

# American Museum Novitates

---

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY  
CENTRAL PARK WEST AT 79TH STREET, NEW YORK 24, N.Y.

---

NUMBER 1724

APRIL 29, 1955

---

## A Review of the North American Genus *Amblycheila* (Coleoptera, Cicindelidae)

BY PATRICIA VAURIE<sup>1</sup>

### INTRODUCTION AND ACKNOWLEDGMENTS

In 1876 these inch-long, black, flightless tiger beetles were so prized by collectors that dealers could ask and be paid from \$12 to \$20 apiece for them. Only a few specimens were known before 1876. Two had been collected dead: one by Say in 1823, from which he described *cylindriformis*, and one by a United States surveying expedition of 1852. One was collected by a Major Sibley and sent to LeConte before 1854, and several were obtained, according to Snow (1877), by "a distinguished American entomologist" who "printed a circular containing a description and life-size figure of the beetle, which he distributed among the army surgeons at the various military posts in the Western territories." It must be remembered that before 1876 it was very difficult for collectors to get to the areas where *Amblycheila* had been taken, not only because there was no railroad west of the Missouri River, but also because of the danger from hostile Indians who roamed the territory. Only well-armed government expeditions could explore with relative safety. By 1876, however, the Indian tribes had withdrawn farther west, and a number of scientific expeditions were undertaken into Kansas. It was on the Yale College geological expedition to western Kansas in the summer of 1876 that Mudge, accompanied by Brous and Williston, obtained about 100 specimens of *A. cylindriformis*. Again in 1877 several hundred more were collected by Williston and Cooper of the Yale expedition, and by an expedition from the University of Kansas headed by Snow. Some

---

<sup>1</sup> Assistant, Department of Insects and Spiders.

of these early specimens are in the collection of the American Museum. The discovery of the nocturnal and hole-digging habits of these beetles naturally decreased their rarity somewhat, but they are certainly not common insects. The only large series I know of in recent times is one taken by Bob Potts in 1938 at Denver, Colorado.

The acquisition of recent specimens of other species besides *cylindriformis* by the American Museum of Natural History prompted the present paper which attempts to answer the question asked by Rivers in 1893, "Are there three species of *Amblychila*, or two, or only one?" Although Rivers had decided that there were but two species, he inadvertently described a third while discussing these two. G. Horn (1893) said there was but one variable species. W. Horn recognized four species in 1903, three species and one subspecies in 1904, but in 1910, 1926, and 1930 recognized only two, each with a subspecies. These changes of status concern the same four forms. With more material now available, the answer to the question asked above is, in my opinion, that there are four distinct species. The confusion of names, the misidentification of single specimens by various authors, and the many changes of status (species, subspecies, variety) have been the rule, not the exception, in this small genus. It is hoped that this review clarifies many points. Unfortunately none of the types has been examined. The types of Reiche, Rivers, and W. Horn are in European institutions; Casey's types are in the United States National Museum; and Tanner's type is at the University of Utah.

Dr. Mont A. Cazier of the American Museum of Natural History, who suggested this study, was kind enough to read the manuscript, and I am grateful to him for his helpful comments. I also wish to thank Dr. P. J. Darlington, Jr., of the Museum of Comparative Zoölogy, for comparing our specimens of *cylindriformis* and *picolomini* with specimens of these species in the LeConte collection; Dr. H. Edwin Cott, of the University of Utah, for information on a locality from that state, and Dr. Rupert L. Wenzel, of the Chicago Natural History Museum, for the loan of material.

#### DISTRIBUTION AND HISTORY

None of the four species of the genus has been taken east of the Mississippi River. One species (*cylindriformis*) inhabits the plains areas from Arkansas and Texas north to Nebraska and west to Colorado and New Mexico (fig. 1). The citation of Arkansas by Leng and other authors may be correct or it may be because the type locality was given as Arkansas. Say, however, modified the locality of his type by saying it was

taken "at the base of the Rocky Mountains," and in 1823 the name Arkansas covered a wider territory than at present. The other species have more restricted ranges: *baroni* in the mountains of southeastern Arizona and northern Sonora, *schwarzi* in the desert mountains of south-eastern California eastward into northern Arizona and north to south-

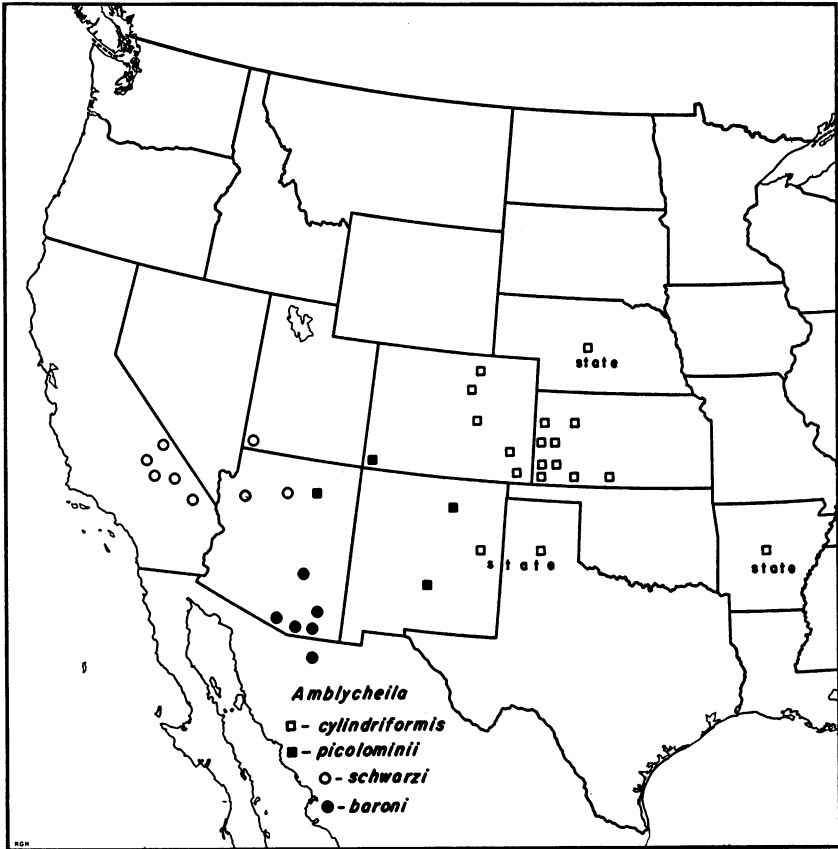


FIG. 1. Distribution of the four species of *Amblycheila*. Records only for the state are so marked.

western Utah, and *picolominii* in extreme southwestern Colorado, northeastern Arizona, and northern and southern New Mexico.

When Say described *cylindriformis* in 1823 he thought it belonged in *Manticora*, a genus of African Cicindelidae, but later, in 1829, he decided it did not belong there and erected the genus *Amblycheila* for it. His species has proved to be the largest, most abundant, and most widespread

of all the species. Ten years later another species (*picolomini*) was added by Reiche who had a single female from the Dupont collection dedicated to the collector Picolomini, who had traveled up the Colorado and Gila rivers. In 1890 Rivers described *baroni*, and in 1893, in an article on the species of *Amblycheila*, he attempted to clarify the identity of *cylindri-formis*, *picolomini*, and *baroni*, not only by presenting three excellent photographs, but also by giving a detailed description of a specimen from Peach Springs, Arizona, which he thought was *picolomini*. Unfortunately he had not seen the type of the latter, and both his photograph and his description of this Peach Springs specimen were not referable to Reiche's species, but represented a new species. It is to this new species (the *picolomini* of Rivers, not Reiche) that Walter Horn in 1903 gave the name of *schwarzi*. In 1904 Horn then saw Reiche's type, which he verified as differing from both *cylindri-formis* and his new *schwarzi* but which he considered a subspecies of the former. More recently confusion of the same names occurred when Martin (1932) published a note on a pair of "*A. picolomini* Reiche" in the California Academy of Sciences. These specimens, from near Skidoo in the Panamint Mountains of eastern California, are *schwarzi* (= *picolomini* of Rivers), according to Cazier (1939). Since 1904 three forms have been described by Casey (1909, 1916, 1924), and one has been described by Tanner (1951).

The genus was reviewed by Thomson in his monograph of the Cicindelidae in 1857, and by George Horn in 1876, when there were but two species known. Leng (1902) included three species in his revision of the family Cicindelidae, although he had seen no specimens of *baroni*, only photographs. The most complete treatments are those of Walter Horn, both in 1904 in his report on the cicindelid collections of Paris and London, and in the "Genera insectorum" of 1910, in which he gives generic and sexual characters in detail (some illustrated), distribution, ecology, and a list of the species.

## BIOLOGY

The first accounts in the United States of the habits of these interesting and formerly very rare insects are those of Snow, Brous, Popenoe, Williston, and G. Horn (1877-1878), followed by those of Gissler (1879), Knaus (1900), Leng (1902), Lantz (1905), W. Horn (1910), Williams and Hungerford (1914), Cazier (1939), and Rumpff (1954, *in litt.*). A resumé of the notes given by these authors follows:

Adults are nocturnal or crepuscular, appearing after sunset to search for food and retiring before sunrise. If the day is cloudy or very warm, they may come out earlier or stay out later, but if it is rainy or cold they

usually remain in their holes or under cover of stones or sticks. They are predaceous on other insects and larvae but "have been observed feeding on excrementitious matter" (G. Horn), and decayed matter (W. Horn, 1910). Williston says, however, that "they never feed on . . . decayed matter." Lantz found *cylindriformis* feeding on the mounds of the ant *Pogonomyrmex occidentalis*. Snow said that members of this species are "especially fond of all sorts of Orthopterous and Lepidopterous larvae," that they will attack large beetles such as *Prionus*, and that he had seen them even eating one another.

A curious observation was made by Dr. Richard G. Zweifel, Associate Curator of Herpetology at the American Museum of Natural History, while he was on a field trip at Dorner's camp at 4100 feet in the piñon belt of the Granite Mountains, San Bernardino County, California. One night he had stored four live *Bufo punctatus* in an empty jar along with a pair of *schwarzi* he had collected the same night (one of these specimens I have examined). The next day three of the toads were dead and the fourth was paralyzed, able only to make respiratory movements of the throat and to blink its eyes. This toad lived for a week. I do not know if the bite of *Amblycheila* could have such a devastating effect or whether some other, unknown factor may have been present. Dr. Zweifel could think of no reason why the toads should have been affected as they were.

Adults live in holes excavated by themselves or often in holes made by kangaroo rats (*Dipodomys*) or other animals. Snow saw two *cylindriformis* in a badger's abandoned hole, and both he and Williston say that the beetles never make their own holes but enter any convenient hole. Although essentially solitary creatures, they often have holes close to one another. Those of *cylindriformis* occur along clay banks by creeks or rivers or in ravines, usually on the brow or top of the cliff but sometimes on the plains back a half a mile from the cliff, or even in the face of the cliff, in which case the burrow slopes backward. Williston says they will not live "in banks at all sandy." The beetles are said to move with a peculiar deliberate swaggering gait, their body held high, their long antennae constantly in motion. These vibratory antennae no doubt aid them to find their prey, because their eyesight is reputedly very poor. Snow says they never discover their victims until they virtually stumble on them, and that they make no attempt to avoid capture by entomologists, "allowing themselves to be picked up as if entirely blind." He reports finding freshly eaten remains of *Amblycheila* in the stomach of a skunk caught in Kansas, and one *cylindriformis* "dead in a spider's web" in Colorado. Williston says large numbers of their remains are found in the excrement of nocturnal birds.

Although some solitary nocturnal insects (*Eleodes* of the Tenebrionidae, *Pasimachus* of the Carabidae), appear to be quite abundant, *Amblycheila* are still relatively rare, at least in collections. They were even more rare before their mode of night life was known, but their occurrence is spasmodic. Knaus relates how collectors who knew the habits of *cylindriformis* collected several hundred specimens in Wallace County, western Kansas, in 1877, but that they have not been so abundant since that time. Williston took "more than five hundred." Knaus himself visited Wallace County in July for two or three seasons around 1900 and could find only a dozen individuals. This species, however, is the most common of the four. On the other hand, about 20 individuals of *schwarzi*, which was described in 1893 and was so rare that only two or three specimens were known as late as 1939 (Cazier), were taken during several visits to a permanent spring at Great Falls Basin, Inyo County, California, by Mr. Darwin Tiemann, curator of the museum at China Lake, California. Another adult was found by N. L. Rump (in litt.) on the gravel bottom of a dry stream below a narrow cliff at the head of Great Falls on June 16, 1951, at 9:30 P.M. when the thermometer registered 93° F. Four adults of *picolomini* were taken in dry, open, rocky country at dusk near Tuba City, Arizona, in July, 1937 (Cazier). The type of *baroni* was found dead in a canyon, and another specimen, beneath a log lying in a damp spot in the Pinal Mountains, Arizona. Some *baroni* have been collected from under stones, and W. Horn reported they will come to bait. Beiderman is said to have lured *baroni* in Carr Canyon, Arizona, by sinking cans baited with asafetida. Williston took an adult *cylindriformis* in Kansas as early as May 21, then no more until the middle of June. At the end of June they were at their greatest abundance, and by the middle of September had become rare.

Gissler dissected some female *Amblycheila* and found from three to six eggs of 4 mm. in length. Williston (p. 164) writes: "The eggs are deposited near the surface of the ground, in groups of from one to two dozen. The young larvae immediately burrow downwards, but come to the surface at dark to lie in wait for food, which consists mostly of ants and small insects. The holes are extended to surprising depths. In some instances I have traced them for nearly three feet. The mature larvae are over two inches long, with very strong mandibles and maxillae. They may be found most readily either in May or August. Singularly unlike the imago, they are very shy and easily alarmed." Larval colonies were discovered by Williams and Hungerford in early August in Wallace County, Kansas. These authors located many colonies of larvae in Kansas but could not always find any adults. The colonies, of from two to 11

individual burrows, might cover a radius of about 10 inches, the burrows sometimes only 1½ inches apart. The burrows descend straight at first, than after about 18 inches turn at a 45-degree angle to descend farther.

A long technical description of the larva of *cylindriformis* can be found in G. Horn (1878) and in Hamilton (1925), and a short description in W. Horn (1908) of what he thought was *schwarzi*. The larva is quite similar to the larvae of *Omus*, *Tetracha*, and *Cicindela*, but has only two eyes instead of eight, and there are differences in the length of the segments of the maxillary palpi and of the antennae (G. Horn, 1878).

### GENUS *AMBLYCHEILA* SAY

*Amblycheila* SAY, 1829, Disseminator of useful knowledge, p. 65. Type, by monotypy and original designation, *Manticora cylindriformis* Say.

*Amblycheila* SAY, 1834, Trans. Amer. Phil. Soc., vol. 4, p. 409 (duplication of above).

*Amblychila*, AGASSIZ, 1846, Nomenclator zoologicus, pt. 2, p. 16 (emendation of spelling).

*Chaleposomus* CHAUDOIR, 1860, Bull. Soc. Imp. Nat. Moscou, vol. 33, no. 4, p. 337.

This genus, of the tribe Megacephalini, subtribe Omina, is composed of four allopatric species of large-sized (21 to 36 mm.), black, carabid-like, wingless beetles of nocturnal habits inhabiting parts of the southwestern United States as far north and east as Nebraska and Arkansas.

They are differentiated from the similar and equally nocturnal and flightless species of the genus *Omus* as follows: In *Amblycheila* the inflexed lateral margins of the elytra are punctate, impunctate in *Omus*, and as wide as, or wider than, the second abdominal segment when measured at the point opposite that segment (they are narrower than this segment in *Omus*). The episterna of the metasternum are longer than wide in *Amblycheila*, but about as wide as long in *Omus*. The eyes are proportionately smaller in *Amblycheila*, those in a specimen of *A. baroni* being equal in size to the eyes of an *Omus* of half of its body size. The distance from the hind border of the eye to the front of the pronotum is thus longer in *Amblycheila*. The sides of the mandibles are glabrous in *Omus*, furnished with setigerous punctures in *Amblycheila*. The facets of the cornea of the eye, studied by Gissler (1879), are convex in *Omus* and smooth in *Amblycheila*, although this is not evident without dissection. The two genera differ also in some sexual characters. The apex of the penis is angulate on one side in *Amblycheila* but entirely circular in *Omus*. The front tarsi in the male (segments one to three) are not enlarged in *Amblycheila* as they are in *Omus*, and the abdomen of the male is truncate at the apex, not deeply emarginate as in *Omus*. The dis-

tribution of the genera is somewhat different. *Omus* is known only from the coastal and mountainous areas on the Pacific coast from British Columbia south to Ventura County, California (latitude 34° N.), and from no farther east than Mono County and Sequoia National Park in Tulare County, California (Cazier, *in litt.*). *Amblycheila* does not occur so far west and thus the two genera are allopatric, although *A. schwarzi* occurs in southwestern Inyo County, California, east across the Sierra Nevada Mountains from Tulare County.

#### DISCUSSION OF GENERIC AND SPECIFIC CHARACTERS

Characters that differ significantly among species are prefixed by an asterisk and are used in the formal descriptions of each species.

\*MANDIBLES: Stout, sickle shaped, quadridentate, the basal tooth bifid (fig. 6); the outside at the base with a few setae-bearing punctures (from four to 14), and its lower border furrowed (or reflexed). No differences in the length or thickness of the mandibles could be found among species in spite of W. Horn's assertions to the contrary (1904), but the number of punctures varies in that *cylindriformis* has at least 10 on each mandible, and the other species fewer (less than 10, usually from three to seven).

PALPI: The maxillary palpi are four-segmented, the last two segments about equal in length and each shorter than the preceding segment, the fourth widened at apex. The labial palpi are also four-segmented, the first two segments hidden, the third longer than the fourth, which is widened apically.

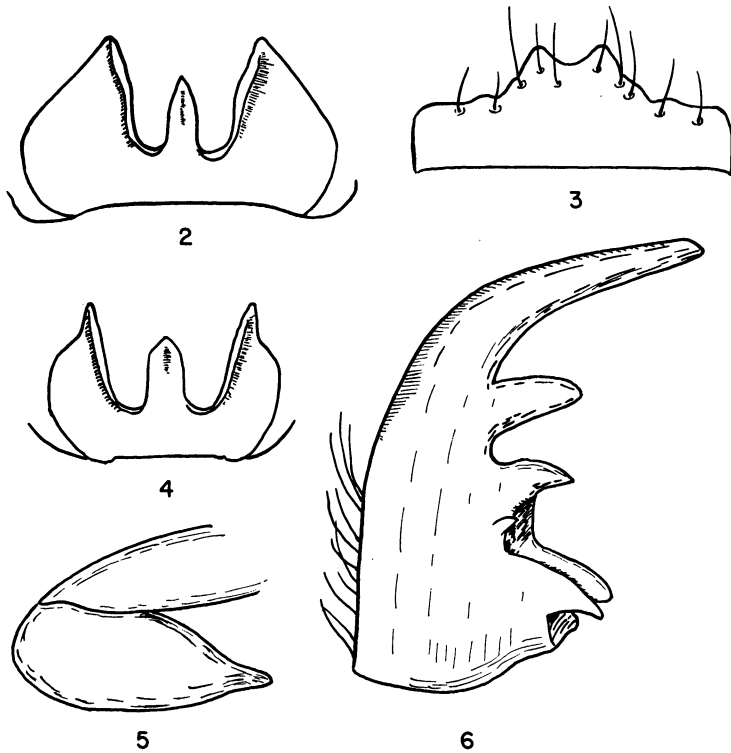
LABIUM: Walter Horn (1904, p. 98) states that the large side pieces or lobes of this sclerite are less sharply acuminate at the apex in *cylindriformis* and *picolomini* than in *baroni* and *schwarzi*, and that the center lobe between these pieces is more sharply acuminate in the first two species (figs. 2, 4). There seems, however, to be so much variability in the shape of these lobes within each species that the labium cannot be used as a specific character. There is variation also in the depth of the furrow or channel in the center of the median lobe.

LABRUM: Transverse, wider in center, short (same length as clypeus), the front border advanced in two median teeth, sometimes a smaller tooth on each side of the median ones, sometimes this area merely sinuate (fig. 3). The shape of the front margin is variable within the species, as is also the number of setae-bearing punctures on the margin. As few as six (an individual of *picolomini*) and as many as 12 (an individual of *cylindriformis*) of these punctures have been counted, although usually they number either eight or 10.



CLYPEUS: Transverse, short (same length as labrum), with a setae-bearing puncture on each side; occasionally one of the punctures is lacking or one or two are added.

\*HEAD: Subquadrate, flat, slightly narrower than the pronotum, the front margin extending forward on each side onto the clypeus, a raised



FIGS. 2-6. Body parts in *Amblycheila*. 2. Labium of *cylindriciformis*, male. 3. Labrum of same. 4. Labium of *baroni*, female. 5. Hind trochanter of *cylindriciformis*, male. 6. Left mandible of same.

border present over the eyes and the insertion of the antennae. There are several supraorbital setae-bearing punctures on each side; also sparse and unsymmetrical punctures on the disc. Although these punctures are present in all species, they are more numerous in some, as was first discovered by W. Horn (1904). Of 82 specimens of all species, the fewest number of punctures found on the head (including those over the eyes) is three (*cylindriciformis*), and the most numerous, 21 (*schwarzi*). Tabulation of the number of punctures in each species shows that those of *cylindriciformis* run from three to 12 (three to eight according to W. Horn), *baroni* from

four to 12 (seven to 12 according to W. Horn), and *schwarzi* from 15 to 21 (15 to 19 according to W. Horn). (Horn does not say how many specimens he had.) I have seen only four specimens of *picolomini*, each of which had four punctures on the head. The other numbers do not give a true picture until broken down. Thus giving the number of punctures and following it by the number of specimens in parentheses, we have :

45 <i>cylindriformis</i>	27 <i>baroni</i>	6 <i>schwarzi</i>
3 (3)		
4 (8)	4 (2)	
5 (14)	5 (2)	
6 (9)	6 (2)	
7 (1)	7 (2)	
8 (4)	8 (3)	
9 (3)	9 (5)	
10 (2)	10 (5)	
	11 (3)	
12 (1)	12 (3)	
		15 (1)
		17 (1)
		18 (2)
		19 (1)
		21 (1)
Average	5.8	8.8
		18.0

EYES: Round, very finely faceted, proportionately small, and not protruding beyond the genae when viewed from above.

ANTENNAE: Eleven-segmented, filiform, narrowing slightly to apex, the first four segments glabrous except for a few long setae, the remaining segments completely covered with short dense fine pile and one or more long setae. Reaching about to the middle of the body.

PRONOTUM: Rather flat, wider in front, the carinate sides converging to the hind margin, front margin slightly produced at middle. Impunctate except for a few setae-bearing punctures laterally in front of middle, or scattered elsewhere (from one to seven punctures on each side of middle line), occasionally lacking entirely (one specimen of *baroni* out of 82 specimens of all species). Middle with a narrow impressed line from base to apex or slightly short of each border. One or two feeble, transverse or broadly V-shaped depressions in front of middle, also laterally at base on both sides of the epipleural carina (margin of pronotum). In contrast to those of the head and mandibles, the punctures on the pronotum show no significant difference among species in their number or position.

\*ELYTRA: Elongate oval, declivous laterally and apically, scarcely wider than pronotum, at least twice as long as wide, fused at suture, no

wings; lateral margins widely inflexed, wider at middle than the length of the second abdominal segment, punctate in four or more rows; each elytron with from one to three carinae extending either halfway to apex or to apical fifth, the middle carina, when there are three, usually slightly longer. The elytral punctures have very fine setae emerging; these are usually not noticeable and are often worn off.

The elytra, as can be seen by their exclusive use in the key to the species, contain the most important distinguishing characters among species. All species have a sharp submarginal carina laterally where the inflexed margin falls off to the side (it is shorter in *baroni*, even sometimes virtually lacking), and all species except *baroni* have also two dorsal carinae on each elytron, one rather near the submarginal carina, the other about a third of the way towards the suture. These carinae extend about four-fifths of the way to the apex; they are somewhat convergent behind in *schwarzi*, rather more parallel in *cylindriformis* and *picolomini*. In *baroni* there are no uninterrupted dorsal carinae as in the other species; some individuals have no carinae on the dorsum at all; others have one short or fragmentary dorsal carina on each elytron. All species except *baroni* have the disc either flat or feebly concave; in *baroni* it is slightly convex. The disc in *baroni* and *schwarzi* has small, very sparse and widely separated punctures, sometimes virtually none at all in the sutural region, whereas in *cylindriformis* and *picolomini* the disc is densely punctured with seven or eight rows of larger punctures, the punctures of greater depth and density in *cylindriformis*, and interspersed in *picolomini* with large evident foveae. The region between the submarginal carina and the actual margin of the elytra has from eight to 10 rows of punctures near the base in *cylindriformis*, no more than six in the other species. The surface of the elytra is most glossy in *schwarzi* and *picolomini*, appearing rugose in *cylindriformis* because of the many dense punctures, and is quite opaque and dull in *baroni*. The elytral punctures in *schwarzi* and *baroni* are definitely asperate or mucronate, whereas in the other two species, although many of them are in fact asperate, they do not seem to be so because each mucron is so small and each puncture behind it is so large.

The apex of the elytra, said by Rivers (1893) and W. Horn (1904) to be impunctate in *schwarzi* and *baroni* but punctate in the other species, has actually some punctures in all species, but in *schwarzi* and *baroni*, both of which have finer dorsal punctures, the punctures of the apex are either present as fine dots or are sparsely scattered, whereas in the two larger species the apices of the elytra have large distinct foveae that may or may not occur next to the suture.

**PROSTERNUM:** Sides of prosternum strongly arched where they meet the inflexed lateral margins of pronotum, impunctate. Walter Horn (1904) found the long setae in front of and between the front coxae to vary according to the species, but I found them very variable in all the 82 specimens examined.

**MESOSTERNUM:** The episterna or side pieces of the mesosternum are very large, concave, their surface opaque, sometimes rugose, occasionally with a few feeble punctures. The narrow epimera reach the middle coxae.

**METASTERNUM:** Furnished with a few setae between the middle coxae that do not seem to differ significantly among species (W. Horn, 1904, thought they differed). The episterna of the metasternum are longer than wide, usually exceedingly rugose, and are narrower than the lateral elytral margin at middle.

**ABDOMEN:** The six segments (first is divided) of the abdomen are the same in all species, the last segment differing between sexes in shape and vestiture (fig. 7). The sexes differ also in the number of setae on the hind borders of each segment except in *baroni*. (See Secondary Sexual Characters below.)

**\*LEGS:** Femora straight, setose. Front tibiae at apex within have a divided brush of very dense pale hairs with two long spines of about equal length protruding; middle tibiae are also spined apically, but inner spine longer; they are furnished on the outer side with a dense fringe of black or pale setae in apical three-fourths; hind tibiae, spined as are the middle ones, have the setae at apex within much denser than elsewhere. The first tarsal segments on all legs are about twice as long as each of the following segments, those on the hind legs more than twice as long in *picolomini*. The claws are simple. The coxae are all separated; the hind coxae may be impunctate or have from one to seven or eight punctures.

The males of two species (*cylindriformis* and *picolomini*) have the hind trochanters produced apically, whereas in the other species the trochanters are blunt at apex (fig. 5). The grooves on the sides of the trochanters, present only in males of the first two species, may or may not be present in both sexes of *baroni* and *schwarzi*.

Although W. Horn (1904) says that *baroni* has longer hind tibiae and tarsi than *schwarzi*, the difference, if any, is so slight that it cannot be judged without more specimens of the same sex and of equal size.

**\*GENITALIA:** The penis is very long, at least one-half of the length of the elytra, tubular in shape, sclerotized, the apex flattened, darker in color, concave on one side, the internal sac opening near the apex ventrally (fig. 10). The shape of the apex varies slightly from species to species.

It would seem that the two strongly sclerotized "teeth" of the female genitalia should be more constant in their shape within the species, but they do not appear to be. The small basal teeth on the inner side of the larger teeth are sometimes shorter, sometimes longer (fig. 11) in the same species, sometimes apparently fused with the large teeth, sometimes well separated. The apices are often blunt, as if from wear. There appears to be no significant difference among species.

\*SECONDARY SEXUAL CHARACTERS: These are present in the hind trochanters, the number of setae on the abdomen, the shape of the last abdominal segment, and the shape of the elytral apices. The hind trochanters are acutely produced at apex and grooved on the side in males of *cylindriformis* and *picolomini* (fig. 5); they are not produced in either sex in the other two species and may be grooved or not. The

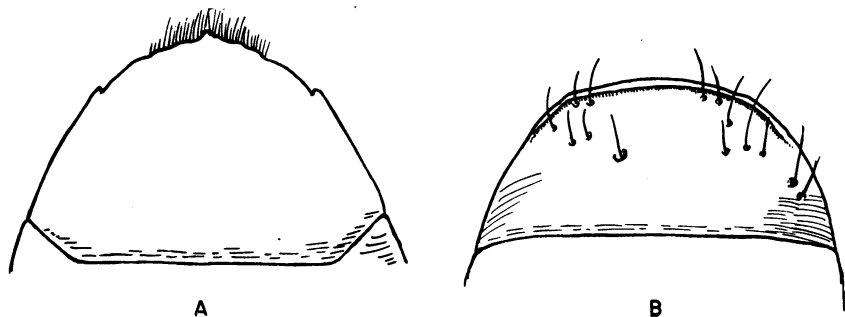


FIG. 7. Last abdominal segment in *Amblycheila*. A. Female (*cylindriformis*). B. Male (*baroni*).

number of setae-bearing punctures on the hind borders of the second to fifth abdominal segments, which W. Horn (1904) thought differed among species, appears to be a sexual character in three of the species. These punctures are less numerous (only two or three laterally) in females, more numerous in males (all along the border) except in *baroni*, a species in which the females apparently have as many abdominal punctures and setae as the males. The last segment of the abdomen differs also between the sexes; it has scattered setose punctures laterally near the apex in the males, no such punctures in the females, but instead a dense fringe of hairs emerging horizontally from the apex itself. The last segment is rounded and margined and longer in the female (usually with a little triangular point in center), truncate and shorter in the male (fig. 7A, B). The apices of the elytra, on the other hand, appear to be more truncate in females, and more pointed and not at all truncate in males. This character is rather difficult to judge, however, because one

elytron is often slightly longer than the other and the apices are often also slightly separated.

\*SIZE AND COLOR: The two smallest species are *baroni* (19 to 26 mm.) and *schwarzi* (22 to 28 mm.); *cylindriformis* is from 30 to 36 mm. long, and *picolomini* 27 to 30 mm. All species are black except *cylindriformis* and some *picolomini* which have the elytra somewhat brownish or, under a lighted microscope, dark red.

HABITS AND HABITATS: These are discussed above under Biology.

#### KEY TO THE SPECIES OF *Amblycheila*

Males have the last abdominal segment broadly truncate, with setae-bearing punctures laterally or near apex. Females have it narrowly truncate or rounded, with a tiny triangular projection in center; they have no setae-bearing punctures but a horizontal fringe of hairs from apex (fig. 7).

1. Each elytron with sometimes two, but never three, long carinae . . . *baroni*  
Each elytron with three long carinae extending at least three-quarters of the way to apex . . . . . 2
2. Elytral disc between carinae with sparse punctures arranged in three or four rows, the sutural region nearly impunctate; male with trochanters on hind legs obtuse at apex as in female . . . . . *schwarzi*  
Elytral disc between carinae with dense punctures arranged in seven or eight rows, the sutural region also densely punctate; male with trochanters on hind legs acutely produced at apex . . . . . 3
3. Elytral disc regularly punctured over entire surface; inflexed area near base of elytra between submarginal carina and real margin with from eight to 10 rows of punctures; elytra brownish to unaided eye, appearing rugose, dull . . . . . *cylindriformis*  
Elytral disc with irregular line of large foveae contrasting with much smaller punctures; inflexed area near base of elytra between submarginal carina and real margin with only four to six rows of punctures; elytra black to unaided eye, appearing smooth, glossy . . . . . *picolomini*

#### *Amblycheila cylindriformis* (Say)

Figures 1-3, 5-6, 7A, 8, 10A, 11

*Manticora Cylindriformis* SAY, 1823, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 139 (type locality, "Arkansa . . . at the base of the Rocky Mountains").

DIAGNOSIS: Differs from all species by having more rows of punctures near the base of the elytra on the inflexed margin and by having more setae-bearing punctures on the sides of the mandibles. Differs from *baroni* and *schwarzi* in its larger size, fewer head punctures, brownish elytra, the male character of produced trochanters, by having the elytra, including the apices, densely, not sparsely, punctured, the punctures large and small, not of the same size throughout. Most similar to *picolomini* with which it agrees in the male trochanter character and the shape

of the body, differing from it in the opaque and rugose elytral surface, the more numerous, larger, and denser elytral punctures, and proportionately shorter and stouter first segment of the hind tarsi.

DESCRIPTION: (See also Discussion of Generic and Specific Charac-



Fig. 8. *Amblycheila cylindriformis* Say.

ters). Length, 30 to 36 mm. Mandibles with at least 10 setae-bearing punctures on each side. Head with an average of 5.8 such punctures for 45 specimens. Elytra brownish, with three long carinae on each side (two dorsal, one submarginal), dorsal carinae parallel throughout; sur-

face rugose to naked eye, dull; disc flat or slightly concave, punctured densely with seven or eight rows of punctures, some larger, some smaller, some feebly mucronate; sutural region equally punctured, punctures on inflexed margin at base arranged in from eight to 10 rows; apex with large fovea-like punctures over most of the surface. Hind tarsi shorter than hind tibiae.

Male with hind trochanters produced acutely at apex, female with them oval, not produced.

DISTRIBUTION: Arkansas, Texas, Nebraska (all *in litt.*), Colorado, Kansas, and New Mexico (fig. 1).

DISCUSSION: This species was the first described and for many years excited much interest because of its rarity and imposing appearance (an excellent full-page photograph is given by Rivers, 1893). The first two specimens in perfect condition (Say's type was defective) were sold in Philadelphia at \$12.50 each (Laurent, 1897), one to the American Entomological Society and one to Mr. Wilt. It is the largest and most common species of the genus and has the widest range. It is apparently most abundant in the western part of Kansas and in eastern Colorado which is probably where the type was taken, "Arkansa . . . at the base of the Rocky Mountains." Although found mainly in the plains, it approaches the mountains at Denver and Colorado Springs.

*Amblycheila cylindriformis* is extremely close to *picolomini*, the differences between the two being slight and relative, but then none of the differences among species in this genus is actually very positive except for the presence of produced hind trochanters in males of *cylindriformis* and *picolomini* and their absence in the other two species. Seen with the unaided eye the elytra of *cylindriformis* appear always uniformly punctate or pock-marked, whereas those of *picolomini* show the punctuation only as large sparse foveae at the base and laterally. Small punctures are, however, present in *picolomini* and can be seen under the microscope, just as large foveae are present in *cylindriformis*, but they are scarcely larger in this species than the other punctures, so are less noticeable. The only other difference between the two species that is not mentioned in the diagnosis above is that the sclerotized apex of the male genitalia (fig. 10A) is less elongate transversely in *cylindriformis* and has the sharp angle less obtuse. See also Discussion of Generic and Specific Characters, above.

SPECIMENS EXAMINED: Kansas: Four males, 13 females, 10; Wallace County, two males, five females; 1876 (F. H. Snow), one male, one female. Colorado: One female; Regnier, Baca County, June, 1920, one male; Fountain Valley, El Paso County, June, 1940 (Gertsch and



Hook), one female; Fountain Valley School, Colorado Springs, El Paso County, June, 1935 (A. B. Klots), one female; Denver, Denver County, 1938 (B. Potts), June, 13 males, 12 females, July, one female, August, one male. New Mexico: one female.

Additional specimens from the following localities are reported by the authors given in parentheses: Nebraska (LeConte), Arkansas and Texas (Leng), Webster Park, Weld County (Popenoe) and Bent County (Lantz), both in Colorado, and the following counties in Kansas: Gove, Barber, Greeley, Norton, Grant, Meade, Stanton, and Wichita (Popenoe, Leng, Williams and Hungerford). A specimen in the LeConte collection from Llano Estacado (eastern New Mexico or northwestern Texas), considered at various times by W. Horn as *picolominii*, was examined and compared for me by Dr. P. J. Darlington, Jr., of the Museum of Comparative Zoölogy, and found to be *cylindriformis*.

*Amblycheila picolominii* Reiche

Figures 1, 10B

*Amblycheila picolominii* REICHE, 1839, Ann. Soc. Ent. France, vol. 8, p. 560, pl. 19, figs. 1-6 (type, female, "Bay of San Francisco, California, 48° latitude").

DIAGNOSIS: Very similar to *cylindriformis* in shape and size, but usually has elytra apparently blacker, less brown, their surface appearing glossy and smooth, not dull and rugose, the discal punctures less numerous, smaller and shallower, but the large foveae more contrasting, the first segment of the hind tarsi proportionately longer and narrower. Differs from *baroni* and *schwarzi* by having both large and small punctures on the elytra, the punctures in more numerous rows, by being larger, and by having the hind trochanters produced in the male.

DESCRIPTION: (See also Discussion of Generic and Specific Characters). Length, 27 to 30 mm. Mandibles with from five to eight setae-bearing punctures on each side. Head with an average of four such punctures (four specimens only). Elytra black or brownish, with three long carinae on each side (two dorsal, one submarginal), dorsal carinae parallel throughout; surface smooth, glossy; disc flat or slightly concave, punctured densely or sparsely with small punctures interspersed with large noticeable foveae, some of the punctures feebly mucronate; sutural region equally punctured; punctures on inflexed margin at base arranged in six or fewer rows; apex with large foveae over most of the surface. Hind tarsi shorter than hind tibiae.

Males with hind trochanters produced acutely at apex, female with them oval, not produced.

DISTRIBUTION: Northeastern Arizona and southwestern Colorado southeastward into New Mexico (fig. 1).

DISCUSSION: The identity of this species, its questionable type locality, and the problem of whether it should be regarded as a species, subspecies, or variety have long puzzled entomologists who have dealt with the genus (Lacordaire, Thomson, LeConte, Leng, Schaupp, Rivers, and G. and W. Horn). The type locality contains an error in its statement because San Francisco is at latitude 38°, not 48°, N. In addition, because *picolomini* (except for the type) is not known from farther west than Tuba City, Arizona, and no species of the genus is known to occur as far north as San Francisco or even on the Pacific coast, it may be assumed that the type locality was, as postulated by Rivers (1893), only the port of call for Picolomini in his travels up the Gila and Colorado rivers, and that the type specimen was taken elsewhere in the region then known as California. George Horn (1893), who studied the maps of Reiche's time (1839), has explained that the territory acquired after the Mexican War and called "California" included a much larger area than the present state and that therefore Picolomini's California *Amblycheila* as well as other insects, such as *Pasimachus*, also labeled California and collected on the same voyage, no doubt came from farther east—from New Mexico, Arizona, or even Texas.

The status and distribution of this species have been confused because even those who saw the type (Lacordaire, Thomson, LeConte, G. and W. Horn) thought it represented but a variation of *cylindriiformis*. Thus LeConte (1870) said the type of *picolomini* had "the punctures of the elytra less deep than usual, and the foveae more numerous," which is quite characteristic of *picolomini*, but he added that he had a specimen of *cylindriiformis* from Fort Union, New Mexico, "which resembles it in these respects." This specimen, as well as a specimen from "Arizona" in the LeConte collection, is *picolomini*, not *cylindriiformis*, as verified for me by Dr. P. J. Darlington, Jr. George Horn (1875) agreed with LeConte that the type was "identical with those [specimens] in the cabinet of Dr. LeConte," but he also called them *cylindriiformis*. Walter Horn (1904, 1910, 1926, 1930) also considered *picolomini* conspecific but placed it as a subspecies, giving, however, the same range for both forms. These two forms have not, to my knowledge, been taken in the same locality, although they have been taken in the same states, in "New Mexico" (*cylindriiformis*), Fort Union and Tularosa, New Mexico (*picolomini*); Denver, Colorado Springs, and Regnier, in Colorado (*cylindriiformis*), Mesa Verde National Park, also in Colorado (*picolomini*). I consider them distinct species because of the differences in

the elytral pattern, sculpture, and punctuation, the male genitalia (fig. 10A, B), the difference in the length of the first segment of the hind tarsi (see diagnosis), and the different number of setae on the mandibles. Also all the known specimens of *picolominii* come from mountainous areas, whereas the other form apparently inhabits the plains. (The Mesa Verde specimen, in the collection of Rev. B. Rotger, is the first record of the species from Colorado.)

Although males can readily be distinguished from males of *schwarzi* by the pointed hind trochanters (as in fig. 5), females may at first glance be difficult to separate. To the unaided eye both species present the same smooth glossy appearance, showing only the large foveae of the elytra, but in *picolominii* smaller punctures are present on the elytra and are lacking in *schwarzi*; also the elytral carinae are not so sharp in *picolominii*; the latter is larger, and has different punctuation on the elytral apices. The number of setae-bearing punctures on the head also differs.

The type of *picolominii* could not be found during my visit to the Paris Museum in 1954, but a specimen with a blue label from "California" was examined. This individual, 28 mm. long, was thought at first to be *schwarzi*, but the head is bare of punctures except for two near the eyes, the elytral apices are punctate, and the elytral disc has both large and small punctures. I think, therefore, that this specimen is *picolominii* with the same "erroneous" locality as Reiche's type.

References by Rivers (1893) to *picolominii*, as well as his photograph, do not concern this species, of which he never saw the type, but *schwarzi* Horn (see that species).

SPECIMENS EXAMINED: Arizona: Twenty miles east of Tuba City, July, 1937 (R. P. Allen), two females. New Mexico: Salt Lake, Tularosa desert, Otero County, July, 1906, 4000 feet (G. Krockow), one male; Fort Union, Mora County, one specimen in the LeConte collection examined for me by Dr. P. J. Darlington, Jr. Colorado: Mesa Verde National Park, Montezuma County, June, 1941 (A. J. Rose), one male. "California" [locality doubtful]: one female.

Other specimens reported in the literature include two additional females from Tuba City, Arizona (Cazier, 1939), and the type, a female.

*Amblycheila schwarzi* W. Horn

Figures 1, 9A, 10C

*Amblychila picolominii*, RIVERS, 1893, Zoe, pp. 219, 220, pl. 29 (type, Peach Springs, Truxton Valley, northwest Arizona, 5000 feet).

*Amblychila Schwarzi* W. HORN, 1903, Deutsche Ent. Zeitschr., p. 196, new name for *A. picolominii* Rivers, preoccupied by *A. picolominii* Reiche, 1839.

*Amblycheila utahensis* TANNER, 1951, Great Basin Nat., vol. 11, p. 47 (type, male, Diamond Valley, 15 miles north of St. George, Washington County, Utah).

DIAGNOSIS: Resembles *cylindriformis* and *picolominii* in the multicarinate elytra, but differs from them and also resembles *baroni* by having much sparser punctures on the elytral disc, the punctures being all of the same size and type (strongly mucronate), by having longer hind tarsi, by being smaller, and by lacking the produced hind trochanters in

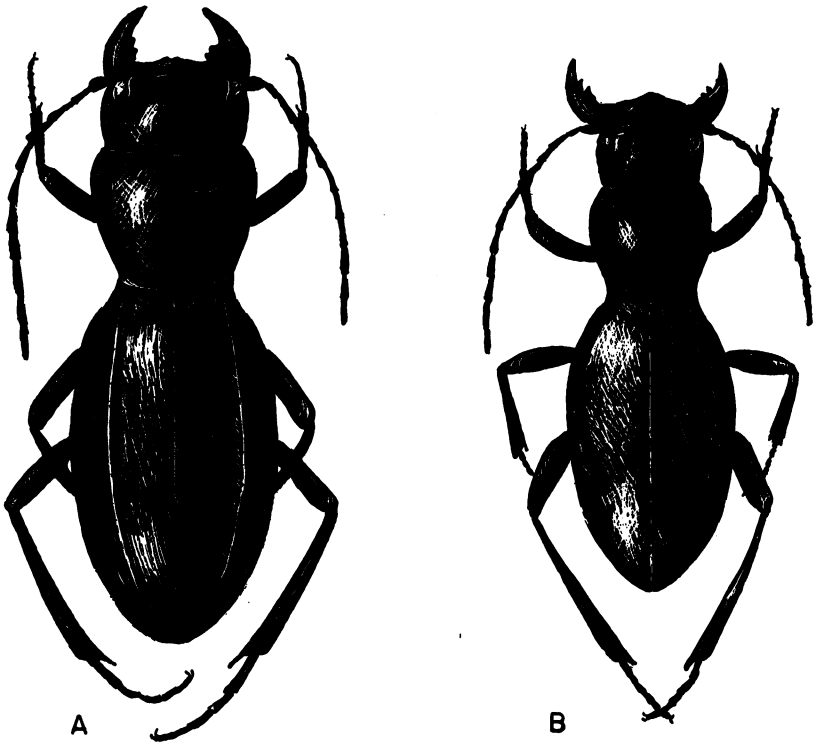


FIG. 9. *Amblycheila*. A. *A. schwarzi* Horn. B. *A. baroni* Rivers.

the male. Differs from *baroni* by having three long carinae on each elytron and many more punctures on the head.

DESCRIPTION: (See also Discussion of Generic and Specific Characters). Length, 22 to 28 mm. Mandibles with from four to nine setae-bearing punctures on each side. Head with an average of 18 such punctures (six specimens). Elytra black, with three long carinae on each side (two dorsal, one submarginal), the innermost dorsal carinae slightly

convergent at apex; surface smooth, glossy; disc concave, punctured sparsely with strongly mucronate or asperate punctures, all of the same size; sutural region virtually impunctate except occasionally at base; punctures on inflexed margin at base arranged in six or fewer rows; apex with tiny sparse punctures. Hind tarsi longer than hind tibiae.

DISTRIBUTION: The desert mountains of southeastern California, east of the Sierra Nevadas, east to northwestern Arizona and southwestern Utah (fig. 1).

DISCUSSION: I cannot understand why W. Horn (1910, 1926, 1930) placed this species as a subspecies of *baroni* Rivers except that the two forms are allopatric. He did say (1910) that he had seen a specimen of *baroni* with flatter dorsum than usual which he thought might show a transition to *schwarzi*. This seems unimportant in view of the fact that *schwarzi* has the elytral disc not only definitely flat but rather concave, and has it bordered on each side by sharp unbroken carinae that are not even present in *baroni*, with the exception occasionally of fragmentary or broken short carinae at the base only. In general appearance this species is more similar to *picolomini* than to *baroni*, but differs as stated in the diagnosis, and also by having the elytral carinae sharper, more pronounced. The apex of the male genitalia in *schwarzi* is even more elongate than in the other species (fig. 10C).

Even before W. Horn had seen the type of *picolomini* Reiche, he realized that the specimens he had seen in the LeConte collection differed from the figure and description given by Rivers for his "*picolomini*" from Peach Springs, Arizona, and he therefore gave his new name, *schwarzi*, to the latter specimen. Examination of the type in 1904 confirmed his name.

I have not seen Tanner's *utahensis* which is said to differ from *schwarzi* in being of smaller size (22 mm.), in having less dense and less deep punctures on the head, and in the darker color of the coxal areas and mouth parts. There are, however, individuals of *schwarzi* just as small (22 mm. from San Bernardino County, California, and from Pintura, Utah), the head punctures always vary somewhat in *Amblycheila*, and I doubt if the color as mentioned can constitute a specific difference. The Utah form is therefore considered a synonym.

SPECIMENS EXAMINED: Arizona: Grand Canyon, September, 1929 (C. C. Searl), one male. California: Granite Mountains, San Bernardino County, April, 1950 (R. Zweifel), one male; Cedar Canyon, Providence Mountains, San Bernardino County, June, 1938, 5000 feet (T. Rodgers), one female; Great Falls Basin, near Trona, Inyo County, May, 1946 (N. L. Rump), one female; 6 miles north of Trona, Inyo County,

June, 1951 (D. Tiemann), one female; Great Falls, Argus Mountains, Inyo County, May, 1951 (D. Tiemann), one female.

Other specimens reported in the literature include one female from the type locality, Peach Springs, Mohave County, 5000 feet, Arizona; about 20 specimens (Rumpp, *in litt.*, in the collection of Darwin Tiemann) from Great Falls, Inyo County, California; two from Skidoo, Panamint Mountains, 5000 feet, Inyo County (Martin, 1932; Cazier,

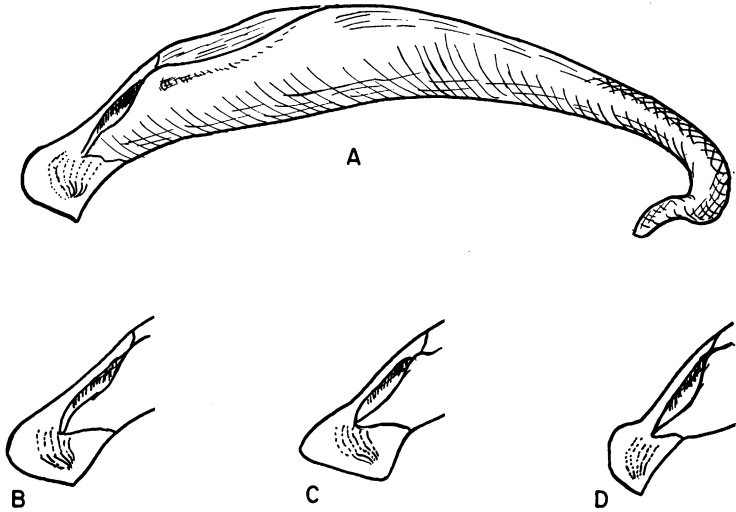


FIG. 10. Male genitalia in *Amblycheila*; ventral views. A. *A. cylindriformis*. B. *A. picolomini*. C. *A. schwarzi*. D. *A. baroni*.

1939); one male from Pintura, Washington County, Utah, April, 1932 (University of Utah); and one male, the type of *utahensis*, from Diamond Valley, 15 miles north of St. George, Washington County, Utah.

#### *Amblycheila baroni* Rivers

Figures 1, 4, 7B, 9B, 10D

*Amblycheila baroni* RIVERS, 1890, Ent. Amer., vol. 6, p. 111 (type, female, Pantano [Pima] County, Arizona, later corrected to male by Rivers, 1893).

*Amblycheila baroni longipes* CASEY, 1909, Canadian Ent., vol. 41, p. 253 (type, male, Baboquivari Mountains, Arizona).

*Amblycheila baroni enodis* CASEY, 1916, Memoirs on the Coleoptera, vol. 7, p. 5 (type, male, Garces, Huachuca Mountains, Arizona).

*Amblycheila ventricosa* CASEY, 1924, Memoirs on the Coleoptera, vol. 11, p. 1 (type, female, Huachuca Mountains, Arizona).

DIAGNOSIS: Differs from all species by having never more than two carinae on each elytron (usually only a submarginal carina), and the

elytral disc convex, not flat or concave. Most similar to *schwarzi* in size, sparseness of the elytral punctures, length of hind tarsi, and in the lack of the male trochanter character present in *cylindriformis* and *picolomini*.

Description: (See also Discussion of Generic and Specific Characters). Length, 19 to 26 mm. Mandibles with from three to six setae-bearing punctures on each side. Head with an average of 8.8 such punctures (27 specimens). Elytra black, either with no carinae, or with a short or long submarginal carina on each side, or with submarginal carinae and a fragmentary dorsal carina (full length in two specimens); surface rather opaque but not rugose; disc convex, punctured sparsely with small, strongly mucronate punctures, all of same size; sutural re-

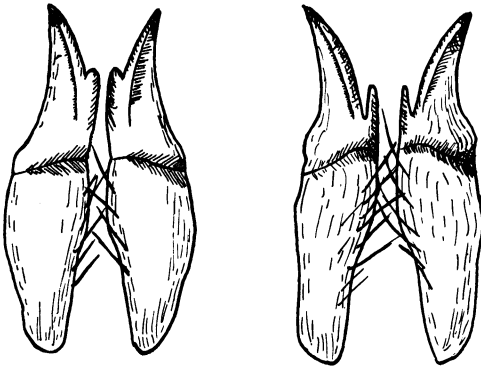


FIG. 11. Female genitalia in *Amblycheila*; ventral views of two specimens of *A. cylindriformis* from Denver, Colorado, showing variation in length and shape of inner tooth.

gion with only a few widely separated punctures; punctures on inflexed margin at base arranged in six or fewer rows; apex punctured with tiny sparse punctures, sometimes virtually impunctate. Hind tarsi longer than hind tibiae.

DISTRIBUTION: The mountains of southeastern Arizona and northern Sonora (fig. 1).

DISCUSSION: This is the least typical of the *Amblycheila* because it lacks the two long dorsal carinae on the elytra; it is dorsally more similar to the species of the genus *Omus*, as is well shown by W. Horn's figures of it and *O. californicus* (1926, pl. 9, figs. 6, 7). In addition to the characters given in the diagnosis, *baroni* differs from the other three species by having the elytra dull, opaque, not glossy as in *schwarzi* and *picolomini*, nor rugose as in *cylindriformis*, and the apex of the male genitalia proportionately smaller (fig. 10D), more evenly rounded. It differs fur-

ther by having less constancy in elytral sculpture, a fact which apparently led Casey to describe his forms, two subspecies of *baroni* (*longipes* and *enodis*) and a species (*ventricosa*), all from the mountains of southeastern Arizona. I have examined a male topotype of *enodis* and find that the differences between it and other *baroni*, as well as the differences given by Casey (1924) in his elaborate key to his other forms and *baroni*, are no more than individual ones. Therefore I agree with W. Horn (1926, 1930) and Cazier (*in litt.*), who saw Casey's types, that these names are synonyms of *baroni*.

Individual variation in this species occurs in the presence or absence of the elytral carinae and in their length. Four of 27 specimens have virtually no submarginal carinae, 10 have these carinae extending only halfway to the apex, only two (Dragoon and Santa Rita Mountains) have long and entire outer dorsal carinae as in other species, no specimens have the inner dorsal carinae entire. The dorsal carinae usually are not formed by solid raised lines but only by short broken ridges, like raised dashes (table 1).

TABLE 1  
INDIVIDUAL VARIATION IN ELYTRAL CARINAE IN TWENTY-SEVEN SPECIMENS  
OF *Amblycheila baroni* BY NUMBER OF SPECIMENS

	Submarginal Carinae 1/3 to 1/2 of Length of Elytra	Submarginal Carinae 3/4 to 4/5 of Length of Elytra	With Outer Dorsal Carinae	With Inner Dorsal Carinae
Arizona				
Huachuca Mountains, Cochise Co.				
Carr Canyon	10	1	3 <sup>a</sup>	None
Carr Canyon	4 <sup>a</sup>	—	None	None
Garces	—	1	None	None
Dragoon, Cochise Co.	—	1	1	None
Pinal Mountains, Gila Co.	—	8	7 <sup>a</sup>	7 <sup>a</sup>
Santa Rita Mountains, Pima Co.	—	1	1	1 <sup>b</sup>
Mexico				
Arispe, Sonora	—	1	1 <sup>a</sup>	None

<sup>a</sup> Carinae nearly obsolete, represented by two or three interrupted short ridges at base only.

Three years after his description, Rivers decided that his type of *baroni* was a male, not a female, and that it was only a small example of "*picolomini*" (= *schwarzi*). Walter Horn later (1910, 1926, 1930) fol-



lowed Rivers in considering *baroni* and *schwarzi* conspecific, which they are not.

SPECIMENS EXAMINED: United States: Arizona: Cochise County, one; Carr Canyon, Huachuca Mountains, Cochise County, July, 1948, 7000 feet (G. E. Ball), four males, four females; July, 1949 (W. J. and J. W. Gertsch), one male, one female; July, 1950, 8000 feet (W. Creighton), one male, three females; August, 1950, 5800 to 7500 feet (P. Boone, T. Cohn, M. Cazier), one female; Garces, Huachuca Mountains, Cochise County, June to September, 4500 to 6500 feet (Beiderman), one (abdomen missing); Huachuca Mountains, September (R. H. Crandall), one female; Dragoon, Cochise County, July, 1917, one male; Madera Canyon, Santa Rita Mountains, Pima County, July, 1949 (W. J. and J. W. Gertsch), one female; Pinal Mountains, Gila County, May, 1935 (F. M. Parker), two males, July, 1948 (F. M. Parker), one female; Middle Pioneer Camp, Pinal Mountains, Gila County, August, 1950, 5000 to 6100 feet (T. Cohn, P. Boone, M. Cazier), six females; Baboquivari Mountains, Pima County (F. H. Snow), one female. Mexico: Sonora: Fifteen miles south of Arispe, 4000 feet, one male.

Other specimens reported from the literature include the following, all from Arizona: the type of *baroni*, male, from Pantano, Pima County; the type of *longipes*, male, Baboquivari Mountains, Pima County; the type of *enodis*, male, from Garces, Huachuca Mountains, Cochise County; and the type of *ventricosa*, female, Huachuca Mountains.

#### REFERENCES CITED

- BROUS, H. A.  
1877. Habits of *Amblychila cylindriformis*. Trans. Kansas Acad. Sci., vol. 5, pp. 11-12, 1 fig.
- CAZIER, M. A.  
1939. Notes on the genus *Amblycheila*. Pan-Pacific Ent., vol. 15, p. 110.
- GISSLER, C. F.  
1879. The anatomy of *Amblychila cylindriformis* Say. Psyche, vol. 2, pp. 233-244, pl. 1, figs. 1-14.
- HAMILTON, C. C.  
1925. Studies in the morphology, taxonomy, and ecology of the larvae of Holarctic tiger-beetles. Proc. U. S. Natl. Mus., vol. 65, no. 2530, pp. 1-87, pls. 1-12.
- HORN, G.  
1875. Synonymical notes and description of new species of North American Coleoptera. Trans. Amer. Ent. Soc., vol. 5, pp. 126-156.  
1876. The sexual characters of North American Cicindelidae with notes on some groups of *Cicindela*. *Ibid.*, vol. 5, pp. 232-240.  
1878. Descriptions of the larvae of the North American genera of Cicindelidae. *Ibid.*, vol. 7, pp. 28-40, pl. 2.

1882. [Session of April 14.] *Ibid.*, vol. 10, p. iv.  
1893. *Amblychila cylindriformis* Say. Ent. News, vol. 4, pp. 281-283.
- HORN, W.  
1903. Briefe eines reisenden Entomologen. Deutsche Ent. Zeitschr., pp. 177-198.  
1904. Ueber die Cicindeliden-Sammlungen von Paris und London. *Ibid.*, pp. 81-99.  
1908. [Sitzung vom 16.X11.07.] *Ibid.*, p. 285, figs. 1-5.  
1910. Genus *Amblychila* Say. In Wytsman, P., Genera insectorum. Brussels, pp. 121-123, pl. 9, fig. 6, pl. 14, figs. 173-176.  
1926. Carabidae: Cicindelinae. In Junk, W., Coleopterorum catalogus. Berlin, vol. 1, pp. 1-345.  
1930. Notes on the races of *Omus californicus* and a list of the Cicindelidae of America north of Mexico (Coleoptera). Trans. Amer. Ent. Soc., vol. 56, pp. 73-86.
- KNAUS, W.  
1900. The Cicindelidae of Kansas. Canadian Ent., vol. 32, pp. 109-116.
- LANTZ, D. E.  
1905. Notes on collecting Cicindelidae. Trans. Kansas Acad. Sci., vol. 19, pp. 252-260.
- LAURENT, P.  
1897. Costly bugs. Ent. News, vol. 8, p. 226.
- LECONTE, J. L.  
1854. Note on the genus *Amblychila* Say. Proc. Acad. Nat. Sci. Philadelphia, vol. 7, pp. 32-33, pl. 1.  
1870. Synonymical notes on North-American Coleoptera. Ann. Mag. Nat. Hist., ser. 4, vol. 6, pp. 394-404.
- LENG, C. W.  
1902. Revision of the Cicindelidae of Boreal America. Trans. Amer. Ent. Soc., vol. 28, pp. 93-186.
- MARTIN, J. O.  
1932. *Amblycheila* in California. Pan-Pacific Ent., vol. 8, p. 111.
- POPENOE, E. A.  
1877. A list of Kansas Coleoptera. Trans. Kansas Acad. Sci., vol. 5, pp. 21-40.
- RIVERS, J. J.  
1893. The species of *Amblychila*. Zoe, vol. 4, pp. 218-223, pls. 28-29.
- SCHAUPP, F. G.  
1878. On the Cicindelidae of the United States. Bull. Brooklyn Ent. Soc., vol. 1, p. 5.
- SNOW, F. H.  
1877. List of Coleoptera. Trans. Kansas Acad. Sci., vol. 5, pp. 15-20.  
1878. *Amblychila cylindriformis* Say. *Ibid.*, vol. 6, pp. 29-32.
- THOMSON, J.  
1857. Monographie des cicindélides. Paris, vol. 1, pp. 1-65, pls. 1-10.
- WILLIAMS, F. X., AND H. B. HUNGERFORD  
1914. Notes on Coleoptera from western Kansas. Ent. News, vol. 25, pp. 1-9, pls. 1-2.
- WILLISTON, S. W.  
1877. On the habits of *Amblychila cylindriformis*. Canadian Ent., vol. 9, pp. 163-165.