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THE ORIGIN, DISTRIBUTION, AND CLASSIFICATION OF THE TIGER BEETLES OF LOWER CALIFORNIA (COLEOPTERA: CICINDELIDAE)

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INTRODUCTION

The fauna and flora of the peninsula of Lower California have been of interest, especially to students of geographical distribution, for many years. Since the time of the earliest known collections of insects from the peninsula (1859-1861, J. Xantus de Vesey) several expeditions have made available considerable material which has greatly enhanced our knowledge of the region (Michelbacher and Ross, 1942). Through studies made on this material the relationships of the insect fauna to that of adjacent areas is now quite well known, and the interrelationships of the species are better understood. However, many problems concerning the origin and the per cent of endemism of the species still remain unsolved because of our incomplete collections both on the peninsula and in northwestern Mexico.

The most extensive collection of Lower Californian insects is that made in the summer of 1938 by Dr. and Mrs. A. E. Michelbacher and Dr. E. S. Ross. The Cicindelidae in the collection form the basis for the present paper. Specimens collected in 1921 by Mr. E. P. Van Duzee are included as are the available records in the literature. The writer is greatly indebted to Dr. Michelbacher and Dr. Ross for the privilege of studying their collections and for the opportunity of studying other material in the collection of the California Academy of Sciences. Thanks are due to Miss Alice Gray who made the drawings.

The numbers given after the references in the bibliographies of each species are cross references to the recorded distributions as listed. No attempt has been made to give complete bibliographies, and only those giving records for Lower California or pertinent information concerning the distributional problems are cited. The maps are constructed to show the relationships of the Lower Californian species and subspecies with those of adjacent geographical areas and are not necessarily complete pictures of the distributions in Mexico proper and the United States.

DISTRIBUTION AND ORIGIN

At the present time the tiger beetles of Lower California indicate the presence of four faunas. The distributional records of a number of species from these four faunas is sufficiently complete to indicate the approximate routes traveled and therefore the means by which this tiger beetle fauna came into existence. There are four endemic subspecies and one species, four of Neotropical and one of Sonoran origin.

The Vancouverian fauna is represented by a single subspecies, *C. pusilla lunalonga* Schaupp (fig. 6) which was collected at the southernmost extremity of this fauna in the San Pedro Martir Mountains. The other members of this polytypic species occur throughout the western states and Canada, generally in the more mountainous areas. This record is merely a southern extension of this subspecies and a continuation of its distribution through the mountains of California.

The Californian fauna is represented by a single subspecies, *C. latesignata latesignata* Le Conte (fig. 4), which is confined to the seacoast and which would therefore have had to extend its distribution entirely around the coastline of Lower California to reach La Cholla, Sonora, Mexico, at which locality it has become unstable, and divergence has been sufficient for this population to be recognized as being subspecifically distinct.

The Sonoran fauna, one of the most readily accessible for populating Lower California, has contributed but four recorded elements. With the easy access this fauna has to Lower California through Arizona, southeastern California, and Sonora, Mexico, this is a surprisingly small number out of a total of 14 species and subspecies. *C. californica californica* Ménétries (fig. 10) extends from San José del Cabo on the tip of Lower California as far north as 12 miles south of Santa Rosalia along the east coast and will un-

doubtedly be found farther north when more collecting is possible in the area. *C. californica praetextata* Le Conte (fig. 10), which occurs in southern California, Arizona, and as far south in Lower California as Angeles Bay, and *C. californica brevihamata* W. Horn (fig. 10) from Mazatlan, Sinaloa, Mexico, were derived from the same basic type which probably spread throughout this entire area, populating Lower California by a southern extension. A similar picture is evident in *C. wickhami* W. Horn (fig. 7) except that it is not a polytypic species and extends as far south as Venedio, Sinaloa, on the mainland of Mexico. The fourth Sonoran element, *C. lemniscata* Le Conte (fig. 5), conforms to this general picture except for its more extensive distribution in north central Mexico, and its Lower Californian range conforms rather closely to that shown for *C. californica californica* Ménétries.

The Neotropical fauna has contributed more elements (eight) to that of Lower California than all others combined and presents the most interesting picture from a distributional standpoint. The distribution of *C. gabbi* G. Horn (fig. 9) from Mazatlan, Sinaloa, to La Cholla, Sonora, to San Ignacio, Lower California, to southern California certainly indicates that this coastal species probably traveled the long way around the northern end of the Gulf to arrive in Lower California and then around the peninsula and up to southern California. *C. macrocnema macrocnema* Chaudoir (fig. 2) occurs primarily in Mexico and extends as far north as Mazatlan, from which point there is a gap in the distribution to Cape San Lucas, Lower California. *Cicindela digueti* W. Horn (fig. 8) extends from La Paz in the south to Mejia Island in the northern portion of Lower California. The northern specimens from Mejia Island are most closely allied to those of *C. sinaloae* Bates (fig. 8) from San Carlos Bay and Empalmi, Sonora, thus showing a north to south distribution on the peninsula. *C. digueti* occurs on a number of islands in the Gulf and may have arrived in Lower California by means of island "jumping." However, its distribution in Lower California is similar to that of *C. californicus californicus* Ménétries, and it may therefore have gone around the northern end of Lower California as did *C. gabbi* G. Horn. *C. trifasciata trifasciata* Le Conte is recorded from a number of localities along the west coast of southern Mexico and *C. trifasciata sigmoidea* Le Conte (fig. 11) from Lower California, southern California, and as far south as Mazatlan, Sinaloa, Mexico. Inasmuch as the latter subspecies is coastal, at least in these latitudes,

it is probable that it, too, found its way around the northern end of the Gulf.

Cicindela carthagena carthagena Dejean (fig. 3) is a Neotropical element that is widely distributed in Mexico. It varies into *C. carthagena haemorrhagica* Le Conte (fig. 3) which occurs in northern Mexico, Lower California, the western United States, and Canada, into *C. carthagena arizonae* Wickham (fig. 3) which occurs along the Colorado River in Arizona and as far north as southern Utah, and finally into *C. carthagena miniscula* Cazier (fig. 3) and *C. carthagena colossea* W. Horn (fig. 3) from Lower California. The latter subspecies appears to be most closely related to *C. carthagena carthagena* but occurs in the same area with that subspecies at San Carlos Bay, Sonora, Mexico, where it apparently maintains itself as a distinct population. In Lower California it is not known from the same localities as *C. carthagena haemorrhagica* but has been taken 12 miles south of Santa Rosalia and at Venancio with *C. carthagena miniscula*. So far as presently known it does not interbreed with either of the other subspecies, even though it occurs in the same localities with two of them. It may be that *C. carthagena colossea* arose from *C. carthagena carthagena* as a result of migrations around the northern end of the Gulf and down the east coast of Lower California where it has subsequently been cut off from that subspecies. Its presence in Sonora may be the result of a "re-invasion" across the Gulf where it is now incapable of genetic interchange with *C. carthagena carthagena*. *C. carthagena haemorrhagica* has apparently extended its range down the west coast of Lower California as far as El Rosario but in the southern portion and east coast has become differentiated into *C. carthagena miniscula* with which it does not occur sympatrically. The latter subspecies does, however, occur sympatrically with *C. carthagena colossea* but appears to be reproductively isolated from it. Additional collecting in northern Lower California and Sonora will undoubtedly make available much information needed in the formulation of this complex subspeciation pattern.

Tetracha carolina carolina (Linnaeus) (fig. 1) extends across the southern portion of the United States and undoubtedly arrived in Lower California as a result of a southward spread of the southern Californian and southwestern Arizonan populations of this Neotropical representative.

From the above discussion it can be seen that there is considerable evidence supporting the conclusion that the Sonoran, Van-

couveran, and Californian elements entered Lower California by a direct north to south extension down the peninsula. Among the Neotropical representatives, *C. gabbi*, *C. carthagensis haemorrhagica*, *C. carthagensis miniscula*, *C. carthagensis colossea*, and *T. carolina carolina* appear either to have gone around the Gulf of Lower California or to have arrived from the north as southern extensions of widely distributed subspecies. The fact that *C. digueti* is more similar to the Mexican *C. sinaloae* in the northern portion of its distribution might also indicate this pattern, although there is also the possibility of an island crossing. Inasmuch as *C. trifasciata sigmoidea* is primarily a sea-coast form it is likely that it came in by way of the more northern route around the head of the Gulf. Distributional information on *C. macrocnema macrocnema* Chaudoir is insufficient to allow any conclusions as to its probable distributional pattern.

There are a number of species and subspecies that will probably be found in Lower California when that peninsula has been more thoroughly collected. These include *C. oregona oregona* Le Conte, *C. senilis* Horn, *C. hirticollis gravida* Le Conte, *C. sperata sperata* Le Conte, and *C. tenuisignata* Le Conte.

CLASSIFICATION

KEY TO THE GENERA OF TIGER BEETLES OF LOWER CALIFORNIA

1. Scutellum not visible; third segment of maxillary palpi longer than fourth
..... *Tetracha*
- Scutellum visible; third segment of maxillary palpi shorter than fourth
..... *Cicindela*

***Tetracha carolina carolina* (Linnaeus)**

Figure 26

Cicindela carolina LINNAEUS, 1767, Systema naturae, ed. 12, p. 657. SCHAUPP, 1883, Bull. Brooklyn Ent. Soc., vol. 6, p. 78.¹ BATES, 1884, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 1.² HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 306.³ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 185.⁴ LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 109.⁵ HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 220. HORN, W., 1908, Genera insectorum, fasc. 82A, pp. 140-141.⁶ GROSSBECK, 1912, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 324. HORN, W., 1926, Ent. Blätter, vol. 22, p. 169.

Megacephala carolinensis LATREILLE, 1806, Genera crustaceorum et insectorum, vol. 1, p. 175, pl. 6, fig. 9. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Megacephala occidentalis KLUG, 1829, Preis-Verzeichniss vorräthiger Insecten-

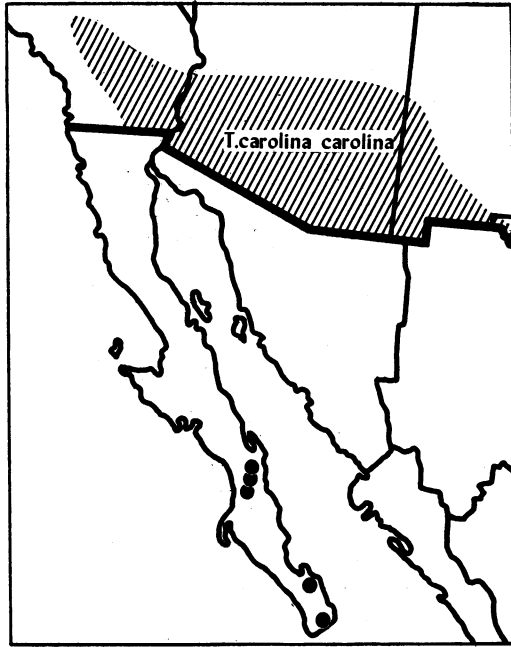


FIG. 1. Distribution of *Tetracha carolina carolina* (Linnaeus).

doubltten des . . . Museums, Berlin, p. 11. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Megacephala Mexicana GRAY, 1832, in Cuvier, The animal kingdom (Griffith), vol. 14, pp. 263-264. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Megacephala maculicornis LA PORTE, 1834, Rev. Ent. Silbermann, vol. 2, p. 29. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Tetracha virgula THOMSON, 1857, Monographie des cicindélides, vol. 1, p. 31. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Megacephala Boisduvalii GISTL, 1837, Systema insectorum, vol. 1, p. 7. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

Megacephala splendida DOKHTUROV, 1882, Species des cicindélides, vol. 1, p. 46. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 72.

This species is a Neotropical element that occurs across the southern portion of the United States from Florida to California and throughout Mexico and the northern portions of Central America. It is most closely related to a number of species in Mexico, West Indies, Central and South America and is one of the two species in this genus that reaches as far north as the United States. The other is *T. virginica* (Linnaeus) which occurs from

Florida to Pennsylvania in the east, from Texas to Nebraska in the west, and into northeastern Mexico.

TYPE LOCALITY: Carolina.

RECORDED DISTRIBUTION: *United States*: Georgia,^{1,5} Louisiana,^{1,5} Florida,^{1,5} Texas,^{1,5} New Mexico,⁵ Arizona,⁵ Fort Yuma.⁴ *Mexico*: San José del Cabo,⁴ from Fort Yuma to San José del Cabo,³ Michoacan,² Chiapas,² Putla,² Oaxaca,^{2,4} west coast of Mexico,³ Vera Cruz,⁴ Morelos,⁴ Guerrero,⁴ Durango.⁴ *West Indies*: Cuba.⁶ *Guatemala*: Rio Navanjo.² *Nicaragua*.⁶

NEW LOCALITIES: *Lower California*: Triunfo, July 13, 1938; Commondu, July 22, 1938; 20 miles north of Commondu, July 23, 1938; 5 miles south of San Miguel, July 20, 1938.

KEY TO THE SPECIES OF *Cicindela* OF LOWER CALIFORNIA

1. Trochanters of front and middle legs without apical setae or pits. 2
- Trochanters of front or middle legs or both with an apical seta or pit. 3
2. Pronotum with setae along front and hind margins long, white, narrower than dorsal setae, and not overlapping to form semitransparent "neck" bands; hind tibiae one-third shorter than hind femora. *macrocnema*
- Pronotum with setae along front and hind margins short, semitransparent, generally wider than dorsal setae, and overlapping to form a semitransparent "neck" band; hind tibiae longer than, or about same length as, hind femora. *carthagena*
3. Front of head clothed with long erect pile; thoracic sternites clothed with erect pile. *latesignata*
- Front of head glabrous except for ocular setae; thoracic sternites clothed with recumbent pile. 4
4. Prosternal episterna with median glabrous area, pile around lower edges, especially near coxae. 5
- Prosternal episterna densely or sparsely pilose throughout. 7
5. Disc of elytra densely, deeply punctate, punctures coalescent laterally, forming irregular transverse ridges; surface shining; humeral and middle lunules united forming a continuous median white line on elytra, with or without connection with apical lunule. *lemniscata*
- Disc of elytra with irregularly scattered, shallow punctures, not generally coalescent and without transverse ridges; surface alutaceous; humeral and middle lunules not united to form a median white line on elytra, never connected with apical lunule. 6
6. Pronotum with side margins straight and subparallel; hind angles prominent. *pusilla*
- Pronotum with side margins evenly rounded; hind angles not evident. *wickhami*
7. Pronotum distinctly margined laterally above prosternal episternal suture. *diguetti*
- Pronotum not or indistinctly margined laterally, evenly rounded to prosternal episternal suture. 8

8. Pronotum with distinct hind angles; descending portion of middle lunule not paralleling elytral suture. 9
 — Pronotum without distinct hind angles, side margins evenly rounded to base; descending portion of middle lunule subparalleling elytral suture *gabbi*
9. Pronotum with side margins evenly rounded; prosternal episternum without erect pile anteriorly; middle lunule not S-shaped. *californica*
 — Pronotum with side margins nearly parallel; prosternal episternum with erect pile anteriorly; middle lunule inverted S-shaped. *trifasciata*

Cicindela macrocnema macrocnema Chaudoir

Figure 17

Cicindela macrocnema CHAUDOIR, 1852, Bull. Soc. Imp. Nat. Moscou, vol. 25, pp. 15–17. BATES, 1884, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 12.¹ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 180.² HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 218. HORN, W., 1908, Genera insectorum, fasc. 82A, pp. 392, 410. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.³

Cicindela Batesi var. *albina* W. HORN, 1894, Deutsche Ent. Zeitschr., p. 240. HORN, W., 1897, *ibid.*, p. 180. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 295.

Cicindela Batesi W. HORN, 1897, Deutsche Ent. Zeitschr., p. 180. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 295.

No Lower Californian specimens of this Neotropical species have been studied but there is no reason to doubt W. Horn's record of its occurrence at Cape San Lucas. It occurs from Nicaragua to Lower California, but the route traversed from Mazatlan, Sinaloa, to Cape San Lucas will remain in doubt until additional records are available from northwestern Mexico and Lower California.

TYPE LOCALITY: Acapulco, Mexico.

RECORDED DISTRIBUTION: *Mexico proper*: Mazatlan,¹ Salina Cruz,² Tonalá,² San Benito (Soconusco).² *Lower California*: Cape San Lucas.³ *Guatemala*: Champerico,¹ Paraiso.¹ *Nicaragua*: San Juan del Sur.¹

NEW LOCALITY: *Mexico*: San Blas, Nayarit.

KEY TO THE SUBSPECIES OF *Cicindela carthagena* DEJEAN

1. Size large (12.5–16.0 mm.); form robust (Lower California).
 *carthagena colossea*
- Size small to medium (8.2–14.2 mm.); form narrow, linear. 2
2. Color brilliant to dull cupreous with green reflections (northwestern Arizona, southwestern Utah). *carthagena arizonae*
- Color dark green or black. 3
3. Thoracic sternites and elytra black (southern Lower California).
 *carthagena miniscula*



FIG. 2. Distribution of *Cicindela macrocnema macrocnema* Chaudoir.

- Thoracic sternites brilliant cupreous green, elytra dark green or black. 4
 4. Size small (8.2–11.0 mm.) (Mexico and Central America)
 *carthagena carthagena*
 — Size medium (10.4–14.2 mm.) (northern Mexico, northern Lower California,
 and western North America) *carthagena haemorrhagica*

Cicindela carthagena carthagena Dejean

Cicindela carthagena DEJEAN, 1831, Species général des coléoptères, vol. 5, p. 229. BATES, 1881, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 9.¹

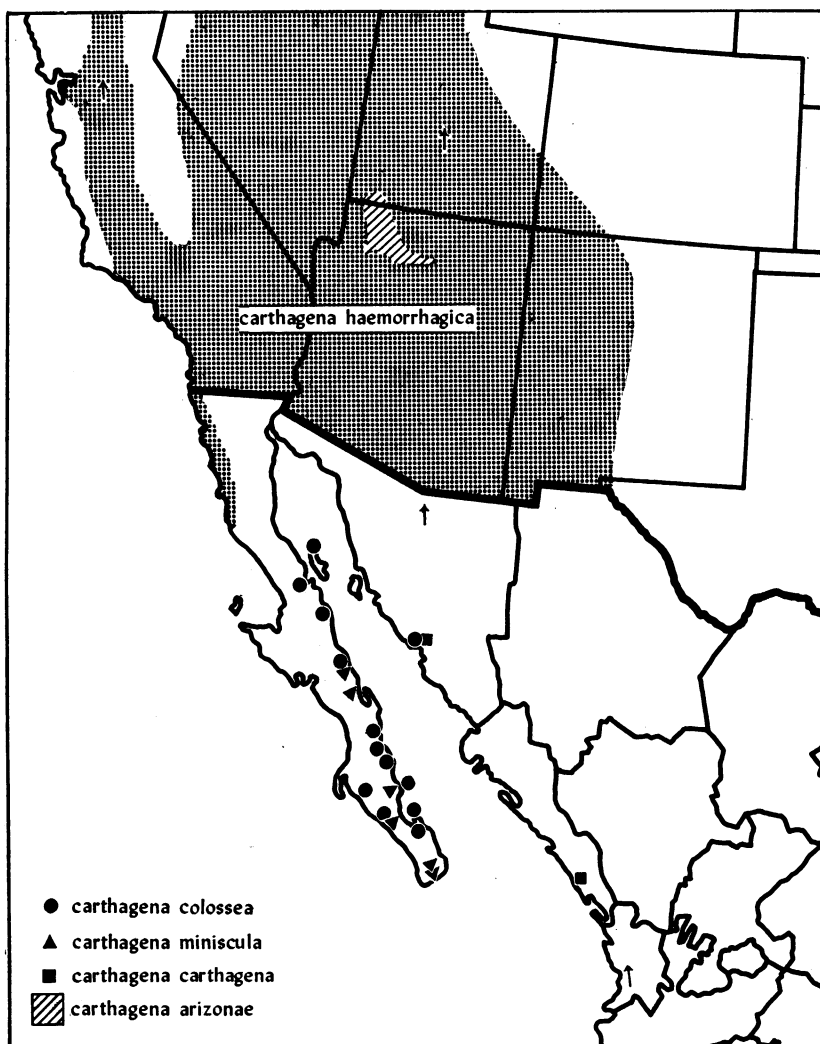


FIG. 3. Distribution of *Cicindela carthagenae* Dejean.

HORN, W., 1897, *Deutsche Ent. Zeitschr.*, p. 179.² HORN, W., 1903, *Jour. New York Ent. Soc.*, vol. 11, p. 218. HORN, W., 1908, *Genera insectorum*, fasc. 82A, pp. 388, 402.

Cicindela carthagenae hentziana W. HORN (*nec* Leng), 1926, in Junk, *Coleopterorum catalogus*, vol. 1, p. 289.

Cicindela carthagenae Hentzi W. HORN (*nec* G. Horn), 1926, in Junk, *Coleopterorum catalogus*, vol. 1, p. 289.

Although this subspecies does not occur in Lower California, it is mentioned here because it is the Mexican relative of the three

subspecies occurring there. It is here considered to be of Neotropical origin with subspecies ranging as far north as Canada. Most of the closely related species are of southern origin, where this particular group of *Cicindela* species reaches its greatest abundance and diversity.

TYPE LOCALITY: Colombia.

RECORDED DISTRIBUTION: *Guatemala*: Champerico.¹ *Nicaragua*: Chantales.¹ *Colombia*.¹ *Mexico*: Acapulco.²

NEW LOCALITIES: *Mexico*: Tenacatito Bay; Guaymas, Sonora.

Cicindela carthagena haemorrhagica Le Conte

Cicindela haemorrhagica LE CONTE, 1851, Ann. Lyc. Nat. Hist., New York, vol. 5, pp. 171-172. LE CONTE, 1861, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 335.¹ SCHAUPP, 1884, Bull. Brooklyn Ent. Soc., vol. 6, pp. 105-106.² BATES, 1884, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 9.³ HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 306.⁴ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 179. LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 176.⁵ HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 218. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 388.

Cicindela haemorrhagica var. *pacifica* SCHAUPP, 1883-1884, Bull. Brooklyn Ent. Soc., vol. 6, pp. 84, 106, pl. 4, fig. 110. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 290.

Cicindela pacifica var. *nevadiana* CASEY, 1924, Memoirs on the Coleoptera, vol. 11, p. 16. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 290.

Cicindela woodgatei CASEY, 1913, Memoirs on the Coleoptera, vol. 4, p. 40. Horn, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 289.

This subspecies is widely distributed in western North America and northwestern Mexico and thus far is known to occur down the west coast of Lower California as far as El Rosario. It is one of the most variable subspecies in maculation, ranging from fully maculated to immaculate.

TYPE LOCALITY: San Diego, California.

RECORDED DISTRIBUTION: *United States*: Upper California (maritime),¹ California,^{2,4} Utah,² Nevada,² New Mexico,⁵ Arizona.⁵ *Mexico*: Northwest frontier.³ *Lower California*: Along Pacific coast of peninsula to El Rosario.⁴

Cicindela carthagena colossea W. Horn

Figures 22, 23

Cicindela carthagena colossea W. HORN, 1926, Ent. Blätter, vol. 4, pp. 169-170.¹

This is the largest and most robust subspecies of *C. carthagena carthagena*. It is colored a dull cupreous brown with greenish reflection and is heavily marked throughout. The males have the sides of the elytra subparallel (fig. 23), whereas in the females the elytral margins are expanded laterally at about the basal fourth (fig. 22). In size the females range from 12 to 16 mm. in length, from 5.5 to 6.5 mm. in width; the males, from 12.5 to 14 mm. in length, from 4 to 5 mm. in width.

TYPE LOCALITY: "Insel San Jose,"¹ La Paz.¹

RECORDED DISTRIBUTION: "Insel San Jose,"¹ La Paz.¹

NEW LOCALITIES: *Lower California*: Point Refugio, Gulf of California, Angel de la Guardia Island, June 29, 1921 (E. P. Van Duzee); Granite Island, Gulf of California, Angel de la Guardia Island, May 2, 1921 (E. P. Van Duzee); Espiritu Santo Island, Gulf of California, May 31, 1921 (J. C. Chamberlin); San Francisco Bay, Gulf of California, May 10, 1921 (E. P. Van Duzee); Agua Verde, May 26, 1921 (E. P. Van Duzee); San José Island, Gulf of California, June 10, 1921 (E. P. Van Duzee); La Paz, June 29, 1919 (G. F. Ferris); Loreto, May 19, 1921 (E. P. Van Duzee); Angeles Bay, Gulf of California, May 7, 1921 (E. P. Van Duzee); 12 miles south of Santa Rosalia, June 27, 1928 (Michelbacher and Ross); Venancio, July 17, 1938 (Michelbacher and Ross); Escondido Bay, June 14, 1921 (E. P. Van Duzee). *Mexico*: San Carlos Bay, Gulf of California, July 8, 1921 (E. P. Van Duzee).

Cicindela carthagena miniscula, new subspecies

Figure 12

Cicindela Hentzii G. HORN (*nec* Dejean), 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 307 (misidentified).

Leng proposed a new name for *Hentzii* G. Horn, but since this name has been validated as a synonym of *Cicindela carthagena* by W. Horn, I have not included it in the synonymy of this subspecies in order to avoid the introduction of a new homonym.

Similar to *C. carthagena haemorrhagica* but smaller in size and black above and on thoracic sternites. Humeral lunule narrowly interrupted subapically; middle lunule complete, slightly expanded at margin; subapical marginal spot present; apical lunule narrowly interrupted subbasally. Thoracic sternites black; abdomen reddish brown; legs black with greenish reflections. Male: length, 10.5 mm.; width, 4 mm.; female: length, 11.0 mm.; width, 4 mm.

TYPE MATERIAL: Holotype male, allotype female from 12 miles south of Santa Rosalia, Lower California, June 27, 1938 (Michelbacher and Ross), deposited in the collection of the California Academy of Sciences. One male paratype from Venancio, Lower California, July 17, 1938 (Michelbacher and Ross); seven male paratypes from Mulege, Baja California, May 14, 1921 (E. P. Van Duzee), deposited in the collections of the California Academy of Sciences and the American Museum of Natural History. One male paratype from San José del Cabo (Charles Fuchs) in the collection of the United States National Museum.

The series is remarkably uniform in size and markings. Specimens from Santa Rosa and San Evaristo that resemble *C. carthagena haemorrhagica* in color are smaller than that subspecies and are more properly assigned to *C. carthagena miniscula*. *C. carthagena haemorrhagica* has undergone similar instability in two other portions of its extensive range. The populations from Oregon contain a small percentage of black individuals as do those from Jemez Springs, New Mexico, and Gila Valley, Arizona. However, black individuals from these localities are not reduced in size, and the markings tend towards reduction as in *C. carthagena haemorrhagica*. It is interesting to note these three nearly parallel evolutionary trends at the extremities of the distribution of this widely ranging subspecies.

KEY TO THE SUBSPECIES OF *Cicindela latesignata* LE CONTE

- 1. Head and pronotum dark green; elytra black tinged with purplish or green *latesignata latesignata*
- Head and pronotum brilliant cupreous red with greenish reflections; elytra brilliant cupreous red tinged with green, pits brilliant green *latesignata parkeri*

***Cicindela latesignata latesignata* Le Conte**

Figures 24, 25

Cicindela latesignata LE CONTE, 1851, Ann. Lyc. Nat. Hist., New York, vol. 5, p. 172. LE CONTE, 1860, Trans. Amer. Phil. Soc., new ser., vol. 11, pp. 39-40. SCHAUPP, 1884, Bull. Brooklyn Ent. Soc., vol. 6, p. 91.¹ BATES, 1884, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 4.² HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 306.³ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 165.⁴ LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 138. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 215. HORN, W., 1908, Genera insectorum, fasc., 82A, pp. 375-376. HORN, W., 1926, Ent. Blätter, vol. 22, p. 169.⁵

Cicindela latesignata obliviosa CASEY, 1913, Memoirs on the Coleoptera, vol. 4, p. 20. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 270.

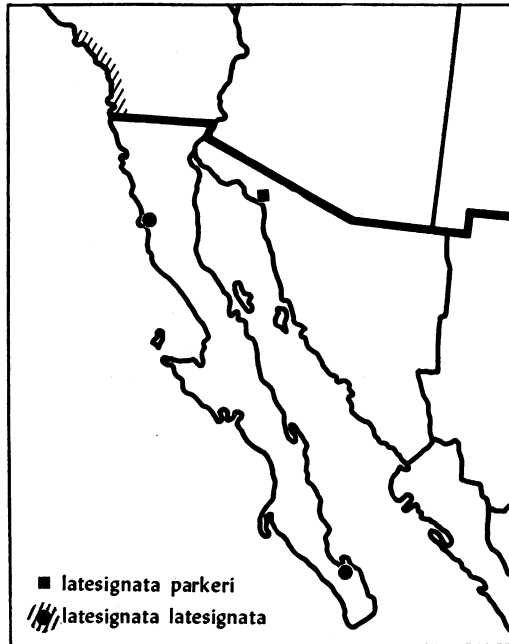


FIG. 4. Distribution of *Cicindela latesignata* Le Conte.

Until recently this species was known only from southern California and Lower California, but in 1941 Mr. Frank Parker discovered its presence as a distinct subspecies at La Cholla, Sonora, Mexico. The species is considered to be an element of the Californian fauna and, since it is confined to the coastal regions, it will most certainly be found in additional localities around the coast of Lower California and Mexico. It is not closely related to any Neotropical element, whereas its affinities with *C. tranquebarica* Herbst, which is confined to the United States and Canada, are very great. There seems to be little doubt but that the species has followed the coast line from California around the tip of Lower California into northern Sonora, Mexico. It is very doubtful that it could have made its way across the peninsula in recent times to reach Sonora directly from southern California, and its very close relationship with *C. latesignata parkeri* would indicate a recent divergence.

TYPE LOCALITY: San Diego, California.

RECORDED DISTRIBUTION: *United States*: San Diego, California.^{1,3} *Mexico proper*: Northwest boundary.^{2,4} *Lower California*: San Quentin,^{3,4} La Paz.⁵

Cicindela latesignata parkeri, new subspecies

Structurally the same as *C. latesignata latesignata*. Differs from this subspecies by having the entire upper surface colored a brilliant cupreous red, except for the punctures, which are green, and the white lunules; under surface and legs green, tinged with brilliant cupreous red. The holotype male has the humeral, middle, and apical lunules complete and separated from each other; allotype female with all lunules narrowly connected along the margins.

TYPE MATERIAL: Holotype male and allotype female collected at La Cholla, Sonora, Mexico, April 20, 1941, by F. H. Parker, deposited in the American Museum of Natural History. Nineteen topoparatypes deposited in the collection of F. H. Parker and two in the American Museum of Natural History.

The markings in the paratype series vary from being narrowly connected along the margins to being completely united, leaving a V-shaped pigmented area on the disc and base of elytra. This variation exists in *latesignata latesignata*, and the reduced intrapopulation form in that subspecies was described by Casey as *obliviosa* (fig. 25). In two of the paratypes the green color of the elytral pits predominates, giving the elytra a greenish cupreous coloration.

Cicindela lemniscata Le Conte

Figure 13

Cicindela lemniscata LE CONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 220. LE CONTE, 1860, Trans. Amer. Phil. Soc., new ser., vol. 11, p. 59. HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 307.¹ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 184.² LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, pp. 174-175.³ HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 220. HORN, W., 1908, Genera insectorum, fasc. 82A, pp. 384-385. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.⁴

Cicindela lemniscata is a typical Sonoran element that is abundantly represented in Texas, New Mexico, Arizona, and northwestern Mexico. Throughout this distributional range the species maintains unusual stability for a member of this genus, and no divergent populations have yet been observed. The large gap between the northernmost Lower Californian record (45 miles north of San Ignacio), the most southwestern Arizonan record (Gila), and the westernmost Mexican record (Rio Mayo, Sonora) is probably due to lack of collecting in the area rather than any

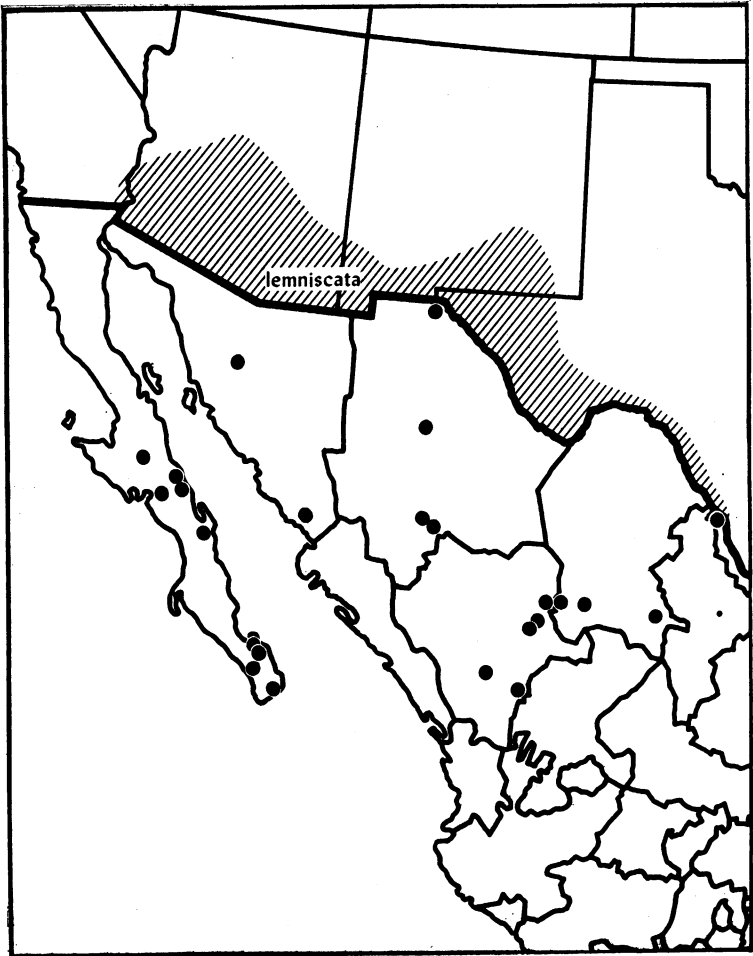


FIG. 5. Distribution of *Cicindela lemniscata* Le Conte.

natural barrier. There are specimens in collections labeled "California" which would bring the distributions even more closely approximate. When more collecting in northern Lower California has been accomplished, it is likely to disclose the presence of this species throughout the present distributional gap. The Lower Californian populations of *C. lemniscata* almost certainly progressed down the peninsula from Sonora, Arizona, and California.

TYPE LOCALITY: "San Diego trip."

RECORDED DISTRIBUTION: *United States*: Texas,¹ Arizona,¹ New Mexico.³ *Mexico proper*: Northern Sonora,² Chihuahua,²

(Villa Lerdo), Durango² (Coyote Laredo). *Lower California*: San José del Cabo,¹ La Paz,¹ Santa Rosalia (Diguet),⁴ El Mogote.⁴

NEW LOCALITIES: *Lower California*: 25 miles south of Santa Rosalia, July 25, 1938 (Michelbacher and Ross); Triutfo, July 13, 1938 (Michelbacher and Ross); 20 miles north of Comondonu, July 23, 1938 (Michelbacher and Ross); 45 miles north of San Ignacio, July 27, 1938 (Michelbacher and Ross).

KEY TO THE SUBSPECIES OF *Cicindela pusilla* SAY

1. Basal, median, and apical lunules on elytra connected along margin. *pusilla cinctipennis*
- Basal, median, and apical lunules on elytra not connected along margin. 2
2. Median lunule extending towards, and often united with, apical portion of basal lunule. *pusilla imperfecta*
- Median lunule not extending towards, nor united with, apical portion of basal lunule. 3
3. Median lunule reaching margin, expanding basally and apically, occasionally united with basal lunule on margin. *pusilla pusilla*
- Median lunule only occasionally reaching margin, and if so not greatly expanded along it, never uniting with basal lunule. *pusilla lunalonga*

***Cicindela pusilla lunalonga* Schaupp**

Figure 15

Cicindela lunalonga SCHAUPP, 1884, Bull. Brooklyn Ent. Soc., vol. 6, p. 122. HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 306 (*pusilla*).¹ HORN, W., 1897, Deutsche Ent. Zeitschr., vol. 1, p. 182 (*pusilla*). LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 157. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 219.² HORN, W., 1908, Genera insectorum, fasc. 82A, p. 390. CAZIER, 1937, Pan-Pacific Ent., vol. 13, no. 3, pp. 117-118.

Cicindela tuolumnae LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, pp. 19-20. CASEY, 1914, Memoirs on the Coleoptera, vol. 5, pp. 19-20. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 390.

Cicindela tularensis CASEY, 1914, Memoirs on the Coleoptera, vol. 5, pp. 19-20. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 293.

Cicindela pusilla wagneri CAZIER, 1937, Pan-Pacific Ent., vol. 13, no. 3, pp. 117-118.

This Vancouverian element is known from California, British Columbia, Canada, Idaho, Washington, Montana, Nevada, Utah, and Arizona. The Lower Californian occurrence is the southernmost record in its distribution or in the distributions of any of its allied subspecies. Its presence in Lower California is not surprising as the record is adjacent to Californian localities, and while it does not shed any particular light on the distributional problem, it does show that Vancouverian elements are present, at least in

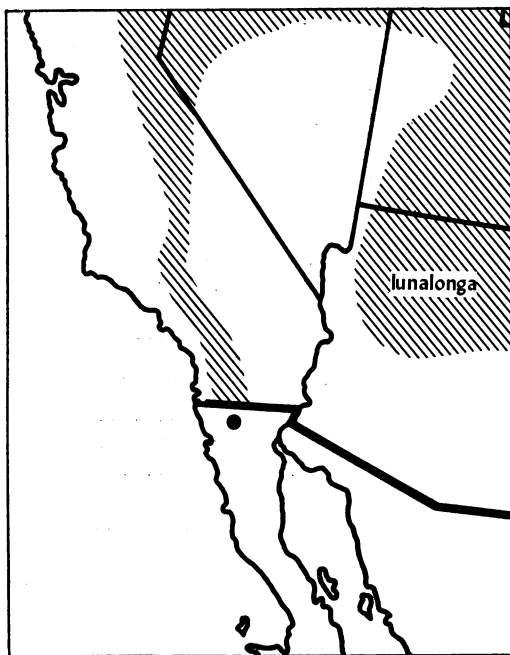


FIG. 6. Distribution of *Cicindela pusilla lunalonga* Say.

the San Pedro Martir Mountains. No specimens from Lower California have been examined by the writer, but specimens from Prescott, Arizona, and Riverside, California, were used in this study.

TYPE LOCALITY: Sierra Nevada, California (H. Edwards).

RECORDED DISTRIBUTION: *United States*: California.¹ *Lower California*²: San Pedro Martir Mountains.¹

Cicindela wickhami W. Horn

Figure 14

Cicindela wickhami W. HORN, 1903, Deutsche Ent. Zeitschr., pp. 182-183. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 219. HORN, W., 1908, Genera insectorum, fasc. 82A, pp. 388-389. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.¹

Cicindela viridisticta SCHAUPP (*nec* Bates, in part), 1884, Bull. Brooklyn Ent. Soc., vol. 6, p. 103. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 290. LENG (in part), 1902, Trans. Amer. Ent. Soc., vol. 28, p. 175. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 388.

Cicindela lemnisticta SMYTH, 1907, Trans. Kansas Acad. Sci., vol. 21, p. 188. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 389.

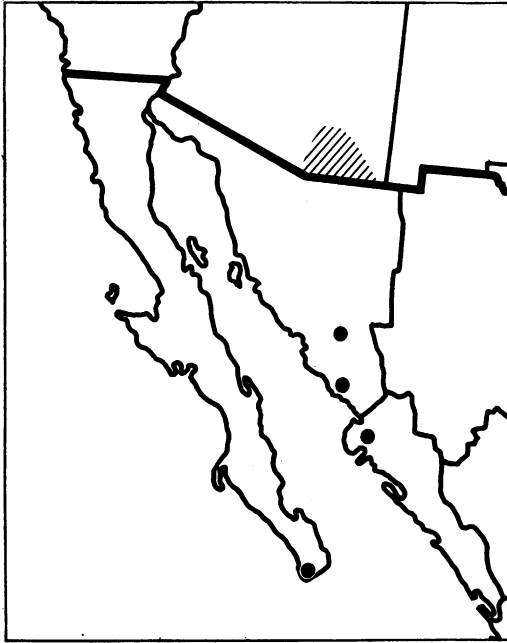


FIG. 7. Distribution of *Cicindela wickhami* W. Horn.

This species is a Sonoran element that occurs in Arizona, Sonora and Sinaloa, Mexico, and according to W. Horn at Cape San Lucas in Lower California. No specimens from the latter locality have been examined by the writer. Its occurrence in Lower California can probably be accounted for as discussed under *C. lemniscata*, a species for which we have more extensive data but which has the same general distribution as *C. wickhami*.

TYPE LOCALITY: Tucson, Arizona.

RECORDED DISTRIBUTION: *United States*: Arizona, Santa Catalina Mountains; Douglas; Coyote Mountains; San Xavier; St. Cruz village, Cababi Mountains. *Mexico*: Rio Mayo, Sonora; Venedio, Sinaloa. *Lower California*: Cape San Lucas¹ (Petit).

Cicindela digueti W. Horn

Figure 18

Cicindela digueti W. HORN, 1897, Deutsche Ent. Zeitschr., p. 186. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 217. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 384. HARRIS AND LENG, 1916, The Cicindelinae of North America, p. 10. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.¹

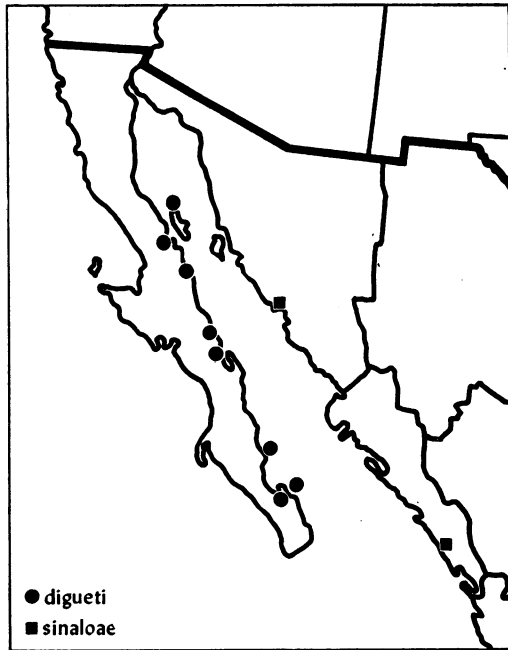


FIG. 8. Distribution of *Cicindela digueti* W. Horn and *C. sinaloae* Bates.

In the original description, Horn compared *C. digueti* with *C. punctulata* Olivier, to which it has not the slightest resemblance. It is, however, closely related to *C. sinaloae* (fig. 16), differing from that species in being of larger average size, of a more shining appearance, and having generally more reduced markings.

It is interesting to note that *C. digueti* occurs on the Gulf side of Lower California, where it is present on a number of the islands off the coast, and also that the forms more nearly resembling *C. sinaloae* were taken on Mejia Island and at Angeles Bay in the northern extremity of the known distribution. Since neither *C. digueti* nor *C. sinaloae* has been taken in the extreme northern portion of the Gulf and since they are both strong fliers, it might be reasonable to assume that *C. digueti* may have arisen as a result of a migration across the islands from Tiburon to San Esteban San Lorenzo and from there to Lower California and the islands off the coast. However, it is equally plausible to assume that, since they are more divergent than are *C. latesignata latesignata* and *C. latesignata parkeri*, they may have gone around the northern end of the Gulf at an earlier date and subsequently migrated southward to their present position. More extensive collecting in

northwestern Sonora may reveal their presence there and thus settle this question. The two species were undoubtedly derived from a common stock, and as such *C. digueti* represents an endemic Neotropical element in the fauna of Lower California.

TYPE LOCALITY: "California inf."

RECORDED DISTRIBUTION: *Lower California*: La Paz,¹ "Insel San Jose."¹

NEW LOCALITIES: *Lower California*: Coyote Cove, Conception Bay, June 29, 1938 (Michelbacher and Ross); 12 miles south of Santa Rosalia, June 27, 1938 (Michelbacher and Ross); Mejia Island, Gulf of California, June 28, 1921 (E. P. Van Duzee); San José Island, Gulf of California, June 10, 1921 (E. P. Van Duzee); Angeles Bay, Gulf of California, June 26, 1921 (E. P. Van Duzee); La Paz, June 4, 1921 (E. P. Van Duzee); San Francisquito Bay, Gulf of California, May 10, 1921 (J. C. Chamberlain); Ceralbo Island, Gulf of California, June 6, 1921 (E. P. Van Duzee).

Cicindela gabbi G. Horn

Figure 21

Cicindela gabbi G. HORN, 1866, Proc. Acad. Nat. Sci. Philadelphia, vol. 18, pp. 395-396. SCHAUPP, 1884, Bull. Brooklyn Ent. Soc., vol. 6, p. 102.¹ BATES, 1884, Biologia Centrali-Americana, Coleoptera, vol. 1, p. 11.² HORN, W., 1897, Deutsche Ent. Zeitschr., p. 181.³ LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 168.⁴ HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 219. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 391.

Cicindela gabbi G. Horn is most closely related to the Neotropical group of species, including *C. chlorocephala* Chevrolat and *C. leuconoe* Bates, than to any American species and is therefore considered to be a Neotropical element. Its distribution from Mazatlan, Sinaloa, to La Cholla, Sonora, San Ignacio, Lower California, and southern California offers proof of migrations around the northern end of the Gulf of California. Inasmuch as it is confined to coastal areas and conditions, there is little likelihood of any overland migration from the upper portion of the gulf directly to southern California.

The species is extremely stable throughout this area, and thus far no divergent populations have been seen. Additional collecting in Lower California and northwestern Mexico will undoubtedly fill in the extensive gaps now existing in our records.

TYPE LOCALITY: Wilmington (San Pedro), California.

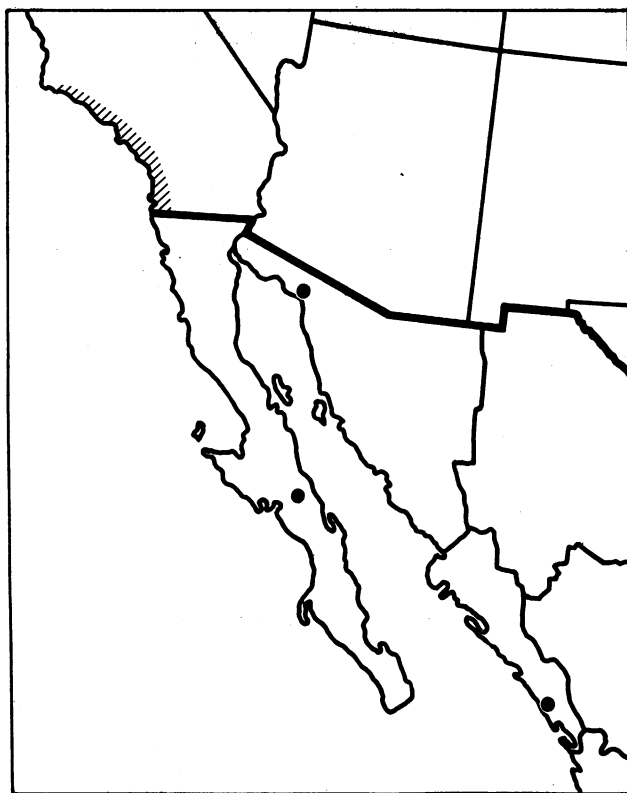


FIG. 9. Distribution of *Cicindela gabbi* G. Horn.

RECORDED DISTRIBUTION: *United States*: Near Wilmington (San Pedro), California¹; San Diego.⁴ *Mexico*: Northwest frontier (Forrer)²; Mazatlan (Sinaloa).³

NEW LOCALITIES: *Lower California*: San Ignacio, June 26, 1938 (Michelbacher and Ross). *Mexico*: La Cholla, Sonora (F. A. Parker).

KEY TO THE SUBSPECIES OF *Cicindela californica* MÉNÉTRIÉS

1. Elytral lunules distinct, not broadly coalescent 2
- Elytral lunules indistinct, broadly coalescent (California).....
- *californica mojavi*
2. Elytral margins entirely white..... 3
- Elytral margins interrupted in front of apical lunules (Lower California)
- *californica californica*
3. Labrum with three acute anterior teeth; size generally small (10.5–11.5
- mm.) (Mazatlan, Sinaloa, Mexico)..... *californica brevihamata*
- Labrum either with three obtuse teeth or unidentate; size generally larger
- (11.5–14 mm.) (western United States and Lower California)....
- *californica praetextata*

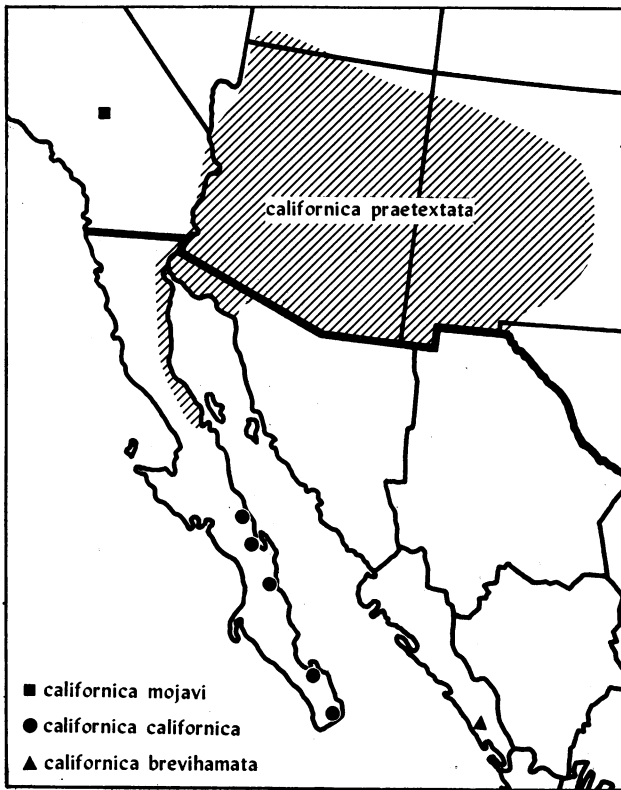


FIG. 10. Distribution of *Cicindela californica* Ménétries.

Cicindela californica californica Ménétries

Figure 19

Cicindela californica MÉNÉTRIES, 1844, Bull. Acad. Imp. Sci., St. Petersburg, Cl. Phys. Math., vol. 2, p. 51. LE CONTE, 1860, Trans. Amer. Phil. Soc., new ser., vol. 11, pp. 44-45, 62. HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 307 (*praetextata*).¹ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 183. LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, pp. 172-173. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 219. HORN, W., 1908, Genera insectorum, fasc. 82A, pp. 390-391. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.² CAZIER, 1937, Pan-Pacific Ent., vol. 13, no. 3, pp. 116-117.

This Sonoran element is known from a number of localities in Lower California, as listed, and has as its closest relative, *C. californica praetextata* Le Conte, a subspecies that has a wide range in the United States and that extends into Lower California as far south as Angeles Bay. *C. californica mojavi* Cazier from Saltdale,

California, and *C. californica brevihamata* W. Horn from Mazatlan, Mexico, are extreme variants of *C. californica praetextata*. This species is most closely allied to other species in the United States (*C. circumpecta* La Ferté) and undoubtedly spread from the Southwest into Lower California and more especially down the Gulf side of the peninsula.

TYPE LOCALITY: California.

RECORDED DISTRIBUTION: *Lower California*: San José del Cabo,¹ La Paz² (Diguët).

NEW LOCALITIES: *Lower California*: 12 miles south of Santa Rosalia, June 27, 1938 (Michelbacher and Ross); Coyote Cove, Conception Bay, June 29, 1938 (Michelbacher and Ross).

Cicindela californica praetextata Le Conte

Cicindela praetextata LE CONTE, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 220.¹ LE CONTE, 1856, Trans. Amer. Phil. Soc., new ser., vol. 11, p. 58. SCHAUPP, 1884, Bull. Brooklyn Ent. Soc., vol. 6, p. 104. HORN, W., 1897, Deutsche Ent. Zeitschr., vol. 1, p. 183. HORN, W., 1903, Jour. New York Ent. Soc., vol. 11, p. 219. LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, pp. 171-172.² CASEY, 1913, Memoirs on the Coleoptera, vol. 4, pp. 33-34.³

Cicindela praetextata fulgoris CASEY, 1913, Memoirs on the Coleoptera, vol. 4, pp. 34-35.³ HORN, W., 1908, Genera insectorum, fasc. 82A, p. 391. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 294.

Cicindela praetextata stringens CASEY, 1913, Memoirs on the Coleoptera, vol. 4, pp. 34-35.³ HORN, W., 1908, Genera insectorum, fasc. 82A, p. 391. HORN, W., 1926, in Junk, Coleopterorum catalogus, vol. 1, p. 294.

This subspecies is closely allied to *C. californica californica*, differing only by having all the markings connected along the margin. It resembles *C. californica brevihamata* but is larger in size and the labrum is less acutely toothed. The latter subspecies has the disc of the elytra red, but this condition also exists in specimens of *C. californica praetextata* from Arizona and California.

TYPE LOCALITY: "San Diego trip."

RECORDED DISTRIBUTION: *United States*: Texas,^{2,3} Arizona,² New Mexico,² Utah,^{2,3} California.¹

NEW LOCALITIES: *Lower California*: Angeles Bay, Gulf of California, June 26, 1921 (E. P. Van Duzee).

KEY TO THE SUBSPECIES OF *Cicindela trifasciata* LE CONTE

1. Color brownish green.....*trifasciata trifasciata*
- Color greenish.....*trifasciata sigmoidea*

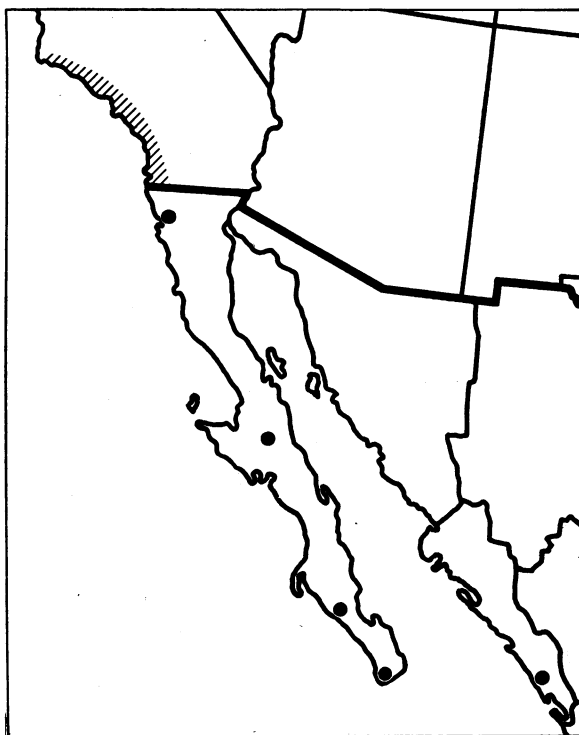


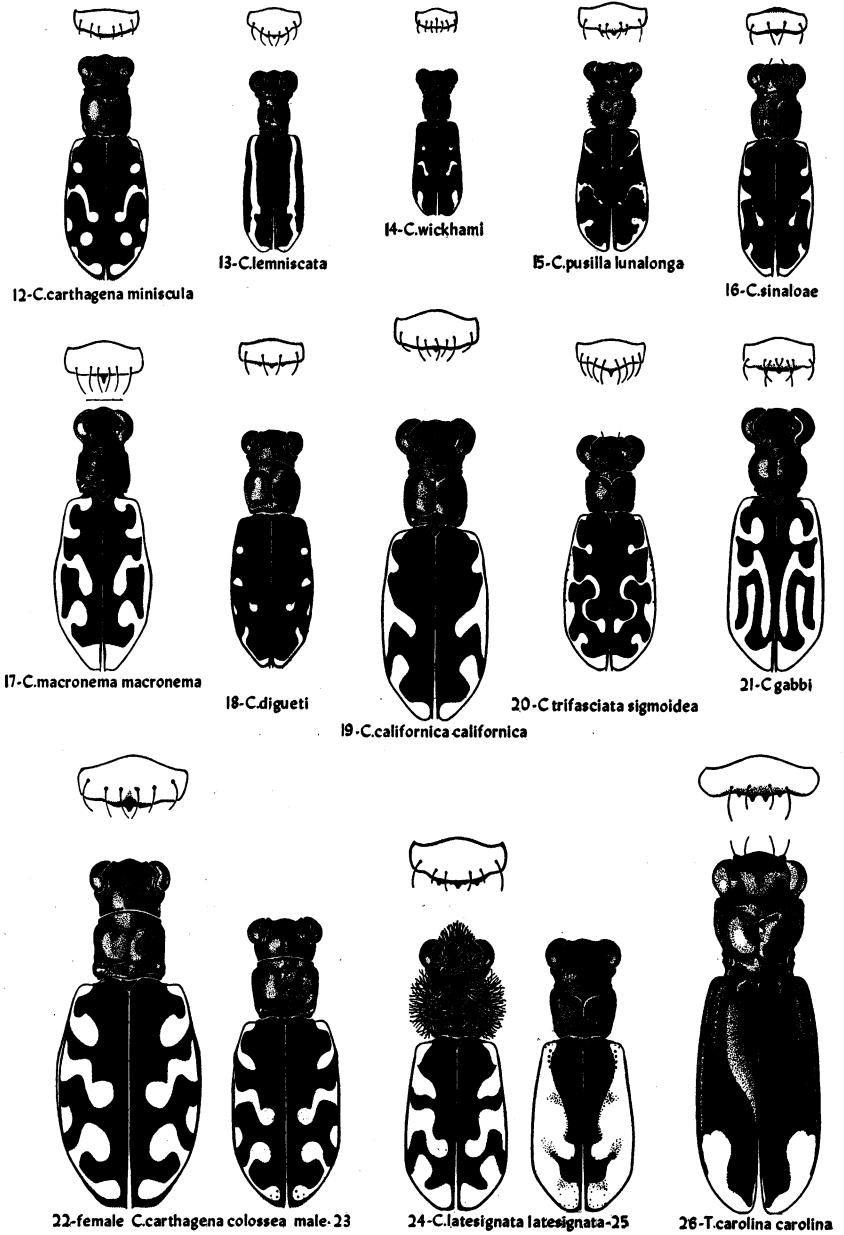
FIG. 11. Distribution of *Cicindela trifasciata sigmoidea* Le Conte.

Cicindela trifasciata sigmoidea Le Conte

Figure 20

Cicindela sigmoidea LE CONTE, 1851, Ann. Lyc. Nat. Hist., New York, vol. 5, p. 172. LE CONTE, 1860, Trans. Amer. Phil. Soc., new ser., vol. 11, p. 52. LE CONTE, 1861, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 335. HORN, G., 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 306.¹ HORN, W., 1897, Deutsche Ent. Zeitschr., p. 181. LENG, 1902, Trans. Amer. Ent. Soc., vol. 28, p. 160. HORN, W., 1908, Genera insectorum, fasc. 82A, p. 391. HORN, W., 1926, Ent. Blätter, vol. 22, p. 170.²

This Neotropical element is the westernmost extension of *C. trifasciata trifasciata* which occurs in numerous localities in Mexico, Central America, Revilla Gigedo Islands, and the West Indies and of *C. trifasciata ascendens* Le Conte which occurs in the southern states from North Carolina to Texas. It extends as far north in California as Naples. The lack of adequate distributional data precludes the formulation of any definite con-



FIGS. 12-26. Dorsal views of the species of tiger beetles of Lower California.

clusions as to the route traveled from Mexico to Lower California, but the Californian populations were undoubtedly derived from those of Lower California. However, in view of the patterns shown in *C. latesignata latesignata* and *C. gabbi* they probably migrated around the northern end of the Gulf of California.

TYPE LOCALITY: San Diego, California.

RECORDED DISTRIBUTION: *United States*: Arizona,¹ southern California.¹ *Lower California*¹: Cape San Lucas.²

NEW LOCALITIES: *Lower California*: Venancio, July 17, 1938 (Michelbacher and Ross); 45 miles north of San Ignacio, July 27, 1938 (Michelbacher and Ross); Ensenada, August 5, 1934 (Cazier).

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