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The Genus *Chimarra* Stephens (Trichoptera: Philopotamidae) in Vietnam

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The Genus *Chimarra* Stephens (Trichoptera: Philopotamidae) in Vietnam

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Abstract. Currently, the genus *Chimarra* Stephens (Trichoptera: Philopotamidae) is represented in the Oriental Region by 259 species. Of these, 61 species have been described or recorded from Vietnam. In this paper, 9 new species from Vietnam are described and illustrated (*Chimarra aculeata*, *C. carinata*, *C. corneola*, *C. insolita*, *C. mina*, *C. prominens*, *C. rostrata*, *C. undulata*, and *C. ungula*). In addition, 3 new country records are noted (*Chimarra areli* Malicky and Mey, *Chimarra pipake* Malicky and Chantaramongkol, and *Chimarra suthepensis* Chantaramongkol and Malicky), and 1 new species group (minuta Group) is proposed and populated. An additional species group (georgensis "Group"), with 1 new species from Vietnam, but otherwise only known from Africa, is discussed, but not formally defined. A table listing all known Vietnamese species of *Chimarra* is included, along with discussion of variability in the anal veins of the forewing found within this genus, and its relevance for defining subgenera and species groups.

Key words. Caddisfly, Trichoptera, Philopotamidae, *Chimarra*, new species, new records, species group, Vietnam

Introduction

The genus *Chimarra* (Trichoptera: Philopotamidae) was described by Stephens (1829) and placed in the subfamily Chimarrinae by Rambur (1842). Currently, there are four established subgenera (*Chimarra*, *Chimarrita* Blahnik, *Curgia* Flint, and *Otarrha* Blahnik) within the genus (Blahnik 1997, 1998, 2002; Flint 1998). The latter three of these subgenera are confined to the Neotropics. The subgenus *Chimarra* is known from all biogeographical regions, excluding Antarctica. The genus *Chimarra* is more diverse than all caddisfly genera except *Rhyacophila* Pictet. Over 700 species have been described worldwide, with 259 of them found in the Oriental Region. Currently, 61 species are recorded from Vietnam (Kimmins 1957; Malicky 1978, 1989, 1994, 1995, 2009; Jacquemart 1979; Chantaramongkol and Malicky 1989; Malicky and Chantaramongkol 1993; Mey 1998, 2005; Armitage et al. 2005; Oláh and Malicky 2010).

Nine new species of the genus *Chimarra* and 3 new country records for Vietnam were discovered during a recent examination of museum material. The new species are described and illustrated herein. A list of the 73 species of *Chimarra* now known from Vietnam (~10% of world *Chimarra* fauna) are presented in Table 1, organized by species group.

Material and methods

The material presented in this paper was collected by personnel of the Royal Ontario Museum (**ROM**) and the American Museum of Natural History (**AMNH**), or was provided by Dr. Wolfram Mey

of the Museum für Naturkunde der Humboldt-Universität zu Berlin (**MNHB**). Holotypes and paratypes are deposited in the ROM and AMNH, consistent with the source of the material examined.

Specimens were cleared in 10% KOH and subsequently examined under a stereomicroscope. Drawings were first penciled using a drawing tube, and later inked by hand. Terminology for genitalia and wings follows that used by Blahnik (1998) for *Chimarra*.

Table 1. Vietnamese *Chimarra* organized by species group

digitata Group

Chimarra akkaorum Chantaramongkol and Malicky
Chimarra andrikovicsi Oláh and Malicky
Chimarra argax Malicky
Chimarra chiangmaiensis Chantaramongkol and Malicky
Chimarra doisongta Oláh and Malicky
Chimarra gether Malicky
Chimarra khamuorum Chantaramongkol and Malicky
Chimarra loanga Oláh and Malicky
Chimarra okuihorum Mey
Chimarra shanorum Chantaramongkol and Malicky

tsudai Group

Chimarra aculeata Blahnik, Arefina-Armitage, and Armitage
Chimarra alcicorne Malicky
Chimarra areli Malicky and Mey
Chimarra bachmana Oláh and Malicky
Chimarra caimochina Oláh and Malicky
Chimarra cucphuonga Oláh and Malicky
Chimarra cumata Malicky and Chantaramongkol
Chimarra devva Malicky and Chantaramongkol
Chimarra fansipangensis Mey
Chimarra guiva Oláh and Malicky
Chimarra haimuoi Malicky
Chimarra haimuoiba Malicky
Chimarra haimuoibon Malicky
Chimarra haimuoimot Malicky
Chimarra haimuoinam Malicky
Chimarra hoangliensis Mey
Chimarra huonghoa Oláh and Malicky
Chimarra insolita Blahnik, Arefina-Armitage, and Armitage
Chimarra inthanonensis Chantaramongkol and Malicky
Chimarra jaroschi Malicky
Chimarra joliveti Jacquemart
Chimarra juliana Oláh and Malicky
Chimarra juliatra Oláh and Malicky
Chimarra ketla Oláh and Malicky
Chimarra khula Oláh and Malicky
Chimarra lacaya Oláh and Malicky
Chimarra lahuorum Chantaramongkol and Malicky
Chimarra lannaensis Chantaramongkol and Malicky
Chimarra litugena Malicky and Chantaramongkol
Chimarra maoga Oláh and Malicky
Chimarra meorum Chantaramongkol and Malicky
Chimarra mina Blahnik, Arefina-Armitage, and Armitage

Chimarra mlabriorum Chantaramongkol and Malicky
Chimarra mommaides Mey
Chimarra nahesson Malicky and Chantaramongkol
Chimarra opaca Mey
Chimarra quyenta Oláh and Malicky
Chimarra rostrata Blahnik, Arefina-Armitage, and Armitage
Chimarra sirdiqua Oláh and Malicky
Chimarra spinifera Kimmins
Chimarra spitzeri Malicky
Chimarra suthepensis Chantaramongkol and Malicky
Chimarra uncula Mey
Chimarra undulata Blahnik, Arefina-Armitage, and Armitage
Chimarra vitcona Oláh and Malicky

minuta Group, new species group

Chimarra alleni Chantaramongkol and Malicky
Chimarra bimbltona Malicky
Chimarra dakronga Oláh and Malicky
Chimarra damqua Oláh and Malicky
Chimarra haimuoihai Malicky
Chimarra motranga Oláh and Malicky
Chimarra muoitam Malicky
Chimarra pipake Malicky and Chantaramongkol
Chimarra prominens Blahnik, Arefina-Armitage, and Armitage
Chimarra thanglena Oláh and Malicky
Chimarra ungula Blahnik, Arefina-Armitage, and Armitage

georgensis "Group" (*Chimarrhafra* Lestage)

Chimarra corneola Blahnik, Arefina-Armitage, and Armitage

Unplaced within a species group

Chimarra bancha Oláh and Malicky (minuta Group?)
Chimarra carinata Blahnik, Arefina-Armitage, and Armitage
Chimarra dexara Oláh and Malicky (minuta Group?)
Chimarra muoibay Malicky (minuta Group?)
Chimarra muoichin Malicky (digitata Group?)
Chimarra uppita Malicky and Chantaramongkol (minuta Group?)

digitata Group

This is a name originally used by Ross (1956) to refer to a group of *Chimarra* occurring in Asia, but also widely distributed in the African and Australian regions, characterized by having a membranous mesal lobe of tergum X and widely separated, sclerotized lateral lobes, each of which has 2 sensilla (unusually 1, or several). The dorsal margin of segment IX is often very narrow, but usually forms a continuous sclerotized strap. American species of the subgenus *Chimarra* are probably all derived from this group. The group was more formally and narrowly defined by Blahnik et al. (2009). Diagnostic characters include, especially, a characteristic, sinuous inflection of the Rs vein in the forewing, often with a swollen node at the inflection point and distortion of the wing membrane. Usually the discal cell is relatively short (length about 2 times its width). Additionally, the anal veins of the forewing have a cross-vein between 1A and 2A, proximal to the intersection of 3A, so that the 2A vein appears to be "forked" apically. In the other 3 groups discussed here, both the 2A and 3A veins appear to be looped to the 1A vein. Other venational attributes include the *s* cross-vein in the forewing

that is pigmented (not hyaline) and the *m* cross-vein that is distinctly proximal to the *s* and *r-m* cross-veins (thus, the cross-veins are non-linear). Other characters include (usually) the development of well developed dorsolateral apodemes on the anterior margin of segment IX in the male and a strong basal inflection of the inferior appendages, usually with the apical part narrowed and dorsally or posterodorsally directed. At least in the species from Vietnam, the species also seem to be characterized by males with enlarged and modified protarsal claws (also present in many members of the tsudai Group) and with elongate endothecal spines (1-2, or with a 3rd very small apical one). If more than 1 in number, these are asymmetric in size and position on the endotheca. However, the latter 2 characters may not be consistently present or characteristic of species in this group from other geographical areas. In most species of the digitata Group, the endotheca is also "textured" with minute spines or papillate projections (sometimes lengthened to form a tract of small spines) and the ventral apex of the phallotheca is projecting. In almost all of these features, except for the presence of elongate endothecal spines, *C. marginata* Linnaeus (type species for the subgenus *Chimarra*) conforms very closely. It is possible that this group would be more usefully expanded to include this species and renamed the marginata Group. However, we refrain from doing so until all of the various lineages of Old World *Chimarra* are better characterized. Although none of the new species from Vietnam belong to this group, a list of the Vietnamese species included is found in Table 1. These can be added to the list of species from Borneo placed previously in this group by Blahnik et al. (2009). Undoubtedly, examination will show that other Asian *Chimarra* belong here as well.

tsudai Group

This name was first used by Ross (1956) to refer to a group of Asian *Chimarra* characterized by a segment IX that is unsclerotized dorsally, and thus the dorsal margin of segment IX and mesal lobe of segment X is absent or narrowly membranous. These species are also characterized by sclerotized lateral lobes that are divided to form separated mesal and lateral lobes, usually both with multiple (often many) sensilla. The mesal pair is generally membranous basally and forms upright projections straddling the phallic apparatus. More than half the Asian species of *Chimarra* belong to this group, including the majority of the species from Vietnam. In this paper, we describe 5 new species belonging to this group: *C. aculeata*, *C. insolita*, *C. mina*, *C. rostrata*, and *C. undulata*. A number of species in this group have modifications of tergum VIII, often with a mesal invagination and/or marginal spines, but only a few of the species from Vietnam are so characterized. Blahnik et al. (2009) formally defined this group, listed the species belonging to the group, and also discussed additional characters. Venational attributes of the forewing include an Rs vein that is usually somewhat modified, curved toward the anal margin and sometimes weakly inflected just before the fork forming the discal cell. The veins at the basal fork of the discal cell are somewhat swollen and the discal cell is usually relatively elongate (length about 3 times or more its width). Like the digitata Group, the *s* cross-vein in the forewing is usually pigmented (non hyaline) and the *m* cross-vein is proximal to the *s* and *r-m* cross-veins. However, these characters seem to be more variable in this group and some exceptions will probably be noted. Both the 2A and 3A veins of the forewing are looped to the 1A (thus, there is no apparent apical "fork"). In species examined, males have enlarged and modified protarsal claws. Structures of the phallic apparatus are extremely variable in this group and many species have included tracts of small spines or a phallotheca with a projecting apex. Elongate endothecal spines are probably always absent. The elongate spines sometimes featured in illustrations of these species seem invariably to be modifications of the phallotremal sclerite complex, which varies greatly among the species. A list of the Vietnamese species belonging to this group is found in Table 1.

***Chimarra aculeata* sp. n.**
(Figure 1)

Diagnosis. This species is possibly most similar to *C. uncula* Mey. Both species have paired spine-like projections from dorsolateral margins of segment IX and also a modified tergum VIII, with a

mesal invagination and accompanying spines. The differences, however, are considerable. The armature of tergum VIII is especially distinctive in *C. aculeata* in that the dorsal margin has a distinctive pair of brushes composed of many spines bordering the mesal invagination; also, the apices of the resulting lobes each have a small tassel of spines. The shape of the inferior appendages is also quite different in the 2 species.

Description. Forewing length (male) 6.1 mm. Color (in alcohol) yellowish-brown. Head elongate (postocular parietal sclerite extended behind eye). Mesoscutellar setal wart pear-shaped, with usual anterior suture. Maxillary palps with 1st segment very short, 2nd segment relatively elongate (nearly as long as segment 3), 3rd segment elongate, subequal to segment 5, 4th segment short. Tarsi of males highly modified, tarsal claws enlarged and sinuous, asymmetric in length and curvature. Forewing with Rs deflected (curved toward anal margin) and weakly, sinuously inflected before base of discal cell; veins at base of discal cell

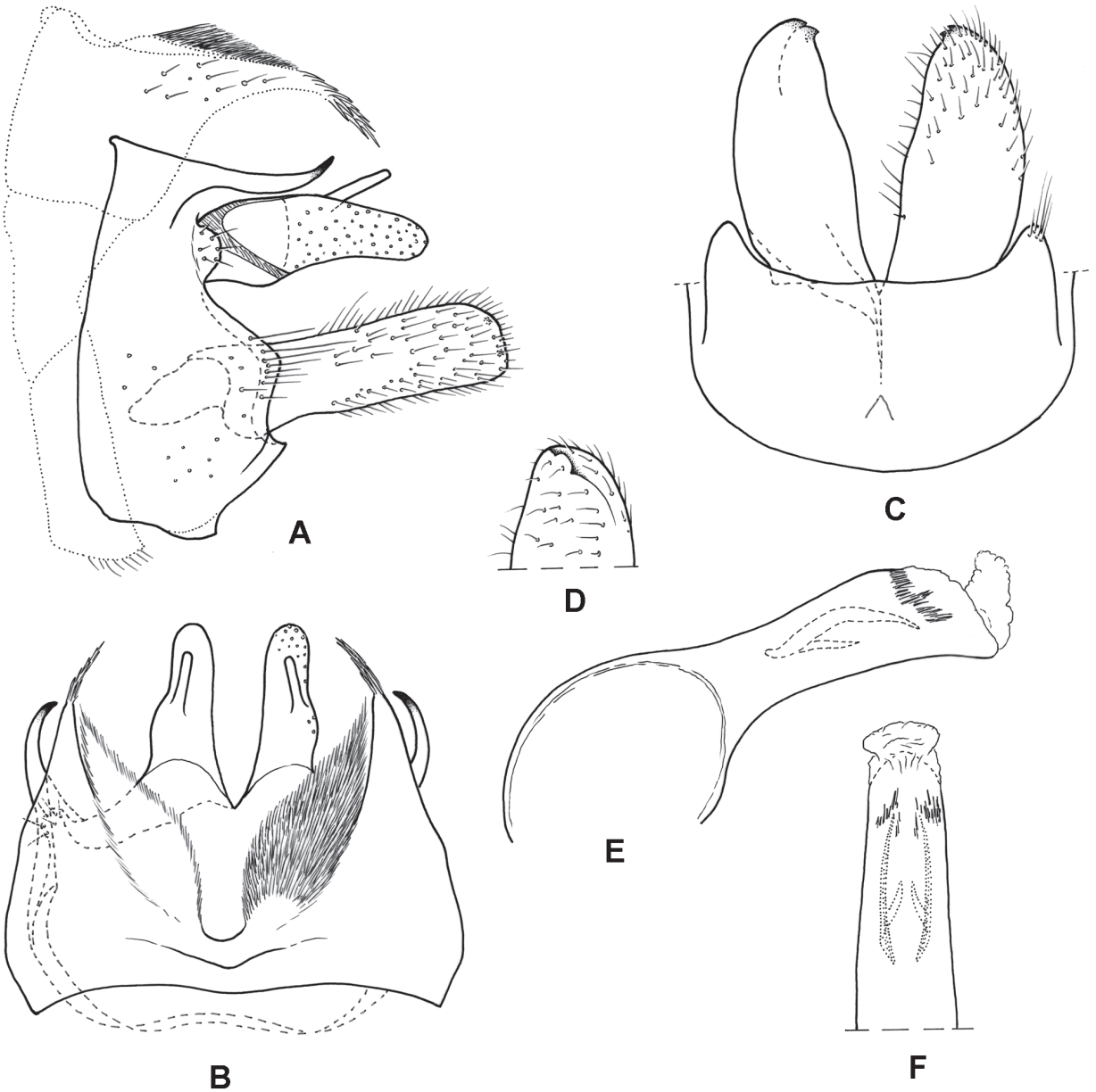

Figure 1. *Chimarra aculeata* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Distal portion of left inferior appendage, dorsal; E) Phallic apparatus, lateral; F) Phallic apparatus, dorsal.

not or hardly swollen, length of discal cell about 3 times width; *r-m* and *m* cross-veins hyaline (unpigmented), *s* not hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 narrowly separated, not fused.

Male genitalia: Segment VIII with sternum very short, tergum highly modified; tergum, as viewed laterally, with ventral margin about 2 times length of sternum, dorsum of tergum about 2 times length at base, narrowing and acute posteriorly, apex with projecting tract of spinose setae, setae somewhat mesally directed, as viewed dorsally; tergum, as viewed dorsally, with deep, more or less V-shaped mesal emargination, emargination extending almost to anterior margin, lateral margins of emargination with dense, leaf-shaped tract of spinose setae, tract narrow at base, tapering, acuminate apically. Segment IX unsclerotized dorsally, with distinct, very short dorsolateral apodemes on anterior margin; as viewed laterally, with anterior margin extending nearly linearly from apodemes, anteroventral margin not produced (truncate as viewed dorsally or ventrally); dorsolateral margins of tergum, on either side, with posteriorly projecting, spine-like process, extending about as far as lobe of tergum VIII, processes slightly mesally curved as viewed dorsally; width of segment below processes relatively short (anterior and posterior margins narrowly separated), posterior margin lengthened below preanal appendages, angulate at about level of inferior appendages; ventral process very short, subtriangular, broadest basally, projecting ventrally. Tergum X with lateral lobes moderately elongate, simple in structure; in lateral view, linear with rounded apex, in dorsal view with slight bulge on lateral margin at about middle, apices rounded; lobes with numerous sensilla, almost uniformly distributed. Mesal lobes of tergum X short, digitate, weakly sclerotized, posteriorly directed, forming about 45 degree angle with lateral lobe, each lobe (apparently) with 3 minute sensilla, 2 apically and 1 at midlength on lateral margin. Preanal appendages very small and rounded, somewhat flattened laterally, fused basally to posterior margin of segment IX. Inferior appendages, as viewed laterally, moderately elongate, linear, uniform in width, subtruncate apically; as viewed ventrally, with lateral margins rounded, mesal margins subparallel in basal half, narrowing apically, apices rather broadly rounded; appendages, as viewed caudally, with pair of minute sclerotized spine-like projections or cusps on mesal margin. Phallotheca relatively short, tubular, with usual basal expansion. Endotheca apparently short, with paired tracts of short spines. Phallotremal sclerite complex prominent, extending over half length of phallotheca, composed of ring structure with very short, paired, spinose ventral "rods"; ring open dorsally, on each side with projecting, elongate, curved, spine-like dorsolateral sclerites.

Material examined. Holotype male: **VIETNAM**: Ha Giang Province, 1170 m, 22°46.07'N, 104°49.51'E, 11-16 September 2000, Malaise trap, C. Johnson, K. Long (**AMNH**).

Etymology. This species is named for the spinose setae on tergum VIII (*aculeata* is Latin for having or bearing spines).

Chimarra areli Malicky and Mey 2008 (in Malicky 2008), new record

Material examined. VIETNAM: Kon Tum Province, vill. Mang Canh, 2-9 June 2006, V. Zolotuhin, 4 males, 9 females (**MNHB**); Quang Nam Province, Ngoc Linh, 920 m, 15°11.2'N, 108°2.3'E, 15 March 1999, light trap, D. Grimaldi, L. Herman, C. Johnson, K. Long, E. Sterling, 1 male (**AMNH**).

Distribution. Cambodia, Vietnam (Kon Tum, Quang Nam).

Chimarra insolita sp. n.

(Figure 2)

Diagnosis. We are unsure about the closest affinity of this species, which has a general similarity to a number of species in the tsudai Group. It is most readily diagnosed by the distinctive, angled apicomesal projection on the dorsal margin of each inferior appendage. This projection is also evident in lateral view.

Description. Forewing length (male) 6.2 mm. Color (in alcohol) yellowish-brown. Head relatively elongate (postocular parietal sclerite extended behind eye). Mesoscutellar setal wart pear-shaped, with usual anterior suture. Maxillary palps with 1st segment very short, 2nd segment moderately elongate (shorter than segment 3, longer than segment 4), 3rd segment relatively elongate, slightly shorter than segment 5, 4th segment short. Tarsi of males somewhat modified, tarsal claws moderately enlarged, asymmetric in length and curvature. Forewing with Rs strongly deflected (curved toward anal margin) and sinuously inflected before base of discal cell; veins at base of discal cell somewhat swollen, length of discal cell about 3 times width; *r-m* and *m* cross-veins hyaline (unpigmented), *s* not hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 narrowly separated, not fused.

Male genitalia: Segment VIII with sternum short, subtending ventral margin of segment IX; tergum widened dorsally, dorsal margin rounded, projecting, without distinct modifications, about twice length of sternum VIII. Segment IX unsclerotized dorsally, with distinct, short dorsolateral apodemes on anterior margin, anterior margin extending nearly linearly from apodemes, curved in

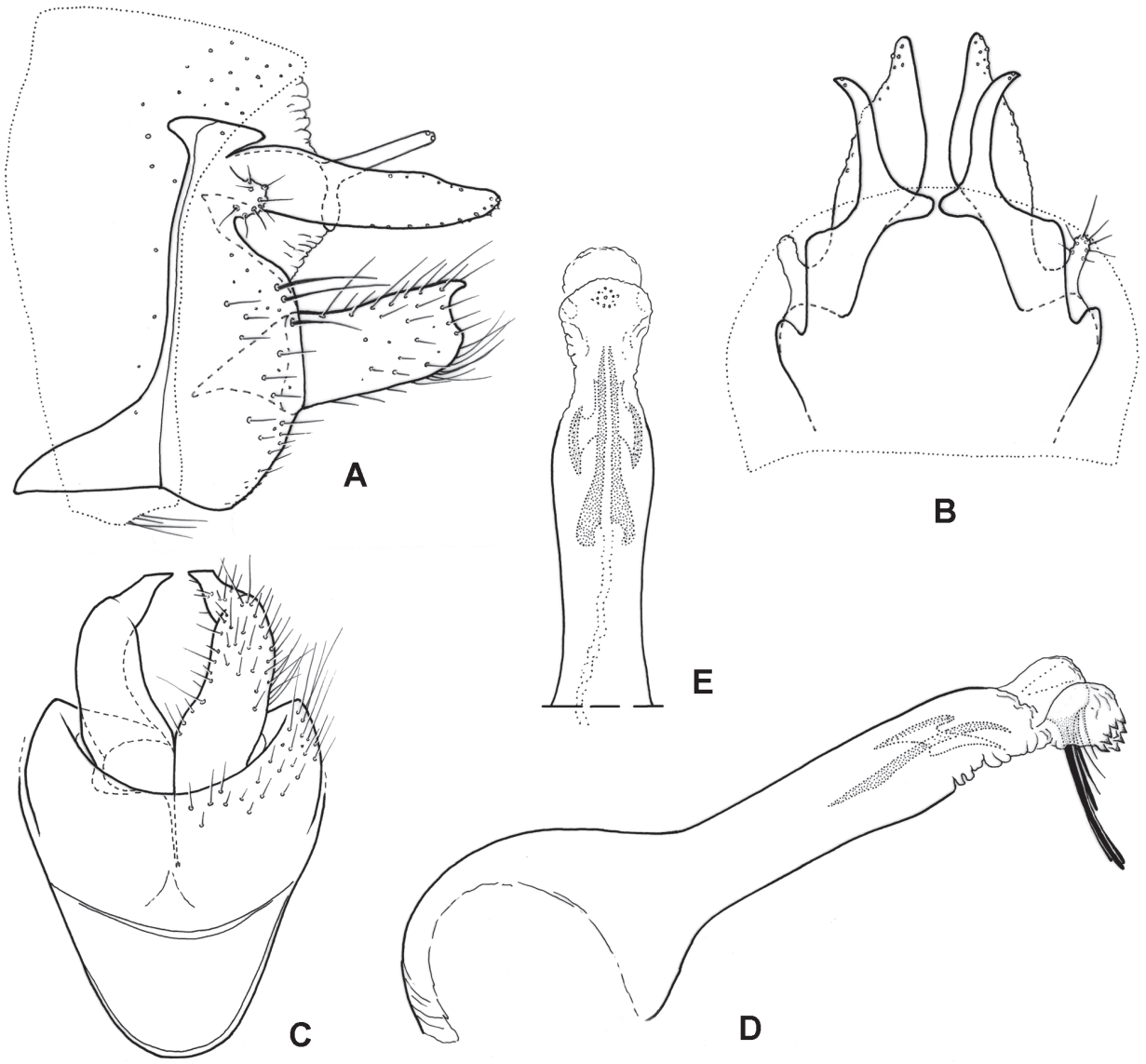

Figure 2. *Chimarra insolita* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

ventral half to form strongly projecting ventral margin, anteroventral margin strongly convexly rounded (as viewed dorsally or ventrally); segment very short dorsally (anterior and posterior margins narrowly separated), posterior margin abruptly, angularly lengthened below preanal appendages; ventral process very short, subtriangular, broad basally, ventrally projecting. Tergum X with lateral lobes simple in structure, elongate, narrow, rounded apically, with numerous sensilla along dorsal, ventral, and apical margins; mesal lobes digitate, nearly uniform in width, apices acute, lobes strongly reclinate and posteriorly projecting, apices of lobes, as viewed dorsally, curved outward, each lobe with two small subapical sensilla. Preanal appendages short, rounded, somewhat constricted basally (knob-like). Inferior appendages relatively short, subquadrate, each with mesally curved process from posterodorsal margin; as viewed ventrally, with apicoventral margin rounded and dorsomesal process narrowing apically to form very distinct, acute, posteromesally angled process; extreme apex of process mesally incurved, resulting in apices of paired appendages being nearly proximate. Phallotheca moderate in length, tubular, with usual basal expansion. Endotheca short, membranous, apicomesally with moderately elongate, narrow spine-like projection, apparently formed of several closely apposed seta-like spines; apex also with pair of small, rounded, membranous lobes, each with numerous, minute, weakly-sclerotized spines. Phallotremal sclerite complex elongate, more than half length of phallotheca, formed of elongate curved rod and ring structure with paired lateral sclerites.

Material examined. Holotype male: **VIETNAM**: Ha Giang Province, 1210 m, 22°45.55'N, 104°50.02'E, 22 September 2000, aerial Malaise trap, C. Johnson (**AMNH**). **Paratype**: 1 male, Ha Giang Province, 1170 m, 22°46.15'N, 104°49.38'E, 7 September 2000, Black light/MV lamp, C. Johnson, T.C. Nguyen, R. Hanner (**AMNH**).

Etymology. This species is named for the unusually long, spine-like projection of the endotheca (*insolita* is Latin for unusual or strange).

***Chimarra mina* sp. n.**
(Figure 3)

Diagnosis. *Chimarra mina* belongs to a subgroup of species in the tsudai Group characterized by having a distinctive lateral brush of very elongate setae on the inferior appendages. The subgroup includes *C. crepidata* Kimmins, *C. haimuoi* Malicky, *C. lahuorum* Chantaramongkol and Malicky, *C. oreithyia* Malicky, *C. pontus* Malicky, *C. scopulifera* Kimmins, *C. semiramis* Malicky, and *C. suthepensis* Chantaramongkol and Malicky. Species differ in details of the shape of the inferior appendages, especially the position and shape of the apicomesal projections, the shape of the lateral lobes of tergum X, and in the armature of the phallic apparatus. Distinctive characters of *C. mina* include apicomesal projections on the inferior appendages that are relatively narrow basally (and thus more distinctly awl-like than some others in this group), a short tergum X with a basolateral bulge, and endothecal spines that include a pair of clustered spines.

Description. Forewing length (male) 6.0 mm. Color (in alcohol) yellowish-brown. Head relatively elongate (postocular parietal sclerite extended behind eye). Mesoscutellar setal wart pear-shaped, with usual anterior suture. Maxillary palps with 1st segment very short, 2nd segment moderately elongate (shorter than segment 3, longer than segment 4), 3rd segment elongate, subequal to segment 5, 4th segment short. Tarsi of males distinctly modified, tarsal claws enlarged and sinuous, asymmetric in length and curvature. Forewing with Rs deflected (curved toward anal margin) and sinuously inflected before base of discal cell; veins at base of discal cell somewhat swollen, length of discal cell about 3 times width; *r-m* and *m* cross-veins hyaline (unpigmented), *s* not or only slightly hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 narrowly separated, not fused.

Male genitalia: Segment VIII with sternum short, subtending ventral margin of segment IX, ventral margin with very short posteroventral process, process broadly rounded as viewed ventrally, posterior margin of sternum with staggered row of moderately elongate setae on either side of ventral

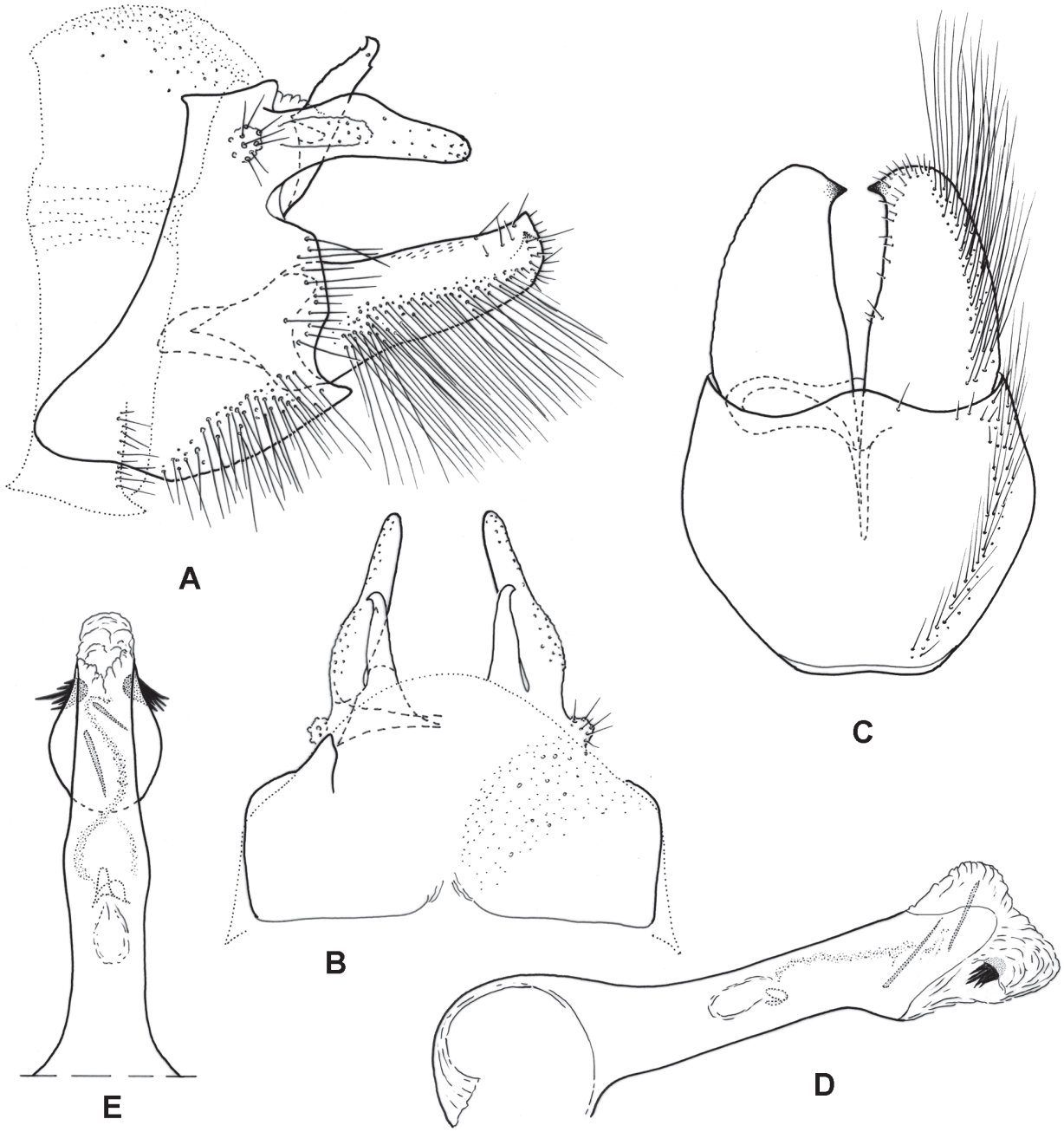

Figure 3. *Chimarra mina* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

process; tergum slightly widened dorsally, without distinct modifications. Segment IX unsclerotized dorsally, with dorsolateral apodemes minute, scarcely developed; as viewed laterally, with anterior margin extending linearly from apodemes, curved in ventral half to form projecting ventral margin, anteroventral margin subtruncate mesally (as viewed dorsally or ventrally); segment short dorsally (anterior and posterior margins narrowly separated), abruptly, angularly lengthened on posterior margin below preanal appendages and additionally lengthened below inferior appendages; ventral process absent; ventrolateral margins of segment with brush of moderately elongate setae, as apparent extension of lateral brush of inferior appendages, brush extending half or more length of segment, mesal surface of segment (between brushes) very scabrously developed. Segment X with lateral lobes

moderately elongate (shorter than inferior appendages); each lobe, as viewed laterally, with broadly rounded dorsal bulge near middle and apparent lateral bulge near base, apex of lobe broadly rounded; as viewed dorsally, with distinct, densely sensillate, basolateral bulge, apex of lobe digitate, rounded apically, apices of opposite lobes slightly converging; sensilla numerous on apical and lateral margins of lobes, very dense on basolateral bulges; mesal lobes of tergum X more or less upright, somewhat posteriorly directed, each lobe moderately broad basally, narrowed apically, extreme apex with small anteriorly hooked spine, each lobe (apparently) with 2 minute sensilla, located preapically on dorsal and ventral margins. Preanal appendages very small, rounded, fused basally to lateral margin of segment IX. Inferior appendages moderately elongate, linear; as viewed laterally, wide at base and narrowed apically, apex subtruncate, ventral margin of apex rounded, dorsal margin with acute angle (apicomesal projection), lateral margin of each appendage with brush of very elongate, posteriorly directed setae, not quite extending to apex; as viewed ventrally, with lateral margins broadly rounded, apices subtruncate, each with distinct, sclerotized, flattened apicomesal projection on mesal surface, projection relatively narrow basally, very distinctly acute as viewed ventrally, ventral surface of appendages without setae, except for distinctly demarcated lateral brush. Phallotheca moderately elongate, tubular, with usual basal expansion, apex with distinct rounded lateral expansions (possibly sclerotized base of endotheca) and also slight ventral expansion. Endotheca with 2 short, narrow, distinctly sclerotized spines and also paired clusters of shorter, sclerotized spines (about 4-6, varying in length), endothecal membrane unexpanded in specimen examined, but apparently moderately elongate and textured with minute spines. Phallotremal sclerite complex composed of short rod and ring structure, rod with small sclerite near apex.

Material examined. Holotype male: **VIETNAM**: Ha Tinh Province, Huong Son, 900 m, 18°21'N, 105°15'E, 15 May 1998, Malaise trap, J. Carpenter, D. Grimaldi, L. Herman, K. Long, D. Silva (**AMNH**).

Etymology. This species is named for the non-hairy ventral surface of the inferior appendage (*mina* is Latin for hairless).

***Chimarra rostrata* sp. n.**
(Figure 4)

Diagnosis. This species is perhaps most similar, in general features, to *C. areli* Malicky and Mey, especially in the general shape of the inferior appendages. In both species these are similar in length and have a distinct preapical indenture on the mesal margin, as viewed ventrally. *Chimarra rostrata* differs in having 2 short apicomesal spine-like projections on each of the inferior appendages, and also in the short armored mesal lobes of tergum X, as well as the distinctive, sclerotized, downturned ventral apex of the phallotheca.

Description. Forewing length (male) 5.8-6.2 mm. Color (in alcohol) dark brown. Head moderately elongate (postocular parietal sclerite somewhat extended behind eye). Mesoscutellar setal wart broadly pear-shaped, without apparent anterior suture. Maxillary palps with 1st segment very short, 2nd segment moderately elongate (shorter than segment 3, longer than segment 4), 3rd segment relatively elongate, 4th segment short, 5th segment slightly shorter than segment 3. Tarsi of males modified, tarsal claws moderately to distinctly enlarged, asymmetric in length and curvature. Forewing with Rs deflected (curved toward anal margin) and sinuously inflected before base of discal cell; veins at base of discal cell slightly swollen, length of discal cell about 3 times width; *r-m* and *m* cross-veins hyaline (unpigmented), *s* not hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 narrowly separated, not fused.

Male genitalia: Segment VIII with sternum short, subtending ventral margin of segment IX; tergum scarcely longer than sternum, only slightly widened dorsally, without modifications. Segment IX unsclerotized dorsally, with distinct, short dorsolateral apodemes on anterior margin; as viewed

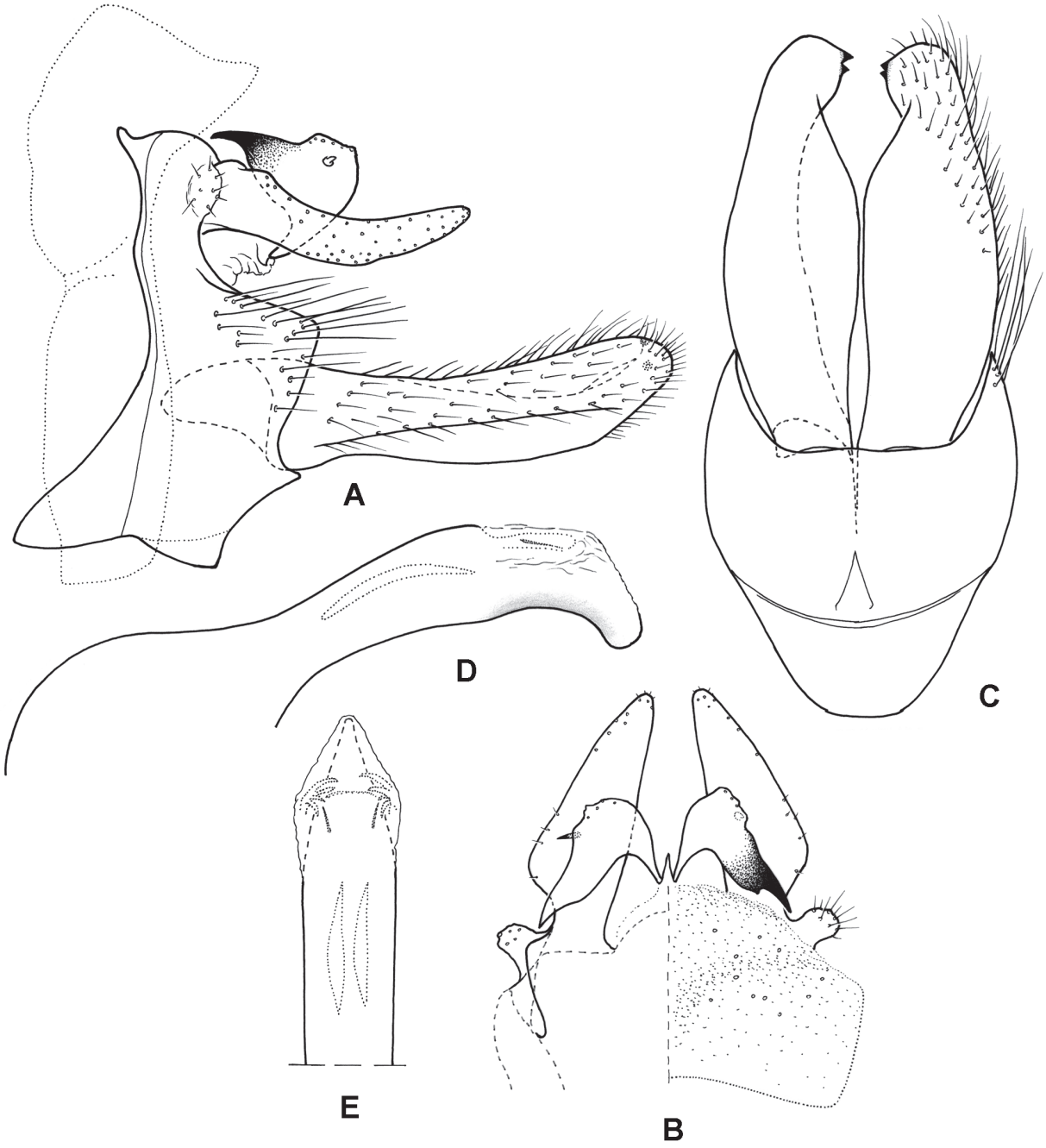

Figure 4. *Chimarra rostrata* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

laterally, with anterior margin extending nearly linearly from apodemes, curved in ventral half to form strongly projecting ventral margin, anteroventral margin strongly convexly rounded (as viewed dorsally or ventrally); segment very short dorsally (anterior and posterior margins narrowly separated), posterior margin abruptly, angularly lengthened below preanal appendages; ventral process very short, subtriangular, broad basally, ventrally projecting. Tergum X with lateral lobes moderately elongate (but much shorter than inferior appendages), dorsoventrally flattened, and relatively simple in structure; as viewed laterally, slightly curved downward at base, gradually narrowed and subacute apically; as viewed dorsally, elongate subtriangular, broadened near base and tapering apically, apices

subacute; paired lobes relatively narrowly separated mesally, each lobe with numerous sensilla on lateral and ventral margins; mesal lobes of tergum X short and broad, complex in structure, ventral margins converging below phallotheca, dorsal margins flared outward, with 1-3 sclerotized, anteriorly curved spines on lateral margin, somewhat variably developed in different specimens and not always symmetrical on 2 lobes. Preanal appendages very short, rounded, somewhat flattened, fused basally to lateral margin of segment IX. Inferior appendages elongate, moderately dorsoventrally flattened, linear and slightly upturned as viewed laterally, with ventral margin slightly bulging; as viewed ventrally, relatively broad and uniform in width for basal three-fourths, very distinctly, angularly notched on mesal surface at apical one-fourth, apices more or less rounded, each with pair of very small, spine-like preapical projections. Phallotheca moderately elongate, tubular, with usual basal expansion, apicoventral margin sclerotized and projecting, distinctly downturned, extreme apex forming a subtriangular, laterally flattened (keeled) projection. Endotheca (apparently) only moderately elongate, mostly membranous and unmodified, but with small cluster of about 5-6 small spines. Phallotremal sclerite complex composed of pair of elongate, flattened, sclerotized rods, extending about half length of phallotheca.

Material examined. Holotype male: **VIETNAM**: Thua Thien-Hue Province, Bach Ma NP, near junction of Rhododendron and Five Lakes trails, 1200 m, 16°11.17'N, 107°50.92'E, 16 June 2000, B. Hubley, C. Darling (**ROM 2000531**). **Paratypes**: 28 males, same data as holotype; 1 male, 2 females, Quang Nam Province, Ngoc Linh, 1460 m, 15°2'N, 108°2.3'E, 24 March 1999, sweep, D. Grimaldi, L. Herman, C. Johnson, K. Long, E. Sterling (**AMNH**).

Etymology. This species is named for the beak-like mesal lobes of tergum X (*rostrata* is Latin for beaked).

Chimarra suthepensis Chantaramongkol and Malicky 1989, new record

Material examined. VIETNAM: Ha Tinh Province, Huong Son, 900m, 18°21'N, 105°15'E, 15 May 1998, Malaise trap, J. Carpenter, K. Long, D. Grimaldi, L. Herman, D. Silva, 1 male (**AMNH**).

Distribution. Peninsular Malaysia, Thailand, Vietnam (Ha Tinh).

Chimarra undulata sp. n.
(Figure 5)

Diagnosis. We are unsure of the closest affinity of this species. Among species in the tsudai Group, it is distinctive because of the shape of the inferior appendages, which are very broad basally, as viewed laterally, tapering linearly to an acute apex. The relatively elongate, broad, undulate shape of the lateral lobes of tergum X constitutes a useful additional diagnostic character.

Description. Forewing length (male) 5.0 mm, (female) 5.5 mm. Color (in alcohol) pale yellowish-brown, appendages and setal warts yellowish-white. Head moderately elongate (postocular parietal sclerite somewhat extended behind eye). Mesoscutellar setal wart pear-shaped, without apparent anterior suture. Maxillary palps with 1st segment very short, 2nd segment moderate in length (shorter than 3rd, longer than 4th), 3rd segment elongate, subequal to segment 5, 4th segment short. Tarsi of males distinctly modified, tarsal claws enlarged and sinuous, asymmetric in length and curvature. Forewing with Rs distinctly deflected (curved toward anal margin) and weakly, sinuously inflected before base of discal cell; veins at base of discal cell slightly swollen, length of discal cell about 3 times width; *r-m* and *m* cross-veins hyaline (unpigmented), *s* not hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 narrowly separated, not fused.

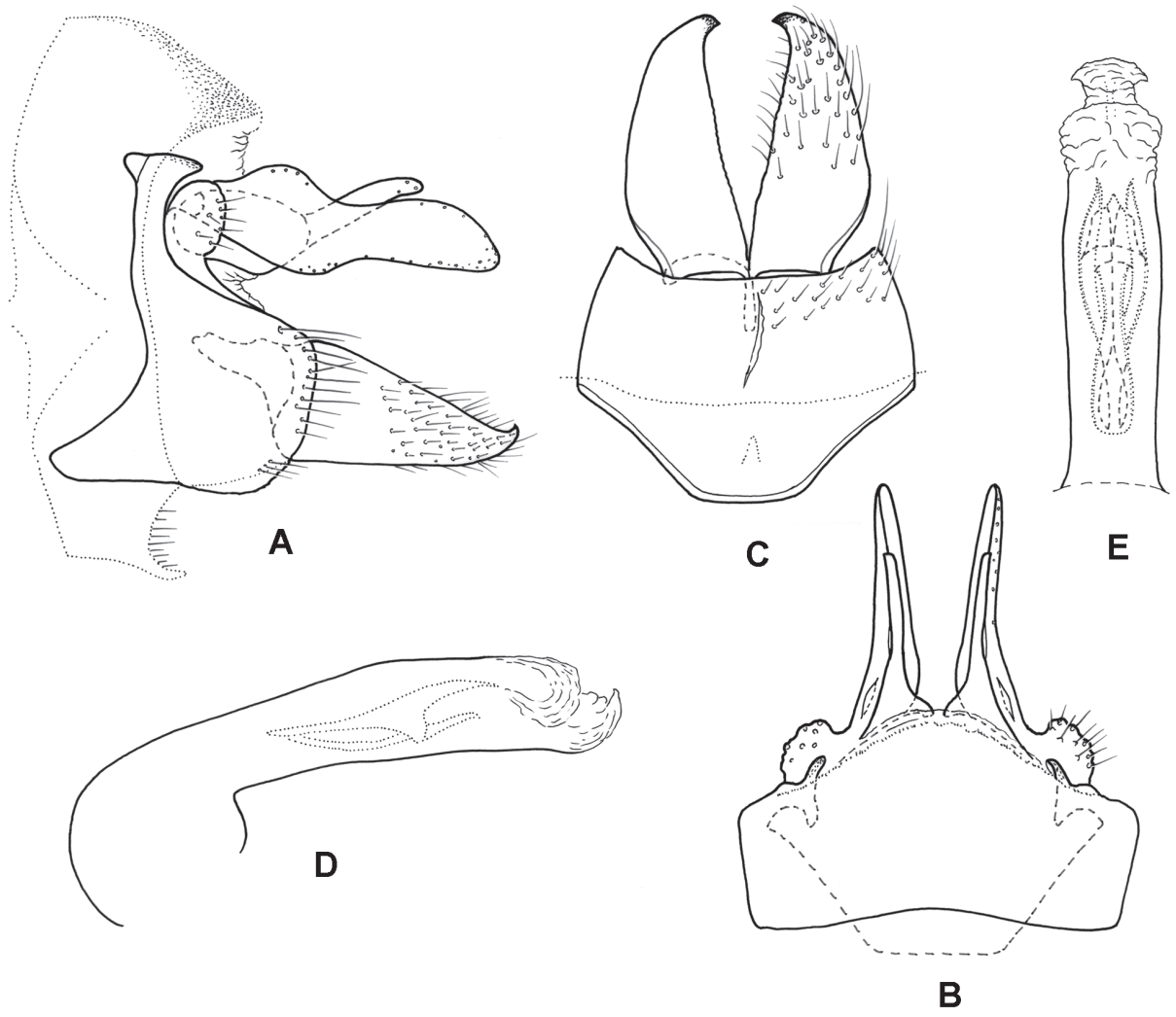

Figure 5. *Chimarra undulata* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

Male genitalia: Segment VIII relatively short, partially subtending ventral margin of segment IX, ventrally with distinct, short, subacute, posteroventrally projecting process at midlength; tergum widened dorsally, dorsal margin protruding, length about 1.5 times that of sternum, without distinct modifications. Segment IX unsclerotized dorsally, with distinct, small dorsolateral apodemes on anterior margin; in lateral view, with anterior margin extending nearly linearly from apodemes, curved in ventral half to form projecting ventral margin, anteroventral margin (as viewed dorsally or ventrally) with lateral margins tapering, subtruncate mesally; segment very short dorsally at level of preanal appendages (anterior and posterior margins very narrowly separated), posterior margin greatly lengthened below preanal appendages to dorsal margin of inferior appendages (about midheight of segment), then abruptly, angularly bent, extending linearly to ventral margin of segment; ventral process very short and ventrally projecting, broad basally, rounded apically. Tergum X, as viewed laterally, with lateral lobes relatively elongate and broad (greater in total length than inferior appendages), each with weakly rounded projection on basodorsal and ventral margins, apex rounded, sensilla mostly restricted to dorsal, ventral, and apical margins; mesal lobes of tergum X digitate, rather strongly reclinate, posteriorly directed, each with about 4 small sensilla near apex. Preanal appendages moderately large, rounded, laterally flattened, fused basally to posterior margin of segment

IX. Inferior appendages moderately elongate; as viewed laterally, trianguloid, base very broad, dorsal and ventral margins linear, tapering to sclerotized apex, apex with apparent mesal curvature even in lateral view; appendages, as viewed ventrally, with lateral margins curved (more strongly near base and at apex), mesal margins nearly linear, apices of appendages incurved and appearing acute; apices, as viewed caudally, narrowly subtruncate (very weakly emarginate). Phallotheca relatively short, tubular, slightly widened from base to apex, basal expansion moderate. Endotheca (apparently) short and membranous, without spines. Phallotremal sclerite complex very enlarged and elongate, about two-thirds length of phallotheca; ring structure not apparent as such, but with elongate, paired, dorsolateral sclerites projecting from general region of "ring", each forked preapically, apices of both branches acute; ventral "rod" elongate, sclerotized, evident.

Material examined. Holotype male: **VIETNAM**: Quang Nam Province, Ngoc Linh, 950 m, 15°10'N, 108°5'E, 16 April 1999, Malaise trap, K. Long, C. Johnson (**AMNH**).

Etymology. This species is named for the undulate dorsum of the lateral lobes of tergum X (*unda* is Latin for wave).

minuta Group, new group

Eleven species, including *C. prominens* and *C. ungula* described below, are assigned to a new species group (Table 1), and may be primitive (plesiomorphic), species related to the digitata Group, as defined by Blahnik et al. (2009). They have some of the apomorphic characters of this group, but also have retained many plesiomorphic characters. The mélange of characters makes assessing their actual relationship difficult. The plesiomorphic characters would exclude them from being considered members of the digitata Group, *sensu strictu*. To be considered as a separate group, the included taxa must be monophyletic. Evidence for monophyly of this group is admittedly rather weak. However, all of the species seem to be small in size and have the Sc and R_1 of the hind wing fused (a character that has apparently evolved multiple times in *Chimarra*, but is not typical of the digitata Group). Additionally, they can be recognized by a set of plesiomorphic characters not found in the digitata Group, *sensu strictu*, as discussed below. The set of plesiomorphic and apomorphic characters possessed by these species was pointed out in the redescription of *C. polyneikes* Malicky by Blahnik et al. (2009), without the awareness that many species, including a number from Vietnam, share this character set. The group is named for *C. minuta* Martynov, a species described from India. It is the first named species of *Chimarra* (of which we are aware) that clearly belongs here. The group seems to be widespread and a number of additional species probably belong here; the general similarity of species in this group to species in the digitata Group makes it difficult to assign species to either one group or the other, based solely on illustrations and descriptions found in the literature, and accounts for why some of the species from Vietnam were not assigned to species group. It is also possible that when all species are considered, some will be found to form an evolutionary grade connecting the 2 groups. At this point, and particularly with reference to the species from Vietnam, it seems useful to segregate species into these 2 groups. A tentative list of the species from Vietnam belonging to these 2 groups is included in Table 1.

Primitive or plesiomorphic characters (not found in the digitata Group, *sensu strictu*) include a straight or weakly curved Rs vein in the forewing and a tendency for the *s* cross-vein to be hyaline (unpigmented). Additionally, unlike species in the digitata Group, the anal veins of the forewing lack an apical fork (2A and 3A both looped to 1A). That this is a primitive condition in the subgenus *Chimarra* is argued by the presence of this state in the tsudai and georgensis groups, as well as in the subgenera *Curgia* and *Otarrha* (see Discussion). Other primitive characters include males with unmodified protarsal claws, the absence of a pronounced dorsolateral apodeme on the anterior margin of segment IX (although a minute apodeme or broadly rounded projection may be present), absence of a textured or minutely spined endotheca, and absence of a sclerotized ventral apex of the phallotheca (characters generally found in species in the digitata Group, but not confined to it).

Apomorphic characters suggesting a relationship to the digitata Group include the presence of exactly 2 sensilla on tergum X of males, the *m* cross-vein in the forewing that is proximal to the *s* and *r-m* cross-veins (unlike members of the georgensis "Group", as well as other subgenera of *Chimarra* and the genus *Chimarrhodella* Lestage) and also inferior appendages that have a distinct basal inflection. However, in individual taxa (including *C. polyneikes*) the *m* cross-vein may be linear with the *s* and *r-m* cross-veins, narrowing the distinction between this group and the georgensis "Group", which is also largely characterized by plesiomorphic characters. In most of the taxa in the minuta Group, the *m* cross-vein is not very greatly removed from the *s* and *r-m* cross-veins, possibly accounting for the variability. A small ventral process on segment VIII of the male seems to be invariably present in members of this group; it may be present or absent in members of the digitata Group. It is difficult to say whether this is a plesiomorphic or apomorphic character. Like members of the digitata Group, 2 relatively elongate endothecal spines are present. However, these appear to be always equal in length and symmetrically position, thus differing from members of the digitata Group found in Vietnam, though the character state seems to be present in some members of the digitata Group from other regions. The function and etiology of these elongate endothecal spines is unknown; they seem to be incompletely emerged even when the endotheca is fully everted. Inasmuch as it is typical of species in the digitata Group to have an elongate endotheca, it may be that the endothecal spines somehow aid in the eversion of the structure, the asymmetrically positioned spines possibly allowing for a longer endotheca. It is tempting to correlate these elongate spines with parameres, although Schmid (1989) argued for the ancestral loss of these structures in the suborder Annulipalpia. Certainly, they are much simpler in structure than would be typical for parameres. Possibly, they have been "rederived" in the *Chimarra* that possess them from a latent developmental ground plan.

Description. Forewing without a pronounced sinuous inflection of Rs, vein straight or sometimes weakly curved toward anal margin; veins at base of discal cell usually somewhat enlarged; discal cell relatively short (length about 2.5 times width); *m* cross-vein usually proximal to *s* and *r-m* cross-veins, or occasionally co-linear, *s* cross-vein hyaline; 2A and 3A both looped to 1A (2A without apparent apical "fork"). Male protarsal claws unmodified, not enlarged.

Male genitalia: Segment VIII not highly modified, tergum often slightly longer than sternum, sternum apparently always with short ventral process. Segment IX with anteroventral margin at least somewhat expanded, sometimes distinctly so, subtruncate or weakly invaginated mesally as viewed dorsally or ventrally; anterodorsally without distinct apodemes (but small projections or broadly rounded marginal projections sometimes present); dorsal margin relatively short, but present, continuous posteriorly with projecting membranous mesal lobe of tergum IX; ventral process usually very small, subtriangular, ventrally or posteriorly projecting. Membranous mesal lobe of tergum X relatively short, sometimes lightly sclerotized, weakly divided apically or not, never with sensilla. Lateral lobes of tergum X sclerotized, widely separated, often relatively short and simple in structure, sensilla reduced to 2 (apparently consistently), these usually large and prominent. Preanal appendages short, setose, often somewhat flattened. Inferior appendages very variable in shape, usually with a strong basal inflection, as viewed laterally (as in members of the digitata Group), or with apical half abruptly narrowed, as viewed ventrally. Phallotheca generally narrow tubular, without projecting ventral apex. Endotheca with 2 endothecal spines (relatively short to very elongate), symmetrical in size and position, membrane not noticeably "textured" with papillae or small spines. Phallotremal sclerite complex variable in length and development.

Chimarra pipake Malicky and Chantaramongkol 1993, new record

Material examined. VIETNAM: Thua Thien-Hue Province, Nam Dong District, Huong Loc commune, ca. 9 km SE Khe Tre, 16°9.403'N, 107°47.782'E, 26 May - 1 June 2002, C. Darling, 2 males, 1 female (**ROM 2002508**).

Distribution. Thailand, Vietnam (Thua Thien-Hue).

***Chimarra prominens* sp. n.**
(Figure 6)

Diagnosis. This species is probably most like *C. haimuoihai* Malicky. Both species have rather similar shaped inferior appendages, more or less linear, as viewed laterally, and with a transverse ridge on the mesal surface. Also, both species have a tergum X with short lateral lobes, each of which has a projecting ventral lobe with 2 prominent sensilla. *Chimarra prominens* differs significantly in having a relatively unmodified tergum VIII and in having 2 pairs of elongate spines in the phallic apparatus.

Description. Forewing length (male) 3.9 mm. Color (in alcohol) pale yellowish-brown, appendages yellowish-white. Head short (postocular parietal sclerite short). Mesoscutellar setal wart pear-shaped, with usual short anterior suture. Maxillary palps with 1st segment very short (hardly longer than

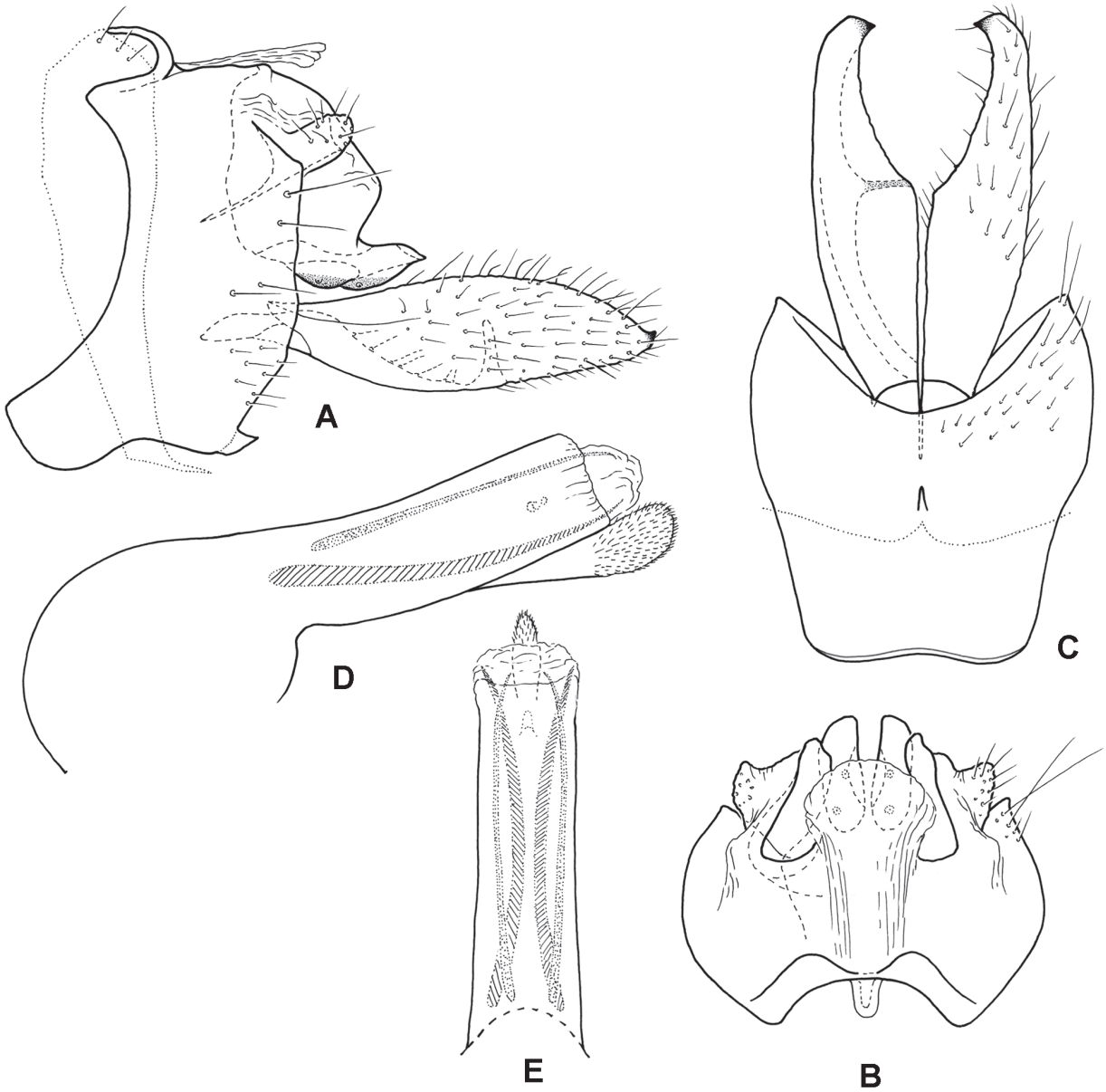

Figure 6. *Chimarra prominens* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

wide), 2nd segment relatively short (slightly longer than segment 4), 3rd segment elongate (nearly 2 times length of segment 4), 5th segment slightly longer than segment 3. Male with tarsi very narrow, tarsal claws very small, symmetrically curved (unmodified). Forewing with Rs not or scarcely curved, discal cell relatively short (length about 2 times width), veins at base of discal cell distinctly swollen; *s*, *r-m* and *m* cross-veins hyaline, *s* and *r-m* linearly aligned, *m* distinctly proximal, anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 fused.

Male genitalia: Segment VIII with sternum very narrow ventrally, subtending ventral margin of segment IX, posteroventral margin with short, dorsoventrally flattened process, apex of process acute in both lateral and ventral views; tergum slightly widening dorsally, posteromesal margin depressed, with deep V-shaped emargination, extending almost to anterior margin, otherwise unmodified. Segment IX sclerotized dorsally; as viewed dorsally, with posteromesal margin concave, with small, anteriorly curved, tab-like mesal sclerite; as viewed laterally, with short, broadly rounded dorsolateral apodemes on anterior margin, anterior margin concavely rounded, ventral margin moderately produced, weakly emarginate mesally, as viewed dorsally or ventrally; segment moderately elongate dorsally, length more or less uniform extending to ventral projection; posterior margin weakly angulate at preanal appendages, narrowing below inferior appendages; ventral process very short, subtriangular, posteriorly-directed. Tergum X with mesal lobe short, membranous; lateral lobes sclerotized, very short, dorsal margins strongly sloped, ventral margin of each lobe with projecting, cupped lobe with 2 prominent sensilla near ventral margin, lobes from opposite sides converging mesally below phallic apparatus. Preanal appendages short, rounded, slightly narrowing basally (knob-like), emerging intersegmentally between terga IX and X. Inferior appendages moderately elongate, linear, narrowed basally and apically, apex forming small, acute, mesally directed, tooth-like projection; as viewed ventrally, with lateral margins gradually curved, mesal margins subparallel for more than half length, abruptly diverging and narrowing apically; mesal margin with conspicuous sclerotized transverse ridge at inflection point. Phallotheca moderately elongate, broadly tubular with usual basal expansion; apicoventral margin forming projecting apical sclerite; sclerite, as viewed laterally, with apex rounded and covered with minute microtrichia, as viewed ventrally with apex strongly compressed and keel-like. Endotheca membranous (not textured); phallic apparatus, internally, with 2 pairs of elongate, symmetrically positioned spines, ventral pair robust, somewhat dorsally curved, apices slightly diverging, dorsal pair much narrower, needle-like, nearly straight except apices distinctly ventrally curved. Dorsal pair of spines possibly part of modified phallotremal sclerite complex, phallotremal sclerite structure otherwise difficult to discern or interpret.

Material examined. Holotype male: **VIETNAM**: Ha Tinh Province, Huong Son, 200-300 m, 18°21'N, 105°15'E, 5 May 1998, sweep, J. Carpenter, D. Grimaldi, L. Herman, K. Long, D. Silva (**AMNH**).

Etymology. This species is named for the apicoventral projection of the phallotheca (*prominens* is Latin for jutting out or prominent).

Chimarra ungula sp. n.

(Figure 7)

Diagnosis. This species has an apparent close similarity to both *C. thaiorum* Chantaramongkol and Malicky and *C. atnia* Malicky and Chantaramongkol, especially in the elongate inferior appendages and the curvature of these in ventral view. It differs from either species in that the apices of the appendages are more strongly bent in their apical half, as viewed laterally, and in the very prominent basomesal protuberance of the appendages. Additionally, the lateral lobes of tergum X are much shorter and the mesal lobe of tergum X has a very distinctive Y-shaped apicomesal sclerite.

Description. Forewing length (male) 3.8 mm. Color (in alcohol) yellowish-brown. Head short (postocular parietal sclerite not elongate). Mesoscutellar setal wart pear-shaped, with usual anterior suture. Maxillary palps absent (broken off in specimen examined). Male with tarsi very narrow, tarsal claws very small, symmetrically curved (unmodified). Forewing with Rs not noticeably modified,

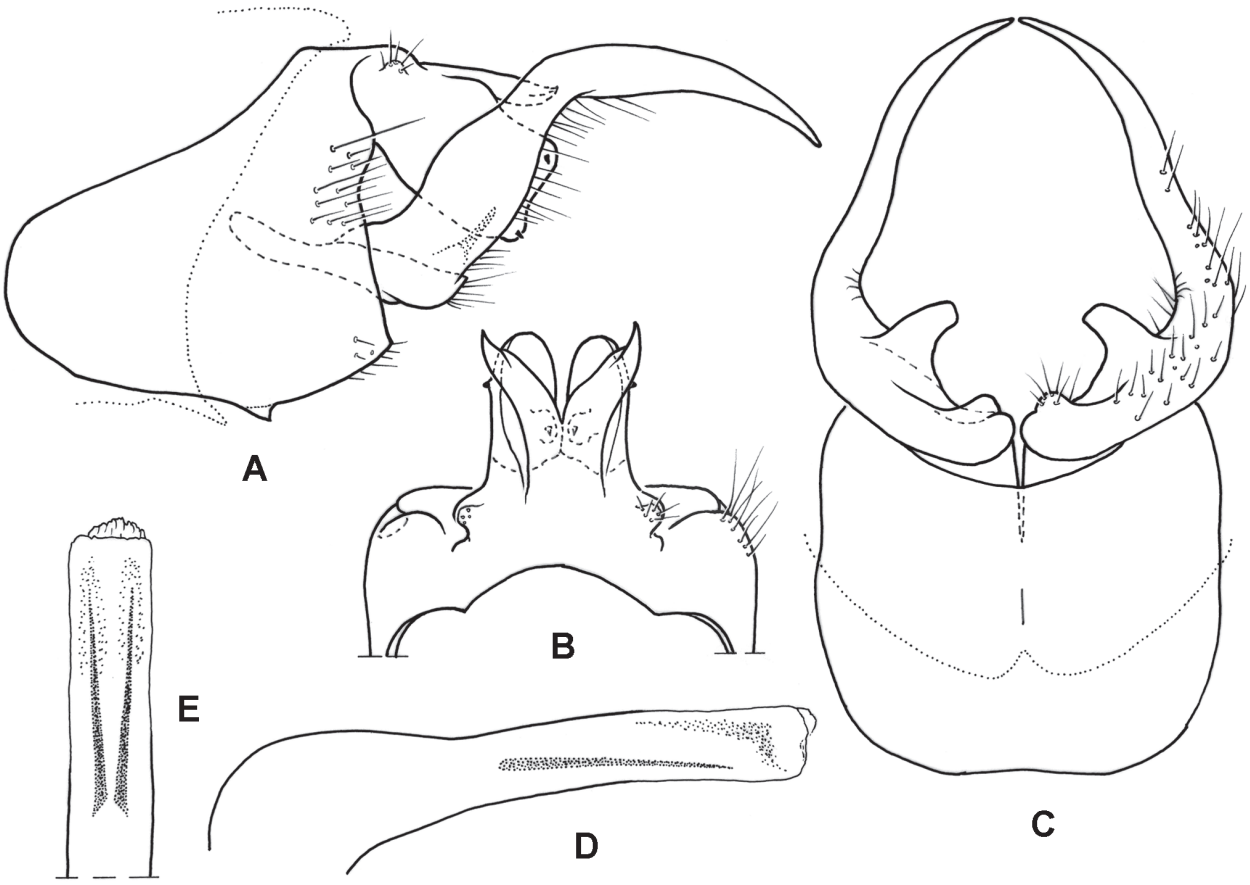

Figure 7. *Chimarra ungula* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal.

veins at base of discal cell somewhat swollen; 1st fork slightly proximal to *s* cross-vein; *r-m* and *m* cross-veins hyaline, *s* partially hyaline, *s* and *r-m* linearly aligned, *m* slightly proximal; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 fused.

Male genitalia: Segment VIII with sternum very short, ventrally with short ventral process from posterior margin, process dorsoventrally flattened, acute in lateral view, subacute as viewed ventrally; tergum slightly widened dorsally, without distinct modifications. Segment IX sclerotized dorsally, dorsum very short, posterior margin concave as viewed dorsally; as viewed laterally, with dorsolateral apodemes on anterior margin only suggestively developed, anteroventral margin greatly, sinuously developed and projecting, extending almost to anterior of segment VII, mesal margin broadly truncate, as viewed dorsally or ventrally; posterior margin of segment nearly straight, with only slight angular projection below preanal appendages; ventral process emerging near middle of segment, very small, subtriangular, posteroventrally projecting. Tergum X with mesal lobe lightly sclerotized, continuous with posterior margin of segment IX, apex flared and divided mesally, forming Y-shaped apical sclerite; lateral lobes short and rounded, nearly converging ventrally below phallotheca, each lobe with 2 large prominent sensilla, 1 preapically and 1 on short rounded lobe on ventral margin. Preanal appendages very small and rounded, fused basally to base of tergum X. Inferior appendages very elongate; as viewed laterally, angled dorsally from base, very strongly posteriorly curved in apical half, apical part very narrow, curved-lanceolate in shape, tapering apically, apex acute; as viewed ventrally, very sinuously curved, bowed outward in basal half, converging in apical half, each appendage with prominent, projecting, subtruncate protuberance on mesal margin in basal half. Phallotheca moderately elongate, narrow, tubular, with usual basal expansion. Endotheca unexpanded in specimen examined, apparently granulate in texture, internally with 2 symmetrically paired, elongate spines,

extending over half length of phallotheca. Phallotremal sclerite complex not clearly evident, apparently forming short, weakly sclerotized rod and ring structure, rod with small preapical sclerite.

Material examined. Holotype male: **VIETNAM**: Nghe An Province, W of Con Cuong, Khe Moi Forestry Camp, 18°56'N, 104°49'E, 24-29 October 1994, D. Currie (**ROM 946105**).

Etymology. This species is named for the claw-like shape of the inferior appendage (*ungula* is Latin for claw).

georgensis "Group" (*Chimarrhafra*)

The genus *Chimarrhafra* was established by Lestage (1936) to include only *C. georgensis* K.H. Barnard. It was subsequently reduced to a species group of *Chimarra* by Ross (1956), who considered it allied to the *Vigarrha* lineage, a genus originally described from the Philippines by Navás (1922), based on a female specimen. *Vigarrha* was also reduced to a synonym of *Chimarra* by Ross (1956). As a lineage, the latter is not currently well characterized and its relationship to species placed in *Chimarrhafra* needs to be better established. If related, the name *Vigarrha* would have priority. The name *Chimarrhafra* has had dubious usage since Ross reduced it to a synonym of *Chimarra*, treated as a genus by Jacquemart (1967), a subgenus by Morse (1974), or reduced to a synonym of *Chimarra* (*Chimarra*) by Blahnik (1998). If used to characterize a distinct species group, the species in this lineage are also not currently well defined and only those species directly placed here (in the genus or subgenus or species group) can be inferentially included. However, this excludes some obviously closely related species that were simply described in the genus *Chimarra*, without a subgeneric designation or assessment of their closest affinity. Also, membership of some species directly placed in the group needs to be reevaluated. Additionally, a number of undescribed species in this group are known from Africa. It is probably better to wait for their description to properly characterize the group. At present, it is sufficient to say that it does seem to form a distinct species group with plesiomorphic characters that would place it at or near the base of the *Chimarra* (*Chimarra*) lineage. Characters suggesting this include the nearly unmodified Rs vein in the forewing (either without the distinct curve or inflection that generally characterizes species in the subgenus *Chimarra*, or with the Rs vein only slightly curved), and also *s*, *r-m*, and *m* cross-veins in the forewing that are all hyaline (unpigmented) and linearly arranged. The latter character is found in the genus *Chimarrhodella* (sister taxon to *Chimarra*) as well as the subgenera *Chimarrita*, *Otarrha*, and *Curgia*. In many species segment IX has the ventral margin very weakly, or not evidently produced. Whether this is a general characteristic of the group remains to be determined. The number of sensilla present on the lateral lobes of tergum X is somewhat difficult to state, due to the reduced or scabrous development of the lobes, but apparently these are also reduced in number. Apomorphic characters include a fusion of the R_1 and Sc of the hind wing (a character that seems to have evolved multiple times in *Chimarra,* and is also present in the minuta Group), and possibly also the very short and ventrally deflected phallotheca (the latter at least characterizing some of the species). Inferior appendages seem to lack the distinct basal inflection that characterizes species in the digitata and minuta groups (a presumed plesiomorphy). To date, members of this group have not been recognized outside of Africa. One new species recognized here, *Chimarra corneola*, is very similar to *C. georgensis*, type species of *Chimarrhafra*, sharing a number of apomorphic similarities, and thus can be definitively placed in the *Chimarrhafra* lineage. It is the first Asian species to be placed in this group.

***Chimarra corneola* sp. n.**
(Figure 8)

Diagnosis. Among described species, *Chimarra corneola* is perhaps most similar to *C. georgensis*, sharing a number of similarities, including, especially, the divided, spine-like lateral lobes of tergum X; and, the shape of the phallotheca, which is very short and has its apex strongly deflexed, with a

pair of spine-like apical projections. However, it differs in the details of the shape of the lateral lobes and inferior appendages. The minutely spined ventral division of the lateral lobe of tergum X is especially distinctive.

Description. Forewing length (male) 4.6-5.2 mm, (female) 5.1-5.4 mm. Color (in alcohol) medium brown. Head short (postocular parietal sclerite not elongate). Mesoscutellar setal wart pear-shaped, with usual anterior suture. Maxillary palps with 1st segment very short (about as long as wide), 2nd segment short (length about 2 times width), 4th segment subequal to 2nd, 3rd segment very long (about 3 times length of segment 2), 5th segment subequal to or longer than segment 3. Tarsi of male very narrow, tarsal claws very small, symmetrically curved (unmodified). Forewing with Rs weakly inflected (curved toward costal margin), veins at base of discal cell distinctly swollen; 1st fork nearly sessile or slightly proximal to *s* cross-vein; *s*, *r-m*, and *m* cross-veins hyaline (unpigmented) and linearly aligned; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 fused.

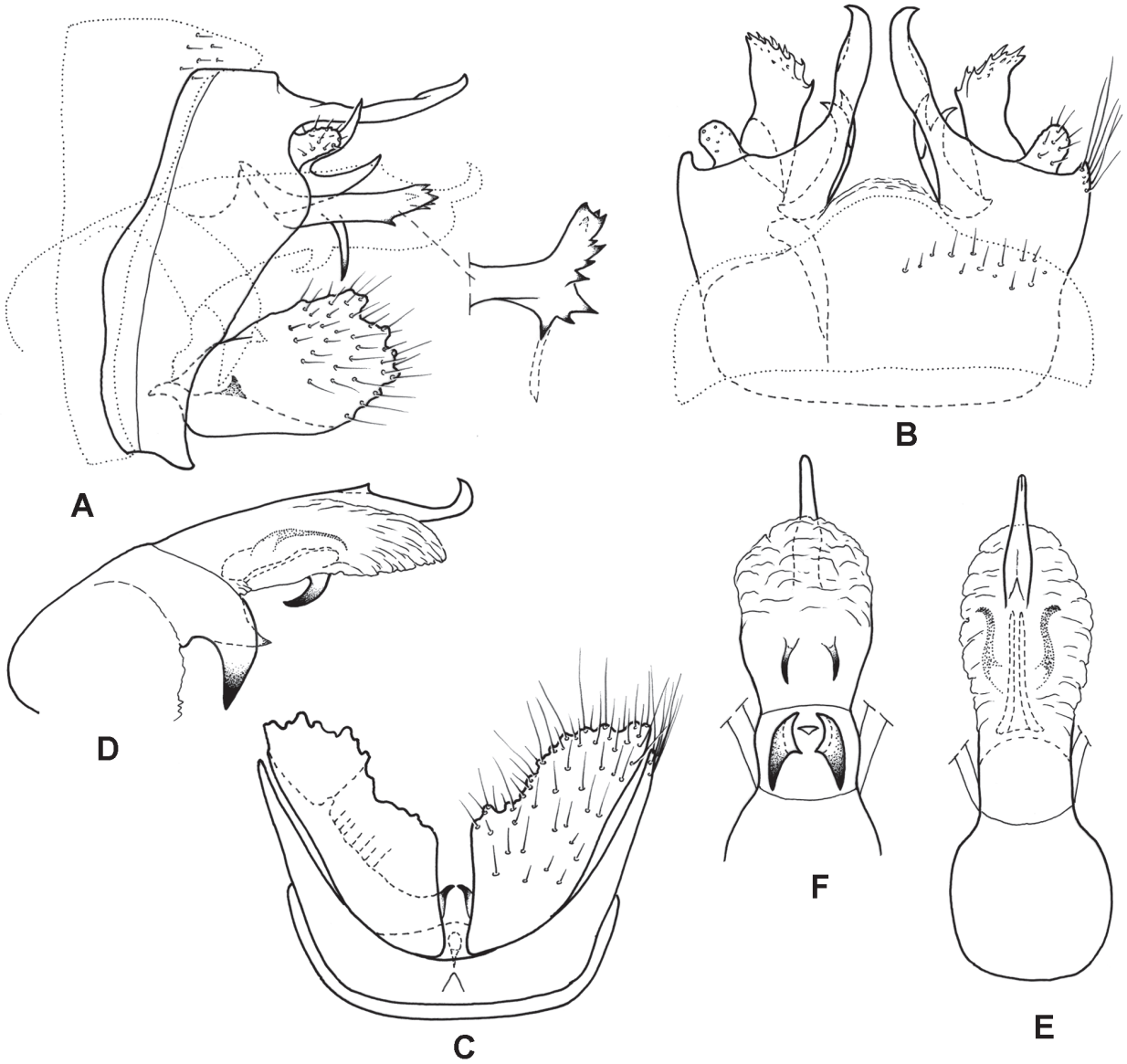

Figure 8. *Chimarra corneola* sp. n., male genitalia. A) Lateral (inset – paratype); B) Dorsal; C) Ventral; D) Phallic apparatus, lateral; E) Phallic apparatus, dorsal; F) Phallic apparatus, ventral.

Male genitalia: Segment VIII with sternum very short ventrally, slightly longer dorsally; tergum gradually lengthened dorsally, dorsal margin projecting mesally, about 3-4 times length of sternum at ventral margin, without distinct modifications. Segment IX short throughout; dorsal margin sclerotized, concave mesally, forming sclerotized ridge, continuous with anterolateral margin of segment; as viewed laterally, without distinct dorsolateral apodemes, anterior margin undulate (not expanded ventrally), posterior margin with subangulate projection below preanal appendages; ventral margin very short, with short, subacute, posteriorly-oriented ventral process; dorsal margin with paired, digitate projections from posterior margin, these fused basally with basomesal margins of preanal appendages, processes (as viewed dorsally) converging mesally, apices acute and curved outward. Tergum X with mesal lobe membranous, very short, scarcely evident; lateral lobes strongly sclerotized, short, divided into complex, spined structure, these fused on either side to sclerotized lateral wings of phallocrypt, lobes dorsomesally forming a pair of short, scabrous spines, ventrolaterally forming outward curved, sclerotized process with numerous short spines, each process with basoventral digitate projection, projection with single apical sensillum. Preanal appendages short, rounded, dorsoventrally flattened, each partially fused mesally with projecting dorsal process of tergum IX and ventrolateral lobe of tergum X. Inferior appendages short, more or less ovate, but with apical margins very irregular due to stout, projecting marginal setae; as viewed ventrally with basomesal margins subparallel, apices irregular; mesal surface (sparsely) with stiff erect setae. Phallotheca very short, fused to and securely anchored by sclerotized lateral wings of phallocrypt, basal expansion only weakly developed; ventral apex very strongly ventrally curved, almost from base of phallotheca, apex, as viewed ventrally, forming pair of sclerotized spines. Endotheca weakly sclerotized in basal part, ventrally with pair of symmetrical, short, recurved spines. Phallotremal sclerite complex difficult to interpret; as interpreted here, composed of relatively short rod and ring structure with associated, very prominent dorsomesal spine-like structure, spine recurved near apex, bordered basolaterally by short, curved sclerites (paired basal sclerites lyre-shaped, as viewed dorsally).

Material examined. Holotype male: **VIETNAM**: Gia Lai Province, An Khe District, 10 km NW Buoebloy, Cha River, on road to Tram Lap, 27 June 1996, UV light, D. Currie (**ROM 961098**). **Paratypes**: 1 female, same data as holotype; 7 males, 11 females, Gia Lai Province, An Khe District, Tram Lap, Azun River, 2 km NW on trail from forestry building, 14°27'N, 108°33'E, 17 June 1996, D. Currie, J. Swann (**ROM 961056**); 48 males, 55 females, ibid., 23 June 1996 (**ROM 961084**); 2 males, 1 female, ibid., 3 km NE forestry building, 21 June 1996 (**ROM 961076**).

Etymology. This species is named for the several hornlike projections of the genitalia (*cornu* is Latin for horn).

Unplaced within a species group

Most of the species left unplaced to species group probably belong to one of the groups described above (as suggested in Table 1), but specimens were not available to assess their placement. The following new species is also left unplaced to species group. It shares a number of general similarities to members of the minuta Group and possibly belongs there. Like members of that group it has 2 very prominent sensilla on each of the lateral lobes of tergum X and a general similarity in form. However, the inferior appendages lack the basal inflection of members in that group and the phallic apparatus lacks the distinctive pair of elongate and symmetrically positioned endothecal spines that seem to characterize the minuta Group. Additionally, the cross-veins in the forewing are all hyaline and linearly aligned. These more primitive characters are found in members of georgensis "Group". However, the overall similarities are otherwise not very great. When the latter group is better characterized, it may provide the basis to reassess the relationship of this species.

Chimarra carinata sp. n.

(Figure 9)

Diagnosis. This is a distinctive species, best diagnosed by the very short lateral lobes of tergum X, each of which has a digitate ventral projection, and also by the structure of the inferior appendages, which are ovate and each have two mesal cusps, best seen in caudal view. The species is interesting in having some plesiomorphic features that characterize the georgensis "Group", including a forewing with unmodified Rs vein, hyaline and linearly aligned cross-veins, and anal veins without an apical fork. It also possesses the apomorphic fusion of the Sc and R_1 in the hind wing that characterizes species in the georgensis "Group", but lacks the highly modified and shortened phallotheca found in the type species for the group. As discussed above, fusion of the Sc and R_1 in the hind wing seems to have occurred in a number of lineages (as for instance, in the minuta Group discussed above and in the subgenus *Otarrha*). The character occurs especially among smaller species.

Description. Forewing length (male) 4.0 mm. Color (in alcohol) light yellowish-brown. Head relatively short (postocular parietal sclerite not elongate). Mesoscutellar setal wart pear-shaped, with very

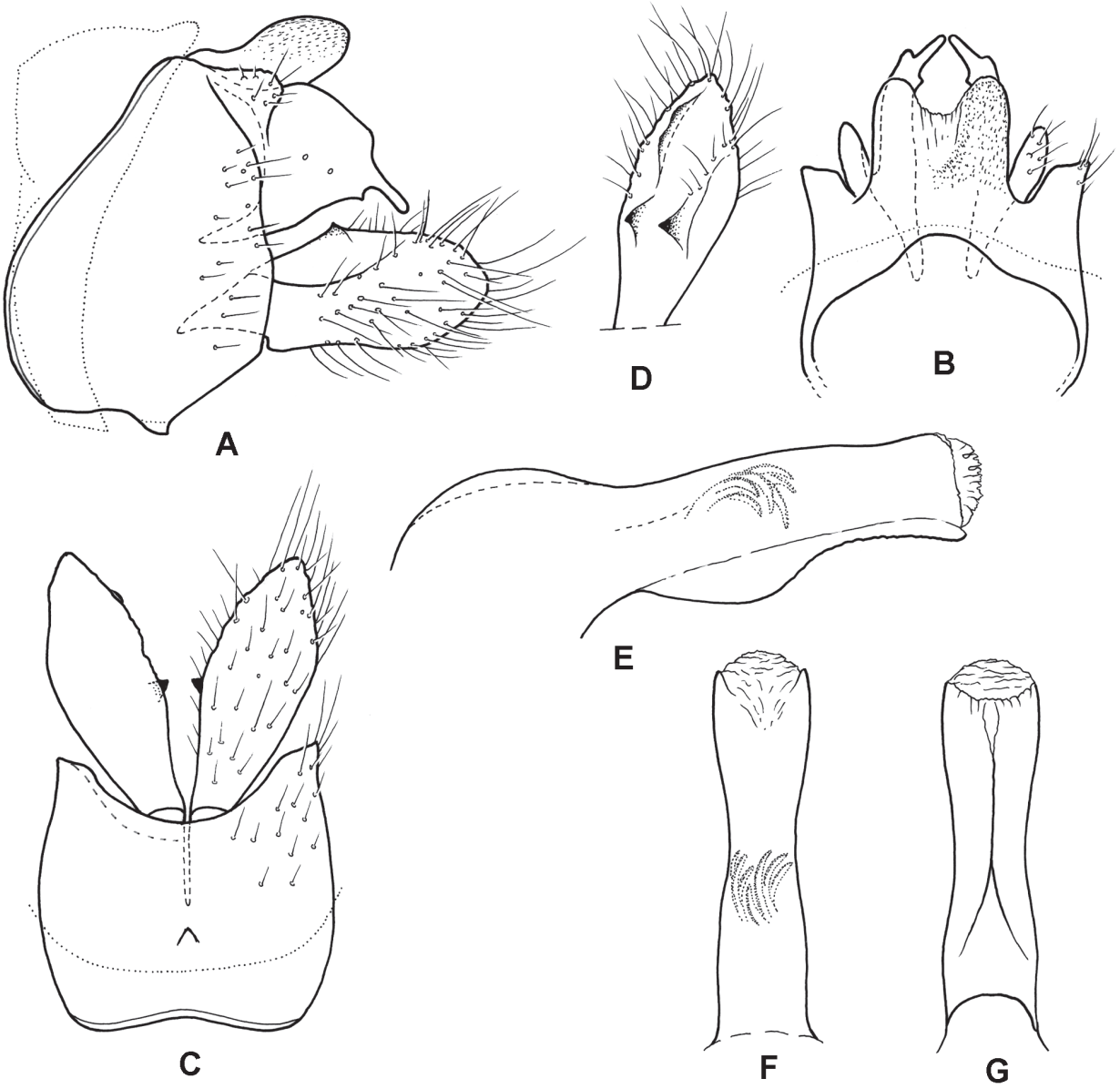

Figure 9. *Chimarra carinata* sp. n., male genitalia. A) Lateral; B) Dorsal; C) Ventral; D) Left inferior appendage, dorsal; E) Phallic apparatus, lateral; F) Phallic apparatus, dorsal; G) Phallic apparatus, ventral.

weak anterior suture. Maxillary palps with 1st segment very short (about as long as wide), 2nd segment short (length about 2 times width), 4th segment subequal to 2nd, 3rd segment very long (more than 3 times length of segment 2), 5th segment subequal to segment 3. Tarsi of male very narrow, tarsal claws very small, symmetrically curved (unmodified). Forewing with Rs straight, not noticeably modified; 1st fork slightly proximal to *s* cross-vein; *s*, *r-m*, and *m* cross-veins hyaline (unpigmented) and linearly aligned; anal veins without apical fork (2A and 3A both apparently looped to 1A). Hind wing with Sc and R_1 fused.

Male genitalia: Segment VIII with sternum short, subtending ventral margin of segment IX; tergum somewhat widening dorsally, without distinct modifications. Segment IX with dorsal margin sclerotized, anteromesal margin concave as viewed dorsally; segment relatively short dorsally (anterior and posterior margins narrowly separated), longer ventrally (more than 3 times dorsal length); as viewed laterally, without distinct dorsolateral apodemes on anterior margin, anterolateral margin distinctly, sinuously produced ventrally, from about level of preanal appendages (ventromesal margin emarginate as viewed dorsally or ventrally); posterior margin somewhat angularly widened below preanal appendages to ventral margin of inferior appendages, narrowing ventrally to ventral process; ventral process from about middle of segment, very small, subtriangular, ventrally projecting. Tergum X with mesal lobe short and slightly elevated, lightly sclerotized, lobe with mesal invagination, extending about half length of lobe; mesal lobes very short, scarcely longer than dorsal lobe, relatively simple in overall structure, each lobe with narrow, digitate projection from posteroventral margin, projections converging mesally below phallic apparatus; each lobe with prominent sensillum at base of digitate projection and also with 2 small lateral sensilla. Preanal appendages prominent, rounded as viewed laterally, somewhat laterally flattened, emerging intersegmentally between posterior margin of segment IX and base of tergum X. Inferior appendages simple in structure, ovate as viewed laterally or ventrally, with fine setae, those near apical margin very elongate; each appendage with sclerotized tooth-like projection on dorsal margin, acute as viewed laterally, broadly cusped as viewed caudally, and also 2nd small, acute tooth on mesal surface, near ventral margin. Phallotheca moderately elongate, tubular, with usual basal expansion; ventrally with longitudinal keel, extended in basal part to form rounded projection, as viewed laterally. Endotheca membranous (untextured), unexpanded in specimen examined, but with apparent cluster of short curved spines. Phallotremal sclerite complex not evident, possibly small or weakly sclerotized.

Material examined. Holotype male: **VIETNAM**: Quang Nam Province, Ngoc Linh, 950 m, 15°11.2'N, 108°2.3'E, 23 March 1999, Malaise trap, D. Grimaldi, L. Herman, C. Johnson, K. Long, E. Sterling (**AMNH**).

Etymology. This species is named for the longitudinal ventral keel of the phallotheca (*carinata* is Latin for keeled).

Discussion of variation in the anal veins of the forewing in *Chimarra*
(and its relevance for defining subgenera and species groups)

One of the most diagnostic features of Trichoptera, and especially useful in discerning fossil species belonging to the lineage (since they are frequently only known from wing impressions) is the looped anal veins of the forewing. The typical condition is for the 1A and 2A veins to merge and continue as a single vein to the wing margin, where they typically either meet or approach the Cu2 vein, which is curved at its apex to form what is known as the arculus. Usually the arculus is somewhat hyaline or unpigmented. The appearance is for the 2A vein to be looped to the 1A vein and the 3A vein is then looped to the 2A vein. Depending on which taxa are considered, a cross-vein may or may not be present between the 1A and 2A veins. In some genera of Philopotamidae, including *Chimarrhodella*, the sister taxon to *Chimarra*, the cross-vein between the 1A and 2A veins is absent; thus, the condition appears as a simple one in which the 2A vein is looped to the 1A vein and the 3A vein is looped to the 2A vein. Usually both loops are small and basal, possibly accounting for why a cross-vein is not present. In *Chimarra*, the intersection of 1A and 2A tends

to be more distal and 2 character states are found. The first state is analogous to other taxa of Trichoptera in which a cross-vein is present between 1A and 2A. Possibly this character state was derived or "rederived" in *Chimarra*, simply due to the more apical intersection of 2A with 1A, with the attendant likelihood that a cross-vein would form. In *Chimarra* species in which this state is found, usually the cross-vein is relatively apical, occurring just before the juncture of 3A with 2A; thus, the condition is one in which the 2A vein appears to be "forked" apically. The other condition, which is unusual for Trichoptera, is for the 2A vein to be looped to 1A, and the 3A is also looped to 1A, distal to the intersection of 2A. The intermediate state leading to this condition is undoubtedly the first state, achieved simply by the loss of the apical part of 2A before its intersection with 3A (part of the apical fork); thus, 2A becomes looped to 1A at the cross-vein and its distal part, before the intersection of 3A, is lost. The apparent loop of 3A to 1A is achieved by a composite of the basal part of 3A and the apical part of 2A. In some respects, the tendency for the apical part of a vein to be lost should not be surprising, and might be anticipated by the basic ground plan in Trichoptera that results in looped veins in the forewing in the first place, a loop resulting from a cross-vein joining the previous vein, and loss of the distal part of a vein. In *Chimarra*, the second, and ostensibly more derived, character state (both 2A and 3A looped to 1A), is more prevalent than the first (2A with an apparent apical "fork"), and found, for instance, in the subgenera *Curgia*, *Otarrha*, some species in the subgenus *Chimarrita*, and also in many species in the subgenus *Chimarra*, including several lineages inferred to be relatively primitive or basal within the subgenus. The first character state (2A with an apparent apical "fork"), which by the above scenario would be inferred to be more primitive, is found in some species in the subgenus *Chimarrita* (possibly primitively) and also in some taxa of the subgenus *Chimarra*. At least in the subgenus *Chimarra*, based on the principle of parsimony, it seems likely that this character state is secondarily rederived, and thus what appears to be a primitive character is actually a derived character. Significantly, it likely indicates a relationship of taxa within the subgenus *Chimarra* with the character state.

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