elytral setae very short, and the setae on the elytral margins fine, not thick, the bases of the setae separated by about the length of the setae, not in contiguous groups of two, three, or more setae. It differs from *gemmulatus* by having the odd elytral intervals broader, rounded on top, not sharply elevated or cristiform, the elevations flattening out at the posterior declivity and on the outer odd intervals. From *acanthinus* it differs by having the elytral setae yellow, not dark, and the even elytral intervals without definite tubercles. The occurrence of *sonorae*, *tuberculatus*, *contractus*, and *robinsoni* in the state of Texas is shown in figure 12.

A comparison of the male genitalia in six specimens from Mt. Graham in southern Arizona with those in five specimens from Jemez Mountains in northern New Mexico shows no constant difference in these organs.

The genitalia in *sonorae*, as in *tuberculatus*, are exceedingly variable in small details. Robinson (*in litt.*) noted a number of variations in several series. He says "the median lobe . . . sometimes has a parallel groove on either side near the margin; at other times there is a depression at the apex of the median lobe; another variation may be three depressions triangularly placed in the median lobe." He found also that many males had the lobe narrower than in other males, with the side margins gently sloping to the apex, but I have seen both types of genitalia (narrow and broad, more and less acuminate) in males taken at the same locality (Fort Collins, Colorado; Carbon County and Como, Wyoming). Some of the variations are very similar to those found in some *tuberculatus*, the only difference in these cases between the two species being a slight one in the shape and width of the lateral lobes (fig. 25N, R).

I have examined the types of LeConte's *sonorae* and *alternans* and agree with Horn (1874) that they are the same species. Although Bates (1887) records *lecontei* (= *sonorae*) from Puebla and Jalapa in southeastern Mexico, I have seen these specimens at the

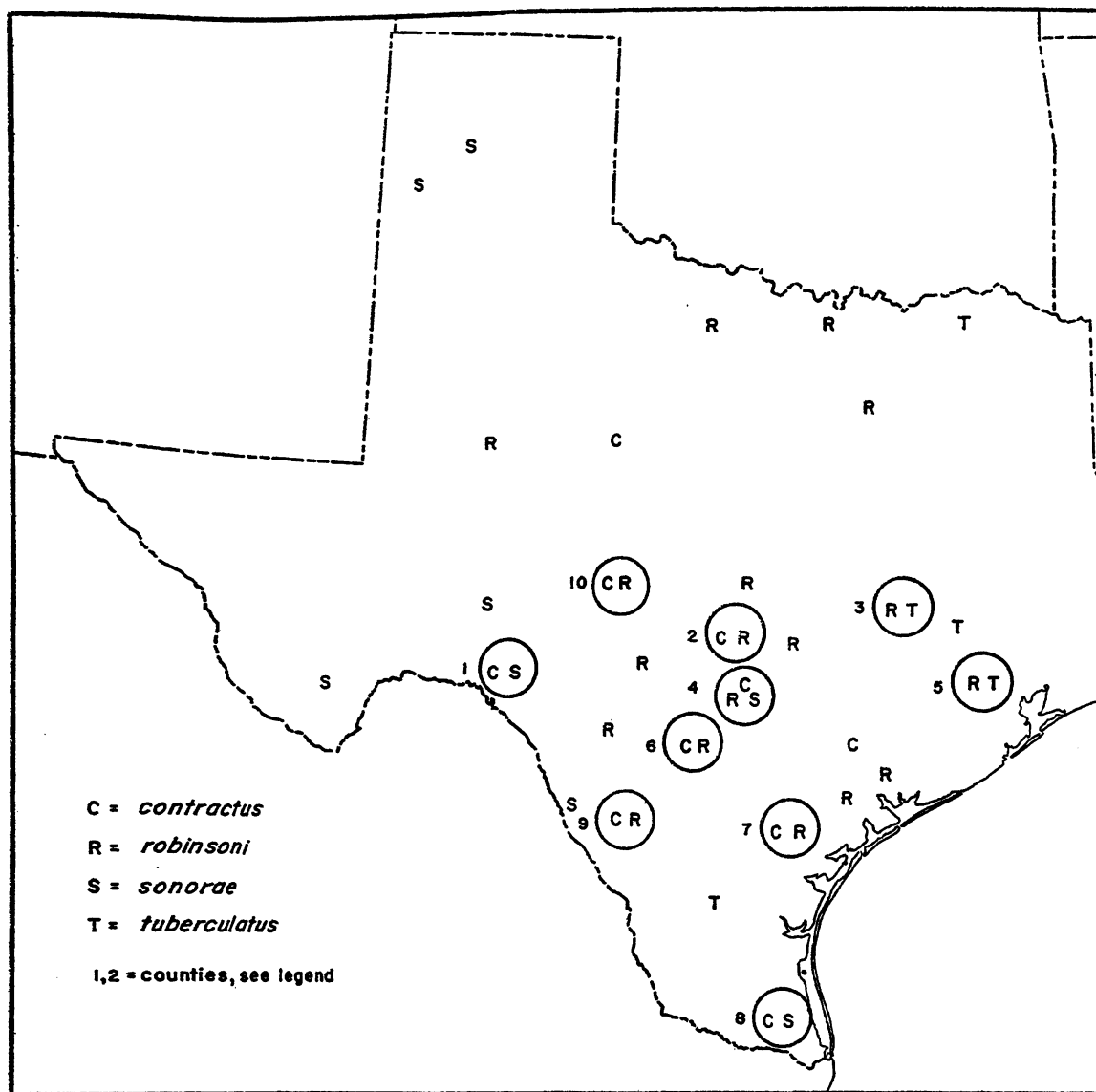


FIG. 12. Occurrence of four closely related *Trox* in Texas. Circles indicate counties in which two or more species occur together: 1, Val Verde; 2, Blanco; 3, Brazos; 4, Comal; 5, Harris; 6, Bexar; 7, Bee; 8, Cameron; 9, Dimmit; 10, Menard. Records of *robinsoni* from the northern counties of Burnet, Cooke, and Jackson are from Robinson (*in litt.*).

British Museum, and they are not *sonorae* but *plicatus*. Two of them (from Puebla) have cotype labels which must certainly have been put on in error (by Bates or Sallé?), as Harold (1872) did not describe a new form but merely renamed *alternans* (= *sonorae*).

HABITS: There are few records of the habits of this wide-ranging species. Individuals are

known to come to light and also have been collected at carrion.

Trox contractus Robinson

Figures 12, 250

Trox (Trox) contractus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 153, pl. 4, fig. 11 (type, male, New Braunfels, Comal County, Texas, in collection of Mark Robinson).

DIAGNOSIS: Differs from the other species of the group in the strong contraction of the apex of the median lobe of the male genitalia.

DESCRIPTION: (See also characters of group). Length, 7.5 to 10 mm. Head not tuberculate, setae inconspicuous. Antennal scape with fulvous hairs, club fulvous. Otherwise exactly as in *sonorae* except for the male genitalia (fig. 250).

DISTRIBUTION: Texas only (see map, fig. 12).

SPECIMENS EXAMINED: A total of 37 from 10 localities in Texas (see Appendix).

DISCUSSION: This species seems to bear the same relation to *sonorae* as does *fuliginosus* in the hastate scutellum group to *monachus*. Both *contractus* and *fuliginosus* appear to occur in very small numbers and in a restricted area (Texas in both cases), and they cannot be distinguished with certainty from the abundant and widespread species to which they are so closely related and with which they cohabit (*sonorae* and *monachus*, respectively) except by reference to the male genitalia. In the case of *fuliginosus* and *monachus* I was able to find a few general external differences, but between *contractus* and *sonorae* I have found none except that *contractus* never has black hairs on the antennal scape (in *sonorae* they may be black or fulvous). The genitalia, however, cannot be confused in spite of the variations in the genitalia of *sonorae*, and this fact, as well as the restricted geographical range of *contractus*, inclines me to keep *contractus* as a distinct species. The two species occur together in at least three counties in Texas—Val Verde, Cameron, and Comal (see distribution map, fig. 12).

The genitalia of *contractus* are more similar to those of *robinsoni* than to those of *sonorae*, but externally *contractus* is usually separable from *robinsoni*, not only in the less elevated, broader elytral intervals but also in the more serrate hind tibiae.

The only females included in the specimens of *contractus* examined are nine from Cypress Mills in Blanco County and one from Dimmit County, localities from which I also have males. I have other females but no males, from Laredo, Wichita Falls, Weslaco, and San Diego in Texas. These may be *contractus* or *sonorae* or even *robinsoni*. It is difficult to

get a true picture of the distribution of *contractus* because one-quarter of the specimens examined have no further locality than "Texas."

The median lobe of the genitalia is strongly constricted before the apex, much more abruptly so than in *robinsoni*, and the entire apical portion (fig. 250) resembles a long blunt finger, this portion being narrower than the lateral lobes on either side. The lateral lobes do not bend inward at their apices as in *robinsoni* and *sonorae*, nor do they clasp the median lobe closely; in a natural position there is a space visible near the apex between the lateral and the median lobes. The type, which I have examined, has the genitalia extracted.

HABITS: Specimens from Menard, Texas, were found on a goat's carcass.

***Trox robinsoni*, new species**

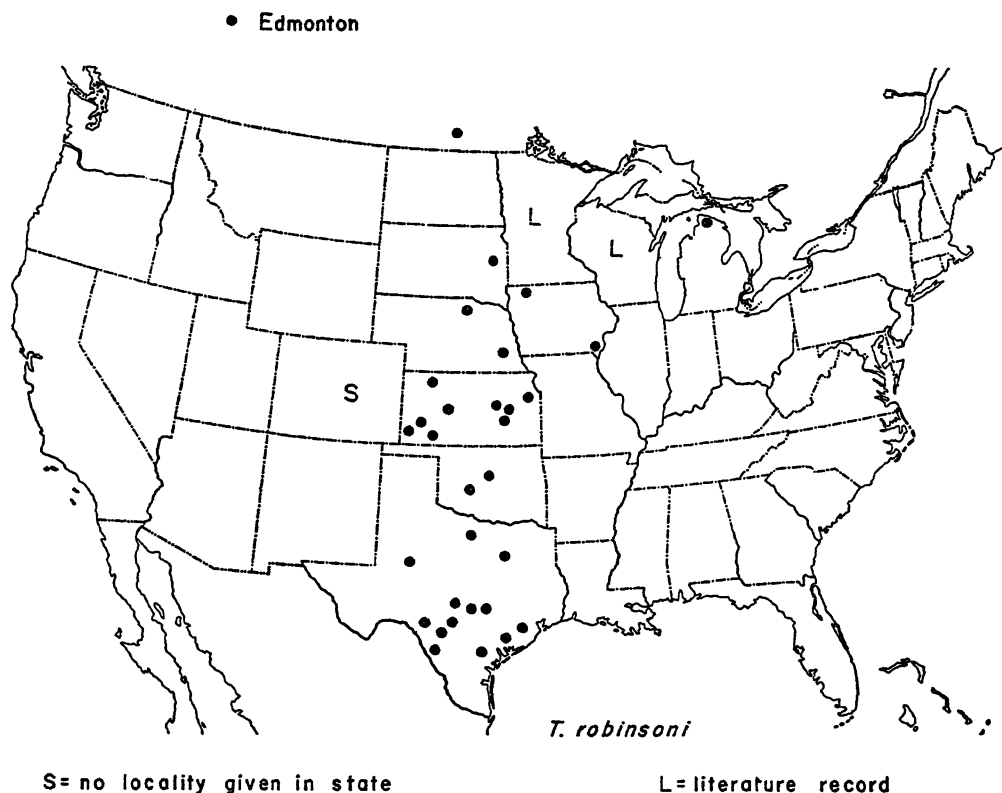
Figures 12, 13, 25P

DIAGNOSIS: Differs in general from *sonorae* and *contractus* in the more sharply elevated third elytral interval and in the more feebly serrate hind tibiae, but often separable from them only by the difference in the male genitalia.

DESCRIPTION OF HOLOTYPE, MALE: (See also characters of group). Length, 8.5 mm. Wing, 11.5 mm. Head not tuberculate, setae inconspicuous. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose and setose, lateral tubercles present as gentle swellings. Elytra shining, the third interval sharply, narrowly, and continuously elevated, fifth interval a little less elevated, both rounded on top, all odd intervals clothed with round or elongate patches of short yellow setae that are shorter than the intervals are high and about one-third of the length of the setae at base of pronotum; shining, non-setose areas of third interval no wider than the patches of setae and not so high; marginal setae separated by their own lengths, the setae single; margins scarcely crenulate. Hind tibiae feebly serrate and spinose externally on inner side, no more than spinose on outer side.

Allotype, female, similar but larger (9 mm.) and with the transverse row of setae on the head conspicuous.

TYPES: Holotype, male, Brazos County,

FIG. 13. Distribution of *Trox robinsoni*.

Texas, September 25, 1933; allotype, female, Dallas County, Texas, January 21, 1934 (J. H. Robinson, collector), and 232 paratypes from 38 localities in Texas, Oklahoma, Kansas, Colorado, Nebraska, South Dakota, Iowa, Michigan, and Manitoba and Alberta, Canada (see Appendix). Holotype, allotype, and 39 paratypes in the American Museum of Natural History. Other paratypes in the University of Kansas, University of Missouri, Museum of Comparative Zoology, Chicago Natural History Museum, United States National Museum, Agricultural and Mechanical College of Texas, California Academy of Sciences, and in the private collections of Mark Robinson, E. R. Leach, A. T. McClay, Henry Howden, Owen Bryant, and L. J. Bottimer.

DISTRIBUTION: Manitoba, Canada, south through central United States to Texas, also Alberta, Canada, Colorado, Michigan, and (Robinson, *in litt.*) Wisconsin and Minnesota (see map, fig. 13).

DISCUSSION: This species is named in honor of Mr. Mark Robinson who has done so much important work in the taxonomy and biology of North American *Trox*. He discovered this new species and had intended to publish a description, but the pressure of other work prevented him from doing so.

The species is most readily confused with *sonorae* and *contractus*, resembling both of these species in some of its elytral variations, but differing always in the male genitalia and usually in the narrower and straighter hind femora and tibiae, and in the less serrate hind tibiae on which also the outer projection externally is not a tooth, as in the other two species, but a spine. All three species occur in Texas (see map, fig. 12), and *sonorae* and *robinsoni* occur also in a number of the same central states (South Dakota, Nebraska, Kansas, probably Oklahoma) and in Alberta, Canada.

No specimens of *robinsoni* or *contractus* have been seen with black hairs on the an-

tenal scape as in most *sonorae*, but many Texas and Arizona specimens of *sonorae* have the hairs fulvous as in *robinsoni*. The variability in the elytral pattern in both *robinsoni* and *sonorae* lies in the shape of the patches of setae (round, elongate, very elongate), the spacing of the patches (close together or widely separated), and in the sharpness of the elevation of the third and fifth intervals. The degree of elevation of the intervals is, in addition, a relative character and thus even more difficult of definition. Many *robinsoni* can be identified at a glance, especially if the elevated third interval has only a few (four or five) very elongate or confluent patches of setae. The setae appear more prominent in most *robinsoni* than in *sonorae* or *contractus*, because in the two latter species they are sparser, are less elevated than the black shining portions of the interval, and are in narrower patches than the non-setose portions.

The size range of the paratypes is from 7 to 10 mm. The male genitalia (fig. 25P) are most similar to those of *plicatus*, although in a natural position the lateral lobes do not close over and nearly hide the median lobe as they do in *plicatus*. In both these species the median lobe has a more convex upper surface than in *sonorae*, its apex is quite blunt and is rather bulbous ventrally, and its greatest width is nearer the middle than the apex. The median lobe differs from that of *contractus* by having its sides not suddenly contracted at the apex, but gently sloping, and the apical portion about as wide as each lateral lobe to either side, not narrower as in *contractus* and *plicatus*. Sometimes, however, the difference between *robinsoni* and *contractus* is not very noticeable, in which case the shape of the apices of the lateral lobes will usually serve to separate them.

HABITS: Notations on Texas specimens show that the species has been taken at chicken feathers, from a mouse's nest under a stone, from the carcasses of squirrels, goats, and sheep, from a light trap, and at light.

Trox gemmulatus Horn

Figure 25Q

Trox gemmulatus HORN, 1874, Trans. Amer. Ent. Soc., vol. 5, p. 8 (type locality, San Diego

[California]; lectotype in Museum of Comparative Zoölogy, designated by Robinson, 1940).

DIAGNOSIS: This is the only species of the group in which all four odd intervals of each elytron (whether longitudinally confluent or composed of separate tubercles) are sharply elevated and cristiform all the way to the posterior declivity. Generally larger, pronotum wider, more convergent in front.

DESCRIPTION: (See also characters of group). Length, 9.5 to 11.5 mm. Wing, 12 mm. on specimen of 10 mm. Head not tuberculate, but surface uneven, setae inconspicuous. Antennal scape with fulvous hairs, club either gray-brown or fulvous. Pronotum shining, lateral tubercles strongly elevated, large, elongate, their inner margins parallel with median ridges. Elytra shining, all odd intervals sharply, strongly tuberculate, tubercles on third, sometimes fifth, interval usually longitudinally confluent at base or in basal half, all other tubercles separated by flat spaces, those on seventh interval at base usually very prominent on humeral umbone, tubercles cristiform on top, most of them elongate, the yellow setae so short as to be just emergent; even intervals, also sutural interval, with widely spaced (about four or five times their diameter), round, setae-bearing tubercles that are larger than in other species except *acanthinus*; marginal setae separated by their own lengths, sometimes two or three issuing from same point; margins strongly crenulate. Hind tibiae strongly serrate and spinose externally on inner side, with a small but definite tooth on outer side near middle.

DISTRIBUTION: California, northern Baja California, Arizona, New Mexico, and South Dakota.

SPECIMENS EXAMINED: A total of 220 from 20 localities (see Appendix). Of these specimens, only 10 are from localities outside California and Baja California. Two specimens from Kissimmee, Florida, and one from South Carolina are evidently mislabeled.

DISCUSSION: The short yellow setae on the elytra are often so worn that only the round pits from which they emerge are visible, but in typical fresh specimens the setae, though short, are so arranged on their tubercles that they extend a bit beyond the rear end of the tubercles, giving the general effect of short-barbed arrows. The tubercles in the center of

the even intervals are proportionately larger and more distinct than in any other species of the group except *acanthinus* from southern Mexico. The tubercles traversing the humeral umbone on the seventh interval and the tubercles behind the middle coxae are also more conspicuous than in other species, and the elevation of the odd intervals is two or three times higher. The only other species of the group that has been taken in California (where the populations of *gemmulatus* are most numerous), is *sonorae* (one specimen only, from San Diego), and the other species with oval scutellum that occur in California (*affinis*, *atrox*, *fascifer*, and *scaber*) could not be confused with *gemmulatus*.

The lectotype was designated by Robinson (1940) as the specimen in the Horn collection with the type label on it. I have seen the lectotype and two cotypes.

The male genitalia (fig. 25Q) are very similar to those of *sonorae* (fig. 25N).

HABITS: One specimen was taken under coyote dung.

***Trox acanthinus* Harold**

Figure 25Q

Trox acanthinus HAROLD, 1872, Coleopterologische Hefte, vol. 9, p. 154 (type locality, Mexico, here restricted to the state of Veracruz).

DIAGNOSIS: Differs from other species of the group in a combination of characters: surface shining, not tomentose; antennae and all setae and hairs dark; elytral tubercles round, widely spaced (sometimes by five times their diameter), their setae short, stiff, scale-like, the longitudinal areas between the tubercles flat, not at all elevated; tubercles on even intervals nearly as large as those on odd intervals.

DESCRIPTION: (See also characters of group). Length, 9 to 10 mm. Head not tuberculate, but surface uneven, setae inconspicuous. Antennal scape with dark hairs, club gray-brown. Pronotum shining, the median depression shallow and somewhat humped in center, lateral tubercles strongly elevated, elongate, large, covering a third of the area between median ridges and lateral margins, their inner margins sinuous. Elytra shining, all odd intervals strongly tuberculate, tubercles round, separated by flat spaces at least twice their diameter, tubercles with stiff dark

setae that are longer than tubercles are high; even intervals, also sutural interval, with same kind of tubercles that are almost as large as those on odd intervals, but with fewer setae; marginal setae separated by less than their own lengths, two or three issuing from same point; margins scarcely crenulate. Hind tibiae strongly serrate and spinose externally on inner side, with definite tooth on outer side near middle.

DISTRIBUTION: Jalapa and San Andres Chalchicomula in Veracruz, Mexico.

SPECIMENS EXAMINED: Mexico: one male, three females, and six not dissected; Veracruz: Jalapa, one male, one female; San Andres Chalchicomula: two (cotypes).

DISCUSSION: This species, in its robust form and shiny appearance and in the larger tubercles on the even intervals of the elytra, resembles *gemmulatus* more than any of the other species of the group. It differs from that species by having the hairs on the antennal scape and the setae on the elytra virtually black, not yellow, the odd elytral intervals not cristiform, all the tubercles round, not elongate, all well separated, none longitudinally confluent. The sculpture of the entire elytra is very rough, rugose, and shining. The black bristly setae protruding from the large elytral tubercles are similar to those of *capillaris* in the *unistriatus* group, but in *capillaris* there are no true tubercles. The male genitalia are similar to those of *gemmulatus* (see fig. 25Q).

The species is not known from the United States. Three of the other species of the group occur also in Mexico: *gemmulatus* in northern Baja California, *sonorae* in three northern states, and *plicatus* in the same three states, also farther south, including Veracruz.

HABITS: No information.

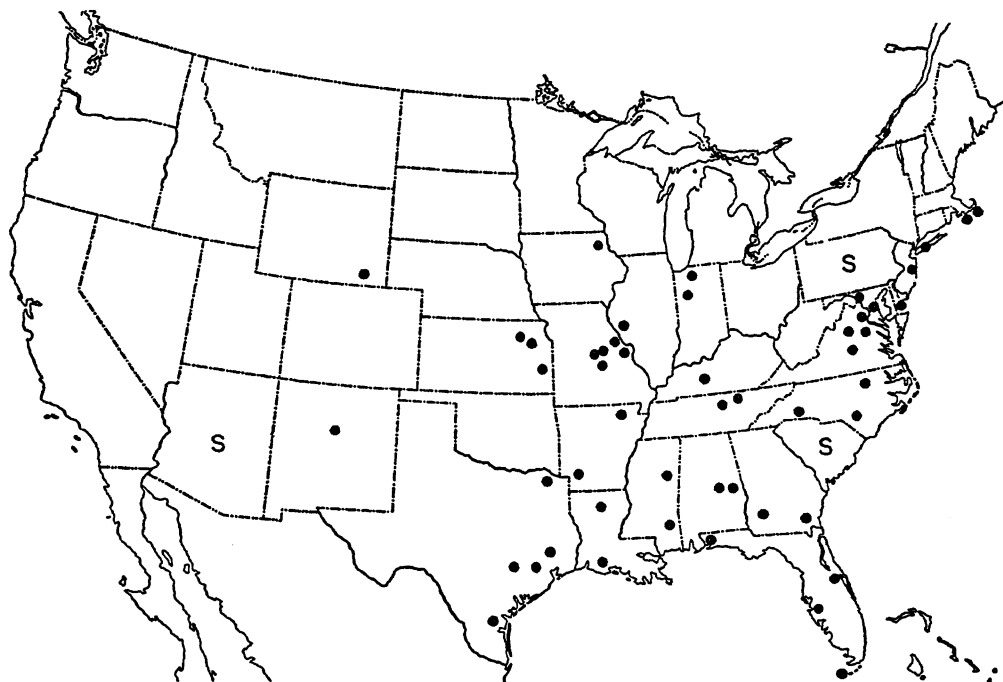
***Trox tuberculatus* (De Geer)**

Figures 12, 14, 25R

Scarabaeus tuberculatus DE GEER, 1774, Mémoires pour servir à l'histoire des insectes, vol. 4, p. 318, pl. 19, fig. 2 (type, Pennsylvania).

Trox serrulatus BEAUVOIS, 1805, Insectes recueillis . . . en Amérique, p. 176, pl. 4b, fig. 9 (type, Georgia).

Trox canaliculatus SAY, 1824, in Keating, Narrative of an expedition to . . . St. Peter's River . . . under Long, vol. 2, app. 2, p. 278 (type, "North-west Territory").

*T. tuberculatus*

S=no locality given in state

FIG. 14. Distribution of *Trox tuberculatus*. Other species with the same general type of distribution are *scaber*, *aequalis*, *capillaris*, *unistriatus*, and *asper*.

DIAGNOSIS: Differs from other species of the group except *plicatus* by having longer, more abundant, more erect setae on the elytral intervals (setae long enough to meet over the tubercles) and the marginal setae of the elytra often contiguous in small groups of two to three setae. Differs from *plicatus* in the less costate, more tuberculate, odd elytral intervals that are flat between the tufts of setae (except at base of third), in the usually darker setae, and in the definitely setose, but not bituberculate head.

DESCRIPTION: (See also characters of group). Length, 7.5 to 11 mm. Wing, 13.5 on specimen of 10 mm. Head not tuberculate, four tufts of setae or scattered setae conspicuous. Antennal scape with fulvous hairs, club fulvous. Pronotum heavily tomentose, lateral tubercles scarcely defined except by their dark erect setae. Elytra tomentose, the odd intervals, except third at base which often is longitudinally confluent, not elevated between the setae-bearing tubercles, the latter round or elongate, setae dark or bronze, oc-

casional yellow, dense, bushy, long, as long as tubercles are high and nearly as long as setae at base of pronotum, setae on suture longer than in other species of the group, nearly as noticeable as those on other odd intervals; marginal setae usually separated by about their own lengths but often two or three setae issuing from same point; margins scarcely crenulate. Hind tibiae externally feebly serrate but strongly spinose on inner side, feebly toothed or spinose on outer side.

DISTRIBUTION: Massachusetts south to Florida and west to eastern Kansas and eastern Texas; also Wyoming, New Mexico, and Arizona (see map, fig. 14).

SPECIMENS EXAMINED: A total of about 200 from 56 localities. Of these only four are from the western states (see Appendix).

DISCUSSION: This is the only truly eastern species of the group (east of the Mississippi River and south of Lake Michigan), but it also occurs in eastern Kansas and Texas in the territory of other species and occasionally wanders even farther west.

A number of individuals have the elytral setae yellow as in *plicatus*, but in the majority of specimens the setae are bronze or brownish. The only other species with dark setae on the elytra is *acanthinus* from southern Mexico, from which *tuberculatus* differs by having the elytral setae long and the antennal hairs and the club fulvous, not black.

Although both Harold and Horn distinguish this species from *sonorae* in part by the fact that *tuberculatus* has the median depression of the pronotum "entire," or not divided at middle, this character is not constant in series of either species. The pronotal depression, however, more often appears entire in *tuberculatus* because this species has more tomentosity which tends to obscure any irregularities. In the areas where the two species occur sympatrically (figs. 11, 12, and 14), *tuberculatus*, if its characteristic long elytral setae are worn, can still be separated from *sonorae* by the fact that the setose tubercles on the odd intervals are separated by flat spaces, not elevated ones. One of the species in the *unistriatus* group (*variolatus*) is, in its long dark elytral setae, a small replica of *tuberculatus*, but *tuberculatus* differs from it, in addition to the group differences, by having the head not bituberculate and the clypeus rounded.

I have included three specimens from Sanford, Sarasota, and Flamingo, in peninsular Florida, which may possibly not be this species because the elytral setae are so short and are also yellow. The only male unfortunately has the apex of the median lobe of the genitalia broken off. Although the specimens are rather worn, the setae appear so uniformly short that it may not be merely a question of wear. Additional specimens from peninsular Florida will no doubt solve the problem. The only other specimens seen from Florida are two typical ones from Pensacola, in the extreme west close to Alabama.

The male genitalia resemble most closely those of *sonorae* and *gemmulatus*, but the median lobe is generally broader, more broadly rounded to the apex, and has a small, narrow, finger-like projection at the apex that usually extends beyond the lateral lobes (fig. 25R). The lateral lobes do not nearly cover the median lobe as they do in

plicatus, and their shape is slightly different at the apex. There is some variation in the shape of the median lobe which is broader apically in some specimens than in others, with the sides more abruptly or less abruptly convergent.

I have not seen the type, which is probably in some European institution, nor have I seen any specimens from the type locality (Pennsylvania).

HABITS: Notations on two specimens give squirrel and rat carrion as indications of the habits of this species. Robinson (*in litt.*) mentions individuals feeding on chicken feathers and cat fur. One specimen came to light.

Trox plicatus Robinson

Figure 25P

Trox (Trox) plicatus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 153, pl. 4, fig. 10 (type, male, Palmerlee, Cochise County, Arizona, in collection of Mark Robinson).

DIAGNOSIS: Differs from all species in the group by having two tubercles on the front of the head; these are sometimes not well marked. Differs from all but *tuberculatus* by having most of the marginal setae of the elytra densely bunched together with their bases touching, and the setae on the dorsum much longer. Differs from *tuberculatus* in the more costate, more convex, odd elytral intervals.

DESCRIPTION: (See also characters of group). Length, 7.5 to 9 mm. Wing, 12 mm. on specimen of 8.5 mm. Head feebly to strongly bituberculate, setae inconspicuous. Antennal scape with fulvous hairs, club fulvous. Pronotum either shining or tomentose, lateral tubercles present as gentle swellings. Elytra either shining or tomentose, third and fifth intervals feebly, narrowly, and continuously elevated, rounded on top, all odd intervals set with small, regularly spaced tufts of long yellow or bronze setae nearly as long as setae on basal margin of pronotum and much longer than the intervals are high; marginal setae in densely set bunches of two to 10 setae with their bases touching, usually a few setae are separated by their own lengths; margins scarcely crenulate. Hind tibiae strongly serrate and spinose externally on inner side, with a small

but definite tooth on outer side near middle.

DISTRIBUTION: Arizona, New Mexico, and Texas (mostly western Texas) in the United States; northwestern Mexico [states of Chihuahua, Durango, Zacatecas, also Sonora (in *lit.*)], south to Aguascalientes, Michoacan, Hidalgo, Distrito Federal, Puebla, and Veracruz.

SPECIMENS EXAMINED: A total of about 800 from 71 localities in the above states. Of these, 187 are from 31 localities in Mexico. The only specimens seen from eastern Texas are four from Fedor, Lee County.

DISCUSSION: The dense setae on the elytral margins are not usually contiguous throughout but are grouped in bunches of from two or three up to 10 setae, the bunches separated by small spaces. In *tuberculatus*, which occurs with *plicatus* in eastern Texas only, the marginal setae are not nearly so dense or abundant as a rule, but there are often at least some groups of two or three setae with the bases contiguous. The setae on the elytral intervals are always light in color in *plicatus* and usually, but not always, dark in *tuberculatus*. In the other five species of the group the elytral setae are shorter, not so erect, not meeting over the tubercles, and the marginal setae are well separated and usually single. The tubercles on the head in *plicatus* are usually definite, but when feeble they are not very different from the irregularities found on the heads of *gemmulatus* and *acanthinus*.

This species appears to be most abundant in Arizona, principally in the mountains, three-fourths of all the specimens examined coming from that state. Of the remaining fourth, only 26 are from New Mexico, 24 from the Davis Mountains in western Texas, four from Lee County in southeastern Texas, and the others (about 180) from Mexico. *Trox sonorae* occurs also in Mexico, but *plicatus* is much more numerous there and also extends farther south, as far as Michoacan, Distrito Federal, and Veracruz. In Durango and Chihuahua in northern Mexico and in the southwestern United States, the two species occur in many of the same localities.

The median lobe of the genitalia resembles that of *robinsoni* except that it is not so wide at the middle (fig. 25P). In *plicatus* in a natural position when the lateral lobes have not been spread apart, the median lobe is nearly covered by them, especially at the base, not mostly exposed as in *tuberculatus* and *robinsoni*. In *plicatus*, *robinsoni*, and *contractus*, in contrast to *sonorae*, *acanthinus*, *gemmulatus*, and most *tuberculatus*, the median lobe is convex dorsally towards the apex, not flat or concave, and the apex is more rounded.

The type and nine paratypes have been examined.

HABITS: The only indication of the habits of this species is a specimen from Chihuahua which was taken in the pellets of the owl (*Strix occidentalis*) on the ground.

THE *UNISTRIATUS* GROUP

For a discussion of the group, see page 22.

Trox variolatus Melsheimer

Figures 15, 25S

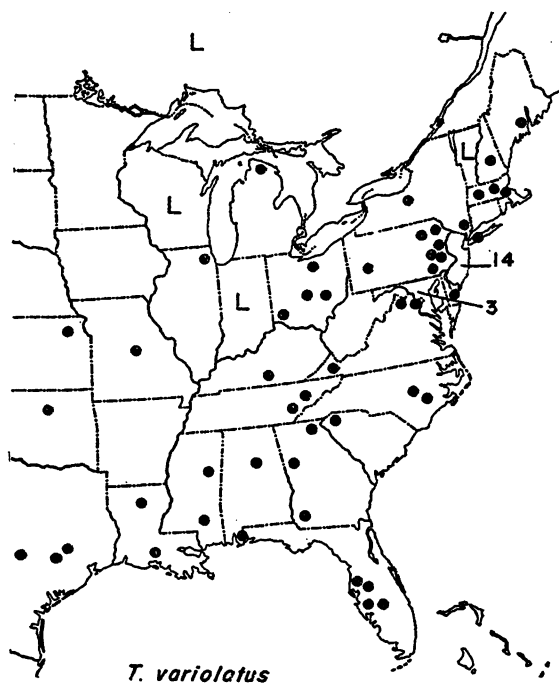
Trox variolatus MELSHEIMER, 1846, Proc. Acad. Nat. Sci. Philadelphia, vol. 2, p. 138 (type, Pennsylvania; lectotype in Museum of Comparative Zoölogy, designated by Robinson, 1940).

Trox erinaceus LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 212 (type, South Carolina; lectotype in Museum of Comparative Zoölogy, designated by Robinson, 1940).

Trox (Trox) variolatus monticola ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 158, pl. 4, fig. 16 (type, male, Pocono Mountains, Pike County, Pennsylvania, in collection of Mark Robinson). New synonymy.

DIAGNOSIS: Differs from other species with two median ridges on the pronotum and the median depression entire by having the ridges abruptly elevated near the middle and clothed with long dark setae, by having the clypeus obtusely triangular, not broadly rounded, the prosternum behind the front coxae bituberculate, and the reflexed elytral margins with a row of setose tubercles.

DESCRIPTION: (See also characters of group). Length, 6 to 8.5 mm. Wings, 10 mm. long on two males of 7 and 8 mm. Head bituberculate, setae conspicuous. Clypeus obtusely triangular. Antennal club fulvous. Pronotum about twice as wide as long, tomentose, median ridges higher behind



L = literature record

FIG. 15. Distribution of *Trox variolatus*. Other species with the same general type of distribution are *affinis*, *hamatus*, *foveicollis*, *sordidus*, *monachus*, and *scabrosus*.

middle, the ridges, front margin, and lateral tubercles with dark erect setae. Elytra tomentose, all intervals flat, not elevated, but with conspicuous tufts of dense erect long setae on odd intervals (twice longer than the setae at base of pronotum), tufts nearly contiguous on base of third interval, widely separated elsewhere, usually round, sometimes elongated, bronze or black, occasionally yellow, tufts on suture nearly as large as those on other odd intervals; striae punctures usually not visible; reflexed elytral margins with smaller tubercular tufts of setae that are larger towards the apex; marginal setae separated by nearly their own lengths, sometimes denser; margins crenulate at base. Prosternum behind front coxae bituberculate. Proepisterna with inner margins angulate at middle.

DISTRIBUTION: Eastern states west to parts of eastern Kansas, Oklahoma, and Texas. Ontario, Canada (Robinson, *in litt.*). (See map, fig. 15.)

SPECIMENS EXAMINED: A total of 230 from

73 localities in the above region with the exception of Vermont, Rhode Island, Connecticut, West Virginia, Iowa, Minnesota, and Arkansas; only one specimen from Oklahoma, two from Kansas, one from Missouri.

DISCUSSION: This small, dark-tufted species resembles the species of the *tuberculatus* group (see above) in the transverse pronotum with the high median ridges and setose lateral tubercles and in the shape of the proepisterna, and resembles the following species (*sordidus*, *capillaris*, and *unistriatus*) in the rectangular, not acute, hind angles of the pronotum and in the type of male genitalia. The elytral intervals, except where the tufts of setae emerge, are nearly as flat as in *capillaris*, whereas in the other species mentioned at least some of the odd intervals are elevated, in all or in part. The pronotum when denuded of its characteristic long setae looks quite different, the median depression then appearing much shallower because it lacks the contrast of the setae on either side.

Robinson's subspecies *monticola* from Pocono Pines, Pennsylvania, was based on specimens from the "mountains or colder part of the range of typical *variolatus*" and are said to have the elytral intervals "wider and flatter" and the tubercles "for the most part more elongate." After comparison of the type and eight paratypes of this form, also five other specimens from Bar Harbor, Maine, one of the paratype localities, with specimens from New Jersey, Florida, Georgia, and other states, I cannot agree that there are any morphological differences correlated with geography or altitude, and therefore place *monticola* in synonymy with *variolatus*. There is no observable difference in the genitalia of the two forms. It is true that often the elytral tufts are more elongate in some individuals, but this may occur in any locality. In a series of 11 specimens from Rancocas Park, New Jersey, two specimens not only have the tufts more elongate, but one of them has them elongate on one elytron and not on the other. Sometimes the setae are run together for half of the length of the interval. The color of the setae differs in the paratype series of *monticola*, as elsewhere, being sometimes almost yellow, though generally bronze, if not black.

Robinson (1940) found the lectotypes of

LeConte's *erinaceus* and of Melsheimer's *variolatus* to represent the same species, thus correcting Harold's error in placing *variolatus* as a synonym of *scaber*, I have also examined these specimens and agree with Robinson.

In the male genitalia (fig. 25S) the median and lateral lobes are almost three times as long as the basal piece. The genitalia are similar to those of *sordidus* but more elongate and with the apex of the median lobe more or less pointed, not at all truncate.

HABITS: Notations on specimens show that this species has been taken in a variety of situations: in barred owl pellets or their remains, rabbit hair and bones, rabbit skin, fox carrion, chicken traps, hen feathers, dead sheep, mouse hair under an osprey's nest, in dung, and from the skin of a dead squirrel.

***Trox sordidus* LeConte**

Figure 25T

Trox sordidus LeConte, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 211 (type locality, "Georgia, New York, Kansas," here restricted to Georgia, type in Museum of Comparative Zoölogy).

DIAGNOSIS: Differs from other species of the group by having the third elytral interval in basal third or half raised sharply, almost carinate, confluent, its setae continuous, and all the elytral setae extremely short. Differs from all but *capillaris* by having the median ridges of the pronotum narrower, sinuous, scarcely elevated and on about the same plane as the lateral tubercles, these being elongate and usually connected with the median ridges. Differs from *capillaris* in elytral pattern and in the more widely separated marginal setae.

DESCRIPTION: (See also characters of group). Length, 7 to 8 mm. Wings, 9 mm. long on a specimen of 8 mm., 8 mm. on three specimens of 7 mm. Head bituberculate or quadrituberculate, setae inconspicuous. Clypeus broadly rounded. Antennal club fulvous, dark red, or grayish. Pronotum almost twice as wide as long, not tomentose, median ridges sinuous, lateral tubercles elongate, often joined to median ridges at base and in front of middle, setae, if visible on elevations, yellow, sparse. Elytra mostly shining, third interval elevated and confluent in basal third or half, remainder of third and all of other odd intervals broken into round or elongate

tubercles clothed with short yellow setae (only half of the length or less of the setae at base of pronotum); striae punctures usually visible; reflexed elytral margins with two or three tiny tubercles in basal fourth; marginal setae separated by their own lengths, margins slightly crenulate. Prosternum behind front coxae with projecting tooth. Proepisterna with inner margins angulate in front of middle.

DISTRIBUTION: Most of the eastern United States west to Kansas, and Texas (Robinson, *in litt.*). Ontario, Canada.

SPECIMENS EXAMINED: A total of 153 from 58 localities (see Appendix).

DISCUSSION: Although much smaller in size, *sordidus* resembles the following species (*capillaris*) in its stocky robust form, in the convexity of the pronotum and elytra, and in the shape of the proepisterna. These two species appear to have shorter wings than the other two species in the group. In some instances, where there is mud on the pronotal depressions, *sordidus* might be mistaken for one of the smaller species of the *terrestris* group (pronotum divided into four distinct large foveae). These foveae are vaguely present in *sordidus*, but they are not distinct and they are not enclosed by high, heavily encrusted, tomentose ridges. The latter are generally shining in *sordidus* and have large punctures visible. The pronotum is more convex than in the *terrestris* group.

The male genitalia are of the same type as those of *variolatus*, but the median lobe is not so elongate and is sharply truncate apically (fig. 25T).

HABITS: This species has been taken in foxes' dens in Massachusetts, and from lizard carrion in North Carolina.

***Trox capillaris* Say**

Figures 3D, 25U

Trox capillaris Say, 1823, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 238 (type, "Upper Missouri").

DIAGNOSIS: Differs from all species in the United States in the scale-like quality of the dark or black shining elytral setae that are arranged for the most part in widely separated, round, non-tuberculate clumps. All the elytral intervals are at the same level and entirely tomentose between the clumps of setae.

DESCRIPTION: (See also characters of group). Length, 8 to 10 mm. Wings, 11 mm. long on specimen of 10 mm. Head quadrituberculate, setae conspicuous. Clypeus broadly rounded. Antennal club fulvous or dark red. Pronotum less than twice as wide as long, tomentose, the median ridges, tubercles, and front margin with sparse reclining yellow setae. Elytra tomentose, all intervals flat, none elevated, clothed with conspicuous flat clumps of dense, semi-erect, short setae on odd intervals (shorter than setae at base of pronotum), setae scale-like in texture, not hair-like, clumps of setae nearly contiguous at base of third interval, widely separated elsewhere (by twice their diameter or more), usually round, occasionally elongate, bronze or black in color, clumps on suture smaller than those on other odd intervals; large striae punctures and capillary lines usually visible; reflexed elytral margins with one or two tiny tubercles at base; marginal setae contiguous and overlapping, especially towards apex; margins not crenulate. Prosternum behind front coxae with projecting tooth, often covered by tomentosity. Proepisterna with inner margins angulate in front of middle.

DISTRIBUTION: Northeastern states to Tennessee, Missouri, Kansas, also Texas, Utah, and Ontario, Canada; Indiana, Iowa (Robinson, *in litt.*)

SPECIMENS EXAMINED: A total of 140 from 44 localities (see Appendix).

DISCUSSION: This species resembles *unistriatus* in the large and evident rows of striae punctures outlined by strong capillary lines, in the often dark red color of the elytra, and in their densely fringed margins, and in the shape and sculpture of the pronotum, but differs by being stouter, less elongate in shape, by having the elytra wider behind, not nearly parallel, the elytral setae in clumps or tufts, not in parallel lines of setae, the setae dark, not pale, the proepisterna angulate farther front. Once it has been seen and recognized, *capillaris* is always identifiable on its distinctive elytral pattern. The capillary ridges often show on only one side of the striae punctures.

The median lobe of the male genitalia (fig. 25U) is in the form of an arrowhead, but of the same general type as others in the group.

HABITS: Specimens from New Jersey and Maryland were taken from dead dogs or cats, and some from Massachusetts in a fox's den.

Trox unistriatus Beauvois

Figures 1C, 25V

Trox unistriatus BEAUVOIS, 1805, Insectes recueillis . . . en Amérique, p. 175, pl. 4b, fig. 5 (type, Pennsylvania).

Trox porcatus SAY, 1825, Jour. Acad. Nat. Sci. Philadelphia, vol. 5, p. 193 (type, United States).

DIAGNOSIS: The combination in this species of strikingly large squarish striae punctures in regular, clearly marked rows on the elytra, the long lines of fine yellow setae in double rows on the odd intervals, and the transverse quadrate pronotum with nearly parallel sides separates it from other species in the group.

DESCRIPTION: (See also characters of group). Length, 9 to 12 mm. Wings, 15 and 16 mm. long on four specimens of 11 and 12 mm., 13 mm. on specimen of 10.5 mm. Head bituberculate or quadrituberculate, setae inconspicuous. Clypeus broadly rounded. Antennal club fulvous. Pronotum less than twice as wide as long, tomentose, median ridges, tubercles, and front margin with sparse erect yellow setae. Elytra mostly shining, suture and odd intervals feebly elevated, flat on top, clothed with a double line of fine yellow setae, setae more or less continuous on third interval, separated into elongated, widely separated patches on other odd intervals; even intervals with same vestiture but in shorter patches; striae punctures very large, as wide as intervals, usually visible; reflexed elytral margins with no setae or tubercles; marginal setae contiguous and overlapping; margins not crenulate. Prosternum behind front coxae feebly carinate, often appearing flat. Proepisterna with inner margins angulate at middle.

DISTRIBUTION: All the Canadian provinces except British Columbia south to Colorado in the west and North Carolina in the east; also Florida, Louisiana, and Texas.

SPECIMENS EXAMINED: A total of 549 from 129 localities in the above region except the states of North Dakota, Wyoming, West Virginia, and Delaware. Only one specimen each has been seen from Florida, Louisiana,

and Texas; according to the distribution of the species these may well be accidental.

DISCUSSION: This appears to be the most numerous species in Canada and the northern states of the groups with oval scutellum except *scaber*. It is very close to *capillaris*, differing as stated under that species. Like *capillaris* it is readily recognized once seen. It is also the largest of the species with oval scutellum, some individuals being as large as some *tytus*, *suberosus*, and *rubricans*, all of which have the scutellum hastate. The double lines of setae on the third elytral interval are often contiguous for three-quarters of the

length of the interval.

The male genitalia have the basal piece reduced as in the three preceding species of the group. The median lobe is broader than in the other species, especially in the apical half, and has a median carina apically (fig. 25V).

Say's *porcatus*, the type of which I have not seen, was placed in synonymy with *unistriatus* by Harold and Horn.

HABITS: Notations on specimens examined specify that this species has been found on carrion, remains of porcupine, decayed fish, and in chicken traps.

THE *SUBEROSUS* GROUP

For a discussion of the group, see page 22.

Trox tytus Robinson

Figures 3F, 4A, 16, 26B

Trox (*Omorgus*) *tytus* ROBINSON, 1941, Ent. News, vol. 52, p. 228, fig. 1 (type, male, Broomall, Pennsylvania, in collection of Mark Robinson).

DIAGNOSIS: Elytra not tuberculate, entirely tomentose. Velvety brown in color, but usually greased and thus appearing black. Differs from all species with hastate scutellum by having no tubercles on front of the head.

DESCRIPTION: (See also characters of group). Length, 11 to 14 mm. Wings normal, 17 mm. long on two females of 13 and 14 mm. Head convex, not bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose, not ridged, apical depressions lacking, evenly convex, smooth, tubercles only faintly indicated at base; lateral margins not incised, but sometimes just perceptibly emarginate. Elytra with humeral umbone prominent, alternate (odd) intervals scarcely elevated, tomentose, broad, and flat, with elongate patches of paler tomentosity; other (even) intervals flat, entirely tomentose; no subapical umbone; elytral margins scarcely reflexed, without setae or tubercles. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs smooth all around, not ridged.

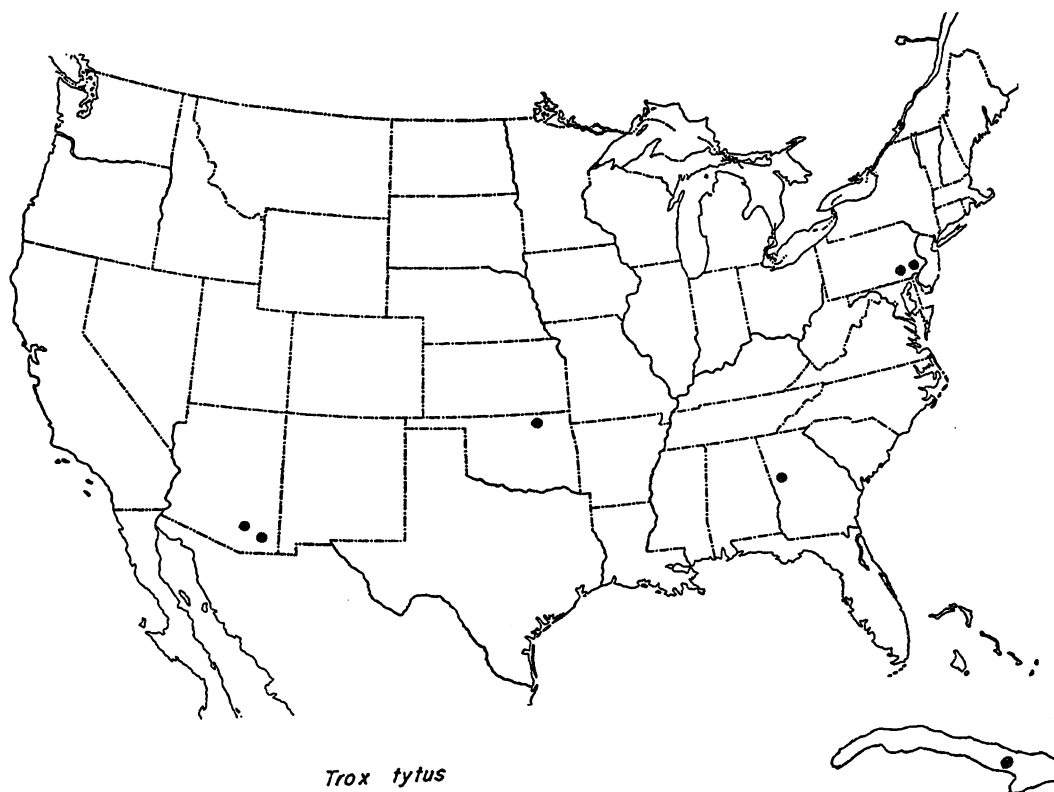
DISTRIBUTION: Pennsylvania, Georgia, Oklahoma, Arizona, and Cuba, or probably wherever barn owls have nests (see map, fig. 16).

SPECIMENS EXAMINED: A total of 56 from seven localities (see Appendix).

DISCUSSION: The geographical range of this species will no doubt prove to be less discontinuous when more barn owls' nests are investigated. The 192 specimens in Robinson's type series, as well as one of the specimens from Georgia, were all found in such nests.

This is one of the smoothest of the large species, all the normally elevated or tuberculate areas of pronotum and elytra being flattened or virtually obsolete. In this it resembles *loxus* and *suberosus* but differs from both in the shape of the hind angles of the pronotum which are broadly rounded and drooping backward (fig. 4A-C). The elytral intervals are without the bare black spots usually present in *suberosus*, but have elongate flat patches of short tomentosity; in *loxus* the flat patches are replaced by more tubercular elevations. When the elytra are completely denuded, as in two of the paratypes of *tytus*, the striae punctures are seen to be as wide as half the sutural interval. The usually obsolete head tubercles can be discerned as an elongate swelling on the specimen from Cuba. The hind tarsi appear shorter than in other species with hastate scutellum, and the scutellum itself appears more rounded apically, but this may well be owing to the greater area of tomentosity that obscures the outline.

The male genitalia, while resembling those of *rubricans* in great part, differ by having

FIG. 16. Distribution of *Trox tytus*.

the inner margins of the lateral lobes not ovate but nearly parallel for a short distance at their base (fig. 26B, D). These lobes are more widely separated at the middle than in *suberosus*, exposing more of the median lobe. The sac within the lobe is not sclerotized.

HABITS: The type and paratypes were taken by Robinson in the nests of the barn owl (*Tyto alba pratincola* Bonaparte). A specimen from Georgia and two from Lynndell, Pennsylvania, were collected also from barn owls' nests.

***Trox loxus*, new species**

Figures 4C, 17

DIAGNOSIS: Most similar to *tytus* in the smooth and entirely tomentose, velvety pronotum and elytra, but much smaller, the head bituberculate, the hind angles of the pronotum drawn forward obliquely, not drooping backward.

DESCRIPTION OF HOLOTYPE, FEMALE: (See also characters of group). Length, 8.5 mm. Wings normal, 10.5 mm. Head bituberculate.

Antennal scape with fulvous hairs, club fulvous. Pronotum about one-third wider than long, entirely tomentose, not ridged, apical depressions lacking, rather evenly convex, smooth, but with faint median depression, tubercles only faintly indicated at base; lateral margins entire, not at all emarginate, sides oblique from rounded hind angle to basal constriction. Elytra with humeral umbone prominent, alternate (odd) intervals entirely tomentose, feebly tuberculate, with elongate setose tubercles separated by more than their lengths, the spaces between the tubercles flat; less elevated (even) intervals with smaller, scarcely elevated tubercles, entirely tomentose; subapical umbone scarcely indicated; elytral margins scarcely reflexed and without visible setae or tubercles. Metasternal depression at least as wide as long, perhaps a trifle wider than long. Tarsal segments on middle and hind legs tomentose, apparently smooth all around, not ridged, third, fourth, and fifth segments scarcely longer than wide, setae on posterior margins

of segments sparse (four to six on each segment).

Holotype, female, El Palmar, 16 kilometers west of Tetzonapa, Veracruz, Mexico, June 9 to 15, 1948, 600 feet, jungle, rubber, coffee; W. Nutting and F. Werner, collectors, in collection of Museum of Comparative Zoölogy.

DISTRIBUTION: Veracruz, Mexico, and possibly Argentina (see below).

DISCUSSION: This species seems to be somewhat intermediate between *tytus* and *suberosus*. It resembles the former in its smooth, scarcely sculptured pronotum with non-emarginate sides, and resembles *suberosus* in its bituberculate head and its oblique lateral margins at the base of the pronotum (fig. 4C). These margins, however, are more oblique in *loxus*, and they are not incised as in *suberosus*. They also do not have the fine long hairs laterally and apically as in that species. The vestiture and tomentosity of the elytra are nearly as in *tytus*, not a shining glaze as in typical *suberosus*, but *loxus* has narrow setose tubercles under the tomentose covering on the odd intervals, whereas *tytus* has scarcely elevated broad flat patches. Both *tytus* and *suberosus* are usually much larger than *loxus*, but a few *suberosus* are as small, and additional specimens of *loxus*, of course, may show some variation in size as well as in other characters. The wing seems a little shorter than in other species with normal wings, being only 2 mm. longer than the total length of the beetle, whereas it is usually 4 mm. longer.

A second female specimen, which externally appears to be this species, has been examined in the collection of the British Museum. It comes from Patquia, La Rioja Province, northern Argentina, collected by K. J. Hayward. The occurrence of a species of *Trox* in such extremely widely spaced localities would be most unusual, and, if a fact, then *loxus* would be the only species (except the abundant *suberosus*) to occur in both North and South America. It is true that *tytus* occurs in five isolated localities in the United States and Cuba (in barn owls' nests only), and that the distribution of *rubricans* (southern Texas to Nicaragua) is also quite discontinuous, but the distance separating the populations of these species is not nearly so great as in the

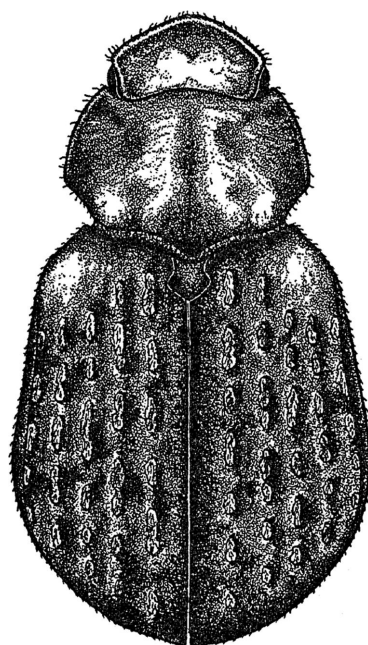


FIG. 17. *Trox loxus*, type.

case of *loxus*. There are three possible explanations to offer: first, one or the other specimen may be purely accidental; second, *loxus* may have some specialized habitat not yet known, the discovery of which might explain its apparent rarity and/or fill in the gaps in its distribution; third, the specimen from Argentina may represent a distinct species that is as similar externally to *loxus* as *fuliginosus* is to *monachus*, *inflatus* to *punctatus*, *aequalis* to *affinis*, *foveicollis* to *insularis*, etc. Whether the last explanation is true can be proved only by the acquisition of males and examination of their genitalia. These organs are the only differentiating character certain to distinguish the other pairs of species mentioned, although some slight relative differences can sometimes be discerned externally. In the present case there are also some slight differences which may or may not be individual ones. The Argentine specimen differs from the Mexican by having the pronotal sides just perceptibly sinuate in front of the hind angles which are rounded and obliquely declivous as in the latter. The pronotum is not so smooth in the Argentine specimen; it has slightly more sculpturing, with a recognizable median depression, and

with slight depressions in front of the faintly indicated median basal tubercles. The elytra are less heavily encrusted and show very large stria punctures that are more or less obscured in the specimen from Mexico. The size is but a half millimeter shorter.

HABITS: No information.

Trox suberosus Fabricius

Figures 3E, 4B, 26A

Trox suberosus FABRICIUS, 1775, *Systema entomologiae*, p. 31 (type, Brazil).

Trox crenatus OLIVIER, 1789, *Entomologie*, vol. 1, no. 4, p. 7, pl. 1, fig. 4 (type, Cayenne).

Trox gibbus OLIVIER, 1789, *op. cit.*, vol. 1, no. 4, p. 13, pl. 2, fig. 13 (type, Santo Domingo).

Trox ovatus BEAUVOIS, 1805, *Insectes recueillis . . . Amérique*, p. 175, pl. 4b, fig. 2 (type, Santo Domingo).

Trox denticulatus BEAUVOIS, 1805, *op. cit.*, p. 176, pl. 4b, figs. 7, 8 (type, Pennsylvania). Preoccupied by *denticulatus* Olivier, 1789.

Trox alternatus SAY, 1835, *Boston Jour. Nat. Hist.*, vol. 1, p. 179 (type, United States).

Trox tuberosus CASTELNAU, 1840, *Histoire naturelle . . . des insectes: coleoptères*, vol. 2, p. 107. Error for *suberosus*.

Omorgus punctatus LECONTE, 1854, *Jour. Acad. Nat. Sci. Philadelphia*, vol. 7, p. 215 (type, "from New York to Santa Fe and Texas"). Preoccupied by *punctatus* Germar, 1824.

Trox nobilis WOLLASTON, 1867, *Coleoptera hesperidum*, p. 93 (type, Island of Fogo, Cape Verde Islands).

DIAGNOSIS: Elytra very feebly tuberculate, mostly tomentose. Differs from all species with hastate scutellum in the long fine hairs on the pronotal margins, and from all except *tytus* and *loxus* by having the pronotal ridges and tubercles coalesced into a nearly smooth convex surface (at base the tubercles are slightly indicated), and the elytra also nearly smooth. Differs from *tytus* in the bituberculate head and from *tytus* and *loxus* in the acutely incised lateral margins of the pronotum.

DESCRIPTION: (See also characters of group). Length, 9 to 14 mm. Wings normal, 17 mm. long on males of 12.5 and 13 mm., 15 mm. on male of 12 mm., 16 mm. on female of 12 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose, not ridged, evenly convex in apical half medially (median de-

pression sometimes indicated), tubercles and lateral depressions confluent, virtually obsolete; lateral margins sharply incised in basal fourth, sometimes the sinuation in front of the incision is as large as the hind lobe. Elytra with humeral umbone prominent, odd intervals either not elevated, except the third feebly, not tuberculate, and almost entirely tomentose, or odd intervals feebly elevated and with black and shining small flattened "tubercles" alternating with tomentose patches; even intervals flat or slightly rugose, tomentose; subapical umbone not prominent; reflexed elytral margins apparently without tubercles or setae. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs apparently smooth, not ridged.

DISTRIBUTION: All of the United States except the Pacific northwest and northern New England; all of Mexico; probably all of Central and South America; Galapagos Islands; Bahamas; West Indies; Cape Verde Islands (probably accidental).

SPECIMENS EXAMINED: A total of about 2500 from most of the above localities.

DISCUSSION: The many synonyms of *suberosus* are an indication of its great variability and widespread occurrence, but in fact this species, once its general aspect becomes familiar, is externally more readily identifiable than *punctatus*, *inflatus* or *tesselatus*. Fresh specimens have a smooth yellowish or buffy glaze that is characteristic of the species, and all specimens can be identified by the pronotum. The combination of the oblique basal margins of the pronotum, the smaller lobe at the hind angles with the deep, acute emargination in front of it, as shown in figure 4B, in addition to the smooth surface and the long marginal hairs, separates this species from all others. Some of the above characters are present in *carinatus*, *fuliginosus*, *monachus*, and *scabrosus*, but all these species have the pronotum strongly sculptured and ridged.

The elytra vary in the elevation or tuberculation of the intervals and in the extent and distribution of the tomentose covering. The odd intervals occasionally appear as tuberculate as in some *punctatus*; sometimes they are as flat as in *tytus*. Fresh specimens generally show only four or five black spots on each

odd interval, the rest of the elytra being tomentose, but individuals that have all the tomentosity worn off appear quite different. On these denuded individuals the odd intervals are seen to be about evenly convex throughout, not at all tuberculate; thus the tubercular effect is caused only by the tomentosity. The large stria punctures in denuded specimens appear to be larger and more regular than in other species of the group; they are about as wide in diameter as the intervals between. A series of 30 specimens from Georges Island in the Gulf of California close to the coast of Sonora in the Bahia San Jorge are all denuded in this manner so that the large punctures are strikingly evident. The male genitalia in these specimens are the same as in specimens from other localities.

No evidence of geographical variation could be found in spite of the wide range of the species, the variations apparently occurring in any populations. Thus five individuals from Hood Island in the Galapagos, as are scattered specimens from New Jersey, Massachusetts, California, or Mexico, are entirely and smoothly coated, showing virtually no black areas and no tubercles on the elytra. In Brazil there is a large species (17 mm.) with the same pronotum and smooth-glazed coat as *suberosus*, and almost the same elytra, but it has the middle tibiae curved, the hind tibiae fringed within at apex with long hairs in the male, and entirely different male genitalia. Harold (1872) probably included this species with *suberosus* as his variety a, as he gave the length as 17 mm. and the locality as the Antilles and Brazil. He does not mention the tibiae.

The longest of the hind tibial spurs is noticeably thick and apically spatulate in the female of *suberosus*, narrower and more acuminate in the male. The male genitalia (fig. 26A) resemble those of *tytus* and *rubricans* in the long narrow apices of the lateral lobes, but differ by having these lobes nearly meeting across the median lobe, hiding it in great part, and by having the apices always extending beyond the median lobe. The internal sac is not sclerotized.

The synonymy of *suberosus*, as also that of the cosmopolitan *scaber*, has been taken from Harold (1872) and Arrow (1912), and I

have not examined the types of any of these synonyms. The type of *punctatus* LeConte was not found in the LeConte collection at the Museum of Comparative Zoölogy, but a specimen there with a label in LeConte's handwriting ["*O. punctatus* (Germ.) Lec. *T. alternatus* Say"] agrees with *suberosus*.

The occurrence of Wollaston's *nobilis* (= *suberosus*) in the Cape Verde Islands is probably accidental. Harold (1872) said the type of *nobilis* lacked both head and thorax but that Wollaston sent him an elytron of his form and that it represented an abundant form of *suberosus*. What there was of the insect was found under a stone high up on a cliff, and Harold could not think of an explanation of how this American beetle arrived there unless it was brought by a ship or thrown up by the sea to be carried up the cliff by a bird.

HABITS: Arrow (1903) says that specimens from St. Vincent in the West Indies are commonly found in fungi, a habit not reported, to my knowledge, for any other *Trox*. Other specimens have been taken under goat carrion, chicken feathers, at malt, under cow chips, and at light. This is one of the commonest species taken at light.

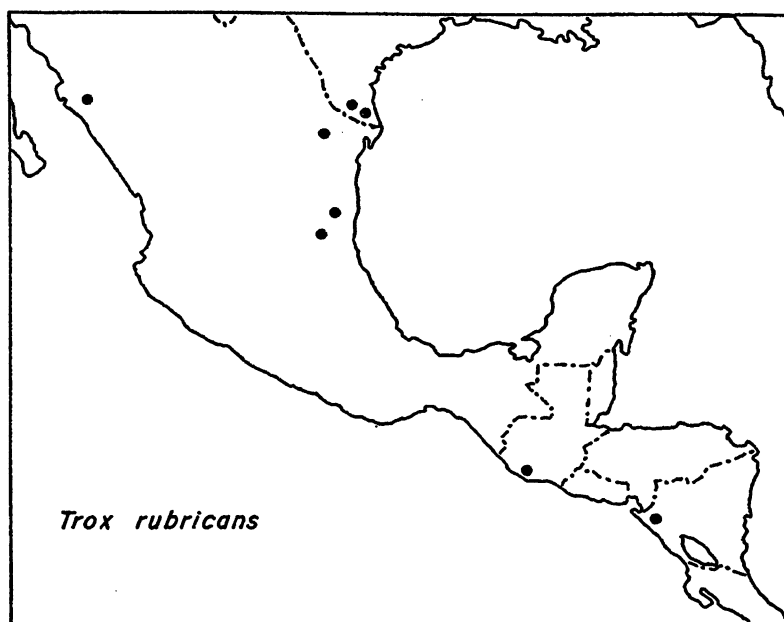
Trox rubricans Robinson

Figures 18, 26D

Trox (*Omorgus*) *rubricans* ROBINSON, 1946, Trans. Amer. Ent. Soc., vol. 72, p. 57 (type, male, Venedio, Sinaloa, Mexico, in California Academy of Sciences).

DIAGNOSIS: Elytra tuberculate, tubercles tomentose. The longitudinal pattern of tomentose tubercles alternating with bare black patches on the odd elytral intervals is the same as in *suberosus*, but the intervals are usually more elevated in *rubricans*, which differs further in the shape of the pronotal side margins, in the deep pronotal depressions and high elevations, in the stronger subapical umbone, and in the narrower hind tarsal spur (longest spur).

DESCRIPTION: (See also characters of group). Length, 11.5 to 14 mm. Wings normal, 18 mm. long on a male of 14 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum with ridges and tubercles bare, the rest tomentose, apical depressions feeble, other depressions well

FIG. 18. Distribution of *Trox rubricans*.

marked, lateral margins gently emarginate at about basal third. Elytra with humeral umbone prominent, alternate (odd) intervals strongly elevated (often worn and scarcely elevated) from base to prominent subapical umbone, third interval evenly convex, the bare spaces nearly as elevated as the tomentose tubercles, but other odd intervals broken into separate elongate or round tubercles covered with tomentose coating, bare spaces between these tubercles flat or only slightly elevated; non-elevated (even) intervals flat, with a row of minute setose patches in center; reflexed elytral margins with a row of similar patches of setae in more than apical half. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs seemingly smooth all around, not ridged (specimens heavily tomentose).

DISTRIBUTION: Extreme southeastern Texas, northern Mexico, Guatemala, and Nicaragua (see map, fig. 18).

SPECIMENS EXAMINED: A total of 15 from 10 localities (see Appendix).

DISCUSSION: This apparently rare species has a rather discontinuous distribution: southern Texas south to San Luis Potosi in Mexico, and on the Pacific coast of Mexico in Sinaloa, also Escuintla in Guatemala, and

Polvon in Nicaragua. The only truly inland locality for *rubricans* is Presidio which may be in either Chihuahua or Durango (not shown on the map, fig. 18).

Robinson (*in litt.*) has seen but five specimens in addition to the two from Sinaloa he had at the time of his description. Some of these were from Brownsville, Cameron County, Texas. I also have specimens from Cameron County and one also from Hidalgo County near by; these specimens are not quite typical, but two of them are males and have the genitalia of *rubricans*. The elytra in these Texas specimens and also in a female from Valles, Mexico, have the tomentose patches so worn down as to resemble the elytra of *suberosus* which occurs also in Brownsville, but the pronotum is nearly the same as in a paratype and other specimens of *rubricans*, that is, definitely ridged and depressed, with the tubercles distinct. The pronotum of *rubricans* is very much like that of some forms of *punctatus*. Some individuals might be mistaken for *asper*, but comparison will show that that species has a different pronotum and elytra.

The lateral lobes of the male genitalia are elongate and narrowed apically as in *suberosus* and *tytus*, but they do not close narrowly over

the median lobe as in *suberosus* (fig. 26D), and the outer margins are constricted before the apex which is not true in *tytus*. The apex of the median lobe is at least twice as broad as the apices of the lateral lobes, as in *tytus*, not of the same width as in *suberosus*. The internal sac is an elongate, soft, not sclerotized organ.

HABITS: The specimen from Tamaulipas was taken at light in a dense scrub area.

***Trox carinatus* Loomis**

Figures 4D, 19, 27A

Trox carinatus LOOMIS, 1922, Jour. Washington Acad. Sci., vol. 12, p. 135, fig. 1 (type, male, Sacaton, Arizona, in United States National Museum.)

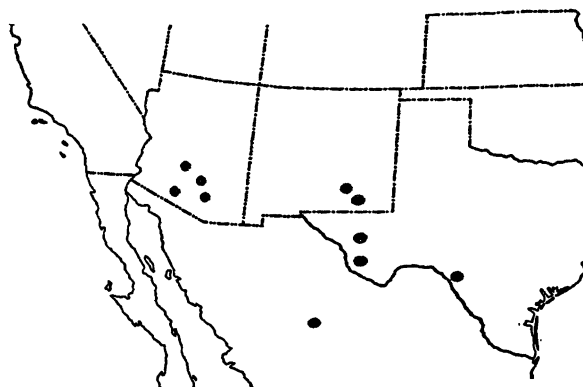
DIAGNOSIS: Elytra not tuberculate, mostly bare. Differs from all other species with hastate scutellum by having four prominent continuous carinae on each elytron, the hind angles of the pronotum more widely distant from the elytral humeri, and the pronotal constriction at base longer, more oblique.

DESCRIPTION: (See also characters of group). Length, 12 to 15 mm. Wings normal, 17 mm. on a female of 14 mm., 14 mm. on a female of 12 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose, ridged, and tuberculate, depressions well marked, lateral margins sharply incised or gently emarginate in front of base. Elytra with humeral umbone prominent, alternate intervals strongly carinate from base to prominent tubercular subapical umbone, the two inner carinae on each elytron more prominent; carinate (odd) intervals topped by widely separated tomentose patches; non-carinate (even) intervals more or less flat or with slight rugosities, more or less bare; reflexed elytral sides without setae or tubercles. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs strongly ridged and rugose, excavate ventrally and on sides at base.

DISTRIBUTION: Southern Arizona and New Mexico, southwestern Texas in the United States; Chihuahua, Mexico (see map, fig. 19).

SPECIMENS EXAMINED: A total of 12 from 10 localities (see Appendix).

DISCUSSION: Only 12 specimens of this species have been examined, all of which have



T. carinatus

FIG. 19. Distribution of *Trox carinatus*. Other species with approximately the same distribution are *gemmulatus*, *inflatus*, and *tesselatus*.

the elytra quite uniform, mostly bare and shining, with the tomentose patches very narrow and small. On a specimen from Chihuahua, Mexico, which is quite worn, the pronotal incision is scarcely evident. Seems most similar to *tomentosus* (western and southern Mexico), but in that species the elytra are not carinate throughout but at the base of the third interval only, and the pronotal constriction differs. The specimen from Chihuahua is the first record of *carinatus* from Mexico.

The male genitalia are exceedingly similar in size and shape to those of *fuliginosus* (fig. 27B) from south central Texas, the only differences discernible being that the apex of the median lobe in *carinatus* is narrower and more acuminate and the internal sac differs in shape and is sclerotized (fig. 27A).

HABITS: The type was taken with a specimen of *inflatus* "in a moist recess among rocks on the top of a desert peak," and the allotype (near Tucson, Arizona) in the "nest of a rat among rocks" (Loomis).

***Trox tomentosus* Robinson**

Figure 26E

Trox (Omorgus) tomentosus ROBINSON, 1941, Trans. Amer. Ent. Soc., vol. 67, p. 135, fig. 12 (type, male, Nayarit, Mexico, in collection of Mark Robinson).

DIAGNOSIS: Elytra tuberculate, mostly tomentose. Differs from most species with hastate scutellum by having the basal part

of the third elytral interval narrowly, sharply carinate, confluent, and entirely tomentose; not broad and convex as in *fuliginosus* and *monachus*, nor with black polished tubercles or portions of tubercles as in *asper*. The row of minute setose tubercles along the reflexed elytral margins extends from basal fourth to the apex in *tomentosus*, but is present only in apical third in *asper*.

DESCRIPTION: (See also characters of group). Length, 11 to 14 mm. Wings normal, 16 mm. long on a female of 12.5 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose, ridged, and tuberculate, depressions well marked, lateral margins incised or emarginate at basal third. Elytra with humeral umbone prominent, alternate intervals strongly elevated from base to prominent tubercular subapical umbone, base of third interval carinate, confluent, and tomentose, remainder of third and other odd intervals broken into elongate, tomentose, separated tubercles, the spaces between the tubercles on each interval flat, tomentose; non-elevated (even) intervals flat, with a row of minute round tufts of setae in center (usually not visible); reflexed elytral margins with a similar row of setae except in basal fourth. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs seemingly ridged and rugose, but covered with heavy coating.

DISTRIBUTION: Western coast of Mexico from southern Sonora to Oaxaca.

SPECIMENS EXAMINED: Mexico: Sonora: Minas Nuevas, August, one female. Nayarit: one male, one female (the type and allotype of *tomentosus*). Oaxaca: Salina Cruz, July, one male. (Robinson, *in litt.*, says he has seen a specimen from the state of Sinaloa.)

DISCUSSION: This species, as are *rubricans* and *carinatus*, appears to be quite rare. The specimens listed above are, so far as I know, the only ones known. It is the only species in the group with hastate scutellum that is endemic to Mexico, and its rarity may be owing to lack of material from the Pacific coast and southern Mexico. The male genitalia (fig. 26E) are externally quite similar to those of *punctatus* except for the depression on the median lobe. The median lobe was not dissected because of lack of males.

HABITS: The specimen from Sonora came to a Coleman lantern on a gravel path in wooded country in the Sierra de Alamos, 1700 feet.

Trox monachus Herbst

Figures 4G, 20, 27C

Trox monachus HERBST, 1790, *Natursystem aller bekannten in- und ausländischen Insekten*, vol. 3, p. 25, pl. 21, fig. 7 (type, "Ostindien," in Zoologisches Museum, Berlin, error for North America; type locality here restricted to North Carolina).

Trox tuberculatus BEAUVOIS, 1805, *Insectes recueillis . . . en Amérique*, p. 175, pl. 4b, fig. 3 (type, "Saint-Domingue"). Preoccupied by *tuberculatus* De Geer, 1774.

Omorgus pustulatus LECONTE, 1854, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 7, p. 215 (type, "Southern States," in Museum of Comparative Zoölogy).

DIAGNOSIS: Elytra tuberculate, entirely tomentose. Differs from other species with hastate scutellum except *fuliginosus* by having the tubercles on alternate intervals of elytra very prominently large and round and distinctly, widely separated from one another (often by twice or more their diameter), all tubercles entirely covered with tomentose coating, with no black areas visible. Differs from *fuliginosus* only in the rather larger tubercles on the reflexed elytral margins and in the male genitalia.

DESCRIPTION: (See also characters of group). Length, 12 to 15 mm. Wings normal, length, 19 mm. on a male of 15 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum tomentose, ridged, and tuberculate, depressions well marked, lateral margins deeply emarginate at basal third. Elytra with humeral umbone prominent, alternate intervals strongly elevated and tuberculate to the prominent tubercular subapical umbone, third interval at base with the tubercles partially confluent, tomentose, remainder of third interval and all of other odd intervals broken into well-separated, round, occasionally elongate, large tomentose tubercles, the spaces between the tubercles on each interval flat, tomentose, sometimes with a narrow denuded black line or spot; non-elevated (even) intervals flat, tomentose, with scattered minute round setose patches; reflexed elytral margins with

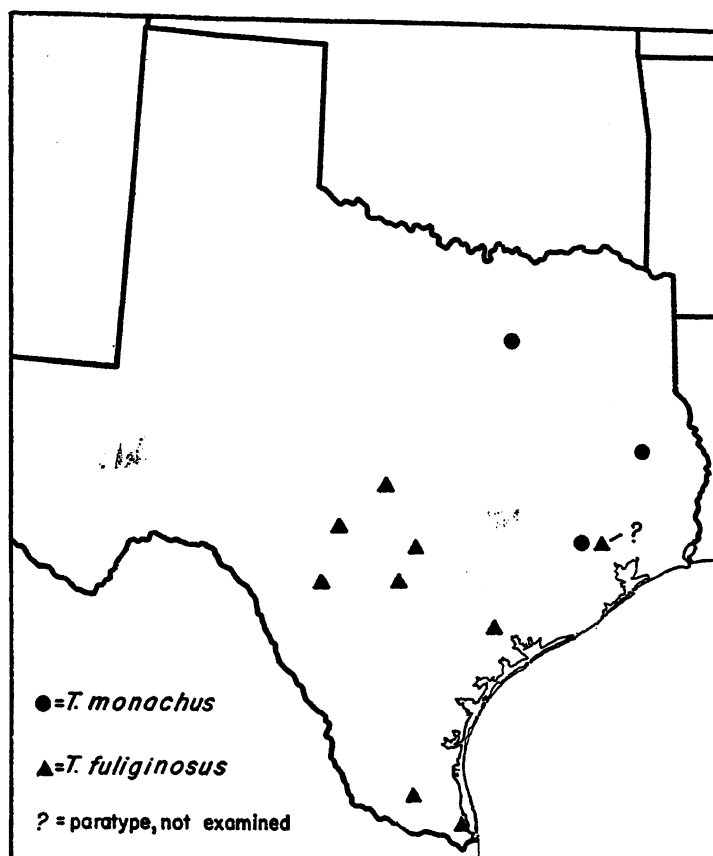


FIG. 20. Distribution of *Trox fuliginosus* and *T. monachus* in Texas, showing both species in Harris County.

irregularly placed, large, tomentose tubercles. Metasternal depression about as wide as long. Tarsal segments on middle and hind tarsi apparently smooth, not ridged, heavily tomentose.

DISTRIBUTION: Eastern United States west, south of the Great Lakes, to Kansas, Oklahoma, and eastern Texas.

SPECIMENS EXAMINED: A total of 304 from 76 localities in the range given above except from the New England states, New Jersey, and West Virginia. The majority of localities are in Georgia, North Carolina, Florida, and Missouri. The 39 specimens from eastern Texas are from Dallas, Angelina, and Harris counties (see map, fig. 20).

DISCUSSION: Once it has been recognized, *monachus*, with its characteristic elytral pattern, is one of the easiest species to identify, excepting always *fuliginosus* (see below).

The geographical range of *monachus* is the same as that of *scabrosus* and approximately the same as that of *asper*, both similar-appearing species with the same general, dense, over-all tomentose coating. They have bare black portions at the front end of the elytral tubercles, however, which are not present in *monachus*, and small but definite tubercles on the less elevated (even) intervals where *monachus* has merely patches of setae. The tubercles on the reflexed elytral margins, however, are larger in *monachus* than in *scabrosus*, and they are lacking except at the apex in *asper*. Two additional species (*suberosus* and *tytus*) also have a nearly entire tomentose coating and also occur in the eastern states, but they do not have the strongly sculptured pronotum of *monachus*.

The external resemblance between this species and *fuliginosus* (Texas, Mexico,

Guatemala) is quite remarkable, but perhaps no more so than the external resemblance between *scutellaris* and *umbonatus*, or between *nodosus* and *texanus*. In the latter pair the male genitalia are virtually identical, but the reduced wings differ distinctly in length. In *scutellaris* and *umbonatus* the male genitalia are quite different, whereas the wings, which are vestigial in both, are virtually identical. The genitalia differ and the wings are similar also in *monachus* and *fuliginosus*, but externally these two species have fewer observable differences than the *scutellaris-umbonatus* pair. These differences (given under the diagnosis of *fuliginosus*) are relative ones, and both species must be present for comparison. However, as far as our known records show, the two species are probably allopatric, although they may occur together in Harris County, Texas (see map, fig. 20). I have examined a dissected male of *monachus* from this locality, and one of the paratypes of *fuliginosus* also comes from Harris County. This paratype, however, is a female (not examined) and may well be a specimen of *monachus*. With additional material the question as to whether these species overlap or not may be settled. Bates (1887) reports *monachus* from "Mexico," but I have dissected four specimens placed under this species at the British Museum and find that the two males are *fuliginosus*, as are presumably also the females.

The type locality, East Indies, given by Herbst, is an error, for *monachus* is strictly a North American species. Herbst's type was a specimen from Voet's cabinet labeled "ex Ind. Orient," which had been described and figured by Voet (1776) but under a name not based on the Linnean binomial system. The only subsequent author to mention this locality is Harold (1872, p. 118) who pointed out that Voet's drawing was unmistakably *monachus*; Harold then gives various localities in which the species occurs in North America. He states also that Beauvois' type locality of Santo Domingo for *tuberculatus* (= *monachus*) is false, and that the insect is not found there. He adds that many of the localities given by Beauvois are open to question. I have not examined the type of *monachus* nor that of *tuberculatus*, but LeConte's *pustulatus* has been examined, and it

is a synonym of *monachus*, as Harold said.

The male genitalia (fig. 27C) in specimens of equal size are narrower in *monachus* than in *fuliginosus*, more convex, not so flat, and the inner margins of the lateral lobes at base are ovate in outline, not narrowly parallel. The internal sac differs in shape from all others; it is sclerotized, but not so strongly as in *inflatus*.

HABITS: A specimen from Jackson's Island, Maryland, June, bears the notation "ex nest buzzard." None of the other large species, with the exception of *tytus*, has been reported from the nests of birds. Other specimens (North Carolina) were taken in or under chicken feathers, a cat carcass, squirrel carrion, and in a malt trap. Blatchley (1910) found the species mating June 7 in southern Indiana.

Trox fuliginosus Robinson

Figures 20, 27B

Trox (*Omorgus*) *fuliginosus* ROBINSON, 1941, Ent. News, vol. 52, p. 134 (type, male, New Braunfels, Comal County, Texas, in the United States National Museum).

DIAGNOSIS: Elytra tuberculate, entirely tomentose. Distinguished with certainty from the preceding species (*monachus*) only by the differences in the male genitalia. The elytral tubercles, however, are sometimes less abruptly elevated than in *monachus*, more often elongate, smaller in size, and the reflexed elytral margins usually have much smaller tubercles, sometimes mere patches of setae.

DESCRIPTION: (See also characters of group). Length, 13 to 15 mm. Wings normal, length, 18 mm. on a male of 14 mm. Otherwise exactly as in *monachus* except the reflexed elytral margins with tomentose tubercles, if visible, very small.

DISTRIBUTION: South central and possibly southeastern Texas; Veracruz and Yucatan, Mexico, and Guatemala (see map, fig. 20).

SPECIMENS EXAMINED: A total of 28 from 14 localities (see Appendix).

DISCUSSION: This species is so similar externally to *monachus* that Robinson probably would never have discovered it if he had not dissected the genitalia. The "iron-gray" color of the coating mentioned by Robinson seems to be characteristic of old or rubbed

specimens, for the color in fresh specimens is more tan or buffy than gray. Some individuals may even be red, a color thought to be characteristic of *monachus*, but that species also shows the same variations in color as *fuliginosus*. Worn specimens of *fuliginosus* reveal the fact that the tubercles at the base of the third elytral interval are not always confluent. This is true also in *monachus*, but in *fuliginosus* the smooth tomentose coating usually covers these basal tubercles uniformly, whereas in *monachus* the coating follows the indentations caused by the separate tubercles. The character of the reflexed elytral margins is not always constant in either species, and it is often not observable because of the tomentosity.

I have not seen any specimens from Harris County in southeastern Texas, but a female paratype comes from that locality (see discussion under *monachus*). Except for this specimen, *fuliginosus* occurs west and south of the range of the widespread *monachus*. The Mexico (Yucatan) and Guatemala localities mentioned above are represented by only one specimen each, both (unfortunately) females. It seems logical to assume, however, that these are females of *fuliginosus* rather than of *monachus*, because males of the former have been examined from "Mexico" and from Veracruz, Mexico, and the Yucatan female has the small tubercles of *fuliginosus* on the reflexed elytral margins.

The male genitalia differ from those of *monachus* and from those of all other species except *carinatus* by having the inner margins of the lateral lobes narrowly parallel for a short distance at base (fig. 27B). They are rather similar in size and shape to those of *carinatus*, but the internal sac is not sclerotized.

HABITS: Individuals have been taken under dead sheep and a dead buzzard.

***Trox scabrosus* Beauvois**
Figure 26C

Trox scabrosus BEAUVOIS, 1805, Insectes recueillis . . . en Amérique, p. 175, pl. 4b, fig. 4 (type, South Carolina).

DIAGNOSIS: Elytra tuberculate, almost entirely tomentose, typically with bare spots present only on third and fifth intervals. Rather similar to *monachus* and *fuliginosus*,

but larger, the antennal hairs usually darker; the elytral tubercles are tomentose only in the center or behind, the less elevated intervals have a triple row of small tomentose tubercles, not minute patches of setae, and the large tubercles are oblong in shape, not round. Differs from other species with hastate scutellum by having the longest of the hind tibial spurs broader, less acuminate.

DESCRIPTION: (See also characters of group). Length, 13 to 17.5 mm. Wings normal, length, 18 mm. on a specimen of 14 mm., 21 mm. on a female of 17 mm. Head bituberculate. Antennal scape with hairs usually black, sometimes fulvous, or mixed, club black or dark red. Pronotum ridged, tomentose, and tuberculate, depressions well marked, lateral margins deeply emarginate at basal third or fourth. Elytra with humeral umbone prominent, alternate intervals strongly elevated and tuberculate to the prominent tubercular subapical umbone, third interval at base with tubercles sometimes partially confluent, most of the third interval and the other odd intervals broken into separate, occasionally contiguous, large, elongate tubercles that are mostly tomentose, but with bare black portions of varying extent at the front end, spaces between tubercles on each interval flat, tomentose; less elevated (even) intervals with a triple row of much smaller tomentose tubercles, those in center larger; reflexed elytral margins with scattered tomentose tubercles. Metasternal depression as wide as long. Tarsal segments on middle and hind legs apparently smooth, not ridged, heavily tomentose.

DISTRIBUTION: Ontario, Canada, and a few of the eastern United States west to Nebraska, Kansas, Oklahoma, and eastern Texas. Arizona [?] (Robinson, *in litt.*).

SPECIMENS EXAMINED: A total of 98 from 24 localities (see Appendix).

DISCUSSION: Although the large elytral tubercles are sometimes round as in *monachus* and *fuliginosus*, they are more closely placed and not entirely tomentose. They are tomentose in about the same degree as those in *asper*, another eastern species. These two species have a similar elytral pattern, but the elytral tubercles are proportionately larger in *scabrosus* (as broad as the median basal tubercles of the pronotum, narrower in *asper*)

and are more often irregular in their spacing. The broader hind tibial spur in *scabrosus*, generally larger total size, darker antennal hairs, and different male genitalia serve further to differentiate it from *asper*. Another difference noted by Harold (1872), which appears constant, is that the reflexed elytral margins in *scabrosus* have scattered tomentose tubercles along their length, whereas in *asper* the tubercles are present only towards the apex. In many individuals, of course, these tubercles are hidden by heavy tomentosity.

The geographical range of *scabrosus* overlaps the range of the abundant western *punctatus* in the central states. In this area they may be confused because of the great variability of the elytra in *punctatus*, but the reflexed elytral margins in *punctatus* have no tubercles, and the middle and hind tarsi are ridged and rugose. I question Robinson's report (*in litt.*) of *scabrosus* in Arizona and wonder if he may not have *punctatus*.

The male genitalia are almost the same as those of *texanus* and *nodosus* (fig. 26C), species with reduced wings; they are proportionately smaller than those of *monachus*, *fuliginosus*, or *punctatus*, the median lobe is narrower, more acuminate at apex, and the lateral lobes are truncate, not pointed, at apex. The internal sac is not sclerotized.

HABITS: Blatchley (1910) found this species "on the sandy shores of lakes and rivers." Two specimens from North Carolina were taken under chicken feathers and under a dead chicken. Robinson (*in litt.*) took specimens feeding on the scattered hairs from diseased cattle in Florida.

***Trox asper* (LeConte)**

Figure 27G

Omorgus asper LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 215 (type locality, "Georgia or South Carolina," here designated as South Carolina; type in Museum of Comparative Zoölogy).

DIAGNOSIS: Elytra tuberculate, almost entirely tomentose, typically with bare spots present on parts of third and fifth intervals only. Differs markedly from all species in the genus by the shape of the apices of the lateral lobes of the male genitalia. Otherwise quite similar in appearance to *scabrosus*, the

tomentose elytral tubercles being black and shining in front in both species, but *asper* generally is much smaller, has the elevated elytral intervals narrower than the basal tubercles of the pronotum, the reflexed elytral margins with small tubercles apically, but not elsewhere, and the antennal hairs and club lighter in color.

DESCRIPTION: (See also characters of group). Length, 10 to 14 mm. Wings normal, length, 17 mm. on a female of 13 mm., 18 mm. on a male of 14 mm. Head bituberculate. Antennal scape with hairs fulvous, club fulvous (dark red in one specimen). Pronotum tomentose, ridged, and tuberculate, depressions well marked, lateral margins acutely emarginate at basal third. Elytra with humeral umbone prominent, alternate intervals strongly elevated and tuberculate to the prominent tubercular subapical umbone, third interval at base with tubercles usually confluent, the rest of third interval and the other odd intervals broken into separate, elongate, sometimes round, tubercles that are mostly tomentose but with black shining portions of varying extent at front end, spaces between tubercles on each interval flat, tomentose; less elevated (even) intervals with a row of much smaller tomentose tubercles in center and a row of setose patches on either side, those on second interval (next to suture) often noticeably larger than those on other even intervals; reflexed elytral margins with a row of tomentose tubercles in less than apical half. Metasternal depression about as wide as long. Tarsal segments on middle and hind legs apparently smooth in most specimens, but actually with ridges basally.

DISTRIBUTION: Eastern United States west to Nebraska, Kansas, and Texas, also Utah. Mexico [?] (Bates).

SPECIMENS EXAMINED: A total of 80 from 26 localities (see Appendix).

DISCUSSION: Some heavily tomentose females of the variable *punctatus*, a western species that occurs with *asper* in a number of states just west of the Mississippi River, are difficult to distinguish from those females of *asper* that have the tubercles on the elevated elytral intervals wider than usual, that is, wider than, or as wide as, the basal pronotal tubercles. In general, however, there is far

more tomentosity on the elytra in *asper*, especially on the outer elevated intervals where each tubercle is usually entirely tomentose, and the tubercles of the even intervals are smaller than in *punctatus* and less broadly tuberculate. In *asper* and *scabrosus* the tomentosity is more an integral part of the tubercle itself, whereas in most *punctatus*, *inflatus*, and *tesselatus*, the tomentosity is merely present between the tubercles.

The distribution of this species, as well as that of *scabrosus*, appears rather spotty and discontinuous, but both species no doubt occur throughout the eastern states. I have checked Bates's report (1887) of *asper* from northern Sonora and from Presidio in Mexico. The latter specimen is a male *rubricans*. The specimen from Sonora, although a female, I believe to be *asper*. The Utah record is quite far west, but the specimen is a male, so unquestionably this species. The type, a specimen in almost perfect condition, has been examined.

The male genitalia are of the same type as those of *punctatus*, except that the apices of the lateral lobes are cut out in a distinctive fashion unlike any others in the genus (fig. 27G). The internal sac is similar to that of *punctatus*.

HABITS: A specimen from Texas was collected, with *suberosus*, under a heap of feathers, all that remained of a dead chicken.

Trox punctatus Germar

Figures 1D, 4E, 27F

Trox punctatus GERMAR, 1824, Insectorum species novae, vol. 1, p. 113 (type, Kentucky).

Omorgus integer LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 216 (type locality, "Texas and northern Sonora"; lectotype, designated by Robinson, 1940, in Museum of Comparative Zoölogy).

Omorgus morsus LECONTE, 1854, *ibid.*, vol. 7, p. 216 (type, "Texas and Kansas," in Museum of Comparative Zoölogy).

DIAGNOSIS: Elytra tuberculate, mostly bare, pronotum at base laterally incised or not. Very variable. Differs from some *inflatus* only in the male genitalia, and sometimes by the larger basal tubercles of the pronotum. Differs from *tesselatus*, which has nearly the same elytra, in smaller size and in the ridged, rugose, not smooth, tarsal segments on

middle and hind legs. Differs from most *asper* in the sparse tomentosity on the elytra, but from some *asper* only in the male genitalia.

DESCRIPTION: (See also characters of group). Length, 10.5 to 15 mm. Wings normal, 15.5 mm. on a male and female of 12.5 mm., 16.5 mm. on a male of 13 mm., 17 mm. on a male of 14 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous to dark brown or dark red. Pronotum with ridges and tubercles bare, depressions tomentose, well marked, lateral margins strongly or but scarcely emarginate at basal third. Elytra with humeral umbone prominent, odd intervals usually either feebly or strongly elevated to prominent tubercular subapical umbone, their tubercles larger than those on even intervals, or occasionally all intervals about equally elevated throughout, the tubercles sometimes confluent transversely, tubercles mostly black and shining on all intervals, with areas of tomentosity behind, surface of tubercles flattened (usually) or convex, their shape variable, more often oblong; even intervals either with smaller tubercles and bare, or covered with smooth tomentosity and no tubercles visible; reflexed elytral margins with tiny patches of setae in apical fifth (usually not visible). Metasternal depression about as wide as long. Tarsal segments on middle and hind legs ridged, rugose, excavate ventrally and on sides at base.

DISTRIBUTION: Western United States from Montana, Utah, and southern California east to the Mississippi River, also Kentucky, Ohio (Blatchley), and Mississippi (Robinson, *in litt.*). Northern and central Mexico (Baja California, Sonora, Chihuahua, Nuevo Leon, Durango, Guanajuato, and Aguascalientes).

SPECIMENS EXAMINED: A total of 816 from 175 localities in the above regions except Wyoming, North Dakota, Minnesota, Iowa, and Louisiana. The majority of specimens are from Kansas, Colorado, New Mexico, Texas, Arizona, and Mexico; there is only one specimen each from Utah, California, and Aguascalientes. A specimen from "Fla." is evidently mislabeled.

DISCUSSION: This species and the two that follow (*inflatus* and *tesselatus*) differ from all

the preceding species with hastate scutellum by having the elytral tubercles mostly bare and shining, not covered entirely or in great part by tomentose coating. Tomentose areas are actually present behind each tubercle, but they are usually much shorter and narrower than the tubercle itself and are usually much abraded or greased so that all that shows on the elytra are well-spaced black tubercles. These three species agree with the four following species (*nodosus*, *texanus*, *umbonatus*, and *scutellaris*) in the black and shining tubercles, but differ from them by having the metasternal depression about as wide as long. Although *punctatus*, *inflatus*, and *tesselatus* are so variable externally that they are often and readily confused, the male genitalia differ not only externally but internally as well, for the internal sac has a different shape in each of the three species.

The elytral variations in *punctatus* and the variation in the presence and/or depth of the pronotal emargination caused LeConte to describe *morsus* and *integer*, but these forms apparently grade one into the other and cannot therefore be considered as separate species, nor are the variations correlated with the geographical distribution of the forms. (These forms, the types of which I have examined, were synonymized by Horn in 1874.) The most abundant form has the elytral tubercles on the eight odd intervals elevated above the plane of the even intervals, and very large, flat on top, either square or oblong in shape, widely separated by twice their diameter from one another by the intervening tomentosity. Another form has the tubercles convex and round and closely set, the tomentosity appearing as part of the tubercle, as in *asper*, but all combinations of the two varieties have been seen. The tubercles may also be oblong or elongate on some intervals, and short on others, or convex on some intervals and flat on others. The even or usually less elevated intervals have a tomentose coat in fresh specimens and tiny patches of setae, as in *fuliginosus*, *tomentosus*, and *rubricans*. When such specimens have long tomentose areas behind the tubercles on the odd intervals they bear a close resemblance to both *asper* and *rubricans*. When the tomentose coat is worn, as it most often is, then the even intervals are seen to be rugose

or tuberculate, their black tubercles being generally, but not by any means always, smaller than those on the odd intervals, and not so elevated. In an examination of some 800 specimens I found the ridges at the base or on the sides of the middle and hind tarsi visible in all but a very few heavily encrusted specimens; the normal tomentose coating on the tarsi does not entirely obscure the ridges, nor does abrasion wear them down completely.

Although the type locality is Kentucky, no additional specimens have been seen or reported from that state. The species has been taken, however, from neighboring Missouri. Bates (1889) gives Escuintla, Guatemala, as a locality for this species, but the specimen he had, which I have seen, is a male of *rubricans*.

The lateral lobes of the male genitalia (fig. 27F) are like those of *inflatus*, but proportionately smaller, the median lobe is not bulbously inflated as in *inflatus*, and the internal sac is sclerotized and very different in size and shape.

HABITS: Specimens were collected from under a dead cow and a burro and at light, also from carcasses of a goat, a skunk, a rabbit, and sheep.

Trox inflatus Loomis

Figure 27D

Trox inflatus LOOMIS, 1922, Jour. Washington Acad. Sci., vol. 12, p. 135, fig. 1 (type, male, Sacaton, Arizona, in the United States National Museum).

DIAGNOSIS: Elytra tuberculate, mostly bare. Differs from *tesselatus* in the male genitalia, and by having the tarsi on the middle and hind legs stouter, more compressed, not so cylindrical, also heavily ridged, excavate, not smooth, the middle segments scarcely, if at all, longer than wide, not elongate as in *tesselatus*. Differs very little from some *punctatus* except in the male genitalia.

DESCRIPTION: (See also characters of group). Length, 12 to 16 mm. Wings normal, 18 mm. on a male and a female of 14.5 mm. Head bituberculate. Antennal scape with fulvous hairs, club fulvous. Pronotum with ridges and tubercles bare, depressions tomentose, well marked, lateral margins not or only slightly emarginate in basal third.

Elytra with humeral umbone prominent, intervals either about equally elevated and tuberculate throughout, or the odd intervals with larger or higher tubercles, tubercles often confluent transversely, mostly black and shining, but with small areas of tomentosity behind that often seem absent because of greasing; surface of tubercles flattened (usually), or convex, their shape variable; subapical umbone prominent, tuberculate; reflexed elytral sides with tiny patches of setae in apical fifth (usually not visible). Metasternal depression as wide as long. Tarsal segments on middle and hind legs ridged, rugose, excavate ventrally and on sides at base.

DISTRIBUTION: Arizona, New Mexico, and Texas in the United States; Chihuahua, Mexico.

SPECIMENS EXAMINED: A total of 107 from 28 localities, only three specimens from Mexico (see Appendix).

DISCUSSION: I have not seen the type of *inflatus*, but Loomis' figure of the genitalia is sufficient for identification. Loomis described the elytra as having "four rows of elongated and flattened tubercles . . . hardly to be distinguished from the intervals between them," but he had only two specimens, so could not record further variations. Although in general the elytra in *inflatus* are rather uniformly tuberculate and those in *punctatus* more contrasting (alternate intervals larger and more elevated), the variation in both species precludes the use of the elytra for identification. The only usable external differentiating characters lie in the tarsi and the pronotum, and even here the differences are slight and relative. The tarsi on the middle and hind legs are usually more rugose, more compressed laterally, in *inflatus* and have the central segments appearing stouter, more nearly square, the claw segment especially stouter, more strongly ridged. (The tarsi are like those of *carinatus*, *scutellaris*, and *umbonatus*.) On the pronotum, the basal median tubercles are generally narrower and smaller in *inflatus* and appear to flatten out before the basal margin, whereas in *punctatus* the tubercles are twice as wide and longer, and are apparently joined to the base. Many individuals of both species, however, cannot be distinguished unless dissected. The male

genitalia are truly inflated in *inflatus*, the dorsal part of the median lobe protruding from the enclosing lateral lobes and exceedingly convex; in *punctatus* this area is flat (fig. 27D, F). The internal sac is also very different in the two species (fig. 27D, F). As far as present records indicate, *inflatus* has a much more restricted geographic range than *punctatus*, but both species occur not only in some of the same general areas, but in the same localities, as Van Horn, Davis Mountains, Alpine, and Marathon, Texas; Tucson, Arizona, and others.

HABITS: The type was collected with *carinatus* "in a moist recess among rocks on the top of a desert peak."

Trox tessellatus (LeConte)

Figures 4F, 27E

Omorgus tessellatus LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 216 (type locality, "San Diego Trip"; lectotype, male, "Lower California," designated by Robinson, 1940, in Museum of Comparative Zoölogy).

Trox (Omorgus) nigrescens ROBINSON, 1941, Trans. Amer. Ent. Soc., vol. 67, p. 134, fig. 11 (type, male, San Jose del Cabo, Baja California, in collection of Mark Robinson). New synonymy.

DIAGNOSIS: The combination of the following characters distinguishes this species from others in the group: elytra tuberculate, mostly bare, the tubercles all of about the same elevation; pronotal sides not incised; head with tubercles depressed, more or less fused at center; hind tarsi smooth, not ridged. The exceedingly long and narrow male genitalia are diagnostic.

DESCRIPTION: (See also characters of group). Length, 14 to 17 mm. Wings normal, 18 mm. on two males of 14 mm., 18.5 mm. on a male of 15 mm. Head bituberculate but tubercles usually not distinctly separated, more or less fused at center. Antennal scape with fulvous hairs, club fulvous. Pronotum with ridges and tubercles bare, depressions tomentose, well marked, lateral margins not or just perceptibly emarginate at basal third. Elytra with humeral umbone prominent, intervals usually about equally elevated and tuberculate throughout or the odd intervals sometimes with slightly larger or higher tubercles, tubercles sometimes confluent transversely, black and shining but with areas of

tomentosity behind (often greased), surface of tubercles convex (usually) or flattened, their shape variable; subapical umbone prominent, tubercular; reflexed elytral sides with tiny patches of setae in apical fifth (usually not visible). Metasternal depression as wide as long. Tarsal segments on middle and hind legs smooth all around, not ridged.

DISTRIBUTION: Kansas, Arizona, New Mexico, and Texas in the United States. Baja California, Sonora, Guerrero in Mexico. Sinaloa, Mexico (Robinson, *in litt.*).

SPECIMENS EXAMINED: A total of 144 from 33 localities, only 34 specimens from the United States (see Appendix).

DISCUSSION: The characters which best distinguish *tesselatus* from the two preceding species (*punctatus* and *inflatus*) are the fused tubercles on the head, the smooth tarsi, and the male genitalia. These characters are more reliable in the case of these three species than is the sculpture of the elytra, because some specimens of *tesselatus* have the tubercles on the even intervals of the elytra smaller or less elevated than usual and thus resemble some specimens of *punctatus* in which these even interval tubercles are larger and more elevated than usual. In *inflatus* the elytra vary also. The lack of definite emargination of the pronotal sides in *tesselatus* occurs also in some *punctatus* and *inflatus*. When the front of the head and the tarsi are so heavily coated that their details cannot be seen, then, if the pronotal sides are not emarginate, recourse to the genitalia is necessary for identification. Probably *inflatus* is generally more similar to *tesselatus* dorsally than is *punctatus*, but the difference in tarsi is more marked than it is between *tesselatus* and *punctatus*. The hind tarsal segments in *inflatus* are not only very strongly carinate, excavated, and rugose, especially on the claw segment, but the second, third, and fourth segments are nearly square, not twice as long as wide as in *tesselatus* and most *punctatus*. In addition, the general size of *tesselatus* is larger than in either of the other two species, the hind tibiae are narrower, and the hind angles of the pronotum are usually more nearly right angles, not obtuse. The male genitalia are thin and elongate in *tesselatus* (fig. 27E), the internal sac and the median lobe differing from those of the other two

species. These three species occur in approximately the same area of the southwestern United States and northern Mexico, but the range of *punctatus* is more extensive.

In a few specimens of *tesselatus* the head tubercles are as obsolete as they are in *tytus*, a very different species with the pronotal depressions and elevations also obsolete. Two *tesselatus* of 135 examined were found with the head strongly bituberculate.

Some specimens from inland Mexican states (Nuevo Leon, Chihuahua, Durango, Guanajuato), said by Bates (1887, p. 116) to "belong to the form *T. tessellatus* Lec.," were examined by me at the British Museum; they are not this species, but *punctatus*.

The type and paratype of *nigrescens* Robinson and about 100 other specimens from Baja California have been examined and compared with the lectotype and cotypes of *tesselatus* and with specimens from the southwestern United States, including a specimen from Altar Valley, Arizona, which Robinson had compared with the type of *tesselatus*. I find no specific differences and therefore consider *nigrescens* a synonym of *tesselatus*.

HABITS: Robinson (1940) mentions a series of six specimens collected on a dead hawk.

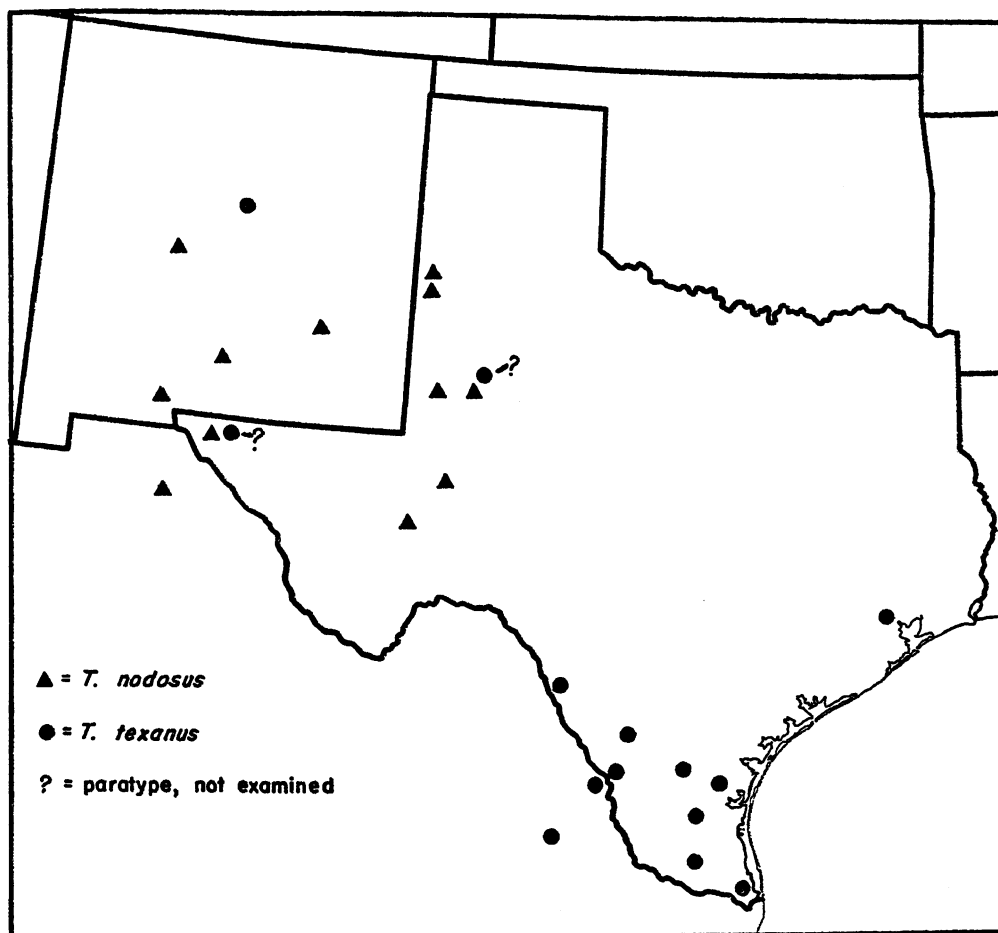
Trox nodosus Robinson

Figures 21, 22A, 23A, 26C

Trox (Omorgus) nodosus ROBINSON, 1940, Trans. Amer. Ent. Soc., vol. 66, p. 152, pl. 4, fig. 12 (type, male, La Mesa, Dona Ana County, New Mexico, in collection of Mark Robinson).

DIAGNOSIS: Elytra tuberculate, mostly bare. Differs from other species with the metasternal depression wider than long, except *texanus*, by having the wings reduced but not vestigial, the humeral umbone therefore not completely obsolete; the enclosing tubercles on each side of the scutellum flatter, more elongate, not bulbous, and only slightly elevated above the scutellum; the hind tarsal segments smooth, not ridged at base; the male genitalia much smaller; the base of pronotum with median lobe longer, more angulate, not gently rounded. Differs from *texanus* only in the longer wing and by having the hind tibiae straight in both sexes.

DESCRIPTION: (See also characters of group). Length, 15 to 19 mm. Wings reduced,

FIG. 21. Distribution of *Trox nodosus* and *T. texanus*.

length from 13 to 16 mm. in eight specimens ranging in length from 15.5 to 18 mm. Head bituberculate. Antennal scape with black hairs, club gray or brown to black. Pronotum with ridges and tubercles bare, depressions tomentose, well marked; lateral margins incised in front of base, occasionally gently emarginate. Elytra with humeral umbone partially obsolete, intervals usually about equally elevated and tuberculate throughout, the odd intervals sometimes with slightly broader or more elongate tubercles, tubercles contiguous, mostly black and shining but with small patches of tomentosity behind each one (if tomentosity worn, then the setae pits can be seen), surface of tubercles convex or flattened, their shape rounded, elongate, or polygonal, many of the tubercles

transversely confluent; no subapical umbone; reflexed elytral margins with or without a row of small tomentose tubercles in more than apical half. Metasternal depression twice as wide as long. Tarsal segments on middle and hind legs smooth all around, not ridged. Male with hind tibiae straight on inner margin, the setae sparser than in *texanus*.

DISTRIBUTION: Central and southern New Mexico, western Texas; northern Chihuahua in Mexico (see map, fig. 21).

SPECIMENS EXAMINED: A total of 32 from 15 localities, only four of the specimens being from Mexico (see Appendix).

DISCUSSION: This species and the following (*texanus*) have the wings proportionately smaller than in any of the preceding species, but they are not so small as in the two species

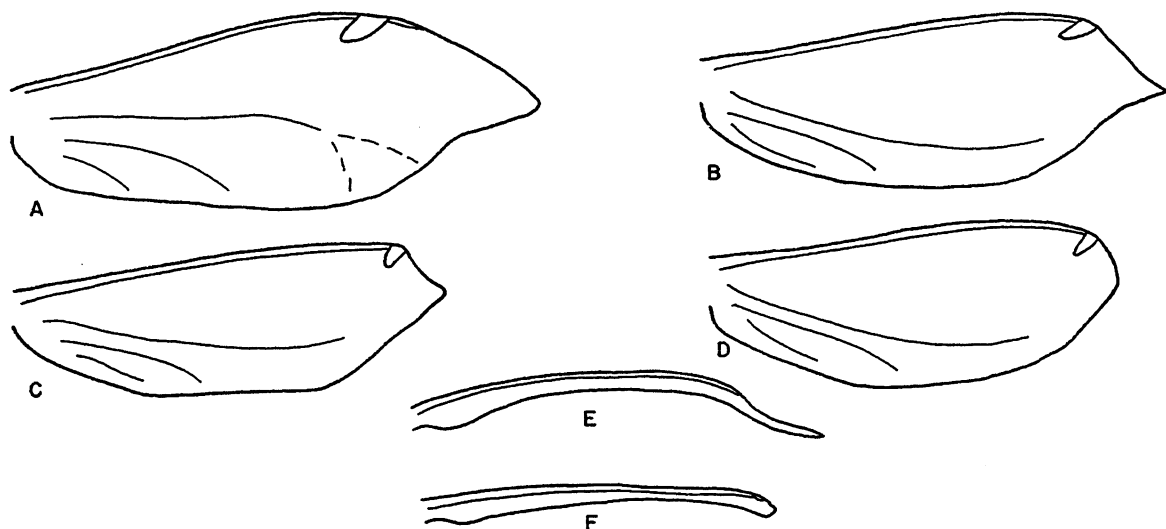


FIG. 22. Diagram of reduced and vestigial wings in *Trox*, showing position of pterostigma. A. *T. nodosus*. B-D. *T. texanus*. E. *T. umbonatus*. F. *T. scutellaris*. The veins shown are much simplified.

scutellaris and *umbonatus*, in which the wing is reduced to a mere ribbon a millimeter or so in width (fig. 22). The wing in *nodosus* and *texanus* is scarcely more than half of the size of the wing in preceding members of the group, and probably is too small to permit of flight. A normal wing (as in *asper*, *scabrosus*, *monachus*, *punctatus*, etc.), when spread, is at least a third longer than the elytra and about one-fourth longer than the entire beetle, whereas in *nodosus* and *texanus* it is visibly shorter than the beetle and no longer than the elytra. The opaque dark spot (pterostigma) is situated in fully winged species at about the middle of the costal margin, whereas in *nodosus* and *texanus* it is at or near the apex. The wing in these two species is also narrower than in others, and some of its veins are but faintly indicated.

Although males of *nodosus* can be distinguished from those of *texanus* by their straight, not concave, hind tibiae, the females are virtually indistinguishable externally, and extraction of the wing is the only certain means of identification in most instances. Robinson was the first to discover these wing differences between the two species. In the material at hand the proportion in per cent of the wing length to the total length (measured from the front of the pronotum to the apex of the elytra) in eight specimens

of *nodosus* (three males, five females) is 76.4–88.8, average 85.9, and in eight specimens of *texanus* (four males, four females) is 50.0–61.1, average 56.0. The measurements were found not to vary sexually. The wing in *nodosus* is not only longer, but it has the apex more constricted and prolonged and the pterostigma farther from the apex. The distance from this opaque spot to the apex comprises about a third of the costal margin of the wing in *nodosus*, whereas in *texanus* the distance is much foreshortened and comprises only about a fifth or less of the costal margin. The pterostigma is also darker in color in *nodosus* and clearly marked, but pale and often feebly indicated in *texanus*. A further difference not mentioned by Robinson is that the wing is variable in shape in *texanus* (this is not sexual), some individuals having the apex truncate, some having it rounded, some slightly constricted and prolonged but blunt, some having it nearly the same shape as in *nodosus* (fig. 22B–D). When the apex of the wing is truncate in *texanus* there is no projection of the costal margin beyond the pterostigma and no folding of the apex. In *texanus*, then, the wing appears to be becoming more obsolete than in *nodosus*, and to be approaching the condition found in *umbonatus* and *scutellaris*.

Additional differentiating characters be-

tween the two species as given by Robinson include the humeral umbone which is somewhat more prominent in *nodosus* (both species are necessary for comparison), and the elytral tubercles which are "more or less elongate" in *texanus*. Loomis, however, in his description of *oligonus* (= *texanus*) found these tubercles "rounded," and in fact they are extremely variable in both species.

Although none of the 32 specimens of *nodosus* examined was taken in extreme southeastern Texas where the majority of *texanus* occur, at least three specimens of the latter are reported from within the range of *nodosus*. One of these, a male from Estancia in central New Mexico, I have seen; the others are two paratypes of *oligonus* (= *texanus*) from Dawson and El Paso counties in western Texas, counties from which I have seen males of *nodosus*. It is possible, however, that Loomis may have had both species among his paratypes, and these two specimens should be seen and, if they are females, have their wings extracted.

The male genitalia of *nodosus* seem to be essentially the same as those of *texanus* and *scabrosus* (fig. 26C); none of the three has the internal sac sclerotized. The median lobe usually has a shallow groove or grooves in the center dorsally.

The four specimens from Samalayuca, Chihuahua, are the first to be reported from Mexico; this locality is not very far south of the New Mexico border.

HABITS: No information.

Trox texanus (LeConte)

Figures 21, 22B-D, 23B, 26C

Omorgus texanus LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 214 (type, Eagle Pass [Maverick County], Texas; lectotype, female, designated by Robinson, 1940, in Museum of Comparative Zoölogy).

Omorgus suturalis LECONTE, 1854, *ibid.*, vol. 7, p. 214 (type, Texas; lectotype, male, designated by Robinson, 1940, in Museum of Comparative Zoölogy). New synonymy.

Trox oligonus LOOMIS, 1922, Jour. Washington Acad. Sci., vol. 12, p. 133, fig. 1 (type, San Diego, Texas, in United States National Museum). New synonymy.

DIAGNOSIS: Elytra tuberculate, mostly bare. The male differs from all species in the

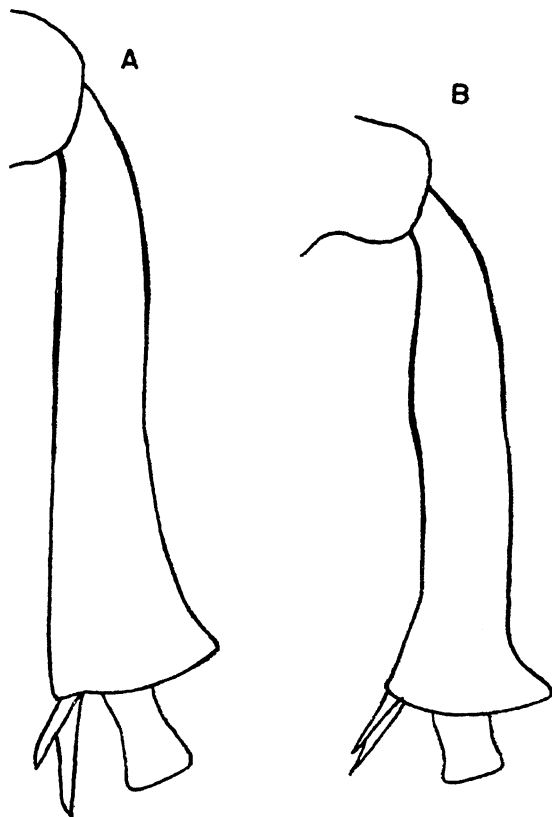


FIG. 23. Hind tibiae of two males. A. *Trox nodosus*. B. *T. texanus*.

genus in North America by having the hind tibiae slightly bent and concave within, the inner margin near the apex sinuate and bristling with very dense dark setae (fig. 23B). Both sexes differ from those of *umbonatus* and *scutellaris* as stated under *nodosus*, and females differ from those of *nodosus* only in the shorter, narrower wing (fig. 22B-D).

DESCRIPTION: (See also characters of group.) Length, 15 to 19 mm. Wings reduced, length from 7 to 11 mm. on eight specimens ranging in length from 14 to 19 mm. All other characters the same as in *nodosus* (see above), except for the following: Antennal scape reddish, not dark, in one of 21 specimens examined. Male with hind tibiae excavate or depressed on inner face, inner margin emarginate before apex, the setae, especially towards apex, denser and longer than in *nodosus*.

DISTRIBUTION: Extreme southern and southeastern Texas, western Texas [?], central New Mexico. Nuevo Leon in Mexico

(Robinson, *in litt.*); Tamaulipas. (See map, fig. 21.)

SPECIMENS EXAMINED: A total of 24 from 12 localities (see Appendix).

DISCUSSION: This appears to be the only one of the *suberosus* group in which the hind tibiae are modified in the male sex, a character not mentioned by previous authors. In the groups of smaller species there is also but one species (*hamatus*) in which the hind tibiae differ in the male (the hind tibiae are greatly enlarged and flattened).

I have examined the lectotypes and co-types of LeConte's *texanus* and *suturalis* and find that the lectotype of the latter is the male of *texanus*. One male and two female paratypes of *oligonus* Loomis from San Diego, Texas, have been examined by me and by Robinson (who also examined the type), and I agree with Robinson (*in litt.*) that this name also is a synonym of *texanus*. There is some doubt about the identification of two of the other paratypes (not seen) which come from the same localities in western Texas as two specimens of *nodosus*, and may probably prove to be that species.

The wings, genitalia, and other characters are discussed under the preceding species (*nodosus*).

HABITS: No information.

***Trox umbonatus* (LeConte)**

Figures 22E, 26F

Omorgus umbonatus LECONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 214 (type, Texas; lectotype, male, designated by Robinson, 1940, in Museum of Comparative Zoölogy).

Trox platycyphus LOOMIS, 1922, Jour. Washington Acad. Sci., vol. 12, p. 133, fig. 1 (type, southern Texas, in United States National Museum).

Trox (Omorgus) confluentus ROBINSON, 1941, Trans. Amer. Ent. Soc., vol. 67, p. 134, fig. 10 (type, male, La Sal Mountains, San Juan County, Utah, in collection of Mark Robinson). New synonymy.

DIAGNOSIS: Elytra tuberculate, mostly bare. Differs from all other North American species in the genus except *scutellaris* by being virtually wingless, therefore lacking the humeral umbone, and by having the scutellum more deeply depressed. Very close to *scutellaris*, but differs by having the elytra more parallel, not ovate, their lateral margins less reflexed, the tubercles larger, trans-

versely so confluent as virtually to obliterate the smaller rows, more strongly alternating in size, not so evenly matched as in *scutellaris*; median pair of tubercles at apex of pronotum convex or flat behind, scarcely depressed in front, not entirely concave within; differs further in the color of the antennae and in the male genitalia.

DESCRIPTION: (See also characters of group.) Length, 14 to 19 mm. Wings vestigial, length from 9 to 10 mm. on three specimens from 15 to 16 mm. long, wing only about 1 mm. broad. Head bituberculate. Antennal scape with fulvous hairs, club fulvous to dark red. Pronotum with ridges and tubercles bare, the rest tomentose, apical depressions feeble, not extending to base of anterior median tubercles, other depressions well marked; lateral margins not incised, but may be gently emarginate in front of base. Elytra with humeral umbone lacking, intervals about equally elevated and tuberculate throughout, the odd intervals with longer and broader tubercles than the even intervals, tubercles contiguous, black, and shining, with only occasional small patches of tomentosity behind, surface of tubercles flattened, the shape variable, often polygonal or elongate, and irregular because of the strong transverse coalescence; no subapical umbone; reflexed elytral margins with no setae or tubercles. Metasternal depression twice as wide as long. Tarsal segments on middle and hind legs ridged and rugose, especially at base, but often these segments so tomentose that they appear smooth.

DISTRIBUTION: Utah, Arizona, New Mexico (Robinson, *in litt.*), and Texas; the states of Chihuahua, Coahuila, Tamaulipas, and Nuevo Leon in northern Mexico.

SPECIMENS EXAMINED: A total of 52 from 14 localities (see Appendix), about a third of the specimens being from Mexico.

DISCUSSION: This species and the following (*scutellaris*) form a separate group, although at first glance they resemble *nodosus* and *texanus*, all four species occurring in the same general region of the southwestern United States and in northern Mexico. *Trox scutellaris* and *umbonatus* are the only species in North America that have the wing reduced to a narrow strip not more than 1 mm. wide and with all but the costal vein lacking, and

they have proportionately much larger and broader male genitalia than any others of the group. The scutellum is also proportionately smaller than in other species and is deeply sunk between the tuberculate inner basal margin of each elytron. These two species resemble *nodosus* and *texanus* and differ from other species in the short metasternum, with the median depression much wider than long, and in the obliteration or near obliteration of the elytral umbone at the humerus. They differ from *nodosus* and *texanus* as stated in the diagnosis of *nodosus*.

The tubercles on the elytra in *umbonatus* are so flattened and so confluent, both transversely and longitudinally, that their tubercular appearance is virtually lost except at the base of the elytra. Often there is so much coalescence on the disc that the "tubercles," or raised black areas, extend without a break across four or five intervals. The wing in three specimens has only a slightly thickened area where the pterostigma should be, and the costal margin of the wing extends beyond this area in a narrow curved streamer (fig. 22E). In *scutellaris* this extension is only half, or less, as long.

The male genitalia of *umbonatus* (fig. 26F) are strongly constricted in apical third as are those of *scutellaris*, but much more abruptly than in that species, and the lateral lobes meet more closely across the median lobe than they do in *scutellaris*. The internal sac is not sclerotized.

Robinson (1940) placed *platycyphus* Loomis (type locality, southern Texas) in synonymy with *umbonatus*. I have examined four paratypes of *platycyphus* from Cotulla, Texas, the lectotype and cotypes of *umbonatus*, and also the specimen from Arizona that Robinson compared with the types of both forms, and I agree with Robinson that they are the same species. I also consider *confluentus* Robinson from Utah a synonym. Robinson says that the median lobe (his "aedeagus") in *confluentus* "is longer and is not concave dorsally as in *umbonatus*," but I find that the type and paratype of *confluentus* do have slight evidence of a concavity at the dorsal apex, and that the depth of the concavity appears to vary in other males of *umbonatus*. This is not the only variation in the genitalia; the shoulder of the lateral lobes at

the constriction sometimes has a sharp transverse ridge, sometimes a feeble one. The "even more confluent" elytral tubercles of *confluentus* fall within the range of variation present in *umbonatus*, some specimens from Nuevo Leon, Mexico, having as much coalescence as the type of *confluentus* from Utah. This species has not been reported from Mexico previously.

HABITS: The only indication of the habits of this species is a notation on four specimens from Laredo, Texas, that they were collected on a dead coyote.

Trox scutellaris Say

Figures 2A, 22F, 24, 26G

Trox scutellaris SAY, 1823, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 238 (type, "Upper Platte," here restricted to New Mexico).

DIAGNOSIS: Elytra tuberculate, mostly bare. Differs from all other species in the genus in North America except *umbonatus* by being virtually wingless, therefore lacking the humeral umbone. Differs from *umbonatus* by having the elytra ovate, their lateral margins more reflexed, the tubercles neither so large nor so confluent and all approximately of equal size on all intervals; median pair of apical tubercles on pronotum depressed within, not mostly flat or complanate; antennae darker throughout, male genitalia of different shape.

DESCRIPTION: (See also characters of group. Length, 13 to 19 mm. Wings vestigial, length from 5 to 8 mm. on five specimens ranging from 13 to 18 mm. in length, wing only about 1 mm. wide. Head bituberculate. Antennal scape with black hairs, club black, occasionally brown or dark red. Pronotum with ridges and tubercles bare, depressions tomentose, well marked, lateral margins scarcely emarginate in front of base. Elytra with humeral umbone lacking, intervals about equally elevated and tuberculate throughout, odd and even intervals in general with tubercles of more or less the same size but sometimes those on odd intervals larger; tubercles contiguous, black, and shining, with only occasional small patches of tomentosity behind, surface of tubercles flattened or convex, their shape variable but usually more or less round; no subapical umbone; reflexed elytral margins with no

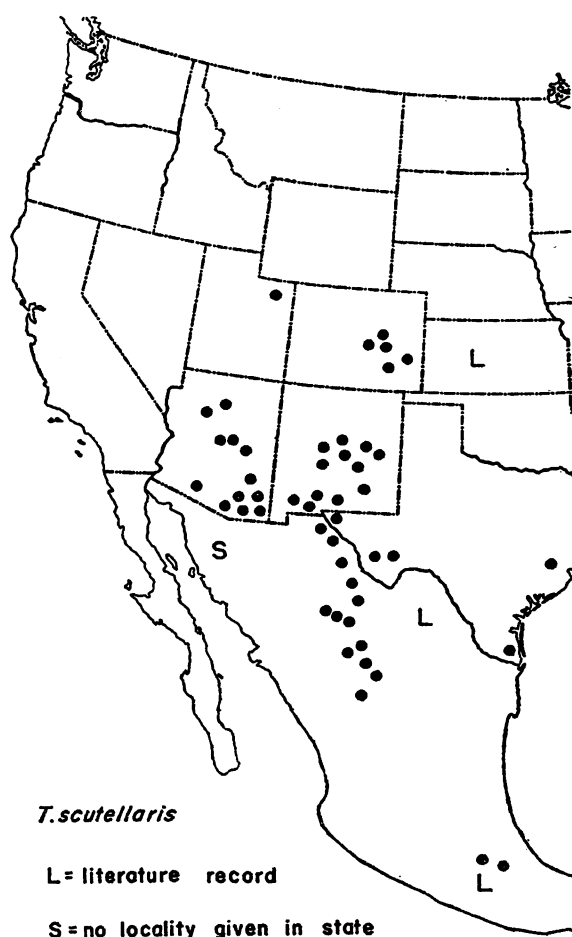


FIG. 24. Distribution of *Trox scutellaris*. Other species with approximately the same distribution are *plicatus* and *umbonatus*.

setae or tubercles. Metasternal depression twice as wide as long. Tarsal segments on middle and hind legs ridged and rugose, especially at base.

DISTRIBUTION: Kansas (Robinson, *in litt.*) and southwestern United States. In Mexico the states of Sonora, Chihuahua, Coahuila (Robinson, Bates), and Durango in the north, and Puebla, Distrito Federal, and Morelos (Harold) in the south (see map, fig. 24).

SPECIMENS EXAMINED: A total of 267 from 60 localities in the above regions. More than a third of the specimens come from Mexico.

DISCUSSION: Although the statements made in the key and diagnoses (that the elytral tubercles are more or less the same size in *scutellaris* and more regular in shape

than those of *umbonatus*) apply to the majority of individuals, there are a number of exceptions in the material studied. Some of the tubercles of the odd intervals are occasionally at least twice as large as those on the even intervals and suture (as is the general rule in *umbonatus*); sometimes also there are one, perhaps two or three, much smaller tubercles on an interval on which the rest of the tubercles are about equal in size. However, even in such individuals, the elytra do not show the great contrast between large and small tubercular intervals as they do in *umbonatus*, and the tubercles are not quite so flat; often they are convex. A long series of 29 specimens from Cuevas Matamoros, Mexico, have the elytra quite typical and quite uniform.

The color of the antennae is constant, only an occasional individual having the club and/or the hairs on the scape reddish instead of black.

The male genitalia have the constriction at about apical third gradual (fig. 26G), not abrupt as in *umbonatus*, and the inner margin of the lateral lobes broadly exposes the median lobe. The apex of the median lobe ventrally is much narrower than in *umbonatus*; dorsally it is deeply concave. The genitalia were examined on 28 males from Arizona, Texas, New Mexico, and Mexico; in two or three specimens the dorsal surface of the median lobe is somewhat alutaceous, but it is shining in all others. A groove, feeble in some, stronger in others and varying in length, is usually visible in the center of the lobe, and in two specimens (New Mexico and Arizona) there are definite hollows or depressions on the dorsal surface, but these appear to be caused by mechanical means. The internal sac is not sclerotized.

The wing is shown in figure 22F as compared with the wing of *umbonatus* (fig. 22E). The slightly thickened area near the apex represents the pterostigma; the apex is sometimes folded over.

HABITS: Ten specimens from Yerbanis, Durango, were taken under the dry, whitened leg bones of a dead horse; some were inside the hoof. A series from Cuevas Matamoros in Chihuahua were collected from under a dead cow. No published data on the habits of this species have been seen.

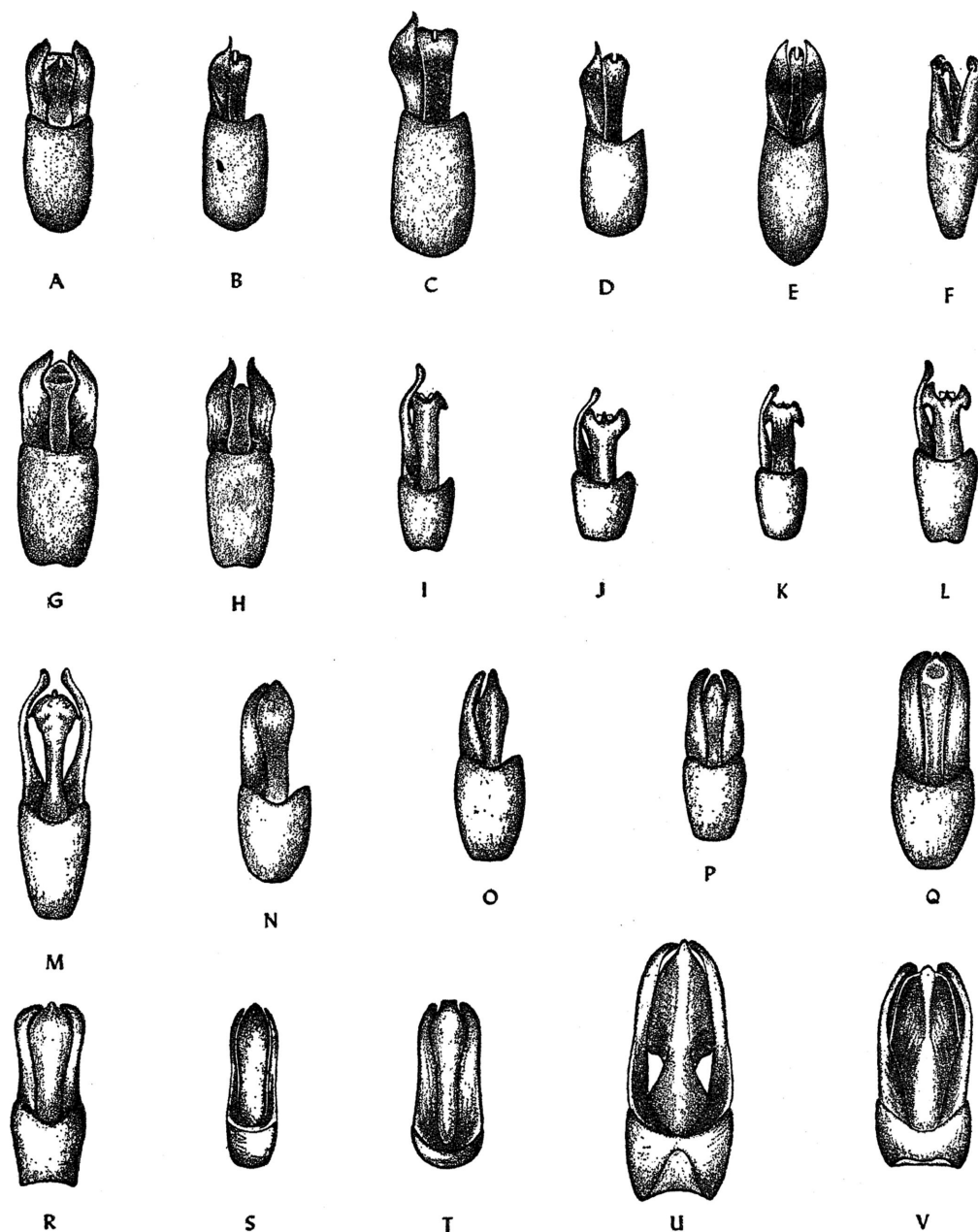


FIG. 25. Male genitalia of *Trox*, dorsal views except F. In some cases lateral lobe removed on one side to show shape of median lobe. A. *T. scaber*. B. *T. aequalis*. C. *T. affinis*. D. *T. fascifer*. E. *T. striatus*. F. *T. laticollis*, three-quarter view, ventral. G. *T. atrox*. H. *T. hamatus*. I. *T. spinulosus*. J. *T. foveicollis*. K. *T. terrestris*. L. *T. insularis*. M. *T. frontera*. N. *T. sonorae*. O. *T. contractus*. P. *T. robinsoni* and *T. plicatus*. Q. *T. gemmulatus* and *T. acanthinus*. R. *T. tuberculatus*. S. *T. variolatus*. T. *T. sordidus*. U. *T. capillaris*. V. *T. unistriatus*.

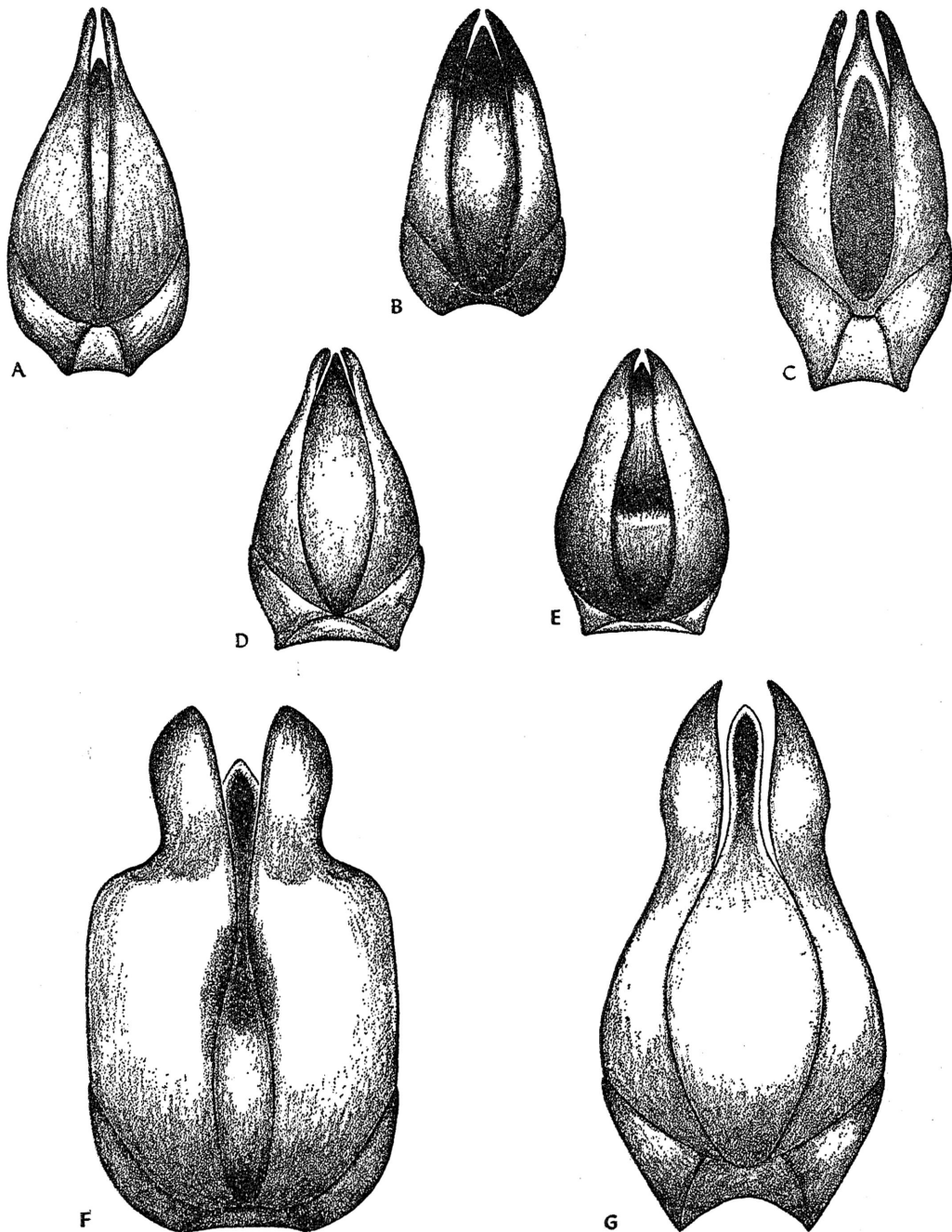


FIG. 26. Male genitalia of *Trox* of *suberosus* group, dorsal views. A. *T. suberosus*. B. *T. tytus*. C. *T. scabrosus*, *T. nodosus*, and *T. texanus*. D. *T. rubricans*. E. *T. tomentosus*. F. *T. umbonatus*. G. *T. scutellaris*.

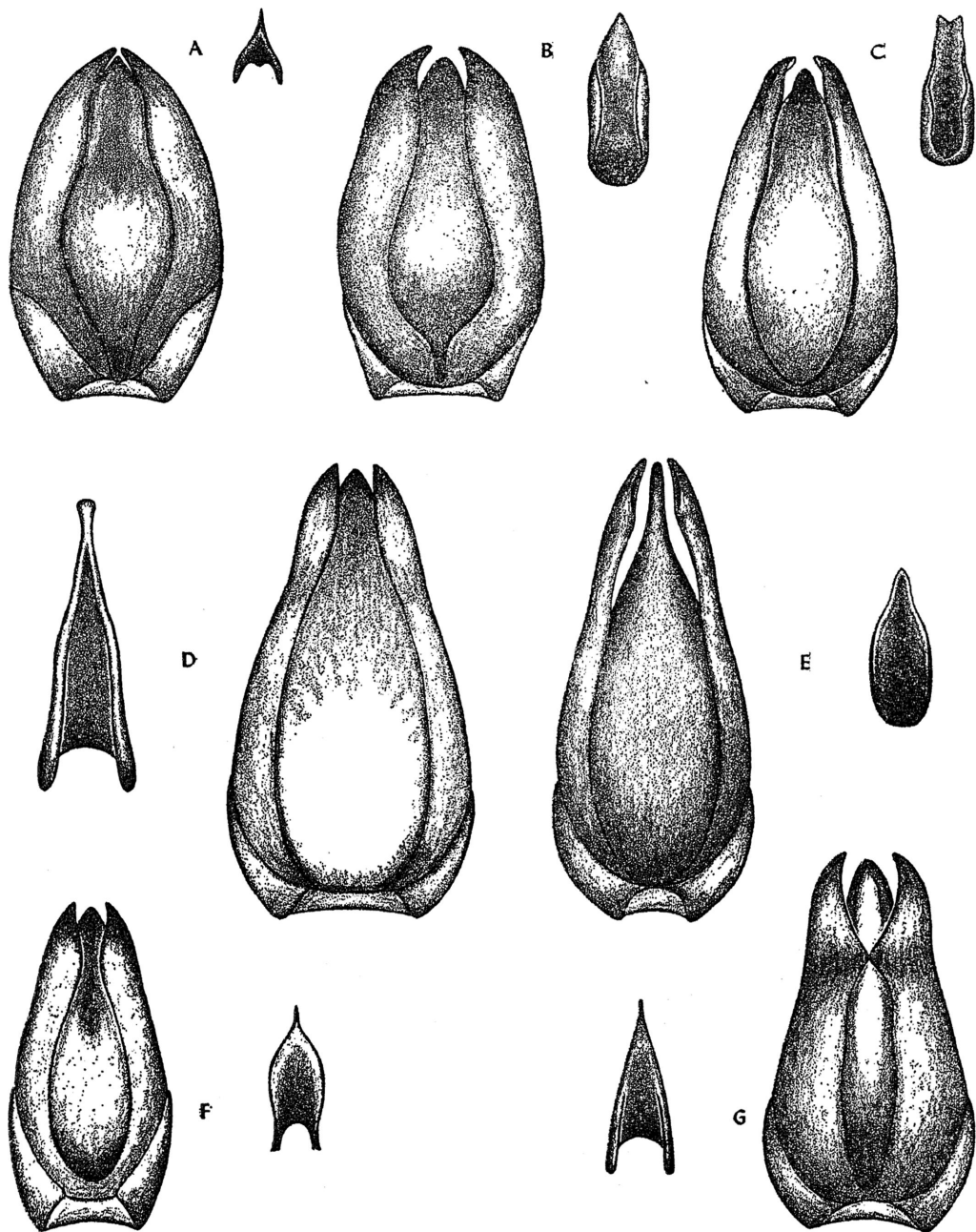


FIG. 27. Male genitalia of *Trox* of *suberosus* group, dorsal views, with sclerotized internal sacs. A. *T. carinatus*. B. *T. fuliginosus*. C. *T. monachus*. D. *T. inflatus*. E. *T. tessellatus*. F. *T. punctatus*. G. *T. asper*.

APPENDIX

SPECIMENS EXAMINED

SPECIMENS EXAMINED are listed below for 23 of the 41 species. For species with fewer than five localities (*striatus*, *insularis*, *frontera*, *acanthinus*, *loxus*, and *tomentosus*) the specimens are listed in the text. For species with 60 or more localities (*scaber*, *aequalis*, *atrox*, *hamatus*, *sonorae*, *plicatus*, *variolatus*, *unistriatus*, *suberosus*, *monachus*, *punctatus*, and *scutellaris*) the specimens examined are not listed anywhere, but the distribution is given in more detail in the text and on the maps. Counties are given only where considered significant, as in the state of Texas.

Trox affinis Robinson

New York: 1 ♂; Bear Mountain, May, 1 ♂; New Windsor, 1 ♀. *New Jersey*: Moorestown, May-Aug., 5 ♂ (type and paratypes), 5 ♀ (paratypes); Rancocas Park, July, 4 ♂ (paratypes). *Pennsylvania*: Cupola, June, 2 ♂, 5 ♀. *Maryland*: Plummer's Island, May, 1 ♂, 2 ♀. *Kansas*: 1 ♀. *Texas*: 1 ♂, 1 ♀. *Louisiana*: New Orleans, Oct., 1 ♀.

Trox fascifer LeConte

UNITED STATES: *Oregon*: Medford, June, July, 2 ♂, 1 ♀, 2; Corvallis, 1 ♂, 1 ♀; Nashville, 1 ♀. *California*: 1 ♂; Contra Costa Co., June, 1; Northfork, July, 1 ♀; Murphys, May, 1 ♀; San Francisco, 1 (type).

CANADA: *British Columbia*: Duncan, 1 ♀; Vancouver, 1 ♂.

Trox laticollis LeConte

Massachusetts: Framingham, May, 1 ♂, 1 ♀, 3; Natick, May, June, 17. *New York*: 1 (type); Lancaster, 1. *Pennsylvania*: Pocono Mountains, June, 1 ♀; Easton, Apr., 1. *Iowa*: Ames, Apr., May, 3.

Trox spinulosus

Trox spinulosus simi Robinson

New Jersey: Moorestown, May, 1 ♂ (type); Stow Creek, May, 1 ♂ (paratype); Jericho, July, 1 ♂ (paratype). *Pennsylvania*: Delaware Co., July 1 (paratype); Glenolden, June, 1 ♂; Darby, May, 1 ♂, 1 ♀, 2; Broomall, May, 26. *Maryland*: Sparrows Pt., July, 1 ♂, 4 ♀; Plummer's Island, June, 1 ♀. *North Carolina*: 1 ♀.

Trox spinulosus spinulosus Robinson

Michigan: La Salle, Sept., 1 ♂ (type), June, Sept., 9 ♂, 12 ♀ (paratypes). *Ohio*: 4 ♂; Clermont Co., June, 1 ♂; Glen Este, July, 4 ♂, 1 ♀. *Indiana*:

Stilesville, June, 1 ♀. *Illinois*: Urbana, Apr., 1 ♀; Chicago, 1 ♀; Pittsfield, July, 3 ♂. *Kentucky*: Frankfort, May, 2 ♀. *Tennessee*: 1 ♂, 2 ♀; Elmwood, 1 ♂, 1 ♀; Nashville, July, 1 ♂, 2. *Missouri*: 1 ♂; St. Louis, June, July, 7 ♂, 8 ♀; Columbia, 2 ♂, 2; St. Charles, June, 1 ♂; Allenton, July, 2 ♂, 1 ♀; Creve-Coeur, May, 1 ♂, 1 ♀. *Iowa*: 1 ♂, 1 ♀; Iowa City, 1 ♂, 3 ♀; Mt. Pleasant, June, 1; Ames, May, 1 ♀; Lake Okoboji, July, 1 ♂. *Nebraska*: Fort Omaha, May, 1 ♂. *Kansas*: 2 ♀; Onaga, May, 2 ♂; Atchison, May, 1 ♂; Wichita, 2 ♂; Toronto, 1 ♀; Lawrence, 2 ♂, 1 ♀; Medora, June, 1 ♂; Wallace Co., 1 ♂; Douglas Co., June, July, 1 ♂, 3 ♀. *Oklahoma*: Tulsa, June, 1 ♀. *Louisiana*: New Iberia, Jan., 1 ♀.

Intermediates (*spinulosus* × *dentibius*)

Texas: 1 ♂; Archer Co.: Bunde, Apr., 7 ♂, 6 ♀, 7; Menard Co.: Menard, May, 10 ♂; Kerr Co.: Kerrville, Feb.-Aug., 46 ♂; McLennan Co.: Waco, 1 ♂; Lee Co.: Fedor, 1 ♂, 2 ♀; Brazos Co., Apr., 1 ♂; Hidalgo Co.: Weslaco, 1 ♂; Uvalde Co.: Sabinal, Oct., 1 ♂; Concan, 1 ♂; Cameron Co.: Brownsville, June, July, 1 ♂, 1 ♀; Val Verde Co.: Del Rio, 1 ♂.

Trox spinulosus dentibius Robinson

UNITED STATES: *Arizona*: Huachuca Mts.: 1 ♂, 1 ♀ (paratype), 2, Carr Canyon, June, 1 ♂, 4 ♀, 4, Ramsay Canyon, July, 1 ♀, 4, Sunnyside, Garden Canyon, 1; Chiricahua Mts.: June, 2 ♀, 12, Cave Creek, Chiricahua National Monument, July, 2; Baboquivari Mts.: 2, Baboquivari Canyon, 6, Browns Canyon, 2; White Mts.: 2; Santa Rita Mts.: 13, June, 1 ♀, Madera Canyon, 6; Santa Catalina Mts.: Peppersauce Canyon, 3, Sabino Basin, July, 2; Tumacacori Mts.: Calabasas Canyon, 1; Douglas, 2; Nogales, July, 1 ♂, 1 ♀, 2; Patagonia, 4 ♂, 2 ♀, 19; Jerome, 1; Globe, 2 ♂, 38; Ruby, 1; Arivaca, 1; Mayer, 1; base of Pinal Mts., Aug., 1; San Carlos Lake, Sept., 1; Oracle, 1 ♂, 1; Ft. Grant, 2; Prescott, Aug., 1; Elgin, July, 1; Cochise Co.: Palmerlee, Miller Canyon, 1 ♂ (type), 1. *New Mexico*: Hope, 2; Organ, 2; Alamogordo, 1; Silver City, 1 ♂. *Texas*: Brewster Co.: 3; Alpine, Aug., 7 ♂, 13 ♀, 16; Big Bend, Chisos Mts., June, 5, July, 10, Aug., 9; Jeff Davis Co.: Fort Davis, 5; Davis Mts., June, July, 1 ♂, 3 ♀, 4.

MEXICO: *Baja California*: Triunfo, 1 ♂. *Chihuahua*: Valle de Olivos, July, 4; Samalayuca, June, 5; Primavera, 2; Catarinas, July, 10; San Jose Babicora, July, 1; Canon Prieto near Primavera, July, 1 ♀, 1; Santa Clara Canyon, near Par-

rita, June, 2; Santa Barbara, May, 2, July, 3; 63 miles west of Santa Barbara, July, 6; Huejotitlan, July, 1. *Coahuila*: La Gloria, south of Monclova, Aug., 1 ♀. *Durango*: Encino, July, 7; Durango, Aug., 2; San Juan del Rio, July, 1 ♂, 1 ♀, 5. *Michoacan*: Mazamitla, July, 1 ♂. *Morelos*: Cuernavaca, 1 ♂, 1 ♀.

Trox foveicollis Harold

Massachusetts: Springfield, 1 ♀. *Pennsylvania*: Delaware Co., May, 1 ♂; Bucks Co., May, 1 ♂, 1 ♀, 1; York, June, 1 ♀. *New York*: West Point, 1 ♀. *New Jersey*: 1; Lakewood, 1 ♀; Riverton, June, 1 ♂; Bayside, July, 1 ♂; Riverside Hts., July, 1 ♂; Marshalltown, Apr., 1 ♂; Moorestown, June, 7 ♂, 4 ♀, 7; Atsion, June, 1 ♂, 5 ♀; Burlington Co., Aug., 2 ♂, 3 ♀; Centerton, July, 1 ♂, 1 ♀; Riverside, July, 1 ♂, 1 ♀; Rancocas Park, Apr., July, 2 ♀. *District of Columbia*: 8. *Maryland*: 3 ♂, 1 ♀; Baltimore, 1 ♂; Catonsville, June, 1 ♂; Chesapeake Beach, May, 1 ♂, 1 ♀; Sparrow's Pt., July, 1 ♀. *Virginia*: Falls Church, June, 1 ♂, 1; University of Richmond, May, 1 ♀; Ivy, June, 1 ♀. *North Carolina*: 1 ♂; Raleigh, Mar.-June, 7 ♂, 26 ♀, 5. *South Carolina*: 3 ♀; Camden, 1 ♂. *Florida*: 1 ♀; Miami, Aug., 1 ♂, 4 ♀; Punta Gorda, Mar., Apr., 4 ♂, 2 ♀. *Ohio*: Columbus, Sept., 1 ♂. *Indiana*: Michigan City, July, 1 ♂, 2 ♀; Orleans, July, 1 ♀; Montague, Apr., 1 ♂; Lafayette, June, 1 ♂, 2 ♀; Marshall Co., July, 1 ♀. *Illinois*: Pittsfield, Aug., 1 ♂. *Missouri*: 1 ♂, 1 ♀; St. Louis, Mar., May, July, Aug., 21 ♂, 14 ♀; St. Joseph, June, 1 ♀; Ranken, June, 1 ♂; Columbia, May to Aug., 2 ♂, 1 ♀; Allenton, 1 ♂. *Arkansas*: 1 ♀; Hope, 1 ♂ (type of *aciculeatus*), May, 1 ♀ (paratype of *aciculeatus*), July, 1 ♂, 2. *Kansas*: 1 ♀; Onaga, 1 ♂; Osage Co., June, 1 ♂; Lawrence, July, 1 ♀; Douglas Co., 2 ♂. *Oklahoma*: Jackson Co., June, 1 ♂; Latimer Co., July, 1 ♀; Wichita National Monument, June, 1 ♂. *Texas*: 2 ♀; Brazos Co., Mar., 1 ♂, 1 ♀; Victoria, Mar., 1 ♂. *Louisiana*: Vernon, 1 ♀; Vowel's Mill, 1 ♀; Pearl River, Apr., 2 ♂, 1 ♀. *Mississippi*: Holly Springs, 1 ♀.

Trox terrestris Say

Massachusetts: Nantucket, Aug., 1 ♀. *Pennsylvania*: Downingtown, May, 1 ♂. *New York*: Rockaway, Aug., 1 ♂, 1 ♀; Sunken Meadow State Park, Long Is., June, 2 ♀. *New Jersey*: Ocean City, June, 1 ♂, 1 ♀; Rancocas Park, May-Aug., 7 ♂, 2 ♀, 7; Brown's Mills, Aug., 1 ♂, 2 ♀, 1; Lakehurst, Mar., Apr., 2 ♂, 3 ♀, 14, Sept., 1 ♂; Ocean Co., 1 ♂; Lahaway, Aug., 1; Retreat, May, 1 ♀; Speedwell, Aug., 1 ♀. *North Carolina*: Southern Pines, May, Apr., 6 ♂, 11 ♀; Raleigh, June, 1; Lake Matamuskeet, 1 ♀. *South Carolina*: 3 ♂; Swansea, 1; Beaufort, 5. *Georgia*: 2 ♂, 2; Newton, Aug., 1 ♀. *Florida*: 10; Miami, Aug., 2 ♂, 2 ♀, 4;

Dunedin, Feb., Mar., 2; Tarpon Springs, 1; Interlachen, Mar., 1 ♀; North Smyrna, Mar., 1 ♂; Enterprise, 2; St. Augustine, 8; MacDill Field, Tampa, Mar., 2 ♂; Winter Park, 6; Sanford, 2; Crescent City, 1; Kissimmee, 2; Punta Gorda, Mar., 2 ♂, 1 ♀; Melbourne, Dec. 1; Pensacola, Dec., 1 ♂; Fort Myers, Mar., 1; Palatka, 1; Charlotte Harbor, 3; Lake Placid, Jan., 1 ♂, 17; Ormond, 1; Gainesville, Sept., 1 ♀. *Alabama*: Auburn, 1 ♂. *Mississippi*: Brooklyn, Mar., 1 ♀.

Trox contractus Robinson

Texas: 1 ♂ (paratype), 10 ♂; Comal Co.: New Braunfels, 1 ♂ (type); Blanco Co.: Cypress Mills, Aug.-Oct., 1 ♂, 9 ♀; Bee Co.: Beeville, Nov., 1 ♂; Taylor Co.: Abilene, Jan., 1 ♂; Dimmit Co.: Jan. to Mar., 3 ♂, 1 ♀; Lavaca Co.: Yoakum, Feb., 1 ♂; Val Verde Co.: May, 1 ♂; Bexar Co.: San Antonio, 1 ♂; Cameron Co.: Esperanza Ranch, Brownsville, June, 2 ♂; Menard Co.: Menard, Apr., 3 ♂.

Trox robinsoni, new species

The following specimens are all paratypes.

UNITED STATES: *Michigan*: Douglas Lake, July, 1 ♂, 1 ♀. *Iowa*: Dickinson Co., 2 ♀; Burlington, 1. *South Dakota*: 1 ♂; Volga, 3 ♂, 3 ♀. *Nebraska*: Lincoln, May, 1 ♂, 1 ♀; Meadville, June, 1 ♀. *Kansas*: West Kansas, 3; Wichita, 2 ♂, 3 ♀; Dodge City, 3 ♂, 4 ♀; McPherson Co., 1 ♀; McPherson, 1 ♂; Ellis, 1 ♂; Lakin, Sept., 1 ♀; Decatur Co., 1 ♀; Harvey Co., Aug., 1 ♂, 1 ♀; Lawrence, Apr., 1 ♀; 13 miles south of Meade, 1 ♂; Kendall, 1 ♀. *Colorado*: 1 ♂, 1 ♀, 1. *Oklahoma*: Weatherford, Apr., 1 ♂; Logan Co., Mar., 1 ♂, 2 ♀, 1. *Texas*: 19 ♂, 18 ♀, 5; Bee Co.: Beeville, Nov., Dec., 2 ♂, 2 ♀, 1; Bexar Co.: San Antonio, June, 1 ♀, Nov., 1 ♂, 2 ♀; Blanco Co.: Cypress Mills, Oct., 1 ♂; Round Mt., 1 ♂, 1 ♀; Brazos Co.: Jan., 1 ♀, Apr., 1 ♂, Sept., 2 ♂, 1 ♀; College Station, Mar. to June, 5 ♂, 8 ♀; Comal Co.: New Braunfels, Apr., 1 ♀; Dimmit Co.: May, 1 ♂; Dallas Co.: Feb., 1 ♂, Dallas, Oct., Nov., 10 ♂, 7 ♀, 19; Harris Co.: May, June, 3 ♂, 2 ♀; Howard Co.: Big Springs, 1 ♂; Uvalde Co.: Sabinal, Oct., 1 ♀; Victoria Co.: Victoria, Mar., 1 ♂, 1 ♀; Archer Co.: Bunde, 1 ♀; Travis Co.: Austin, Nov., 4 ♂, 3 ♀, 1; Kerr Co.: Kerrville, Mar. to Nov., 34 ♂, 2 ♀; Menard Co.: Menard, Apr. 13 ♂.

CANADA: *Alberta*: Edmonton, June, 1 ♂. *Manitoba*: Aweme, May, June, July, 2 ♂, 3 ♀.

Trox gemmulatus Horn

UNITED STATES: *California*: 38; San Diego, 1 (lectotype), 2 ♂ (cotypes), 64; Los Angeles, 4; Poway, 2; Claremont, 8; Fresno, 5; Pomona, 1; Placentia, 12; Riverside, 10; Mission Valley, 9; Chula Vista, 7; Yerba Linda, 4; Concord, 2; Or

ange County, 1; Dalton Canyon, 10; Lakeside, 6; 7 miles west of San Bernardino, 4. *Arizona*: Tucson, 6. *New Mexico*: Bent, 3. *South Dakota*: 1.

MEXICO: *Baja California*: Ensenada, 22.

Trox tuberculatus De Geer

New York: Jericho, May, June, 1 ♂, 2 ♀, 1. *New Jersey*: 1; Atlantic City, 1. *Virginia*: Hawlin, Apr., 1; Fredericksburg, Apr., 10; Hillsboro, Oct., 2; Fluvanna Co., 1. *District of Columbia*: 2. *Maryland*: 3; Hagerstown, Apr., 1; Prince George Co., 2. *North Carolina*: Southern Pines, May, June, 4, Oct., Nov., 4; Tryon, 1; Raleigh, Jan. to Oct., 16. *South Carolina*: 1. *Tennessee*: Nashville, July, 1 ♂; Elmwood, 1. *Florida*: Pensacola, Dec., 2 ♀; Sanford, Feb., 1 ♀; Sarasota, Feb., 1 ♀; Flamingo, Mar., 1 ♂. *Alabama*: Montgomery, 1 ♂, 5; Auburn, Apr., 2. *Mississippi*: Lucedale, May, 1 ♀; Agricultural College, Apr., 2 ♂, 8. *Louisiana*: 2; Gueydan, May, 1 ♀. *Texas*: Duval Co.: San Diego, 4 ♂; Brazos Co.: Mar., 1 ♂; College Station, Feb., 1 ♀; Montgomery Co.: Willis, 2 ♂, 1 ♀; Harris Co., May, 1 ♂; Lamar Co.: Paris, Mar., 1 ♀. *Arkansas*: 1 ♀; Knobel, Aug., 1; Hope, 1 ♀, 7. *Missouri*: 5; Columbia, Mar. to May, 2 ♂, 15; Jefferson, May, 2; St. Charles, 2; St. Louis, 3; Fulton, 1. *Iowa*: Clermont, June, 1 ♀. *Illinois*: 1; Pittsfield, July to Oct., 11. *Indiana*: Lafayette, 1 ♂, 3; Pine, 1. *Kansas*: 2; Douglas Co., 1 ♂, 26; Lawrence, Apr., 3; Topeka, 2 ♂, 1 ♀; Ft. Scott, May, 1 ♂, 2. *New Mexico*: Santa Fe, Nov., 1 ♂. *Arizona*: 1 ♂. *Wyoming*: Cheyenne, June, 1 ♂.

Trox sordidus LeConte

UNITED STATES: *Massachusetts*: Milton, 7; Cambridge, 1; Natick, 6; Amherst, 1; Forest Hills, 1; Sherborn, 1; Springfield, 7. *New Hampshire*: Exeter, 2; Wilton, 1. *New York*: 1; New York City, 1; Bronxville, 1; Flatbush, 2; Babylon, 1; West Point, 3; Ithaca, 1; New Windsor, 1. *New Jersey*: 1; Palisades, 1; Lakehurst, 2; Browns Mills, 2; Riverton, 1; Houghton Hall, 1. *Pennsylvania*: 15; Lansdowne, 2; Franklinville, 4; Water Gap, 3; Mt. Airy, 7; Rockville, 2; Broomall, 2; Bethlehem, 6; Easton, 1; Jeanette, 10; Delaware County, 4. *Maryland*: 2; Baltimore, 4; Takoma Park, 2. *Virginia*: Fredericksburg, 1; Falls Church, 1; Hillsboro, 1; Frederick County, 1. *North Carolina*: 1; Washington, 1; Raleigh, 2; Oxford, 1. *Georgia*: 1 (type). *Ohio*: 4; Jefferson, 1. *Indiana*: Dubois Co., 1. *Iowa*: 1; Iowa City, 2. *Kansas*: Douglas Co., 1; Wilson Co., 1; Lawrence, 1. *Missouri*: 3; Columbia, 2; St. Louis, 1. *Mississippi*: 1; Longview, 1; Agricultural College, 1.

CANADA: 1; *Ontario*: 1.

Trox capillaris Say

UNITED STATES: *Massachusetts*: 5; Lexington, 1; Lenox, 1; Sherborn, 5; Springfield, 1; Arlington, 3; Cambridge, 1; Natick, 5; Monterey, 1; Framingham, 4. *Connecticut*: Cornwall, May, July, 2 ♂, 9. *New York*: West Point, 1; New Windsor, 1; Pike, 1; Rockaway Beach, 1. *New Jersey*: Englewood, 1; Boonton, 3; Split Rock Lake, 1; Phillipsburg, 4. *Pennsylvania*: 1; Water Gap, 1; Waynesboro, 1; Linglestown, 13; Jeanette, 9; Mt. Alto, 1 ♂; Easton, 9; Wind Gap, 1; Rockville, 1. *Maryland*: 1; College Park, 2; Tacoma Park, 2. *Virginia*: Massanutten Mt., 1 ♀; Bluemont, 1; Great Falls, 1; Dead Run, 1; Hillsboro, Oct., 1. *Tennessee*: Elmwood, 1; Knox Co., Apr., 2. *Ohio*: 1 ♂, 3 ♀, 1; Glen Este, 4. *Michigan*: 2. *Kansas*: 1 ♂; Lawrence, 2; Douglas Co., 3. *Missouri*: 1; Columbia, 10; St. Louis, 1. *Texas*: New Braunfels, May, 1. *Utah*: 3.

CANADA: 3; *Ontario*: Ridgeway, May, 2.

Trox tytus Robinson

UNITED STATES: *Pennsylvania*: Lyndell, June, 9 (paratypes); Broomall, June, 1 ♂ (type), May, June, 11 ♂, 6 ♀, 23 (paratypes). *Georgia*: Barnesville, Sept., 2. *Oklahoma*: Pearson, July, 1 ♀. *Arizona*: Tucson, June, 1; Texas Pass, Dragoon Mountains, July, 1 ♀.

CUBA: Baragua, May, 1.

Trox rubricans Robinson

UNITED STATES: *Texas*: 1 ♂; Cameron Co.: Sept., 1 ♀, Brownsville, June, 2 ♂, 2 ♀; Hidalgo Co.: Weslaco, May, 1 ♀.

MEXICO: *Nuevo Leon*: Linares, Sept., 1 ♀. *Tamaulipas*: 13 kilometers east of Magiscatzin, May, 1 ♂. *San Luis Potosi*: Valles, May, 1 ♀. *Durango or Chihuahua* (?): Presidio, 1 ♂. *Sinaloa*: Venedio, June, 1 ♂ (paratype), 1 ♀.

GUATEMALA: Escuintla, 1 ♂.

NICARAGUA: Polvon, 1 ♀.

Trox carinatus Loomis

UNITED STATES: *Arizona*: Globe, July, 2 ♀; Tucson, 2 ♀; Alamo Canyon, Ajo Mts., July, 1 ♀; Phoenix, May, 1 ♀. *New Mexico*: Loving, May, 1 ♂; Carlsbad Cavern, July, 1 ♀. *Texas*: Presidio Co., 1; Davis Mts., June, 1 ♀; Quemado, May, 1 ♀.

MEXICO: *Chihuahua*: Salaires, July, 1 ♂.

Trox fuliginosus Robinson

UNITED STATES: *Texas*: 1 ♂; Comal Co.: 1 ♂, New Braunfels, Apr., June, 2 ♂, 1 ♀, 1; Llano Co.: Llano River, May, 1 ♂, 1 ♀; Bexar Co.: San Antonio, June, 1 ♂; Victoria Co.: Victoria, May, 1 ♂; Cameron Co.: Brownsville, 3 ♂; Hidalgo Co.,

July, 2♂; Uvalde Co.: Uvalde, 1♂; Kerr Co.: Kerrville, 6♂, 1♀.

MEXICO: 2♂, 2♀. *Veracruz*: Cordoba, 1♂. *Yucatan*: Chichen Itza, Sept., 1♀.

GUATEMALA: Sabaatas, La Rofa (locality not found), 1♀.

Trox scabrosus Beauvois

UNITED STATES: *New York*: New York City, 2♀. *New Jersey*: 4; Atlantic City, 1♂; Cape May, 1; Hopatcong, 1♀. *North Carolina*: 3; Southern Pines, May–Oct., 10♂, 3♀, 6. *Georgia*: Tybee Is., Apr., June, 7. *Florida*: 2♂, 4; Oak Lodge, 1♀; Lake Worth, 3. *Alabama*: Mobile, June, 1♀. *Ohio*: Sandusky, Cedar Pt., June, 2. *Illinois*: 1♂; Chicago, 1. *Nebraska*: 1♀; Watts Lake, Cherry Co., June, 1. *Kansas*: Clay Co., May, June, 4; Seward Co., 1; Meade Co., 4; Medora, 4; Douglas, 1; Syracuse, 1. *Oklahoma*: Alva, 1; Woodward, 1. *Texas*: 1♂, 2; Jacksonville, Apr., 1; Wilson Co., 10. (Blatchley, 1910, has seen a specimen from Indiana.)

CANADA: *Ontario*: Point Pelee, May, 3♂, 1♀, 5.

Trox asper LeConte

UNITED STATES: *Massachusetts*: 1♂, 1♀; Springfield, 2♂; Winchendon, 1. *Rhode Island*: Providence, 2. *New York*: 1♂, 1♀; Montauk Pt., July, 1♀. *New Jersey*: 1; Clifton, July, 2. *Pennsylvania*: 1. *Maryland*: 3; Silver Spring, June, 1♂ (compared with type by Mark Robinson). *District of Columbia*: 10. *Virginia*: 2; Falls Church, May, 1. *North Carolina*: 3; Raleigh, Apr., June, 13; Wake Co., June, 1; Oxford, Aug., 1. *South Carolina or Georgia*: 1 (type). *Illinois*: Pittsfield, July, 2. *Minnesota*: 1. *Iowa*: 1; Elk City, May, 1♀. *Missouri*: 1♂; St. Louis, June, July, 2♂, 1; St. Charles, June, 1; Branson, July, 1. *Arkansas*: Hope, Apr., 1♂, 1♀, 5. *Nebraska*: 1♂. *Kansas*: 3; Osage, 1♀, 1; Topeka, 1♀; Douglas Co., 2♀; Linn Co., 1♀, 2. *Texas*: Lee Co.: Lincoln, Aug. 1. *Utah*: Roosevelt, June, 1♂. (Blatchley, 1910, reported it from Indiana, and, 1928, from Florida; Robinson, *in litt.*, from Mississippi, and Harold, 1872, from Louisiana.)

MEXICO: *Northern Sonora*: 1♀.

Trox inflatus Loomis

UNITED STATES: *Arizona*: 1♂, 2♀; Phoenix, Apr., 1♀, May, 1♂, Sept., 1♀; Superior, July, 1♂, 2♀; Wenden, July, Aug., 1♂ (compared with type by Mark Robinson); Tucson, 1; Alamo Canyon, Ajo Mts., July, 1♀; Skeleton Cave, Mojave Co., July, 1♀. *New Mexico*: Eddy Co., July, 4♂, 8♀, 14; White City, June, 1♀; Deming, Sept., 1♂; Mesquite, Aug., 1♂; Carlsbad Cavern, July, 3; Carrizozo, June, 2; Tortugas, July, 1♂. *Texas*:

1; Brewster Co.: Boquillas, July, 1♂; Alpine, May, June, 1♂, 4; Marathon, May, 2♂, 3; Rio Grande, 1♂; Chisos Mts., July, 1♂; Culberson Co.: July, 1; 10 miles north of Van Horn, Sept., 4♂, 4; Jeff Davis Co.: 18 miles west of Fort Davis, July, 1♂, 4; Davis Mts., June, July, 3♂, 3; El Paso Co.: El Paso, 1; Presidio Co.: Presidio, July, 1; Green Valley, July, 1♂; Terrell Co.; Sanderson, June, 4♂, 17.

MEXICO: *Chihuahua*: Catarinas, July, 1♂; Santa Barbara, July, 1♀; Salas, July, 1♂.

Trox tessellatus LeConte

UNITED STATES: *Kansas*: 1♂. *New Mexico*: 10 miles north of Columbus, Sept., 1♂. *Arizona*: 6♂, 3♀; Altar Valley, Aug., 2♂, 1; Douglas, 2♀; Congress Junction, July, 1♀; Globe, 1♀, July, 1♂; San Bernardino Ranch, Cochise Co., Aug., 1♂; 10 miles east of Tucson, Aug., 1♂; Tucson, June–Aug., 1♂, 2♀, 5; Thatcher, June, 1♂; Santa Rita Mts., Aug., 1♂; Santa Catalina Mts., 1♂; Baboquivari Mts., July, 1♀. *Texas*: El Paso, Aug., 1.

MEXICO: *Sonora*: Pitiquito, July, 1♀; Desemboque, Aug., 1♀; San Lorenzo, 12 kilometers south of Magdalena, Sept., 1♂; Posa [Poza?], Sept., 1♂, 1. *Baja California*: 1♂ (lectotype of *tessellatus*); San Jose del Cabo, 2♂ (type and paratype of *nigrescens*), 2; Santa Rosa, Aug., 2♂, 1♀, Cape San Lucas, 1♀; Todos Santos, 1♂; San Pedro, July, 4; San Antonio District, July, 1♂; 15 miles west of La Paz and La Paz, July, 2♂, 1♀, 22; San Domingo and 15 miles south of San Domingo, July, 3♂, 57; Arroyo Seco, Oct., 1; Venancio, July, 1♀, 2; Triunfo, July, 1; 5 miles south of Miraflores, July, 1. *Guerrero*: Acapulco, 1♂.

Trox nodosus Robinson

UNITED STATES: *New Mexico*: 2; Le Mesa, June, 2♂ (type and paratype); Mesquite, near Mesilla Park, July, 1♂ (paratype); Mesilla Park, July, 1♂, 1♀, 1; Roswell, Oct., 1; Escondida, Aug., 1♂; White Sands, June, July, 1♂, 3♀, 2. *Texas*: El Paso Co.: El Paso, 1♂; Bailey Co.: Muleshoe, Aug., 1♂, Coyote Lake, 1♀; Gaines Co.: Seminole, June, 2♀; Pecos Co.: Fort Stockton, Apr., 1♂, 1♀; Crane Co.: Crane, 1♂, 2♀, 1; Dawson Co.: Lamesa, May, 1♂.

MEXICO: *Chihuahua*: Samalayuca, June, 3♀, Aug., 1♀.

Trox texanus LeConte

UNITED STATES: *Texas*: 6♂ (including lectotype of *suturalis*), 2♀; Duval Co.: San Diego, May, 1♂, 1♀ (paratypes of *oligonus*), June, 1♀ (paratype of *oligonus*); Maverick Co.: Eagle Pass, 3♀ (lectotype and cotypes of *texanus*); Hidalgo

Co.: Edinburg, 1 ♂; Brooks Co.: Falfurias, May, 1 ♂, 2; Webb Co.: 20 miles south of Laredo, Apr., 1 ♂; Cameron Co.: Brownsville, July, 1 ♂; Los Indios, June, 1 ♀; La Salle Co.: Encinal, 1 ♂; Harris Co.: Houston, 1 ♀; Kleberg Co.: Kingsville, 1 ♂. *New Mexico*: Estancia, July, 1 ♂.

MEXICO: *Tamaulipas*: Nuevo Laredo, 1 ♀.

***Trox umbonatus* LeConte**

UNITED STATES: *Utah*: San Juan Co.: La Sal Mountains, 2 ♂ (type and paratype of *confluen-*

tus). *Arizona*: 1 ♂. *Texas*: 1 ♂ (lectotype of *umbonatus*), 6; Hidalgo Co.: Edinburg, 3, Hidalgo, Aug., 1; Maverick Co.: Eagle Pass, 6; Webb Co.: Laredo, Feb., 4; Uvalde Co.: Uvalde, June, 2 ♂, Laguna, May, 1; Val Verde Co.: Del Rio, June, 1 ♂, 3 ♀; La Salle Co.: Cotulla, July, 4 (paratypes of *platycyphus*).

MEXICO: *Chihuahua*: Camargo, Sept., 1 ♂. *Coahuila*: Monclova, 1. *Tamaulipas*: Abasolo, May, 1 ♀. *Nuevo Leon*: Rancho Presa Nueva, July, 5 ♂, 5 ♀, 5.

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