



SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 99

Washington: 1949

No. 3237

THE SPECIES OF ICHNEUMON-FLIES OF THE GENUS  
CARDIOCHILES OCCURRING IN AMERICA NORTH OF  
MEXICO

By YING-TOU MAO

THE Cardiochilinae are a comparatively small subfamily of ichneumon-flies of the family Braconidae. *Cardiochiles* Nees is the only genus in North America. It is a distinct group, differing rather noticeably from other Braconidae in having the third abscissa of radius arched forward (pl. 4, figs. 4, 5). The species tend to fall into two well-defined groups, one with hairy eyes and the habitus of a microgasterine and the other with bare eyes and the habitus of a sawfly. Although apparently best represented in the southern part of the United States, *Cardiochiles* occurs as far north as southern Canada. Little is known concerning the host relationships of members of the genus. The hosts are probably always lepidopterous larvae, but few species have been reared. *C. nigriceps* Viereck is a conspicuous exception. It has been obtained abundantly from larvae of the tobacco bud-worm, *Heliothis virescens* (Fabricius).

This study was carried out under a fellowship granted by the Science, Education and Art Division, Department of State, Washington, D. C., U. S. A. The problem was suggested by C. F. W. Muesebeck, Division of Insect Identification, U. S. Bureau of Entomology and Plant Quarantine, to whom the author is very much indebted for his guidance during the course of the investigation. Thanks are due to Dr. H. K. Townes, Jr., R. A. Cushman, and A. B. Gahan of the same Division for their valuable suggestions and criticisms. The author is also indebted to Dr. E. A. Chapin, curator of insects, U. S. National Museum, for the use of facilities at the Museum, and to Miss

M. M. Carpenter for arranging interlibrary borrowings. In addition, thanks are due E. T. Cresson, Jr., of the Academy of Natural Sciences of Philadelphia, for the loan of the *Cardiochiles* collection of that institution for study and to Prof. H. B. Hungerford, of the University of Kansas, for the loan of the type of *Cardiochiles nigroclypeus* Viereck.

### Subfamily CARDIOCHILINAE Ashmead

Cardiochilinae ASHMEAD, in Smith, *Insects of New Jersey*, p. 592, 1900; Proc. U. S. Nat. Mus., vol. 23, p. 129, 1901.—SZÉPLIGETI, in Wytzman, *Genera insectorum*, fasc. 22, p. 142, 1904.

Frons impressed and with a more or less distinct median longitudinal carina; scape and pedicel polished, flagellum dull; cheek, temple, and occiput not margined; clypeus not impressed to form a rounded depression with the mandibles; mandibles crossing at tips. Mesonotum with notaulices meeting, usually in an acute angle; mesopleuron with a foveolate groove at its posterior margin; prepectus margined or not; forewing with three cubital cells, the second cell longer than wide; radial cell elongate, extending to near the apex of wing; third abscissa of radius curved or subangulate basally; subdiscoidal vein originating below middle of discoidal vein; nervulus postfurcal; stigma broad or lanceolate; hind wing with radiellian cell divided. Abdomen sessile, with the usual sutures; articulation between second and third tergites rigid.

### Genus CARDIOCHILES Nees

*Cardiochiles* NEES, Nov. Acta Acad. Nat. Caes. Leop. Carol., vol. 9, p. 307, 1818, no species; *Hymenopterorum ichneumonibus affinium monographiae* . . ., vol. 1, p. 224, 1834, one species. (Type, *Ichneumon saltator* Fabricius, first included species.)

*Toxoneuron* SAY, Journ. Boston Soc. Nat. Hist., vol. 1, p. 258, 1936. (Type, *Toxoneuron viator* Say, by designation of Viereck, 1914.)

*Tenthredoides* CRESSON, Proc. Ent. Soc. Philadelphia, vol. 4, p. 290, 1865. (Type, *T. seminiger* Cresson.) (Monobasic.)

*Ditherus* CAMERON, Journ. Bombay Nat. Hist. Soc., vol. 14, p. 434, 1902. (Type, *D. ruficollis* Cameron.) (Monobasic.)

*Schönlandella* CAMERON, Rec. Albany Mus., vol. 1, p. 169, 1904. (Type, *S. nigromaculata* Cameron, by designation of Viereck, 1914.)

*Ernestiella* CAMERON, Spolia Zeylanica, vol. 3, p. 81, 1905. (Type, *E. nigromaculata* Cameron.) (Monobasic.)

<sup>1</sup> *Hartemita* CAMERON, Wien. Ent. Zeit., vol. 29, p. 99, 1910. (Type, *H. latipes* Cameron.) (Monobasic.) (New synonymy.)

<sup>2</sup> *Psilommiscus* ENDERLEIN, Arch. Naturg., vol. 78, p. 98, 1912. (Type, *P. sumatranus* Enderlein.) (Monobasic.) (New synonymy.)

<sup>1</sup> This new generic synonymy is on the authority of C. F. W. Muesebeck who has seen the genotypes.

Eye hairy or bare; scape and pedicel shining and with longer pubescence than the flagellum; antennae multiarticulate, the number of segments not constant within species; scape rather stout, pedicel short and globular; face 1.0 to 3.0 times as wide as long and usually with a medial tubercle or short ridge above, or with a median longitudinal carina; occiput more or less concave, immargined; notaulices always distinctly impressed, usually foveolate, rarely smooth; prepectus immargined; mesopleuron with upper, lower, and posterior grooves (pl. 4, fig. 3), the first two foveolate or smooth, the posterior groove always foveolate; propodeum usually rugose and usually areolated; third abscissa of radius arched or subangulate basally; interanal vein represented by a short stump continued as a pigmented line, or by a pigmented line only, rarely absent; hind tibia sometimes simple but often somewhat compressed and broadened more or less toward apex, which may be expanded into a flaring process; hind basitarsus more or less flattened; tibial spurs long, hind tarsal claws usually pectinate or toothed; first abdominal suture curving slightly to the margin or extending obliquely forward to the margin (pl. 4, figs. 10, 11); second tergite usually shorter than, rarely as long as, the third; ovipositor sheath short or long but never longer than the abdomen.

CARDIOCHILES ABDOMINALIS (Cresson)

*Toxoneuron abdominale* CRESSON, Can. Ent., vol 5, p. 68, 1873 (male).

*Toxoneura abdominalis* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 51, 1894.

*Cardiochiles abdominalis* ASHMEAD, in Smith, Insects of New Jersey, p. 592, 1900.

*Female*.—Length 6.5 mm. Head and thorax black; inner orbit narrowly, outer broadly, and ventral incompletely, ferruginous, eye grayish black; clypeus pale ferruginous, its apical margin black; wings fuliginous; legs ferruginous, except coxae, trochanters basally, and femora basally, black and hind tarsi dusky; abdomen ferruginous; ovipositor sheath black. Antenna around 32-segmented; eye bare; ocelli elevated; vertex smooth, polished; frons polished with a slight depression below anterior ocellus followed by a weak, median, longitudinal elevation; face about 2.50 times as wide as long, punctate, convex, with a short median ridge above and below this slightly elevated; clypeus punctate, its median basal portion elevated, its apical margin slightly flaring, and not notched; temple bulging, wider than eye in dorsal view; malar furrow about 0.67 as long as the basal width of the mandible; galea tapering, slightly shorter than the long axis of the eye. Posterior portion of lateral face of pronotum rugose medially; median lobe of mesoscutum with a shallow longitudinal depression each side of the median line; notaulices moderately foveolate; upper groove of mesopleuron foveolate; lower groove weakly foveolate; pos-

terior groove coarsely rugose with a smooth depression at the middle anterior to the groove; metapleuron rugose, median lower part of anterior portion smooth; propodeum rugose, carinae of areola moderately distinct but costulae not well defined, spiracle ovate. First abscissa of radius longer and thicker than that of basal vein; third abscissa of cubitus longer than fourth; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by about 0.67 of its own length; first abscissa of submedius slightly shorter than second; interanal vein represented by a short pigmented stump. Fifth segment of fore tarsus longer than second; apex of hind tibia thickened and expanded outwardly into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus, second and fifth segments of middle tarsus about equal; inner spur of hind tibia about half as long as basitarsus, which is slightly longer than the next three tarsal segments combined, second and fifth tarsal segments about equal. First abdominal suture slightly curved to the margin; second tergite shorter than third medially; hypopygium about as long as the first three tergites combined, plow-share-shaped, ovipositor sheath sparsely pubescent, spatulate, polished, its exposed part about 0.67 as long as hypopygium (pl. 5, fig. 40).

*Type*.—In the Academy of Natural Sciences of Philadelphia.

In addition to the type the author has examined specimens from Dallas, Tex., September 22, 1905; Addis, La., October 26, 1912; Lafayette, La., November 6, 1938; Illinois; Washington, D. C., September 16, 1883; and Tifton, Ga.

#### CARDIOCHILES APICALIS (Cresson)

*Toxoneuron apicale* CRESSON, Can. Ent., vol. 5, pp. 66, 68, 1873.

*Toxoneura apicalis* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 51, 1894.

*Cardiochiles apicalis* ASHMEAD, in Smith, Insects of New Jersey, p. 592, 1900.

*Female*.—Length 4.20 mm. Black, eye blackish gray; pedicel dark ferruginous apically; middle part of mandible light ferruginous; wings with apical third fuliginous, the rest hyaline; apical two-thirds of fore femur, fore tibia, apical half of middle femur, and basal third of middle tibia, ferruginous; fore and middle tarsi, apical two-thirds of middle tibia, and spurs of fore and middle tibiae, blackish. Antenna 27-segmented; eye hairy, ocelli elevated; vertex smooth, polished; frons smooth, polished, and with a median longitudinal carina; face slightly less than 2.50 times as wide as long, its median line slightly elevated and with a short tubercle above; clypeus smooth, its apical median margin distinctly notched; temple wider than eye in dorsal view; galea short. Median portion of lateral face of pronotum wrinkled; median lobe of mesoscutum nearly smooth, flat, and without a distinct depression on each side of the median longitudinal line; notaulices narrow, finely foveolate; upper groove of mesopleuron foveolate,

lower groove weakly foveolate, posterior groove coarsely foveolate; metapleuron rugose, median ventral part of its anterior portion smooth; propodeum rugose, carinae moderately high, spiracle short ovate. First abscissae of radius and basal vein about equal; third abscissa of cubitus much shorter than fourth; nervulus postfurcal by about half of its length; first abscissa of submedius shorter than second; interanal vein represented by a lightly pigmented stump. Second and fifth segments of fore tarsus about equal; apex of hind tibia not thickened or expanded into a flaring process; inner spur of middle tibia about 0.75 as long as basitarsus, second tarsal segment slightly longer than fifth; inner spur of hind tibia about 0.67 as long as basitarsus, basitarsus about as long as the next three tarsal segments combined, second tarsal segment longer than fifth; hind tarsal claws pectinate. First tergite weakly sclerotized laterally; first abdominal suture extending obliquely forward to the margin; second tergite shorter than the third medially; hypopygium in profile plowshare-shaped, about as long as the first two tergites combined, its median ventral line folded; ovipositor sheath about as long as the first five abdominal tergites combined, pubescent, slightly broadened apically, and its tip bent ventrally (pl. 5, fig. 26).

*Male*.—Essentially similar to the female.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

In addition to the type the author has studied specimens from Atco, N. J., June 7, 1893; Plummers Island, Md., June 1914; Glen Echo, Md., summer, 1922; Glencarlyn, Va., June 9, 1912; Champaign, Ill.; Mount Pleasant, Iowa, May 26, 1934; Onaga, Kans.; and Chickamauga, Ga., July 10, 1898.

#### *CARDIOCHILES ARUGOSUS*, new species

*Female*.—Length about 5.5 mm. Head and thorax black; eye grayish black; wings light fuliginous on about apical half, subhyaline basally; legs ferruginous, coxae, fore and middle trochanters, hind trochanters basally, and fore and middle femora basally, black; hind tibia apically and apical four segments of fore and middle tarsi blackish; tibial spurs blackish, fore tibial spur ferruginous; hind tarsus black; abdomen ferruginous, first tergite black medially; ovipositor sheath black. Antenna about 38-segmented, eye bare; ocelli elevated; vertex smooth, polished; frons smooth, polished, and with a slight depression below the anterior ocellus followed by a median longitudinal elevation; face about 2.50 times as wide as long, polished, with a short median ridge above, its median line slightly elevated; clypeus smooth and polished, its apical margin not notched; temple slightly wider than eye in dorsal view; galea short. Posterior portion of lateral face of pronotum rugose medially; median lobe of mesoscutum

smooth, without a distinct longitudinal depression on each side of the median line; notaulices finely foveolate, meeting in a rather acute angle; upper groove of mesopleuron somewhat broadened, and striately partitioned, lower groove foveolate, posterior groove coarsely foveolate with a depression at the middle leading anteriorly to the lower groove; metapleuron rugose, median ventral part of anterior portion plain; propodeum rugose, carinae moderately distinct, spiracle long ovate; first abscissa of radius longer than that of basal vein; third abscissa of cubitus shorter than fourth; recurrent vein shorter than second abscissa of cubitus; nervulus postfurcal by about half of its own length; first abscissa of submedius slightly shorter than second; interanal vein represented by a pigmented stump. Second and fifth segments of fore tarsus about equal; apex of hind tibia not expanded outwardly into a flaring process; inner spur of middle tibia about 0.70 as long as basitarsus, second and fifth tarsal segments subequal; inner spur of hind tibia about 0.67 as long as basitarsus, basitarsus slightly shorter than the next three tarsal segments combined, second tarsal segment longer than fifth, third and fifth tarsal segments about equal; hind tarsal claws pectinate. First abdominal suture slightly curved to the margin; second tergite shorter than third; hypopygium small, slightly shorter than first tergite, in profile rounded posteriorly, its median ventral line without a longitudinal fold; ovipositor sheath short, pubescent, its exposed part about half as long as hypopygium (pl. 5, fig. 36).

*Male*.—Essentially similar to the female.

*Type*.—U.S.N.M. No. 58282.

*Type locality*.—Auburn, Ala. (June 6, 1897, C. F. Baker).

Described from numerous specimens of both sexes collected at localities in Alabama, Georgia, Louisiana, New Jersey, Maryland, Virginia, Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, South Dakota, Nebraska, Kansas, Texas, Utah, Oregon, and Ontario.

CARDIOCHILES ARUGOSUS var. PULLUS, new variety

This variety differs from typical *arugosus* only in having the wings uniformly fuliginous.

*Type*.—U.S.N.M. No. 58283.

*Type locality*.—Howell, Utah (June 7, 1930, G. F. Knowlton).

Described from eight females (one type) and four males. The paratypes are from Mount Hood, Oreg.; Riverton, N. J., June 13, 1901; Rusk County, Tex., June 18, 1940; Newell, S. Dak., June 28, 1923; Franklin County, Ohio, June 13, 1942; Onaga, Kans.; Opelousas, La., April 30, 1897; and Salt Lake City, Utah, May 3, 1928. Four paratypes are in the collection of the Academy of Natural Sciences of Philadelphia and two in the collection of Ohio State University.

*CARDIOCHILES BREVITARSIS*, new species

*Female*.—Length about 7 mm. Head black, narrow inner and broad outer orbits ferruginous; cheek ferruginous below. Thorax ferruginous, proepisternum, anterior margin of lateral face of pronotum, lower part of mesopleuron, and propodeum black, metanotum infuscated; foreleg ferruginous, coxa and trochanter black, and last tarsal segment fuscous; middle leg similar; hind leg ferruginous, coxa partly black and tarsus fuscous. Wings fuliginous, veins and stigma dark. Abdomen ferruginous. Pubescence of head chestnut-brown. Antenna (incomplete); eye bare and slightly bulging; ocelli elevated; vertex smooth and polished; frons smooth, polished, and with a median longitudinal elevation; face about 2.50 as wide as long, punctate, with a short median longitudinal ridge above; clypeus punctate, with longer pubescence than face, slightly elevated medially on basal half, apical margin, truncate, not notched; temple slightly narrower than eye in dorsal view; galea short. Median lobe of mesoscutum with a shallow longitudinal depression each side of median line; notaulices shallow and smooth; mesopleuron polished, upper and lower posterior grooves shallowly foveolate; metapleuron rugose, median lower part of anterior section smooth; propodeum rugose, carinae prominent; areola large, broader than spiracular area; spiracular area acute posteriorly, spiracle ovate. First abscissa of radius slightly longer than that of basal vein; third abscissa of cubitus shorter than fourth; recurrent vein slightly longer than second abscissa of cubitus; nervulus postfurcal by 0.67 its own length; first abscissa of submedius shorter than second; interanal vein represented by a short stump. Second and fifth segments of fore tarsus subequal; apex of hind tibia slightly thickened outwardly at apex but without a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus, second segment of middle tarsus shorter than fifth; inner spur of hind tibia more than half as long as the basitarsus, second and fifth tarsal segments about equal, basitarsus broad, flattened, and shorter than the last four tarsal segments combined; hind tarsal claws pectinate, each with four to five visible teeth basally. First abdominal suture slightly curved to the margin; second tergite about half as long as third medially; hypopygium very similar to that of *rubidus*, in profile obtuse, slightly shorter than hind basitarsus, its median ventral line without a longitudinal fold. Ovipositor sheath spatulate, slender (more slender than that of *rubidus*), small, pubescent, the exposed part about 0.67 as long as the hypopygium.

*Type*.—U.S.N.M. No. 58284.

*Type locality*.—Los Angeles, Calif. (Coquillett).

Described from the type, a female paratype from San Diego, Calif., August 25, 1927, and one specimen without abdomen from Los Angeles, Calif.

## CARDIOCHILES CALIFORNICUS (Ashmead), new combination

*Toxoneura californica* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 50, 1894 (female).

*Female*.—Length about 6.5 mm. Black, upper orbit dark ferruginous; eye grayish black; wings light fuliginous on apical 0.40, the rest hyaline; coxae and trochanters black; tarsi blackish; femora ferruginous, more or less black basally; tibiae including spurs ferruginous. Antenna 28-segmented; eye bare; ocelli elevated; vertex smooth and polished; frons smooth, polished, with the median portion below the anterior ocellus weakly rugulose; face slightly less than 2.50 times as wide as long, punctate, and with a short median ridge above; clypeus mostly smooth, its basal half slightly elevated, its apical margin truncate and slightly arched; temple wider than eye in dorsal view; galea about two-thirds as long as the long axis of eye. Median portion of lateral face of pronotum rugose; mesoscutum and scutellum evenly punctate; median lobe of mesoscutum with a shallow longitudinal depression along each side of the median line; notaulices distinct and finely foveolate; mesopleuron finely punctate, upper groove widened posteriorly and coarsely pitted, lower groove foveolate, posterior groove strongly foveate; metapleuron rugose on posterior section, the anterior portion smooth; propodeum rugose, areola defined by low carinae, other areas not clearly delimited, pleural carinae very strong. First abscissae of radius and basal vein about equal; third abscissa of cubitus shorter than the fourth; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by 0.67 its length; first and second abscissae of submedius about equal; interanal vein represented by a short pigmented stump. Second and fifth segments of fore tarsus about equal; apex of hind tibia thickened but not expanded into a strongly flaring process; inner spur of middle tibia about half as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about half as long as the basitarsus, which is about as long as the next three tarsal segments combined, second tarsal segment longer than the fifth; hind claws pectinate basally. Second tergite shorter than the third medially; hypopygium very prominent, plowshare-shaped, surpassing last tergite, about as long as the first five tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath bare, polished, bent downward at apex, its exposed part about 0.80 as long as hypopygium (pl. 5, fig. 20).

*Male*.—Essentially similar to the female; antenna 33-segmented.

*Type*.—U.S.N.M. No. 2171.

Known only from the three specimens comprising the type series and four specimens in the Academy of Natural Sciences of Philadelphia. All are from California.

*CARDIOCHILES DIGNUS*, new species

*Female*.—Length 7.5. Black except the following: Narrow inner and broad outer orbital markings, outer half of tegula, lateral margins of first and second tergites, and a spot in each basal lateral angle of third tergite ferruginous; eye grayish black: forewing with about apical 0.40 fuliginous, the remainder yellow; stigma, part of metacarpus, costa, first abscissa of radius, basal vein, part of first abscissa of cubitus, medius, and most of submedius ferruginous; hind wing yellow on basal half, infuscated on apical half, veins ferruginous, second abscissa of metacarpella, radiella, and cubitella dark; legs ferruginous, with all coxae and trochanters black, the apical segment of hind trochanter mostly ferruginous, hind tarsi blackish; ovipositor sheath black. Antenna incomplete, 32 segments remaining; eye bare; ocelli elevated; vertex and frons smooth and polished; face about 2.50 times as wide as long, punctate, and with a low median tubercle above, below which it is broadly, slightly elevated; clypeus rougher than face, slightly elevated on basal median half, its apical margin not notched but distinctly reflexed; temple narrower than eye in dorsal view; galea short. Median portion of the lateral face of pronotum rugose; mesonotum very minutely punctate; mesopleuron minutely punctate, upper and lower grooves foveolate, posterior groove weakly foveolate; metapleuron rugose, with the basal triangular portion mostly smooth; propodeum rugose, the areola sharply defined by prominent carinae but costulae weak and indistinct, spiracular area open posteriorly, spiracle long ovate. First abscissa of radius longer than that of basal vein; third abscissa of cubitus longer than fourth; recurrent vein and second abscissa of cubitus equal; nervulus postfurcal by about its length; first abscissa of submedius shorter than second; interanal vein represented by a short pigmented stump. Fifth and second segments of fore tarsus about equal; hind tibia flattened toward apex, but not expanded into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus; inner spur of hind tibia about 0.67 as long as basitarsus; middle and hind tarsi incomplete. First abdominal suture slightly curved to the margin; second tergite shorter than third; hypopygium short, in profile obtuse, its median ventral line without a longitudinal fold; ovipositor sheath short, pubescent, its exposed part about half as long as the hypopygium (pl. 5, fig. 29).

*Type*.—U.S.N.M. No. 58285.

*Type locality*.—Victoria, Tex.

Described from a single female specimen collected April 27, 1912, by J. D. Mitchell.

## CARDIOCHILES DILATUS, new species

*Female*.—Length 6 mm. Head and thorax black; orbits and middle part of clypeus ferruginous; middle of mandible dark red; wings fuliginous, darkest apically, stigma and costa more or less ferruginous, at least basally; coxae and trochanters black, femora ferruginous, tibiae ferruginous, apex of hind tibia blackish, fore tarsus blackish, basal half of fore basitarsus ferruginous, middle tarsus blackish, hind tarsus black; abdomen ferruginous, median portion of first tergite black; ovipositor sheath black. Pubescence of head short; antenna 32-segmented in type; eye bare; ocelli elevated; vertex smooth, polished; frons smooth, polished, with a transverse pit below anterior ocellus; clypeus slightly elevated along basal margin, its apical margin truncate, slightly arched, and not notched; temple slightly wider than eye in dorsal view; malar furrow about half as long as basal width of mandible; galea much shorter than long axis of eye. Posterior portion of lateral face of pronotum weakly rugose; median lobe of mesoscutum with a shallow longitudinal depression each side of the median line; notaulices narrow, finely foveolate; upper groove of mesopleuron foveolate, its lower groove weakly foveolate, metapleuron rugose, except lower part of anterior portion which is smooth; propodeum finely rugose, its carinae, except pleural carinae, low and very indistinct. First abscissae of radius and basal vein about equal; third and fourth abscissae of cubitus about equal; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by 0.80 its own length; first and second abscissae of submedius about equal; interanal vein represented by a short stub continued as a pigmented line. Second and fifth segments of fore tarsus about equal; apex of hind tibia thickened on outer margin and expanded into a flaring process; inner spur of middle tibia slightly less than 0.67 as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about half as long as basitarsus, basitarsus about as long as the next three segments combined, second tarsal segment longer than the fifth; hind claws pectinate basally. Second tergite shorter than the third medially; hypopygium large but not surpassing last tergite, about as long as first three tergites combined; ovipositor sheath thinly pubescent, about as long as the hypopygium (pl. 5, fig. 22).

*Male*.—Essentially similar to the female except that the abdomen is more extensively marked with black and the femora are more or less blackish basally.

*Type*.—U.S.N.M. No. 58286.

*Type locality*.—Yermo, Calif. (April 28, 1937, M. Cazier).

Described from the type, four males, Roseville, Calif., swept from grass, April 10, 1931, C. C. Wilson, and one male and one female from Los Angeles, Calif.

*CARDIOCHILES EXPLORATOR* (Say)

*Bracon (Toxoneuron) explorator* SAY, Boston Journ. Nat. Hist., vol. 1, pt. 3, p. 259, 1836 (female, male); in LeConte, Complete writings of Thomas Say on the entomology of North America, vol. 2, p. 710, 1859.

*Toxoneuron explorator* CRESSON, Can. Ent., vol. 5, p. 67, 1873.

*Toxoneura explorator* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 50, 1894.

*Cardiochiles explorator* VIERECK, Trans. Kans. Acad. Sci., vol. 19, p. 288, 1905.

*Female*.—Length about 4.0 mm. Black; middle part of mandible brownish yellow; wings light to dark fuliginous; femora ferruginous, fore and middle femora black basally; tibiae and spurs ferruginous, middle and hind tibiae dark apically; fore and middle tarsi dusky, hind tarsus black; ovipositor sheath black. Antenna 30-segmented; first flagellar segment longer than second, the second and third about equal; eye hairy; ocelli elevated; vertex smooth, polished; frons smooth, polished, face about twice as wide as long, smooth, polished; clypeus polished, its apical margin distinctly notched; temple slightly wider than eye in dorsal view; galea short. Lateral face of pronotum smooth and shining; mesoscutum smooth and shining; notaulices narrow, very finely foveolate, meeting in an acute angle and extending nearly to the transverse fossa; mesopleuron smooth and polished, upper groove broad and finely foveolate, lower groove usually smooth, posterior groove rather coarsely foveolate, metapleuron rugose on posterior section, smooth and shining on triangular anterior section; propodeum rugose, the carinae rather prominent and the areas usually well defined, spiracle ovate. First abscissae of radius and basal vein subequal; third abscissa of cubitus about half as long as fourth; recurrent vein slightly longer than second abscissa of cubitus; nervulus postfurcal by a little more than half its length; first abscissa of submedius slightly shorter than second; interanal vein represented as a pigmented line. Apex of hind tibia not thickened into a flaring process; inner spur of middle tibia about 0.80 as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about 0.67 as long as basitarsus, basitarsus slightly shorter than the next three tarsal segments combined, second tarsal segment longer than fifth, third and fifth segments about equal; hind claws pectinate. Second tergite shorter than third; hypopygium not surpassing last tergite; ovipositor sheath about as long as first three tergites combined, narrow basally, broadened apically, its tip slightly bent downward (pl. 5, fig. 15).

*Male*.—Essentially similar to the female.

*Type*.—Lost.

The material studied includes specimens from Indiana, Illinois, Kansas, Missouri, Colorado, Ohio, Texas, New Mexico, and Arizona. One specimen is labeled as having been reared from the garden web-

worm, *Loxostege similalis* (Guenee). Published records citing *Gnori-moschema operculella* (Zeller) as host presumably apply to the closely similar new species, *insculptus*.

**CARDIOCHILES FLORIDANUS** (Ashmead), new combination

*Toxoneura floridana* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 50, 1894 (male).

*Toxoneuron floridanum* PATTON, Psyche, vol. 7, p. 179, 1894.

*Female*.—Length about 6 mm. Black; middle part of mandible ferruginous; wings fuliginous, veins dark; coxae and trochanters black; femora ferruginous, fore and middle femora black basally; fore and middle tibiae ferruginous, apex of the latter black, hind tibia black, its basal 0.67 dark ferruginous ventrally; fore tibial spur ferruginous, spurs of middle and hind tibiae black; tarsi black, the four basal segments of fore tarsus dark ferruginous. Antenna of type incomplete; eye conspicuously hairy; ocelli elevated; vertex smooth, polished; frons smooth, polished, with a weak median longitudinal carina; face slightly less than twice as wide as long, smooth; clypeus flat, smooth, its apical margin notched medially, clypeal furrow weak; temple slightly wider than the eye in dorsal view; galea short. Median portion of lateral face of pronotum rugose; mesonotum smooth; notaulices narrow, sharp, finely foveolate; mesopleuron polished, upper groove widened and partitioned, lower groove foveolate, posterior groove coarsely foveate, with a smooth shallow groove at the middle leading anteriorly to the lower groove; metapleuron rugose, its anterior portion mostly smooth and polished; propodeum rugose, carinae distinct and high, spiracular area long, spiracle long ovate. First abscissa of radius slightly longer than that of basal vein; third abscissa of cubitus much shorter than fourth; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by slightly more than half its length; first abscissa of submedius shorter than second; interanal vein represented by a pigmented line. Second and fifth segments of fore tarsus about equal; hind tibia not expanded into a flaring process; inner spur of middle tarsus about as long as basitarsus; inner spur of hind tarsus about 0.67 as long as basitarsus; basitarsus of hind leg about equal to the next three tarsal segments combined, third tarsal segment longer than fifth. Second tergite shorter than third medially; hypopygium plowshare-shaped, not or barely surpassing last tergite. Ovipositor sheath pubescent, broadened apically, and about as long as first three abdominal tergites combined (pl. 5, fig. 30).

*Male*.—Essentially similar to the female but with middle and hind tibiae almost entirely black.

*Type*.—U.S.N.M. No. 50155.

Specimens examined, in addition to the type, which is from Jacksonville, Fla., include a male reared at Manhattan, Kans., May, 1940.

from *Epipaschia zelleri* Grote; an unlabeled female; a female from Albany, Ga., April 20, 1938, P. W. Fattig; a male from Ontario, Canada, June, R. C. Osburn; and a male from Guadalajara, Mexico, August 2, 1913.

*CARDIOCHILES INSCULPTUS*, new species

*Female*.—Length about 3 mm. Black; middle part of mandible dark red; foreleg yellowish brown, coxa, trochanter, and basal half of femur black, last three tarsal segments blackish; middle leg yellowish brown, coxa, trochanter and basal part of femur black, apical half of basitarsus and all of the following tarsal segments blackish; hind leg yellowish brown, coxa and trochanter black, apex of tibia and tarsus blackish. Antennae of specimens in type series incomplete; first flagellar segment and scape about equal; eye closely hairy; ocelli elevated; vertex smooth, polished; frons smooth, polished, and with a weak median longitudinal carina; face about twice as wide as long, smooth, polished, with a short median ridge above; clypeus smooth, polished, and with apical margin notched medially; temple slightly broader than the eye; galea short. Lateral face of pronotum striate medially on its anterior half; notaulices finely foveolate, meeting in a rather broad angle; mesopleuron smooth, polished, upper groove foveolate, lower groove completely, finely foveolate, posterior groove foveolate, with a smooth groove from the middle leading to the lower groove; metapleuron rugose on posterior section, smooth and polished on anterior section; propodeum rugose, areola and spiracular areas delimited, costulae obsolete. First abscissa of radius longer and thicker than that of basal vein; fourth abscissa of cubitus 1.50 times as long as third; recurrent vein slightly shorter than second abscissa of cubitus; nervulus postfurcal by about half its own length; interanal vein represented by a pigmented line. Hind tibia not thickened apically and without a flaring process; inner spur of middle tibia about 0.75 as long as basitarsus, second and fifth tarsal segments equal; inner spur of hind tibia about 0.67 as long as basitarsus, basitarsus shorter than the next three tarsal segments combined, second tarsal segment longer than the fifth, third and fifth segments about equal; hind tarsal claws pectinate. First abdominal suture extending obliquely forward to the margin; second tergite slightly shorter than third; hypopygium not extending as far as apex of last tergite, about as long as the first three tergites combined, in profile pointed, its median ventral line folded longitudinally. Ovipositor sheath spatulate, pubescent, about as long as the hypopygium (pl. 5, fig. 23).

*Male*.—Essentially similar to the female.

*Type*.—U.S.N.M. No. 58287.

*Type locality*.—Beaufort, N. C.

Described from two females and one male from the type locality labeled "with potato tuberworm, June 25, 1942, C. F. Stahl, TCA 817."

## CARDIOCHILES LEVIS, new species

*Female*.—Length about 5 mm. Ferruginous except as follows: Antenna, eye, vertex, frons medially, face above, basal margin of clypeus, clypeal foveae, lower part of temple, proepisternum, lower part of mesopleuron, pectus, lateral margin of first abdominal tergite, part of second tergite, tip of abdomen, and ovipositor sheath black; wings fuliginous; coxae and trochanters black; fore and middle femora black basally; tibiae black apically; fore and middle tarsi blackish; hind tibiae black. Pubescence of head short, yellowish brown; antenna 27-segmented in type; eye bare; ocelli elevated; vertex smooth, polished; frons smooth, polished, impressed, with a low tubercle below anterior ocellus; face about three times as wide as long, smooth, polished, and without a short median ridge above; clypeus polished, its median basal portion slightly elevated, and its apical margin weakly notched medially; temple bulging, wider than eye in dorsal view; galea short. Lateral face of pronotum smooth; mesoscutum smooth and polished; notaulices fine, not foveolate; mesosulcus weak, not foveolate; mesopleuron smooth, polished, its upper and lower grooves smooth, not foveolate, posterior groove finely foveolate, with a smooth groove at the middle leading toward the lower groove; metapleuron smooth and shining; propodeum mostly smooth except for carinae defining the areas, spiracle short ovate. First abscissae of radius and basal vein long and about equal; fourth abscissa of cubitus about twice as long as third; second abscissa of cubitus slightly longer than recurrent vein; nervulus postfurcal by about half of its length; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued as a pigmented line. Fifth segment of fore tarsus longer than second; apex of hind tibia not expanded into a flaring process; inner spur of middle tibia about 0.67 as long as the basitarsus, second tarsal segment shorter than fifth; inner spur of hind tibia about 0.67 as long as basitarsus, basitarsus shorter than the last four tarsal segments combined, second and fifth tarsal segments about equal; hind tarsal claws pectinate basally. First abdominal suture extending obliquely forward to the margin; second and third tergites about equal medially; hypopygium very large, about as long as the first five tergites combined but not surpassing last tergite; ovipositor sheath pubescent, broad at base, narrowing apically, slightly curved downward, the exposed part little shorter than the hypopygium (pl. 5, fig. 31).

*Male*.—Essentially similar to the female except that head is mostly black, and black markings on thorax, abdomen, and legs are more extensive.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

*Type locality*.—Pecos, N. Mex. (June 23).

Described from two females and a male. The allotype and paratype are in the U. S. National Museum; the female is from Juárez, Mexico, and the male from Albuquerque, N. Mex., both collected by T. D. A. Cockerell.

CARDIOCHILES MAGNUS, new species

*Female*.—Length about 8 mm. Head and thorax black with the following parts ferruginous: Narrow inner and broad outer orbits; median basal part of clypeus; mesoscutum and scutellum; upper portion of mesopleuron. Middle portion of lateral face of pronotum dark reddish. Wings fuliginous; costa and stigma dark. Coxae and trochanters black; femora ferruginous, black basally; tibiae ferruginous, hind tibia black at apex; tibial spurs testaceous. Abdomen ferruginous, its tip and hypopygium except base, black. Head elliptical in front view; antenna around 33-segmented; eye bare; ocelli elevated; vertex smooth, polished; frons smooth, polished; face about 2.50 as wide as long, punctate, and with a short median longitudinal ridge above, below which it is broadly a little elevated; clypeus punctate, its median basal portion slightly elevated, its apical margin truncate, not notched; temple bulging, wider than eye in dorsal view; malar furrow about 0.67 as long as basal width of mandible; galea much shorter than long axis of eye. Median portion of lateral face of pronotum rugose; mesoscutum and scutellum smooth and shining; median lobe of mesoscutum with a shallow longitudinal depression on each side of median line; notaulices foveolate; mesopleuron minutely punctate, upper groove foveolate, lower groove coarsely foveate; anterior triangular portion of metapleuron smooth, posterior portion rugulose; propodeum rugose, the carinae prominent, spiracle long ovate. First abscissa of radius longer than that of basal vein; third and fourth abscissae of cubitus about equal; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by somewhat less than its length; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued as a pigmented line. Second and fifth segments of fore tarsus about equal; inner spur of middle tibia about half as long as basitarsus, second and fifth tarsal segments about equal; apex of hind tibia thickened on outer margin and expanded into a flaring process, inner tibial spur less than half as long as basitarsus, basitarsus shorter than remaining tarsal segments combined, second segment longer than fifth; hind tarsal claws pectinate, each with four or five short teeth on basal half. First abdominal suture slightly curved to the margin; second tergite shorter than third, hypopygium plowshare-shaped, very large, surpassing apex of last tergite, about as long as the first five tergites combined; ovipositor sheath longer than hind tibia, broadest at the

middle, smooth, polished, and sparsely pubescent on apical half (pl. 5, fig. 14).

*Male*.—Essentially similar to the female.

*Type*.—U.S.N.M. No. 58289.

*Type locality*.—Plainview, Jefferson County, Colo. (July 1922).

Described from the type and the following eight female and three male paratypes: Male, Platte County, Colo., August 7; female, Plainview, Jefferson County, Colo., July 1922; male and two females, Mexia, Tex., September 13, 1905, parasite of *Schinia* sp. (Phalaenidae); male, Clarendon, Tex., September 19, 1905; female, Garden City, Kans., September 1896, W. H. Menke; male, Wellington, Kans., E. G. Kelly; female, Albuquerque, N. Mex.; and two female paratypes of *Cardiochiles seminigrum* (Cresson) from Colorado. The two last paratypes are in the Academy of Natural Sciences of Philadelphia; the others are in the U. S. National Museum.

**CARDIOCHILES MINUTUS (Cresson), new combination**

*Toxoneuron minutum* CRESSON, Can. Ent., vol. 5, p. 67, 1873 (female).

*Toxoneura minuta* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, p. 49, No. 2, 1894 (female).

*Female*.—Length 2.50 mm.. Black, apical part of pedicel dark ferruginous; wings fuliginous; foreleg black, femur apically, tibia, and first four tarsal segments yellowish white; middle leg black, femur apically and first four tarsal segments yellowish white, tibia blackish; hind leg black, tibia and tarsus blackish, tibial spur yellowish white; lateral part of first tergite and anteroventral corner of second tergite chestnut brown. Antenna 23-segmented, pedicel about 0.40 as long as the first flagellar segment; eye hairy; ocelli elevated; vertex striate. frons impressed, transversely striate, and with a median longitudinal carina; face about twice as wide as long, irregularly punctate, and with an indistinct tubercle above; clypeus somewhat wrinkled, its apical margin distinctly notched; temple slightly wider than the eye in dorsal view; occiput roughened; galea short. Median portion of lateral face of pronotum and the mesonotum irregularly punctate; notaulices sharply impressed, finely foveolate; upper groove of mesopleuron widened and rugose, lower groove foveolate, posterior groove coarsely foveate with a smooth depression at the middle leading to the lower groove; metapleuron rugose, the small anterior portion smooth and polished; propodeum rugose, carinae moderately prominent and the areas distinctly delimited, spiracle short ovate. Wings iridescent; first abscissa of radius and basal vein about equal; fourth abscissa of cubitus about 1.50–2.0 times as long as the third; recurrent vein and the second abscissa of cubitus about equal; nervulus postfurcal by half its own length; first abscissa of submedius slightly longer than the

second; interanal vein absent or represented by a pigmented line. Second and fifth segments of fore tarsus about equal, apex of hind tibia not thickened or expanded into a flaring process; inner spur of middle tibia about as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about half as long as basitarsus, basitarsus shorter than remaining tarsal segments combined, second tarsal segment longer than fifth. First abdominal suture extending obliquely forward to the margin; second tergite shorter than third; hypopygium pointed in profile, and about as long as first two abdominal tergites combined; its median ventral line without a longitudinal fold; ovipositor sheath pubescent, its exposed part slightly less than the first three tergites combined (pl. 5, fig. 27).

Described from the type.

*Male*.—Essentially similar to the female.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

In addition to the type, which is from Illinois, about 25 specimens have been examined. These are from localities in Virginia, Iowa, Tennessee, and Ontario, Canada.

**CARDIOCHILES NEBRASCENSIS, new species**

*Female*.—Length, about 6 mm. Head and thorax black, narrow inner and broad outer orbital markings and basal median part of clypeus yellowish brown; pedicel apically, middle part of mandibles and lateral face of pronotum medially, deep ferruginous; mesoscutum with a small yellowish brown spot inside each posterolateral corner. Wings fuliginous, stigma and costa blackish, the costa light brown basally; legs ferruginous, with fore and middle coxae and trochanters black, the last two tarsal segments of fore and middle legs fuscous; hind coxa with a small black spot on outer side, hind tibia infuscated at extreme apex and hind tarsus black. Abdomen entirely ferruginous; ovipositor sheath black, ferruginous basoventrally. Antenna incomplete; eye bare; ocelli elevated; vertex smooth, polished; frons smooth, polished, and with a median longitudinal carina; face about 2.50 times as wide as long, punctate, and with a median tubercle above, below which a groove extends to the clypeus between two slightly raised areas; clypeus with a median elevation basally, its apical margin not notched; temple wider than the eye in dorsal view; galea at least 0.80 as long as the long axis of the eye, rounded apically. Median lobe of mesoscutum depressed medially; notaulices foveolate, coarsely so posteriorly; mesopleuron finely punctate, upper groove of mesopleuron widened and partitioned, lower groove foveolate, posterior groove coarsely foveate; metapleuron rugose, the small anterior triangular section smooth, with only minute, scattered punctures; propodeum rugose, areola and spiracular areas defined by prominent

carinae, costulae weak or indistinct, spiracle long ovate. Forewings incomplete, third abscissa of cubitus longer than the fourth; nervulus postfurcal by about half its own length; interanal vein represented by a short stump continued as a pigmented line. Fifth segment of fore tarsus longer than second; apex of hind tibia thickened on outer dorsal margin and expanded into a strongly flaring process; inner spur of middle tibia about 0.60 as long as basitarsus, second tarsal segment shorter than fifth; inner spur of hind tibia about half as long as basitarsus, basitarsus shorter than the last four tarsal segments combined, second tarsal segment longer than fifth. First abdominal suture slightly curved to the margin. Second tergite very slightly shorter than third medially; hypopygium a little longer than the first two tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath smooth, polished, spatulate, its exposed part slightly shorter than the hypopygium (pl. 5, fig. 17).

*Type*.—U.S.N.M. No. 58290.

*Type locality*.—Nebraska.

Described from a single female specimen collected by T. Pergande.

**CARDIOCHILES NIGRICANS, new species**

*Male*.—Length 5.5 mm. Intensely black, foretibial spur brownish yellow; forewing with apical 0.40 fuliginous, the rest hyaline, and hind wing with about apical third fuliginous. Head covered with thick, unusually black hair; antenna 48-segmented; eye bare; ocelli elevated; vertex smooth and polished; frons impressed, and with a weak median longitudinal elevation; face polished, flat, more than three times as wide as long, with a low median tubercle above; clypeus polished, about 2.50 times as wide as long, the median apical margin not notched; temple and eye subequal in width in dorsal view; galea short. Median portion of lateral face of pronotum rugose; median lobe of mesoscutum with a shallow depression on each side of median line; notaulices sharp, finely foveolate; mesopleuron polished, with scattered, minute punctures; upper groove foveolate; lower groove weakly foveolate, posterior groove finely foveolate; metapleuron rugose, a flat, polished area on its anterior portion; propodeum rugose, carinae, including costulae, prominent, areola smaller than spiracular area, spiracle ovate. First abscissa of radius longer than that of basal vein; third abscissa of cubitus slightly shorter than fourth; second abscissa of cubitus longer than recurrent vein; nervulus postfurcal by 0.67 its own length; first abscissa of submedius slightly shorter than second; interanal vein represented by a short pigmented stump. Fore femur fringed with long pubescence ventrally, fifth segment of fore tarsus longer than second; hind tibia somewhat compressed and broadened toward apex, but without an apical thickening, and not expanded

into a flaring process; inner spur of middle tibia about 0.75 as long as its basitarsus, second tarsal segment slightly shorter than fifth; inner spur of hind tibia about 0.67 as long as its basitarsus, basitarsus about as long as the next three tarsal segments combined, second tarsal segment slightly shorter than fifth; hind tarsal claws pectinate, each with five short, visible teeth basally. First abdominal suture slightly curved to the margin; second tergite much shorter than third medially.

*Type*.—U.S.N.M. No. 58291.

*Type locality*.—Jacumba, Calif.

Described from a single male collected by D. J. and J. N. Knull, May 18, 1941.

#### CARDIOCHILES NIGRICEPS Viereck

*Cardiochiles nigriceps* VIERECK, Proc. U. S. Nat. Mus., vol. 43, p. 578, 1912 (female, male).—CHAMBERLIN and TENHET, Jour. Agr. Res., vol. 33, p. 21, 1926.

*Toxoneuron* sp. MORGAN and McDONOUGH, U. S. Dept. Agr. Farmers' Bull. 819, p. 6, 1917.

When he described this species Viereck suggested that it might prove to be only a race of *viator* or *seminiger*. It is quite distinct from *viator*, differing in the much shorter galea and labium, in the dark costa and stigma, and in not having apex of hind tibia expanded into a strongly flaring process. Essentially it is very similar to *seminiger* (Cresson) and perhaps is only subspecifically distinct, but for the present at least it seems advisable to give it specific rank. It may be separated from *seminiger* by the following color differences: Pronotum black, median part of lateral face sometimes red or yellowish brown; anterior part of mesoscutum, or at least anterior part of median lobe, black; fore and middle femora largely black or piceous. The middle lobe of the mesoscutum slopes more gradually to the pronotum than in *seminiger* (pl. 4, figs. 6, 7), and the first intercubitus is angulate and often appendiculate below the middle.

*Type*.—U.S.N.M. No. 15007.

In addition to the type series from Georgia and Florida, the author has examined specimens from South Carolina, Georgia, Florida, Virginia, District of Columbia, Alabama, Mississippi, Louisiana, Arkansas, and Colorado. The species is commonly reared as a parasite of the tobacco budworm, *Heliothis virescens* (Fabricius).

#### CARDIOCHILES NIGROCLYPEUS Viereck

*Cardiochiles nigroclypeus* VIERECK, Trans. Kans. Acad. Sci., vol. 19, p. 275, 1905 (male).

*Male*.—Length 6.5 mm. Head and thorax black. Wings entirely dark fuliginous; legs ferruginous, coxae, trochanters, fore and middle femora basally, apex of hind tibia, and tarsi black, tibial spurs dark, except spur of foreleg which is ferruginous; abdomen ferruginous;

external genitalia black. Pubescence chestnut brown. Antenna 45-segmented, eye bare, ocelli elevated, vertex smooth, polished; frons transversely striate, and with a median longitudinal elevation; face slightly less than three times as wide as long, smooth, polished, slightly convex, and with a minute, median tubercle above, clypeus smooth, polished, its median apical margin slightly flaring, not notched; temple and eye of about equal width; occiput aciculate; galea short. Median portion of lateral face of pronotum rugose; median lobe of mesoscutum without a distinct longitudinal depression on each side of median line; notaulices finely foveolate; scutellum sculptured apically; mesopleuron strongly punctate or ruguloso-punctate, upper groove wide and coarsely rugulose; lower groove foveolate, posterior groove finely foveolate; metapleuron rugose, with a triangular, smooth and shining area on anterior portion; propodeum rugose, its carinae including costulae moderately high, areola smaller than the spiracular area, spiracle ovate. First abscissa of radius longer than that of basal vein; third abscissa of cubitus shorter than fourth; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by half of its own length; first abscissa of submedius slightly longer than second; interanal vein represented by a pigmented line, second and fifth segments of fore tarsus about equal; hind tibia without apical thickening or a flaring process; inner spur of middle tibia about 0.60 as long as the basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about 0.60 as long as basitarsus, basitarsus slightly shorter than the last three tarsal segments combined, second and third tarsal segments longer than fifth; hind tarsal claws pectinate, each with seven short teeth basally. First abdominal suture slightly curved to the margin; second abdominal tergite shorter than the third.

*Type*.—In the University of Kansas.

In addition to the male type, from Morton County, Kans., the writer has seen three male specimens simply labeled "Texas."

**CARDIOCHILES ORIZABAE (Cresson), new combination**

*Toxon neuron orizabae* CRESSON, Can. Ent., vol. 5, pp. 66, 67, 1873 (male).

*Male*.—Length 4.2 mm. Black; legs black, with foreleg more or less yellowish brown beyond base of femur, and knee of middle leg yellowish brown; wings light fuliginous. Antenna 30-segmented; eye hairy; ocelli slightly elevated; vertex about as long as the frons, smooth, shining; frons smooth, shining, and with an incomplete, low, median longitudinal carina; face less than one and one-half times as wide as long, smooth, shining, with a small median tubercle above; clypeus smooth, shining, its apical margin notched medially; temple

and eye of about equal width in dorsal view; galea short. Lateral face of pronotum wrinkled medially on anterior half; mesonotum smooth and polished; notaulices fine, indistinctly foveolate; mesopleuron smooth and shining, upper groove broad, rugulose, irregularly partitioned, lower groove weakly foveolate, posterior groove strongly foveate with a delicate curved groove from its middle leading to the lower groove; metapleuron rugose, a large, smooth and polished area anteriorly; propodeum rugose, its carinae, including costulae, prominent, spiracle ovate. First abscissa of radius longer and thicker than that of basal vein; fourth abscissa of cubitus about 1.50 times as long as the third; second abscissa of cubitus and recurrent vein about equal; interanal vein represented by a pigmented line. Second and fifth segments of fore tarsus about equal; inner tibial spur of middle leg very nearly as long as basitarsus, second tarsal segment longer than fifth, third and fifth segments about equal; apex of hind tibia not broadened, inner tibial spur about two-thirds as long as the basitarsus, basitarsus about as long as the next three tarsal segments combined, second tarsal segment longer than third, third longer than fifth; hind tarsal claws pectinate basally. First abdominal suture extending obliquely forward laterally; third tergite slightly over 1.50 times as long as second. (Redescribed from the male type.)

*Female*.—Essentially similar to the male. Hypopygium about as long as hind basitarsus, plowshare-shaped, not surpassing apex of last tergite; ovipositor sheath about as long as the first three segments of hind tarsus combined and pubescent (pl. 5, fig. 34).

*Type*.—In the Academy of Natural Sciences of Philadelphia.

In addition to the type from Orizaba, Mexico, numerous specimens, collected at localities in Georgia, Alabama, Florida, Arkansas, Kansas, Louisiana, Texas, and Mexico have been studied.

#### *CARDIOCHILES PLUTO* (Ashmead), new combination

*Toxoneura pluto* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, No. 1, pp. 48, 49, 1894 (female).

*Male*.—Length about 7 mm. Black; apical end of pedicel, outer orbit, basal part of clypeus, middle part of mandible weakly suffused with red; wings fuliginous; genitalia black. Head with long black hair that is shorter, however, than in *nigricans*; antennae incomplete; eye bare; ocelli elevated; vertex smooth, polished; frons smooth and polished; face about 2.50 times as wide as long, smooth, polished, and with a short median ridge above; clypeus smooth, polished, its apical margin slightly flaring medially, not notched; temple wider than eye in dorsal view; galea short. Posterior portion, except broad margins, of lateral face of pronotum rugose; mesoscutum without a longitudinal depression along each side of the median line; notaulices narrow, finely

foveolate; mesopleuron polished, its upper groove widened, and coarsely partitioned, lower groove finely foveolate, posterior groove coarsely foveate; metapleuron rugose, anterior triangular portion mostly smooth; propodeum rugose, carinae rather prominent, the areas well defined, costulae distinct, spiracle ovate. First abscissa of radius longer than that of basal vein; third and fourth abscissae of cubitus about equal; recurrent vein slightly longer than the second abscissa of cubitus; nervulus postfurcal by half its length; first and second abscissae of submedius about equal; interanal vein represented by a short stump continued by a pigmented line. Forefemur fringed with long pubescence ventrally; hind tibia broadened at apex but not expanded into a flaring process; inner spur of middle tibia a little more than half as long as the basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia slightly more than half as long as basitarsus, basitarsus about as long as the next three tarsal segments combined, second tarsal segment longer than fifth; hind tarsal claws pectinate. First abdominal suture slightly curved to the margin; second tergite shorter than third medially.

*Type*.—U.S.N.M. No. 2170.

Redescribed from the type, from Los Angeles, Calif., and a paratype male, San Bernardino County, Calif., the only known specimens.

CARDIOCHILES RUBICUNDUS, new species

*Female*.—Length 5.5 mm. Ferruginous; antenna, eye, tips of mandibles and ocellar area black; wings fuliginous, costa and stigma ferruginous; antennae black, anterior surface and basal part of posterior surface of scape ferruginous; ovipositor sheath dark ferruginous. Pubescence of head very short, golden; antenna 33-segmented; eye bare; ocelli elevated; vertex smooth and polished; frons smooth, polished, impressed, slightly elevated down the middle; face about 2.25 times as wide as long, convex, punctate, with a median longitudinal ridge above, below which it is a little elevated; clypeus punctate, slightly elevated along basal margin, apical margin truncate, a little flaring, not notched; temple wider than the eye in dorsal view; malar furrow about 0.67 as long as basal width of mandible; galea moderate, but considerably shorter than long axis of eye. Lateral face of pronotum smooth and shining except in the median longitudinal groove, median lobe of mesoscutum with an indistinct median longitudinal elevation; notaulices foveolate; mesopleuron polished, its upper groove coarsely foveolate, its lower groove straight, foveolate, posterior groove foveate; metapleuron mostly smooth; propodeum rugose, carinae moderately high, costulae distinct, spiracle long ovate. First abscissa of radius longer than that of basal vein; third abscissa of cubitus slightly longer than fourth; recurrent vein longer than second

abscissa of cubitus; nervulus postfurcal by 0.67 its length; first abscissa of submedius slightly shorter than second; interanal vein represented by a short stump continued by a pigmented line. Fifth segment of fore tarsus longer than second; hind tibia flattened and broadened toward apex, its outer apical margin thickened and expanded into a flaring process; hind femur broad, nearly half as wide as long; inner spur of middle tibia about 0.75 as long as its basitarsus; inner spur of hind tibia slightly less than 0.67 as long as basitarsus; second segment of middle leg shorter than fifth; basitarsus of hind leg shorter than the remaining four tarsal segments combined; second and fifth segments of hind tarsus about equal; hind tarsal claws pectinate, each with five short visible teeth basally. First abdominal suture slightly curved to the margin; second tergite shorter than third medially; hypopygium in profile obtuse at apex, about as long as second and third tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath more than half as long as hypopygium and a little shorter than hind basitarsus (pl. 5, fig. 32).

*Type*.—U.S.N.M. No. 58292.

*Type locality*.—Las Cruces, N. Mex.

Described from a single female collected by T. D. A. Cockerell.

#### CARDIOCHILES RUBIDUS, new species

*Female*.—Length 7.5 mm. Ferruginous; antenna, eye, vertex and frons medially, mesosternum, propodeum, posterior portion of metapleuron, and ovipositor sheath black; wing fuliginous; costa and stigma ferruginous; hind tarsus fuscous; pubescence of head golden brown. Antennae incomplete; eye bare; ocelli elevated; vertex and frons smooth and polished; face about 2.50 times as wide as long, smooth and shining, with a low median tubercle above; clypeus smooth, its basal half slightly elevated medially, its apical margin truncate, not notched; temple slightly narrower than eye in dorsal view; galea very short. Central portion of lateral face of pronotum weakly sculptured; median lobe of mesoscutum with a shallow longitudinal depression on each side of median line; notaulices moderately foveolate; mesopleuron smooth, upper groove foveolate and widened posteriorly, lower groove with more or less elliptical foveae, posterior groove foveate; metapleuron with posterior portion rugulose and anterior portion smooth; propodeum rugose, areolar carinae low, costulae weak, areola broader than spiracular area, spiracular area acute posteriorly, spiracle long ovate. First abscissae of radius and basal vein equal; third abscissa of cubitus shorter than fourth; recurrent vein slightly longer than second abscissa of cubitus; nervulus postfurcal by slightly over 0.67 its length; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued by a pig-

mented line. Second and fifth segments of fore tarsus about equal; hind tibia somewhat thickened apically but not expanded into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus; inner spur of hind tibia slightly more than half as long as basitarsus; second and fifth segments of middle tarsus about equal; second and fifth segments of hind tarsus about equal; basitarsus of hind legs slightly flattened, about as long as the next three segments combined; hind tarsal claws pectinate, each with three or four teeth on basal half. First abdominal suture slightly curved to the margin, second tergite shorter than third medially; hypopygium in profile obtuse, about as long as second and third tarsal segments of hind leg combined, its median ventral line without a longitudinal fold. Ovipositor sheath short, pubescent, its exposed part about one-third the length of hypopygium (pl. 5, fig. 25).

*Type*.—U.S.N.M. 58293.

*Type locality*.—Six miles west of Lakeview, Oreg., 5,100 feet.

Described from two females; the type is labeled as collected July 8, 1937, by Bolinger and Jewett; the paratype bears only the label "Ariz."

**CARDIOCHILES RUFOSTIGMA, new species**

*Female*.—Length 7 mm. Head, thorax, and abdomen black with the following parts reddish yellow: Narrow inner and broad outer orbits; lateral lobes of mesoscutum posteriorly; and basal half of abdomen except first and second tergites medially. Antenna black. Wings fuliginous, base of costa, stigma except apex, and base of subcostella reddish yellow. Coxae and trochanters black. Femora reddish yellow, darkened outwardly at their bases. Tibiae and their spurs testaceous, hind tibia black at apex. Tarsi black, the basal three and a half segments of the fore tarsus and the basal half of the first segment of the middle tarsus pale. Ovipositor sheath black. Pubescence of head rather long, chestnut brown in color; antennae incomplete; eye bare; ocelli slightly elevated; vertex smooth and polished; frons smooth and polished; face about 3.0 as wide as long, finely punctate, with a short median longitudinal ridge above; clypeus punctate, the punctures a little coarser than those of the face, basal portion slightly elevated, apical margin truncate, not notched; temple wider than eye in dorsal view; galea very short. Central portion of lateral face of pronotum rugose; median lobe of mesoscutum with a weak longitudinal depression each side of median line; notaulices moderately foveolate; mesopleuron punctate, its upper groove foveate and widened posteriorly, lower groove foveolate, posterior groove foveate; metapleuron rugose except on the anterior portion; propodeum rugose, carinae moderately prominent, costulae present, spiracular area about as large as arcola, spiracle long ovate. First abscissa

of radius slightly shorter but thicker than that of basal vein; third abscissa of cubitus slightly shorter than fourth; recurrent vein longer than second abscissa of cubitus; nervulus postfurcal by 0.67 its length; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued by a pigmented line, second and fifth segments of fore tarsus about equal; apex of hind tibia thickened on outer margin at apex and expanded into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus; inner spur of hind tibia about half as long as basitarsus; second and fifth segments of middle tarsus about equal; second segment of hind tarsus longer than fifth; hind tarsal claws pectinate basally, each with three or four visible teeth. First abdominal suture slightly curved to the margin, second and third tergites about equal medially; hypopygium in profile obtuse, about as long as combined length of first two tergites, its median ventral line without a longitudinal fold; ovipositor sheath about 0.67 as long as hypopygium, smooth, polished, spatulate, with short pubescence (pl. 5, fig. 37).

*Male*.—Similar to the female except slightly smaller, mesoscutum entirely black, hind femur and tibia wholly ferruginous, fore and middle tarsi pale.

*Type*.—U.S.N.M. No. 58294.

*Type locality*.—Fairfax, Calif. (May 1, 1921, C. T. Dodds).

Described from two females and two males; the paratypes are merely labeled "So. Cal." Two paratypes are in the Academy of Natural Sciences of Philadelphia.

#### *CARDIOCHILES SEMINIGER* (Cresson)

*Tenthredoides seminiger* CRESSON, Proc. Ent. Soc. Philadelphia, vol. 4, p. 291, 1865 (female, male).

*Toxononura seminigrum* CRESSON, Trans. Amer. Ent. Soc., vol. 4, p. 179, 1872.—CAMERON, Biologia Centrali-Americana, Hymenoptera, vol. 1, p. 411, No. 5, 1887.

*Toxononura seminigra* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, No. 10, pp. 49, 52, 1894.

*Cardiochiles seminigrum* VIEECK, Trans. Kansas Acad. Sci., vol. 19, p. 275, 1905.

*Female*.—Length about 7 mm. Head black, narrow inner and broad outer orbits and basal half of clypeus ferruginous; middle part of mandible dark red; thorax and abdomen ferruginous, proepisternum, anterior margin of the lateral face of pronotum, pectus, ventral half and posterior margin of mesopleuron, metapleuron, and propodeum, black; wings fuliginous, veins dark; legs ferruginous, coxae, trochanters, and femora basally, black; apex of hind tibia, last tarsal segment of foreleg and middle tarsus blackish, hind tarsus black; first tergite black medially; ovipositor sheath black. Antenna 39-segmented in the type, eye bare; ocelli elevated slightly; vertex smooth and polished; frons

smooth and polished; face about 2.50 times as wide as long, minutely punctate, with a low median tubercle above; clypeus slightly elevated along basal margin, apical margin not notched, and slightly arched outwardly; temple wider than eye in dorsal view; galea short. Posterior part of lateral face of pronotum rugose; median lobe of mesoscutum weakly elevated down the middle, the depression on each side of median line weak or indistinct; notaulices finely foveolate; upper and lower grooves of mesopleuron foveolate, posterior groove foveate, metapleuron rugose, except on the small anterior portion which is minutely, shallowly punctate; propodeum rugose, carinae moderately prominent, costulae present, areola rather narrow, spiracle ovate. First abscissa of radius longer than that of basal vein; third abscissa of cubitus slightly longer than fourth; nervulus postfurcal by about 0.67 its length; recurrent vein shorter than second abscissa of cubitus; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued by a pigmented line. Second and fifth segments of fore tarsus about equal; hind tibia broadened at apex but not expanded into a flaring process; inner spur of middle tibia slightly over half as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about half as long as basitarsus, basitarsus flattened and shorter than the last four tarsal segments, second tarsal segment longer than fifth; hind tarsal claws pectinate basally. First abdominal suture slightly curved to the margin; second tergite shorter than third medially; hypopygium in profile acute at apex, about as long as the first two tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath about 0.75 as long as hypopygium, longer than hind basitarsus, slightly pubescent, weakly de-curved at apex (pl. 5, fig. 28).

*Male*.—Essentially like the female.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

In addition to the type, which is from El Paso County, Colo., the author has studied specimens from Colorado, Kansas, Montana, Utah, New Mexico, Texas, Iowa, and Arizona.

CARDIOCHILES TENNESSENSIS, new species

*Female*.—Length 6 mm. Head and thorax black, with broad outer and incomplete, narrow inner orbital markings, and posterior half of mesonotum, ferruginous; lateral face of pronotum and metanotum also more or less ferruginous; wings dark fuliginous; coxae, trochanters, and fore and middle femora black; hind femur ferruginous; fore and middle tibiae and tarsi blackish, hind tibia ferruginous, broadly blackish apically, tibial spurs ferruginous; abdomen ferruginous; ovipositor sheath black. Pubescence of head not especially long or thick, chestnut-brown; antenna 36-segmented; eye bare; ocelli elevated;

vertex smooth and polished; frons smooth, polished, with a small, shallow pit below anterior ocellus, and with a low median longitudinal elevation; face about 2.50 times as wide as long, smooth, and with a median tubercle above; clypeus with longer pubescence than the face, median basal part convex, apical margin not notched; temple slightly wider than eye; galea short. Middle portion of lateral face of pronotum weakly ruguloso-punctate; median lobe of mesoscutum with a depression each side of the median line; notaulices finely foveolate; upper groove of mesopleuron wide, shallow, distinctly partitioned, lower groove weakly, finely foveolate; and posterior groove coarsely foveate; metapleuron ruguloso-punctate, triangular anterior portion plain, a deep pit on the margin between the anterior and posterior portions, and a deep, coarsely foveate groove along upper margin of posterior face; propodeum finely rugose, carinae delimiting areola low, costulae not defined, spiracle short ovate. First abscissae of radius and basal vein about equal; third abscissa of cubitus longer than fourth; first intercubitus sharply angulate and with a short stump of a vein from the angle; second abscissa of cubitus 1.50 times as long as recurrent vein; nervulus postfurcal by 0.67 its length; interanal vein absent. Second and fifth segments of fore tarsus about equal; hind tibia slightly curved, widened at apex, but not expanded into a strongly flaring process; the inner spur of middle tibia slightly more than half as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia about half as long as basitarsus, basitarsus about as long as the last four tarsal segments combined, second tarsal segment longer than fifth; hind tarsal claws pectinate, each with four visible teeth basally. First abdominal suture slightly curved to the margin; second and third tergites of equal length medially; hypopygium about as long as third and fourth abdominal tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath short, the exposed part about 0.25 as long as the hypopygium, smooth and polished (pl. 5, fig. 21).

*Type*.—U.S.N.M. No. 58295.

*Type locality*.—Clarksville, Tenn.

Described from a single female reared August 1909 "from budworm." Presumably the host was the tobacco budworm, *Heliothis virescens* (Fabricius).

Very similar to *nigriceps* Viereck, the common parasite of *Heliothis virescens*, but it may be distinguished from that species by the much less strongly sculptured metapleura and propodeum and by the relatively long second tergite.

CARDIODHILES TEXENSIS, new species

*Female*.—Length 7.5 mm. Head and thorax black, with narrow inner and broad outer orbital markings and spot on clypeus, ferrugi-

nous. Wings dark fuliginous, veins and stigma blackish. Legs ferruginous, their coxae and trochanters black and tarsi fuscous; abdomen ferruginous; ovipositor sheath black. Pubescence of head short and sparse. Antenna 37-segmented in type; eye bare; ocelli elevated; vertex and frons smooth and polished; face convex, punctate except medially, and with a median longitudinal ridge above extending down to the middle; clypeus punctate, elevated basally, apical margin truncate and not notched; temple narrower than the eye in dorsal view; galea very long, its exposed part longer than the long axis of the eye, tapering apically. Median lobe of mesoscutum nearly flat, without a depression on each side of the median line; notaulices moderately foveolate; mesopleuron smooth except for exceedingly minute setigerous punctures, upper groove unusually narrow, finely foveolate, lower groove finely foveolate anteriorly, coarsely so posteriorly, posterior groove coarsely foveate; metapleuron mostly smooth, rugose only on apical third of the large posterior section; propodeum rugose with prominent carinae defining the areas, areola diamond-shaped, costulae distinct, spiracular area not acute posteriorly, spiracle ovate. First abscissa of radius longer than that of basal vein; first intercubitus not angulate; third and fourth abscissae of cubitus about equal; second abscissa of cubitus longer than recurrent vein; nervulus postfurcal by about 0.80 its length; first abscissa of submedius shorter than the second; interanal vein represented by a short stump continued by a pigmented line. Fifth segment of foretarsus longer than the second; apex of hind tibia much thickened outwardly and expanded into a strongly flaring process; inner spur of middle tibia about 0.67 as long as basitarsus, second segment of middle tarsus shorter than fifth; inner spur of hind tibia about half as long as basitarsus, second and fifth tarsal segments about equal, basitarsus shorter than the last four tarsal segments combined; hind tarsal claw pectinate with three to four visible teeth basally. First abdominal suture slightly curved to the margin; third tergite longer than second medially; hypopygium very prominent, extending far beyond apex of last tergite, in profile acutely pointed, about as long as the first five tergites combined, its median ventral line without a longitudinal fold. Ovipositor sheath as long as hind tarsus, narrowing conspicuously from middle to apex, sparsely pubescent (pl. 5, fig. 16).

*Type*.—U.S.N.M. No. 58296.

*Type locality*.—Calvert, Tex.

Described from two females. The type was collected on *Heterotheca subaxillaris* by F. C. Bishopp in October; the paratype was taken at College Station, Tex., October 11, 1936.

Apparently related to *magnus* but is not so stout; it differs further in having the galea much longer, the temple much narrower, and the

hypopygium more produced; in color it differs especially in having the thorax black.

*CARDIOCHILES THERBERIAE* Rohwer

*Cardiochiles therberiae* ROHWER, Proc. U. S. Nat. Mus., vol. 57, pp. 226-227, 1920 (female).

*Female*.—Length 5.5 mm. Head black; incomplete orbital markings, lower part of face, clypeus, lower end of cheek, anterior surface of scape, and apical part of pedicel, brownish yellowish; thorax ferruginous; wings strongly fuliginous, costa and stigma brownish black; foreleg brownish yellow, with coxa, trochanter, and femur basally, black; middle leg black, apex of femur, basal two-thirds of tibia, and tarsus brownish yellow; hind leg black or blackish, tibia dark brown on basal half; spurs of fore and middle tibiae ferruginous, and of hind tibia dark ferruginous; abdomen black, its first and second tergites ferruginous medially. Antenna 33-segmented in type; eye hairy; ocelli elevated; vertex smooth, polished, and flat; frons smooth and polished, and with a low median longitudinal keel; face slightly less than twice as wide as long, smooth and shining; clypeus smooth, polished, its apical margin notched at the middle; temple slightly wider than eye in dorsal view; galea short. Median lower portion of lateral face of pronotum slightly wrinkled; median lobe of mesoscutum without a longitudinal depression each side of median line; notaulices sharply impressed, finely foveolate; mesopleuron smooth, polished, upper groove smooth, lower groove incompletely and weakly foveolate, posterior groove foveolate and with a distinct smooth groove from its middle to the lower groove; metapleuron smooth except ventroposterior corner of posterior portion which is rugose; propodeum rugose, the carinae prominent, areas sharply delimited. First abscissa of radius about 1.50 times as long as that of basal vein; third abscissa of cubitus slightly shorter than fourth; second abscissa of cubitus about 1.50 times as long as recurrent vein; recurrent vein about one-third as long as second abscissa of basal vein; nervulus post-furcal by about half of its length; first abscissa of submedius shorter than second; interanal vein represented by a pigmented line. Second segment of fore tarsus shorter than fifth; apex of hind tibia not expanded into a flaring process; inner spur of middle tibia longer than basitarsus; second and fifth segments of middle tarsus about equal; inner spur of hind tibia about 0.75 as long as basitarsus, basitarsus shorter than the last four tarsal segments combined, second tarsal segment slightly longer than fifth; hind tarsal claws pectinate. First abdominal suture extending obliquely forward laterally; second tergite shorter than third; hypopygium slightly shorter than first tergite, its median ventral line folded; ovipositor sheath about 0.33 as long as the abdomen and pubescent (pl. 5, fig. 39).

*Male*.—Essentially similar to the female except as follows: Length 4.5 mm.; cheek, temple, and face black; antenna 32-segmented; third abscissa of cubitus distinctly shorter than fourth.

This species is very close to *C. thoracicus* (Cresson).

*Type*.—U.S.N.M. No. 22033.

Redescribed from the type female and a paratype male, both from Sabino Basin, Santa Catalina Mountains, Ariz.; and one male from Victoria, Tex., September 18, 1913.

**CARDIOCHILES THORACICUS (Cresson), new combination**

*Toxoneuron thoracicum* CRESSON, Can. Ent., vol. 5, p. 68, 1873 (female).

*Toxoneura thoracica* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, No. 8, pp. 49, 51, 1894 (female, male).

*Female*.—Length 4.5 mm. Head ferruginous, with antennae, cheeks below and lower part of face between cheek and clypeus black; eye grayish black; apical margin of clypeus dark ferruginous; thorax, abdomen, and legs black; pronotum, proepisternum, mesonotum, tegulae, upper part of mesopleuron, apical third of fore femur, and fore tibia and tarsus, ferruginous; wings fuliginous. Antennae incomplete in type; eye hairy, ocelli elevated; vertex smooth, polished, and flat; frons smooth, polished, impressed, and with a median longitudinal carina; face slightly less than twice as wide as long, smooth and polished, slightly elevated medially and with a very indistinct, short, median ridge above; clypeus about 1.50 times as wide as long, smooth and polished, and notched medially on apical margin; temple broader than eye in dorsal view; galea short. Median portion of lateral face of pronotum rugose; median lobe of mesoscutum without a longitudinal depression each side of median line; notaulices distinct and foveolate; mesopleuron smooth and polished, upper and lower grooves foveolate and posterior groove rather coarsely foveolate with a short smooth depression at the middle leading to the lower groove; anterior portion of metapleuron smooth and polished, posterior portion rugose with anterior half plain; propodeum rugose, the carinae high and distinct, and the spiracle ovate. First abscissa of radius 1.50 times as long as that of basal vein; third abscissa of cubitus shorter than fourth; recurrent vein slightly longer than second abscissa of cubitus and about one-half as long as second abscissa of basal vein; nervulus postfurcal by about 0.33 its own length; interanal vein absent. Second and fifth segments of fore tarsus about equal; apex of hind tibia not expanded into a flaring process; inner spur of middle tibia longer than basitarsus, second and fifth tarsal segments of middle leg about equal; inner spur of hind tibia about 0.80 as long as basitarsus, the basitarsus shorter than the last four tarsal segments combined, second and third tarsal segments longer than fifth; hind claws pectinate basally. First abdomi-

nal suture extending obliquely forward to the margin; second tergite slightly shorter than third medially; ovipositor sheath about 0.67 as long as abdomen (pl. 5, fig. 38).

*Male*.—Essentially similar to the female, a transverse black band on vertex between eyes; clypeus notched rather strongly.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

Redescribed from the type female, from Cordova, Mexico, and a male, also from Mexico, in the Academy of Natural Sciences of Philadelphia. The male from Arizona, recorded by Ashmead, is not in the U. S. National Museum.

CARDIOCHILES TIBIATOR (Say)

*Bracon tibiator* SAY, Keating's Narrative of an expedition to the source of St. Peters River . . . , vol. 2, Append., p. 323, No. 1, 1824 (female).—LECONTE, Complete writings of Thomas Say on the entomology of North America, vol. 2, p. 716, No. 17, 1859.—CRESSON, Can. Ent., vol. 5, p. 68, 1873.—ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 51, No. 7, 1894.

*Bracon (Toxoneuron) tibiator* SAY, Boston Journ. Nat. Hist., vol. 1, pt. 3, p. 259, No. 17, 1836.—LECONTE, Complete writings of Thomas Say on the entomology of North America, vol. 2, p. 715, No. 17, 1859.

*Cardiochiles tibiator* ASHMEAD, in Smith, Insects of New Jersey, p. 592, 1900.—VIEBECK, Connecticut Nat. Hist. Surv. Bull. 22, p. 183, 1917.—LEONARD, Cornell Univ. Agr. Exp. Stat. Mem. 101, p. 913, 1928.

*Female*.—Length 5.5 mm. Black, anterior wing hyaline with apical third contrastingly fuliginous; posterior wing hyaline, infuscated at apex; apex of fore femur, fore tibia and tarsus entirely, basal half of middle tibia, middle tarsus, and basal third of hind tibia, yellowish white; pedicel dark ferruginous apically; middle part of mandible dark ferruginous. Antenna about 37-segmented; eye hairy; ocelli elevated; vertex shining, wrinkled and with a transverse low elevation bordering the occiput; frons transversely striate and with a very weak median longitudinal carina; face about twice as wide as long, convex, and with a complete median longitudinal carina; clypeus punctate, apical margin distinctly notched at middle, median basal part slightly elevated; temple striate, and bulging, broader than eye in dorsal view; galea short. Pubescence of thorax silvery or whitish; central portion of lateral face of pronotum rugose; median lobe of mesoscutum very shallowly impressed medially, sometimes with a shallow longitudinal impression each side of median line; the three lobes of mesoscutum a little roughened; notaulices coarsely foveolate; upper groove of mesopleuron rugose, lower groove foveate or rugosofoveate, posterior groove foveolate with a smooth depression at the middle leading anteriorly to the lower groove; metapleuron rugose, anterior triangular portion mostly smooth; propodeum with abundant, long, silvery hair, rugose, carinae prominent, areola diamond-

shaped, spiracle long ovate. First abscissae of radius and basal vein about equal; third abscissa of cubitus much shorter than fourth; recurrent vein and second abscissa of cubitus about equal; nervulus postfurcal by about 0.67 its own length; first and second abscissae of submedius about equal; interanal vein represented by a light pigmented line. Fifth segment of fore tarsus thicker and longer than second, hind tibia flattened and broadened toward apex, but not expanded on outer apical margin; inner spur of middle tibia slightly shorter than basitarsus, second tarsal segment shorter than fifth; inner spur of hind tibia about half as long as basitarsus, basitarsus flattened and broadened, and longer than the last four tarsal segments combined; hind tarsal claws pectinate basally. First abdominal suture extending obliquely forward to the margin; second tergite about half as long as third; hypopygium in profile pointed, about as long as the first two tergites combined, its median ventral line folded; ovipositor sheath about as long as hind basitarsus, pubescent, broadened to near apex, its greatest width about equal to length of second segment of hind tarsus, the tip bent ventrally (pl. 5, fig. 19).

*Male*.—Essentially similar to the female.

*Type*.—Lost.

The material studied includes specimens from Pennsylvania, Maryland, Virginia, District of Columbia, Kentucky, Georgia, and Kansas.

#### CARDIOCHILES TRANSVERSUS, new species

*Female*.—Length 6 mm. Black, upper, outer orbits narrowly ferruginous; wings light fuliginous; fore and middle legs ferruginous, their coxae, trochanters, femora basally, and tarsi black; hind leg ferruginous, with coxa, trochanter basally, apex of tibia, and tarsus black; ovipositor sheath black. Head with long, mostly dark, hairs; antenna 33-segmented in type; eye bare; ocelli elevated; vertex smooth and polished; frons smooth and polished, and with a weak, median longitudinal raised line; face about three times as wide as long, smooth, polished, and with a short median tubercle above; clypeus smooth, polished, basal margin slightly elevated, apical margin truncate, not notched; temple slightly wider than eye in dorsal view; galea short. Median portion of lateral face of pronotum foveolate; mesonotal lobes smooth and polished, impunctate; notaulices finely foveolate; upper groove of mesopleuron coarsely foveolate, lower groove finely foveolate, short, posterior groove evenly foveolate; metapleuron rugose, the small, triangular, anterior portion smooth; propodeum finely rugulose, the carinae prominent, spiracle ovate. First abscissae of radius and basal vein about equal; third abscissa of cubitus slightly shorter than fourth; recurrent vein and second abscissa of cubitus about equal; nervulus

postfureal by 0.67 its own length; first and second abscissae of submedius about equal; interanal vein represented by a pigmented line. Second and fifth segments of foretarsus about equal; apex of hind tibia not conspicuously thickened or expanded into a flaring process; inner spur of middle tibia slightly over half as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia slightly over half as long as basitarsus, basitarsus flattened, shorter than the last four tarsal segments combined, second tarsal segment longer than fifth; hind tarsal claws pectinate basally. First abdominal suture extending obliquely forward to the margin, second tergite shorter than third medially; hypopygium in profile obtuse, about as long as first three tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath smooth and polished, pubescent and broadly rounded at tip (pl. 5, fig. 24).

*Male*.—Essentially like the female.

*Type*.—U.S.N.M. No. 58297.

*Type locality*.—Los Angeles, Calif.

Described from three females and two males, all from the type locality.

**CARDIOCHILES TRUNCUS, new species**

*Female*.—Length 8 mm. Ferruginous except the following: Eye grayish black; antenna except base of scape, vertex and frons except narrowly at the eyes, occiput medially, pectus, and anteroventral margin of lateral face of pronotum black; apical margin of clypeus and tip of mandible dark ferruginous; mouth parts blackish; proepisternum partly blackish; propodeum mostly blackish; tegulae ferruginous; wings fuscous, stigma and veins blackish, costa and costella ferruginous basally; legs ferruginous, fore and middle coxae entirely and hind coxae largely, basal segments of all trochanters, apex of hind tibia, last tarsal segment of foreleg, apical part of basitarsus and the remaining segments of middle tarsus, and hind tarsus, black. Pubescence very short and inconspicuous; antenna 38-segmented in type; eye bare; ocelli elevated; vertex smooth and polished; frons smooth and polished, with a small pit below anterior ocellus, and with a low median longitudinal elevation; face about 2.50 times as wide as long, punctate, with a short median ridge above, below which it is broadly, slightly elevated; clypeus punctate, the median basal part elevated, the apical margin truncate and slightly flaring, not notched; temple wider than eye in dorsal view; malar furrow about 0.80 as long as basal width of mandible; galea about 0.82 as long as long axis of eye. Median portion of lateral face of pronotum rugose; median lobe of mesoscutum distinctly though minutely punctate, lateral lobes smooth; notaulices moderately foveolate; mesopleuron closely,

minutely punctate, upper, lower, and posterior grooves foveolate, the lower groove long, almost complete; metapleuron rugose, except the small triangular basal portion which is smooth; propodeum rugose, carinae prominent, spiracle ovate, strongly oblique. First abscissa of radius longer and thicker than that of basal vein; third and fourth abscissae of cubitus about equal; second abscissa of cubitus slightly shorter than recurrent vein; nervulus postfurcal by slightly over half of its length; first abscissa of submedius shorter than second; interanal vein represented by a short stump continued by a pigmented line. Fifth segment of foretarsus longer than second; apex of hind tibia strongly thickened and expanded into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus, second and fifth tarsal segments about equal; inner spur of hind tibia slightly over half as long as basitarsus, basitarsus flattened and slightly shorter than the next four tarsal segments combined, second tarsal segment longer than fifth; hind claws pectinate basally. First abdominal suture slightly curved to the margin; second abdominal tergite slightly shorter than third medially; hypopygium about as long as the first three tergites combined, its median ventral line without a longitudinal fold; ovipositor sheath polished, pubescent at tip, spatulate, its exposed part about half as long as the hypopygium (pl. 5, fig. 18).

*Male*.—Essentially similar to the female but with face medially, posterior part of temple, metanotum except lateral depressions, lower half of mesopleuron, metapleuron, and propodeum black; genitalia fuscoferruginous; antenna 41-segmented.

*Type*.—In the Academy of Natural Sciences of Philadelphia.

*Type locality*.—Pine Ridge, Nebr. (July).

Described from two females and one male. The allotype is from "18 mi. E. of Lamar, Colo., 3,900 ft. elev.," H. A. Scullen.

CARDIOCHILES VIATOR (Say), new combination

*Bracon (Toxoneuron) viator* SAY, Boston Journ. Nat. Hist., vol. 1, pt. 3, p. 258, No. 15, 1836 (female, male).—LECONTE, Complete writings of Thomas Say on the entomology of North America, vol. 2, p. 710, No. 15, 1859.

*Toxoneuron viator* CRESSON, Can. Ent., vol. 5, p. 69, 1873.—PATTON, Psyche, vol. 7, pp. 178-179, 1894.

*Toxoneura viator* ASHMEAD, Proc. Ent. Soc. Washington, vol. 3, pp. 49, 52, No. 11, 1894.

*Cardiochiles viator* VIERECK, Connecticut Geol. Nat. Hist. Survey Bull. 22, pp. 183-184, 1917 (1916).

*Female*.—Length 7.0 mm. Body ferruginous except the following: Antenna, vertex and frons mostly, median spot on face, occiput, lower and posterior part of cheek, malar region, apical and lateral margin of clypeus, propisternum, sometimes more or less of middle lobe of

mesonotum, mesopleuron except anterior upper part, pectus, metapleuron, propodeum, and ovipositor sheath, black; metanotum blackish, eye grayish black; mouth parts black; wings fuliginous, costa and stigma ferruginous; legs ferruginous, with coxae and trochanters and usually anterior and middle femora basally, black, tarsi brown or blackish. Antenna usually with 31 to 33 segments; eye bare; ocelli elevated, vertex smooth and polished; frons smooth and polished, with a small depression below the anterior ocellus and with a median longitudinal keel; face about 2.50 times as wide as long, punctate, polished, and with a small median tubercle above; clypeus punctate, its basal median part slightly elevated, its apical margin slightly flaring, not notched; temple bulging, wider than eye in dorsal view; galea long and slender, about as long as the long axis of eye, tapering apically. Median part of lateral face of pronotum weakly rugose; median lobe of mesoscutum flat, smooth and shining like lateral lobes; notaulices moderately foveolate; mesopleuron closely, finely punctate, upper groove coarsely foveate, lower groove foveolate, posterior groove coarsely foveate; metapleuron punctate, rugose at apex; propodeum rugose, carinae defining areola prominent, the costulae often indistinct, spiracle long ovate. First abscissa of radius longer than that of basal vein; third and fourth abscissae of cubitus about equal; second abscissa of cubitus slightly longer than recurrent vein; nervulus postfurcal by about 0.67 its length; first abscissa of submedius slightly shorter than second; interanal vein represented by a short stump continued by a pigmented line. Fifth segment of fore tarsus longer than second; apex of hind tibia thickened on outer margin and expanded into a flaring process; inner spur of middle tibia about 0.67 as long as basitarsus, and second tarsal segment slightly shorter than fifth; inner spur of hind tibia about half as long as basitarsus, basitarsus shorter than the next four tarsal segments combined, second and fifth tarsal segments about equal; hind tarsal claws pectinate, with short teeth basally. First abdominal suture slightly curved to the margin; second tergite shorter than third medially; hypopygium in profile pointed, about as long as the first three tergites combined; its median ventral line without a longitudinal fold; ovipositor sheath polished, spatulate, pubescent at tip, its exposed part about 0.75 as long as hypopygium (pl. 5, fig. 35).

*Male*.—Essentially similar to the female.

*Type*.—Lost.

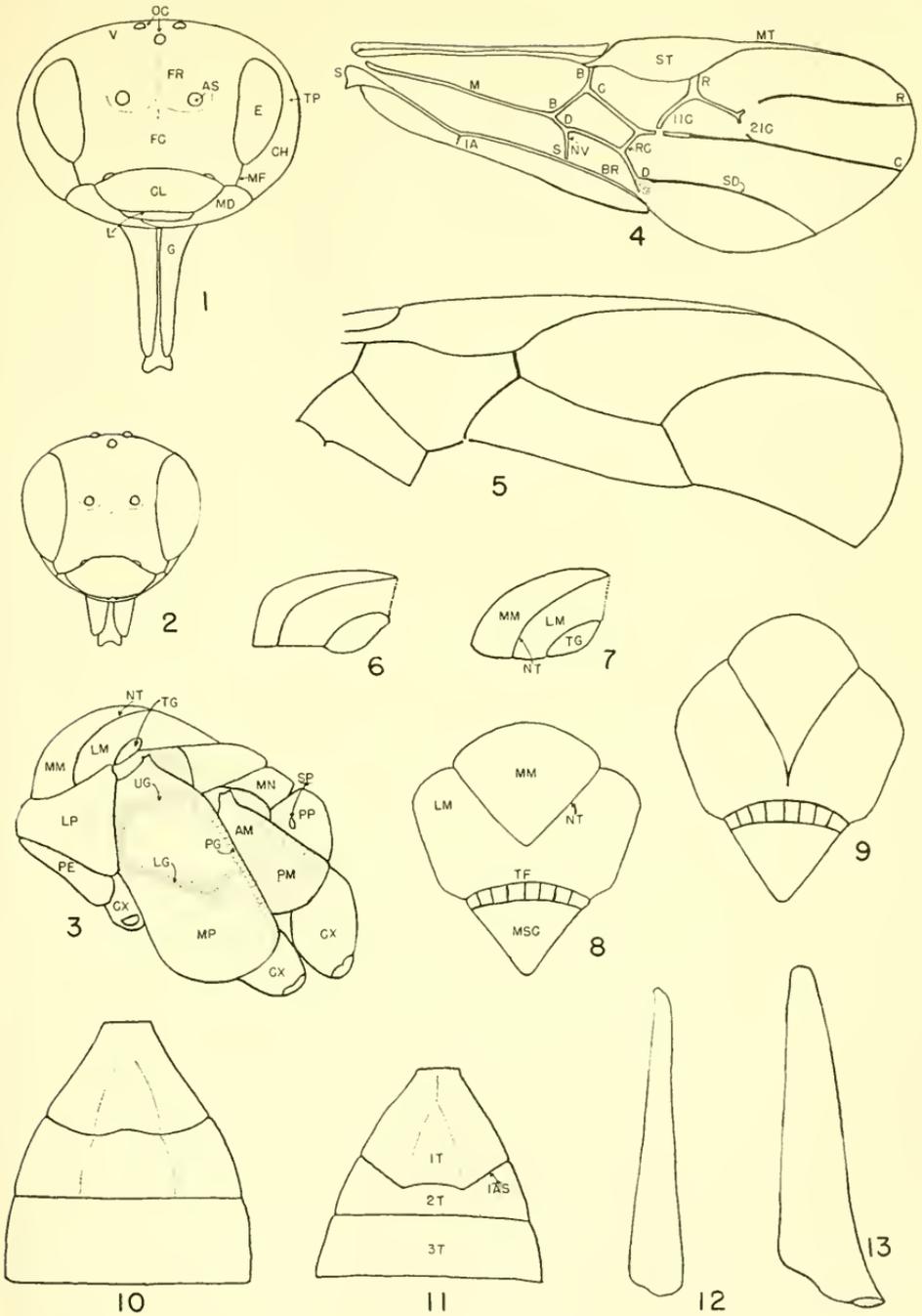
The material studied includes specimens from Connecticut, Pennsylvania, New Jersey, Maryland, Virginia, Ohio, Illinois, Kentucky, Colorado, and Texas.

KEY TO THE SPECIES OF *CARDIOCHILES* OF AMERICA  
NORTH OF MEXICO

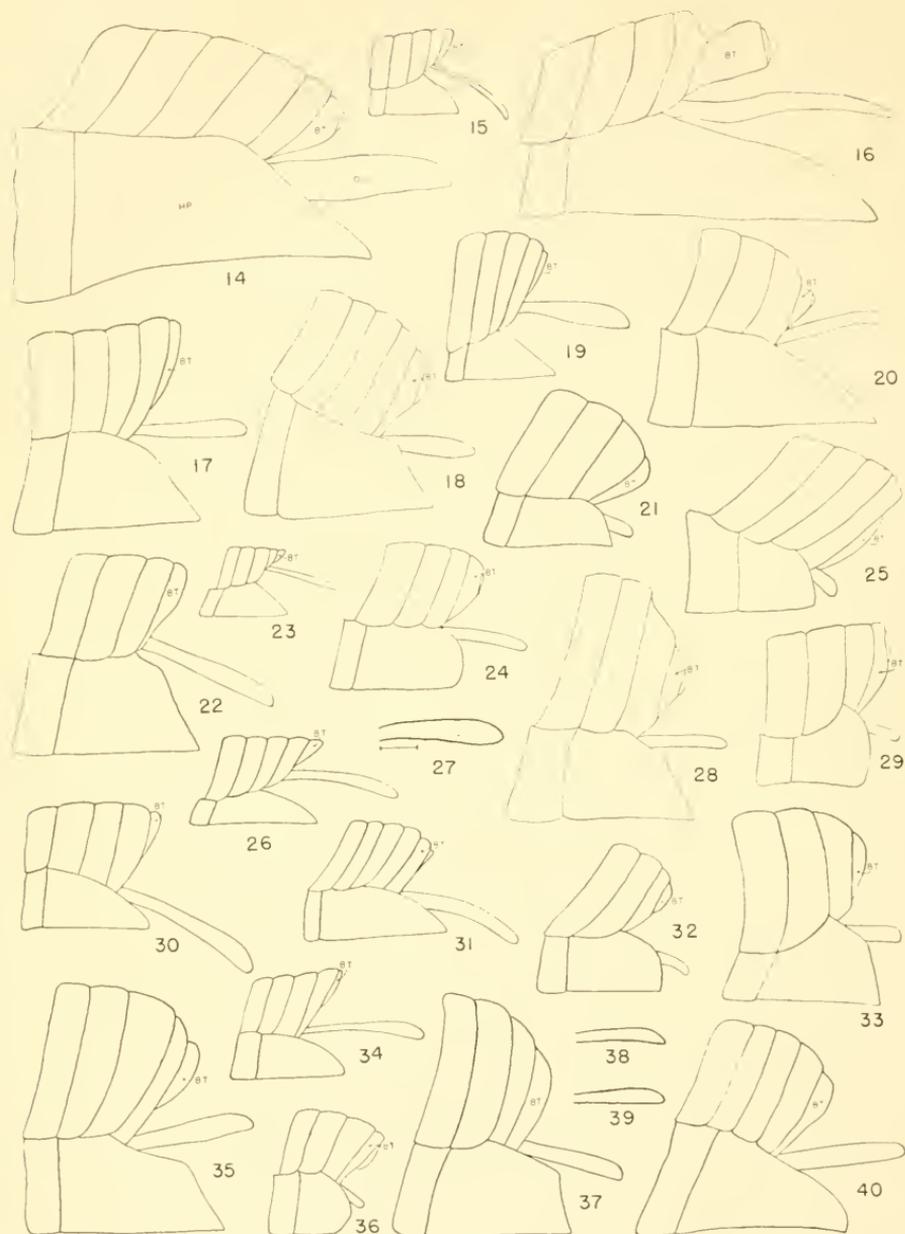
- |  |                                 |
|--|---------------------------------|
| 1. Eyes hairy .....  | 2                               |
| Eyes bare .....  | 10                              |
| 2. Vertex and frons transversely striate or wrinkled.....  | 3                               |
| Vertex and frons smooth.....   | 4                               |
| 3. Face with a median longitudinal carina; apical third of forewing fuliginous,<br>the rest hyaline; about basal 0.40 of hind tibia yellowish white; hind tarsal<br>claw pectinate basally; length about 6 mm.....   | <i>tibiator</i> (Say)           |
| Face without a median longitudinal carina; forewing uniformly fuliginous;<br>hind tibia entirely blackish; hind claw toothed basally; length about<br>2.50 mm.....   | <i>minutus</i> (Cresson)        |
| 4. Thorax at least partly ferruginous.....   | 5                               |
| Thorax entirely black.....   | 6                               |
| 5. Thorax entirely ferruginous; second abscissa of cubitus about 1.50 times as<br>long as recurrent vein; recurrent vein about one-third as long as second<br>abscissa of basal vein; interanal vein represented by a pigmented line.  |                                 |
|  | <i>therberiae</i> Rohwer        |
| Thorax black, varied with ferruginous; second abscissa of cubitus slightly<br>shorter than recurrent vein; recurrent vein about half as long as second<br>abscissa of basal vein; interanal vein absent.....   | <i>thoracicus</i> (Cresson)     |
| 6. Only apical third of forewing lightly infumated.....  | <i>apicalis</i> (Cresson)       |
| Forewing entirely infumated.....   | 7                               |
| 7. Third segment of hind tarsus nearly 1.50 times as long as fifth; hind tibia<br>black.....   | 8                               |
| Third and fifth segments of hind tarsus about equal; hind tibia testaceous,<br>sometimes blackish apically.....  | 9                               |
| 8. Fore femur black, brownish yellowish apically; fore tibia black or blackish;<br>length about 4.5 mm.....  | <i>orizabae</i> (Cresson)       |
| Fore femur and tibia testaceous; length about 6 mm.....  | <i>floridanus</i> (Ashmead)     |
| 9. Notaulices meeting posteriorly in an acute angle (pl. 4, fig. 9); mesopleural<br>furrow usually smooth.....   | <i>explorator</i> (Say)         |
| Notaulices meeting posteriorly in a broad angle (pl. 4, fig. 8); mesopleural<br>furrow foveolate to anterior margin of mesopleuron.  |                                 |
|  | <i>insculptus</i> , new species |
| 10. Anterior margin of clypeus slightly notched at middle; notaulices and<br>mesosulcus smooth; upper and lower grooves of mesopleuron smooth;<br>metapleuron smooth and polished; propodeum areolate, the areas smooth.   |                                 |
|  | <i>levis</i> , new species      |
| Anterior margin of clypeus not notched; notaulices foveolate (except in<br><i>brevitarsis</i> ); mesosulcus foveolate; upper and lower grooves of meso-<br>pleuron usually foveolate; metapleuron always rugose on posterior sec-<br>tion; propodeum usually areolate and always rugose..... | 11                              |
| 11. Apex of hind tibia expanded outwardly into a strongly flaring process (pl. 4,<br>fig. 13).....   | 12                              |
| Apex of hind tibia often thickened but not expanded into a strongly flaring<br>process, outer edge nearly straight.....  | 20                              |
| 12. Galea nearly or quite as long as long axis of eye.....   | 13                              |
| Galea much shorter.....  | 17                              |
| 13. Second segment of middle tarsus noticeably shorter than fifth.....   | 14                              |
| Second segment of middle tarsus as long as fifth.....  | 16                              |
| 14. Costa and stigma yellowish ferruginous.....  | <i>viator</i> (Say)             |
| Costa and stigma dark brown or piceous.....  | 15                              |

15. Temple, in dorsal view, narrower than eye; galea tapering strongly on apical half, its apex subacute; hypopygium far surpassing apex of last tergite in female.....*texensis*, new species
- Temple, in dorsal view, wider than eye; galea not tapering conspicuously, broadly rounded at apex; hypopygium not surpassing apex of last tergite in female.....*nebrascensis*, new species
16. Thorax black; tegulae blackish.....*abdominalis* (Cresson)  
Thorax with pro- and mesonotum reddish yellow; tegulae reddish yellow.  
*truncus*, new species
17. Hind femur unusually broad, its extreme width nearly half its length; usually mesonotum, and sometimes entire thorax ferruginous; plate of first tergite usually ferruginous..... 18  
Hind femur much more than twice as long as its extreme width; thorax black, occasionally mesonotum varied with ferruginous; plate of first tergite black..... 19
18. Head, thorax, legs including coxae, costa, and stigma reddish yellow.  
*rubicundus*, new species  
Head and thorax black, varied with ferruginous; all coxae black; costa and stigma blackish.....*magnus*, new species
19. Propodeal carinae well-developed, the areas sharply defined; wings strongly infumated throughout.....*rufostigma*, new species  
Propodeal carinae very weak, the areas not defined; wings strongly infumated apically, subhyaline basad of stigma.....*dilatatus*, new species
20. Legs entirely black..... 21  
Legs more or less extensively ferruginous..... 22
21. Wings entirely fuliginous; second segment of middle tarsus about as long as fifth.....*pluto* (Ashmead)  
Wings hyaline with apical third to two-fifths fuliginous; second segment of middle tarsus shorter than fifth.....*nigricans*, new species
22. Thorax entirely black..... 23  
Thorax more or less ferruginous..... 28
23. Costa and stigma bright ferruginous; head with ferruginous orbital markings.....*dignus*, new species  
Costa and stigma dark brown or piceous; head entirely black, except sometimes clypeus obscurely reddish..... 24
24. Abdomen black..... 25  
Abdomen more or less extensively, often entirely, ferruginous..... 26
25. Mesoscutum and scutellum closely, finely punctate; face closely punctate, its vestiture short, not conspicuous; propodeal carinae weak, only the areola distinctly defined.....*californicus* (Ashmead)  
Mesoscutum and scutellum smooth and polished; face polished, impunctate, and clothed with conspicuous, long, blackish hair; propodeal carinae prominent, all areas sharply defined.....*transversus*, new species
26. Frons distinctly wrinkled behind scapes; occiput aciculate; scutellum sculptured on apical half; mesopleuron mostly rugulose punctate.  
*nigroclypeus* Viereck  
Frons, occiput, and scutellum smooth and shining; mesopleuron smooth... 27
27. Wings subhyaline on basal half, infumated on apical half.  
*arugosus*, new species  
Wings entirely infumated.....*arugosus* var. *pullus*, new variety
28. Costa and stigma bright orange; head, except large spot on front and vertex, ferruginous.....*rubidus*, new species  
Costa and stigma dark brown or piceous; head largely black..... 29





1, *Cardiochiles viator*, front view of head; 2, *C. floridanus*, front view of head; 3, *Cardiochiles*, diagrammatic lateral view of thorax; 4, *C. apicalis*, forewing; 5, *C. nigriceps*, part of forewing; 6, *C. seminiger*, lateral view of anterior part of mesonotum; 7, *C. nigriceps*, lateral view of anterior part of mesonotum; 8, *C. operculellus*, dorsal view of anterior part of mesonotum; 9, *C. explorer*, dorsal view of anterior part of mesonotum; 10, *C. seminiger*, first three abdominal tergites; 11, *C. tibiator*, first three abdominal tergites; 12, *C. tibiator*, tibia; 13, *C. magnus*, tibia.



Hypopygium and ovipositor sheath of *Cardiochiles*: 14, *C. magnus*; 15, *C. explorator*; 16, *C. texensis*; 17, *C. nebrascensis*; 18, *C. truncus*; 19, *C. tibiator*; 20, *C. californicus*; 21, *C. tennesseensis*; 22, *C. dilatus*; 23, *C. insculptus*; 24, *C. transversus*; 25, *C. rubidus*; 26, *C. apicalis*; 27, *C. minutus*; 28, *C. seminiger*; 29, *C. dignus*; 30, *C. floridanus*; 31, *C. levis*; 32, *C. rubicundus*; 33, *C. nigriceps*; 34, *C. orizabae*; 35, *C. viator*; 36, *C. arugosus*; 37, *C. rufostigmus*; 40, *C. abdominalis*.  
 Ovipositor sheath: 38, *C. thoracicus*; 39, *C. therberiae*.