TIGER BEETLES OF THE GENUS CICINDELA IN ARIZONA (COLEOPTERA: CICINDELIDAE)

by

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INTRODUCTION

Purpose and Scope of the Thesis

Tiger beetles (Coleoptera: Cicindelidae) are active, predatory insects with a worldwide distribution. Bright coloration of the type, and largest genus, Cicindela Linne, has made it the object of extensive collecting by both professionals and amateurs. As a result, many manuscripts have been published concerning collecting techniques (Cutler, 1969; Ferris, 1969; Wendler, 1969; Willis, 1971). These insects are housed in many private and museum collections throughout the world.

According to Vaurie (1950b), there are three habitats in which tiger beetles are almost always found. These are sand hills, alkali lakes or flats, and sand banks. Habitats such as these, which are found throughout most of Arizona, plus warm temperatures, account for that state's large tiger beetle fauna. In addition, the advent of stock water tanks in recent years has provided numerous ideal habitats for the tiger beetles.

Sexually mature adult tiger beetles emerge in the spring and live for two to ten months. The adult males can be easily distinguished by dense pads of hair on their front tarsi. The adult females have a large blade-like ovipositor for depositing eggs in the ground.

The eggs are laid singly and after usually two weeks of incubation hatch into the first larval stage. This larval stage

lasts a month, in which time the larvae dig a vertical burrow and are predacious on arthropods that pass by the entrance.

The next two larval stages vary in length depending on the species and a number of environmental factors, including temperature and moisture. The third larval stage is followed by pupal ecdysis. The pupal stage usually lasts two weeks and is followed by the last ecdysis. Newly emerged adults remain in the burrow for several days as the pigment develops.

There may be either one or two years between generations. If there is one year between generations, the beetles usually hibernate in the third larval stage. If there are two years between generations they may hibernate both years in the larval stage or one year as a larvae and one as an adult. The generations may overlap and color-changes have been observed (Shelford, 1908).

In reviewing the Cicindela literature it became clear that although several general works have been published with zoogeographical emphasis, our knowledge of the distribution of many species is incomplete. These works have largely been arranged according to states, and until recently the southwest United States has been virtually ignored (Rumpp, 1956, 1961; Sumlin, 1976).

Papers including information of Cicindela species in Arizona have been published concerning habitats (Davis, 1921; Payne, 1971; Sherman, 1908; Vaurie, 1950b), life-histories (Shelford, 1908; Hamilton, 1925), and biology and control (Frick, 1957). Species

descriptions and Arizona distributional records have been scattered throughout the literature (Cazier, 1954; Duncan, 1958; Harris, 1913; Van Dyke, 1947; Vaurie, 1950b, Rumpp, 1977). As a result, the total picture of the Cicindela fauna in Arizona is unclear.

In the taxonomy of Cicindela, morphology has been used almost to the exclusion of all other taxonomic characters. Variation in coloration and maculations has resulted in several synonymies. Currently, 37 taxa of Cicindela are known to occur in Arizona.

Definitions of Terms

The following definitions are taken from Torre-Bueno (1950).

cupreous - coppery; metallic copper red

decumbent - bending downward; bending down at the tip from an upright base

dentate - toothed

disc - upper central surface of any part

elytra - anterior chitinous wings of beetles

fovea - a pit

glabrous - hairless, smooth

immaculate - destitute of spots or marks

impunctate - not punctate or marked with punctures

lunule - small crescent shaped mark

maculations - ornamentation or pattern of marking

margin - narrow part of a surface within the edge

ocular - pertaining to the eyes

ocular setae - most Cicindela have one pair of setae near the front of the eye and one pair near the middle of the eye

pilose - covered with hair

punctate - set with impressed points or punctures

sensory setae - all Cicindela have one to three erect sensory setae near the apex of the first antennal segment

serrate - saw-like

setae - hairs, if the setae have been rubbed off, pits will be visible which occur at the base of the setae

testaceous - brownish-yellow

truncate - cut off squarely at the tip

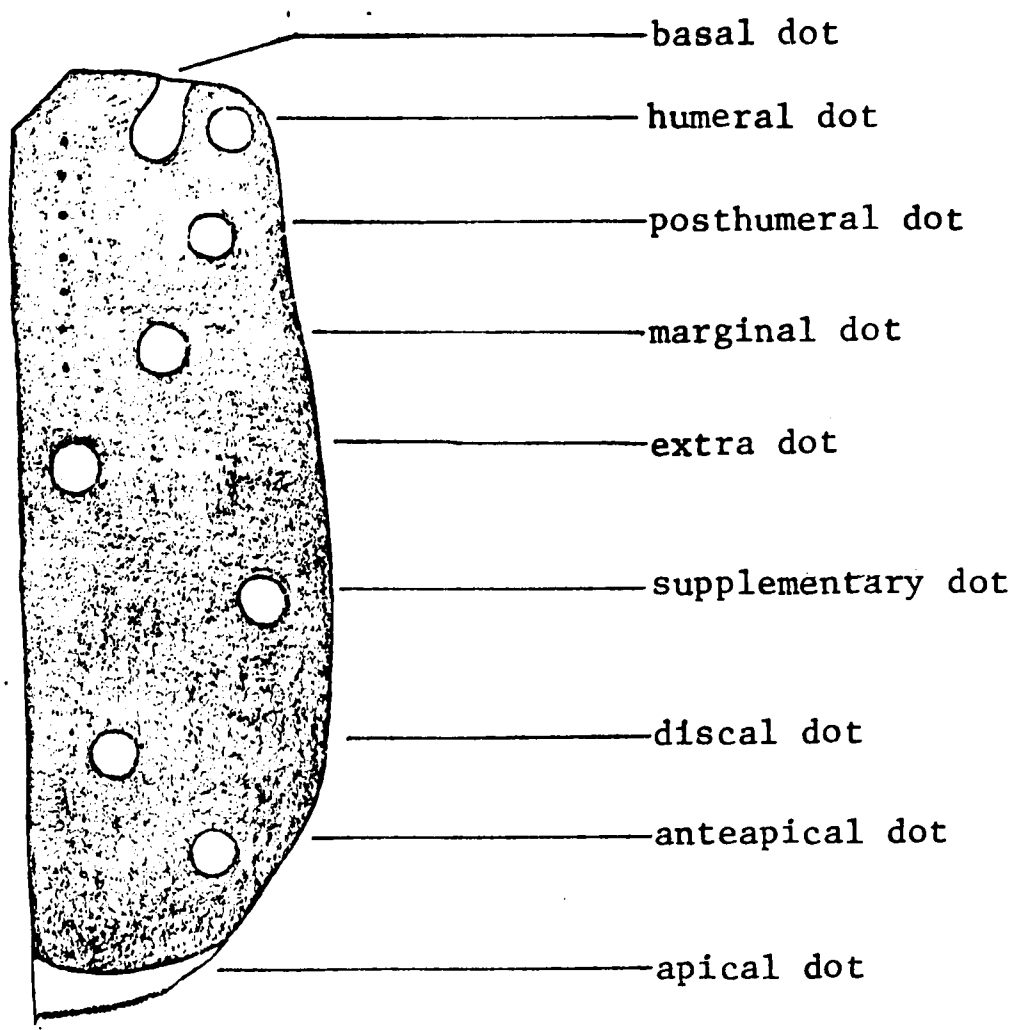

Fig. 1

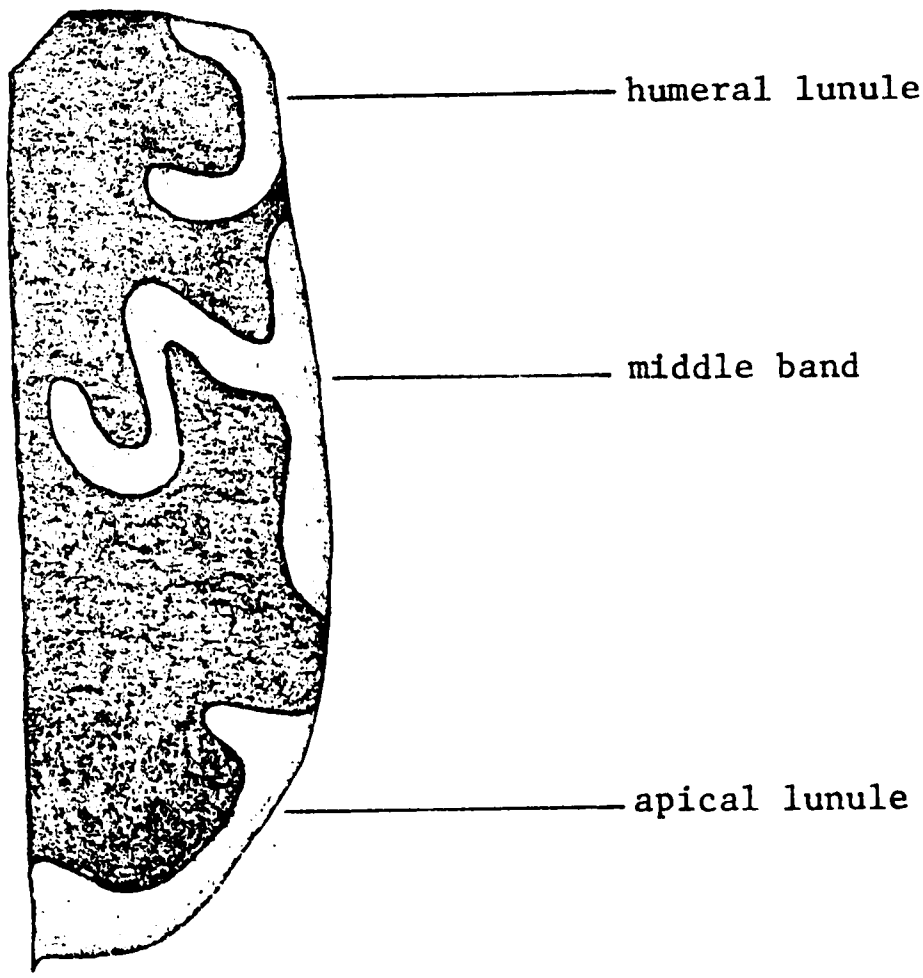

Fig. 2

Figs. 1-2. Types of elytral markings

METHODS AND MATERIALS

The study began with an extensive literature search. Descriptions, localities and habitat notes were reviewed and catalogued. These data were then compared to approximately 10,000 specimens from various collections, examining characteristics commonly used in systematics of the genus: presence or absence of setae, number and size of teeth on the anterior margin of the labrum, and the color and size of maculations on the elytra.

After the preliminary morphological study, the various species of Cicindela were mapped. During the summer of 1978 spot collecting was done throughout Arizona at localities where distributions were unclear.

The maps were then modified to include the new localities. Illustrations of the specimens were added, all at the same scale for ease of comparisons. Diagnosis, remarks and keys were then included for further identification of the taxa.

FINDINGS AND INTERPRETATIONS

The family Cicindelidae can be distinguished from other beetles by the first abdominal segment, which is divided behind the coxae, and the the head, which is as wide as or wider than the thorax. Three genera occur in Arizona: *Amblychila* Say, *Cicindela* Linne and *Tetracha* Hope.

The genera may be separated by the following key:

1. Third joint of the maxillary palpi shorter than the fourth . . . . . *Cicindela*
   Third joint of the maxillary palpi longer than the fourth 2
2. (1) Eyes small, size 25-35 mm . . . . . *Amblychila*
   Eyes large, size 20-25 mm . . . . . *Tetracha*

Of the three genera, nearly all of the Arizona tiger beetle fauna belong to the genus *Cicindela*. In this genus there are thirty-seven nominal taxa composed of six monotypic species and thirty-one subspecies of twenty-three polytypic species.

New county records included in the Arizona distributions are designated by an asterisk. The majority of these new records are in the collection of Arizona State University and were collected by Dr. Mont A. Cazier.

Check list of Species and Subspecies

Known to Occur in Arizona

Cicindela Linne, 1758

C. debilis Bates, 1890

C. fulgida Say, 1823

C. haemorrhagica haemorrhagica LeConte, 1851

C. haemorrhagica arizonae Wickham, 1899

C. hirticollis corpuscula Rumpp, 1961

C. hornii Schaupp, 1883-1884

C. lemniscata LeConte, 1854

C. lengi jordai Rotger, 1974

C. lepida Dejean, 1831

C. longilabris vestalia Leng, 1902a

C. marutha Dow, 1911

C. nevadica citata Rumpp, 1977

C. nevadica tubensis Cazier, 1939

C. nigrocoerulea LeConte, 1848

C. obsoleta santaclarae Bates, 1890

C. ocellata Klug, 1834

C. oregona maricopa Leng, 1902a

C. oregona navajoensis Van Dyke, 1947

C. pimeriana LeConte, 1866

C. praetextata praetextata LeConte, 1854

C. praetextata erronea Vaurie, 1951

C. praetextata fulgoris Casey, 1913

C. pulchra pulchra Say, 1823

C. pulchra dorothea Rumpp, 1977

C. punctulata Oliver, 1790

C. purpurea cimarrona LeConte, 1868

C. purpurea graminea Schaupp, 1883-1884

C. repanda Dejean, 1825

C. sedecimpunctata Klug, 1834

C. sperata LeConte, 1857

C. tenuisignata LeConte, 1851

C. terricola cinctipennis LeConte, 1848

C. tranquebarica kirbyi LeConte, 1866

C. tranquebarica lassenica Casey, 1914

C. viridisticta arizonensis Bates, 1881-1884

C. wickhami Horn, 1903a

C. willistoni sulfontis Rumpp, 1977

Key to the Arizona Species of Cicindela

1. Front trochanter with subapical seta or pit, middle trochanter may or may not have seta or pit. 4

   Front and middle trochanters without subapical seta or pit . . 2

2. (1) Apical dot or lunule present. 3

   Apical dot or lunule absent . . . . . ocellata

3. (2) Elytral margins slightly convex, widest at middle or basal third . . . . . haemorrhagica

Elytral margins nearly parallel, gradually widening to apical fourth . . . . . *sedecimpunctata*

4. (1) Middle trochanter with subapical seta or pit 7

Middle trochanter without subapical seta or pit. 5

5. (4) Elytron with maculations connected to form a submedian longitudinal stripe. . . . . *lemniscata*

Elytron with maculations not forming a submedian longitudinal stripe. 6

6. (5) Elytra impunctate, proepisternum bronze or green with bronze reflections . . . . . *wickhami*

Elytra punctate, proepisternum deep green or blue . . . . . *viridisticta*

7. (4) Clypeus glabrous or with very few erect setae. 11

Clypeus clothed with decumbent setae 8

8. (7) Antennae and legs without pigment, appearing pale tan. . . . . *lepida*

Antennae and legs pigmented blue, green or cupreous. . . . 9

9. (8) First antennal segment with distal sensory setae only. . 10

First antennal segment with decumbent setae below distal sensory setae. . . . . *nevadica*

10. (9) Proepisternum blue to green. . . . . *marutha*

Proepisternum bronze . . . . . *sperata*

11. (7) Front of head bare except for ocular setae 20

Front of head pilose medially. 12

12. (11) Gena pilose. 13

Gena bare. 15

13. (12) First antennal segment with a few erect setae or pits below distal sensory setae 14

First antennal segment with distal sensory setae only . . . . . repanda

14. (13) Apical elytral margins serrate, color cupreous . . . . lengi

Apical elytral margins not serrate, color blue black or green. . . . . purpurea

15. (12) First antennal segment with several erect setae or pits below distal sensory setae 16

First antennal segment with distal sensory setae only . . . . . hirticollis

16. (15) Elytra immaculate or with maculations consisting of humeral dot and may have short transverse line . . . . . pimeriana

Elytra maculations consisting of more than humeral dot and transverse line. 17

17. (16) Elytra dull. 18

Elytra shiny 19

18. (17) Labrum unidentate, proepisternum blue-green with cupreous reflections. . . . . willistoni

Labrum tridentate, proepisternum rosy with some cupreous reflections. . . . . tranquebarica

19. (17) Proepisternum green with cupreous reflections, medium size (11-12 mm). . . . . *fulgida*

Proepisternum blue with green reflections, large size (15-17 mm). . . . . *pulchra*

20. (11) Elytra with subsutural row of fovea extending from base to near apex. 21

Elytra with obscure fovea, none at all, or fovea only at base. 22

21. (20) Apical elytral margins serrate . . . . . *punctulata*

Apical elytral margins not serrate . . . . . *nigrocoerulea*

22. (20) Proepisternum glabrous . . . . . *debilis*

Proepisternum pilose, may be just a few setae near coxal margin 23

23. (22) Apical elytral margins serrate 24

Apical elytral margins not serrate 25

24. (23) Middle band long and slender, and curving inward . . . . . *tenuisignata*

Middle band short and wide or represented by a bulge. . . . . *praetextata*

25. (23) Elytra immaculate. . . . . *hornii*

Elytra with maculations. 26

26. (25) First antennal segment pilose medially, below sensory setae. . . . . *longilabris*

First antennal segment with distal sensory setae only. . 27

27. (26) Size large (19-21 mm), pronotum smooth and dull. . . . . *obsoleta*

Size medium (10-11 mm), pronotum granulate and shiny . . . . . *terricola*

Cicindela debilis Bates

(Figs. 3, 34)

Cicindela debilis Bates, 1890:509; W. Horn, 1897:182; W. Horn, 1903b:219; Harris, 1911:52; W. Horn, 1915:389; W. Horn, 1916:14; Leng, 1920:42; Cazier, 1954:287.

Cicindela debilis var. *segnis* Harris, 1913:69; W. Horn, 1915:389; Cazier, 1954:287.

Type data. -- Type(s) from "Cuidad in Durango, Mexico" (Cazier, 1954); British Museum, Natural History, London.

General distribution. -- MEXICO: Coahuila, Durango; UNITED STATES: Arizona, New Mexico.

Arizona distribution. -- Cochise and Santa Cruz counties (Fig. 34).

Diagnosis. -- Color blue-green, dorsally; purple-blue, ventrally. Head finely rugose, bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax granulate, slightly pilose laterally; proepisternum bare, purple-blue. Legs

pigmented purple-blue, with setae on front and middle trochanters. Abdomen bald to sparsely hairy. Elytra (Fig. 3) evenly punctate, rounded at apex with spine, widest at middle. Length 7-10 mm.

Remarks. -- The two varietal names of this species were synonymized by Cazier (1954). This species is very distinct and shows little variation in size, color and maculation. Adults can be collected in sandy fields from July to November.

Cicindela fulgida Say

(Figs. 4, 35)

Cicindela fulgida Say, 1823:141; Dunn, 1891:153; Wickham, 1899:217; Leng, 1902a:139; Smyth, 1907:182; W. Horn, 1916:7; Leng, 1920:41; Cazier, 1936:159; Vaurie, 1950b:146; Wallis, 1961:51; Graves, 1963:494; Willis, 1967:153; Ferris, 1969:10.

Cicindela fulgida var. subnitens, Calder, 1922:62.

Cicindela fulgida var. pseudowillistoni, W. Horn, 1938:13; Ferris, 1969:10.

Type data. -- Type(s) from "Missouri Territory," near the mountains on the Platte and Arkansas rivers; Academy Natural Sciences, Philadelphia, lost or destroyed.

General distribution. -- UNITED STATES: Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas, Utah, Wyoming.

Arizona distribution. -- Coconino and Navajo counties (Fig. 35).

Diagnosis. -- Color red with green and cupreous reflections dorsally, green with cupreous reflections ventrally. Head rugose, pilose medially; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with proximal erect setae. Thorax rugose, pilose laterally; proepisternum pilose, green with cupreous reflections. Legs pigmented green with cupreous reflections, with setae on front and middle trochanters. Abdomen pilose. Elytra (Fig. 4) glossy, densely punctate, serrate at apex, with spine, widest at apical fourth. Length 10-12 mm.

Remarks. -- Adults of this polytypic species can be collected in June and July along streams and mud flats in northeast Arizona. Members of this species are distinct and show little variation in size and maculation.

Cicindela haemorrhagica LeConte

Key to the Subspecies of *Cicindela haemorrhagica* LeConte

Color black, black-blue to black-green, body robust. . . . . *haemorrhagica*

Color reddish brown, body size reduced. . . . . *arizonae*

Hybrid populations between *haemorrhagica* and *arizonae* have been found in southern Utah and will probably be found in northern Arizona.

Cicindela haemorrhagica haemorrhagica LeConte

(Figs. 5, 36)

Cicindela carthagena var. haemorrhagica LeConte, 1851:171; LeConte, 1857:55; Bates, 1884:9; Schaupp, 1883-1884:105; Dunn, 1891:154; Blaisdell, 1892:48; G. Horn, 1892:27; G. Horn, 1894:306; W. Horn, 1897:179; Wickham, 1899:217; W. Horn, 1903b:218; Smyth, 1907:181; Smyth, 1908:181; W. Horn, 1915:388; W. Horn, 1916:13; Leng, 1920:42; Moore, 1937:109; Hatch, 1938:236; LaRivers, 1946: 139; Cazier, 1948:11.

Cicindela bisignata Dokhturoff, 1883:12; Leng, 1920:42.

Cicindela carthagena var. pacifica Schaupp, 1883-1884:106; Dunn, 1891:154; Blaisdell, 1892:49; Casey, 1913:40; Leng, 1920:42; W. Horn, 1926a:290; LaRivers, 1946:139.

Cicindela haemorrhagica var. pacifica: Leng, 1902:176.

Cicindela carthagena var. woodgatei Casey, 1913:40; Leng, 1920:42; W. Horn, 1926a:289.

Cicindela pacifica var. nevadiana Casey, 1924:16; W. Horn, 1926a:290.

Cicindela carthagena var. nigroides Hatch, 1938:236.

Cicindela haemorrhagica haemorrhagica: Leng, 1920:176; Cazier, 1954:282; Rumpp, 1956:131; Frick, 1957:503.

Type data. -- Type(s) from San Diego, San Diego County, California (Cazier, 1954); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Baja California Norte; UNITED STATES: Arizona, California, Idaho, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming.

Arizona distribution. -- Cochise, Graham, Maricopa, Pima and Yuma counties (Fig. 36).

Diagnosis. -- Color black with some green reflections dorsally, black ventrally. Head finely striate, bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax feebly rugose, slightly pilose laterally; proepisternum pilose, black. Legs pigmented black, front and middle trochanters without setae. Abdomen slightly pilose laterally. Elytra (Fig. 5) faintly and evenly punctured, apex finely serrate, with spine, widest at middle. Length 10-16 mm.

Remarks. -- This widely distributed subspecies occurs along streams, lakes and alkali flats. Adults can be found from June to September. There is much variation throughout its range. The maculations may be broad and complete or consist of broken lunules, in which case specimens resemble C. sedecimpunctata. The two can be distinguished by characters in the key and by the broadness of the maculations found in C. haemorrhagica.

Cicindela haemorrhagica arizonae Wickham (new combination)

(Fig. 36)

Cicindela rufiventris var. arizonae Wickham, 1899:226; Leng, 1902a:178.

Cicindela carthagena arizonae: Smyth, 1907:181; W. Horn, 1915:388; W. Horn, 1916:13; Leng, 1920:42.

Type data. -- Male syntypes from Canyon of Colorado River (date unknown, R. Hayward: July 1892, Townsend); in the University of Iowa.

General distribution. -- UNITED STATES: Arizona, Utah.

Arizona distribution. -- Coconino County (Fig. 36).

Diagnosis. -- Color brown-red with purple and green reflections dorsally, cupreous ventrally. Head striate bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax rugose, pilose laterally; proepisternum pilose, cupreous with red reflections. Legs pigmented cupreous, front and middle trochanters without setae. Abdomen pilose laterally. Elytra granulate, apex serrate, with spine, widest at middle. Length 10-12 mm.

Remarks. -- Cazier (1954) recognized C. haemorrhagica as a distinct species. Until now arizonae has remained as a subspecies under C. carthagena. However, arizonae is more closely related to C. haemorrhagica as is evident by its smaller size and reduced maculations. Therefore, arizonae is now placed as a subspecies under C. haemorrhagica.

Adults of this subspecies are found from May to August in the Grand Canyon. They have the markings of C. haemorrhagica but can be distinguished by their brilliant red-brown color.

Cicindela hirticollis corpuscula Rumpp

(Figs. 6, 37)

Cicindela hirticollis corpuscula Rumpp, 1961:174.

Type data. -- Holotype, male, from Potholes, Imperial County, California (12 May 1946, N. L. Rumpp); United States National Museum, Washington, D. C.

General distribution. -- UNITED STATES: Arizona, California, Nevada, Utah.

Arizona distribution. -- Coconino*, Graham, Greenlee*, Maricopa, Navajo*, Pinal* and Yuma counties (Fig. 37).

Diagnosis. -- Color dull bronze dorsally, reddish bronze ventrally. Head finely striate, pilose; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax slightly rugose, pilose laterally; proepisternum pilose, cupreous. Legs pigmented reddish bronze, front and middle trochanter with setae. Abdomen slightly pilose. Elytra (Fig. 6) shallowly punctate throughout, apex serrate, with spine, widest before middle. Length 11-12 mm.

Remarks. -- Adults of this subspecies can be collected from April to November. They are primarily located on sand banks along the Colorado River and its tributaries. This species somewhat resembles *C. repanda* but can easily be distinguished by its larger size and somewhat pointed abdomen.

Cicindela hornii Schaupp

(Figs. 7, 38)

Cicindela anthracina G. Horn, 1880:139 (preoccupied).

Cicindela hornii Schaupp, 1883-1884:80, Leng, 1902a:127; W. Horn, 1903b:216; Smyth, 1907:188; W. Horn, 1916:9; Leng, 1920:41; Cazier, 1954:247.

Cicindela ritteri Bates, 1890:496; W. Horn, 1900:116; Leng, 1920:41.

Type data. -- Type(s) from Fort Bayard, Grant County, New Mexico (Cazier, 1954); type depository unknown.

General distribution. -- MEXICO: Chihuahua, Durango; UNITED STATES: Arizona, New Mexico, Texas.

Arizona distribution. -- Cochise and Pima counties (Fig. 38).

Diagnosis. -- Color entirely glossy black to purple-black. Head finely rugose, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax smooth to slightly rugose, single row of short hair laterally; proepisternum slightly pilose. Legs pigmented, setae on front and middle trochanter. Abdomen glabrous. Elytra (Fig. 7) coarsely punctate near base, feebly serrate at apex with weak spine, widest at middle. Length 13-15 mm.

Remarks. -- With the exception of color, the characters in this species are stable. It can easily be distinguished by its

glabrous, immaculate appearance. This species is rare, but adults may be found at high altitude, from June to August, along rocky hillsides. They are very difficult to catch.

Cicindela lemniscata LeConte

(Figs. 8, 39)

Cicindela lemniscata LeConte, 1854:220; LeConte, 1857:59; Dunn, 1891:152; G. Horn, 1892:27; G. Horn, 1894:307; W. Horn, 1897:184; Wickham, 1899:224; Leng, 1902a:174; W. Horn, 1903b:220; Smyth, 1905:252; Smyth, 1907:187; Casey, 1913:16; W. Horn, 1915:384; W. Horn, 1916:11; Leng, 1920:41; W. Horn, 1926:170; Cazier, 1948:15; Vogt, 1949:6; Cazier, 1954:263.

Type data. -- Male, holotype, from San Diego, California to El Paso, Texas (1850-1852, T. H. Webb); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Nayarit, Sinaloa, Sonora; UNITED STATES: Arizona, California, New Mexico.

Arizona distribution. -- Cochise, Gila, Graham, Maricopa, Pima, Pinal, Santa Cruz, Yavapai and Yuma counties (Fig. 39).

Diagnosis. -- Color cupreous red dorsally, cupreous red ventrally. Head striate to granulate-rugose, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory

setae only. Thorax rugose, slightly pilose laterally; proepisternum bare, blue. Legs pigmented cupreous with green reflections, setae on front trochanter only. Abdomen pilose. Elytra (Fig. 8) deeply granulate, serrate at apex, with spine, widest at apical fourth. Length 7-10 mm.

Remarks. -- Throughout the summer, adults may be collected at night around lights, or during the day along streams, ponds and lakes. They are very distinct and show little variation in size, maculation and coloration.

Cicindela lengi jordai Rotger

(Figs. 9, 39)

Cicindela lengi jordai Rotger, 1974:9.

Type data. -- Holotype, male, from Heart Canyon, 4 miles north of Aztec, San Juan County, New Mexico (29 May 1970, B. Rotger); collection of Rev. B. Rotger.

General distribution. -- UNITED STATES: Arizona, Colorado, New Mexico, Wyoming.

Arizona distribution. -- Apache* County (Fig. 39).

Diagnosis. -- Color bronze with green and blue reflections dorsally, blue-green with cupreous reflections ventrally. Head granulate, pilose; labrum tridentate; clypeus glabrous; gena pilose.

Thorax striate, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue-green with cupreous reflections, setae on front and middle trochanter. Abdomen pilose. Elytra (Fig. 9) granulate at base, smooth at apex, apex serrate with spine, widest at apical fourth. Length 12-15 mm.

Remarks. -- Adults of this recently described subspecies are present from May to June along sandy banks of dry washes. Their large size and broad maculations make them very distinctive. The only Arizona specimen was taken in June just west of Fort Defiance in Apache County.

Cicindela lepida Dejean

(Figs. 10, 40)

Cicindela lepida Dejean 1831:255; LeConte, 1848:181; LeConte, 1857:51; Jones, 1884:74; Leng and Beutenmuller, 1894:95; Wickham, 1899:224; Knaus, 1900:109; Leng, 1902a:169; Leng, 1902b:239; Smyth, 1905:252; Criddle, 1907:105; Fall, 1907:155; Smyth, 1907:180; Shelford, 1908:168; Blatchley, 1910:27; Fox, 1910:75; Knaus, 1915:35; Dow, 1916:69; W. Horn, 1916:18; Leng, 1920:43; Hamilton, 1925:32; Dawson and Horn, 1928:13; Cazier, 1939:28; Vaurie, 1950b:148; Cazier, 1954:297; Wallis, 1961:67; Graves, 1963:501; Graves, 1973:191.

Cicindela lepida var. insomnis Casey 1913:35.

Type data. -- Type(s) from "America septentrionale"; University of Paris.

General distribution. -- MEXICO: Chihuahua; UNITED STATES: Alabama, Arizona, Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Louisana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas, Utah, Wisconsin, Wyoming; CANADA: Manitoba, Ontario, Quebec, Saskatchewan.

Arizona distribution. -- Apache*, Coconino, Mojave and Navajo* counties (Fig. 40).

Diagnosis. -- Color bronze with green reflections dorsally, green-bronze ventrally. Head striate, pilose; labrum unidentate; clypeus with decumbent setae; gena bare; first antennal segment pilose medially, not pigmented. Thorax rugose, pilose laterally and medially; proepisternum pilose, green-bronze. Legs not pigmented, pale tan, front and middle trochanters with setae. Abdomen densely pilose. Elytra (Fig. 10), shallow punctations, apex obtuse, faint spine to no spine, widest at apical fourth. Length 9-12 mm.

Remarks. -- This monotypic species has an extensive range throughout the United States. In Arizona, adults can be found from June to August. They are easily distinguished by their light color and are most often collected on sandy slopes.

Cicindela longilabris vestalia Leng

(Figs. 11, 34)

Cicindela longilabris var. *vestalia* Leng, 1902a:121; Leng, 1920:41; Hatch, 1938:235.

Cicindela montana var. *uteana* Casey, 1924:12.

Type data. -- Lectotype, female, designated by Dahl (1941) from Maiden, Silver Bow County, Montana (17 June 1890, F. C. Bowditch); American Museum of Natural History, New York.

General distribution. -- UNITED STATES: Arizona, Idaho, Montana, Utah, Wyoming.

Arizona distribution. -- Apache* and Coconino counties (Fig. 34).

Diagnosis. -- Color entirely black, brown or green. Head granulate-rugose, bald; labrum tridentate; clypeus glabrous; gena bald; first antennal segment pilose medially. Thorax striate, pilose laterally; proepisternum bare to slightly pilose. Legs pigmented, front and middle trochanters with setae. Abdomen glabrous to slightly pilose. Elytra (Fig. 11) granulate, rounded to apex, spine, widest at middle. Length 15-16 mm.

Remarks. -- Adults of this rather rare species occur at high elevations from June to August. Maculations are variable and so narrow that the elytra may appear immaculate. Specimens may occasionally be found on gravel along road sides.

Cicindela marutha Dow

(Figs. 12, 41)

Cicindela sperata var. *marutha* Dow, 1911:272; Leng, 1920:42.

Cicindela sperata var. *rubicunda* Harris, 1911:55.

Cicindela marutha: Cazier, 1954:296.

Type data. -- Syntypes from Fort Wingate, McKinley County, New Mexico (J. Woodgate); type depository unknown.

General distribution. -- MEXICO: Chihuahua; UNITED STATES: Arizona, Colorado, New Mexico, Texas, Utah.

Arizona distribution. -- Apache*, Cochise, Coconino*, Maricopa*, Mojave* and Navajo* counties (Fig. 41).

Diagnosis. -- Color cupreous to green with cupreous reflections dorsally, blue-green ventrally. Head granulate-striate, pilose; labrum unidentate; clypeus pilose; gena bare; first antennal segment with sensory setae only. Thorax striate, pilose laterally and medially; proepisternum pilose, blue-green with cupreous reflections. Legs pigmented green with cupreous reflections, front and middle trochanter with setae. Abdomen pilose laterally. Elytra (Fig. 12) punctate basal to near smooth apical, somewhat obtuse, apex serrate, with spine, widest at apical third. Length 13-14 mm.

Remarks. -- From June to August adults of this monotypic species can be found on alkali flats or around seepage. (See discussion under *C. sperata*.)

Cicindela nevadica LeConte

Key to the Subspecies of

Cicindela nevadica LeConte

Color reddish brown, markings broad. . . . . *tubensis*

Color brownish bronze, with green micropits, middle band narrow. . . . . *citata*

Cicindela nevadica citata Rumpp

(Fig. 42)

Cicindela nevadica citata Rumpp, 1977:170.

Type data. -- Holotype, male, from 8 kilometers WSW Willcox, Cochise County, Arizona (20 July 1970, N. L. Rumpp); type no. 12528, California Academy of Sciences, San Francisco.

General distribution. -- UNITED STATES: Arizona.

Arizona distribution. -- Cochise County (Fig. 42).

Diagnosis. -- Color brown bronze with green reflections dorsally, brown with green reflections ventrally. Head granulate, pilose; labrum unidentate; clypeus pilose; gena pilose; first antennal segment pilose medially. Thorax feebly granulate, pilose laterally and medially; proepisternum pilose, bronze. Legs pigmented green with cupreous reflections, front and middle trochanters with setae.

Abdomen pilose laterally. Elytra punctate with blue-green micropits, subsutural row of fovea, apex obtuse, serrate, with spine, widest at apical third to middle. Length 10-11 mm.

Remarks. -- This recently described subspecies is found in the Sulphur Springs Valley in southeastern Arizona. It can be distinguished from C. nevadica tubensis by its bronze-green color. Adult specimens have been collected in July or August along playa lakes.

Cicindela nevadica tubensis Cazier

(Figs. 13, 42)

Cicindela nevadica tubensis Cazier, 1939:24; Vaurie, 1951:7.

Type data. -- Holotype, female, from Tuba City, Coconino County, Arizona (5 July 1937, R. P. Allen); American Museum of Natural History, New York.

General distribution. -- UNITED STATES: Arizona, New Mexico, Utah.

Arizona distribution. -- Apache, Coconino and Navajo Counties (Fig. 42).

Diagnosis. -- Color cupreous-red dorsally, cupreous with some green reflections ventrally. Head granulate-striate, pilose; labrum unidentate; clypeus pilose; gena pilose; first antennal segment pilose medially. Thorax striate, pilose medially and laterally;

proepisternum bronze, pilose. Legs pigmented cupreous with some green reflections, front and middle trochanter with setae. Abdomen pilose laterally. Elytra (Fig. 13), shallow green punctures, rounded to apex, spine, widest at middle. Length 11-12 mm.

Remarks. -- This subspecies can be distinguished from C. nevadica citata by its cupreous-red color. Adults are found from June to August in large populations along bodies of water. Members of this species take flight when approached but, with care, can be caught by hand.

Cicindela nigrocoerulea LeConte

(Figs. 14, 43)

Cicindela nigrocoerulea LeConte, 1848:181; Leng, 1902a:123; W. Horn, 1903b:213; Smyth, 1905:252; Smyth, 1907:180; Casey, 1909:267; W. Horn, 1916:9; Leng, 1920:41; Cazier, 1954:246.

Cicindela robusta Leng, 1902a:124.

Cicindela robusta var. bowdichi Leng, 1902a:124; Leng, 1920:41.

Cicindela nigrocoerulea var. feminalis Casey 1909:269.

Cicindela nigrocoerulea var. triplicans Casey 1909:270.

Cicindela nigrocoerulea var. velutoidea Casey 1909:270.

Cicindela snowi Casey 1909:269; Leng, 1920:41.

Type data. -- Type(s) Arkansas River, probably in Colorado (Cazier, 1954); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Aguascalientes, Chihuahua, Coahuila, Durango, Sonora, San Luis Potosi, Zacatecas; UNITED STATES: Arizona, Colorado, Kansas, New Mexico, Texas.

Arizona distribution. -- Apache*, Cochise, Coconino*, Gila, Graham, Maricopa*, Navajo*, Pima, Pinal*, Santa Cruz* and Yavapai counties (Fig. 43).

Diagnosis. -- Color blue to green with cupreous reflections dorsally, purple-blue ventrally. Head finely rugose, bald; labrum tridentate; clypeus glabrous; gena glabrous; first antennal segment with sensory setae only. Thorax finely rugose, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue-green, front and middle trochanter with setae. Abdomen sparsely pilose. Elytra (Fig. 14), base heavily punctate, apex almost smooth, subsutural row of fovea, apex rounded to small spine, widest at middle. Length 10-14 mm.

Remarks. -- This species shows variation throughout its range. Adults may be immaculate or have complete maculations (Fig. 14). Color may range from brilliant blue to dull green. Adults are found from June to October in fairly dry areas near alkali soil. They closely resemble C. punctulata but can be distinguished by the following characters: widest at middle and not serrate at apex.

Cicindela obsoleta santaclarae Bates

(Figs. 15, 44)

Cicindela obsoleta santaclarae Bates, 1890:493; W. Horn, 1903b:216; Smyth, 1907:188; Casey, 1909:268; W. Horn, 1916:9; Leng, 1920:41; Cazier, 1954:249.

Cicindela obsoleta var. *anita* Dow, 1911:271.

Type data. -- Type(s) from Santa Clara, Chihuahua, Mexico (Cazier, 1954); British Museum, Natural History, London.

General distribution. -- MEXICO: Chihuahua, Durango; UNITED STATES: Arizona, New Mexico.

Arizona distribution. -- Apache*, Cochise, Gila*, Navajo*, Pima*, Pinal*, Santa Cruz and Yavapai* counties (Fig. 44).

Diagnosis. -- Color entire green to blue-green to black. Head finely striate, bald; labrum tridentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax smooth to finely rugose, pilose laterally, proepisternum pilose. Legs pigmented, front and middle trochanter with setae. Abdomen sparsely pilose. Elytra (Fig. 15), minute punctures at base, smooth at apex, apex serrate to smoothly rounded, widest at middle. Length 20-22 mm.

Remarks. -- Adults of this species can be easily distinguished by their large size. Somewhat rare, they can be found at high elevations, from June to September, in short grass. Maculations vary and may consist of lunules or be broken into dots.

Cicindela ocellata Klug

(Figs. 16, 40)

Cicindela ocellata Klug, 1834:33; Graves, 1973:180.

Cicindela flavopunctata Chevrolat, 1833-1835:2; Bates, 1881:10; Bates, 1890:505; Dunn, 1891:152; W. Horn, 1897:177; W. Horn, 1903b:217; Knaus, 1906:147; Smyth, 1907:185; W. Horn, 1915:387; W. Horn, 1916:12; Leng, 1920:42; Vogt, 1949:1; Cazier, 1954:275.

Cicindela incerta Chevrolat, 1833-1835:127.

Cicindela humeralis Chevrolat, 1841:13.

Cicindela flavopunctata var. *chiapana* Bates, 1890:505.

Type data. -- Type(s) from Mexico (Cazier, 1954); probably part of the Walther Horn Collection at Berlin-Dahlem, East Berlin.

General distribution. -- COSTA RICA; NICARAGUA; HONDURAS; EL SALVADOR; GUATEMALA; BRITISH HONDURAS; MEXICO: Aguascalientes, Chiapas, Colima, Distrito Federal, Guanajuato, Jalisco, Michoacan, Morelos, Nayarit, Oaxaca, San Luis Potosi, Sinaloa, Sonora, Veracruz, Yucatan, Zacatecas; UNITED STATES: Arizona, New Mexico.

Arizona distribution. -- Cochise, Gila*, Graham, Pima*, Pinal* and Santa Cruz* counties (Fig. 40).

Diagnosis. -- Color cupreous-brown with blue-green reflections dorsally, cupreous-bronze ventrally. Head granulate, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with

sensory setae only. Thorax smooth to faintly rugose, pilose laterally; proepisternum cupreous, pilose. Legs pigmented green with cupreous reflections, front and middle trochanter without setae. Abdomen pilose. Elytra (Fig. 16), shallowly to deeply, evenly punctate, serrate at apex, with spine, widest at apical third. Length 9-10 mm.

Remarks. -- Adults of this species occur along the southern border of Arizona from June to October. They are often taken at lights, or in sandy areas near water. Specimens show little variation with respect to size, color and maculation.

Cicindela oregona LeConte

Key to the Subspecies of *Cicindela oregona* LeConte

Color dark purple. . . . . *maricopa*

Color cupreous . . . . . *navajoensis*

Cicindela oregona maricopa Leng

(Figs. 17, 45)

Cicindela oregona maricopa Leng, 1902a:147; Smyth, 1907:181; W. Horn, 1916:7; Leng, 1920:41.

Type data. -- Lectotype, male, designated by Dahl (1941) from Phoenix, Maricopa County, Arizona; American Museum of Natural History, New York.

General distribution. -- UNITED STATES: Arizona, California, Nevada, New Mexico.

Arizona distribution. -- Cochise*, Coconino, Gila*, Greenlee*, Maricopa, Navajo*, Pima*, Pinal and Yavapai counties (Fig. 45).

Diagnosis. -- Color blue-green to purple dorsally, blue-green ventrally. Head granulate, bald; labrum tridentate; clypeus glabrous; gena bare; first antennal segment pilose medially. Thorax granulate-striate, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue-green, front and middle trochanter with setae. Abdomen sparsely pilose. Elytra (Fig. 17), granulate, finely serrate at apex, with spine, widest at middle. Length 11-14 mm.

Remarks. -- Maculations in this subspecies show little variation, while coloration may range from blue-green to purple. Adults occur from April to October along streams.

Cicindela oregona navajoensis Van Dyke

(Fig. 45)

Cicindela oregona navajoensis Van Dyke, 1947:155.

Type data. -- Holotype, male, from 15 miles WNW Kayenta, Navajo County, Arizona (17-24 June 1933, H. N. Hultgren); type

number 5864, California Academy of Sciences, San Francisco.

General distribution. -- UNITED STATES: Arizona, Utah.

Arizona distribution. -- Coconino* and Navajo counties (Fig. 45).

Diagnosis. -- Color cupreous dorsally, metallic green ventrally. Head granulate-striate, bald; labrum tridentate; clypeus glabrous; gena bare; first antennal segment pilose medially. Thorax granulate-striate, pilose laterally; proepisternum pilose, green with cupreous reflections. Legs pigmented cupreous, front and middle trochanter with setae. Abdomen bare to sparsely pilose. Elytra with green punctures, serrate at apex, with spine, widest at middle. Length 11-14 mm.

Remarks. -- This subspecies has the maculations of C. oregona maricopa but can be distinguished by its cupreous color. Adults are found in northern Arizona, from June to July, along streams. They are sometimes confused with C. repanda, from which they differ by their usually broken humeral and apical lunules and their first antennal segment, which is pilose medially.

Cicindela pimeriana LeConte

(Figs. 18, 46)

Cicindela viatica LeConte, 1857:62 (preoccupied).

Cicindela pimeriana LeConte, 1866:363; Leng, 1902a:127; W. Horn, 1903b:215; Smyth, 1907:186; W. Horn, 1916:7; Leng, 1920:41; Cazier, 1954:242.

Cicindela pimeriana var. cochisensis Casey, 1909:274.

Type data. -- Type(s) from Sonora, Mexico (Cazier, 1954); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Sonora; UNITED STATES: Arizona, New Mexico.

Arizona distribution. -- Cochise County (Fig. 46).

Diagnosis. -- Color entire blue to blue-green, glossy. Head granulate to finely rugose, pilose; labrum tridentate; clypeus glabrous; gena bare; first antennal segment pilose medially. Thorax finely rugose, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue-green, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 18) shallowly punctate, serrate at apex, with spine, widest at apical third. Length 11-13 mm.

Remarks. -- This monotypic species occurs in the southeastern corner of Arizona. Adults can be found from June to August, on sandy soil near water. Specimens show little variation in size and shape. However, the maculations vary from a humeral spot and a transverse line to being immaculate. Despite this, their glossy blue-green color makes it easy to distinguish them from other species.

Cicindela praetextata LeConte

Key to the Subspecies of *Cicindela praetextata* LeConte

1. Color dull green or blue with no cupreous reflections. . .*erronea*

   Color red, or brown, or if green then with cupreous reflections. 2

2. (1) Color brown, body robust. . . . . .*praetextata*

   Color cupreous-red or cupreous-green, body elongate. . . . . *fulgoris*

Cicindela praetextata praetextata LeConte

(Fig. 47)

Cicindela praetextata LeConte, 1854:220; LeConte, 1857:58; Schaupp, 1883-1884:104; W. Horn, 1897:183.

Cicindela circumpicta praetextata: Leng, 1902a:171.

Cicindela californica praetextata: W. Horn, 1903b:219; Casey, 1913:33; W. Horn, 1915:391; W. Horn, 1916:14; Leng, 1920:42; Cazier, 1948:24.

Type data. -- Syntypes, males, from San Diego, California, to El Paso, Texas (1850-1852, T. H. Webb); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- UNITED STATES: Arizona, California, Utah.

Arizona distribution. -- Gila, Graham, Maricopa, Pinal, Yavapai and Yuma counties (Fig. 47).

Diagnosis. -- Color light brown dorsally, bronze ventrally. Head striate, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax smooth to slightly rugose, pilose medially and laterally; proepisternum pilose, bronze. Legs pigmented bronze, front and middle trochanter with setae. Abdomen pilose. Elytra evenly punctate, serrate at apex, with spine, widest at apical third. Length 12-14 mm.

Remarks. -- This subspecies has the maculations of C. praetextata fulgoris (Fig. 19) but can be distinguished by its dull, light brown color. Adult specimens are commonly collected throughout central Arizona, from June to August, on sandbanks.

Cicindela praetextata erronea Vaurie

(Fig. 47)

Cicindela praetextata viridicyanea Vaurie, 1950a:1 (preoccupied).
Cicindela praetextata erronea Vaurie, 1951:12; Rumpp, 1956:131; Rumpp, 1957:144.

Type data. -- Holotype, male, from Willcox, Cochise County, Arizona (1 September 1947, F. H. Parker); American Museum of Natural History, New York.

General distribution. -- UNITED STATES: Arizona.

Arizona distribution. -- Cochise County (Fig. 47).

Diagnosis. -- Color blue or green dorsally, blue ventrally. Head striate, bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax striate, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue with green reflections, front and middle trochanter with setae. Abdomen pilose. Elytra evenly punctate throughout, serrate at apex, with spine, widest at apical third. Length 12-13 mm.

Remarks. -- Adults of this subspecies are found only in the Sulphur Springs Valley of Arizona. Their blue-green color makes them easy to distinguish. Specimens show little variation with regard to size and shape. Maculations also resemble those of *C. praetextata fulgoris* (Fig. 19). They can be collected from July to September on mud flats at the water's edge.

Cicindela praetextata fulgoris Casey

(Figs. 19, 47)

Cicindela praetextata var. *fulgoris* Casey, 1913:34.

Cicindela praetextata var. *stringens* Casey, 1913:34.

Type data. -- Type(s) from El Paso, El Paso County, Texas; United States National Museum, Washington, D. C.

General distribution. -- UNITED STATES: Arizona, New Mexico, Texas.

Arizona distribution. -- Cochise and Navajo* counties (Fig. 47).

Diagnosis. -- Color cupreous red, may have green reflections dorsally, bronze with green reflections ventrally. Head granulate, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax rugose, pilose medially and laterally; proepisternum pilose, bronze. Legs pigmented bronze or green, front and middle trochanter with setae. Abdomen densely pilose. Elytra (Fig. 19), punctate throughout, serrate at apex, with spine, widest at apical third. Length 11-12 mm.

Remarks. -- From July to September, adults of this subspecies can be found on sand and alkali flats. They can be distinguished from C. p. praetextata by their red color and more elongate size.

Cicindela pulchra Say

Key to the Subspecies of Cicindela pulchra Say

Color red with violet reflections, immaculate or with reduced maculations. . . . . pulchra

Color red with green reflections, maculations usually connected along margin . . . . . dorothea

Cicindela pulchra pulchra Say

(Figs. 20, 48)

Cicindela pulchra Say, 1823:142; Wickham, 1899:213; Smyth, 1907:188; W. Horn, 1916:7; Leng, 1920:41.

Type data. -- Type from "Missouri Territory," along the Platte and Arkansas rivers near the mountains; Academy Natural Sciences, Philadelphia, lost or destroyed.

General distribution. -- UNITED STATES: Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas, Wyoming.

Arizona distribution. -- Apache and Cochise counties (Fig. 48).

Diagnosis. -- Color purple-violet with green reflections, glossy dorsally, blue to blue-green ventrally. Head granulate, pilose; labrum tridentate; clypeus glabrous; gena bare; first antennal segment pilose medially. Thorax smooth to slightly rugose, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue-green, front and middle trochanter with setae. Abdomen sparsely pilose. Elytra (Fig. 20) punctate, rounded at apex, faint spine, widest at apical fourth. Length 16-18 mm.

Remarks. -- Adults of this subspecies occur from July to August on bare sand and gravel. Coloration ranges from violet to deep purple and maculations consist of isolated spots. They are easy to distinguish and should be confused with no other species.

Cicindela pulchra dorothea Rumpp

(Figs. 21, 48)

Cicindela pulchra dorothea Rumpp, 1977:170.

Type data. -- Holotype, male, from 5.2 to 6.2 kilometers SE of Wilcox, Cochise County, Arizona (26 July 1946, N. L. and D. H. Rumpp); type number 12529, California Academy of Sciences, San Francisco.

General distribution. -- UNITED STATES: Arizona.

Arizona distribution. -- Cochise County (Fig. 48).

Diagnosis. -- Color red-orange with blue-green reflections, glossy dorsally, blue to blue-green ventrally. Head slightly rugose, pilose; labrum tridentate; clypeus glabrous; gena bare; first antennal segment pilose medially. Thorax rugose, pilose laterally; proepisternum pilose, blue-green. Legs pigmented blue to blue-green, front and middle trochanter with setae. Abdomen slightly pilose. Elytra (Fig. 2) punctate, smooth and rounded at apex, with spine, widest at apical fourth. Length 15-16 mm.

Remarks. -- In July and August, this orange-red subspecies has been collected on the open flatlands of southeastern Arizona. Maculations are variable and may be connected along the outer margin or reduced to dots. This subspecies can be distinguished from *C. pulchra* by its color, broad maculations, and smaller size.

Cicindela punctulata Oliver

(Fig. 22)

Cicindela punctulata Oliver, 1790:27; Gould, 1834:54; LeConte, 1848:182; Leng and Beutenmuller, 1894:93; Wickham, 1899:218; Leng, 1902a:158; Leng, 1902b:239; W. Horn, 1903b:217; Brimley, 1906:81; Smyth, 1907:181; Criddle, 1907:105; Shelford, 1908:168; Blatchley, 1910:27; Fox, 1910:75; Johnson, 1915:307; Knaus, 1915:35; Goldsmith, 1916:447; W. Horn, 1916:10; Leng, 1920:41; Blanchard, 1921:396; Hamilton, 1925:41; Dawson, 1928:6; Cartwright, 1935:73; Vogt, 1949:6; Vaurie, 1950b:150; Cazier, 1954:251; Wallis, 1961:61; Graves, 1963:503; Willis, 1967:154; Graves, 1973:117.

Cicindela micans Fabricius 1798:61; Say, 1818:426; Leng, 1920a:159; Smyth, 1905:252.

Cicindela obscura Melshimer, 1806:46.

Cicindela jenisoni Gistl, 1837:55.

Cicindela punctulata var. boulderensis Casey, 1909:271.

Cicindela prolixa Casey, 1916:33.

Cicindela punctulata chihuahuae Bates, 1890:500; Leng, 1920:41; Tanner, 1928:269; Cazier, 1954:251; new synonym.

Cicindela fontinaria Casey, 1916:33.

Type data. -- Type(s) from New Jersey (Cazier, 1954); Museum National d'Histoire Naturelle, Paris, destroyed.

General distribution. -- MEXICO: Chihuahua, Sonora; UNITED STATES: Alabama, Arizona, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin, Wyoming; CANADA: Alberta, Manitoba, New Brunswick, Ontario, Quebec, Saskatchewan.

Arizona distribution. -- Apache, Cochise, Coconino, Gila*, Maricopa, Navajo*, Pima*, Santa Cruz* and Yavapai counties.

Diagnosis. -- Color brown to green to blue to purple dorsally, blue-green to purple ventrally. Head granulate-rugose, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax granulate to nearly smooth, pilose laterally; proepisternum pilose, cupreous to blue-green. Legs pigmented green with cupreous to blue-green reflections, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 22) punctate throughout, subsutural row of green fovea, serrate at apex, with spine, widest at apical fourth. Length 10-14 mm.

Remarks. -- In the past, the subspecific name chihuahuae has been used for the high altitude green to purple color form, and

punctulata for the low altitude green to brown form of this species. Extensive collecting and mapping (Mayr, 1969:178) of the wide ranging intermediate populations have shown these to be a good example of clinal variation, not subspeciation. Therefore, chihuahuae is placed in synonymy.

Adult specimens of this common species can be collected throughout most of Arizona from May to September along roadsides, alkali flats or near water. They are strong fliers and often difficult to catch. The elytra may be immaculate or maculations may consist of isolated spots. (See discussion under C. nigrocoerulea.)

Cicindela purpurea Oliver

Key to the Subspecies of

Cicindela purpurea Oliver

Color black to black-green with maculations usually complete around margin. . . . . cimarrona

Color green with cupreous reflections, maculations not complete around margin . . . . . graminea

Cicindela purpurea cimarrona LeConte

(Figs. 23, 49)

Cicindela purpurea cimarrona LeConte, 1868:49; Leng, 1902a:134; Smyth, 1907:183; Leng, 1920:40.

Type data. -- Syntypes, 6 male(s), female(s) from south of Raton Mountain, Colfax County, New Mexico (1867, S. Lewis); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- UNITED STATES: Arizona, Colorado, New Mexico.

Arizona distribution. -- Graham County (Fig. 49).

Diagnosis. -- Color entire black or green. Head rugose, pilose, labrum tridentate; clypeus glabrous; gena pilose; first antennae segment pilose medially. Thorax granulate, pilose laterally; proepisternum slightly pilose. Legs pigmented, front and middle trochanters with setae. Abdomen sparsely pilose. Elytra (Fig. 23) granulate-punctate, smooth at apex, with weak spine, widest at apical fourth. Length 12-15 mm.

Remarks. -- This subspecies has been collected at over 8,000 feet in the Graham Mountains. Adults occur from June to August on bare soil. Specimens show little variation in size, color and maculation, and are easily distinguished.

Cicindela purpurea graminea Schaupp

(Figs. 24, 49)

Cicindela purpurea graminea Schaupp, 1883-1884:89; Dunn, 1891:153; Wickham, 1899:215; Leng, 1902a:132; Smyth 1907-1908:180; Leng, 1920:40; Hamilton, 1925:27; Dawson and Horn, 1928:9; LaRivers, 1946:135.

Cicindela purpurea var. *auguralis* Casey, 1913:21.

Cicindela purpurea var. *ardelio* Casey, 1913:21.

Cicindela purpurea var. *inducta* Casey, 1913:22.

Cicindela nigerrima Leng, 1918:139.

Type data. -- Type(s) from Kansas and California; type depository unknown.

General distribution. -- UNITED STATES: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, Wyoming; CANADA: Alberta, British Columbia, Manitoba, Saskatchewan.

Arizona distribution. -- Apache*, Coconino and Greenlee* counties (Fig. 49).

Diagnosis. -- Color dark green dorsally, dark blue with some green reflections ventrally. Head granulate-striate, pilose; labrum tridentate; clypeus glabrous; gena pilose; first antennal segment pilose medially. Thorax granulate, pilose laterally; proepisternum pilose, rosy. Legs pigmented green with cupreous reflections, front and middle trochanter with setae. Abdomen sparsely pilose. Elytra (Fig. 24) shallowly punctate, smooth at apex, with weak spine, widest at apical fourth. Length 10-12 mm.

Remarks. -- Adults occur from July to August throughout most of Arizona along barren soil or sandy beaches. They are distinct due to their coloration and narrow maculations.

Cicindela repanda Dejean

(Figs. 25, 50)

Cicindela repanda Dejean, 1825:74; Jones, 1884:74; Dunn, 1891:154; Leng and Beutenmuller, 1894:93; Wickham, 1899:215; Knaus, 1900:109; Leng, 1902a:147; Hood, 1903:113; Smyth, 1905:252; Moore, 1906:338; Criddle, 1907:105; Smyth, 1907:184; Shelford, 1908:170; Blatchley, 1910:27; Fox, 1910:75; Davis, 1912:18; Goldsmith, 1916:447; Leng, 1920:40; Blanchard, 1901:396; Hamilton, 1925:31; Dawson and Horn, 1928:7; W. Horn, 1930:81; Cartwright, 1935:71; Hatch, 1938:233; Vaurie, 1950b:151; Willis, 1967:154; Graves, 1969:86; Graves, 1973:168.

Cicindela baltimorensis LeConte, 1857:43.

Cicindela unijuncta Casey, 1897:299.

Cicindela repanda var. hoosieri Mares, 1921:310.

Cicindela repanda var. duncani Knaus, 1924:126.

Cicindela maehleri Robinson 1948:27.

Type data. -- Type(s) from "America septentrionale"; University of Paris.

General distribution. -- UNITED STATES: Alabama, Arizona, Arkansas, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota,

Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming; CANADA: Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, Saskatchewan.

Arizona distribution. -- Maricopa County (Fig. 50).

Diagnosis. -- Color brown with some green reflections dorsally, green-blue with bronze reflections ventrally. Head granulate, pilose; labrum tridentate; clypeus glabrous; gena pilose; first antennal segment with sensory setae only. Thorax rugose, pilose laterally; proepisternum rosy, pilose. Legs pigmented cupreous with green reflections, front and middle trochanter with setae. Elytra (Fig. 25) granulate-punctate, subsutural row of green fovea, serrate at apex, with weak spine, widest at middle. Length 11-12 mm.

Remarks. -- Adults of this species are found throughout the summer along sandy beaches. Although markings are stable they are often confused with other species. (See discussion under *C. hirticollis corpuscula* and *C. oregona navajoensis*.)

Cicindela sedecimpunctata Klug

(Figs. 26, 51)

Cicindela sedecimpunctata Klug, 1834:32; LeConte, 1856:57; Schaupp, 1883-1884:106; Bates, 1884:259; Bates, 1890:503; W. Horn,

1897:172; Smyth, 1907:181; Casey, 1913:15; Cazier, 1954:270.

Cicindela rufiventris var. sedecimpunctata: Leng, 1902a:178; W. Horn, 1903b:216; W. Horn, 1915:386; W. Horn, 1916:12.

Cicindela rufiventris var. ventanasa Bates, 1890:503.

Cicindela sedecimpunctata var. sonorana Casey, 1913:40.

Type data. -- Type(s) from Mexico (Cazier, 1954); probably part of the Walther Horn Collection at Berlin-Dahlem, East Berlin.

General distribution. -- MEXICO: Chihuahua, Durango, Guanajuato, Sinaloa, Sonora, Zacatecas; UNITED STATES: Arizona, New Mexico, Texas.

Arizona distribution. -- Cochise, Coconino*, Gila*, Graham, Greenlee, Navajo*, Pima, Pinal and Santa Cruz counties (Fig. 51).

Diagnosis. -- Color brown with some blue and green reflections dorsally, bronze ventrally. Head striate, bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax rugose, pilose laterally; proepisternum pilose, bronze with blue-green reflections. Legs pigmented bronze with green reflections, front and middle trochanter without seta. Abdomen pilose. Elytra (Fig. 26) evenly punctate throughout, serrate at apex with spine, widest at apical fourth. Length 10-13 mm.

Remarks. -- Adults occur in large numbers on mud flats or along sandy shores. They may be found with C. haemorrhagica but can be

separated by size and coloration (see discussion under C. haemorrhagica). This species is active from May to November and can be easily collected during the hottest part of the day as they sit, under debris, in the shade at the water's edge.

Cicindela sperata LeConte

(Figs. 27, 52)

Cicindela sperata LeConte, 1857:50; G. Horn, 1876:239; Wickham, 1899:206; Leng, 1902a:167; W. Horn, 1903b:219; Smyth, 1907:185; W. Horn, 1916:17; Leng, 1920:42; Vogt, 1949:1; Cazier, 1954:296.

Type data. -- Type(s) from "Rio Grande, at various places" (Cazier, 1954); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Chihuahua, Coahuila, Durango, Tamaulipas; UNITED STATES: Arizona, California, New Mexico, Texas, Utah.

Arizona distribution. -- Apache*, Cochise*, Coconino, Navajo* and Yuma counties (Fig. 52).

Diagnosis. -- Color brown-cupreous dorsally, green ventrally. Head rugose, pilose; labrum unidentate; clypeus pilose; gena bare; first antennal segment with sensory setae only. Thorax striate, pilose medially and laterally; proepisternum pilose, bronze. Legs

pigmented bronze, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 27) closely punctate throughout, serrate at apex, with spine, widest at apical third. Length 12-14 mm.

Remarks. -- Adults occur from June to August on mud flats and at water banks. Superficially, they resemble C. marutha but are distinguished by the following characters: deeper punctations on the elytra, bronze proepisternum and the striate appearance of the thorax.

Cicindela tenuisignata LeConte

(Figs. 28, 46)

Cicindela tenuisignata LeConte, 1851:171; Dunn, 1891:152; Wickham, 1899:220; Leng, 1902a:153; W. Horn, 1903b:218; W. Horn, 1916:10; Leng, 1920:41; LaRivers, 1946:138; Vogt, 1949:6; Cazier, 1954:256.
Cicindela psilogramma Bates, 1890:507.

Type data. -- Type(s) from "Colorado Desert," probably California (Cazier, 1954); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- MEXICO: Baja California Norte, Chihuahua, Coahuila, Durango, Sinaloa, Sonora, Tamaulipas; UNITED STATES: Arizona, California, Nevada, New Mexico, Texas, Utah.

Arizona distribution. -- Cochise, Coconino*, Gila*, Graham, Maricopa, Navajo*, Pima*, Pinal*, Yavapai* and Yuma* counties (Fig. 46).

Diagnosis. -- Color brown-bronze dorsally, metallic green with bronze reflections ventrally. Head striate, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax granulate, pilose laterally; proepisternum bronze, pilose. Legs pigmented bronze, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 28) punctate, serrate at apex, with spine, widest at apical fourth. Length 11-12 mm.

Remarks. -- Adults of this monotypic species are found throughout most of Arizona from May to November. They show little variation and are easily distinguished by the narrow descending middle band. They most often occur in ditches and on alkali flats.

Cicindela terricola cinctipennis LeConte

(Figs. 29, 38)

Cicindela pusilla var. *cinctipennis* LeConte, 1848:182; LeConte, 1857:45; Schaupp, 1883-1884:82; Dunn, 1891:154; Wickham, 1899: 206; Leng, 1902a:155; W. Horn, 1915:390; W. Horn, 1916:14; Leng, 1920:42; Wallis, 1916:64.

Cicindela pusilla var. cyanella LeConte, 1857:46; Schaupp, 1883-1884: 95; Leng, 1902a:155; W. Horn, 1903a:196; Leng, 1920:42.

Cicindela terricola cinctipennis: Huber, 1969:19.

Type data. -- Type(s) from the Rocky Mountains; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- UNITED STATES: Arizona, Colorado, New Mexico, Montana, Utah, Wyoming; CANADA: Alberta, Saskatchewan.

Arizona distribution. -- Apache*, Coconino and Navajo counties (Fig. 38).

Diagnosis. -- Color bronze with blue-green reflections dorsally, blue-green ventrally. Head striate, bald; labrum tridentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax granulate-striate, pilose laterally and medially; proepisternum pilose, green. Legs pigmented green with bronze reflections, front and middle trochanter with setae. Abdomen pilose laterally. Elytra (Fig. 29) punctate throughout, smooth at apex, with spine, widest at apical fourth. Length 9-12 mm.

Remarks. -- From July to September, adults of this species may be collected in short grass along the edges of alkali flats, or on muddy shores. They resemble no other species and are easily distinguished.

Cicindela tranquebarica kirbyi LeConte

(Figs. 30, 53)

Cicindela obliquata Dejean, 1825:72; Blaisdell, 1892:48; Leng, 1902a:145 (preoccupied).

Cicindela tranquebarica kirbyi LeConte, 1866:362; Wickham, 1899:206; W. Horn, 1916:6; Leng, 1920:40; Dawson and Horn, 1928:8; Cazier, 1939:27; LaRivers, 1946:136.

Cicindela tranquebarica var. *deffracta* Casey, 1909:273.

Cicindela admiscens Casey, 1913:8.

Type data. -- Type(s) from "America septentrionale"; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

General distribution. -- UNITED STATES: Arizona, Colorado, Kansas, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, Wyoming; CANADA: Alberta, Manitoba, Saskatchewan.

Arizona distribution. -- Apache*, Coconino, Gila*, Navajo* and Maricopa* counties (Fig. 53).

Diagnosis. -- Color coppery brown with some blue-green reflections dorsally, blue-green with cupreous reflections ventrally. Head striate-granulate, pilose; labrum tridentate; clypeus glabrous; gena bald; first antennal segment pilose medially. Thorax granulate,

sparsely pilose laterally; proepisternum pilose, rosy. Legs pigmented bronze, front and middle trochanter with setae. Abdomen pilose laterally. Elytra (Fig. 30) granulate at base, punctate at apex, serrate at apex, weak spine to no spine, widest at apical fourth. Length 13-15 mm.

Remarks. -- Adults of this subspecies may be found from April to June along lakes, streams and in grassy fields near water. Specimens show little variation. They can be distinguished from C. willistoni sulfontis by characters in the key, and from C. tranquebarica lassenica by its brown color.

Cicindela tranquebarica lassenica Casey

(Fig. 53)

Cicindela tranquebarica lassenica Casey, 1914:22.

Cicindela tranquebarica cibecuei Duncan, 1958:43; new synonym.

Type data. -- Type locality reported as probably California (Casey, 1914). Rumpp (personal communication) has indicated Casey's material is identical to populations below the Mogollon Rim, Gila and Navajo counties, Arizona; United States National Museum, Washington, D. C.

General distribution. -- UNITED STATES: Arizona.

Arizona distribution. -- Gila and Navajo counties (Fig. 53).

Diagnosis. -- Color entirely navy blue to black. Head striate-granulate, pilose; labrum tridentate; clypeus glabrous; gena bald; first antennal segment pilose medially. Thorax striate, pilose laterally; proepisternum pilose. Legs pigmented, front and middle trochanter with setae. Abdomen pilose laterally. Elytra granulate at base, punctate at apex, serrate at apex, with weak spine to no spine, widest at apical fourth. Length 13-15 mm.

Remarks. -- Norman Rumpp (personal communication) has compared types of lassenica Casey to cibecuei Duncan, and found them to be the same. Casey listed the type locality as probably California, but it is actually one of the populations below the Mogollon Rim in east-central Arizona. Following Rumpp's suggestion, I propose to place cibecuei in synonymy under lassenica.

Adults of this subspecies are distinctive due to their coloration. They may be found in creek beds from April to June.

Cicindela viridisticta arizonensis Bates

(Figs. 31, 35)

Cicindela viridisticta arizonensis Bates, 1881-1884; W. Horn, 1935; 65; Cazier, 1954:284.

Cicindela arizonensis: W. Horn, 1903b:219; W. Horn, 1915:388; W. Horn, 1916:13; Leng, 1920:42.

Cicindela viridisticta: Schaupp, 1883-1884:103; Leng, 1902a:115; W. Horn, 1903a:182; Smyth, 1907:188.

Type data. -- Type(s) from Arizona (Cazier, 1954); British Museum, Natural History, London.

General distribution. -- MEXICO: Chihuahua; UNITED STATES: Arizona.

Arizona distribution. -- Cochise, Gila*, Maricopa*, Pima and Santa Cruz* counties (Fig. 35).

Diagnosis. -- Color brown-bronze dorsally, greenish-blue ventrally. Head granulate-striate, bald; labrum unidentate; clypeus glabrous; gena bare; first antennal segment with sensory setae only. Thorax granulate-striate, pilose laterally, proepisternum bald, deep green or blue. Legs pigmented green with cupreous reflections, front trochanter with setae, middle trochanter without. Abdomen sparsely pilose. Elytra (Fig. 31) evenly, deeply punctate, subsutural row of fovea, serrate at apex with weak spine, widest at apical fourth. Length 7-8 mm.

Remarks. -- Adults of this subspecies show little variation throughout their range. They occur from July to October in short grass along streams, ditches and ponds. Superficially, this subspecies resembles C. wickhami but can be distinguished by the subsutural row of fovea, and a more convex appearance.

Cicindela wickhami Horn

(Figs. 32, 48)

Cicindela wickhami W. Horn, 1903a:182; Smyth 1907-1908:180; Leng, 1920:42; W. Horn, 1926:170; Cazier, 1948:18; Cazier, 1954:284.

Cicindela lemniscata: Smyth, 1907:188 (misidentification).

Type data. -- Type(s) from Tucson, Pima County, Arizona (Cazier, 1954); Berlin-Dahlem, East Berlin.

General distribution. -- MEXICO: Baja California Norte, Sonora, Sinaloa; UNITED STATES: Arizona.

Arizona distribution. -- Cochise, Pima, Pinal and Santa Cruz counties (Fig. 48).

Diagnosis. -- Color cupreous-green to cupreous-red dorsally, cupreous, green and blue ventrally. Head granulate-striate, bald; labrum unidentate; clypeus glabrous; gena bald; first antennal segment with sensory setae only. Thorax granulate-striate, pilose laterally and medially; proepisternum bald, bronze or green with bronze reflections. Legs pigmented brown with cupreous reflections, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 32), shallow green punctations, weakly serrate at apex, with no spine to weak spine, widest at apical fourth. Length 6-8 mm.

Remarks. -- Adults may be collected from June to July in bare areas along water. (See discussion under C. viridisticta arizonensis.)

Cicindela willistoni sulfontis Rumpp

(Figs. 33, 50)

Cicindela willistoni sulfontis Rumpp, 1977:170.

Type data. -- Holotype, male, from 5.6 kilometers WSW of Willcox, Cochise County, Arizona; type number 12530, California Academy of Sciences, San Francisco.

General distribution. -- UNITED STATES: Arizona.

Arizona distribution. -- Cochise County (Fig. 50).

Diagnosis. -- Color dark blue-green, green-bronze or dull brown dorsally, blue-green or green with blue and cupreous reflections ventrally. Head granulate-striate, pilose; labrum unidentate; clypeus glabrous; gena bald; first antennal segment pilose medially. Thorax rugose, pilose laterally; proepisternum pilose, blue-green with cupreous reflections. Legs pigmented blue-green or green with cupreous reflections, front and middle trochanter with setae. Abdomen pilose. Elytra (Fig. 33), even green punctations throughout, weakly serrate, with spine, widest at middle. Length 13-14 mm.

Remarks. -- Adults of this species occur from mid-July to August on mud flats in the Sulphur Springs Valley. Maculations show little variation but there are two color forms, green and brown. (See discussion under C. tranquebarica kirbyi.)

Figs. 3-8. Dorsal view of *Cicindela* species: 3, *C. debilis*; 4, *C. fulgida*; 5, *C. haemorrhagica haemorrhagica*; 6, *C. hirticollis corpuscula*; 7, *C. hornii*; 8, *C. lemniscata*.

Fig. 3

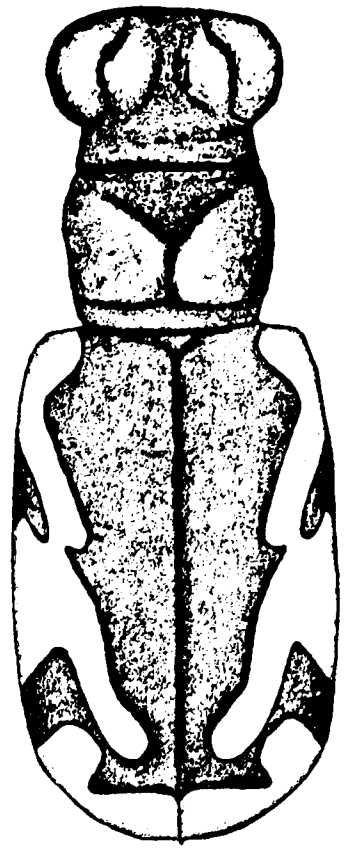

Fig. 4

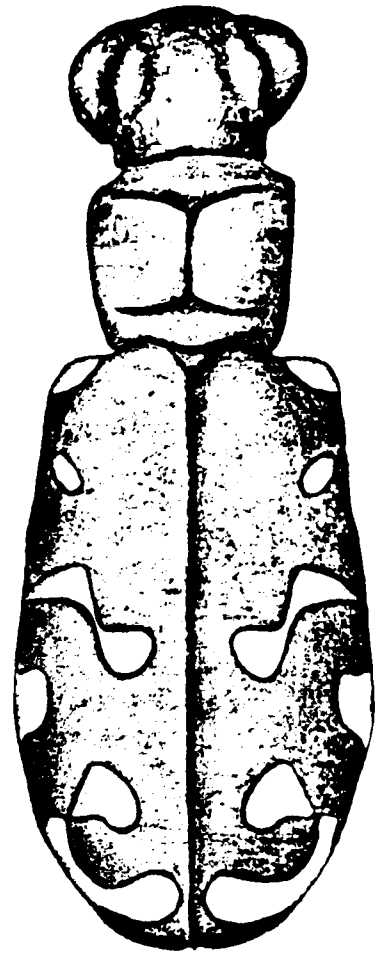

Fig. 5

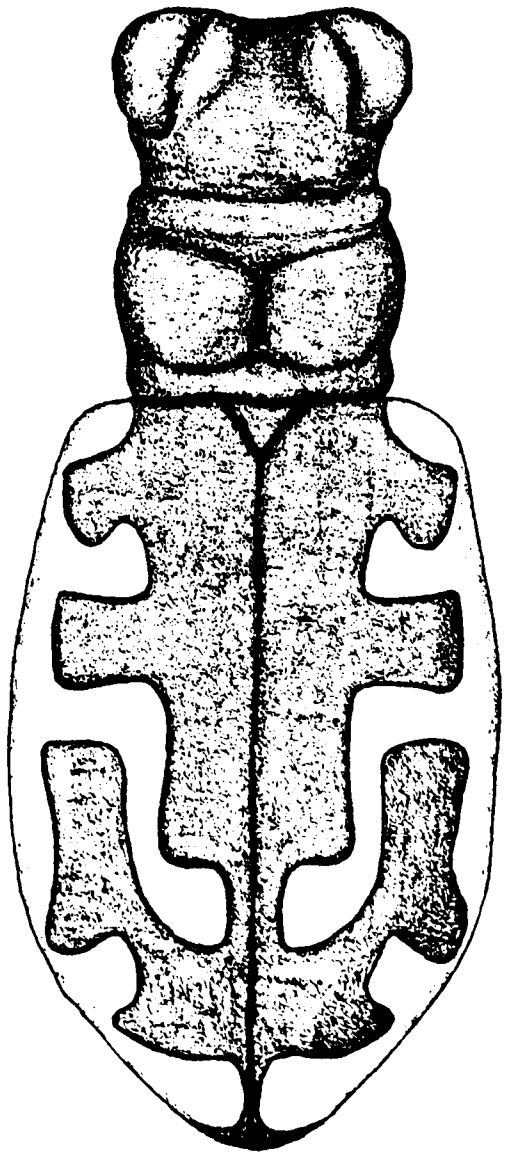

Fig. 6

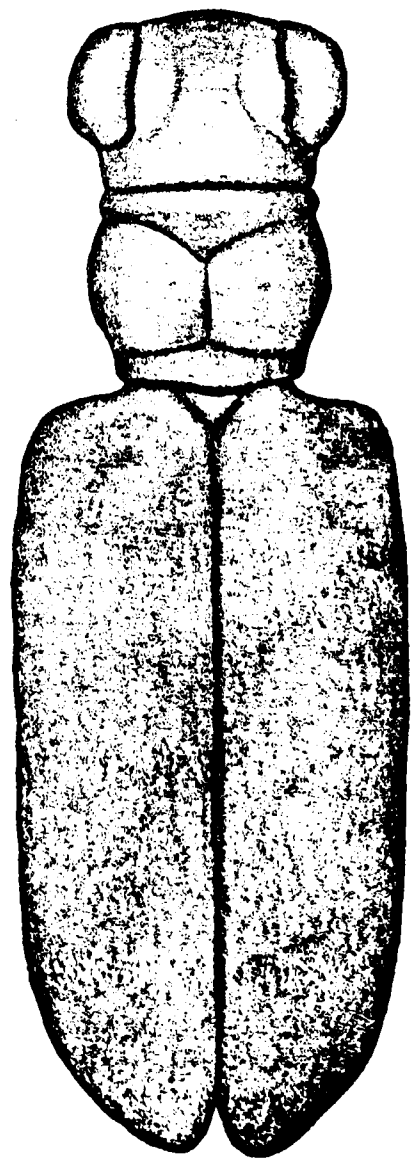

Fig. 7

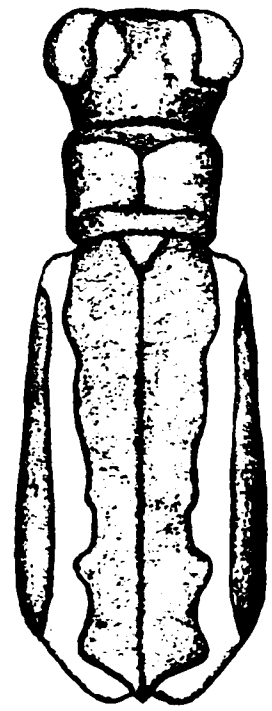

Fig. 8

Figs. 9-14. Dorsal view of *Cicindela* species: 9, *C. lengi jordai*; 10, *C. lepida*; 11, *C. longilabris vestalia*; 12, *C. marutha*; 13, *C. nevadica tubensis*; 14, *C. nigrocoerulea*.

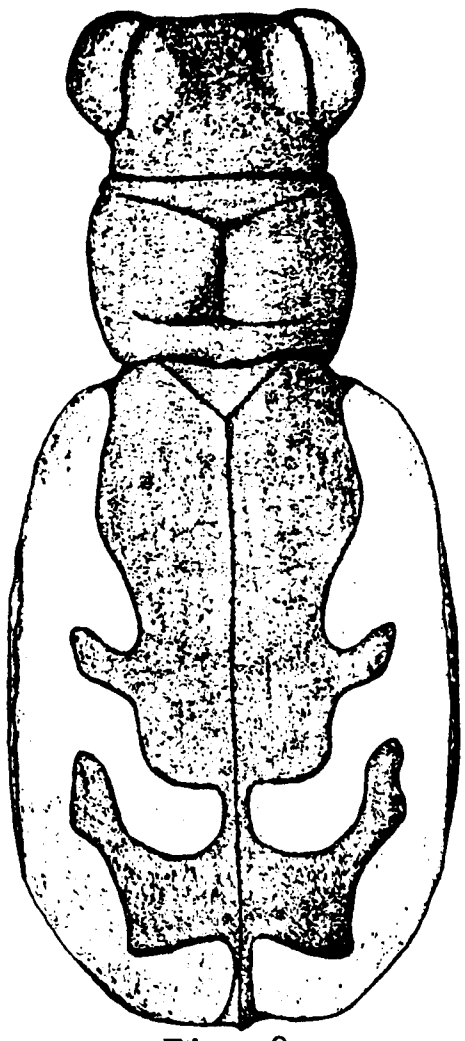

Fig. 9

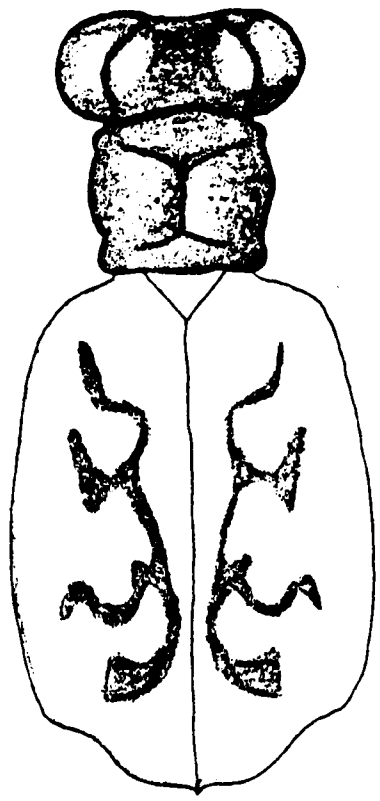

Fig. 10

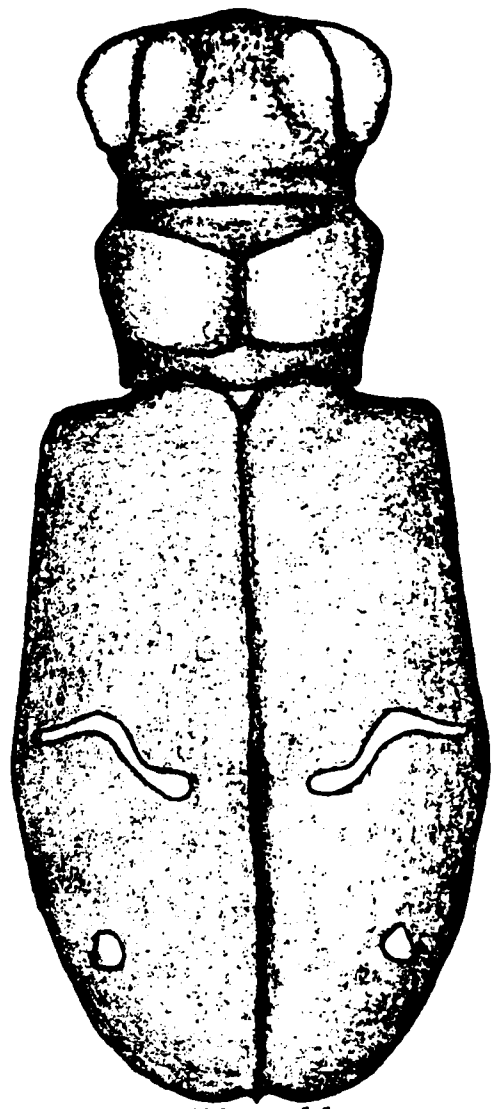

Fig. 11

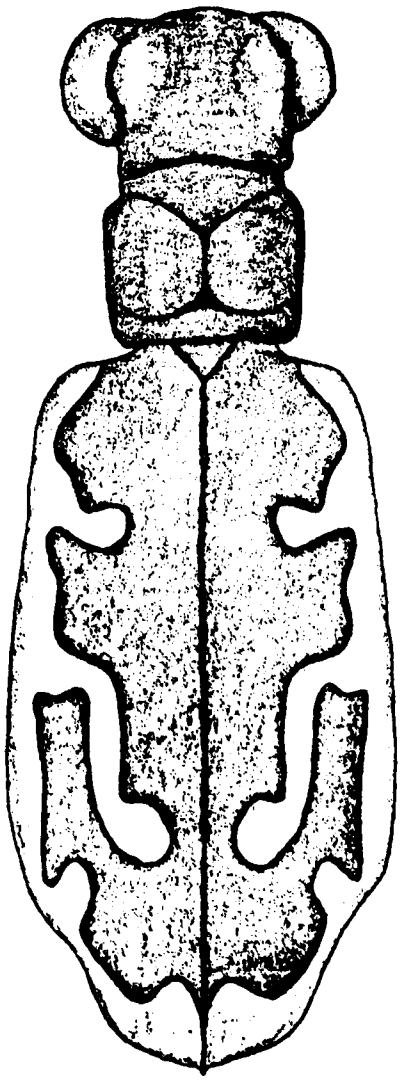

Fig. 12

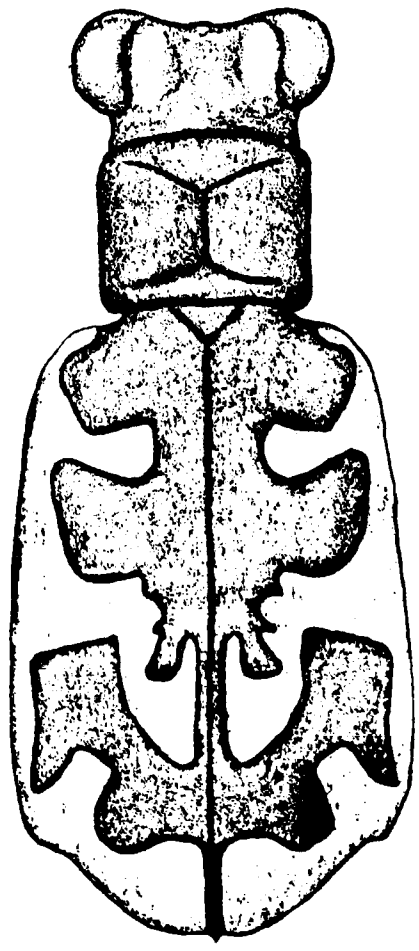

Fig. 13

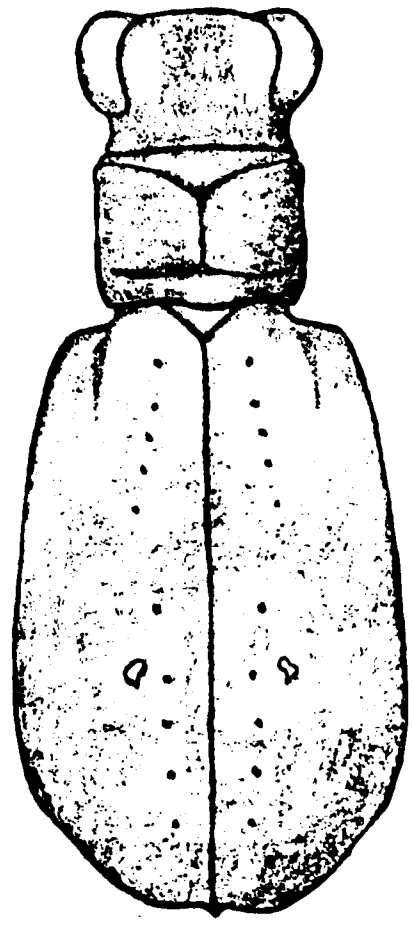

Fig. 14

Figs. 15-19. Dorsal view of *Cicindela* species: 15, *C. obsoleta santaclarae*; 16, *C. ocellata*; 17, *C. oregona maricopa*; 18, *C. pimeriana*; 19, *C. praetextata fulgoris*.

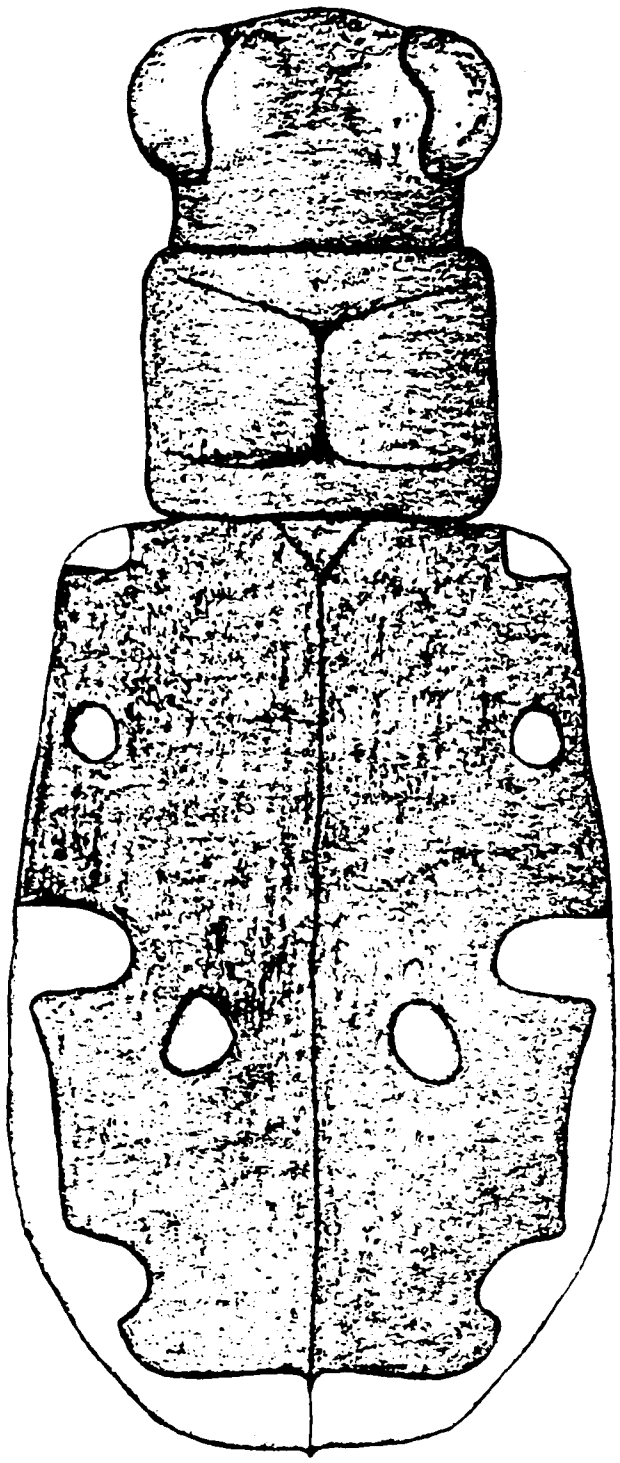

Fig. 15

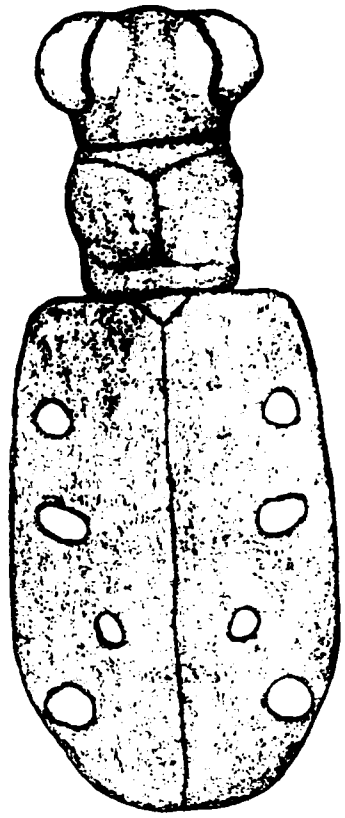

Fig. 16

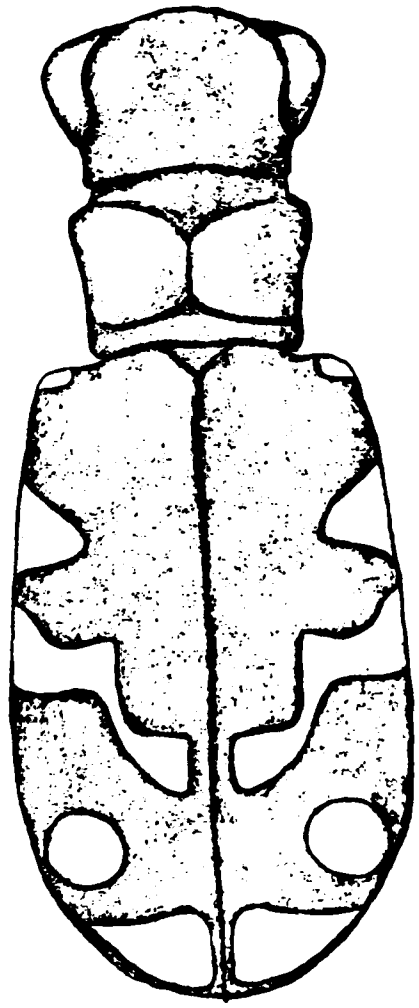

Fig. 17

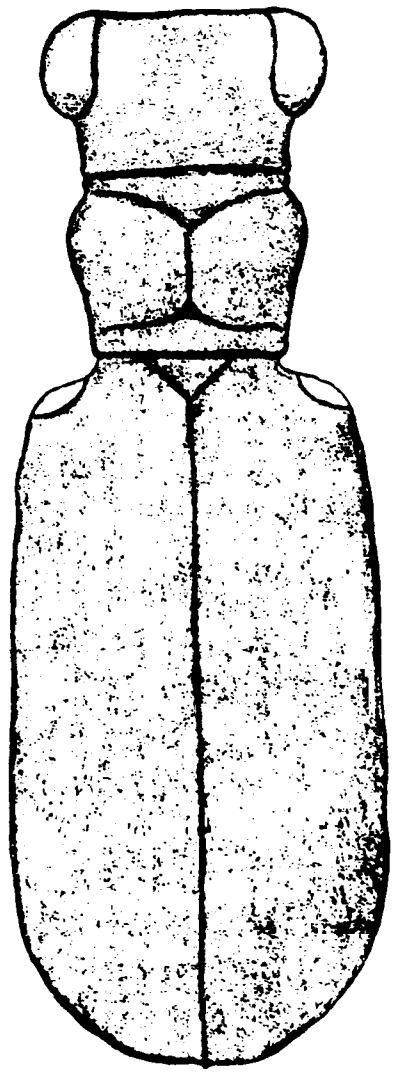

Fig. 18

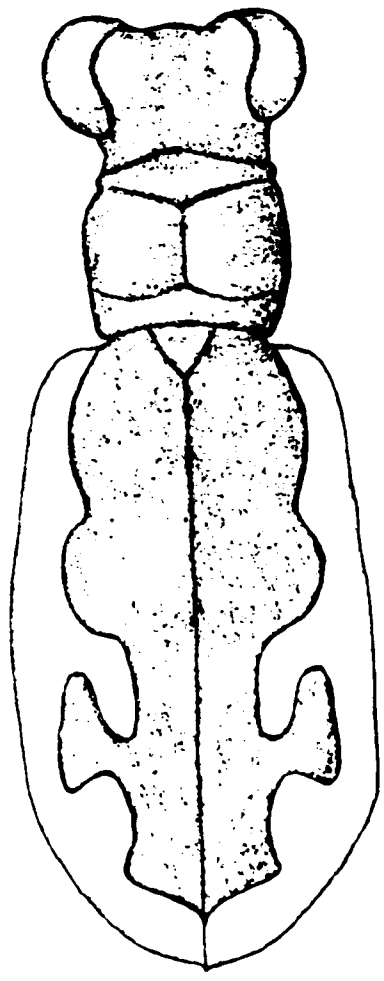

Fig. 19

Figs. 20-24. Dorsal view of *Cicindela* species: *C. pulchra pulchra*; 21, *C. pulchra dorothea*; 22, *C. punctulata*; 23, *C. purpurea cimarrona*; *C. purpurea graminea*.

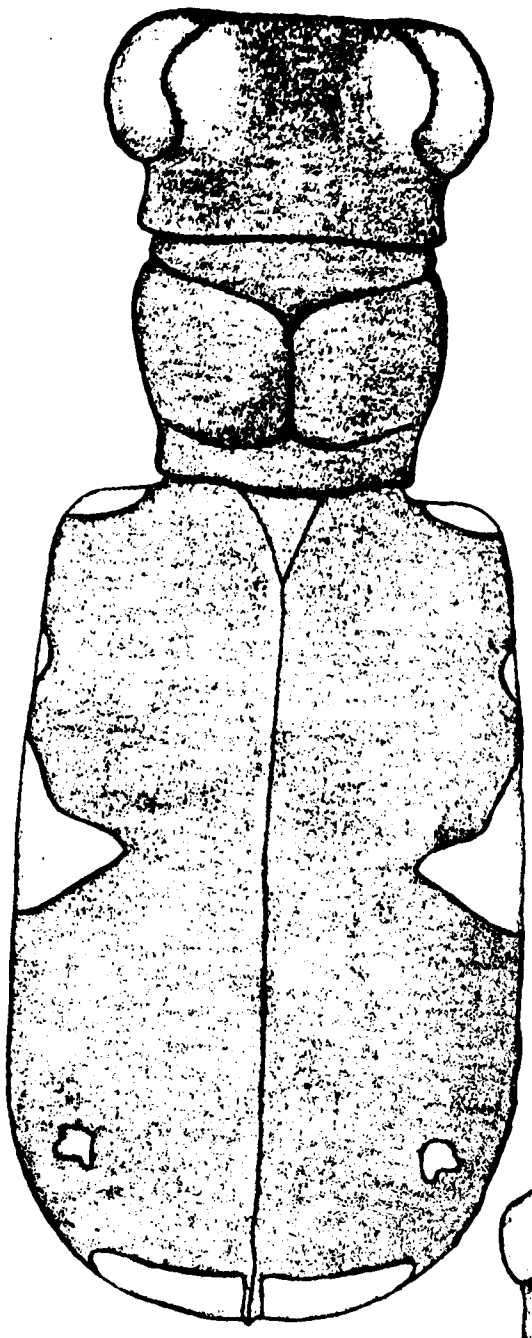

Fig. 20

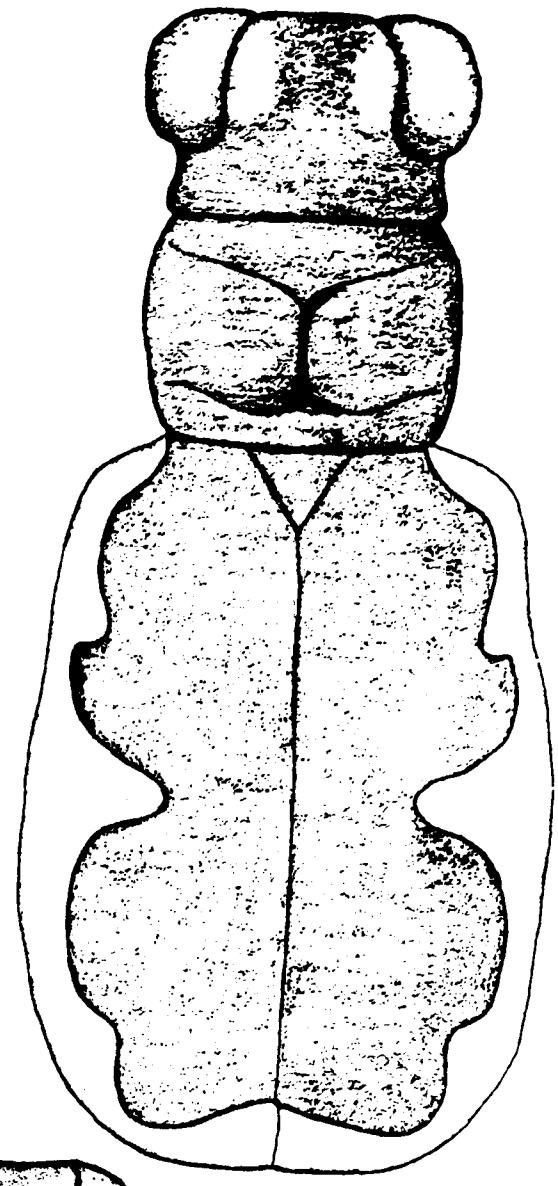

Fig. 21

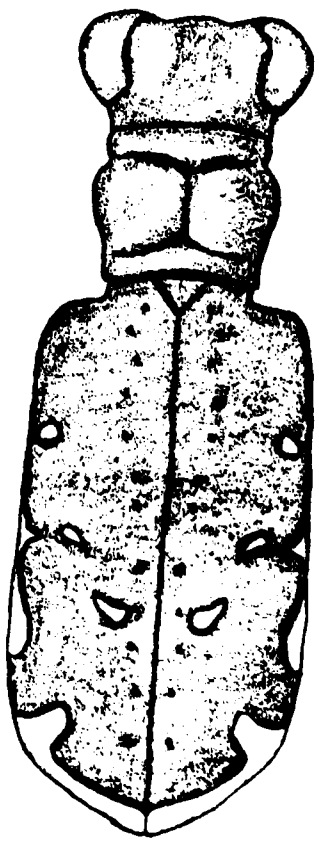

Fig. 22

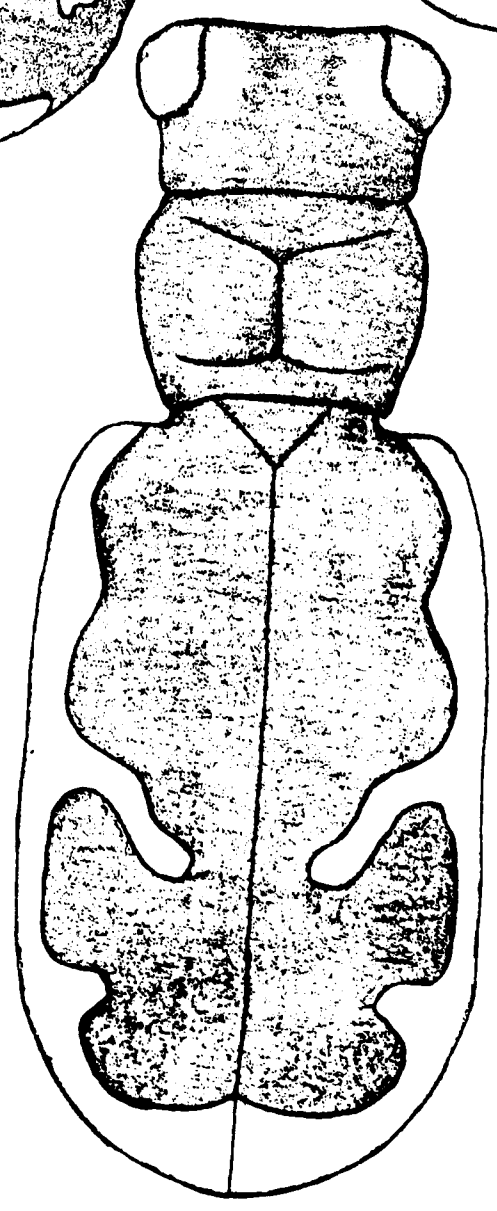

Fig. 23

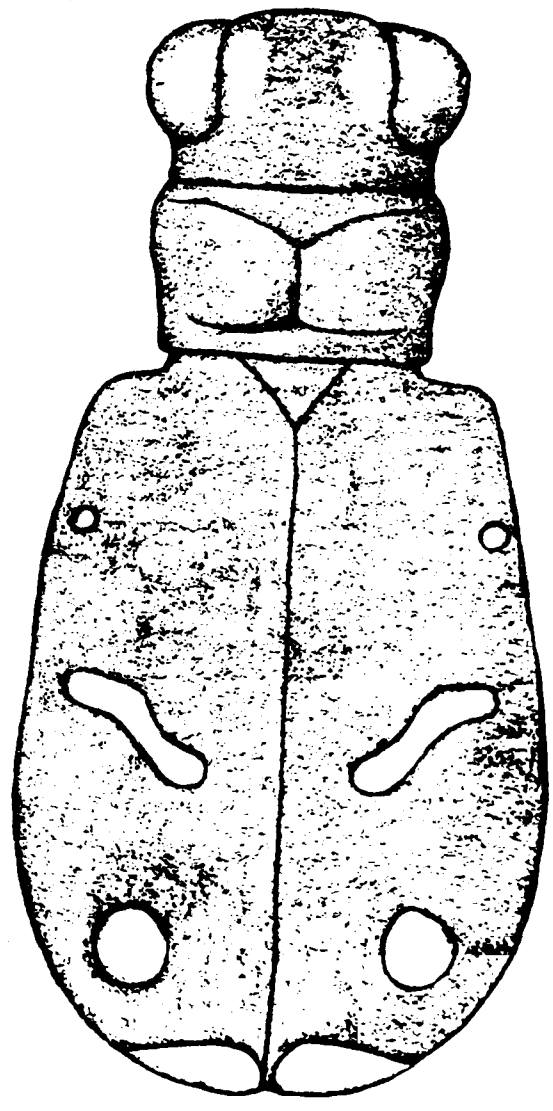

Fig. 24

Figs. 25-30. Dorsal view of *Cicindela* species:

25, *C. repanda*; 26, *C. sedecimpunctata*; 27, *C. sperata*; 28, *C. tenuisignata*; 29, *C. terricola cinctipennis*; 30, *C. tranquebarica kirbyi*.

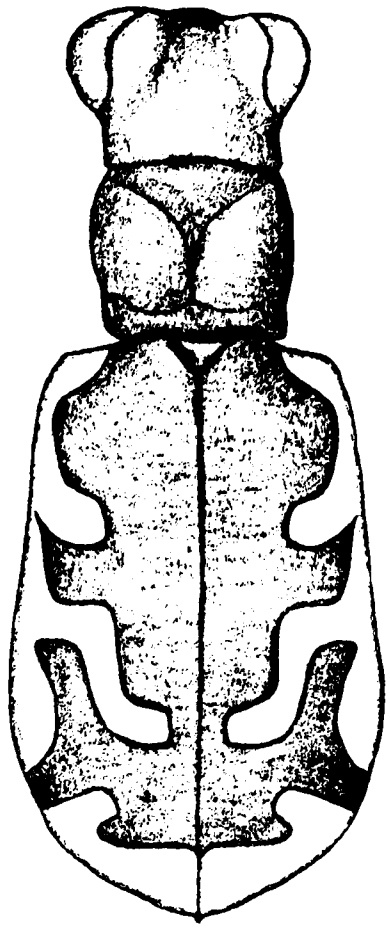

Fig. 25

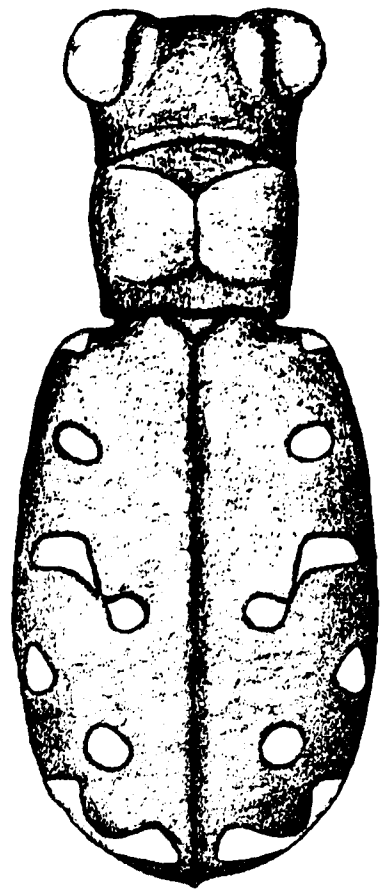

Fig. 26

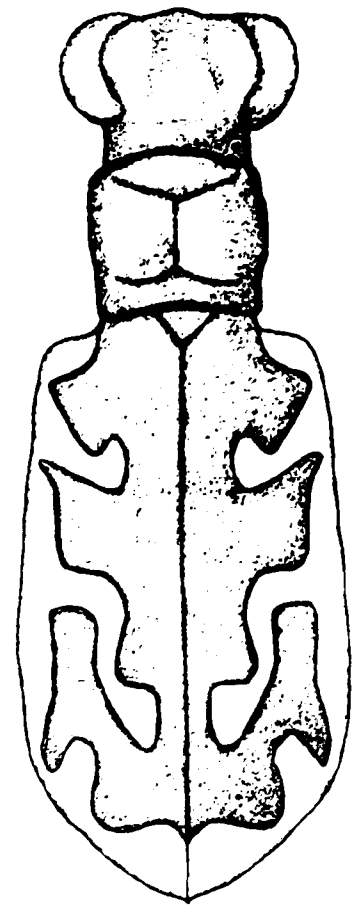

Fig. 27

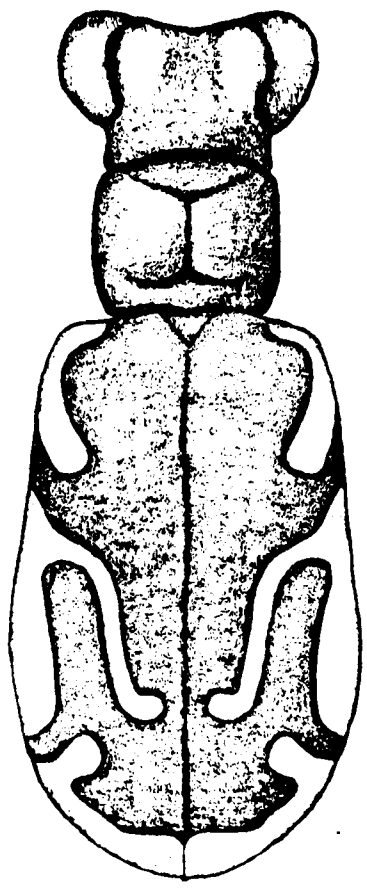

Fig. 28

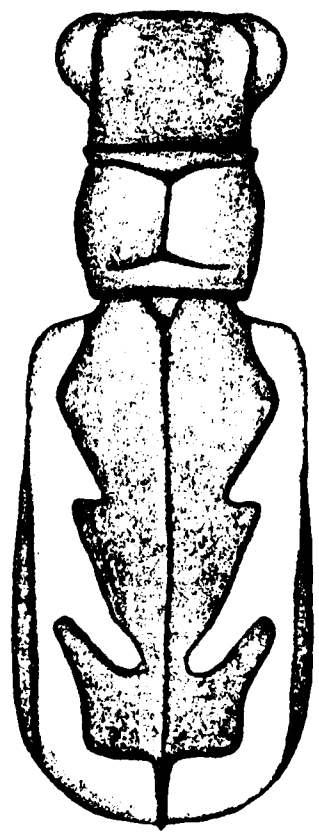

Fig. 29

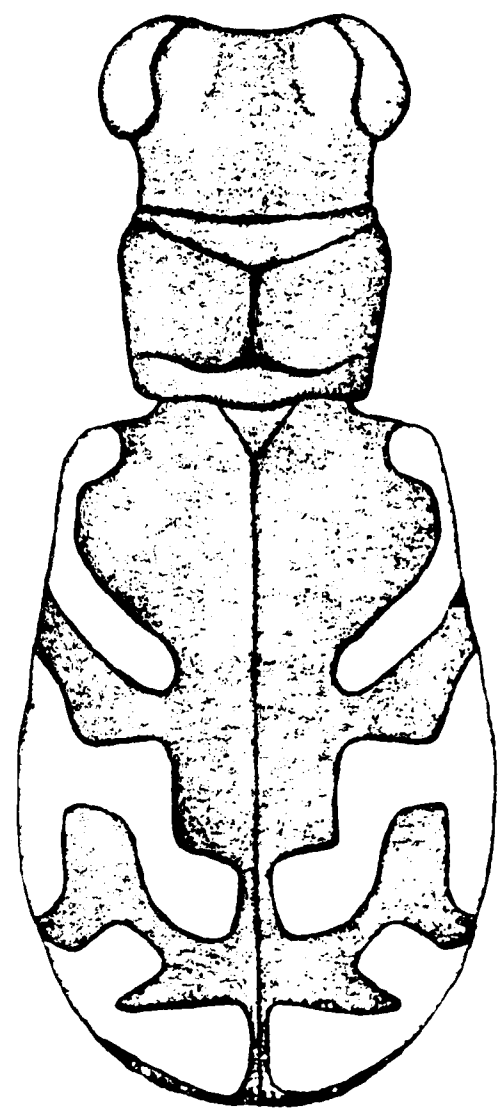

Fig. 30

Figs. 31-33. Dorsal view of *Cicindela* species: 31, *C. viridisticta arizonensis*; 32, *C. wickhami*; 33, *C. willistoni sulfontis*.

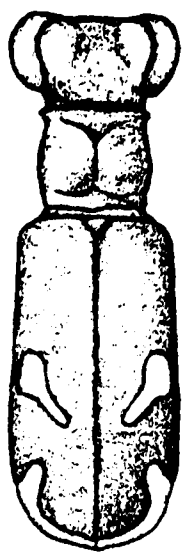

Fig. 31

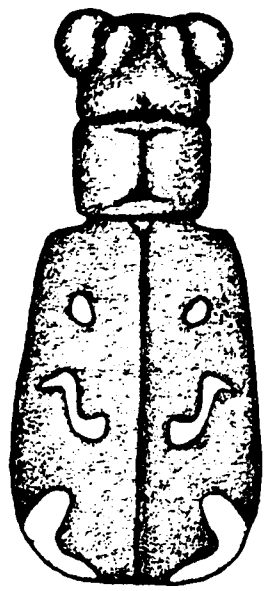

Fig. 32

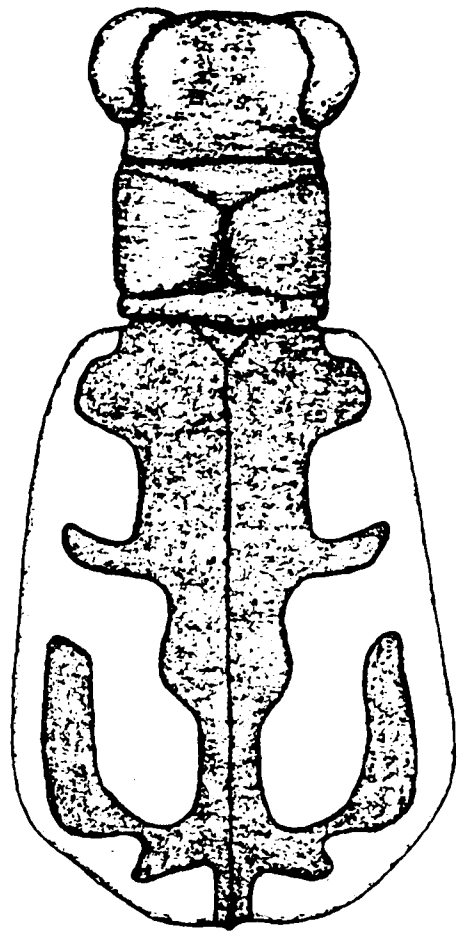

Fig. 33

Figs. 34-37. Arizona distribution of *Cicindela* species: 34, *C. debilis* (wavy lines), and *C. longilabris vestalia* (straight lines); 35, *C. fulgida* (wavy lines), and *C. viridisticta arizonensis* (straight lines); 36, *C. haemorrhagica arizonae* (wavy lines), and *C. haemorrhagica haemorrhagica* (straight lines); 37, *C. hirticollis corpuscula*.

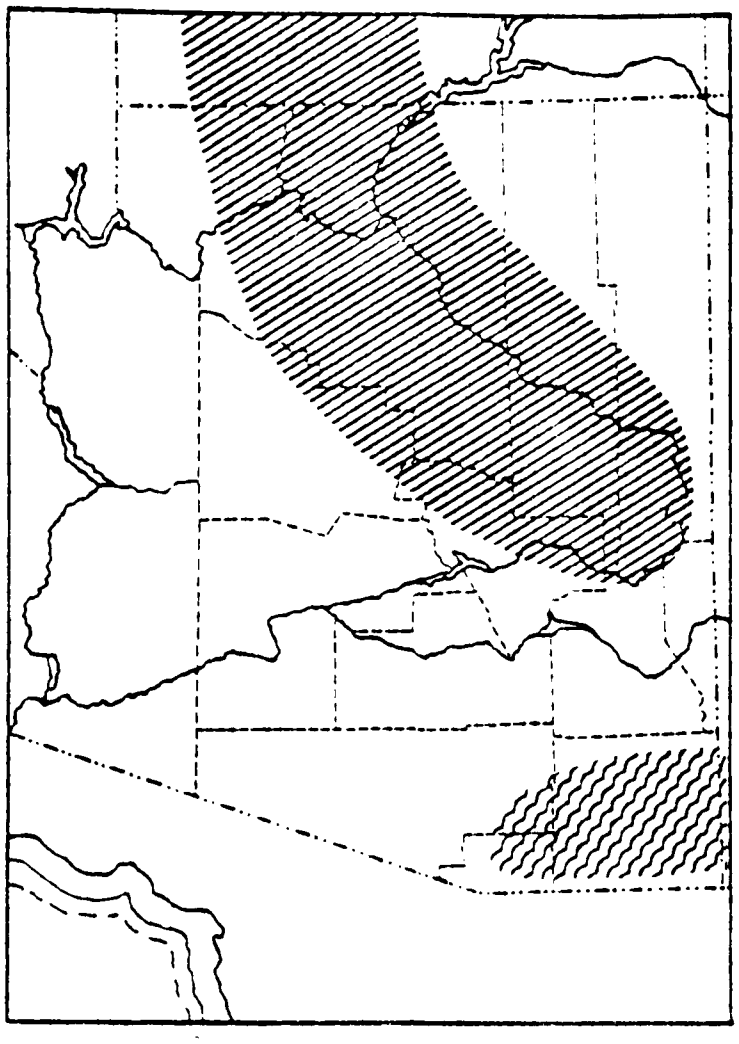

Fig. 34

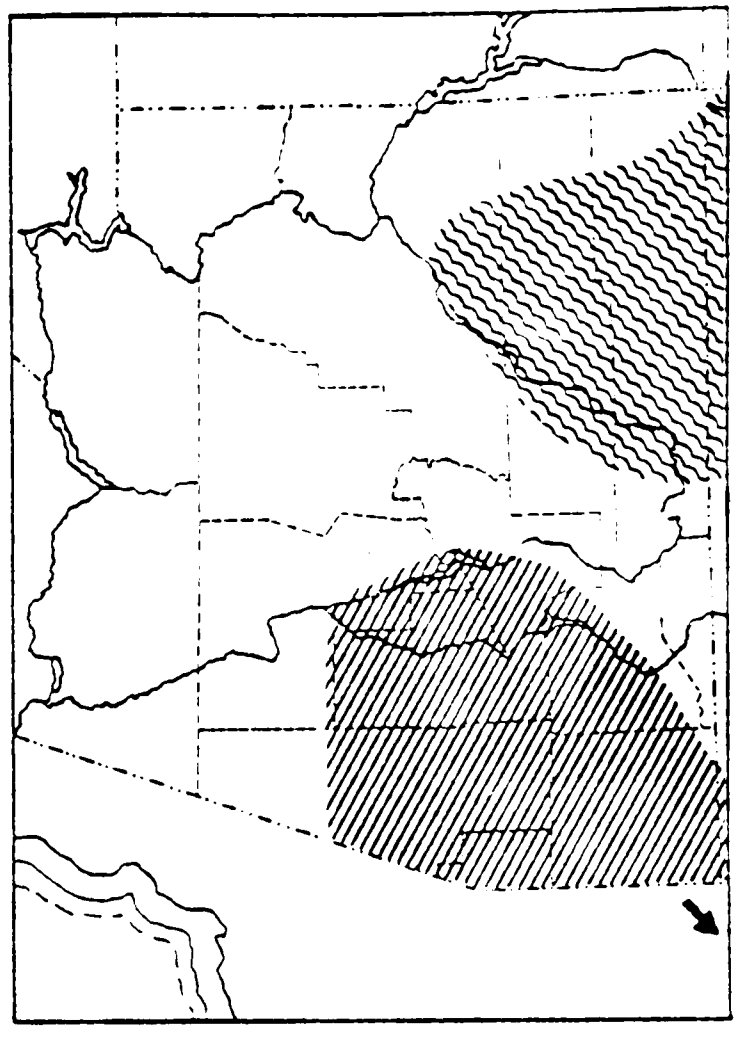

Fig. 35

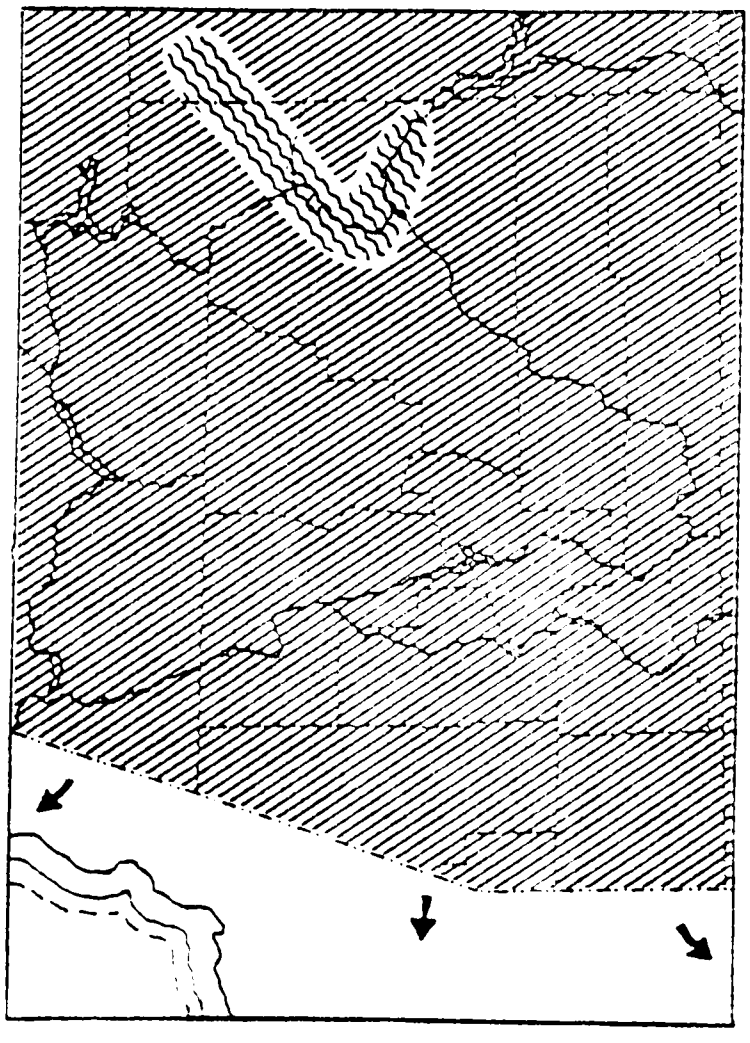

Fig. 36

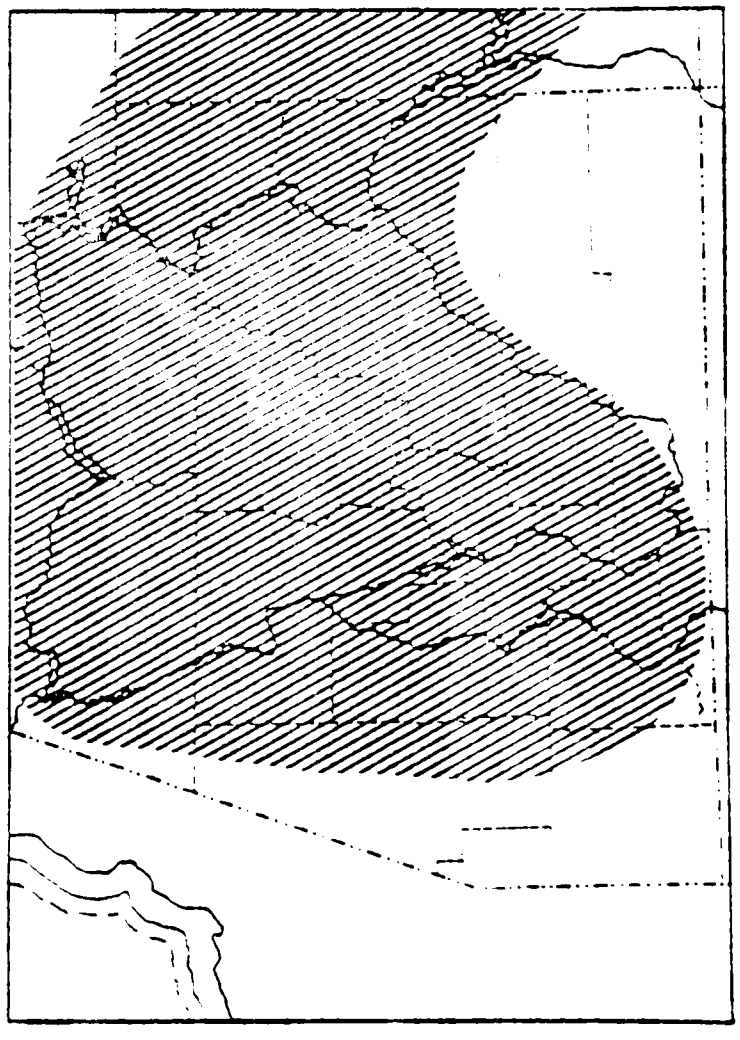

Fig. 37

Figs. 38-41. Arizona distribution of *Cicindela* species: 38, *C. hornii* (wavy lines), and *C. terricola cinctipennis* (straight lines); 39, *C. lengi jordai* (wavy lines), and *C. lemniscata* (straight lines); 40, *C. ocellata* (wavy lines), and *C. lepida* (straight lines); 41, *C. marutha*.

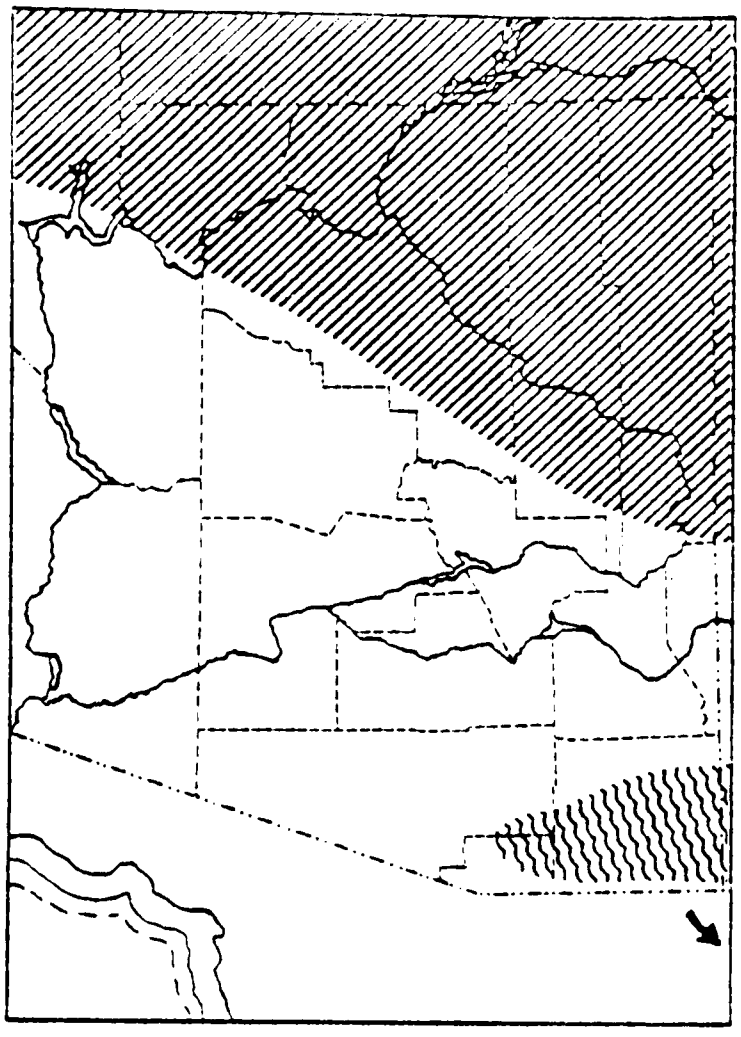

Fig. 38

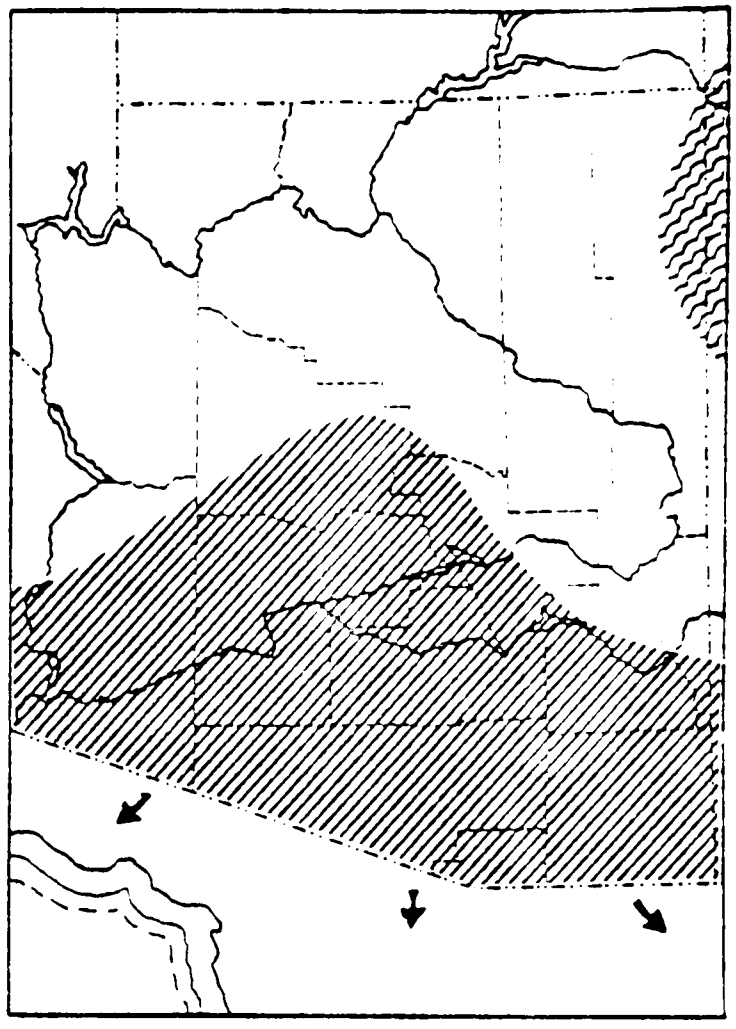

Fig. 39

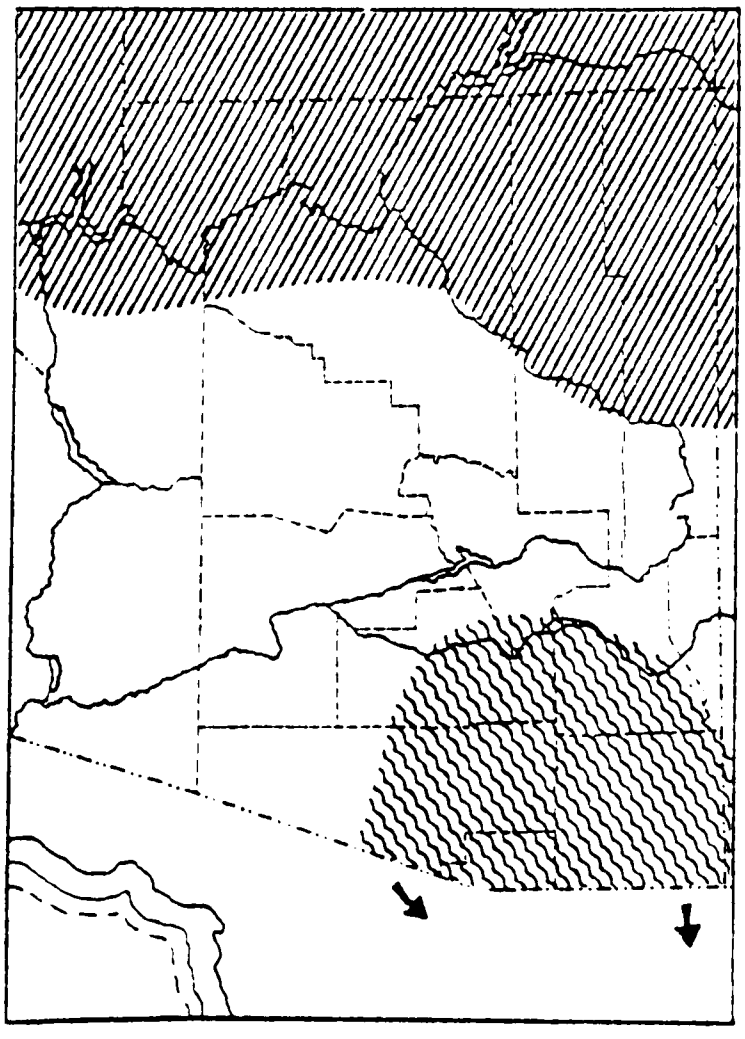

Fig. 40

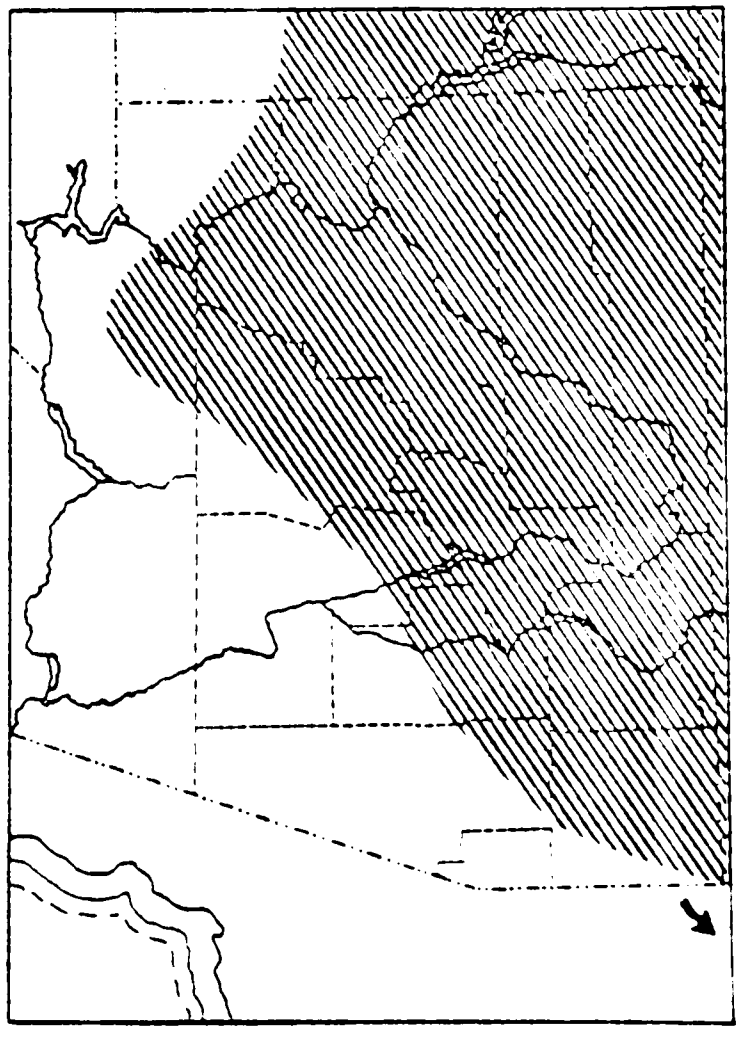

Fig. 41

Figs. 42-45. Arizona distribution of *Cicindela* species: 42, *C. nevadica citata* (wavy lines), and *C. nevadica tubensis* (straight lines); 43, *C. nigrocoerulea*; 44, *C. obsoleta santaclarae*; 45, *C. oregona navajoensis* (wavy lines), and *C. oregona maricopa* (straight lines).

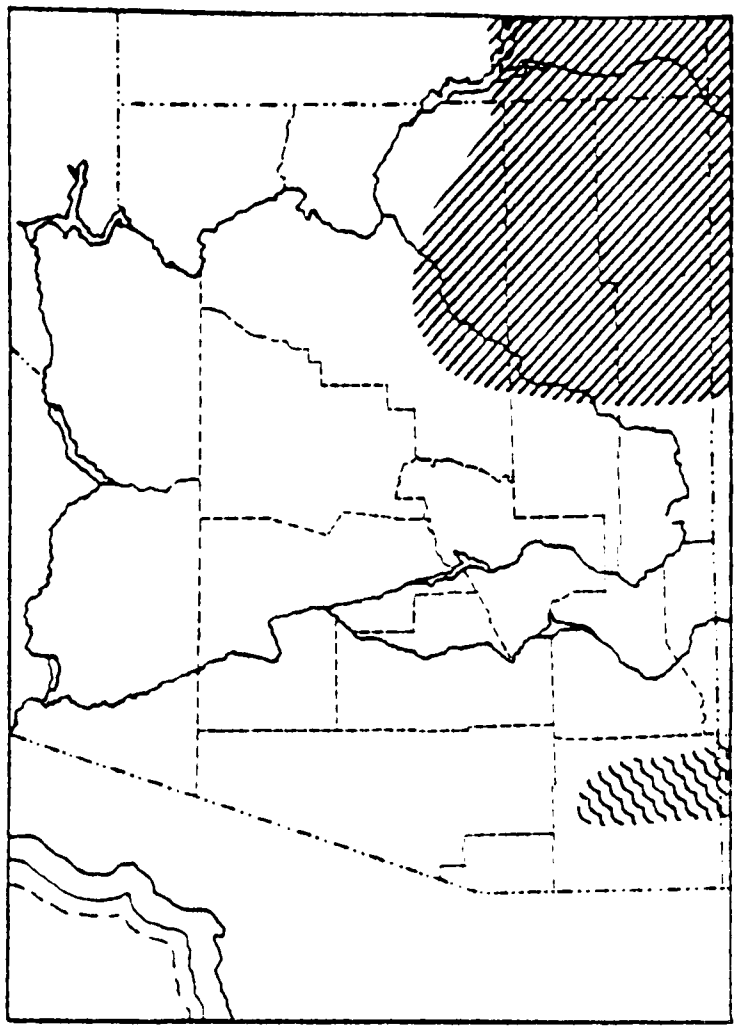

Fig. 42

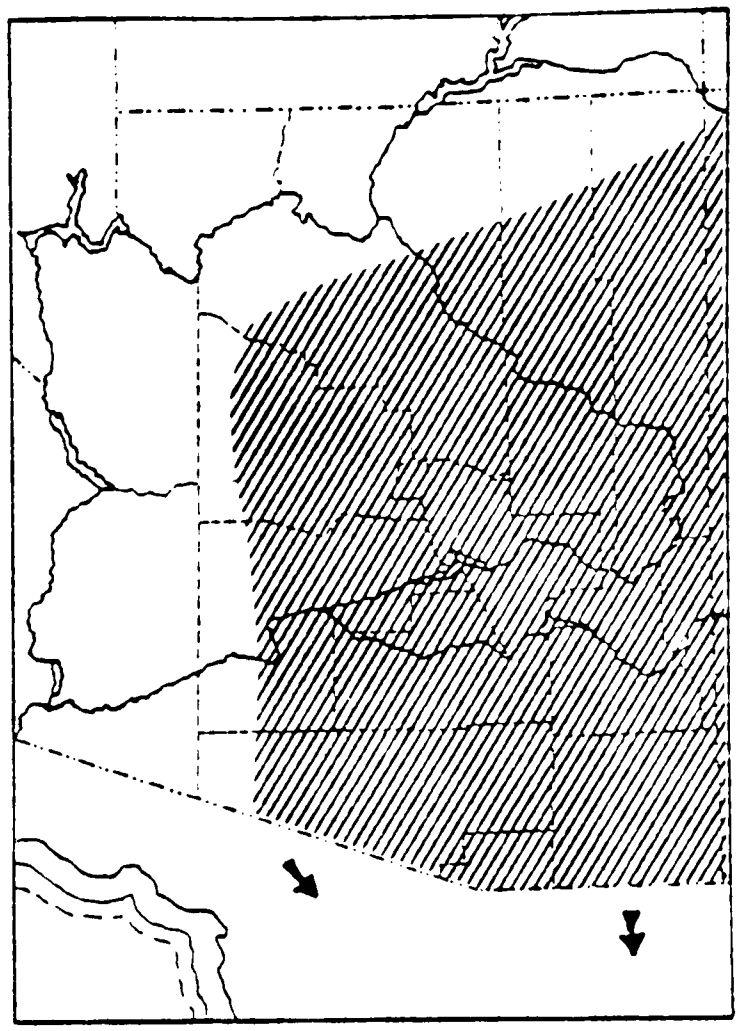

Fig. 43

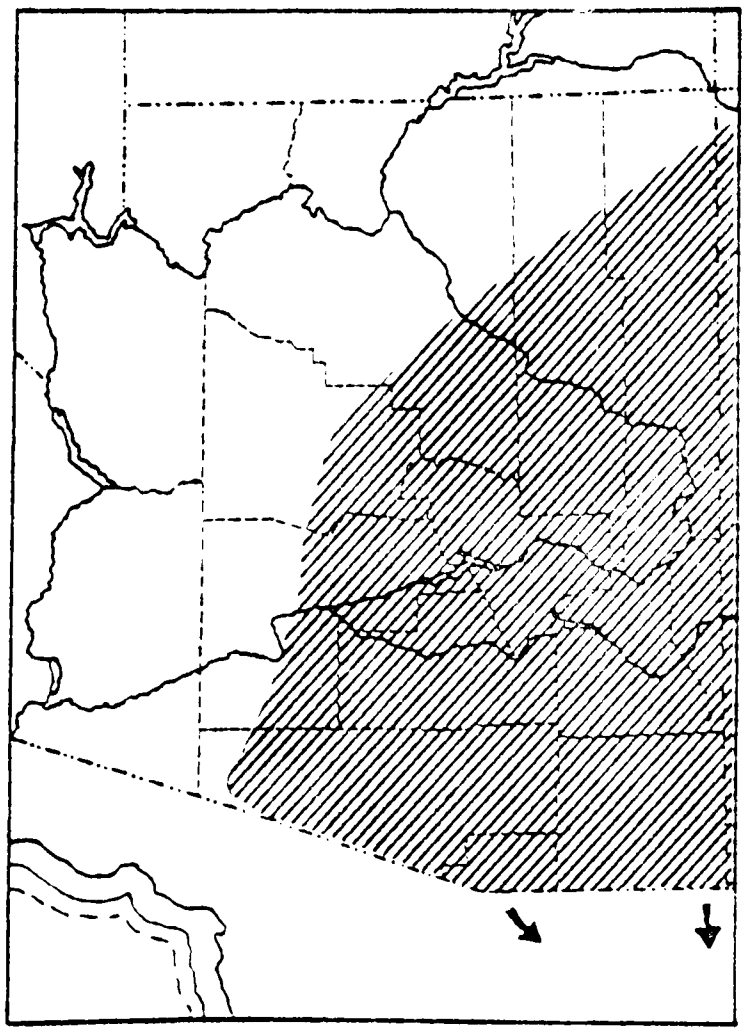

Fig. 44

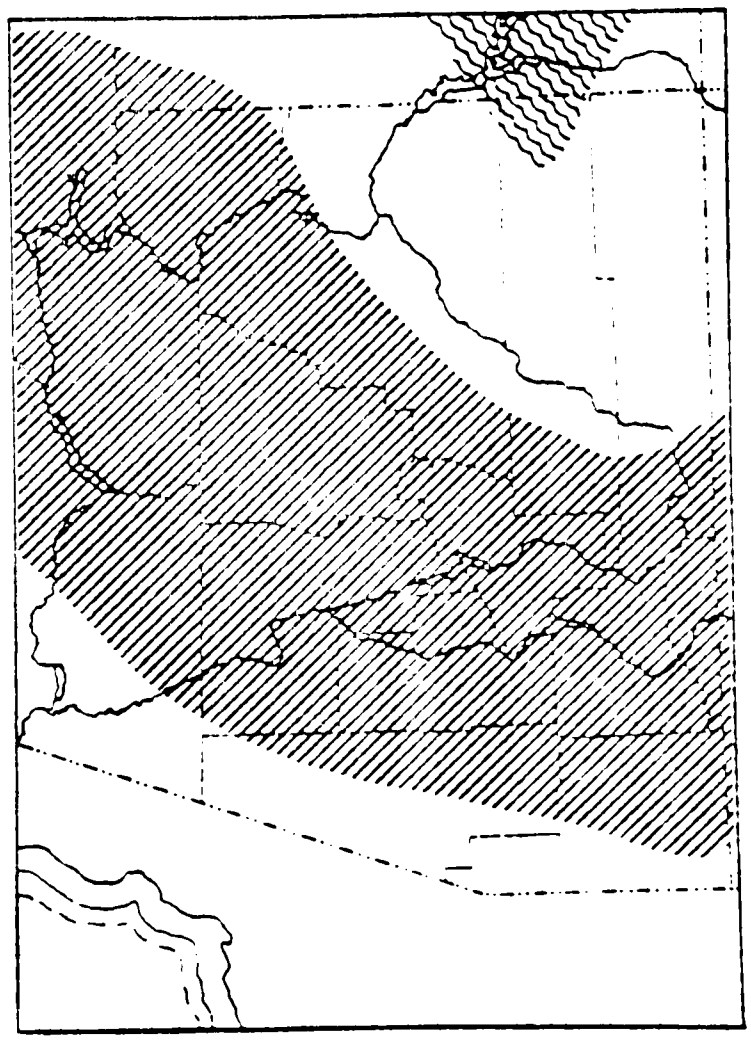

Fig. 45

Figs. 46-49. Arizona distribution of *Cincindela* species: 46, *C. pimeriana* (wavy lines), and *C. tenuisignata* (straight lines); 47, *C. praetextata fulgoris* (wavy lines), *C. praetextata praetextata* (straight lines), and *C. praetextata erronea* (dots); 48, *C. pulchra pulchra* (wavy lines), *C. wickhami* (straight lines), and *C. pulchra dorothea* (dots); 49, *C. purpurea cimarrona* (wavy lines), and *C. purpurea graminea* (straight lines).

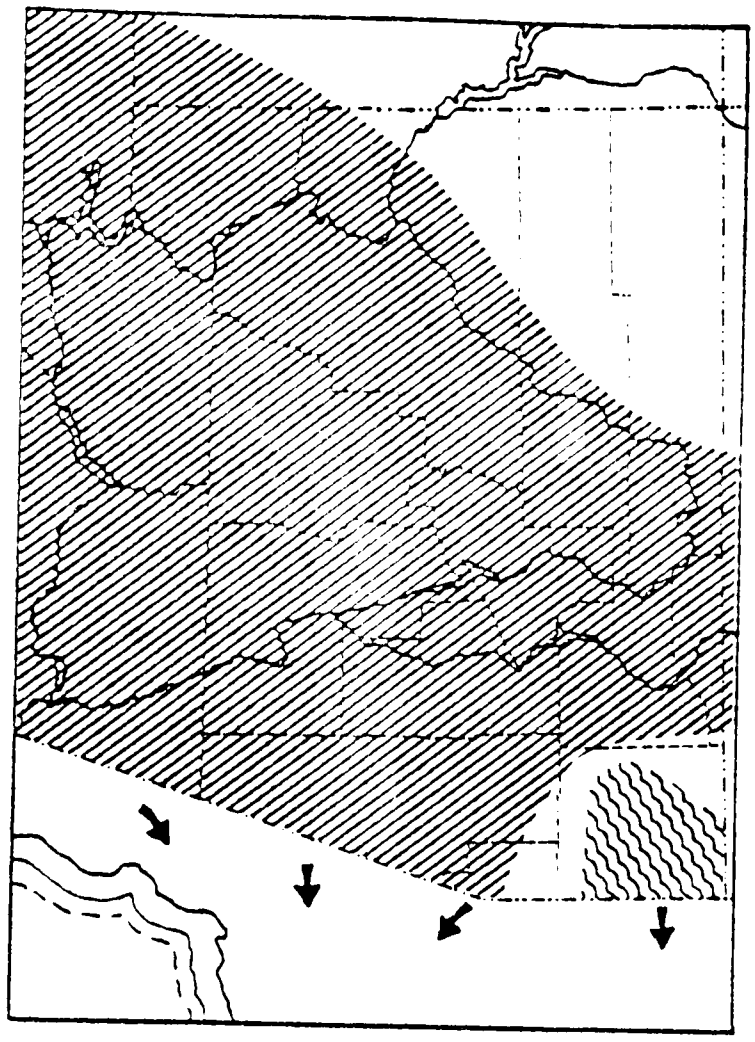

Fig. 46

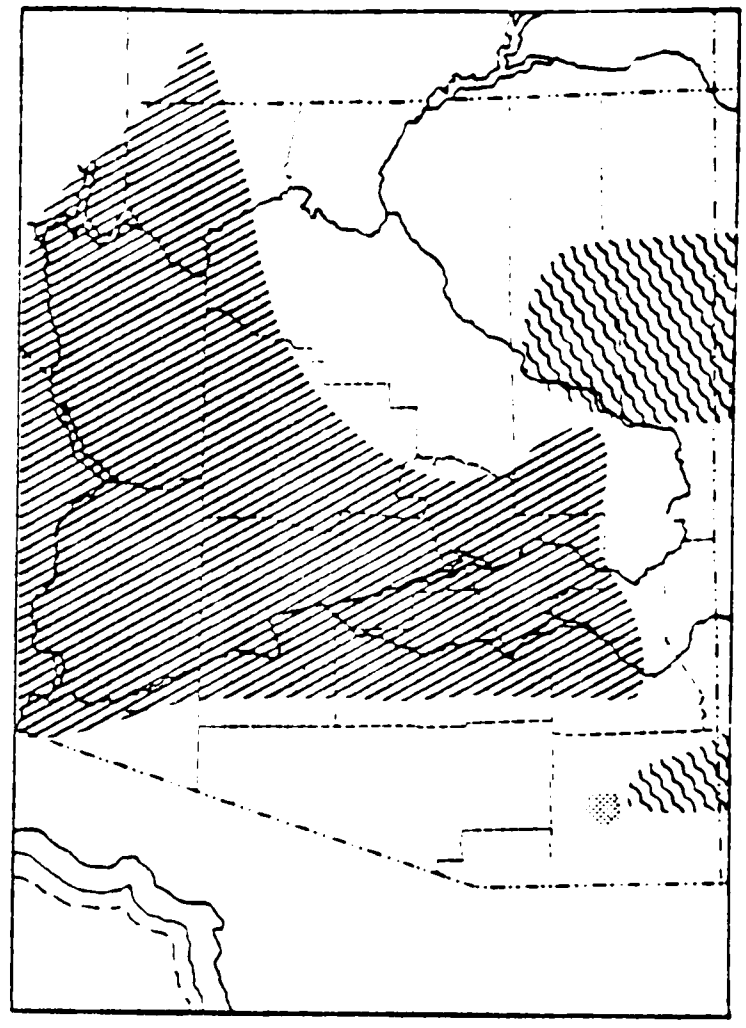

Fig. 47

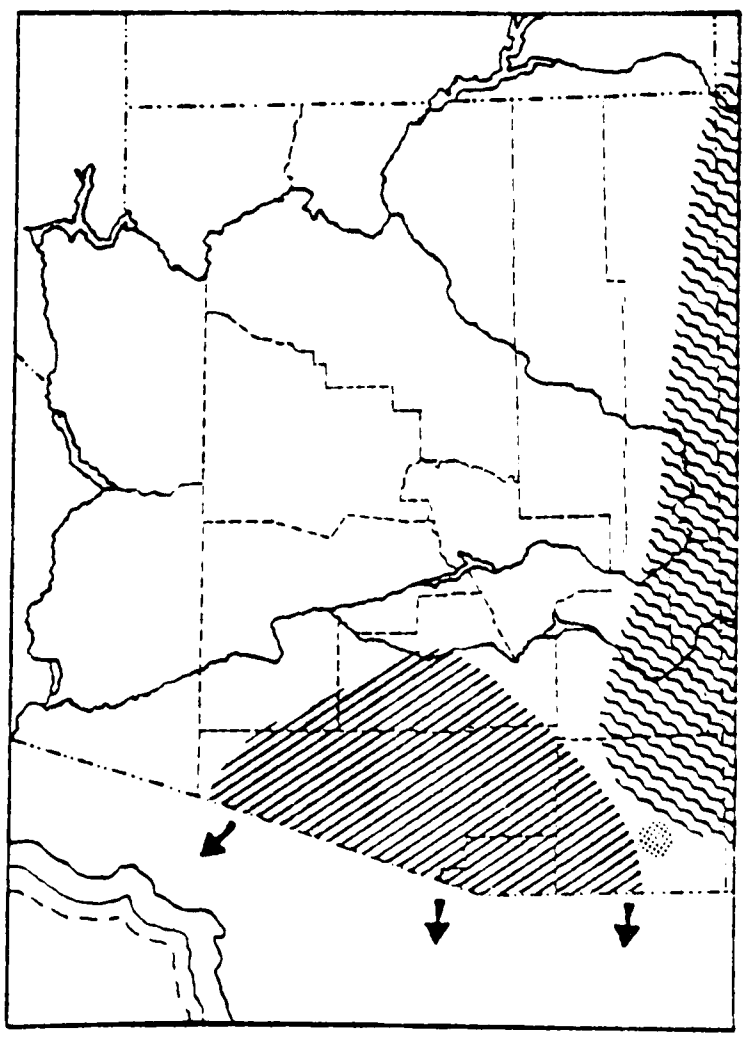

Fig. 48

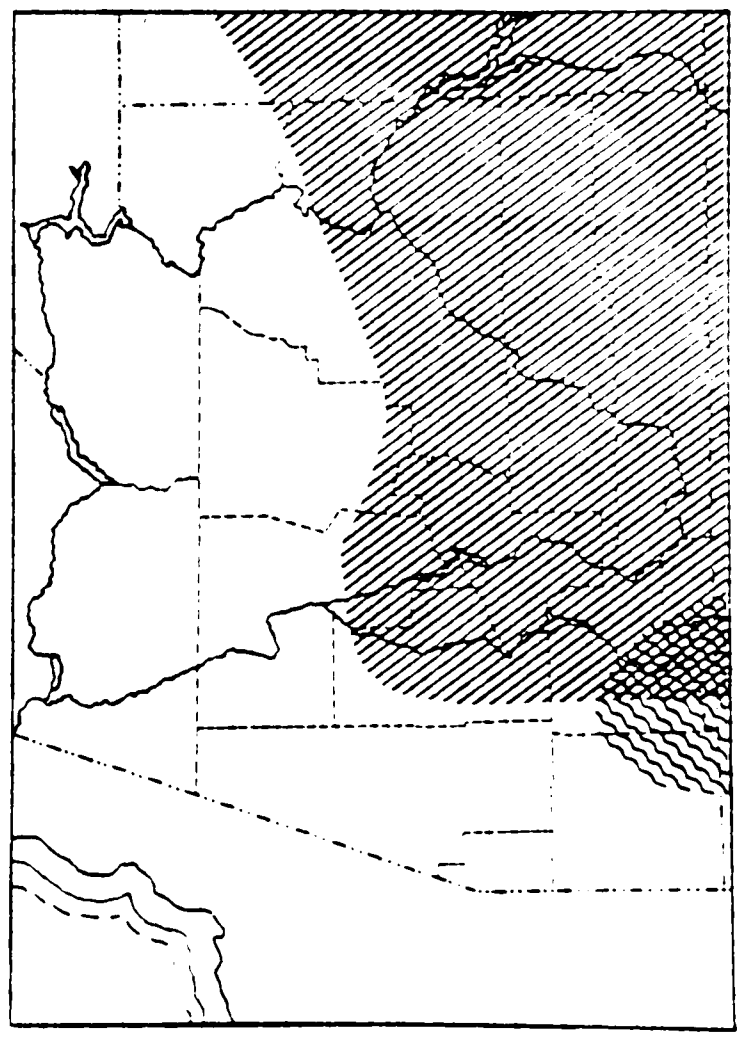

Fig. 49

Figs. 50-53. Arizona distribution of *Cicindela* species: 50, *C. willistoni sulfontis* (wavy lines), and *C. repanda* (straight lines); 51, *C. sedecimpunctata*; 52, *C. sperata*; 53, *C. tranquebarica lassenica* (wavy lines), and *C. tranquebarica kirbyi* (straight lines).

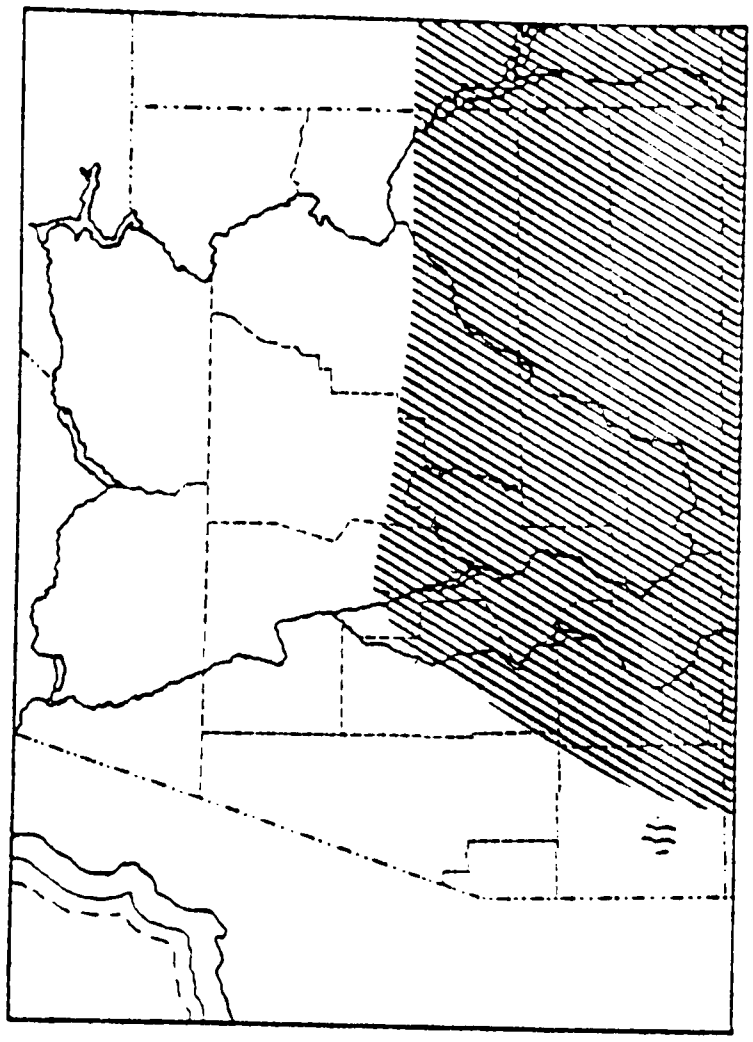

Fig. 50

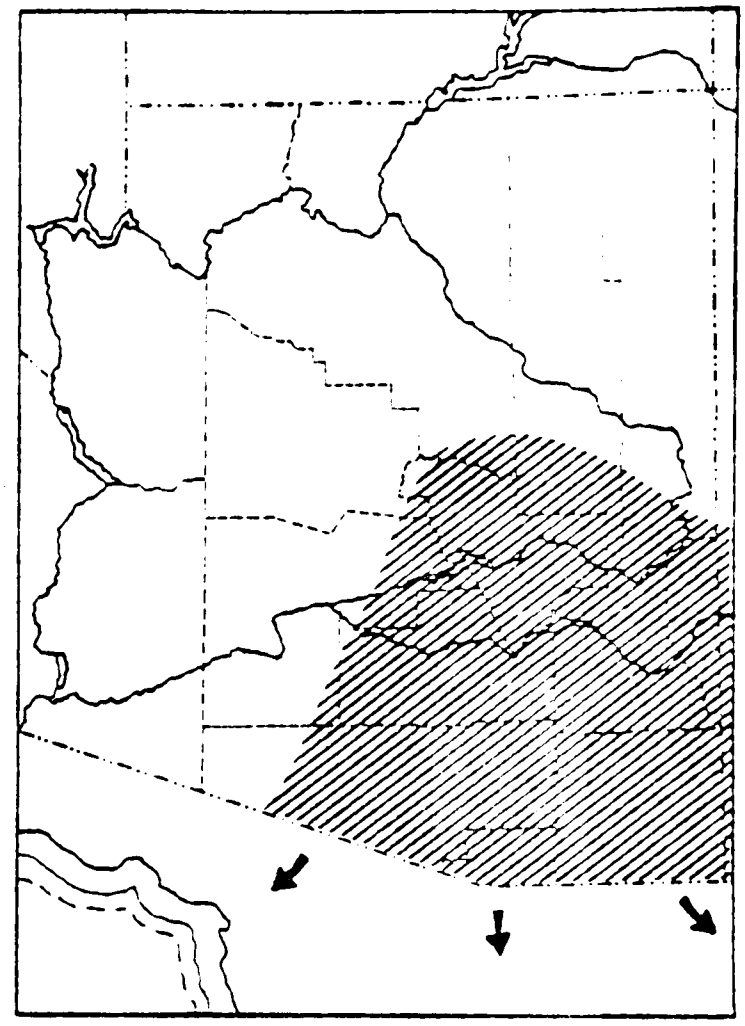

Fig. 51

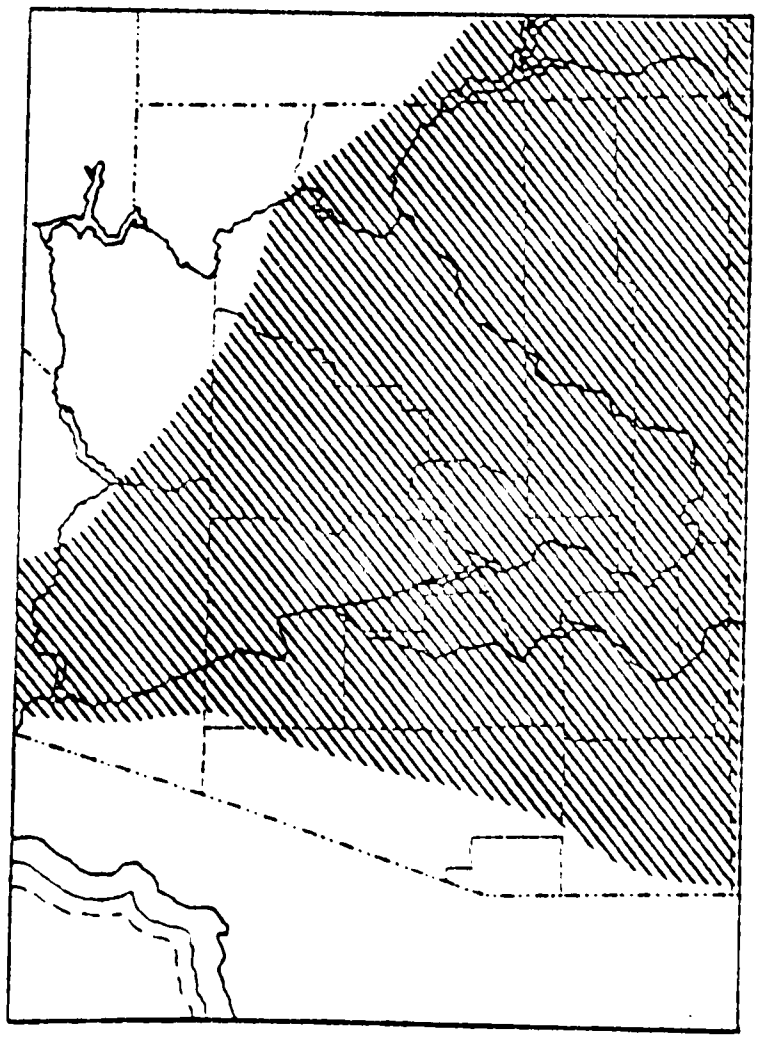

Fig. 52

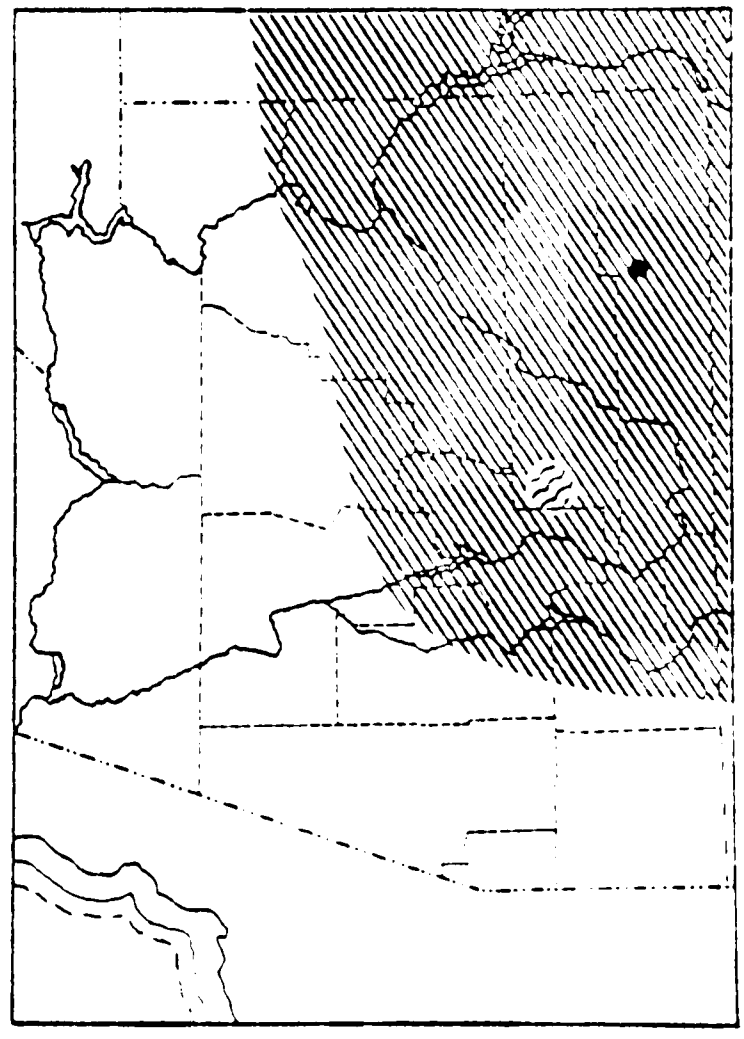

Fig. 53

LITERATURE CITED

Bates, H. W. 1881-1884. Biologia Centrali-Americana, Coleoptera, Cicindelidae, 1(1):1-18.

_____. 1890. Additions to the Cicindelidae fauna of Mexico, with remarks on some of the previously recorded species. Trans. Entomol. Soc. London, 3:493-510.

Blaisdell, F. E. 1892. Notes on the Cicindelidae observed in San Diego County. ZOE, a Biological J., 3(1):47-48.

Blanchard, F. N. 1921. The tiger beetles (Cicindelidae) of Cheboygan and Emmet counties, Michigan. Papers Michigan Acad. Sci., Arts and Letters, 1:396-417.

Blatchley, W. S. 1910. An illustrated descriptive catalogue of the Coleoptera or beetles (exclusive of the Rhynchophora) known to occur in Indiana. Bull. Indiana Dept. Geology and Nat. Resources, Indianapolis, 1:27-36.

Brimley, C. S. 1906. Notes on the Odonata and other insects of Lake Ellis, North Carolina. Entomol. News, 17:81-85.

Calder, E. E. 1922. New Cicindelas of the fulgida group. Canadian Entomol., 44:62.

Cartwright, O. L. 1935. The tiger beetles of South Carolina with the description of a new variety of Tetracha virginica (L.) (Coleoptera, Cicindelidae). Bull. Brooklyn Entomol. Soc., 30:67-77.

Casey, T. L. 1897. Coleopterological notices, VII. Ann. New York Acad. Sci., 9:285-684.

_____. 1909. Studies in the Caraboidea and Lamellicornia. Canadian Entomol., 41:253-279.

_____. 1913. Studies in the Cicindelidae and Carabidae of America. Mem. Coleoptera, 41:1-192.

_____. 1914. Studies in Omus and Cicindela. Mem. Coleoptera, 5:1-24.

_____. 1916. Further studies in the Cicindelidae. Mem. Coleoptera, 7:1-34.

_____. 1924. Additions to the known Coleoptera of North America. Mem. Coleoptera, 11:1-347.

Cazier, M. A. 1936. Review of the willistoni, fulgida, parowana, and senilis groups of the genus Cicindela (Coleoptera-Cicindelidae). Bull. Brooklyn Entomol. Soc., 34(1):24-28.

_____. 1948. The origin, distribution, and classification of the tiger beetles of lower California (Coleoptera: Cicindelidae). American Mus. Novitates, 1382:1-28.

_____. 1954. A review of the Mexican tiger beetles of the genus Cicindela (Coleoptera, Cicindelidae). Bull. American Mus. Nat. Hist., 103(3):227-310.

Chevrolat, A. 1833-1835. Coleopteres du Mexique. Strasbourg, fasc 1-4 (1834), fasc. 5-8 (1835), 429 pp.

Chevrolat, A. 1841. Coleopteres du Mexique. Mag. Zool., Paris, 2(3):1-16.

Criddle, N. 1907. Habits of some Manitoba "tiger beetles" (Cicindela). Canadian Entomol., 39:105-114.

Cutler, B. 1969. Of early birds and worms (on collecting). Cicindela, 1(2):14.

Dahl, R. 1941. The Leng types of Cicindelidae. Entomol. News, 52:169-172 and 188-191.

Davis, W. T. 1912. Notes on the distribution of several species of tiger beetles. J. New York Entomol. Soc., 20(1):17-20.

_____. 1921. Cicindela tranquebarica and its habits. Bull. Brooklyn Entomol. Soc., 16:111.

Dawson, R. W. and W. Horn. 1928. Tiger beetles of Minnesota. Univ. Minnesota Tech. Bull., 56:1-13.

Dejean, A. 1825. Species general des coleopteres. Paris, 451 pp.

_____. 1831. Species general des coleopteres, supplement Cicindelidae. Paris, 5:195-276.

Dokhturoff, W. 1883. Essai sur la subdivision du genre Cicindela. Rev. mens. Entomol., 1:1-70.

Dow, R. P. 1911. On some rare Cicindelae (Coleoptera). Entomol. News, 22:271-272.

_____. 1916. Plaster-casting insect burrows. Psyche, 23:69-74.

Duncan, D. K. 1958. A new subspecies of the genus Cicindela. Pan-Pacific Entomol., 38:43.

Dunn, G. W. 1891. The tiger beetles of California. ZOE, a Biological J., 2(2):152-154.

Fabricius, J. C. 1798. Supplementum Entomologiae systematicae. Hafniae, pp. 1-572.

Fall, H. C. and T. D. Cockerell. 1907. The Coleoptera of New Mexico. Trans. American Entomol. Soc., 33:145-272.

Ferris, C. D. 1969. Notes on collecting early Cicindela in eastern Wyoming. Cicindela, 1(2):9-13.

Fox, H. 1910. Cicindelidae in northern Cape May County, New Jersey, during the summers of 1908-09. Entomol. News, 21:75-82.

Frick, K. E. 1957. Biology and control of tiger beetles in alkali bee nesting sites. J. Econ. Entomol., 50:503-504.

Gistl, J. 1837. Systema insectorum. Munich, 1:1-132.

Goldsmith, W. M. 1916. Field notes on the distribution and life habits of the tiger beetles (Cicindelidae) of Indiana. Proc. Indiana Acad. Sci., 26:447-455.

Gould, A. A. 1834. On the Cicindelae of Massachusetts. Boston J. Nat. Hist., 1(1):41-55.

Graves, R. C. 1963. The Cicindelidae of Michigan. American Midland Nat., 69(2):492-507.

_____. 1969. An upper Michigan population of Cicindela repanda with reduced elytral maculae (Coleoptera: Cicindelidae). Coleopts. Bull., 23:86-88.

Graves, R. C. 1973. The tiger beetles of Arkansas, Louisiana, and Mississippi (Coleoptera: Cicindelidae). Trans. American Entomol. Soc. Philadelphia, 99(2):157-203.

Hamilton, C. C. 1925. Studies on the morphology, taxonomy and ecology of the larvae of holoarctic tiger-beetles (Family Cicindelidae). Proc. United States Nat. Mus., 65:1-87.

Harris, E. D. 1911. List of the North American Cicindelidae in the Harris collection. Yonkers, New York, 68 pp.

_____. 1913. Three new Cicindelids. J. New York Entomol. Soc., 21(1):67-69.

Harris, E. D. and C. W. Leng, Eds. 1916. The Cicindelinae of North America as arranged by Dr. Walther Horn in Genera Insectorum. American Mus. Nat. Hist., New York, 23 pp.

Hatch, M. H. 1938. Coleoptera of Washington: Carabidae: Cicindelinae. Univ. Washington Pub. in Biol., 1(5):225-240.

Hood, L. E. 1903. Notes on Cicindela hentzii. Entomol. News, 14:113-116.

Horn, G. 1876. Descriptions of the larvae of the North American genera of Cicindelidae. Trans. American Entomol. Soc., 7:28-40.

_____. 1880. Contributions to the Coleopterology of the United States. Trans. American Entomol. Soc., 8:139-154.

_____. 1892. Variations of color-markings in Coleoptera. Entomol. News, 3:25-28.

Horn, G. H. 1894. The Coleoptera of Baja California. Proc. California Acad. Sci., 2(4):302-449.

Horn, W. 1897. Die mexicanischen Cicindeliden. Deutsche Entomol. Zeitschr, pp. 161-185.

_____. 1900. Uber einige U.S.A. - Cicendelen. Entomol. Nachr., 26:116-119.

_____. 1903a. Briefe eines reisenden Entomologen. Deutsche Entomol. Zeitschr., pp. 117-198.

_____. 1903b. List of the Cicindelidae of Mexico and on their relationship with the species of the United States. J. New York Entomol. Soc., 9(4):213-221.

_____. 1915. Genera Insectorum, Coleoptera, Family Carabidae, Subfamily Cicindelinae. Bruxelles, P. Wytsman, 82:1-486.

_____. 1926. Uber alte und neue Cicindelinen der Welt. Entomol. Blatter, 22:164-173.

_____. 1930. Notes on the races of Omus californicus and a list of the Cicindelidae of America north of Mexico. Trans. American Entomol. Soc., 56:73-86.

_____. 1935. Cicindelae from the Pacific coast of Mexico, the West Indies and the United States. Pan-Pacific Entomol., 11(2):64-65.

_____. 1938. 2000 Zeichnungen von Cicindelinae. Entomol. Beihefte aus Berlin-Dahlem, 5:1-71.

Huber, R. 1969. Homonymy in the Neartic Cicindela. Cicindela, 1(2):19-21.

Johnson, H. L. 1915. Coleoptera found in the vicinity of Meriden, Connecticut. Entomol. News, Philadelphia, 26:307-319.

Jones, E. 1884. Habits of Cicindelidae in Kansas. Bull. Brooklyn Entomol. Soc., 7:74-76.

Klug, F. 1834. Uebersicht der Cicindelidae der Sammlung. Jahrb. Insectenk., Berlin, 296 pp.

Knaus, W. 1900. Cicindelidae of Kansas. Canadian Entomol., 32:109-116.

_____. 1906. Collecting notes on Coleoptera. Canadian Entomol., 38:145-148.

_____. 1915. Collecting notes on Kansas Coleoptera. Brooklyn New York Bull. Entomol. Soc., 10:35-40.

_____. 1924. A color form of Cicindela repanda unijuncta. J. New York Entomol. Soc., 32:126.

LaRivers, I. L. 1946. An annotated list of the Cicindelidae known to occur in Nevada. Pan-Pacific Entomol., 22(4):134-141.

LeConte, J. 1848. A descriptive catalogue of geodephagous Coleoptera. Ann. Lyc. Nat. Hist., New York, 4:173-474.

_____. 1851. Descriptions of new species of Coleoptera from California. Ann. Lyc. Nat. Hist., New York, 5:125-216.

_____. 1854. Descriptions of new Coleoptera collected by T. H. Webb, M.D., in the years 1850-51 and 52, while Sec. to the U. S. and Mexican boundary commission. Proc. Acad. Nat. Sci. Philadelphia, 7:220-263.

LeConte, J. 1857. Revision of the Cicindela of U. S. Trans. American Phil. Soc., 11(2):27-63.

_____. 1866. Additions to Coleopterous fauna of the U. S., No. 1. Proc. Acad. Nat. Sci. Philadelphia, 18:362-363.

_____. 1868. New Coleoptera collected on the survey for the extension of the Union Pacific Railway, E. D. from Kansas to Fort Craig, New Mexico. Trans. American Entomol. Soc., 2:49-51.

Leng, C. W. and W. Beutenmuller. 1894. Preliminary hand-book of the Coleoptera of North Eastern America. J. New York Entomol. Soc., 2:87-96.

Leng, C. W. 1902a. Revision of the Cicindelidae of boreal America. American Entomol. Soc., 28:93-196.

_____. 1902b. Notes on the Cicindelidae of the pine barrens of New Jersey. J. New York Entomol. Soc., 10:236-240.

_____. 1918. A new race of Cicindela with notes on other races and species. J. New York Entomol. Soc., 26(3-4):138-141.

_____. Leng, C. W. 1920. Catalogue of the Coleoptera of America, north of Mexico. Mount Vernon, New York, J. D. Sherman, 470 pp.

Mares, A. 1921. A new species and a new variety of Cicindela (Coleoptera).

Mayr, E. 1969. Principles of Systematic Zoology. McGraw-Hill, New York, 428 pp.

Melshimer, E. 1806. Catalogue of insects of Pennsylvania, Part I. Hanover, York County: Printed for the author by W. D. Lepper, 48 pp.

Moore, R. 1906. Notes on the habits of Cicindela. Entomol. News, 17:338-343.

_____. 1937. A list of the beetles of San Diego County, California. Occ. Papers San Diego Soc. Nat. Hist., 2:1-109.

Oliver, G. A. 1790. Entomologie, ou histoire naturelle des insectes Coleopteres, 2(33)1-485.

Payne, J. 1971. Preferred temperature ranges of Cicindela repanda Dejean and Cicindela rufiventris Dejean (Coleoptera: Cicindelidae). J. Tennessee Acad. Sci., 46:(4):129-130.

Robinson, J. H. 1948. Description of a new tiger beetle from Texas. Ann. Entomol. Soc. America, 41(1):27.

Rotger, B. 1974. Coleoptera of New Mexico, U.S.A. Cicindela, 6(1):9-11.

Rumpp, N. L. 1956. Tiger beetles of the genus Cicindela in southwest Nevada and Death Valley, California, and descriptions of two new subspecies. Bull. S. California Acad. Sci., 55:131-144.

_____. 1957. Notes on the Cicindela praetextata californica tiger beetle complex. Description of a new subspecies from Death Valley, California. Bull. S. California Acad. Sci., 58:144-154.

_____. 1961. Three new tiger beetles of the genus Cicindela from southwestern United States (Cicindelidae-Coleoptera). Bull. S. California Acad. Sci., 60:165-187.

Rumpp, N. L. 1977. Tiger beetles of the genus Cicindela in the Sulphur Springs Valley, Arizona, with descriptions of three new subspecies. Proc. California Acad. Sci., 41(4):169-182.

Say, T. 1818. American Entomology. Trans. American Phil. Soc., 1:1-485.

_____. 1823. Descriptions of the Coleopterous insects collected in the late expedition to the Rocky Mountains, performed by order of Mr. Calhoun, Sec. of War, under the command of Major Long. Acad. Nat. Sci. Philadelphia, 3:139-331.

Schaupp, F. G. 1883-1884. Synoptic tables of North American Coleoptera: Cicindelidae. Bull. Brooklyn Ent. Soc., 6:73-126.

Shelford, V. E. 1908. Life-histories and larval habits of the tiger beetles (Cicindelidae). Linnean Soc. J. Zool., 30:157-184.

Sherman, F. 1908. Notes on tiger beetle elevations. Entomol. News, 19:360-362.

Smyth, E. G. 1905. Notes on collecting Cicindelidae. Trans. Kansas Acad. Sci., 19:252-260.

_____. 1907-1908. Notes on collecting Cicindelidae - II. Kansas Acad. Sci., 21:180-188.

Sumlin, W. D. 1976. A new subspecies of Cicindela politula from west Texas and a note on Cicindela cazieri (Coleoptera: Cicindelidae). J. Kansas Entomol. Sco., 94(4):521-526.

Tanner, V. M. 1928. The coleoptera of Zion National Park, Utah. Ann. Entomol. Soc. America, Columbus, 21:269-280.

Torre-Bueno, J. R. de la. 1950. A glossary of entomology. Brooklyn Entomol. Soc., Brooklyn, New York, 345 pp.

Van Dyke, E. C. 1947. New species of Coleoptera from western North America. Pan-Pacific Entomol., 23(4):155.

Vaurie, P. 1950a. Four new subspecies of the genus Cicindela (Coleoptera, Cicindelidae). American Mus. Novitates, 1458:1-6.

_____. 1950b. Notes on the habits of some North American tiger beetles. J. New YOrk Entomol. Soc., 58:143-153.

_____. 1951. Five new subspecies of tiger beetles of the genus Cicindela and two corrections. American Mus. Novitates, 1479:1-12.

Vogt, G. B. 1949. Three new Cicindelidae from south Texas with collecting notes on other Cicindelidae (Coleoptera). Bull. Brooklyn Entomol. Soc., 44(1):1-9.

Wallis, J. B. 1961. Cicindelidae of Canada. Univ. of Toronto Press, Toronto, Canada, 74 pp.

Wendler-Funaro, C. de. 1969. "Tiger hunting" in every land. Cicindela, 1(2):15-18.

Wickham, H. F. 1899. The habits of American Cicindelidae. Proc. Davenport Acad. Nat. Sci., pp. 206-228.

Willis, H. L. 1967. Bionomics and zoogeography of tiger beetles of saline habitats in the central United States (Coleoptera: Cicindelidae). Kansas Univ. Sci. Bull., 47:145-313.

_____. 1971. Collecting Cicindelidae in the northwest. Cicindela, 3:41-51.