

FEMALES OF *CHIMARRA* (TRICHOPTERA: PHILOPOTAMIDAE) FROM EASTERN NORTH AMERICA

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Abstract.—Descriptions of females of the ten known eastern North American species of *Chimarra* are given and an identification key provided. Diagnostic characters are evident in the thickness of veins at the first fork of the radial sector in each forewing and in the shapes of the spermathecal sclerite and ventral plates beyond abdominal sternum VIII. A summary of published distributional records is provided for all *Chimarra* species of eastern North America.

The caddisfly genus *Chimarra* (Trichoptera: Philopotamidae), with 429 known species, occurs in all major biogeographic regions except Antarctica, with greatest diversity in the southern hemisphere (Morse, in preparation). Ten species of *Chimarra* occur in eastern North America, typically one or two species in most unpolluted streams. For purposes of this paper, "eastern" refers to Ontario, and the US states adjacent to either side of the Mississippi River and eastward.

The genus can be distinguished readily from other genera in larval and adult stages (Schmid 1980; Merritt and Cummins 1996; Wiggins 1996) and the males of the eastern North American species can be diagnosed using the revision of Lago and Harris (1987). However, neither the females nor the immature stages of these species can be identified with available literature. Consequently, studies which are dependent on the identification of these life stages are hindered, such as those concerning the behavior and ecology of mating and egg-laying adults or the delineation of different microhabitats. Furthermore, determinations of other ecological characteristics of the larvae and also their differential responses to various pollutants are difficult.

Discovery of species-diagnostic characters for caddisfly larvae requires association of larvae with identifiable adults. These adults may be affiliated with larvae either by rearing or by field techniques (Milne 1938; Merritt and Cummins 1996; Wiggins 1996). Therefore, knowledge of adult identification characteristics of both sexes of a species, rather than just of one sex, doubles the opportunity for identifying larvae.

Ross (1944) gave a key for the males and females of four of the five *Chimarra* species that were known in eastern North America at that time, *C. aterrima* Hagen, *C. feria* Ross, *C. obscura* (Walker), and *C. socia* Hagen. With the subsequent descriptions of five additional species, the total number of known *Chimarra* species in eastern North America has reached ten. Lago and Harris (1987) revised these species,

describing, illustrating, and keying males for all the eastern North American species of this genus, mapping the known distributions, and inferring their phylogeny. However, no successful attempts have been made to distinguish the females of this genus since 1944.

In this investigation, females were associated with identifiable males by simultaneous collection in light traps and by correspondence in color of body, wings, and appendages. This method of association is not as nearly certain as the capture of copulating specimens or the rearing of viable eggs from the results of such unions. However, the probability that the associations are correct is improved by the facts (1) that only ten morphologically distinguishable females were found, corresponding with the known number of males, and (2) that most of the collections included several specimens each of only one male and one female morphotype.

The usual method for studying genitalia of Trichoptera is to remove non-cuticular material with caustic potash (KOH) or other digesting substances as described, for example, by Ross (1944). This method was used to examine the female spermathecal sclerites in this study. However, the external characteristics were more distinctive for females that had not been prepared by this technique; cleared genitalia of female *Chimarra* tended to become distorted and the diagnostic ventral plates beyond abdominal sternum VIII lost their dark color more quickly than usual in the clearing process. Therefore, most specimens were studied externally in an uncleared condition, preserved in 75% ethyl alcohol. Drawings of these specimens were subsequently prepared using a Wild® M5 dissecting microscope equipped with a grid ocular in one eyepiece.

The specimens examined are deposited, as indicated, in the following institutions: Clemson University Arthropod Collection, Clemson, South Carolina (CUAC), Illinois Natural History Survey, Urbana, Illinois (INHS), University of Mississippi, University, Mississippi (UMS), and Clarion University, Clarion, Pennsylvania (CLAU).

Chimarra Stephens

We concur with Schmid (1980) in the opinion that abdominal segment IX in females of most species of Annulipalpia, including Philopotamidae, is absent or inconspicuous. In the females of *Chimarra*, there is a pair of plates ventrolaterally of tergum X, called "ninth sternum" by Ross (1944), but unnamed by any other authors we know. Typically there is no sternum of segment X (Ross' "segment IX") in Trichoptera males or females, such that these ventrolateral plates may have some other origin. Determination of the homology of these plates is beyond the scope of this investigation. Thus, we call them simply "ventral plates." Otherwise, the terminology of Nielsen (1980) is employed.

Adults: Bodies and appendages of eastern North American species tan to dark orange to near black, wings brown to black. Forewing with first fork of radial sector (rs) vein thickened in most species. Sternum VII with ventromesal projection.

Female terminal segments VIII–XI together obviously shorter than segment VII. Sternite and tergite VIII fused and forming sclerotized ring. Segment VIII with two, sometimes three, pairs of posteroventral setose spots and tergite VIII with one pair of posterolateral setose spots. Segment IX apparently absent. Segment X with tergum

divided longitudinally on meson and separate laterally from pair of ventral plates (discussed above), varying in size, shape, and sclerotization, always separated from each other by membrane on ventral meson. Segment XI forming pair of setose lobes, each lightly sclerotized, bulbous, and carrying a cercus apically. Vaginal apparatus membranous, carrying spermathecal sclerite anteriorly.

EASTERN NORTH AMERICAN *CHIMARRA* SPECIES

Females of eastern North American species of *Chimarra* differ from males not only in primary sexual characters, but also in size (females usually are slightly larger) and in the fact that the middle legs of females are natatorial, with the tibiae and tarsal segments tending to be flattened and fringed with hairs, especially the basal tarsal segment.

Lago and Harris (1987) provided a phylogeny of the eastern North American species of *Chimarra*. It will not be possible to infer a phylogeny of these same species based on female characters until the females of out-group species are known, determining the polarities of in-group character transformations. Thus we are not yet able to test the hypotheses of Lago and Harris (1987).

A summary of records for North American states and provinces (standard two-letter postal codes) is provided for each species below, with a few additions noted beyond the distributional records of Lago and Harris (1987) and Armitage (1983 and 1991).

Chimarra aterrima Complex Lago and Harris, 1987

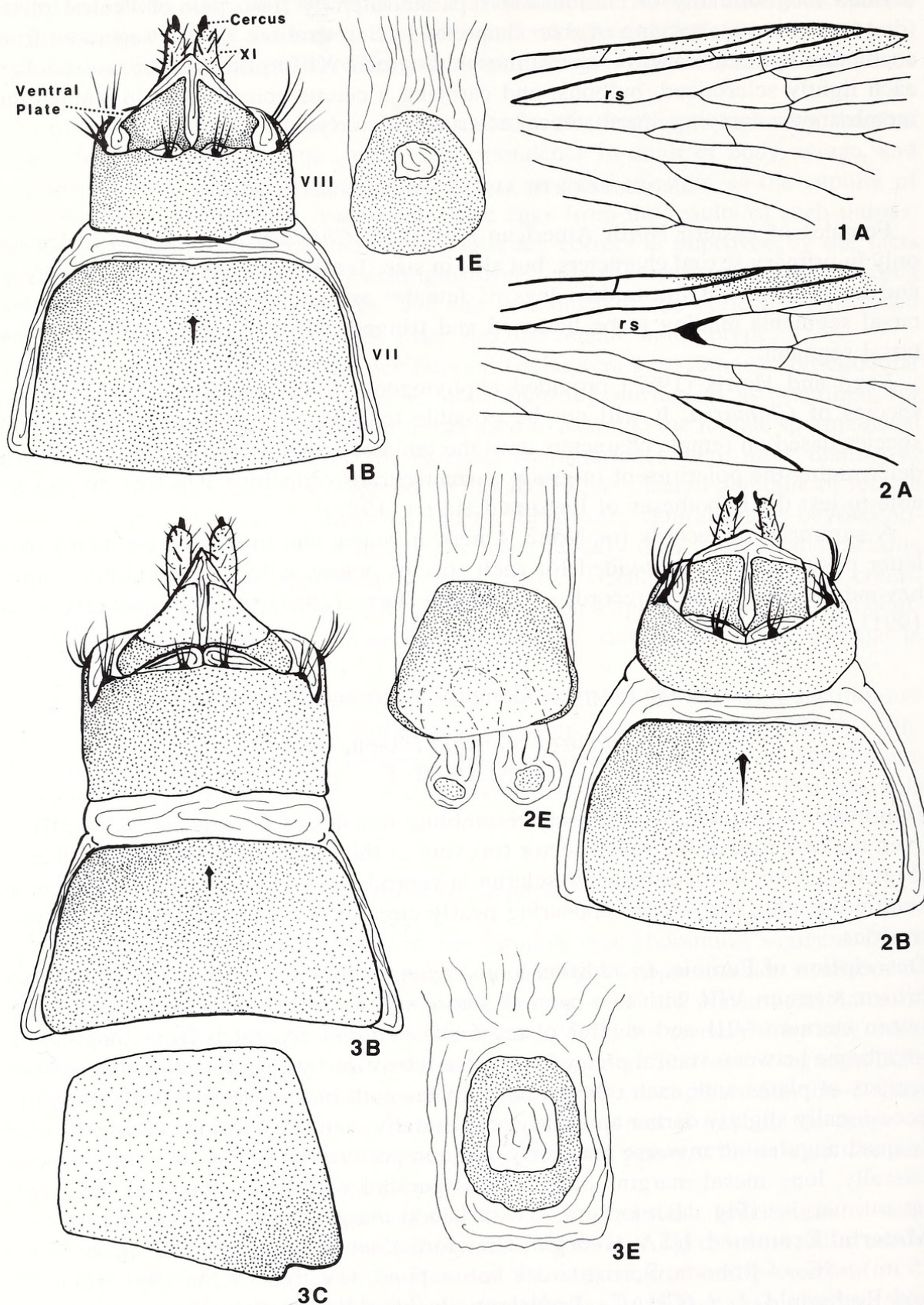
Chimarra aterrima Hagen, 1861

Figs. 1A, B, E

Diagnosis of Female. Most closely resembling females of *C. augusta* Morse. However, the first fork of the radial sector (rs) vein of the forewing is not at all thickened (Fig. 1A). Also, the spermathecal sclerite in ventral view (Fig. 1E) has a conspicuous central opening, the sclerite appearing nearly circular and without anterolateral protrusions.

Description of Female. In addition to characters mentioned in diagnosis, body dark brown; sternum VIII with two pairs of setose spots posteroventrally; membrane between sternum VIII and ventral plates transverse and separated from longitudinal membrane between ventral plates by slender sclerotized strip connecting anteromesal corners of plates with each other; ventral plates with little differential sclerotization, occasionally slightly darker anteriorly and laterally; ventral plates appearing distinctly quadrangular—transverse anteriorly, oblique posteriorly, longitudinal mesally and laterally, long mesal margins more or less parallel with each other and with short lateral margins (Fig. 1B); tergum X with lateral margins straight in dorsal view.

Material Examined. USA, **Georgia:** Crawford County, Camp Eunice, approx. 8 km (5 mi) SSE. of Roberta, Spring Creek below pond, UV light, 5 Jun 1981, Hamilton and Rothschild, 1 ♀ (CUAC). **Louisiana:** Jackson Parish, Schoolhouse Spring, 25 May 1997, Morse, 10 ♀ (CUAC). **South Carolina:** Aiken County, Savannah River Plant, Upper Three Runs Creek at SRP Rd. 8-1, 12–13 Apr 1979, McEwan and Powell, 1 ♂ 1 ♀ (CUAC); Savannah River Site, Upper Three Runs Creek approx.



Figs. 1-3. Characters of females of *Chimarra* species. 1, *C. aterrima*; 2, *C. augusta*; 3, *C. falculata*; A = middle section of right forewing, dorsal view; B = abdominal segments VII-XI, ventral view; E = genital chamber and spermathecal sclerite, ventral view.

2 km downstream of SC 125, 12 Jul 1990, Floyd, 1 ♀; also, 27 Jul 1990, 1 ♀; 24 Aug 1990, 1 ♀; 7 Sep 1989, 4 ♀; 20 Sep 1990, 1 ♀ (all CUAC); Savannah River Site, Upper Three Runs Creek at Road C bridge crossing, 12 Jul 1990, Floyd, 1 ♂, 1 ♀; also, 27 Jul 1990, 1 ♀; 7 Sep 1989, 2 ♀ (all CUAC); Greenville County, Brushy Creek just upstream of confluence with N. Saluda (Poinsett) Reservoir, off Rte. 969, Greenville Watershed property, 15 Jun 1992, Floyd, Morse, and Woodring, 1 ♀ (CUAC); Oconee County, W. trib. Burgess Creek, 0.5 km from Hwy 130, 34.93N, 83.00W, black light, 14 Apr 1995, Prather and Miller, 1 ♀ (CUAC); Pickens County, Clemson University Experimental Forest, Lake Issaqueena, 18 Apr 1991, Mitchell, 1 ♀ (CUAC); Clemson University Experimental Forest, W. trib. Sixmile Creek, el. 227 ♂ (740 ft), 5–12 Apr 1988, Malaise Trap, Hoffman, 19 ♂, 60 ♀; also, 12–19 Apr 1988, 24 ♂, 54 ♀; 19–24 Apr 1988, 7 ♂, 19 ♀; 24 Apr–4 May 1988, 4 ♂, 5 ♀; 8–15 May 1988, 1 ♂, 1 ♀; 12–20 Jun 1988, 8 ♀ (all CUAC); Clemson University Experimental Forest around Lake Issaqueena, Wildcat Creek, el. 236 ♂ (770 ft), 4–12 Apr 1988, Hoffman, Malaise Trap, 1 ♀; also, 12–19 Apr 1988, 3 ♂, 4 ♀; 24 Apr–4 May 1988, 1 ♂, 4 ♀; 12–20 Jun 1988, 1 ♀ (all CUAC).

Distribution. Eastern North America; Canada: MB, NB, NF, NS, ON, PQ; United States of America: AL, AR, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, SC, TN, TX, VA, VT, WI, WV.

Chimarra augusta Morse, 1971

Figs. 2A, B, E

Diagnosis of Female. Most closely resembling *C. aterrima*. However, the first fork of the radial sector (rs) vein in the forewing is thickened (Fig. 2A). Also, the spermathecal sclerite, from ventral view (Fig. 2E), appears complete, lacking a conspicuous opening and having a pair of sclerite-bearing semi-membranous protrusions anterodorsally.

Description of Female. In addition to characters mentioned in diagnosis, body dark orange to tan; sternum VIII with two pairs of setose spots posteroventrally; membrane between sternum VIII and ventral plates transverse, membrane between ventral plates longitudinal, these two membranous regions separated by contiguous anteromesal corners of ventral plates; ventral plates with no differential sclerotization, appearing quadrangular, transverse apically (Fig. 2B).

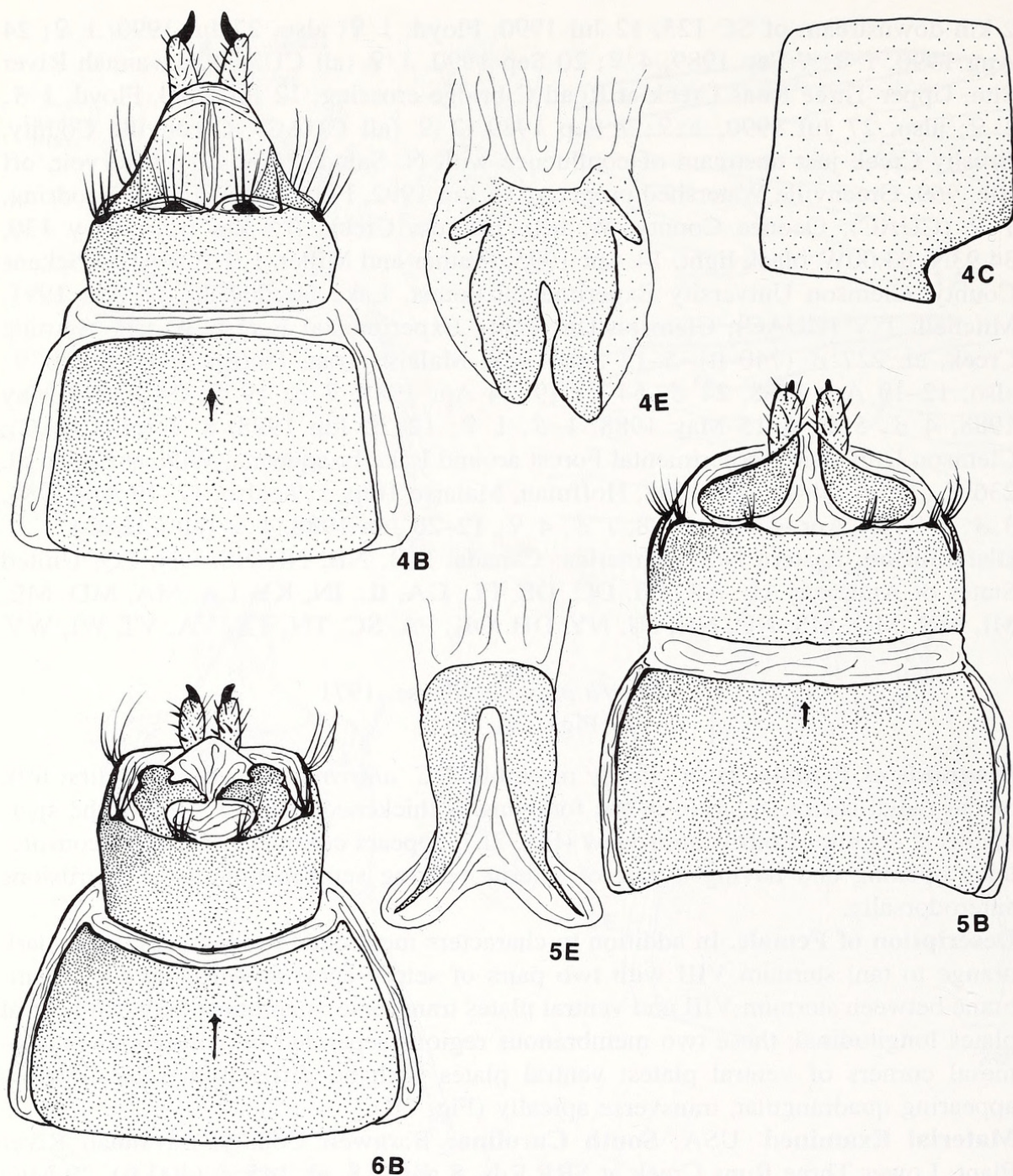
Material Examined. USA, **South Carolina:** Barnwell County, Savannah River Plant, Lower Three Runs Creek at SRP Rds. 8 and 8-8, el. 145 ♂ (400 ft), 29 May 1984, Morse, 1 ♀ (CUAC); Oconee County, Brasstown, Devil's Hole Creek, UV light, 19 Jul 1969, Douglass, 3 ♂, 7 ♀ (CUAC).

Distribution. Southern Appalachian Mountains. United States of America: AL, SC, TN, VA, WV.

Chimarra feria Ross, 1941

Figs. 4B, C, E

Diagnosis of Female. Most similar to *C. holzenthali* Lago and Harris. However, the female of this species is distinguishable by the comparatively small ventromesal projection of sternum VII, approximately 1/3 as tall as long in profile (Fig. 4C) and by the ring-like appearance of the spermathecal sclerite from ventral view (Fig. 4E).



Figs. 4-6. Characters of females of *Chimarra* species. 4, *C. feria*; 5, *C. florida*; 6, *C. holzenthali*; B = abdominal segments VII-XI, ventral view; C = abdominal sternum VII, left lateral view; E = genital chamber and spermathecal sclerite, ventral view.

Description of Female. In addition to diagnostic characters above, body color dark brown, sternum VIII with two pairs of posteroventral setose spots; transverse membrane between sternum VIII and ventral plates separated from longitudinal membrane between plates by contiguous anteromesal corners of plates; ventral plates more darkly sclerotized anteriorly, plates thus appearing transverse, mesal margins nearly parallel (Fig. 4B); lateral margins of tergum X straight in dorsal view.

Material Examined: Canada, **Ontario:** Jock's Creek, 10 mi. S. Ottawa, 24 May

1964, Ricker, 3 ♂, 1 ♀ (INHS); Peal Creek, TLH, Peal T. Bay, 9 Jul 1980, Nimmo, 2 ♀ (UMS). **Quebec:** Hull, Gatineau Park, Creek below beaver dam, 31 May 1964, Ricker, 1 ♂, 1 ♀ (INHS). USA, **Arkansas:** Montgomery County, L. Missouri River - Albert Pike, LM-3S, 19 Sep 1980, EJ Bacon, 1 ♀; also, 20 Sep 1980, 19 ♀ (all CUAC). **Illinois:** [County ?], Herod, May 1946, Ross and Mohr, 14 ♂, 1 ♀ (INHS); [County ?], Eddyville, Lusk Creek, 16–17 May 1947, Burks, 6 ♂, 1 ♀ (INHS); [Lee County ?], Dixon Springs, 30 Aug 1951, Ross and Richards, 4 ♂, 2 ♀ (INHS); Pope County—Bell Smith Springs, 29 Apr 1949, Sanderson and Stannard, 4 ♂, 3 ♀ (INHS); Bell Smith Springs, along stream, 4 May 1950, Sanderson and Stannard, 1 ♂, 1 ♀ (INHS). **Oklahoma:** [McCurtain County], Broken Bow, 8 Jun 1940, Mrs. Roy Weddle, 1 ♂, 1 ♀ (INHS).

Distribution. Great Lakes region and Mississippi Valley; Canada: ON, PQ, NF; United States of America: AL, AR, IL, IN, KS, KY, MI, MN, MO, MS, NE, OK, TX, WI.

Chimarra holzenthali Lago and Harris, 1987

Figs. 6B, C, E

Diagnosis of Female. Closely resembling *C. feria*. However, females are distinguished by the rather large ventromesal projection of sternum VII, two-thirds as tall as long (Fig. 6C) and by the forked spermathecal sclerite (Fig. 6E).

Description of Female. In addition to characters mentioned in diagnosis, body and wings golden brown; sternum VIII frequently with three pairs of setose spots; transverse membrane between sternum VIII and ventral plates separated from longitudinal membrane between plates by anteromesal corners of plates nearly touching; triangular anterolateral areas of ventral plates more darkly sclerotized, with lightly sclerotized, inconspicuous parts of plates extending toward meson, separated by longitudinal, nearly parallel-sided membrane (Fig. 6B); tergum X with lateral margins straight in dorsal view; cerci large, 2/3 as long as segment XI.

Material Examined. USA, **Louisiana:** Jackson Parish, Schoolhouse Springs near Indian Village, 30 Mar 1973, Morse and Louton, 3 ♀ paratypes (CUAC); also, “28 Apr or 28 Jul 1973,” Morse, Louton, and Dunn, 2 ♀ paratypes (CUAC); 24 Aug 1973, Morse and Louton, 2 ♀ paratypes (UMS); 4 Sep 1973, Dunn, Smith, and Louton, 1 ♂, 1 ♀ paratypes (UMS).

Distribution. Southcentral North America; United States of America: LA, TX (Bowles, et al. 1993).

Chimarra obscura Complex Lago and Harris, 1987

A diagnostic character for males of this Complex not mentioned by Lago and Harris (1987) is that the claws of the foretarsi are unusually large. The claws of the females are of normal small size.

Chimarra falculata Lago and Harris, 1987

Figs. 3B, E

Diagnosis of Female. Markedly dissimilar from other eastern North American species, this species resembles *C. holzenthali* in the forked condition of the spermathecal

sclerite. However, the anterior ends of the forked spermathecal sclerite are acute in *C. falculata* (Fig. 6E) and the ventral plates are tear-drop shaped (Fig. 3B).

Description of Female. In addition to characters mentioned in diagnosis, body, wings, and most appendages medium reddish brown, hind tibiae tan but their spurs medium brown; two pairs of setose spots posteroventrally on sternum VIII; ventral plates without differential sclerotization; membrane between plates wide anteriorly, narrowing posteriorly, continuous with membrane between sternum VIII and ventral plates (Fig. 3B); lateral margins of tergum X straight in dorsal view.

Material Examined. USA, **Florida:** Okaloosa County, Eglin Air Force Base, Turkey Gobbler Creek at Road 211 W. of Hwy. 85, 15 Aug 1985, Armitage, 2 ♀ (CLAU); Eglin Air Force Base, Juniper Creek at Road 221 E. of Hwy 85, 15 Aug 1985, Armitage, 6 ♀ (CLAU); Eglin Air Force Base, Malone Creek at Road 211 W. of Hwy. 85, 15 Aug 1985, Armitage, 2 ♀ (CLAU).

Distribution. Southeastern Coastal Plain; United States of America: AL, FL, GA, MS.

Chimarra florida Ross, 1944

Fig. 5B

Diagnosis of Female. The female of this species is very similar to that of *C. obscura*. However, the membrane between the ventral plates is transversely oval (Fig. 5B) and the ventral plates each have a rounded posterolateral projection.

Description of Female. In addition to characters mentioned in diagnosis, body, wings, and appendages medium to dark reddish brown; sternum VIII with two pairs of posteroventral setose spots; ventral plates with little or no differential sclerotization; membrane between ventral plates constricted where plates extend inward subapically (Fig. 5B); tergum X with lateral margin straight in dorsal view.

Material Examined. USA, **Georgia:** Crawford County, 8 km (5 mi) SSE. of Roberta, Spring Creek above pond at Camp Eunice main site, 7 May 1982, 30 Jun 1983, 8 and 29 Sep 1983, UV light, Hamilton and Holzenthal, 3 m, 17 ♀ (all CUAC); 5 mi. SSE. of Roberta, Spring Creek at old log bridge, UV light, 27 May, 10 and 30 Jun, 4 and 25 Aug, 20 Oct in 1983, Hamilton and Holzenthal, 25 m, 30 ♀ (all CUAC); 8 km (5 mi) SSE. of Roberta, Spring Creek below pond and Camp Eunice, UV light, 5 Jun 1981, Hamilton and Rothschild, 7 ♀ (CUAC); 8 km (5 mi) SSE. of Roberta, Spring Creek at US 341, 11 May, 10 and 30 Jun 1983, UV light, Hamilton and Holzenthal, 2 ♂, 8 ♀ (all CUAC). **Louisiana:** St. Tammany Parish, Talisheek, 4 Jun 1973, Morse and Louton, 1 ♂, 6 ♀ (CUAC). **South Carolina:** Aiken County, Savannah River Plant, Upper Three Runs Creek at SRP Rd. 8-1, 29 Mar, 12-13 Apr, 3 and 10-11 and 17 and 18 and 23-24 and 28 May, 1 and 13 and 26 and 28 Jun, 1 and 29 Jul, 6-8 and 22 Aug, 1 and 4 and 18-19 Sep, 12-13 Oct in 1976, 1977, 1979, and 1984, Morse, Kelly, McEwan, Powell, Herlong, and Prichard, 125 ♂ and 654 ♀ (all CUAC); Savannah River Site, Upper Three Runs Creek at Road C bridge crossing, 11 and 18 Apr, 18 May, 6 and 26 Jun, 12 and 27 Jul, 10 and 24 Aug, 6 and 7 and 20 Sep, 4 Oct in 1989 and 1990, Floyd, 22 ♂, 166 ♀ (all CUAC); Savannah River Plant, Upper Three Runs Creek, approx. 2 km downstream of SC 125, 8 May, 27 Jul, 10 and 24 Aug, 6 and 7 Sep in 1989 and 1990, Floyd, 74 ♀ (all CUAC); Savannah River Plant, Upper Three Runs Creek at SRP Road "F", 28 Jun 1977, Herlong and Prichard, 5 ♀ (CUAC); Savannah River Plant, Tinker Creek

at SRP Rd. 8-1, 18–19 Sep 1976, Herlong and Prichard, 1 ♀ (CUAC); Aiken State Park, Fish Lake outlet, 2–3 Jun 1981, CU Ent 412/612 class, 4 ♀ (CUAC); Aiken State Park, 13–14 Jun 1980, Lay, 1 ♀ (CUAC); Jackson, Hollow Creek at SC 125, 3 May 1988, Hoffman and Spooner, 24 ♀ (CUAC). Barnwell County, Savannah River Plant, Lower Three Runs Creek near SRP Rds. 8 and 8-8, 11–12 Jun and 20–21 Aug 1979, Kelley and McEwan, 2 ♀ (all CUAC).

Distribution. Southeastern Coastal Plain; United States of America: AL, FL, GA, LA, MS, NJ, SC.

Chimarra moselyi Denning, 1947

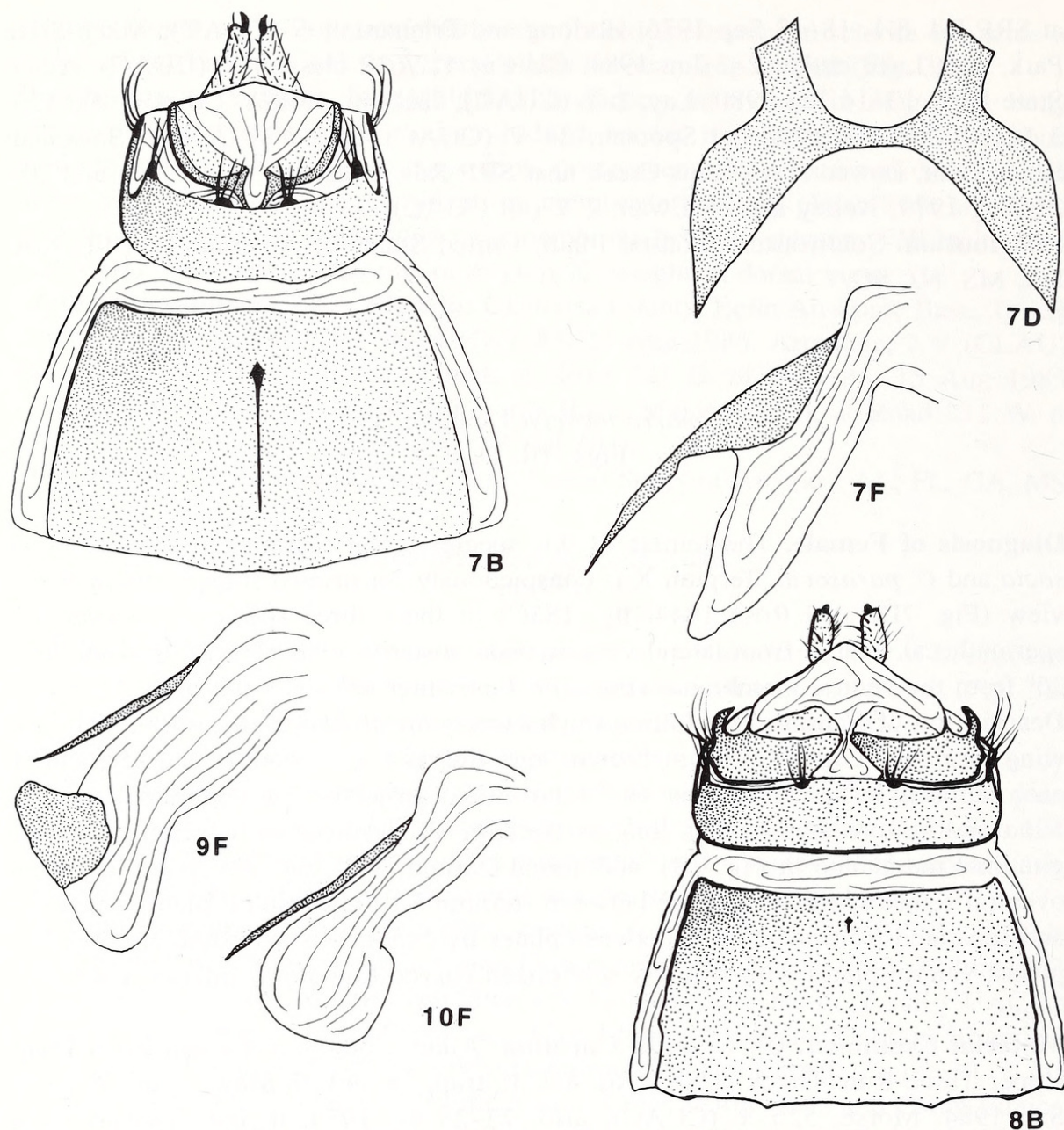
Figs. 7B, D, F

Diagnosis of Female. The female of this species is very similar to females of *C. socia* and *C. parasocia*. Tergum X is conspicuously constricted subapically in dorsal view (Fig. 7D, also Ross 1944, fig. 185C) in these three species. However, the spermathecal sclerite from lateral view is wide posteriorly and diverging about 20°–25° from the ventral membranes (Fig. 7F). Forewings each 5.5–6.8 mm.

Description of Female. In addition to characters mentioned in diagnosis, body and wings and tibial spurs medium brown, legs (but not spurs) and basal segment of each labial palp light brown or tan; ventromesal projection on abdominal sternum VII usually more than half as long as sternum VII (projection represented as longitudinal mesal line in Fig. 7B); abdominal sternum VIII with two pairs of poster-oventral setose spots; membrane between sternum VIII and ventral plates transverse and separated from membrane between plates by contiguous anteromesal corners of plates; ventral plates with strongly sclerotized curved line along anterior and lateral edges.

Material Examined. USA, **South Carolina:** Aiken County, Savannah River Plant, Upper Three Runs Creek at SRP Rd. 8-1, lt. trap, 24 and 28 May, 1 and 29 Jul, 4 Sep 1984, Morse, 525 ♀ (CUAC); also, 23–24 Jul 1979, lt. trap, McEwan and Powell, 1 ♀ (CUAC); Savannah River Site, Upper Three Runs Creek approx. 2 km downstream of SC 125, 18 Apr, 8 and 18 May, 6 and 26 Jun, 12 and 27 Jul, 10 and 24 Aug, 20 Sep, 4 Oct 1990, Floyd, 24 m, 68 ♀ (CUAC); Savannah River Site, Upper Three Runs Creek at Road C bridge crossing, 18 Apr, 8 and 18 May, 6 and 26 Jun, 12 and 27 Jul, 10 and 24 Aug, 20 Sep, 4 Oct 1990 and 1991, Floyd, 1 ♂, 50 ♀ (CUAC). Barnwell County, Savannah River Site, Lower Three Runs Creek at SRS Rds. 8 and 8-8, 29 May and 30 Jul 1984, Morse, 3 ♂, 24 ♀ (CUAC). **Georgia:** Appling/Toombs Counties line, Altamaha River at US Rte. 1, 8–10 Apr 1974, Sherberger and Hager, 19 ♀ (CUAC). Crawford County, approx. 8 km (5 mi) SSE. of Roberta, Spring Creek at US 341, 27 May 1983, Holzenthal and Hamilton, 1 ♀ (CUAC).

Distribution. Ohio River valley and lower elevations in southeastern North America; United States of America: AL, FL, GA, IL, IN, KY, LA, MO, MS, NC, OH, SC, TN, VA.



Figs. 7-10. Characters of females of *Chimarra* species. 7, *C. moselyi*; 8, *C. obscura*; 9, *C. parasocia*; 10, *C. socia*; B = abdominal segments VII-XI, ventral view; D = tergum X, dorsal view; F = genital chamber and spermathecal sclerite, left lateral view.

Chimarra obscura Walker, 1852

Fig. 8B

Diagnosis of Female. The female of this species most closely resembles that of *C. florida* in the anterior separation between the ventral plates and the presence of posterior projections from those plates. However, the posterior projections of the ventral plates are acute and more nearly lateral in this species and are especially prominent in profile from ventral view (Fig. 8B). Furthermore, the anterior membranes between the ventral plates form a conspicuous isosceles triangle.

Description of Female. In addition to characters of diagnosis, head, thorax, wings,

and appendages dark brown, abdomen medium reddish brown; sternum VIII fairly short, approximately 1/3 as long as sternum VII, and with two pairs of posteroventral setose spots; ventral plates conspicuously differentially sclerotized and with mesal margins nearly touching at mid-length, longitudinal membrane separating plates resembling hourglass; spermathecal sclerite U-shaped in ventral view (Ross 1944, fig. 184B).

Material Examined. USA, **Arkansas:** Montgomery County, L. Missouri River - Albert Pike, LM-3S, 19 and 20 Sep 1980, EJ Bacon, 32 ♀ (CUAC). **Georgia/South Carolina:** Rabun/Oconee Counties line, Chatooga River at Rte. 28, 34°55'N, 83°10'W, 28 Jun 1991, Floyd and Nichol, 2 m, 19 ♀ (CUAC). **South Carolina:** Aiken County, Savannah River Plant, Upper Three Runs Creek at SRP Rd. 8-1, 1 Sep 1979, Lt. Trap, Kelley and McEwan, 1 ♀ (CUAC); also, 28 May 1984, Morse, 3 ♀ (CUAC); Savannah River Site, Upper Three Runs Creek, approx. 2 km downstream of SC 125, 18 Apr, 8 May, 6 and 26 Jun, 27 Jul, 10 and 24 Aug, 6 and 7 and 20 Sep, 4 Oct 1989 and 1990, Floyd, 2 ♂, 83 ♀ (all CUAC); Savannah River Site, Upper Three Runs Creek at Road C bridge crossing, 11 Apr, 6 Jun, 12 and 27 Jul, 10 and 24 Aug, 6 and 7 and 20 Sep, 4 Oct 1989 and 1990 and 1991, Floyd, 3 ♂, 87 ♀ (all CUAC); Jackson, Hollow Creek at SC 125, 3 May 1988, Hoffman and Spooner, 5 ♀ (CUAC). Barnwell County, Savannah River Site, Lower Three Runs Creek near SRS Rds. 8 and 8-8, 14-15 Sep 1979, Kelley and McEwan, 1 ♀ (CUAC); Greenville County—Greenville Watershed property, Slicking Creek at confluence with Table Rock Reservoir, 29 Jun 1992, Floyd and Woodring, 1 ♂, 3 ♀ (CUAC); Greenville Watershed property, S. Saluda River at confluence with Table Rock Reservoir, 29 Jun 1992, Floyd and Woodring, 2 ♀ (CUAC). Pickens County, Clemson University Experimental Forest, Wildcat Creek, el. 237 ♂ (770 ft), UV light, 21 May 1988, Hoffman, 1 ♀ (CUAC).

Distribution. Eastern North America except South Atlantic Coastal Plain; Canada: LB, MB, NF, NS, ON, PQ; United States of America: AL, AR, CT, DE, FL, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, NE, NH, NJ, NY, OH, OK, PA, SC, TN, TX, VA, VT, WI.

Chimarra parasocia Lago and Harris, 1987

Fig. 9F

Diagnosis of Female. Very similar to the females of *C. moselyi* and *C. socia*. However, the ventral membranes of the spermatheca have a sclerite that is conspicuous in lateral view (Fig. 9F) and the forewing length is only about 5.0 mm.

Description of Female. Head, thorax, antennae light reddish brown, wings light brown, legs and palps tan; ventromesal projection of sternum VII short, less than half as long as sternum VII; sternum VIII with two pairs of setose spots posteroventrally; membrane between sternum VIII and ventral plates transverse, separated from median membrane by contiguous anteromedial corners of ventral plates; ventral plates each with strongly sclerotized line anteriorly and laterally (as in Fig. 7B); plates divergent, with mesal margins separating posteriorly; tergum X conspicuously constricted subapically in dorsal view (as in Fig. 7D).

Material Examined. USA, **Arkansas:** Montgomery County, L. Missouri River - Albert Pike, LM-3S, 19 and 20 Sep 1980, EJ Bacon, 47 ♀ (CUAC). **Mississippi:**

Simpson County, 3.7 km (2.3 mi) W of Pinola, upstream of Hwy. 28, 20 Jun 1979, Holzenthal, 8 ♀ (CUAC). Wilkinson County, Buff River at Hwy 61, 24 Jun 1982, Lago, 5 ♀ (UMS).

Distribution. Eastern Texas and southern Mississippi River Valley to western edge of southern Appalachian Mountains; United States of America: AL, AR, KY, LA, MO, MS, TN, TX (Bowles et al. 1993).

Chimarra socia Hagen, 1861

Fig. 10F

Diagnosis of Female: The female of *C. socia* is very similar to the females of *C. parasocia* and *C. moselyi*. However, the ventral membranes of the spermatheca are not sclerotized (Fig. 10F) and the forewing is about 5.5–6.0 mm long.

Description of Female. Head, thorax, wings, and antennae ranging from light brown to near black, palps and legs lighter, except dark spurs; ventromesal projection of sternum VII short, less than half as long as sternum VII; sternum VIII with two pairs of posteroventral setose spots; membrane between sternum VIII and ventral plates transverse, separated from median membrane by contiguous anteromedial corners of ventral plates; ventral plates each with strongly sclerotized line anteriorly and laterally (as in Fig. 7B); plates divergent, with mesal margins separating posterad; tergum X conspicuously constricted subapically in dorsal view (as in Fig. 7D; Ross 1944, fig. 185C).

Specimens from the Southern Appalachian Mountains are dark brown, differing from those of the more northern regions of North America, suggesting a genetic difference. However, sufficient material was not available and no other morphological distinctions were found to support this hypothesis.

Most likely, the female described by Ross (1944) as *C. socia* actually was that of *C. moselyi*, first recognized as a separate species in 1947. No *C. socia* specimens have been found in Illinois since Ross' report and his description fits both *C. moselyi* and *C. socia*.

Material Examined. CANADA, **Quebec:** Montreal, 27 Aug 1947, Burks, 7 ♀ (UMS). USA, **Georgia/South Carolina:** Rabun/Oconee Counties, Chattooga River at SC Rte. 28, 34°55'N, 83°10'W, 28 Jun 1991, Floyd and Nichol, 208 ♀ Coleman lt., 6 Jul 1969, PH Carlson, 1 ♂, 5 ♀; 16 and 21 Aug 1969, UV light, Morse, 27 ♂, 20 ♀ (all CUAC).

Distribution. Great Lakes region and northeastern North America and Appalachian Mountains; Canada: LB, MB, NB, NF, NS, ON, PQ; United States of America: CT, DC, GA (record confirmed herein), MA, MD, ME, MI, MN, NC, NH, NJ, NY, PA, SC (record confirmed herein), VA, WI, WV.

KEY TO FEMALES OF THE EASTERN NORTH AMERICAN *CHIMARRA* SPECIES

1. Ventral plates each with prominent lateral extension especially visible in profile from ventral view (Fig. 8B); anterior membranes between plates distinctly triangular (Fig. 8B) *Chimarra obscura* Walker.
- 1'. Ventral plates with lateral extensions not as prominent (Fig. 5B) or absent (Fig. 3B) 2
- 2(1'). Membranes between ventral plates transversely oval (Fig. 5B); ventral plates each with rounded posterolateral projection or extension (Fig. 5B) *Chimarra florida* Ross.

- 2'. Membranes between ventral plates longitudinally oval (Fig. 7B), linear (Figs. 1B, 4B), or narrower posteriorly (Fig. 3B); ventral plates without posterolateral extensions (Fig. 1B) 3
- 3(2'). Ventral plates tear-drop shaped (Fig. 3B); spermathecal sclerite forked and acute anteriorly (Fig. 3E) *Chimarra falculata* Lago and Harris.
- 3'. Ventral plates linear (Fig. 7B), rectangular (Fig. 2B), triangular (Fig. 6B), or transverse (Fig. 4B); spermathecal sclerite not forked (Fig. 1E) or blunt anteriorly (Fig. 6E) 4
- 4(3'). Ventral plates with strongly sclerotized, curved line anterolaterally and with mesal margins diverging posteriorly (Fig. 7B); tergum X margins constricted subapically in dorsal view (Fig. 7D) 5
- 4'. Ventral plates only slightly more sclerotized anterolaterally and with mesal margins parallel (Figs. 1B, 4B, 6B) or plates not differentially sclerotized (Fig. 2B); tergum X margins straight, not constricted 7
- 5(4). Spermathecal sclerite wide posteriorly in lateral view and diverging about 20°–25° from ventral membranes (Fig. 7F) *Chimarra moselyi* Denning.
- 5'. Spermathecal sclerite thin posteriorly in lateral view and diverging only about 15° or less from ventral membranes (Fig. 9F) 6
- 6(5'). Ventral membranes of genital chamber with apical sclerite conspicuous in lateral view (Fig. 9F); forewing about 5.0 mm long . . . *Chimarra parasocia* Lago and Harris.
- 6'. Ventral membranes of genital chamber without apical sclerite (Fig. 10F); forewing 5.5–6.0 mm long *Chimarra socia* Hagen.
- 7(4'). Ventral plates with little (Fig. 1B) or no (Fig. 2B) differential sclerotization, such that plates conspicuously quadrangular 8
- 7'. Ventral plates distinctly more darkly sclerotized anterolaterally, such that plates appearing transverse (Fig. 4B) or triangular (Fig. 6B) 9
- 8(7). Forewings each with first fork of radial sector (rs) thickened (Fig. 2A); spermathecal sclerite without conspicuous opening in ventral view and with pair of sclerite-bearing semimembranous protrusions anterodorsally (Fig. 2E); body usually light tan to dark orange *Chimarra augusta* Morse.
- 8'. Forewing with no forks thickened (Fig. 1A); spermathecal sclerite with conspicuous central opening and without anterodorsal protrusions (Fig. 1E); body dark brown *Chimarra aterrima* Hagen.
- 9(7'). Spermathecal sclerite ring-like in ventral view (Fig. 4E); sternum VII with ventromesal projection 1/3 as tall as long (Fig. 4C); sternum VIII never with more than two pairs of posteroventral setose spots (Fig. 4B); body dark brown *Chimarra feria* Ross.
- 9'. Spermathecal sclerite forked (Fig. 6E); sternum VII with ventromesal projection 2/3 as tall as long (Fig. 6C); sternum VIII frequently with three pairs of posterior setose spots (Fig. 6B); body light tan to dark orange *Chimarra holzenthali* Lago and Harris.

ACKNOWLEDGMENTS

Dr. Paul K. Lago (University of Mississippi), Dr. Steven C. Harris (Clarion University), and Ms. Kathleen Reid Zeiders (Illinois Natural History Survey) kindly loaned specimens for use in this investigation. Dr. Lago, Dr. Harris, Dr. Roger J. Blahnik (Rutgers University), and Dr. Cynthia R.L. Adler (Clemson University) provided useful suggestions for improving the text. Dr. William C. Alexander (SC Governor's School for Science and Mathematics—SC GSSM) was instrumental in his encouragement and review of the manuscript. Dr. Katherine Kellam coordinated the South Carolina High School Summer Research Program which administered

the work. The study was funded by SC GSSM. This is Technical Contribution No. 4260 of the South Carolina Agricultural and Forestry Research System, Clemson University.

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