

The Tiger Beetles of Oklahoma (Cicindelidae)

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INTRODUCTION

The family Cicindelidae is a very noticeable segment of the Oklahoma insect fauna. This is true not because the tiger beetles are represented by a tremendous number of species or because they are regarded as economic pests, but because they are attractively colored and are frequently encountered on the many sand bars and sandy banks along streams and rivers in Oklahoma.

The principal parts of this paper are a key to the adults and a list of the species, including synonymy, descriptions, and distribution records. It is hoped that this will be of help to those interested in the tiger beetles of Oklahoma. In addition, a key to some of the larvae, adapted from Hamilton (1925), is included. Because only a portion of the State's species are treated, the key to the larvae serves more as a guide to identification than as a comprehensive key.

In general, the synonymy is from the Leng catalogue (1920, 1927, 1933, 1939, 1948). It is not the purpose of this work to attempt to present any new synonymy, for it is too limited in scope—this is particularly true for a group as variable as the Cicindelidae; furthermore, Dr. Mont A. Cazier is preparing a revision of the group for the Nearctic Region. His work will, no doubt, clarify the synonymy of the North American tiger beetles, particularly at the subspecific level.

The distribution data included are, for the most part, county records; however, when the number of specimens collected in the State is very small the full collection data are given. The distribution records are based upon specimens and information available in the various insect collections in Oklahoma. The nature of this paper does not warrant a complete check of all museums for Oklahoma specimens. Unless otherwise stated, the records are from specimens in the Entomology Museum of the Department of Entomology, Oklahoma State University. The distributions of specimens in the University of Oklahoma collection [O. U.] are listed only when they represent additional data.

The illustrations for this paper were drawn by Mrs. Barbara Roach, Entomology Museum technician.

GENERAL BIOLOGY

The tiger beetles are predaceous in both the adult and immature stages. The adults are quite active and aggressive. They are capable of running over the ground with considerable speed and, with the exception of two species, *Cicindela belfragei* Sallé and *C. celeripes* Lec., the Oklahoma species are rather good fliers; however, they generally do not fly for any great distance.

In general, the adults are diurnal; however, *Amblycheila cylindriformis* Say is a notable exception and remains under stones during the day and feeds at night. The species of *Megacephala* are also nocturnal. Typically the adults are found in rather specific habitats; that is, one normally finds *Cicindela repanda* Dejean, for example, along the sand bars and shores of the streams near the water or moist sand. *Cicindela formosa* Say, on the other hand, is generally found on the drier, more shifting, secondary sand banks or on the dry sandy washes. This specificity of habitat is even more pronounced in the larval stage.

A typical life cycle for *Cicindela* would be as follows. The overwintering adult becomes sexually mature in spring or early summer. Mating then occurs and shortly thereafter the eggs are laid. Shelford (1907) stated that the last four segments of the abdomen of the female are used as an ovipositor and that these segments and the appendages on them also serve as a digging organ. He stated that the female does not lay an egg in every hole she digs. The soil moisture and the soil particle size probably have something to do with the desirability of the hole.

The eggs are laid singly in well-like holes 9 to 10 mm. in depth. The holes are not covered after oviposition. Upon hatching the larvae begin to make their burrows. Generally the burrows are made at the spots where the eggs were laid (Shelford, 1907).

Shelford (1908) pointed out that the burrows of the different species are more distinguishable than their larvae. In his study, he found that the burrows are usually cylindrical and have a circular opening at the surface. Surrounding the opening for a distance slightly less than its diameter there is a circular area which the larva keeps smooth. Some species have pit type openings to their burrows instead of the smooth circular ones. The larvae have three instars and enlarge the burrow after each molt.

On the dorsum of the larvae is a pair of hooks, used to help secure the larvae in their burrows. The head and prothorax form a shield which "plugs" the opening of the burrow. In this position the larvae wait to seize a passing food organism, pull it into their burrows, and feed upon it.

If one finds a hole in the ground that appears to be a tiger beetle larva burrow, one may wait quietly near by, avoiding casting a shadow over the opening, and within a minute or so the larva will assume its "plugging position." A movement or a shadow will cause the larva to retreat into the burrow. It is perhaps unnecessary to point out that if, after several minutes by an opening, the larva never appears one would do well to find another burrow.

When collecting the larvae it is best to wait until the larvae assume the "plugging position" then quickly cut off their means of retreat by pushing a trowel or some other tool across the burrow under them. Then the trapped larvae may easily be removed and placed in a preservative. It is, of course, possible to dig the larvae out of the burrows. According to Criddle (1907), Shelford (1908) and Hamilton (1925) many of the burrows are at right angles to the surface. However, many tunnels described by Shelford (1908) are to depths of 30 or 50 cm.; thus, it is far less trouble to trap the larvae than to dig them out.

The species having one-year life cycles pupate in their burrows toward the end of summer. As Shelford (1908) states, some of the adults may then leave the burrows instead of remaining there for the winter. If the adults do not remain in the burrow, they feed for awhile and usually later dig an overwintering tunnel. Some species will overwinter under stones and other such shelter. Species having a two-year life cycles overwinter in the larval stage.

Criddle (1907) gives a nice description of an adult tiger beetle digging its overwintering tunnel. The beetles loosen the earth with their mandibles and use one leg at a time when kicking the earth out of the hole. For the first three to eight inches the tunnel is often at an angle from vertical. From that point on the burrow is generally wide enough at all points to allow the beetle to turn around, particularly at the bottom.

The lower area of the tunnel will not have all the soil removed. The beetle remains in a small chamber beneath this dirt. Criddle states that

the beetle faces upward in the burrow, ready for digging its way out the next spring.

In spring the beetles emerge and begin feeding. When searching for food they run in a jerky, zigzag manner, running and standing rather high above the substrate. When the beetles detect the approach of a person they assume a position close to the ground. If one continues forward, they may spring into the air and take flight; however, if the collector is careful and does not cast a shadow on the beetle it is possible to approach within two or three feet without being noticed. Some species, however, seem to be more difficult to approach than others.

As shown by Shelford (1907), the distribution of tiger beetle larvae in any given area is often closely associated with the plant succession of the area. In his studies near Lake Michigan, he found *Cicindela hirticollis* Say larvae in almost any depression great enough to keep the sand moist. As the depression became older and the sand darkened with decaying plant matter, *C. repanda*, found a little higher up on the sides of the depression, replaced *C. hirticollis*. As the vegetation increased the *C. repanda* population decreased and *C. tranquebarica* Herbst. replaced *C. repanda*. Shelford presents similar relationships to plant succession for other tiger beetle species.

KEY TO THE TIGER BEETLES OF OKLAHOMA

1. Sides of elytra widely inflexed (Fig. 3) *Amblycheila cylindriformis*
 Sides of elytra not widely inflexed (Fig. 4) 2
2. Third segment of maxillary palps longer than the 4th
 [*Megacephala*] 3
 Third segment shorter than the 4th [*Cicindela*] 4
3. Elytra greenish-red-bronze colored; well developed apical lunule (Fig. 5) *M. carolina*
 Elytra uniform in color, no dots or lunule *M. virginica*
4. Humeral angles distinct 5
 Humeral angles round, indistinct *C. celeripes*
5. Prothorax with a lateral margin; usually with dots or other marking; various colors (Figs. 1, 2) 6
 Prothorax without a lateral margin; dark species without elytral markings *C. belifragei*
6. Elytra with a row of conspicuous macropunctures (Fig. 6); lunule and marginal line never contiguous 7
 Elytra without the macropunctures in a row or with lunule and marginal line contiguous 8
7. Elytra bluish or greenish *C. punctulata chihuahuae*
 Elytra very dark *C. punctulata punctulata*
8. Elytra with dots only 9
 Elytra with dots and lunule, lunule only or no markings 10
9. Elytral outer margin blue, inner area reddish *C. pulchra*
 Elytral color blue or green, usually with markings *C. sexguttata*
10. Elytra almost entirely white with a light brown pattern *C. lepida*
 Elytral coloring other than the above 11
11. Elytra with lunule or lunule and dots 16
 Elytra plain, no marking 12

12.	Elytra red, margined with blue	<i>C. pulchra</i>	13
	Elytra not colored as above		13
13.	Elytra green basally, becoming reddish apically or head and prothorax blue with the elytra becoming green apically	<i>C. scutellaris unicolor</i>	14
	Elytra not colored as above		14
14.	Solid green species	<i>C. sexguttata</i>	15
	Black or partially black species		15
15.	Elytra black, venter of abdomen dark	<i>C. obsoleta</i>	
	Elytra not black, venter of the abdomen light brown	<i>C. rufiventris cumatilis</i>	
16.	Elytral marking includes dots		17
	Elytral marking without dots		23
17.	Humeral lunule and marginal line contiguous	<i>C. obsoleta</i>	
	Humeral lunule and marginal line not contiguous		18
18.	Blue colored species	<i>C. rufiventris cumatilis</i>	19
	Copper colored species		19
19.	Elytra with more than six marks	<i>C. duodecimguttata</i>	20
	Elytra with six or less marks		20
20.	Elytra with four marks	<i>C. splendida</i>	21
	Elytra with six marks		21
21.	General color bluish	<i>C. rufiventris cumatilis</i>	22
	General color other than bluish		22
22.	Head and thorax copper colored	<i>C. purpurea</i>	
	Head and thorax green	<i>C. splendida</i>	
23.	Lunule and marginal line contiguous		27
	Lunule and marginal line not contiguous		24
24.	Blue species	<i>C. rufiventris cumatilis</i>	25
	Species color other than blue		25
25.	Color a copper tone		26
	Red in color	<i>C. fulgida</i>	
26.	Marginal line well developed	<i>C. repanda</i>	
	Marginal line wanting	<i>C. tranquebarica</i>	
27.	Middle line well developed (Fig. 7)		28
	Middle line not well developed (Fig. 8)		32
28.	Middle line in the form of a straight line running apically from the margin at a 45° angle	<i>C. schauppi</i>	29
	Middle line not as above		29
29.	Middle line well developed with the apical-most part slightly posterior to the anterior of the apical lunule (Fig. 9)	<i>C. cuprascens</i> , <i>C. nevadica knausi</i>	30
	Middle line not extending as far posteriorly as the anterior of the apical lunule		30
30.	Red colored species		31
	Copper colored species	<i>C. hirticollis</i>	

31. Humeral lunule definitely contiguous, middle line not extending far posteriorly, anterior lobe of the apical lunule well developed (Fig. 7); pubescence not erect *C. formosa*
 Humeral lunule almost separate, middle line extending far posteriorly, anterior lobe of the apical lunule feebly developed; pubescence erect *C. lengi*
32. Pubescence present on the head *C. circumpecta*
 Pubescence on head wanting *C. togata*

KEY TO SOME OF THE COMMON OKLAHOMA TIGER BEETLE LARVAE
 (adapted from Hamilton, 1925)

1. Ocelli 1 and 2 subequal 2
 Ocellus 2 distinctly smaller than ocellus 1 *Amblychella cylindriciformis*
2. Median hooks long, curved and sickle-shaped, pointing outward; palpiger with distinct sclerite, proximal segment of labial palpus with two or three spine-like projections on ventral-distal margin [Cicindela]... 3
 Median hooks thorn-like, straight and very slightly curved inward; palpiger membranous, proximal segment of labial palpus without spine-like projections on ventral-distal margin [Megacephala]... 16
3. U-shaped ridge on caudal part of frons bearing two distinct setae 4
 U-shaped ridge on caudal part of frons bearing 3 or 4 distinct setae 11
4. Pronotum chestnut brown *C. sexguttata*
 Pronotum not chestnut brown 5
5. Median hooks with one or two setae; if three, one seta much smaller than other two 6
 Median hooks with three distinct setae 8
6. Inner hooks with the spine-like projection one third or more the entire length of the hook *C. purpurea*
 Inner hooks with the spine-like projection never more than one sixth the entire length of the hook 7
7. Pronotum with the secondary setae few, not more than ten or twelve setae *C. repanda*
 Pronotum with the secondary setae numerous, 50 or more *C. lepida*
8. Ninth abdominal sternum with the caudal margin bearing two groups of more than three setae each *C. tranquebarica*
 Ninth abdominal sternum with the caudal margin bearing two groups of three setae each 9
9. Antennae with the proximal segment bearing 8-11 setae 10
 Antennae with the proximal segment bearing 5 or 7 setae *C. punctulata*
10. Pronotum with 25 to 30 secondary setae *C. oregona*
 Pronotum with 10 or less secondary setae *C. duodecimguttata*
11. Proximal segment of the galea with four stout setae on the mesial margin; head and pronotum a light brown *C. formosa*
 Proximal segment of the galea with three stout setae on the mesial margin; head and pronotum not brown, but metallic 12

12. Inner hooks bearing more than two setae *C. scutellaris*
 Inner hooks bearing two setae 13
13. Pronotum with secondary setae numerous, 50 or more *C. hirticollis*
 Pronotum with 15-20 secondary setae 14
14. Pronotum dark purple with green or blue reflections, margins not
 lighter, median hooks with two setae 15
 Pronotum bright bronze with faint green or purple reflections, lateral
 margins light yellow; median hooks with 3 or 4 setae *C. cuprascens*
15. Pronotum with cephalo-lateral angles extending as far cephalad as
 the mesial part *C. pulchra*
 Cephalo-lateral angles not extending as far cephalad as the mesial
 part *C. obsoleta*
16. Secondary setae on the abdomen not numerous and found only on the
 sclerotized areas *M. carolina*
 Secondary setae on the abdomen numerous and found between as well
 as on the sclerotized areas *M. virginica*

LIST OF SPECIES

Amblycheila Say

Amblycheila Say, 1823. Journ. Acad. Nat. Sci., Phila., 3: 139.

Amblychila Agassiz, 1846 [emend.]. Nomencl. Zool. Index, p. 16.

Chaleposomus Chaudoir, 1860. Bul. Soc. Nat. Moscou, 33: 337.

Amblycheila cylindriformis Say

Amblycheila cylindriformis Say, 1823. Journ. Acad. Nat. Sci., Phila.,
 3: 139.

The large size (slightly over $1\frac{1}{4}$ inches) and the widely inflexed elytra
 are sufficient to distinguish *A. cylindriformis* from other Oklahoma tiger
 beetles. The color is black.

Amblycheila cylindriformis is nocturnal. During the day it remains
 in hiding under stones (Comstock, 1940). Only one specimen of this species
 is known by us to have been collected in Oklahoma.

Distribution: Woodward, Woodward Co., 18 August 1932. [W. D.
 Davis].

Megacephala Latreille

Megacephala Latreille, 1802. Hist. Nat. Crust. et Ins., 3: 79.

Tetracha Hope, 1838. Coleop. Man., 2: 6.

The genus *Megacephala* is readily separated from *Amblycheila* and
Cicindela by the key; therefore, we feel no need to include any description
 of the genus. Furthermore, the key characters separating the two species,
 the presence of the well developed apical lunule in *M. carolina* and their
 absence in *M. virginica* are satisfactory for Oklahoma forms; thus, no
 further description for the species has been included.

Megacephala carolina (Linné)

Cicindela carolina Linné, 1766. Syst. Nat. (12th ed.), 1: 657.

Megacephala carolina, Latreille, 1804. Hist. Nat. Crust. et Ins., 8: 193.

Megacephala carolinensis Latreille, 1806. Gen. Crust. et Ins., 1: 175.

Tetracha carolina, Schaupp, 1883. Bull. Brooklyn Ent. Soc., 6: 78.

Distribution: Bryan, Cleveland, Jackson, LeFlore, Marshall, Murray [O. U.], McCurtain, and Payne Counties. (June - July.)

Megacephala virginica (Linné)

Cicindela virginica Linné, 1766. Syst. Nat. (12th ed.), 1: 657.

Cicindela virginata Linné, 1788. Syst. Nat. (13th ed.), 1: 657.

Tetracha carolina, Hope, 1838. Coleop. Man., 2: 6.

Distribution: Alfalfa, Canadian (O. U.), Cleveland, Harper, Kay, McCurtain, Muskogee, Osage, Pawnee, Payne, Texas, and Tillman (O. U.) Counties. (June - September.)

Cicindela Linné

Cicindela Linné, 1758. Syst. Nat. (10th ed.), p. 407.

Dromochorus Guérin-Ménéville, 1845. Rev. Zool., 8: 439.

Cicindela belfragei Sallé

Cicindela belfragei Sallé, 1872. Bull. Soc. Ent. France, p. 7.

Cicindela pilatei LeConte, 1875 (not Guér., 1845). Trans. Amer. Ent. Soc., 5: 161.

Cicindela sericea Casey, 1897. Ann. New York Acad. Sci., p. 294.

Cicindela pruinina Casey, 1897. Loc. cit.

Dromochorus belfragei, Leng, 1902. Trans. Amer. Ent. Soc., 28: 110.

Description: length $\frac{5}{8}$ inch or slightly less; black species with no elytral markings; lateral margins of pronotum not raised; pubescence very sparse, not erect.

Distribution: Ardmore, Carter Co., 8 June 1939 (Kaiser-Nailon); Wichita Nat'l. Forest, Comanche Co., 12 June 1932 (O. Sandoz, O. U.), 12 June 1937 (Standish-Kaiser); Lincoln Co., 14 July 1931 (E. Hixon); Sulphur, Murray Co., 14 July 1937 (Standish-Kaiser).

Cicindela celeripes LeConte

Cicindela celeripes LeConte, 1848. Ann. Lyc. Nat. Hist. N. Y., 4: 183.

Cylindera celeripes, Rivillier, 1954. Rev. Franc. d'Ent., 21: 265.

Description: small beetles about $\frac{5}{16}$ inch in length; greenish bronze color; elytra as shown in Figure 10; head and dorsum lacking pubescence, ventral surface with recumbent pubescence.

This small, flightless tiger beetle has been collected from just one county in Oklahoma to date.

Distribution: Clinton, Custer Co., 4 June 1939 (Kaiser-Nailon); Weatherford, Custer Co., 24 June 1936 (R. W. Kaiser).

Cicindela circumpecta LaFerté

Cicindela circumpecta LaFerté, 1841. Rev. Zool., p. 39.

Cicindela collaris LaFerté, 1841. Ibid., p. 95.

Cicindela johnsoni Fitch, 1856. New York Agric. Soc., 16: 487.

Cicindela ambiens Casey, 1913. Mem. Col., 4: 33.

Cicindela insipiciens Casey, 1913. Loc. cit.

Habroscelmomorpha circumpecta, Rivillier, 1954. Rev. Franc. d'Ent., 21: 258.

Description: medium sized tiger beetles slightly over $\frac{1}{2}$ inch in length; greenish-blue or reddish in color; lunule and marginal lines occupying less than half of the total elytral area (Fig. 11); pubescence not erect, sparse on pronotum, wanting on head.

Notes: Leng (1902) states that this species is most abundant near the water's edge, where the bare saline ground is moist and warm, and in sheltered areas where the sun shines hottest. In Oklahoma, we often collect the green and brown phenotypes together.

Distribution: Alfalfa, Beckham (O. U.), Cleveland (O. U.), Grant, Harper, Jackson (O. U.), Kiowa (O. U.), Oklahoma (O. U.), Pawnee, Payne, Washington and Woodward Counties. (July - September.)

Cicindela cuprascens LeConte

Cicindela cuprascens LeConte, 1852. Proc. Acad. Nat. Hist. Phila., 6: 65.

Cicindela amnicola Casey, 1913. Mem. Col., 4: 37.

Cicindela mundula Casey, 1913. Loc. cit.

Ellyptoptera cuprascens, Rivillier, 1954. Rev. Franc. d'Ent. 21: 267.

Description: slightly over $\frac{1}{2}$ inch in length; general coloring reddish or greenish copper; elytral pattern as in Fig. 9; pubescence on head, pronotum and venter recumbent.

Notes: *Cicindela cuprascens* is a very common species in Oklahoma. It occurs in large numbers on the sand along the streams and rivers. This species and *C. repanda* are the most common species in Oklahoma. Future collecting will undoubtedly find these two species to be distributed in all counties of Oklahoma.

Vaurie (1954) regards part of this population to be *C. macra fluviatilis* Vaurie. *Cicindela macra* Le Conte has long been regarded as a synonym of *C. cuprascens*. We intend to do further study on these two species, as well as *C. nevadica knausi* Leng at a later date. For the present, we are leaving *C. macra fluviatilis* with *C. cuprascens*.

Distribution: Alfalfa, Beaver, Beckham, Canadian, Cherokee, Choctaw, Cimarron, Cleveland, Comanche (O. U.), Cotton (O. U.) Custer, Dewey, Ellis, Harper, Jackson, Jefferson, Kay, Kingfisher, Kiowa, Logan, Love, Major, Marshall, Mayes, McCurtain, Noble, Okfuskee, Pawnee, Payne, Pottawatomie, Roger Mills, Sequoyah (O. U.), Texas, Tillman, Woods and Woodward. (May - September.)

Cicindela duodecimguttata Dejean

Cicindela duodecimguttata Dejean, 1825. Spec. Col., 1: 73.

Cicindela proteus Kirby, 1837. Fauna Bor. America, 4: 9.

Cicindela bucolica Casey, 1913. Mem. Col., 4: 28.

Cicindela sterope Casey, 1913. Loc. cit.

Cicindela hudsonica Casey, 1916. Ibid., 7: 29.

Description: about $\frac{1}{2}$ inch long; brown-copper in color; lunule and middle line frequently reduced to dots giving a 12-spotted effect (Fig. 12); pubescence sparse and erect, wanting on the pronotal disk, present on front, vertex, and venter.

Notes: *Cicindela duodecimguttata* has not been collected in large numbers in Oklahoma. We have most frequently collected the species along dirt roads in fields located near lakes. Leng (1902) noted that in the northeast this species was commonly collected along paths in cranberry bogs. The larvae are generally found in humus or clay (Shelford, 1908).

Distribution: Blaine, Bryan (O. U.), Choctaw, Cleveland (O.U.), Craig, Johnston (O. U.), Latimer (O. U.), Murray, Noble, Ottawa, and Payne Counties. (April - October.)

Cicindela formosa Say

Cicindela formosa Say, 1817. Journ. Acad. Nat. Sci. Phila., 1: 19.

Cicindela luxuriosa Casey, 1913. Mem. Col., 4: 24.

Description: slightly over $\frac{1}{2}$ inch in length; general color red above, bluish-green beneath; elytra as figured (Fig. 7); pubescence recumbent, sparse on head, wanting on pronotal disk, moderately thick on the venter.

Notes: This species is generally found in dry sandy washes or along the secondary, dry sandy banks of the rivers. Although not rare in the State, *Cicindela formosa* is never collected in large numbers as are *C. cuprascens* and *C. repanda*.

The larvae are always found in sand that is slightly shifting. The opening of the burrow is cemented with saliva. The burrow is not as simple as those of most tiger beetle larvae. In a sense there are two burrows. The first is very short and opens to the surface. The second burrow comes off at an angle from the first burrow a short distance from the opening and then bends straight down. The depth is from 30 to 50 cm. (Shelford, 1908).

Distribution: Alfalfa, Beaver, Cleveland, Cimarron, Greer, Harper, Hughes, Logan (O.U.), McClain (O.U.), Okfuskee, Osage, Payne, Texas, Woods and Woodward Counties. (March - October.)

Cicindela fulgida Say

Cicindela fulgida Say, 1823. Journ. Acad. Nat. Sci. Phila., p. 141.

Description: slightly less than $\frac{1}{2}$ inch in length; bright metallic red dorsally, bluish-green ventrally; elytral pattern consisting of humeral lunule, middle line, and the apical lunule (Fig. 13); pubescence on head, pronotal disk, and venter erect.

Distribution: Alfalfa, Beckham (O. U.), Jackson (O. U.), Major, and Woods Counties. (April - June.)

Cicindela hirticollis Say

Cicindela hirticollis Say, 1817. Journ. Acad. Nat. Sci. Phila., p. 20.

Cicindela albohirta Dejean, 1826. Spec. Col. 2: 425.

Cicindela unita Kollar, 1836. Ann. Hofmus. Wien, p. 330.

Description: slightly over $\frac{1}{2}$ inch long; general dorsal coloring brown-copper with elytral markings as shown in Fig. 14; pubescence on head, pronotum, and venter erect.

Notes: This species is fairly common in Oklahoma. It is frequently collected with *Cicindela repanda*, *C. tranquebarica*, and *C. cuprascens*.

The larval burrows are commonly found in wet sandy depressions. The burrows are straight; 15-20 cm. deep. The larvae have a tendency to leave their burrows after a rain or any other deviation from the optimum (Shelford, 1907, 1908).

Distribution: Alfalfa, Beaver, Cherokee, Cimarron, Cleveland (O. U.), Comanche (O. U.), Ellis, Greer, Harmon, Harper, Kay, Logan, Love (O. U.), McClain (O. U.), McCurtain (O. U.), Murray (O. U.), Osage, Payne, Roger Mills, Texas, Woods (O. U.), and Woodward Counties. (March - October.)

Cicindela lengi W. Horn

Cicindela lengi W. Horn, 1908. Deutsch. Ent. Zeitschr., p. 738.

Cicindela venusta LeConte, 1848. Ann. Lyc. Nat. Hist. New York, p. 179.

Cicindela versuta Casey, 1913. Mem. Co. 4: 24.

Cicindela gracilentia Casey, 1913. Ibid., p. 25.

Description: slightly more than $\frac{1}{2}$ inch in length; red dorsally (sometimes with a slight green tinge), bluish ventrally, lunule as in Fig. 15.

This species resembles *C. formosa* and can be separated from it by the following: (1) the humeral lunule of *C. lengi* is just slightly contiguous with the marginal line if contiguous at all, (2) the anterior lobe of the apical lunule of *C. lengi* is not well developed as is that of *C. formosa*, and (3) the pubescence of *C. lengi* is erect; that of *C. formosa* is not erect. A comparison of the elytral patterns of the two species (Figs. 7 and 15) should demonstrate the difference between the two. Also, when you have specimens of the two together it is obvious that *C. lengi* is smaller than *C. formosa*.

Distribution: Kenton, Cimarron Co., 21 June 1933 (3 specimens).

Cicindela lepida Dejean

Cicindela lepida Dejean, 1831. Spec. Col., 5: 255.

Cicindela insomnis Casey, 1913. Mem. Col., 4: 35.

Elipsoptera lepida, Rivillier, 1954. Rev. Franc. d'Ent., 21: 267.

Description: length slightly more than $\frac{3}{8}$ of an inch; all of the elytral markings are so greatly expanded that the elytra are almost entirely white with a light brown pattern; pubescence on head, pronotum and venter recumbent.

Notes: Shelford (1908) gives the following information in regard to the habits of the larvae of this species. The burrow is 60 to 90 cm. deep with a funnel-shaped opening; they overwinter in the 3rd larval stage and have a two-year life cycle. In his 1907 paper he reported finding the larvae of *C. lepida* in the Lake Michigan area on the lake side of the first sand ridge, among the young cottonwoods.

We have collected rather sizable samples of this species at lights.

Distribution: Beaver, Beckham, Caddo, Canadian, Cimarron, Dewey, Garvin, Jackson, Kiowa, Noble, Major (O. U.), Ottawa, Payne, Roger Mills, and Sequoyah (O. U.) Counties. (June - August.)

Cicindela nevadica knausi Leng

Cicindela knausi Leng, 1902. Trans. Amer. Ent. Soc., 28: 166.

Cicindela nevadica knausi, Horn, 1915. Gen. Ins., 82: 394.

Ellipsoptera nevadica knausi, Rivillier, 1954. Rev. Franc. d'Ent., 21: 261.

The description of *C. nevadica knausi* is essentially the same as *C. cupracens*. The latter is generally larger and has crescent-shaped humeral lunule which give the appearance of a spot between the elytral humeral angles and middle line. In *C. nevadica knausi* the humeral angle is not so developed; thus the "spot" is wanting.

Distribution: Beaver, Beckham, Jackson, Oklahoma, Payne, and Roger Mills Counties. (June - July.)

Cicindela obsoleta Say

Cicindela obsoleta Say, 1823. Journ. Acad. Nat. Sci. Phila., p. 143.

Cicindela vulturina LeConte, 1853. Proc. Acad. Nat. Sci. Phila., 6: 439.

Cicindela prasina LeConte, 1856. Trans. Amer. Philos. Soc., p. 31.

Cicindelidia obsoleta, Rivillier, 1954. Rev. Franc. d'Ent., 21: 257.

Description: rather large species for Oklahoma (slightly over $\frac{1}{4}$ inch in length); color may be black except for the ivory on the labrum and the base of the mandibles (*C. obsoleta*), or the color may be black with the following pattern: humeral lunule contiguous with the marginal line, apical lunule separate, the middle line broken leaving its apex as a dot, also, a faint post-humeral dot is present (*C. obsoleta vulturina* Lec.). We also have specimens with the marking of the preceding form but with a green color instead of the black, and a fourth form, *C. obsoleta prasina* Lec., which is an immaculate green above and a bluish-green beneath.

We do not have a large series of any of these forms from the state. Because of this, plus the fact that the forms are scattered throughout the state, we are treating the group just as *C. obsoleta*.

Notes: Hamilton (1925) records larvae of *C. obsoleta* taken from burrows that were located in the bare adobe or slightly gravelly soil at Haswell, Colorado. He pointed out that the burrows were from 5 to 7 inches deep, slightly spiral, with the bottom often enlarged to about three-eighths of an inch in diameter.

Distribution: Cimarron, Ellis, Johnston (O. U.), McCurtain, Murray, Pittsburg, and Texas Counties. (June - October.)

Cicindela pulchra Say

Cicindela pulchra Say, 1823. Journ. Acad. Nat. Sci. Phila., p. 142.

Description: slightly over $\frac{1}{2}$ inch in length; head, prothorax, venter and margins of the elytra a metallic blue, elytra other than margins, a metallic red; elytra generally with humeral dots; pubescence on head, sides of pronotum and venter erect.

Notes: Hamilton (1925) collected the larvae in New Mexico from the upper end of an arroyo in moist, adobe soil from vertical holes 4 to 8 inches deep.

Distribution: This very beautiful species is rare in Oklahoma. Collections have been made from only the following locations: Kenton, Cimarron Co., 23 June 1933 (W. Chiles); Grant Co., 20 April 1940 (O. U.); Optima, Texas Co., 21 July 1933 (R. Dahms), Woods Co., 1 May 1936 (R. Kaiser); nr. Heman, Woodward Co., 7 April 1949 (W. J. Reinthal, O. U.). (A total of six specimens are in the OSU collection and four in the O. U. collection.)

Cicindela punctulata punctulata Olivier

Cicindela punctulata Olivier, 1790. Ent., 2: 27.

Cicindela micans Fabricius, 1798. Ent. Syst., Supp. p. 61.

Cicindela jenisoni Gistel, 1837. Syst. Ins., 1: 55.

Cicindela boulderensis Casey, 1909. Canad. Ent., 41: 271.

Cicindela prolixia Casey, 1916. Mem. Col. 7: 33.

Cicindela fontinaria Casey, 1916. Loc. cit.

Cicindelidia punctulata, Rivillier, 1954 (in part). Rev. Franc. d'Ent., 21: 256.

Description: slightly under $\frac{1}{2}$ inch long; dark, blackish species; elytra with green macro-punctures in one more or less complete row and in a partial second row, markings not prominent, generally consisting of the humeral, post-humeral, marginal and supplementary dots, the marginal line and the apical lunule.

Notes: This is a common upland or field species. In the western part of the state the subspecies *C. punctulata chihuahuae* Bates as well as some intermediates are also found.

Shelford (1908) states that the eggs are laid in relatively hard soil containing humus. The larval burrows are 30-40 cm. deep, being more shallow prior to the prepupal stage. Shelford points out that the life cycle of this species is somewhat unusual, for the adults do not hibernate although they have a one-year life cycle. They pass the winter in the third instar. Criddle (1907) found the larval burrows in Manitoba to be as deep as 26 inches.

Distribution: Collected in all counties of Oklahoma except the following: Adair, Blaine, Bryan, Canadian, Choctaw, Coal, Cotton, Garfield, Haskell, Kingfisher, Lincoln, Mayes, Muskogee, Nowata, Oklahoma, Okmulgee, Pittsburg, Rogers, Seminole, Tulsa, Wagoner, and Washita. (May - November.)

Cicindela punctulata chihuahuae Bates

Cicindela micans Say, 1818 [not Fab., 1798]. Trans. Amer. Philos. Soc., p. 426.

Cicindela chihuahuae Bates, 1890. Trans. Ent. Soc. London, p. 500.

Cicindela punctulata chihuahuae, Horn, 1915. Gem. Ins. 82: 383.

Cicindelidia punctulata, Riviller, 1954. Rev. Franc. d'Ent., 21: 256.

Description: Almost identical to the above, but blue-green in color, not blackish.

Distribution: Beaver Co., Beaver, 3 July 1960 (K. Schaefer); Cimarron Co., Boise City, 10 July 1933 (W. Chiles), 10 July 1933 (R. Dahms), 11 July 1933 (E. E. Ivy); Kenton, 21-24 June 1933 (E. E. Ivy), 25 June 1933 (A. E. Pritchard), 19 July 1961 (W. A. Drew); Texas Co., Optima, 22 July 1933, (A. E. Pritchard); Woodward Co., Ft. Supply, 9 June 1959 (H. W. Van Cleave).

Cicindela purpurea Olivier

Cicindela purpurea Olivier, 1790. Ent. 2 (2): 14.

Cicindela marginalis Fabricius, 1801. Syst. Eleuth. 1: 240.

Cicindela ramosa Gistel, 1837. Syst. Ins. 1: 31.

Cicindela spreta LeConte, 1857. Ann. Lyc. Nat. Hist. New York, p. 177.

Description: Slightly over $\frac{1}{2}$ inch long; head and thorax cupreous, elytra greenish with a very strong copper tinge, margins of the elytra bright green; elytral markings include humeral dots, a short middle line and apical dot; pubescence on front, thorax and venter erect.

Only one specimen from Oklahoma is in our collection. The species is very variable in its coloration and since the above description is based on a single specimen it may not be accurate for representatives of this species collected in Oklahoma in the future. Based on the coloring, it is likely that our specimen is a representative of the synonymized subspecies, *C. purpurea graminea* Schaupp (*C. p. auduboni* Lec. [= *C. p. graminea*]); however, having just one specimen we are reluctant to do other than call it *C. purpurea*.

Distribution: Stillwater, Payne Co.; 13 April 1932 (W. D. Davis).

Cicindela repanda Dejean

Cicindela repanda Dejean, 1825. Spec. Col. 1: 74.

Cicindela hirticollis Gould, 1834. Bost. Journ. Nat. Hist., 1: 49.

Cicindela baltimorensis LeConte, 1857. Trans. Amer. Philos. Soc., p. 43.

Description: $\frac{1}{2}$ inch or slightly less in length; brown-copper color; humeral lunule separate from the well-developed marginal line and middle line (if contiguous only slightly so), apical lunule distinct and separate (Fig. 16); pubescence on head, prothorax and venter erect.

Cicindela repanda resembles *C. hirticollis* but the humeral lunule and marginal line of *C. hirticollis* are generally broadly contiguous. Also, the

apical lunule of *C. hirticollis* is often contiguous with the marginal line, whereas the apical lunule of *C. repanda* is separate, as in the humeral lunule in most cases. When the humeral lunule of *C. repanda* is contiguous with the marginal line it is just barely so. The two species can also be separated by the shape of the humeral lunule: C-shaped in *C. hirticollis*; (-shaped in *C. repanda*).

Notes: *Cicindela repanda* is one of our most common and numerous species. It is almost always present in large numbers on the damp sand along the streams. The larval burrows are generally found in sloping damp sand that has some humus matter (Shelford 1907, 1908), but they also do well in muddy soil, moist clay, and soil with humus (Hamilton, 1928). The burrows are about 10 centimeters deep at right angles to a sloping surface and oblique to a horizontal surface (Hamilton, 1925). This species has a two-year life cycle.

Distribution: Alfalfa, Beaver, Beckham, Blaine, Bryan, Caddo, Choctaw, Cimarron, Cleveland, Comanche (O. U.), Dewey, Garvin (O. U.), Grady, Greer, Harmon, Harper, Hughes, Jackson, Johnston (O. U.), Kay, Kingfisher, Kiowa, Latimer (O. U.), LeFlore, Logan, Love (O. U.), Major, Marshall, Murray, Muskogee, McClain (O. U.), McCurtain, McIntosh, Noble, Osage, Ottawa, Pawnee, Payne, Pontotoc (O. U.), Pottawatomie, Sequoyah, Stephens, Texas (O. U.), Woods, and Woodward. (February - November.)

Cicindela rufiventris cumatilis LeConte

Cicindela cumatilis LeConte, 1851. Ann. Lyc. Nat. Hist. New York, p. 178.

Cicindela rufiventris cumatilis, Leng, 1902. Trans. Amer. Ent. Soc., 28: 177.

Cicindelidia rufiventris, Rivillier, 1954. Rev. Franc. d'Ent. 21: 257.

Description: $\frac{1}{2}$ inch or less in length; dark blue in color except labrum (ivory) and the venter of the abdomen (light brown); elytra markings variable—immcaulate, with just an apical lunule, or apical lunule with several dots (Fig. 17); pubescence rather sparse, recumbent, wanting on pronotal disk and head.

Distribution: This species has been collected from one locality in Oklahoma: Broken Bow, McCurtain Co., 29 June 1937 (Standish - Kaiser).

Cicindela schauppi G. Horn

Cicindela schauppi G. Horn, 1876. Trans. Amer. Ent. Soc. 5: 240.

Cicindelidia schauppi, Rivillier, 1954. Rev. Franc. d'Ent., 21: 257.

Description: about $\frac{7}{16}$ inch in length; elytra a flat, dull dark green; marking as in Fig. 18; head and ventral aspect of the prothorax bluish, venter of abdomen light brown; pubescence short and recumbent, wanting on head and pronotal disk.

Notes: This beetle has been collected from just three sites in Oklahoma. Two of the sites were old highway beds that contained a gravelly soil somewhat atypical for the area.

Distribution: Coal Co., U. S. 75 nr. Cedar Creek bridge, 14 Sept. 1959 (Drew and VanCleave), same locality, 1 Sept. 1960 (Graves, Suter, and Wagoner); Hughes Co., Holdenville, 14 Sept. 1959 (Drew and VanCleave); Jefferson Co., 12 Sept. 1952 (L. O. Fisher, O. U.).

Cicindela scutellaris unicolor Dejean

Cicindela scutellaris unicolor Dejean, 1825. Spec. Col. 1: 52.

Description: about $\frac{1}{2}$ inch in length; head and prothorax bluish green, elytra green at the base then blending through green to gold to a reddish color. Some specimens lack the gold and reddish tinge and still others may have elytra that are entirely reddish. In still other specimens the head and thorax are blue and the elytra are blue basally blending into green; elytra lack markings; pubescence erect, almost wanting on head and pronotal disk.

Notes: This species is fairly common in Oklahoma. We have most frequently collected it on dry sand banks or along dry sandy washes. Shelford (1908) states that the eggs are laid in dry sand containing little humus. The burrows are 25-45 centimeters in depth.

Distribution: Alfalfa, Blaine, Caddo, Cimarron, Cleveland, Dewey, Harmon, Harper, Hughes, Jackson, Kay, Latimer, Logan (O. U.), McClain (O. U.), McCurtain, Major, Murray, Osage, Payne, Stephens (O. U.) and Woods Counties. (March - October.)

Cicindela sexguttata Fabricius

Cicindela sexguttata Fabricius, 1775. Sept. Ent., p. 226.

Cicindela varians Ljungh, 1799. Kgl. Vet. Acad. Nga. Handle., p. 143.

Cicindela violacea Fabricius, 1801. Syst. Eleuth., 1: 232.

Cicindela guttata Emmons, 1854. Agric. New York, 5: 35.

Cicindela harrisi Leng, 1902. Trans. Amer. Ent. Soc., 28: 128.

Cicindela quadriguttata Davis, 1903. Ent. News, 14: 271.

Cicindela levettei Casey, 1909. Canad. Ent., 41: 270.

Cicindela tridens Casey, 1909. *Ibid.*, p. 271.

Description: about $\frac{1}{2}$ inch in length; metallic green, blue, or bluish green in color; markings of elytra variable—from none to eight dots; pubescence very sparse, wanting on head and pronotum, erect.

Notes: *Cicindela sexguttata*, although not scarce in Oklahoma as are *C. schauppi* and others, is not very common in the state or, at least, has not been as frequently collected as many other species. We have 15 specimens determined by J. W. Angell as *C. sexguttata levettei*, nine specimens determined by him as *C. s. tridens* and 15 specimens determined as *C. s. violacea*. When one looks at the 39 specimens together they seem to grade from one color group to the next and from one marking type to the next. For that reason, we are referring to them as *C. sexguttata*.

Shelford (1908) reports that larvae typically are found in shaded sand or clay containing humus.

Distribution: Alfalfa, Bryan, Caddo, Carter (O. U.), Cleveland, Comanche (O. U.), Craig, Hughes (O. U.), Kiowa (O. U.), Latimer (O. U.), LeFlore (O. U.), Love (O. U.), Mayes (O. U.), McClain (O. U.), McCurtain, Murray, Osage, Ottawa, Pawnee, Payne, and Pushmataha Counties. (April - August.)

Cicindela splendida Hentz

Cicindela splendida Hentz, 1830. Trans. Amer. Philos. Soc., p. 254.

Cicindela discus Klug, 1834. Jahrb. Insect. 1: 23.

Description: $\frac{1}{2}$ inch or slightly more in length; head, prothorax, venter, and margins of the elytra metallic, bluish-green, remainder of elytra reddish except for the ivory apical lunule and the abbreviated middle line (Fig. 19); pubescence on head, prothorax and venter erect.

Notes: *C. splendida* is one of the more colorful tiger beetles found in Oklahoma. We have most frequently collected this species along dirt roads of high clay concentration in somewhat wooded areas. In addition to its relative scarceness, this species is also difficult to collect, for it tends to take flight while the collector is still a good ten feet away.

Distribution: Bryan, Cleveland (O. U.), Craig (O. U.), Grant (O. U.), Jefferson (O. U.), Johnston (O. U.), Latimer (O. U.), LeFlore (O. U.), Logan (O. U.), Love (O. U.), McCurtain, Murray, Osage, Payne, and Pottawatomie Counties. (March - November.)

Cicindela splendida denverensis Horn

Cicindela denverensis Casey, 1897. Ann. N. Y. Ac. Sci., p. 297.

Cicindela purpurea denverensis, Leng, 1902. Trans. Am. Ent. Soc., 28: 132.

Cicindela purpurea splendida denverensis, Horn, 1915. Gen. Ins., 82: 373.

Description: This subspecies has the same marking on the elytra as do the Oklahoma forms of *C. splendida splendida*. It differs in that the color is green throughout.

Distribution: We have but two specimens of this subspecies from Oklahoma in our collection. One specimen was collected in Bryan County in October, 1934. The other specimen was recently collected. It was taken in copula with a specimen of *Cicindela splendida splendida*. Beaver Co., Beaver, Okla., 27 Mar. 1961 (Robert Jones).

Cicindela togata LaFerté

Cicindela togata LaFerté, 1841. Rev. Zool., p. 40.

Eunota togata, Rivillier, 1954. Rev. Franc. d'Ent., 21: 259.

Description: $\frac{1}{2}$ inch or less in length; cupreous with or without a green tinge; markings contiguous along the outer margin (Fig. 8) and generally cover about $\frac{1}{2}$ of the elytral surface; head, pronotum, and ventral surface covered by recumbent pubescence.

Notes: Leng (1902) states that this species is found on saline flats. The Great Salt Plains Refuge area in Alfalfa County is where we have collected most of our specimens.

Distribution: Alfalfa, Beckham (O. U.), Grant, Harper, Jackson (O. U.), Muskogee, and Woods (O. U.) Counties. (July - October.)

Cicindela tranquebarica Herbat

Cicindela tranquebarica Herbat, 1806. Käfer 10: 178.

Cicindela vulgaris Say, 1818. Trans. Amer. Philos. Soc., p. 409.

Cicindela obliquata Dejean, 1825. Spec. Col. 1: 72.

Cicindela turbulenta Casey, 1913. Mem. Col. 4: 25.

Cicindela wichitana Casey, 1914. Mem. Col. 5: 21.

Description: about $\frac{5}{8}$ inch in length; brown-copper; elytra with humeral and apical lunule and middle line, marginal line wanting (Fig. 20); pubescence on head, prothorax, and venter erect.

Notes: Shelford (1908) states that the eggs are laid in a variety of conditions and that the burrows are from 22-50 centimeters deep.

Distribution: Alfalfa, Beaver, Blaine, Caddo, Cleveland (O. U.), Cimarron, Dewey, Garvin (O. U.), Grady, Greer, Harmon, Harper, Haskell, Johnston (O. U.), Kay, Latimer, LeFlore, Logan (O. U.), McClain (O. U.), McCurtain, McIntosh, Murray (O. U.), Muskogee (O. U.), Noble, Okmulgee, Osage, Payne, Pottawatomie, Woods, and Woodward Counties. (March - October.)

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Explanation of Figures

Figures 1 and 2, the naming system for elytral markings (1=humeral lunule, 2=marginal line, 3=middle line, 4=apical lunule, 5=the basal dot [not seen from above], 6=humeral dot, 7=posthumeral dot, 8=marginal dot, 9=supplementary dot, 10=discal dot, 11=anteapical dot, 12=apical dot).

Figure 3, lateral view of *Amblychella cylindriformis* showing the widely inflexed elytra.

Figure 4, lateral view of *Megacephala virginica* showing the non-inflexed elytra.

Figure 5, dorsal view of *Megacephala carolina*

" 6, outline drawing of the dorsal view of *Cicindela punctulata* showing the position of the macropunctures

" 7, dorsal view of *C. formosa*

" 8, " " " *C. togata*

" 9, " " " *C. cuprascens*

" 10, outline drawing of *C. celeripes*

Figure 11, dorsal view of *Cicindela circumpecta*

" 12, " " " *C. duodecimguttata*

" 13, " " " *C. fulgida*

" 14, " " " *C. hirticollis*

" 15, " " " *C. lengi*

Figure 16, dorsal view of *Cicindela repanda*

" 17, " " " *C. rufiventris cumatilis*

" 18, " " " *C. schauppi*

" 19, " " " *C. splendida*

" 20, " " " *C. tranquebarica*



FIG. 1



FIG. 2

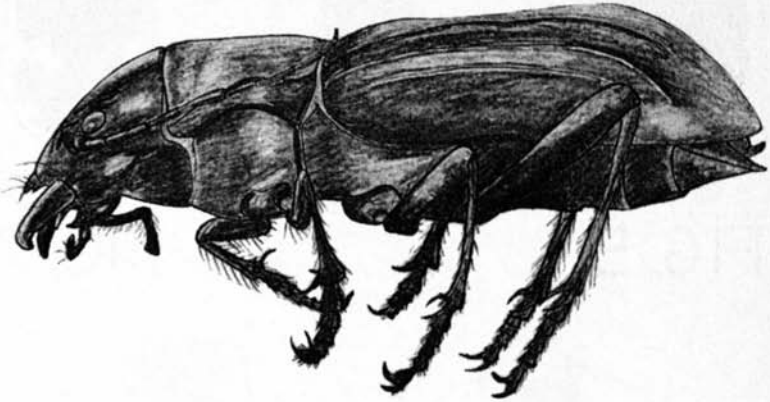


FIG. 3

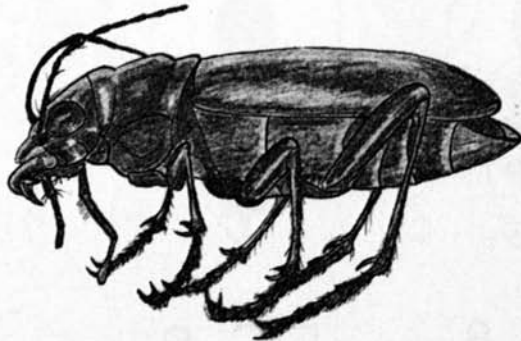


FIG. 4

BR

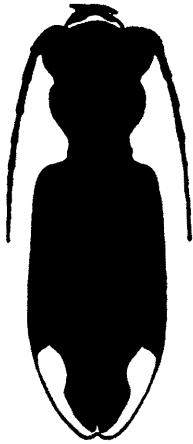


FIG. 5



FIG. 6



FIG. 7

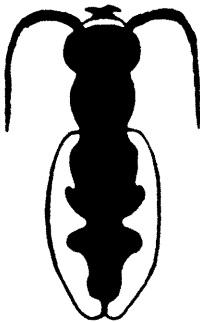


FIG. 8



FIG. 9



FIG. 10

BR

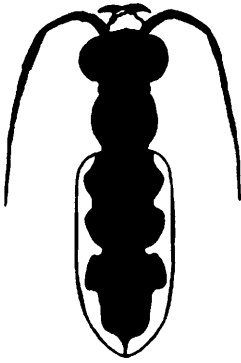


FIG. 11



FIG. 12



FIG. 13

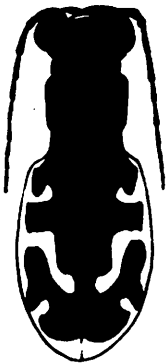


FIG. 14

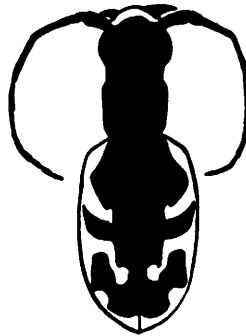


FIG. 15

DR

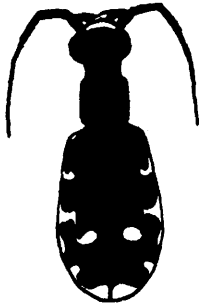


FIG. 16



FIG. 17

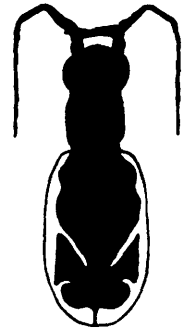


FIG. 18



FIG. 19



FIG. 20

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