

A REVISION OF THE INDOCHINESE GENERA *CHEIROCHELA* AND *GESTROIELLA* (HETEROPTERA: NAUCORIDAE), AND A REVIEW OF THE TRIBE CHEIROCHELINI

Dan A. Polhemus

Dept. of Natural Sciences, Bishop Museum, 1525 Bernice St., Honolulu, HI 96817 USA

Email: bugman@bishopmuseum.org

John T. Polhemus

Colorado Entomological Institute, 3115 S. York St., Englewood, CO 80113 USA

Robert Sites

Enns Entomological Museum, Division of Plant Sciences, University of Missouri, Columbia, MO 65211 USA

Email: bugs@missouri.edu

ABSTRACT. – The tribe Cheirochelini is reviewed, with diagnoses provided for the tribe and its three constituent genera: *Coptocatus*, *Cheirochela* and *Gestroiella*. The history of work on the group is discussed, with particular attention to the role of the Genoa Museum. Keys are provided to the species of all three genera, and three new species are described as follows: *Cheirochela tonkina* from northern Vietnam, *Cheirochela thailandana* from northern Thailand and *Gestroiella siamensis* from southern Thailand. Shaded habitus illustrations are presented for all three of the above genera, as well as illustrations of the male parameres and distribution maps for all species of *Cheirochela* and *Gestroiella*, and illustrations of other selected morphological features for particular *Cheirochela* and *Gestroiella* species.

KEY WORDS. – Heteroptera, Naucoridae, Cheirochelini, Indochina, taxonomy, new species, maps.

INTRODUCTION

The Indochinese genera *Cheirochela* and *Gestroiella*, along with the Bornean genus *Coptocatus*, form a well-defined monophyletic subgroup within the Naucoridae. Their distinctive apomorphies were recognized by Montandon (1897) who proposed the subfamily Cheirochelinae to hold them. The scope of this subfamily was subsequently expanded by Usinger (1938) and La Rivers (1971) to include other taxa from the Philippines and New Guinea respectively. Polhemus (1986), echoed by Stys & Jansson (1988), questioned whether the group of genera combined under Cheirochelinae sensu lato in fact constituted a monophyletic group, or rather one based on superficial structural similarities due to convergent character evolution arising from constraints of life in swift stream environments. Although this question has yet to be resolved by phylogenetic analysis, there remains little doubt as to the monophyly of the tribe Cheirochelini, which contains the three genera mentioned above (Polhemus, 1986).

Of the constituent genera in Cheirochelini, *Coptocatus* was monographed by Polhemus (1986), who recognized three species; a fourth species was added by Nieser & Chen (1991), and the group was monographed once again by Zettel

(2002), with the addition of two further new taxa, bringing its total included species to six. By contrast, the other two genera in this tribe, *Cheirochela* and *Gestroiella*, have not been revised taxonomically in over eighty years. Although the large size and unique morphological specializations of Cheirochelini make them fascinating insects for study, their restriction to Indochina, a remote part of the world that was in a state of political unrest for much of the twentieth century, has greatly hindered work on the group. Only in the last two decades have additional collections become available, allowing clarification of species concepts and recognition of three new species, described below.

TAXONOMIC HISTORY

The early history of taxonomic work on the Cheirochelini of Indochina is closely linked to the development of the natural history museum at Genoa, Italy. This institution was founded in 1867 by Giacomo Doria, a wealthy patron from La Spezia who also became the first director. Management of scientific activities, however, was soon consolidated under the control of Doria's close friend Rafael Gestro, a coleopterist. Gestro used Doria's financial backing to support collectors in various

tropical countries where Italy had real or imagined colonial aspirations, particularly in Africa and Southeast Asia.

Among the collectors sent forth by Gestro was Leonardo Fea, who departed for Burma in March 1885. Despite numerous disruptions brought on by the British invasion of Burma and the subsequent Burmese rebellions, Fea was able to make substantial collections of zoological specimens throughout the length of Burma, spending seven months near Bhamo in the Katchin mountains of the north, four months in the Tenasserim area of the far south, and over a year in the hill country of the Karen states. The resulting collections were delivered back to Gestro at Genoa in early 1889, and subsequently distributed to various specialists.

The insects collected by Fea included examples of large and unusual creeping water bugs in the family Naucoridae, which were forwarded to A. L. Montandon in Bucharest, Romania. These specimens proved to represent three new species in the subfamily Cheirochelinae, two of them in the genus *Cheirochela*, described several decades before by Hope (1841) based on a single specimen from Assam, India (*C. assamensis*). Montandon (1897) named one of the new *Cheirochela* species after Fea (*C. feana*) and the other after Burma, the country of origin (*C. birmaniensis*). Also included in the material were examples of a completely new genus, which Montandon named *Gestroiella*, in honor of Gestro. Montandon returned the types of all three species to the Genoa Museum, where they still reside.

Montandon saw only a few additional specimens of *Cheirochela* and *Gestroiella* in the following decades. Based on limited material from northern Vietnam, he described two more species of *Gestroiella* (*G. schoutedeni* and *G. perfecta*) in 1909 and 1911. At the same time that Montandon was describing these two additional *Gestroiella* species, W. L. Distant was preparing the Hemiptera section for the "*Fauna of British India (including Burma)*", which appeared in 1910. Distant provided good habitus illustrations of both *Cheirochela* and *Gestroiella*, and added a fourth species of *Gestroiella* (*G. insignis*) based on material from Assam. The types of all three of the above species were deposited in the British Museum of Natural History, in London.

Shortly thereafter Gezá Horváth in Budapest, Hungary, came into possession of a very long series of *Gestroiella* taken in Laos. Based on examination of these specimens he concluded that Montandon's two later species were both intraspecific variants of *G. limonocoroides*, and synonymized them in 1918.

At this point, in 1918, all taxonomic activity relating to Indochinese Cheirochelini ceased, and the classification of the group drifted into stasis until the present time. Part of this resulted from the fact that few additional specimens were collected between World War I and the close of the Vietnam Wars in the early 1980s. In addition, in the absence of any keys or reasonable illustrations, even those few specimens that were collected, although readily assignable to genus based on Distant's figures, were extremely difficult to identify to

species without recourse to Montandon's types, which most modern workers seem to have forgotten were in Genoa.

The current study has now managed to reunite the types of all the Indochinese species, permitting an evaluation of the previous species concepts, and proper classification of newly collected material from China, Vietnam, Thailand and Burma. Despite the fact much of the early type material of Cheirochelini came from Burma, the limited recent collections from that country are the first since those of Fea in the late 1880s, strikingly illustrating how sporadic the captures of these insects have been.

By contrast, the Bornean genus *Coptocatus* has been the focus of more recent taxonomic work, with new species descriptions by Polhemus (1986), Nieser & Chen (1991) and Zettel (2002). Although ancillary to the scope of the current paper, this genus is discussed and a key to species is included in order to provide comprehensive coverage of the Cheirochelini as a whole.

METHODS

The current revision is the result of over a decade of work spent accumulating specimens from personal collecting, coupled with loans from major museums. The result has been the most comprehensive representation of Cheirochelini ever assembled for study at one time and place. The following institutions kindly loaned material for this project: Museum National d'Histoire Naturelle, Paris (MHNP); The Natural History Museum, London (BMNH); the United States National Museum, Washington, D. C. (USNM); the Naturhistorisches Museum Wien, Vienna (NHMW); the Museo di Storia Naturale "Giacomo Doria", Genoa (MSNG); the California Academy of Sciences, San Francisco (CAS); the Los Angeles County Museum, Los Angeles (LACM); the Snow Entomological Museum, University of Kansas, Lawrence (SEMK); the National University of Singapore, Kent Ridge, Singapore (NUS). Specimens from the J. T. Polhemus Collection, Englewood, are labelled (JTPC); those from the University of Missouri, Columbia (UMC).

All measurements in the descriptions below are given in millimeters. The width of the head refers to the width as measured across the eyes; the width of an eye is the greatest width measured perpendicular to the longitudinal axis of the head. The anterior/posterior interocular measurement refers to the shortest distances between the eyes at their anterior and posterior ends respectively as viewed from directly above. Descriptions, particularly of colour, were made from dry pinned specimens. Certain structural characters given in the generic descriptions hold constant across all species, and as such are not repeated in the individual species descriptions.

Male genitalia were analyzed by removing the genital capsule, then dissecting away the parameres to reveal the phallosoma and medial process, which were figured in situ in dorsal aspect. The views of the parameres presented represent

dorsal views of these structures as they appear when at rest in the genital capsule.

CL numbers following locality data refer to codes used by the authors to reference ecological notes. Localities in the material examined sections have been assigned to their modern countries, even though these data are usually not present on the original labels of older specimens. Specimens from “Tonkin”, for instance, are listed under Vietnam. Modern place name equivalents (where known) have sometimes been added in brackets to aid in interpretation of older label data. Many of the collecting localities (L-numbers) given in the collection records for RWS in Thailand may be viewed by accessing a Locality Image Database linked to the Enns Entomology Museum internet site. Localities in close proximity to one another (ie., on the same mountain, such as Doi Inthanon in Thailand) are represented by a single symbol on the distribution maps.

TAXONOMY

CHEIROCHELINI La Rivers 1971

Diagnosis. – Large, robust naucorids, body shape elongate ovate to nearly round (Figs. 1, 2, 18), strongly dorsoventrally flattened. Vertex strongly produced posteriorly behind the eyes. Antennae stout, segments I–III subequal in length with their widths roughly equivalent to their lengths (Fig. 4), segment VI slightly more elongate; antennae set into elongate, concave sockets on undersides of eyes. Labrum highly reduced, barely visible at base of rostrum. Rostrum and labrum recessed into a deep cavity on underside of head; maxillary plates adjacent to this cavity lying in a horizontal orientation; anterior section of head strongly produced ahead of the eyes and rostral cavity, forming a marked anteclypeal projection formed by posteroventral folding of the preclypeal cephalic tergum. Legs with fore tarsi and claws fused to form a single segment; fore and hind tibiae bearing pads of short, dense setae ventrally at their apices. Abdominal sternites and paratergites fused to form single transverse plates on segments IV–VI, lateral sections of these plates adjacent to spiracles bearing groups of small, ovate, glabrous depressions amid the hydrofuge pile. Parameres symmetrical. Phallosome symmetrical, with central portion sclerotized, apex lyre-shaped (Fig. 29).

Discussion. – Members of the Cheirochelini display some of the most elegant adaptations to life in swiftly running waters seen anywhere in the insect world, including highly streamlined bodies enhanced by extreme dorsoventral flattening; posteroventral folding of the preclypeal head to form an acute prow; retraction of the labrum, rostrum and antennae into deep cavities on the underside of the head; and fusion of certain abdominal sternites and paratergites to create a smooth ventral surface. Additional apomorphic cheirochelini adaptations to life in fast water include

development of large pads of bristle-like setae at the apices of the middle and hind tibiae to provide enhanced grip in strong currents, and the presence of apparent hydrostatic pressure receptors laterally on the paratergites (Polhemus, 1986, Fig. 7). Although plastron respiration has not been conclusively demonstrated in the Cheirochelinae, it is very likely to occur, given the preponderance of brachypterous morphs, the presence of putative hydrostatic receptors, and preference for swift water habitats (for additional discussion see Polhemus, 1986).

KEY TO GENERA OF CHEIROCHELINI

1. Abdominal and thoracic venter with thick erect hair pile, especially evident when viewed laterally; anterolateral angles of prothoracic venter curved inward to form cup-like depressions adjacent to eyes; ventral margin of anteclypeus with band of dense, short setae *Cheirochela*
 - Abdominal and thoracic venter lacking erect hair pile, bearing instead a covering of very fine, short, closely appressed hairs barely evident in lateral aspect; anterolateral angles of prothoracic venter not curving to form cup-like depressions; ventral margin of anteclypeus lacking fringe of setae 2
2. Posterolateral abdominal angles produced, each ending in two sharp spinose projections (Fig. 18); form broad, rounded; Indochina *Gestroiella*
 - Posterolateral abdominal angles not produced, slightly notched and bidentate but not produced into bispinose projections; form elongate oval (Fig. 1); Borneo *Coptocatus*

COPTOCATUS Montandon, 1909

Diagnosis. – Form elongate-oval. (Fig. 1) Abdominal and thoracic venter with fine pile of short, closely appressed hairs. Pronotum not markedly expanded posteriorly (except in *C. stereos*), posterior width less than 2× width of head; anterolateral angles of pronotum simple, not forming ventrally-directed cup-shaped depressions at apices. Hemelytra of brachypterous forms short and truncate, apices rounded, not reaching to abdominal tergite VI. Parameres variable in shape, either deeply cleft medially and asymmetrically bidentate, or uniramous and tapering on distal half, sometimes with a fringe of long setae on outer margins.

Discussion. – The genus *Coptocatus* is confined to Borneo, and was proposed by Montandon (1909) to hold a single species, *C. oblongulus*, collected near Mt. Kinabalu. Five additional species have been described subsequently by Polhemus (1986), Nieser & Chen (1991) and Zettel (2002). Although clearly members of the tribe Cheirochelini based on synapomorphies of the head and ventral abdomen (see Polhemus, 1986, Figs. 7, 8), *Coptocatus* species are narrower and more elongate in comparison to those of *Gestroiella* or *Cheirochela* (compare Figs. 1, 2 and 18). The key below, modified from Zettel (2002), will permit identification of the species described to date.

REVISED KEY TO SPECIES OF *COPTOCATUS*

Modified from Zettel, 2002

1. Males 2
- Females 7
2. Larger species, body length exceeding 16 mm; anterior margin of fore femur sinuate, bearing 1 or 2 teeth (Fig. 1); posterior margin of fore tibia biconcave (Fig. 1), or bearing a small tooth basally; embolar margin of hemelytra smooth or at most weakly indented; paramere bilobate, with deep medial notch 3
- Smaller species, body length equal to or less than 15.5 mm; anterior margin of fore femur convex (except at extreme apex) and lacking teeth; posterior margin of fore tibia evenly concave, not bisinuate, lacking teeth; embolar margin of hemelytra distinctly indented; paramere shape variable, in some species bilobate as above, in other species strongly narrowed distally to form a single narrow, tapering process 5
3. Posterior margin of abdominal tergite IV in brachypterous forms straight; posterior margin of fore tibia evenly concave and bearing a single small tooth basally; paramere non-setiferous and weakly bilobate, with medial notch shallow; posterolateral angles of pronotum in brachypterous forms produced, elongate and acute; hemelytron of brachypterous morph with pronounced humeral ridge; abdominal sternite VI with a medial process *C. stereos* Nieser & Chen
- Posterior margin of abdominal tergite IV in brachypterous forms convex (Fig. 1); posterior margin of fore tibia bisinuate, lacking teeth (Fig. 1); paramere setiferous and strongly bilobate, with deep medial notch; posterolateral angles of pronotum in brachypterous forms acute but not produced or elongated (Fig. 1); hemelytron of brachypterous morph lacking a pronounced humeral ridge; abdominal sternite VI lacking a medial process 4
4. Body length 19.0–24.5 mm; posterior margin of abdominal sternite V nearly straight *C. kinabalu* Polhemus
- Body length 17.0–17.7 mm; posterior margin of abdominal sternite V weakly concave *C. ibanus* Zettel
5. Paramere bilobate, with deep medial notch *C. tebedu* Polhemus
- Paramere unilobate, forming a single tapering process disally, lacking a medial notch 6
6. Apices of posterolateral angles on abdominal tergites acute .. *C. jaechi* Zettel
- Apices of posterolateral angles on abdominal tergites not acute *C. oblongulus* Montandon
7. Subgenital plate with a narrow, elongate hair patch posteromedially; laterotergite VII broad; dorsal surface punctate, with granulation, if present, only on lateral areas 8
- Subgenital plate with paired hair patches apically or subapically, lacking narrow, elongate hair patch posteromedially (although a small, round hair patch may be present centrally in *C. oblongulus*); laterotergite VII slender; dorsal surface extensively granulate, punctation largely lacking (except in *C. stereos*) 9
8. Medial hair patch on subgenital plate reaching to posterior margin; relatively large species, body length 17.5–22.5 mm; Sabah *C. kinabalu* Polhemus
- Medial hair patch on subgenital plate not reaching to posterior margin; smaller species, body length 16.2–17.4 mm; Sarawak *C. ibanus* Zettel
9. Subgenital plate with paired hair patches both apically and subapically 10
- Subgenital plate with paired hair patches apically only, lacking subapical patches 11

10. Subgenital plate with medial length less than width at base, bearing large subapical hair patches close to lateral margins *C. jaechi* Zettel
- Subgenital plate with medial length equal to width at base, bearing small subapical hair patches well removed from lateral margins *C. tebedu* Polhemus
11. Subgenital plate with distal portion parallel-sided, apex truncate, central section bearing a longitudinal medial furrow; posterolateral angles of pronotum not produced *C. oblongulus* Montandon
- Subgenital plate with distal portion tapering, apex not broadly truncate, central section lacking a longitudinal medial furrow; posterolateral angles of pronotum produced, acute and elongate *C. stereos* Nieser & Chen

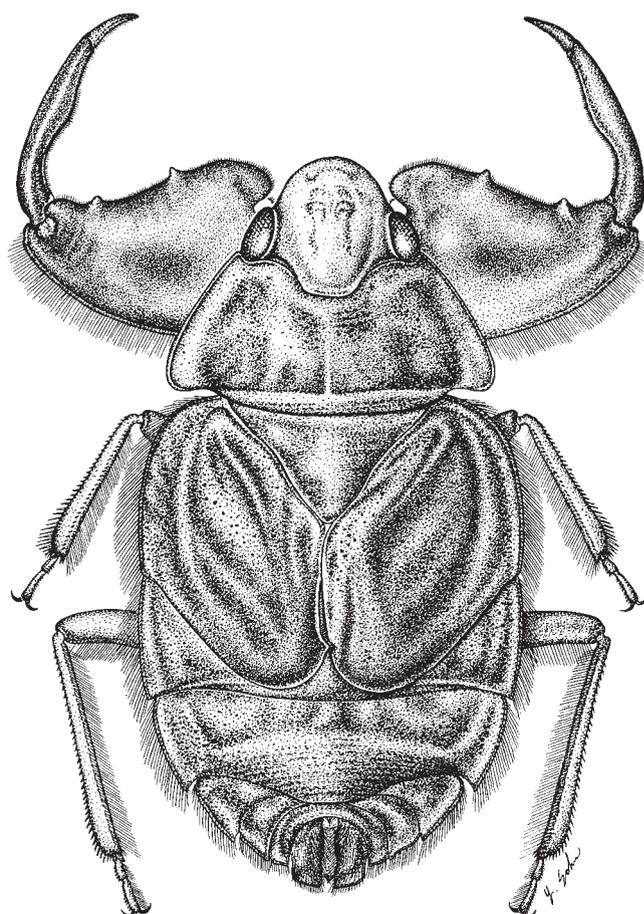


Fig. 1. *Coptocatus kinabalu* Polhemus. Male, dorsal habitus. Drawn by Young Sohn.

CHEIROCHELA Hope, 1841

Cheirochela Hope, 1841: 442.

Diagnosis. – Body size very large, form broadly ovate (Fig. 2). Ventral margin of anteclypeus with band of dense, short setae. Pronotum not markedly widened posteriorly, width less than 2× width of head (Fig. 2); anterolateral angles of curved inward to form ventrally-directed cup-like depressions at apices adjacent to eyes; posterolateral angles with apices acuminate and spinose. Hemelytra of brachypterous forms long, apices angulate, reaching to or surpassing abdominal tergite VI (Fig. 2). Abdominal and thoracic venter with thick

erect hair pile, especially evident when viewed laterally. Parameres elongate, slightly thicker and sometimes weakly bifurcate basally, bearing fringe of long setae on outer margins, apices notched to varying degrees (Figs. 7–11). Phallosome symmetrical, basal shaft elongate, apex expanded and lyre-shaped, similar to that of other genera currently held in the Cheirochelini, relatively homogenous in form among all species examined. Female genital plate triangular, of limited diagnostic value for species separation.

KEY TO SPECIES OF CHEIROCHELA

1. Large, robust species, body length usually exceeding 26 mm; overall body form broad (Fig. 2), ratio of total body length/body width across embolia falling in range of 1.50–1.65/1.00; posterolateral angles of pronotum highly produced and acuminate, ratio of maximum pronotal width/pronotal length along midline in submacropterous individuals falling in range of 3.78–4.21; male paramere shape as in Fig. 8 *C. feana* Montandon
- Slightly smaller and more elongate species, body length usually less than 26 mm; overall form more elongate (Fig. 2), ratio of total body length/body width across embolia falling in range of 1.74–1.95/1.00; posterolateral angles of pronotum only moderately produced, not highly acuminate, ratio of maximum pronotal width/pronotal length along midline in submacropterous individuals falling in range of 3.15–3.60 2
2. Abdominal sternite V lacking a posteriorly directed medial tubercle; medial tubercle on sternite IV small and flattened, usually not projecting posteriorly over the base of sternite V when viewed laterally; preocular head 0.8 × the inner length of an eye or greater (Fig. 2); male paramere shape as in Fig. 10; northern Vietnam *C. tonkina* new species
- Abdominal sternite V with a well developed, posteriorly developed medial tubercle, tip of this tubercle sharply angulate (Figs. 5, 6); medial tubercle on segment IV also well developed, raised and angulate (Fig. 6), often projecting over base of sternite V when viewed laterally; preocular head 0.7 X the inner length of an eye or less; Burma, Thailand, or northeastern India .. 3
3. Smaller species, body length less than 22 mm; medial tubercles on abdominal sternites IV and V not strongly produced posteriorly or projecting over basomedial sections of subsequent sternites (Figs. 5, 6); male paramere bearing a short, thumb-like process on basal half separated from main body of paramere by a deep incision (Fig. 7); Bramaputra River basin of northeastern India *C. assamensis* Hope
- Larger species, body length exceeding 23.5 mm; medial tubercles on abdominal sternites IV and V produced posteriorly over bases of following segments when viewed laterally; male paramere lacking a short, thumb-like process on basal half separated from main body of paramere by a deep incision (Figs. 9, 11); Burma, Laos and Thailand 4
4. Anterolateral angles of pronotum strongly produced and spinose; male paramere lacking a deep notch at apex (Fig. 9); medial process of genital capsule notched at apex (Fig. 13); Burma and Laos *C. birmaniensis* Montandon
- Anterolateral angles of pronotum sharply angulate, but not strongly produced and spinose; male paramere bearing a deep notch at apex (Fig. 11); medial process of genital capsule with apex truncate, not notched (Fig. 15); Thailand and Laos *C. thailandana* new species

***Cheirochela assamensis* Hope**
(Figs. 3–7, 16)

Cheirochela assamensis Hope, 1841: 442.

Supplemental redescription. – **Brachypterous male:** General colouration dark brown, with dark yellow markings on head, pronotum, hemelytra, and lateral abdomen; head dark yellow with dark, posteriorly opening V-shaped mark centrally on frons, posterior margin broadly dark, eyes black; pronotum narrowly margined with dark yellow laterally and posteriorly; hemelytra with claval suture and basal embolar area dark yellow; visible sections of abdominal tergites pale to medium brown, narrowly margined laterally with dark yellow. Overall form elongate-ovate (Fig. 3), size small for genus, body length 21.90, maximum width (across embolia) 11.90; head length 4.00, width 4.80, anterior/posterior interocular 3.30/3.00, eye length 2.00, width 1.00; pronotum length (midline) 2.50, width 8.60; scutellum length 3.10, width 5.00. Hemelytra brachypterous, venation obscure, corium finely and shallowly rugose, membrane rudiments strongly narrowed posteriorly, tips rounded, reaching to posterior margin of sixth visible abdominal tergite.

Discussion. – The holotype of *C. assamensis* came from an unspecified locality in Assam, northeastern India. The specimen is in the Hope Museum in Oxford, and bears the label “Type 437.”

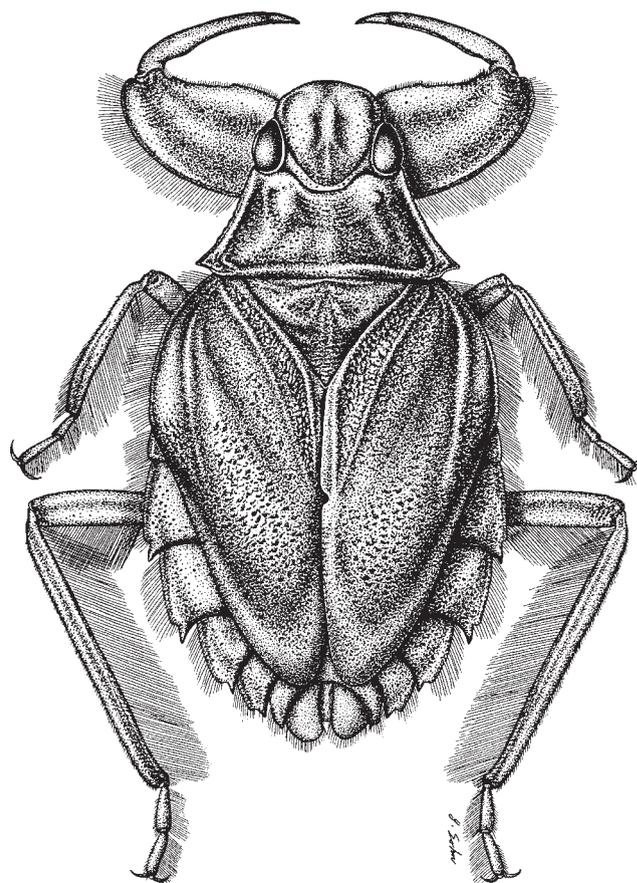


Fig. 2. *Cheirochela tonkina* Polhemus & Polhemus. Male, dorsal habitus. Drawn by Young Sohn.

This is the smallest species in the genus, with the two examples seen having body lengths of 21.0 and 21.2 mm respectively. This species is similar to *C. birmaniensis* in possessing well developed angulate tubercles posteromedially on abdominal sternites IV and V, but differs from that latter species in that these tubercles project primarily downward rather than being produced posteriorly over the bases of the following tergites (Figs. 5, 6). The male parameres of the two species are also differently formed (Figs. 7, 8), with that of *C. assamensis* having a rounded projection on the basal half. Although Distant (1906) considered *C. birmaniensis* to be a synonym of *C. assamensis*, based on a study of the holotypes of both species, we feel that the characters noted above serve to separate the two species and therefore reject Distant's proposed synonymy.

This species has so far been collected only from the upper Brahmaputra drainage basin in far northeastern India (Fig. 16).

Material examined. – INDIA, Assam: 1 brachypterous male, no locality data (holotype, HEMO). Meghalaya: 1 brachypterous male, West Garo Hills, Nokrek N. P., 9–17 May 1996, 950–1250 m, 90°19.5' 25°29.6'E (WGS84 datum), E. Jendek and O. Sausa (NHMW).

***Cheirochella feana* Montandon**

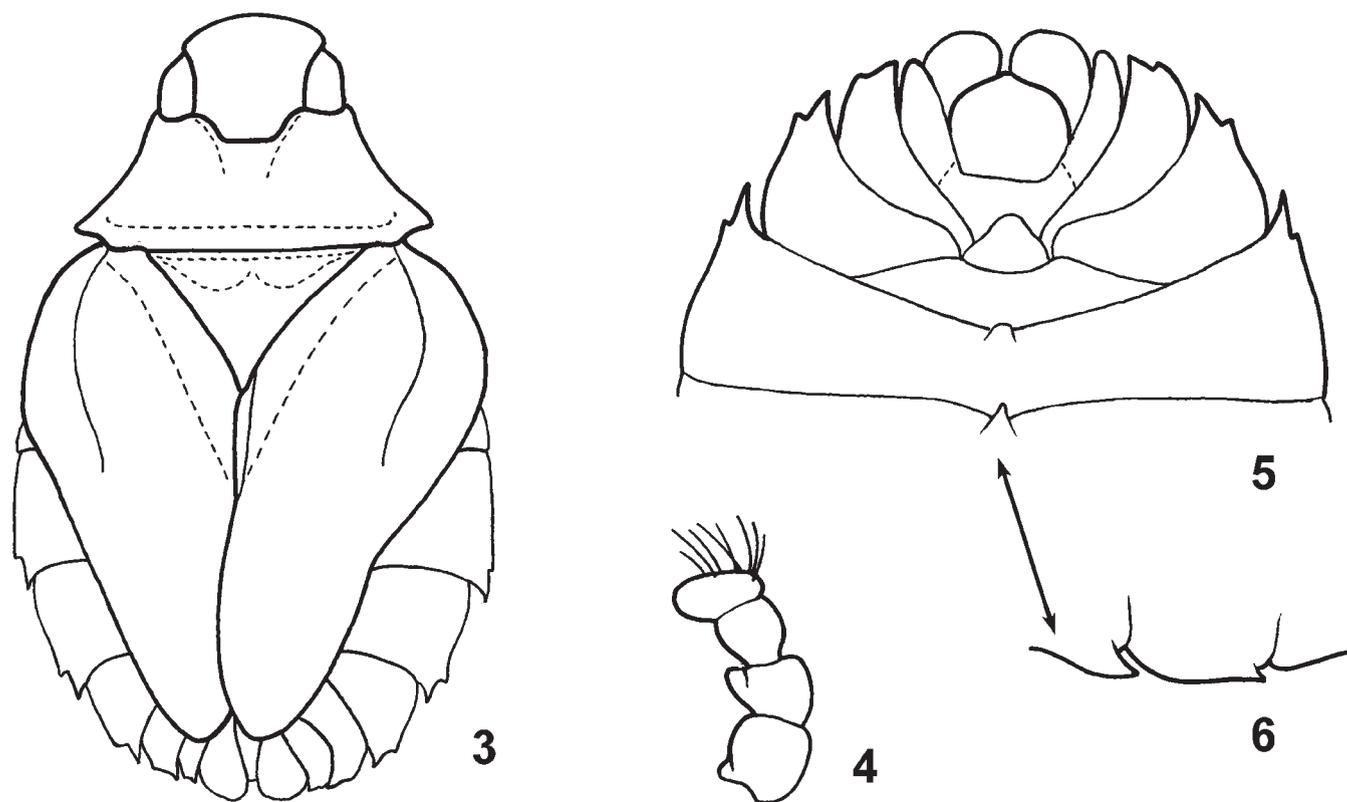
(Figs. 8, 12, 16)

Cheirochella feana Montandon, 1897: 370.

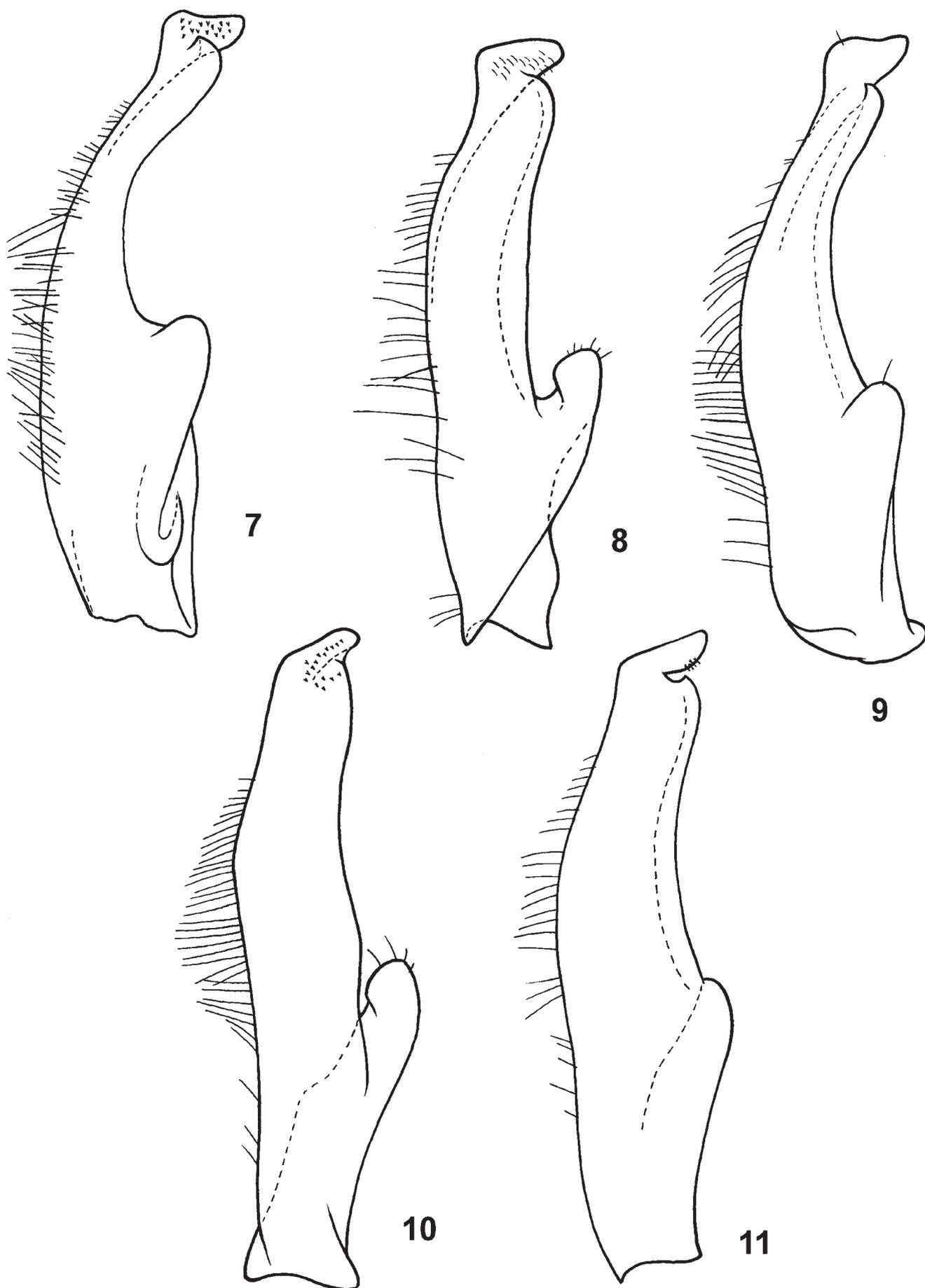
Supplemental redescription. – **Brachypterous male**

holotype: General colouration dark reddish-brown, with anterior portion of tylus, and lateral margins of pronotum, embolia, and all exposed abdominal tergites yellowish; eyes black. Overall form broad and robust (see Distant, 1906, pg. 26, Fig. 16), body length 28.20, maximum width (across embolia) 17.40; head length 5.30, width 6.40, anterior/posterior interocular 5.00/4.00, eye length 2.30, width 1.25; pronotum length (midline) 3.80, width 13.80; scutellum length 4.00, width 7.25. Hemelytra brachypterous, venation obscure, corium deeply and coarsely rugose, membrane rudiments strongly narrowed posteriorly, tips rounded, reaching to posterior margin of fifth visible abdominal tergite.

Discussion. – The series from Catcin Cauri, Burma contains a brachypterous male with the following labels (from top to bottom, commas indicate line breaks, slashes indicate separate labels, comments are in parentheses): “Catcin Cauri, Birmania, Fea. Ag November 1886 (black, printed)/TYPUS (red, printed)/*Cheirochella, feana* Mont., es. tip. (script in Montandon's hand)/*Cheirochella, feana* Montand., type (script in Gestro's hand).” This male is considered the holotype of the species. One of the other brachypterous males in this series bears a label, apparently in Gestro's hand, reading “*Cheirochella feana* Mont. esemplari non



Figs. 3–6. *Cheirochella assamensis* Hope, holotype male, structural details: 3, Dorsal habitus; 4, Left antenna, dorsal view; 5, Terminal abdomen, ventral view; 6, Medial processes on abdominal ventrites IV and V, lateral view.



Figs. 7–11. *Cheirochela* species, male right paramere: 7, *C. assamensis*, holotype; 8, *C. feana*, paratype. 9, *C. birmaniensis*, holotype; 10, *C. tonkina*, paratype; 11, *C. thailandana*, paratype.

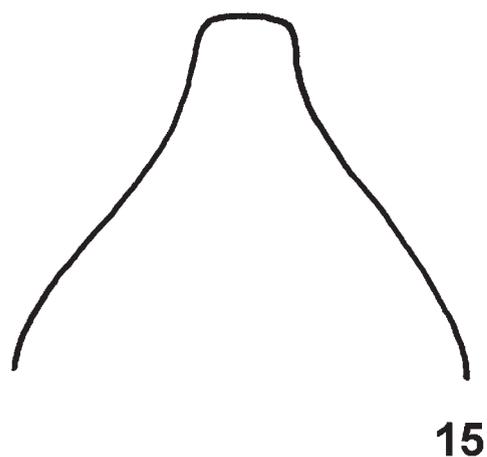
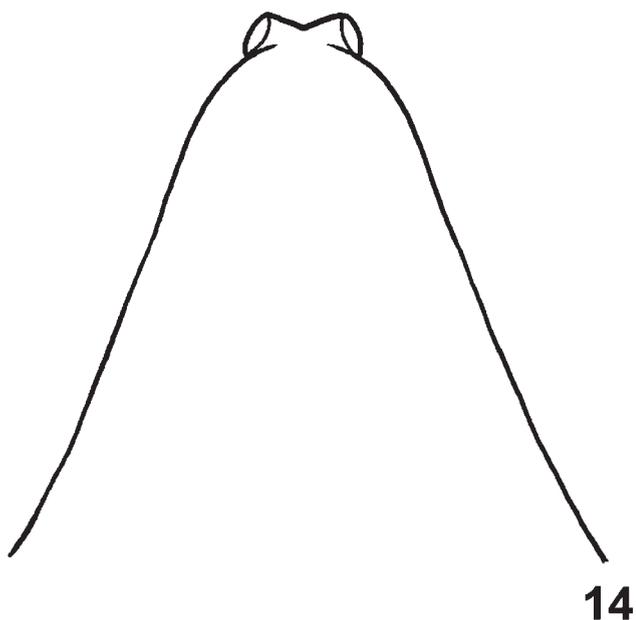
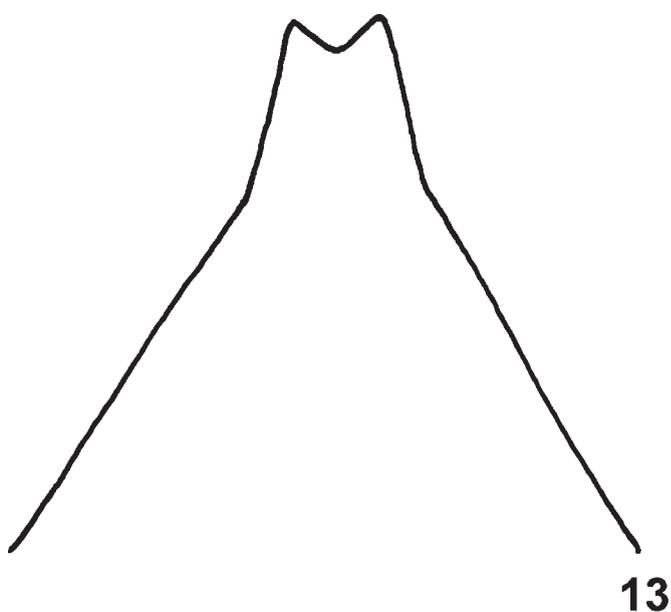
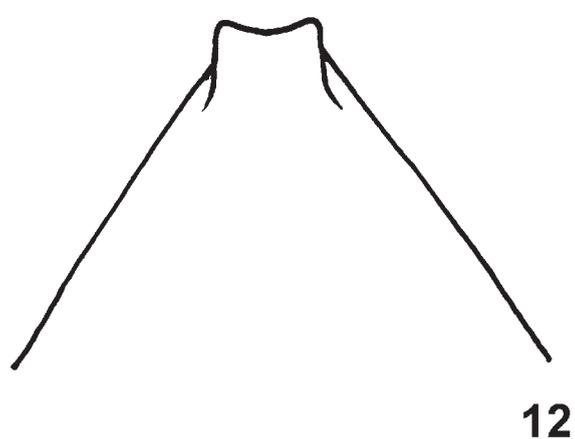
communicati a Mont.”, indicating that it was a specimen from the original series that was somehow not sent to Montandon. The immature specimen also bears a script label reading “larve a Cheirochela probable feai.”

This is a large, robust, broad bodied species, and in certain males the forelegs become extremely massive, with the tibiae strongly curved and well separated from the femora along their middle sections (see Distant, 1906, pg. 26, fig. 16). The colouration of dried specimens often tends toward yellowish highlights on a medium brown background, although the actual type is a dark-coloured specimen. Another aspect of this species that is somewhat difficult to quantify is its “square shouldered” appearance in relation to other *Cheirochela* species, this a result of the more abrupt basal curvature of

the embolar margin. The male paramere has a well developed basal lobe (Fig. 8) of a form similar to that seen in *C. tonkina* (Fig. 10), but the latter species is narrower in body form (Fig. 2), and has less spinose posterolateral angles on the pronotum, and has a differently shaped dorsomedial process in the male genital capsule (Fig. 14).

The type locality of *C. feana* lies in the hills east of Bhamo, a town on the upper Irrawady River in northern Burma. The currently known range extends from this region northeastward into southern China and northern Laos (Fig. 16).

Material examined. – BURMA [MYANMAR], **Kachin Division:** 3 brachypterous males, 3 brachypterous females, 1 immature, Catcin Cauri, Fea, Aug.–Nov.1886 (MSG,



Figs., 12–15. *Cheirochela* species, dorsomedial process of male genital capsule: 12, *C. feana*, paratype; 13, *C. birmaniensis*, holotype; 14, *C. tonkina*, paratype; 15, *C. thailandana*, paratype.

NMNH, MHNP, JTPC). CHINA, **Yunnan**: 3 brachypterous males, 5 brachypterous females, 100 km W. of Kunming, Diaolin Nat. Res., 22 May–2 Jun.1993, E. Jendek and O. Sausa (NHMW). LAOS, **Xiang Khoang Prov.**: 1 brachypterous male, 1 brachypterous female, 1 immature, Xieng Khouang, Muong Pek, 15 Dec.1918, R. V. de Salvaza (BMNH, RMNH).

***Cheirochela birmaniensis* Montandon**

(Figs. 9, 3, 16)

Cheirochela birmaniensis Montandon, 1897: 369.

Supplemental redescription. – Macropterous male holotype:

General colouration dark brown, with dark yellow markings on head, pronotum, hemelytra, and lateral abdomen; head dark yellow with dark, posteriorly opening V-shaped mark centrally on frons, posterior margin narrowly dark, eyes black; pronotum narrowly margined with dark yellow laterally and posteriorly; hemelytra with basal embolium, claval suture, and a pair (1 + 1) of narrow longitudinal streaks lying inward from and slightly posterior to terminus of embolar fractures dark yellow; visible sections of abdominal tergites medium brown, narrowly margined laterally with dark yellow. Form elongate-ovate, body length 25.40, maximum width (across embolia) 13.00; head length 4.10, width 5.10, anterior/posterior interocular 3.00/3.40, eye length 2.25, width 1.00, anteclypeus projecting ahead of eyes for 0.61 the length of an eye; pronotum length (midline) 10.40, width 2.50; scutellum length 5.40, width 7.50. Hemelytra macropterous, reaching nearly to tip of abdomen, claval vein and embolar fracture well defined, all other venation obscure.

Brachypterous male: Similar in general structure and colouration to macropterous male, but with pronotum narrower and scutellum not so tumid. Body length 23.60, maximum width (across embolia) 13.00; pronotum length (midline) 9.60, width 2.80; scutellum length 6.00, width 4.00. Hemelytra brachypterous, venation obscure, corium shallowly and finely rugose, membrane rudiments strongly narrowed posteriorly, tips rounded, reaching beyond posterior margin of sixth visible abdominal tergite.

Discussion. – The two specimens collected by Fea in Burma and now in the Genoa Museum represent co-types of this species. The brachypterous specimen has the following labels (from top to bottom, commas indicate line breaks, slashes indicate separate labels; comments are in parentheses): “Catcin Cauri, Birmania, Fea. Ag November 1886 (black, printed)/TYPUS (red, printed)/birmaniensis Mont. (script in Mondandon’s hand)/*Cheirochela, birmaniensis*, Montand., type brachypt. (script in Gestro’s hand).” The same data for the macropterous specimen reads “Catcin Cauri, Birmania, Fea. Ag November 1886 (black, printed)/TYPUS (red, printed)/*Cheirochela, birmaniensis* Mont., es. tip. (script in Mondandon’s hand)/*Cheirochela, birmaniensis*, Montand., type macropt. (script in Gestro’s hand).” Both specimens are in excellent condition, and the macropterous specimen is herein designated as the lectotype, based on the “es tip”

notation on its labelling, which matches the similar notation on the type of *C. feana*.

Cheirochela birmaniensis is narrower in overall form than *C. feana*, with which it is apparently syntopic in the hill streams of northern Burma. It may be easily separated from both *C. assamensis* and *C. tonkina* by the well developed posteromedial projections on abdominal sternites IV and V, which project posteriorly over the bases of the adjoining segments. The male paramere also has a basal lobe that is much smaller and less well developed than that seen in *C. tonkina* or *C. feana* (compare Figs. 8–10) and a distinctly elongate and apically notched dorsomedial process in the male genital capsule (Fig. 13).

As noted for *C. feana*, the type locality lies in the vicinity of Bhamo, in northern Burma. Based on current collections, this species occurs across the width of the Shan Plateau, from Burma into Laos (Fig. 16).

Material examined. – BURMA [MYANMAR], **Kachin Division:** 1 macropterous male, 1 brachypterous male, Catcin Cauri, Fea, Nov.1886 (co-types, MSNG). LAOS, **Xiang Khoang Prov.:** 1 brachypterous male, Haut Mekong, Nam

Mat, 15 April 1918, R. V. de Salvaza (RMNH).

***Cheirochela tonkina* new species**

(Figs. 2, 10, 14, 17)

Description. – **Brachypterous male:** Of moderate size for genus, general body form rotund, widest across abdomen

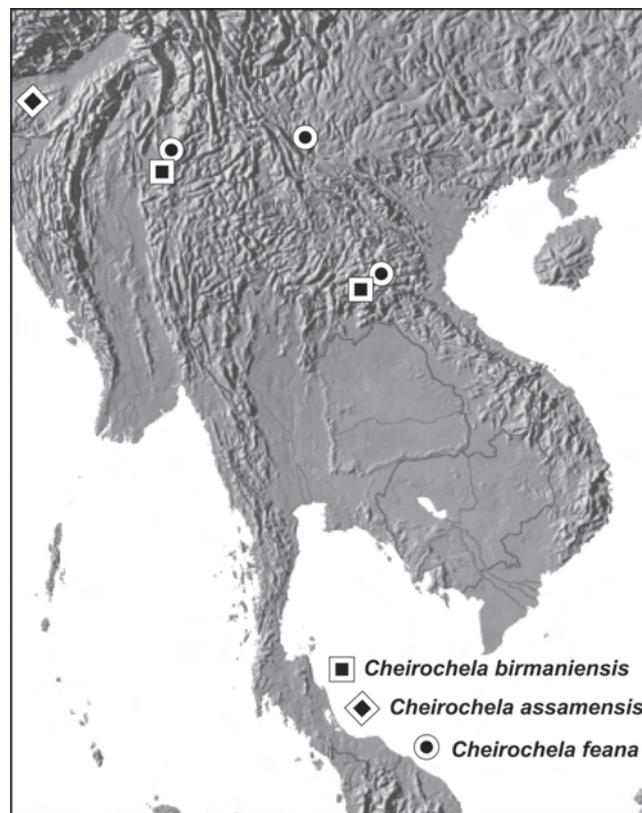


Fig. 16. Distributions of *Cheirochela* species in Indochina: squares = *C. birmaniensis*; diamonds = *C. assamensis*; circles = *C. feana*.

(Fig. 2), basic colouration brown, hemelytra dark brown, wing membrane dark brown. Male length 24.00 mm; maximum width (across abdomen) 12.50 mm; female length 25.00 mm, maximum width 14.00 mm.

Head pale yellowish brown, with dark brown longitudinal markings medially and along inner eye margins; a pair (1+1) of long, irregular, longitudinal brown lines present to either side of midline on vertex between eyes; posterior margin broadly dark, width across eyes/length = 5.44/4.41; eyes black, shining, quadrate posteriorly, tapering anteriorly, width/length = 1.18/2.06, inner margins evenly curved and slightly divergent anteriorly, lateral margins almost straight on anterior third, separated from vertex by shallow furrows, anterior/posterior interocular width = 3.82/3.38, lateral flange weakly developed; posterior margin of vertex rounded, strongly produced behind eyes; anteclypeus with anterior margin broadly rounded, strongly projecting ahead of eyes for 0.88X the length of an eye, projecting beyond rostrum about the length of exposed rostrum; rostral cavity deep, hiding half of segment two in lateral view; rostrum brown, second segment thickened, distal segments slender; antennae set in cavity, with all segments thickened, segments II, III and IV each about half the length of I, not extending to lateral margin of head.

Pronotum yellowish brown, mottled with darker brown at muscle attachments and irregularly dotted with numerous small brown punctations laterally; barely depressed medially behind vertex, width/length (midline) = 10.44/3.31, lateral

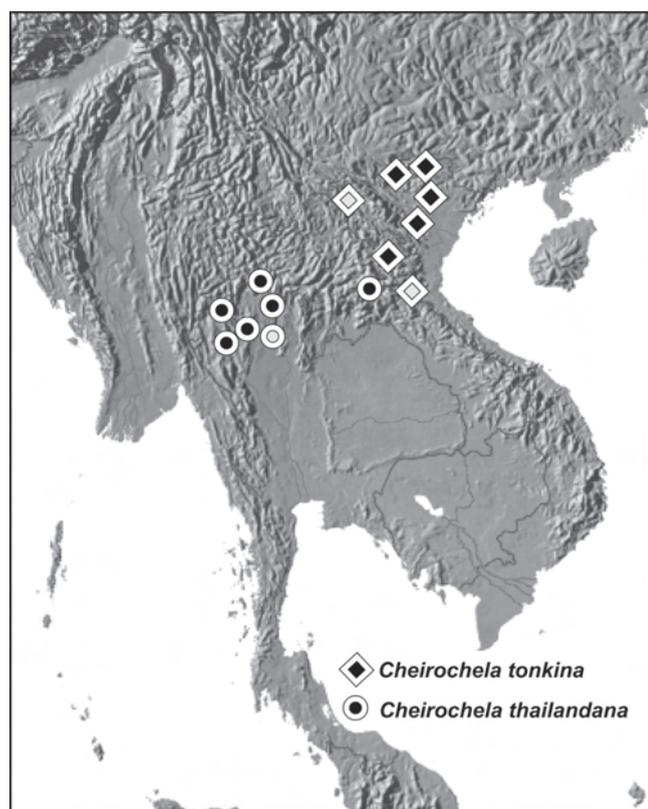


Fig. 17. Distributions of *Cheirochella* species in Indochina: diamonds = *C. tonkina*; circles = *C. thailandana*; greyed symbols indicate localities where only immatures were collected.

margins narrowly explanate, medially granular, concave, anterolateral angles sharply angular, extending forward along eye 1/5 of eye length, posterolateral angles acute produced, posterior margin nearly straight, set off from remainder of pronotum by transverse sulcus. **Scutellum** dark yellow, medially orange-brown, surface sculptured, rugose, width/length (midline) = 6.32/3.82, lateral margins sinuate, sinuate transverse sulcus present along anterior margin. **Hemelytra** dark brown, trending to black in area of reduced membrane; surface coarsely rugose, bearing fine, pale, granular microstructure, each facet convex, shining, without setae; clavus and corium weakly defined, membrane highly reduced, obscure; tips of hemelytra rounded, extending past base of genital segment; embolium demarcated by deep narrow sinuate furrow along inner margin, with a thick fringe of long soft setae arising from outer margin.

Abdomen with lateral portions of segments II–VII exposed when viewed dorsally, all visible tergites orange brown, darker laterally, posterolateral angles of tergite II symmetrical and truncate, of tergites III – VI produced into spines.

Ventral surface light yellowish brown, with head, prosternum, mesosternum centrally and abdomen covered with thick recumbent gold hydrofuge pile; ventral keel of head with tooth at anterior terminus small, barely formed; typical static sense organ cupped into anterolateral angle of prothorax; propleura moderately reflexed posteriorly, barely covering basal portions of mesosternal plate; mesosternal plate not tumescent, medially with a shallow V-shaped sulcus, anterior margin slightly raised, posterior margin tapering and angulate. Abdominal sternites without sutures delineating parasternites; sternite III with a distinct angulate projection medially on posterior margin, sternite IV with a much less pronounced projection, weakly developed.

Legs yellowish brown; fore coxa anterior face with a patch of fine, raised gold setae; anterior trochanters each with a stout ventral tuft of stout setae appearing as a spine-like protuberance; anterior femur with numerous small, dark brown asperities on dorsal surface, bearing a thick pad of gold setae along anterior margin, and fringe of long gold setae along posterior margin; anterior tibia slender, gently curving, grooved along inner face; middle and hind coxae each bearing a single glabrous tubercle distally, plus a fringe of long gold setae; middle and hind trochanters unarmed, posteriorly set with thick recumbent pile; hind femora distally with a row of short dark spinules running lengthwise along posterior margin, and a few short dark spinules scattered along anterior margins; middle tibiae beneath with a thick pad of golden setae on distal half, and a few scattered, stout reddish spines; hind tibiae beneath with a longitudinal pad of golden setae along anterior edge, widening distally to cover entire surface.

Male genitalia with paramere bearing a well developed basal lobe, distal arm possessing only a weak subapical notch (Fig. 10); male phallosome with tip expanded, lyre-shaped; dorsomedial process of male genital capsule in the form of an elongate triangle, apex rounded, bearing a small, bilobed

process (Fig. 14). **Female subgenital plate** triangular, slightly convex basally, lateral margins straight, apex narrow.

Macropterous form: Similar to brachypterous form in general structure and colouration, but lighter, dorsal colouration ranging from yellowish to brown; corium and clavus clearly delineated by a suture; wings fully developed, extending almost to tip of abdomen, membrane well defined in relation to corium, lacking venation; male length 23.00 mm, maximum width 12.70 mm; female length 23.50 mm, maximum width 12.40 mm.

Discussion. – This species is similar in size and general body form to *C. birmaniensis*, but may be separated by the absence of well developed posteromedial tubercles on the abdominal venter, and the much more prolonged preocular head. In *C. birmaniensis*, the length of the head ahead of the eyes is much shorter than the length of the eye, with the ratio of eye length/preocular head length being 1.7/1.0 or greater, while in *C. tonkina* the pre-ocular head is more greatly prolonged, so that this ratio is more nearly equal, being only 1.25/1.0 or less (Fig. 2). The two species may also be easily separated by the form of the male paramere, which in *C. tonkina* bears a prominent basal lobe set off from the distal arm by a deep notch (compare Figs. 9, 10) and the differently shaped dorsomedial process of the male genital capsule (compare Figs. 13, 14).

Ecological notes. – *Cheirochela tonkina* appears to be endemic to the Annamite Mountain chain of Vietnam and associated outlying ranges (Fig. 17). The type locality was a wide, swift, clear mountain river near Sapa, flowing in a bed of mixed alluvial boulders, rocks, gravel and sand. The bed profile was steep, with rapids and small cascades predominating. Immatures of *Cheirochela tonkina* were common here in the benthos, while adults were more localized, being found only in areas of high current velocity and saturated oxygen, particularly along the sides of large boulders swept by the main current.

Types. – Holotype, brachypterous male, VIETNAM, **Lào Cai Prov.**, rocky river and small trib., 16 km NE of Sa Pa on Lào Cai road, 855 m, 22°24'52"N 103°53'51"E, water temp. 19°C., 7 Apr.2000, CL 4397, D. A. Polhemus, J. T. Polhemus and P. Nguyen (USNM). Paratypes: VIETNAM: **Lào Cai Prov.:** 7 brachypterous females, same data as holotype (USNM); 1 macropterous male, 1 macropterous female, 1 brachypterous male, 1 brachypterous female, trib. of Muong Hoa Ho River, 15 km E. of Sapa, cobbles and boulders, 926 m, 7 May 1995, D. Currie, B. Hubley and J. Swann, ROM 956017 (JTPC); 1 brachypterous male, Tonkin, Chapa [= Sapa], May 1916, R. V. de Salvaza (CAS); 1 macropterous male, 1 macropterous female, reg. de Chapa [= Sapa], 1,650 m, 1926, Poilane (MHNP). **Vinh Phu Prov.:** 1 brachypterous male, 1 immature (not paratype), Tam Dao, Sôì Bac stream, 12 Oct.1984, T. Soldán (JTPC); 1 brachypterous male, 3 immatures (not paratypes), Tam Dao, Sôì Bac stream, 20–26 Oct.1984, M. Tonner (JTPC); 1 brachypterous female, Tam Dao hill station, lower waterfall of stream flowing through town, 11 May 1996, B. Hubley and D. C. Darling, ROM

961029 (JTPC). **Hòa Bình Prov.:** 1 brachypterous female, Tonkin, reg. de Hoa Binh, 1927, A. de Cooman (MHNP). **Hà Giang Prov.:** 1 brachypterous female, Tonkin, region de Ha Giang, 1916, S. Olivier (MHNP). **LAOS, Houaphan Prov.:** 1 brachypterous male, 1 brachypterous female, 3 immatures (not paratypes), Ban Saleui, 1,350 m, Xamneua [Xam Nua], 21–24 Jun.2003, M. Sato (JTPC).

Additional material examined (not paratypes). – Immatures presumably belonging to this species were taken at the following localities: VIETNAM, **Nghê An Prov.:** 6 immatures, Choang River, nr. edge of Pu Mat Nature Reserve, 165 m, water temp. 78° F. (26°C), 2 Apr.2000, CL 4387, J. T. Polhemus and P. Nguyen (USNM). **Lai Châu Prov.:** 2 immatures, cascading stream 12 km N. of Lai Châu, 290 m, 22°07'19"N 103°11'30"E, water temp. 22° C, 11 Apr.2000, 1345–1600 hrs., CL 4410, D. A. Polhemus, J. T. Polhemus & P. Nguyen (USNM).

Cheirochela thailandana new species

(Figs. 11, 15, 17)

Description. – **Brachypterous male:** Of moderate size for genus, general body form rotund, widest across abdomen, basic colouration brown, hemelytra dark brown, wing membrane dark brown. Male length 24.70 mm; maximum width (across abdomen) 14.20 mm; female length 24.80 mm, maximum width 14.20 mm.

Head pale yellowish brown, with dark brown longitudinal markings medially and along inner eye margins; a pair (1+1) of long, irregular, longitudinal brown lines present to either side of midline on vertex between eyes; posterior margin broadly dark, width across eyes/length = 5.44/4.21; eyes black, shining, quadrate posteriorly, tapering anteriorly, width/length = 1.00/2.11, inner margins evenly curved and slightly divergent anteriorly, lateral margins less curved on anterior third, separated from vertex by shallow furrows, anterior/posterior interocular width = 4.00/3.16, lateral flange weakly developed; posterior margin of vertex rounded, strongly produced behind eyes; anteclypeus with anterior margin broadly rounded, strongly projecting ahead of eyes for 0.58× the length of an eye, projecting beyond rostrum about the length of exposed rostrum; rostral cavity deep, hiding segment one in lateral view; rostrum brown, second segment thickened, distal segments slender; antennae set in cavity, with all segments thickened, segments II, III and IV each about half the length of I, not extending to lateral margin of head.

Pronotum yellowish brown, mottled with darker brown at muscle attachments and irregularly dotted with numerous small brown punctations laterally; barely depressed medially behind vertex, width/length (midline) = 9.88/2.89, lateral margins narrowly explanate, medially granular, concave, anterolateral angles sharply angular, extending forward along eye 1/4 of eye length, posterolateral angles acute produced, posterior margin nearly straight, set off from remainder of pronotum by transverse sulcus. **Scutellum**

dark yellow, medially orange-brown, surface sculptured, rugose, width/length (midline) = 5.34/3.66, lateral margins sinuate, sinuate transverse sulcus present along anterior margin. **Hemelytra** dark brown, trending to black in area of reduced membrane; surface coarsely rugose, bearing fine, pale, granular microstructure, each facet convex, shining, without setae; clavus and corium weakly defined, membrane highly reduced, obscure; tips of hemelytra rounded, extending past base of genital segment; embolium demarcated by deep narrow sinuate furrow along inner margin, with a thick fringe of long soft setae arising from outer margin.

Abdomen with lateral portions of segments II–VII exposed when viewed dorsally, all visible tergites orange-brown, darker laterally and posteriorly, posterolateral angles of tergite II symmetrical and truncate, of tergites III – VI produced into spines.

Ventral surface light yellowish-brown, with head, prosternum, mesosternum centrally and abdomen covered with thick recumbent gold hydrofuge pile; ventral keel of head with tooth at anterior terminus small, barely formed; typical static sense organ cupped into anterolateral angle of prothorax; propleura moderately reflexed posteriorly, barely covering basal portions of mesosternal plate; mesosternal plate not tumescent, medially with a shallow V-shaped sulcus, anterior margin slightly raised, posterior margin tapering and angulate. Abdominal sternites without sutures delineating parasternites; sternite III with a distinct angulate projection medially on posterior margin, sternite IV with a less pronounced projection.

Legs yellowish-brown; fore coxa anterior face with a patch of fine, raised gold setae; anterior trochanters each with a stout ventral tuft of stout setae appearing as a spine-like protuberance; anterior femur with numerous small, dark brown asperities on dorsal surface, bearing a thick pad of gold setae along anterior margin, and fringe of long gold setae along posterior margin; anterior tibia slender, gently curving, grooved along inner face; middle and hind coxae each bearing a single glabrous tubercle distally, plus a fringe of long gold setae; middle and hind trochanters unarmed, posteriorly set with thick recumbent pile; hind femora distally with a row of short dark spinules running lengthwise along posterior margin, and a few short dark spinules scattered along anterior margins; middle tibiae beneath with a thick pad of golden setae on distal half, and a few scattered, stout reddish spines; hind tibiae beneath with a longitudinal pad of golden setae along anterior edge, widening distally to cover entire surface.

Male genitalia with paramere bearing a weakly developed basal lobe, distal arm with distinct subapical notch isolating a thumb-like apical process (Fig. 11); male phallosome with tip expanded, lyre-shaped; dorsomedial process of genital capsule narrowing distally, tip truncate (Fig. 15). Female subgenital triangular, lateral margins weakly sinuate, apex narrow.

Macropterous form: Unknown

Discussion. – This species is similar in size and general body form to both *C. tonkina* and *C. birmaniensis*. Within this assemblage, *Cheirochella thailandana* shares the well developed posteromedial tubercles on the abdominal venter with *C. birmaniensis*, although they are somewhat less pronounced. It and *C. birmaniensis* also have less prolonged preocular heads than in *C. tonkina*: in *C. birmaniensis* the length of the head ahead of the eyes is much shorter than the length of the eye, with the ratio of eye length/preocular head length being 1.7/1.0 or greater, and in *C. thailandana* 1.64/1.0, while in *C. tonkina* the preocular head is more greatly prolonged, so that this ratio is more nearly equal, being only 1.25/1.0 or less. The most reliable characters separating these species are found in the male genitalia, especially the parameres (compare Figs. 9, 10, 11) and the median process of the genital capsule (compare Figs. 13, 14, 15).

Ecological notes. – Based on current records, *C. thailandana* is widely distributed in northern Thailand (Fig. 17). The Nam Chai River at the type locality was a swift, clear stream 0.25–1.0 m deep running in a bed of mixed alluvial boulders, rocks, cobbles and gravel, and bordered by disturbed upland rain forest. Adults of *C. thailandana* were taken by dislodging large rocks in the swift midstream current and allowing the force of the water to carry them downstream into a net, while immatures were more common in slightly slower water along the channel margins. At this Nam Chai locality, *C. thailandana* occurred syntopically with a diverse array of other benthic-dwelling subaquatic Heteroptera, including *Gestroiella limnocoroides* Montandon, *Aphelocheirus fang* Polhemus & Polhemus, *Aphelocheirus lahu* Polhemus & Polhemus, *Aphelocheirus thai* Polhemus & Polhemus, *Aphelocheirus brevisrostris* Polhemus & Polhemus, *Heleocoris* sp. and *Ctenipocoris* sp. Additional information on the benthic fauna of this river may be found in Polhemus & Polhemus (1989).

Types. – Holotype, brachypterous male, THAILAND, **Chiang Mai Prov.**, Nam Chai River above hydro station intake at Fang Agricultural Research Station, 550 m, 15 Nov.1985, CL 2197, D. A. and J. T. Polhemus (JTPC). Paratypes: THAILAND: **Chiang Mai Prov.**: 2 brachypterous males, 7 brachypterous females, 23 immatures (not paratypes), same data as holotype (JTPC); 1 brachypterous male, Doi Sutep N. P., Montathem Falls, 700–750 m, 6 Nov.1995, H. Zettel (NHMW); 1 male, 1 female, Doi Inthanon National Park, Siriphum Waterfall, 18°32'N 98°31'E, 1,460 m, 9 May 2002, rock face, UMC & CMU teams, L-401 (UMC); 1 female, Doi Inthanon National Park, Siriphum Waterfall at Ban Khun Klang, level 2, 1380 m, 18°32'N 98°31'E; 21 Mar.2002, R. W. Sites, L-314 (UMC); 2 females, same locality, 26 Jun.2002, R. W. Sites, L-412 (UMC); 1 female, same locality, 15 Nov.2001, R. W. Sites, rocks below waterfall, L-248 (UMC); 1 male, same locality, gravel, UMC & CMU teams (UMC); 1 female, Doi Inthanon National Park, Mae Pan Noi at Ban San Pathana, bedrock stream, 18°31'N 98°25'E, 750 m, 7 May 2002, gravel and rocks, UMC & CMU teams, L-393 (UMC); 1 female, Doi Inthanon National Park, Mae Pan Waterfall, 18°31'N 98°27'E, 1100 m, 750 m, 3 Mar.2002, UMC & CMU teams, L-253 (UMC); 1 male, Doi Inthanon National Park,

Mae Klang River at Ecolodge, 18°32'N 98°32'E, 1000 m, 8 May 2002, leafpack, UMC & CMU teams, L-399 (UMC); 1 male, same locality, 4 Apr. 2002, rocks, UMC & CMU teams, L-324 (UMC); 2 females, 1 male, Doi Suthep National Park, Huai Kaew at Nam Tok Sai Noi, 18°48'N 98°55'E, 1100 m, 22 Mar. 2002, G. W. Courtney (UMC); 1 male, Doi Suthep National Park, Huai Kaew above lower falls at Nam Tok Monthathan, 18°49'N 98°55'E, 750 m, 5 Mar. 2002, Sites, Kirawanich, L-261 (UMC). **Mae Hong Son Province:** 1 male, 3 females, Namtok Maw Pang, 19°22'N 98°22'E, 850 m, 19 Mar. 2002, UMC & CMU teams, L-305 (UMC). **Phayao Prov.:** 2 brachypterous males, 1 brachypterous female, Doi Nangka [= Doi Phu Lang Ka], N. Siam, 29 Apr. 1931, H. M. Smith (USNM). **LAOS, Xiang Khoang Prov.:** 1 brachypterous male, Xieng Khouang, Ban Sai, 26 Nov. 1917, R. V. de Salvaza (BMNH).

Additional material examined (not paratypes). – THAILAND, **Chiang Mai Prov.:** 2 immatures, Doi Inthanon National Park, Siriphum Waterfall, 18°32'N 98°31'E, 1,460 m, 9 May 2002, rock face, 21 Mar. 2002, R. W. Sites, L-316 (UMC); 1 immature, same locality, 2 Mar. 2002, Penkhae, L-249 (UMC); 2 immatures, Doi Inthanon National Park, Siriphum Waterfall at Ban Khun Klang, level 2, 1,380 m, 18°32'N 98°31'E; 2 Mar. 2002, Vitheepradit, Kirawanich, L-251 (UMC); 2 immatures, Doi Inthanon National Park, stream from Huai Sai Luang Waterfall, 18°31'N 98°27'E, 1,060 m, 3 Mar. 2002, Vitheepradit & Kirawanich, L-254 (UMC); 4 immatures, same locality, 20 Mar. 2002, R. W. Sites, L-312 (UMC); 1 immature, Doi Inthanon National Park, Nam Tok Vachiratharn, 18°31'N 98°27'E, 650 m, 3 Mar. 2002, Vitheepradit & Kirawanich, L-256 (UMC); 1 immature, Doi Suthep National Park., Sai Yoi Waterfall, 18°48'N 98°55'E, 1,100 m, 5 May 2002, gravel, CMU team, L-402 (UMC); 1 immature, Doi Suthep National Park, Nam Tok Monthathan, 18°49'N 98°55'E, 700 m, 5 Mar. 2002, Vitheepradit, Kirawanich, Sites, L-263 (UMC). **Lampang Province:** 1 immature, Jae Sawn National Park, Nam Tok Jae Sawn; 18°50'N 99°28'E, 650 m, 16 Mar. 2002, CMU team, L-297 (UMC).

GESTROIELLA Montandon, 1897

Gestroiella Montandon, 1897: 371.

Diagnosis. – Form broadly oval to nearly round (Fig. 18). Abdominal and thoracic venter with fine pile of short, closely appressed hairs. Pronotum broad, posterior width approximately 2× the width of the head (Fig. 18); anterolateral angles of simple, not forming cup-shaped depressions ventrally at apices; posteriolateral angles acute but not spinose. Hemelytra of brachypterous forms long, apices angulate, reaching to or surpassing abdominal tergite VI (Fig. 18). Parameres stout basally, suddenly narrowing on distal half to form a tapering arm, lacking a fringe of long setae on outer margins, apices weakly notched (Figs. 26–28).

Discussion. – *Gestroiella* species are remarkably uniform in most aspects of their internal and external anatomy, including

the shapes of the male parameres. In this regard, they present problems similar to the Neotropical genus *Cryphocricos*, of which Usinger (1947) wrote “...specimens exhibit relatively few characters which are useful to the taxonomist. The colouration is rather uniform, the male genitalia are quite similar throughout and such differences as are seen in the female genital plates are quite variable. As in some other Naucorid groups, each species has distinctive facies but the differences are illusive or difficult to describe, e. g. degree of convexity or curvature of pronotal or other margins.”

One internal character that seems to be consistently useful for species separation is the shape of the medial process of the male genital capsule (Fig. 30), which projects posteriorly between the parameres. The tip of this process may be prolonged to varying degrees, and simple or bifurcate. The male parameres also show some degree of difference between species (Fig. 26–28), although this is more a matter of degree, along the lines of the foregoing quote from Usinger. The distribution of posteromedial hair tufts on the female abdominal sternites, which initially seemed useful for species separation, has proven variable within individual species as more material has become available. The key below therefore relies on body size; the male medial process, and geographic distribution.

KEY TO SPECIES OF *GESTROIELLA*

1. Small species, overall body length less than 15 mm
..... *G. siamensis* new species
– Larger species, overall body length exceeding 17 mm 2
2. Median process of male genital capsule acuminate at tip, not bifurcate; females with posteromedial hair tufts on abdominal sternites IV–VI (Fig. 32); Indochina
..... *G. limnocoroides* Montandon
– Median process of male genital capsule bifurcate at tip; females with posteromedial hair tufts on abdominal sternites IV and V only, lacking a tuft on sternite VI (Fig. 31); north-eastern India *G. insignis* Distant

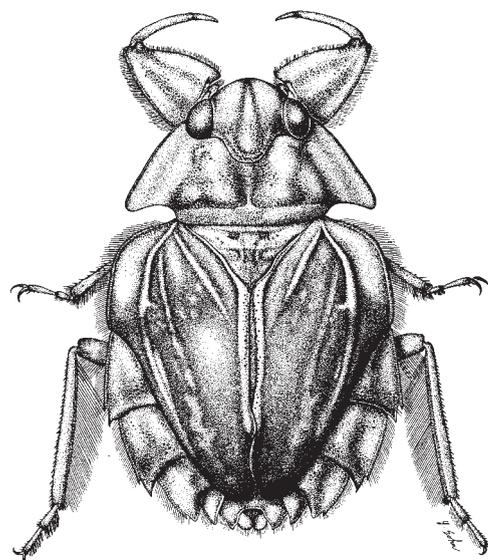


Fig. 18. *Gestroiella siamensis* new species, female, dorsal habitus. Drawn by Young Sohn.

***Gestroiella limnocoroides* Montandon**

(Figs. 19–25, 27, 29, 32, 34, 36–38)

Gestroiella limnocoroides Montandon, 1897: 371.*Gestroiella schoutedeni* Montandon, 1909: 45. Syn. by Horváth, 1918: 142.*Gestroiella perfecta* Montandon, 1911: 86. Syn. by Horváth, 1918: 142.

Supplemental redescription. – **Brachypterous male:** General colouration medium brown, with dark brown hemelytra, dark yellow markings on head, pronotum, scutellum and lateral hemelytra; head dark yellow with darker, posteriorly opening V-shaped mark centrally on frons, eyes black; pronotum dark yellow, narrowly margined with brown laterally, symmetrically mottled with brown centrally at muscle attachment scars; scutellum dark yellow, with pair (1 + 1) of small, roughly circular brown spots to either side of midline on basal half; hemelytra dark brown, with claval suture, entire embolium, outer margin of corium dark yellow, extreme lateral margin narrowly black; visible sections of abdominal tergites dark yellow. Overall form elongate-ovate (Figs. 19, 22), size large for genus, body length 18.60, maximum width (across basal abdomen) 14.80; head length/width 4.00/5.60, anterior/posterior interocular 3.50/3.70, eye length/width 2.00/1.10; pronotum length (midline)/width 2.70/12.90; scutellum length/width 3.20/6.00. Hemelytra brachypterous, not attaining tip of abdomen, reaching to abdominal tergite VII (Fig. 19, 22); venation obscure; corium finely and shallowly rugose; membrane absent; hemelytral apices acutely rounded.

Brachypterous female: Similar to brachypterous male in general size and colouration; body length 17.40, maximum width (across basal abdomen) 12.70.

Macropterous female: Similar to brachypterous female in general structure and colouration but slightly narrower in form (Fig. 25); body length 17.40, maximum width (across basal abdomen) 11.10. Pronotum with posterolateral angles less produced, obtuse (Fig. 25); scutellum enlarged, tumid; hemelytra with clavus well defined (Fig. 25), claval vein evident, membrane present and well defined, lacking evident venation.

Discussion. – The male holotype of *G. limnocoroides* is a brachypterous male specimen (Figs. 19–21) in the Genoa Museum from Asciiu Cheba, Burma bearing the following labels (from top to bottom, commas indicate line breaks, slashes indicate separate labels): “Carin, Asciiu Cheba, 1200–1300 m, L. Fea I-88 (black, printed)/TYPUS (red, printed)/ *Gestroiella, limnocoroides*, Mont. (script in Montandon’s hand)/*Gestroiella, limnocoroides*, gen. n. sp. n., es. tip. (script in Montandon’s hand)/ *Gestroiella, limnocoroides*, Montand., type (script in Gestro’s hand).” Another brachypterous male specimen in The Natural History Museum, London is also labelled as the holotype, and bears the same locality data as the Genoa specimen above, but lacks the type notations by Montandon and Gestro. The Genoa specimen is therefore designated as the lectotype to avoid further confusion.

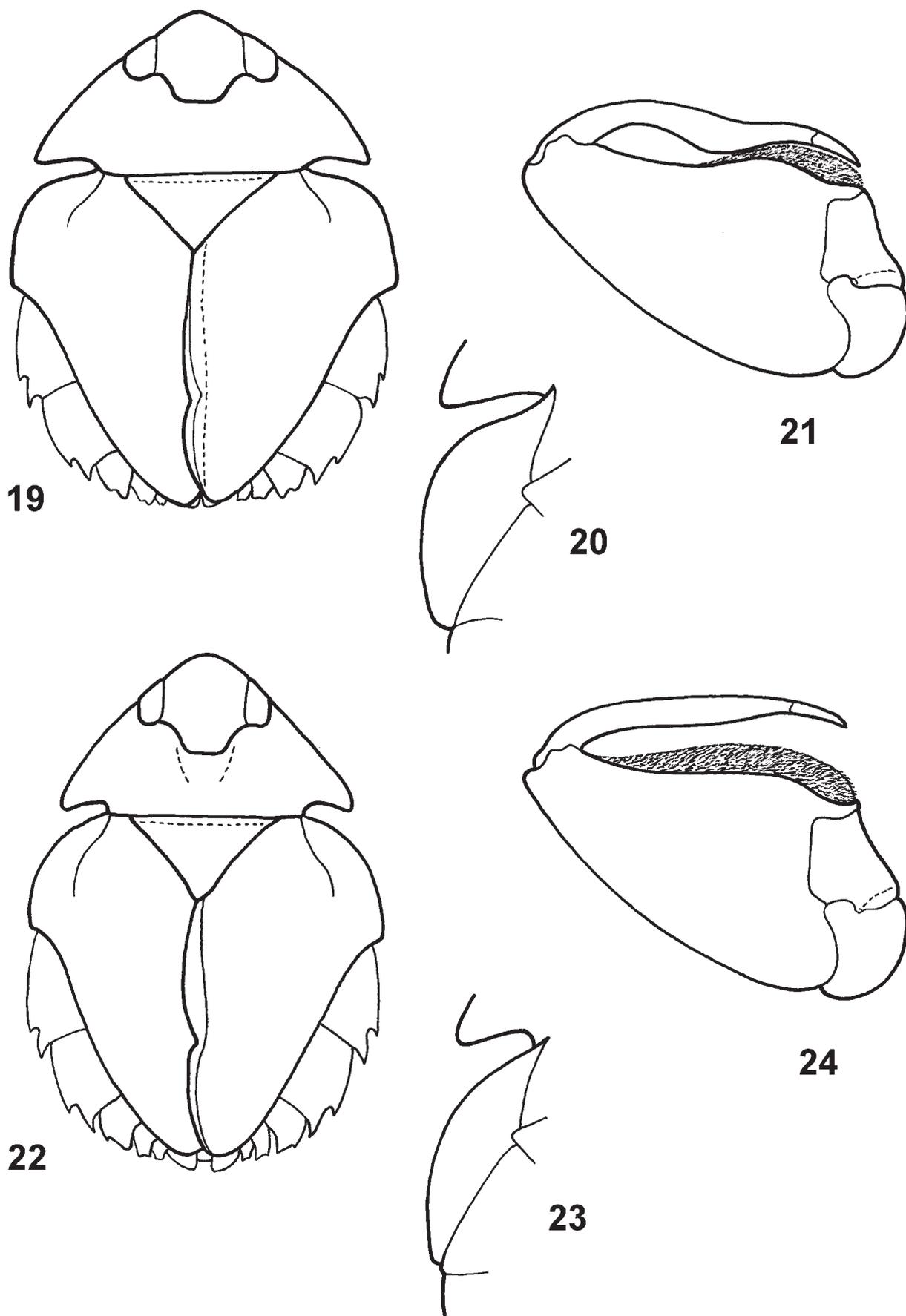
The holotype of *G. schoutedeni* is a brachypterous female (Figs. 22–24) in the Paris Museum from Phuc Son, Annam (in the current Nghê An Province of Vietnam) bearing the following labels (from top to bottom, commas indicate line breaks, slashes indicate separate labels): “Phuc Son, Annam XI.XII, H. Rolle Berlin S. W. 11 (black, printed)/Museum Paris, A. L. Montandon 1909 (black, printed)/*Gestroiella, schoutedeni*, type 1909 Montandon (black script in Montandon’s hand, with type notation in red).” Another brachypterous male from Phuc Son in The Natural History Museum, London is also labelled as the holotype; it bears the same locality data as the specimen above, but lacks the red type notation by Montandon. Still another brachypterous female specimen from Phuc Son in the University of Kansas collection bears a script label below the locality label reading: “*Gestroiella schoutedeni* Mont. Spec. with type from same local.” The Paris specimen is herein designated as the lectotype, in order once again to avoid further confusion.

The holotype of *G. perfecta* has not been located. The specimen came from “Tonkin, Than-Moi” and was considered by Horváth (1918) to be the macropterous form of *G. schoutedeni*.

Gestroiella limnocoroides exhibits a wide degree of intraspecific morphological variation across its range in Indochina, similar to the situation seen with the variable naucorid species *Ambrysus mormon* in western North America. The type specimens from Burma have the pronotal angles broadly produced laterally (Fig. 19), much more so than other specimens from Thailand or Vietnam (Fig. 22). Initially it was thought that this could be a useful character for separating these populations, since the narrower morphs had been given the name *G. schoutedeni* Montandon. Examination of a large amount of material from across Indochina, however, has revealed that no consistently reliable morphometric measurements can be found to separate these supposed taxa across what appears to be a continuous range of variation, possibly linked to varying degrees of incipient submacroptery in populations, or sexual dimorphism. Since the internal genitalic characters of the males do hold constant across all of these populations, as do the external characters of the female abdomen, it is concluded herein that Horváth was correct in his synonymy of *G. schoutedeni* and *G. perfecta* under *G. limnocoroides*.

As interpreted herein, *G. limnocoroides* may be separated from *G. siamensis* by its larger overall size (body length less than 15 mm in *G. siamensis* versus over 17 mm in *G. limnocoroides*), and by its more robust male paramere shape (compare Figs. 27, 28). Although similar in size to *G. insignis*, it may be separated from that species by the angular, non-bifurcate tip of the dorsomedial process in the male genital capsule, and by the pattern of medial hair tufts on female abdominal venter and the shape of the female subgenital plate (compare Figs. 31, 32).

Gestroiella limnocoroides is widely distributed in Indochina (Fig. 34), with the type locality lying east of modern Toungoo, in the western foothills of the Shan Plateau draining to the

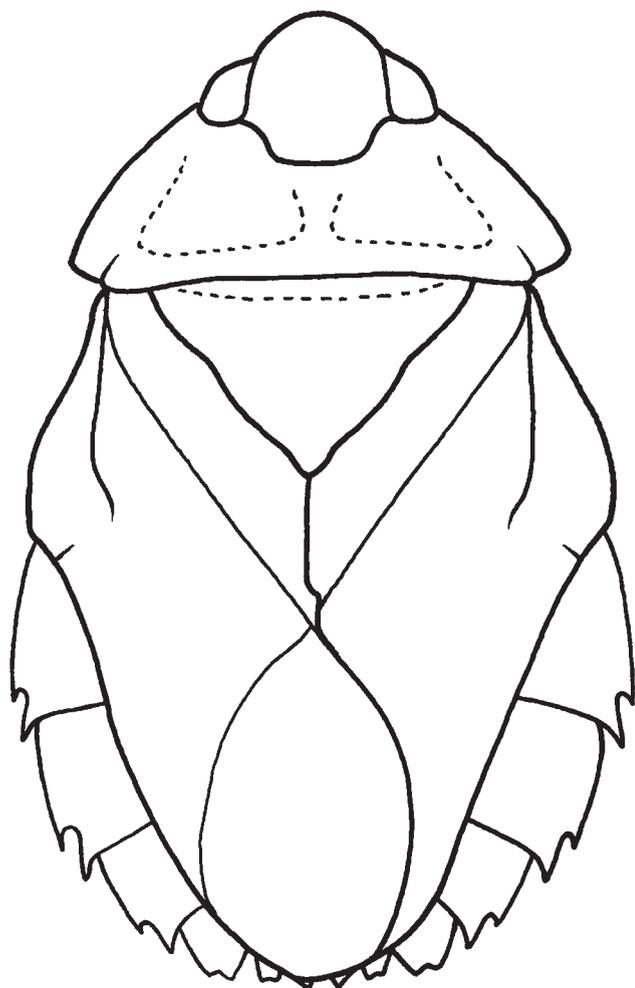


Figs. 19–24. *Gestroiella limnocoroides*, structural details: 19, Dorsal habitus, legs omitted; 20, Embolium of hemelytra, ventral view; 21, Foreleg; 22, Dorsal habitus, legs omitted; 23, Embolium of hemelytra, ventral view; 24, Foreleg. Figs. 19–21: *Gestroiella limnocoroides*, brachypterous male (holotype of *G. limnocoroides*); Figs. 22–24: *Gestroiella limnocoroides*, brachypterous female (holotype of *G. schoutedeni*).

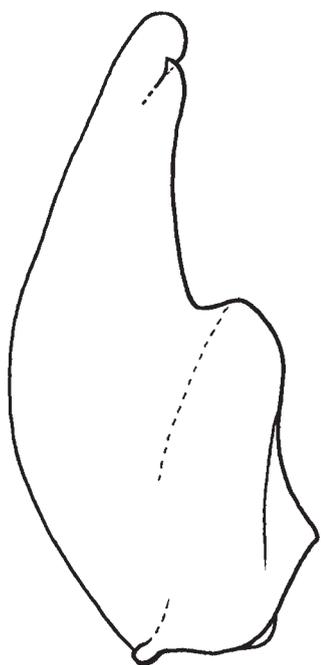
Sittang River. In Vietnam, this is a species of lower elevation rivers below 1,000 m, with beds of gravel and cobbles (Figs. 36–38), and is not generally found in the higher, colder, more rushing streams favored by *Cheirochella tonkina*. By contrast, on the swift Nam Chai River near Fang, in northern Thailand, this species was found syntopically with *Cheirochella thailandana*.

Material examined. – BURMA [MYANMAR], **Kayah Division:** 1 brachypterous male, Carin, Asciiui Cheba, 1,200–1,300 m, L. Fea, Jan.1888 (type, MSNG); 1 brachypterous female, Carin Ghecu, 1,300–1,500 m, L. Fea, Feb.–Mar.1888 (MSNG). **Kachin Division:** 1 macropterous male, 2 brachypterous females, Ma Kyaw Wa River, 3.8 km SW of Putao, 480 m, 27°18.90'N 97°22.93'E, 30 May 1999, H. Schillhammer (USNM). **Kayin Division:** 1 brachypterous male, Dawna [Dawna Range], April 1992 (USNM). CHINA, **Yunnan:** 1 brachypterous male, Ningpo, Le Moults (SEMK); 1 macropterous male, Yunnan, Le Moults (RMNH); 1 brachypterous male, 2 brachypterous females, Simao, Mekong Basin, THH0078, H. H. Tan (NUS); 1 brachypterous male, 4 brachypterous females, 7 nymphs, Xishuangbanna, Manchang stream, 63 km fr Jinghong to Menglun; CM Yan & P. Chew, 30 May 2002, YCM0300 (NUS); 2 brachypterous males, Xishuangbanna, Mengxing River, CM Yang & P.

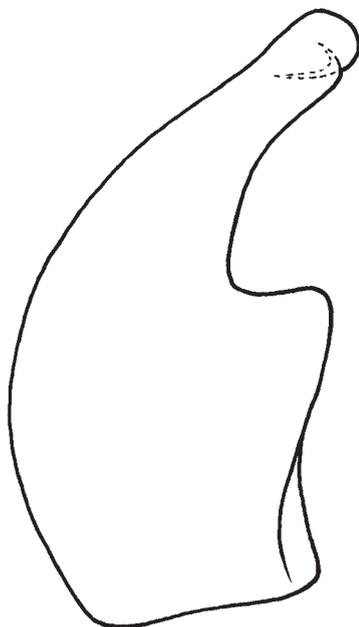
Chew, 1 Jun.2002, YCM0308 (NUS); 1 brachypterous male, 1 brachypterous female, 1 nymph, Xishuangbanna, Nanla River, CM Yang, 2 June 2002 YCM0312 (NUS); 2 brachypterous males, 1 brachypterous female, 1 macropterous female, 5 nymphs, Xishuangbanna, Mengyuan, nr. Village, fast flowing stream, CM Yang, 2 Jun.2002 YCM 0315 (NUS); 1 brachypterous female, 2 nymphs, Xishuangbanna, Mangle Stream, next to rubber plantation, CM Yang & Gao Lei, 4 Jun.2002, YCM0320 (NUS). LAOS, **Houaphan Prov.:** 1 brachypterous male, Ban Saleui, 1350 m, Xamneua [Xam Nua], 21–24 Jun.2003, M. Sato (JTTC). **Louang Phrabang Prov.:** 1 brachypterous male, Luang Prabang, Ban Nam Mo, 3 Apr.1918, R. V. de Salvaza (RMNH); 1 brachypterous male, 1 brachypterous female, Luang Prabang, Ban Na Hai, 10 Mar.1920, R. V. de Salvaza (BMNH); 1 brachypterous male, Luang Prabang, Ban Houei Ngai, 8 Mar.1918, R. V. de Salvaza (BMNH); 4 brachypterous males, Annam, Laos (JTTC); 1 brachypterous female, Pak Teu, 11 Nov.1917, R. V. de Salvaza (BMNH). **Xiang Khoang Prov.:** 3 brachypterous females, Haut Mekong, Nam Mat, 15 Apr.1918, R. V. de Salvaza (BMNH). **Province uncertain:** 1 brachypterous female, Haut Mekong, Muong Sing, 18 Apr.1918, R. V. de Salvaza (BMNH). THAILAND, **Chiang Mai Prov.:** 29 brachypterous males, 19 brachypterous females, Fang Dist., Nam Chai River above hydro station intake at Fang Horticultural Research Station, 550 m, 15 Nov.1985, CL 2197, D. A. and J. T. Polhemus (JTTC); 23 brachypterous males, 51 brachypterous females, 18 immatures, Fang Dist., Mae Mao River, S. of Fang Horticultural Research Station, 500 m, 16 Nov.1985, D. A. and J. T. Polhemus (JTTC); 1 brachypterous male, 1 macropterous male, 5 immatures, Doi Inthanon National Park, Mae Pan Noi at Ban San Pathana, 18°31'N 98°25'E, 750 m, gravel in bedrock stream, 7 May 2002, UMC & CMU teams, L-393 (UMC); 4 brachypterous males, 1 macropterous female, 2 immatures, Doi Inthanon National Park, Mae Klang River at Sob Ab Waterfall, 18°31'N 98°36'E, 543 m, gravel, 8 May 2002, UMC & CMU teams, L-397 (UMC); 1 brachypterous female, Doi Inthanon Nat. Park, Mae Pan Waterfall, 18°31'N 98°27'E, 1,100 m, gravel, 8 Jun.2002, CMU team (UMC); 1 brachypterous male, 4 brachypterous females, Doi Inthanon Nat. Park, Mae Klang River at Ecolodge, 18°32'N 98°32'E, 1,000 m, gravel, 8 May 2002, UMC & CMU teams, L-399 (UMC); 1 brachypterous male, 1 brachypterous female, Fang Horticulture Exp. Farm, Nam Mae Chai, 19°57'N 99°09'E, 600 m, 17 Mar.2002, R. W. Sites, L-301 (UMC); 3 brachypterous males, 13 brachypterous females, ca. 10 km E of Samoeng at River, 18°51'40.2"N 98°38'49.5"E, 11–2 Apr.2000, W. Ullrich (USNM); 3 brachypterous males, 13 brachypterous females, ca. 10 km E of Samoeng at River, 18°51'40.2"N 98°38'49.5"E, 11–2 Apr.2000, W. Ullrich (USNM). **Kampaeng Phet Prov.:** 1 immature, Khlong Lan National Park, 16°07'N 99°16'E, stream at Nam Tok Khlong Lan, 8 Mar.2002, CMU team, L-272 (UMC). **Kanchanaburi Prov.:** 20 brachypterous males, 20 brachypterous females, 4 macropterous males, 2 macropterous females, Amphur Sai Yok, Thong Pha Phum Forest Restoration Station, Mae Nam Noi, 14°31'N 98°37'E, 204 m, 12 Apr.2002, UMC & CMU teams, L-335 (UMC); 6 brachypterous males, 9 brachypterous females 3 macropterous males, 12 immatures, Amphur Thong Pha



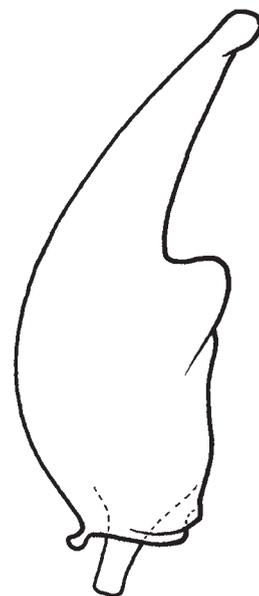
Figs. 25. *Gestroiella limnocoroides*, macropterous female. Specimen from Lao Cai, Tonkin (= northern Vietnam).



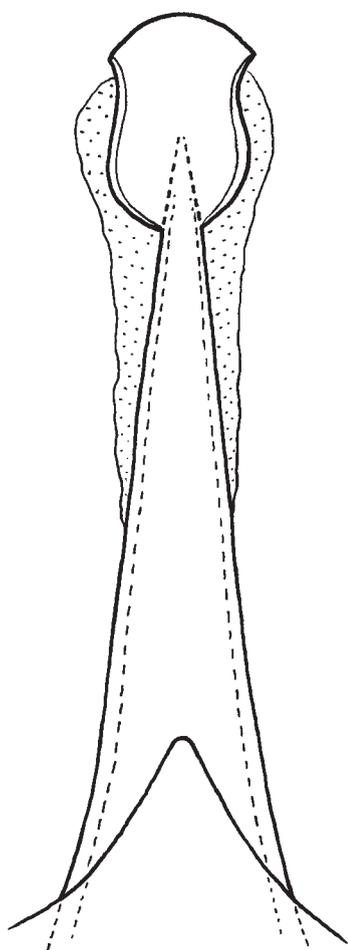
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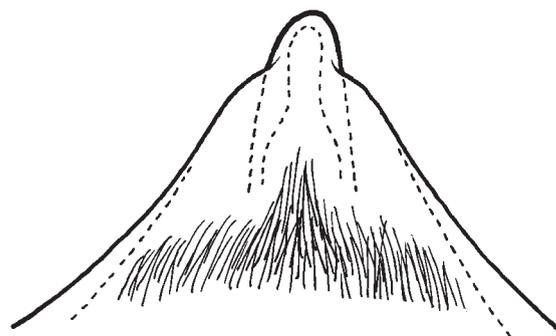
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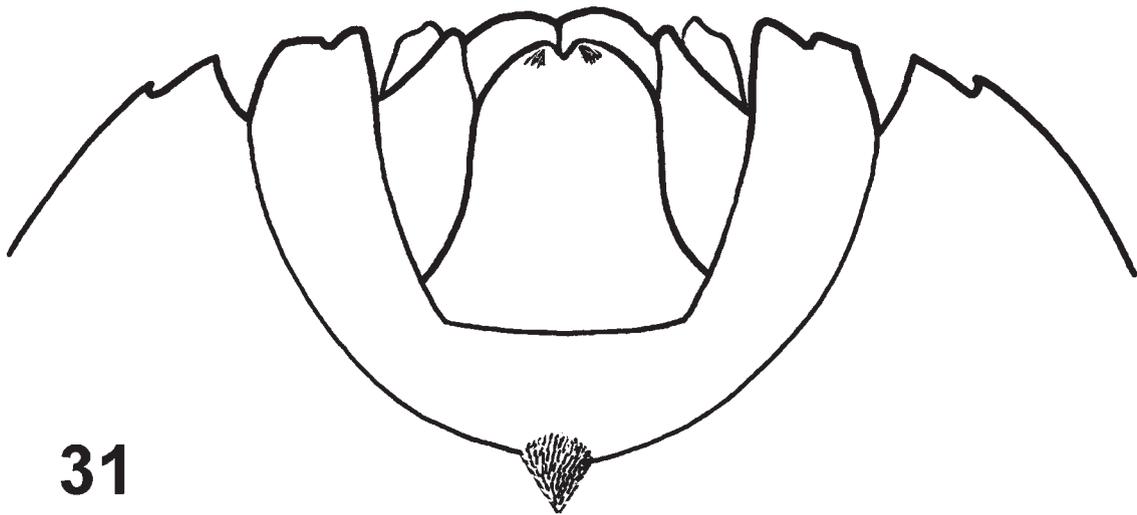


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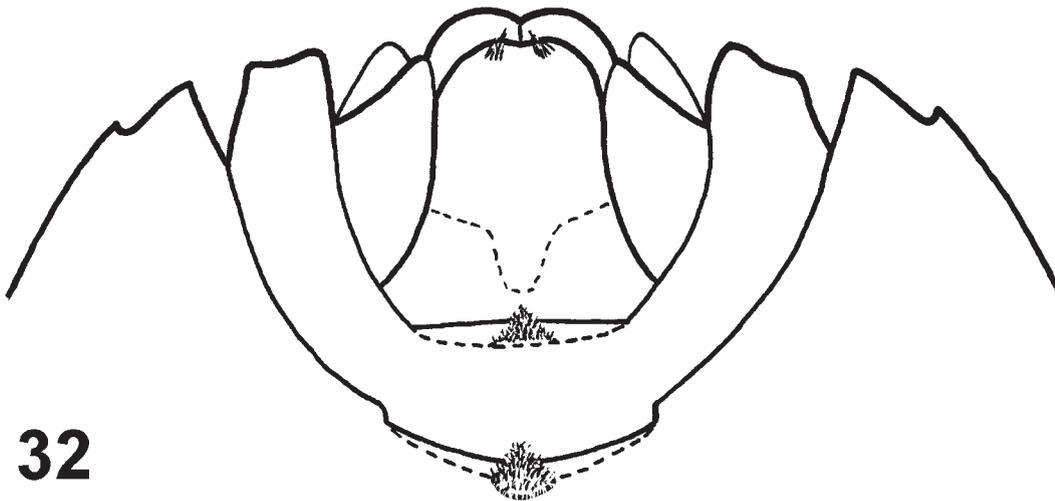


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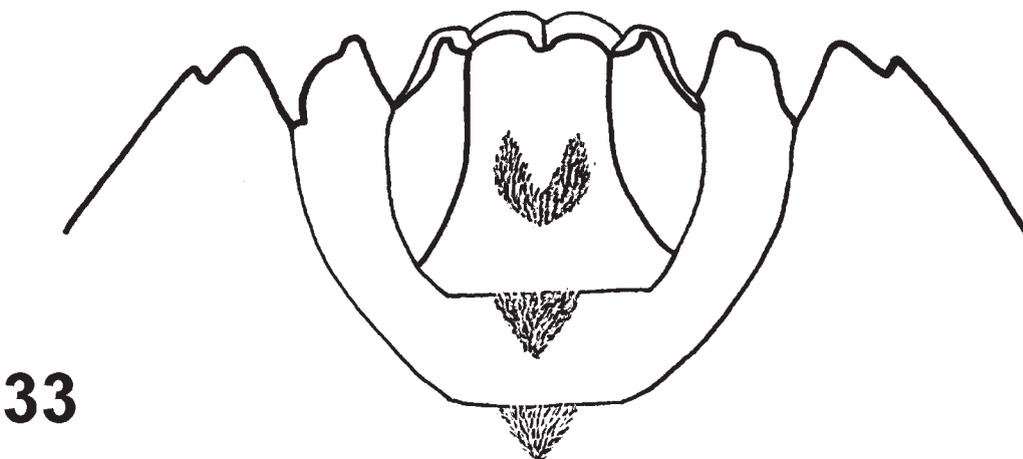
Figs. 26–30. *Gestroiella* species, male genitalia, structural details: 26, *G. insignis*, paramere; 27, *G. limnocoroides*, paramere; 28, *G. siamensis*, paramere; 29, *G. limnocoroides*, phallotheca; 30, *G. siamensis*, dorsomedial process of genital capsule.



31



32



33

Figs. 31–33. *Gestroiella* species, apex of abdomen of female, ventral aspect: 31, *G. insignis*; 32, *G. limnocoroides*; 33, *G. siamensis*.

Phum, Heuy Ou Long, 14°46'N 98°40'E, stream, 139 m, 11 Apr.2002, UMC & CMU teams, L-332 (UMC); 1 brachypterous male, 1 brachypterous female, river at Pong Phu Rawn, 14°38'N 98°31'E, 24 Mar.2002, G. W. Courtney (UMC); 1 brachypterous male, 1 brachypterous female, Amphur Sangkhla Buri, Heuy Li Jia, 15°04'N 98°33'E, gravel stream, 169 m, 13 Apr.2002, UMC & CMU teams, L-338 (UMC); 2 brachypterous males, 1 brachypterous female, Amphur Sangkhla Buri, Heuy Song Ka Lia, 15°13'N 98°26'E, gravel stream, 204 m, 13 Apr.2002, UMC & CMU teams, L-340 (UMC); 20 brachypterous males, 20 brachypterous females, Amphur Thong Pha Phum, Huey Pak Kog, 14°39'N 98°32'E, 184 m, gravel stream, 12 Apr.2002, UMC & CMU teams, L-336 (UMC). **Lampang Prov.:** 1 immature, Jae Sawn National Park, Nam Tok Jae Sawn, 18°50'N 99°28'E, 650 m, 16 Mar.2002, R. W. Sites, L-297 (UMC). **Mae Hong Son Prov.:** 1 brachypterous male, 3 km SE of Mae Hong Son, 13 Nov.1995, H. Zettel (NHMW); 20 brachypterous males, 20 brachypterous females, Huai Pha, 18 km N. of Mae Hong Son, 19°25'N 97°59'E, 340 m, 19 Mar.2002, Sites, Vitheepadit, Kirawanich, L-306 (UMC); 1 brachypterous male, 4 brachypterous females, Nam Tok Mae Surin National Park, Mae Nam Pai, 19°21'N 97°59'E, 310 m, 19 Mar.2002, Sites, Vitheepadit, Kirawanich, L-307 (UMC); 1 macropterous male, 1 macropterous female, 1 brachypterous female, Mae Kong River, ca. 25 km N of Mae Hong Son, Ban Na Pla Chia at Mae Nam Sangel River, 19°30'31.0"N 98°00'05.7"E, 9 Aug.1997, W. Ullrich (USNM); 2 brachypterous females, Tam Pla River, ca. 20 km N of Mae Hong Son, Tam Pla Resort, 19°25'34.2"N 97°59'16.7"E, 8 Aug.1997, W. Ullrich (USNM). **Nan Prov.:** 1 brahypterous male, Mae Charim

National Park, Nam Wa River, 18°36'N 100°59'E, 335 m, 13 Mar.2002, Sites, Vitheepadit, Kirawanich, L-293 (UMC). **Phayao Prov.:** 2 macropterous males, Doi Nangka [= Doi Phu Lang Ka], N. Siam, 29 Apr.1931, H. M. Smith (USNM). **Prachuap Khiri Khan Prov.:** 3 brachypterous males, 4 brachypterous females, 1 macropterous male, 1 macropterous female, 5 immatures, Amphur Bang Saparn, Tumbon Tong Mongkol, Moo Ban Tong Mongkol, 11°14'N 99°22'E, 73 m, 23 Apr.2002, Vitheepadit & Kirawanich, L-362 (UMC); 1 brachypterous female, Amphur Bang Saphan, Tumbon Tong Mongkol, creek from Nam Tok Sai Koo, 11°14'N 99°20'E, 73 m, 23 Apr.2002, Vitheepadit & Kirawanich; L-364 (UMC). **Tak Prov.:** 1 brachypterous female, Mae Nam Moi, Salween basin, 19 Mar.1996, S. H. Tan and N. Sivasothi (ZRC). **VIETNAM, Cao Bang Prov.:** 9 brachypterous males, 22 brachypterous females, rocky stream 5 km E. of Cho Ra, 210 m, water temp. 70°F (21°C), 21 Mar.2000, CL 4370, J. T. Polhemus and P. Nguyen (USNM); 1 brachypterous male, Le Nin stream at Pac Bo cave, 370 m, water temp. 64°F (18°C), 22 Mar.2000, CL 4371, J. T. Polhemus and P. Nguyen (USNM); 1 brachypterous male, 2 brachypterous females, Ban Doc waterfall area, 365 m, water temp. 68°F (20°C), 23 Mar.2000, CL 4372, J. T. Polhemus and P. Nguyen (USNM). **Bac Thai Prov.:** 2 brachypterous males, 3 brachypterous females, Cuc Bo stream, 37 km S. of Bac Canh, 80 m, water temp. 70°F (21°C), 24 Mar.2000, CL 4374, J. T. Polhemus and P. Nguyen (USNM). **Lào Cai Prov.:** 4 brachypterous males, 9 brachypterous females, river 31 km NE of Sa Pa on Lào Cai road, 105 m, 22°27'33"N 103°57'44"E, water temp. 22°C, 9 Apr.2000, 0945–1145 hrs., CL 4405, D. A. Polhemus, J. T. Polhemus and P. Nguyen

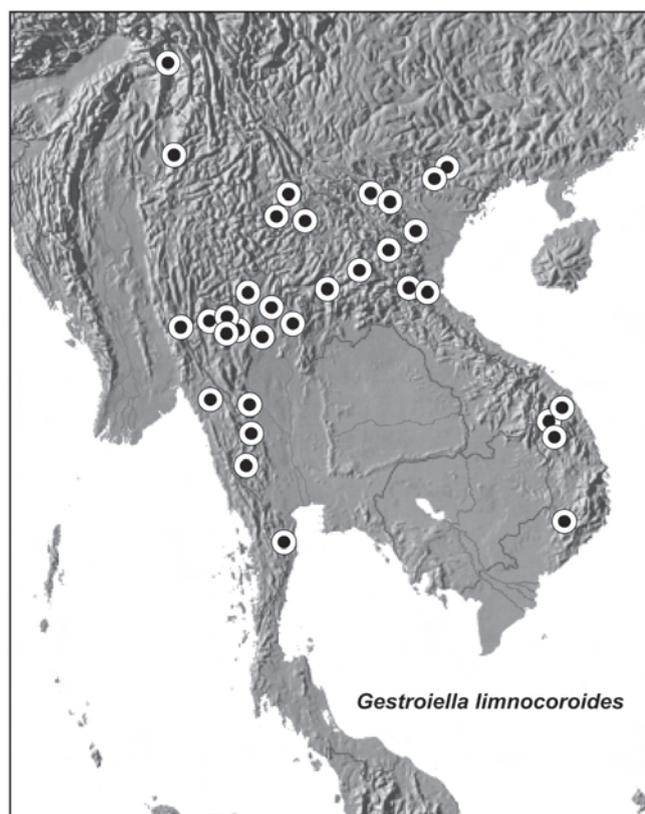


Fig. 34. Distribution of *Gestroiella limnocoroides* in Indochina.

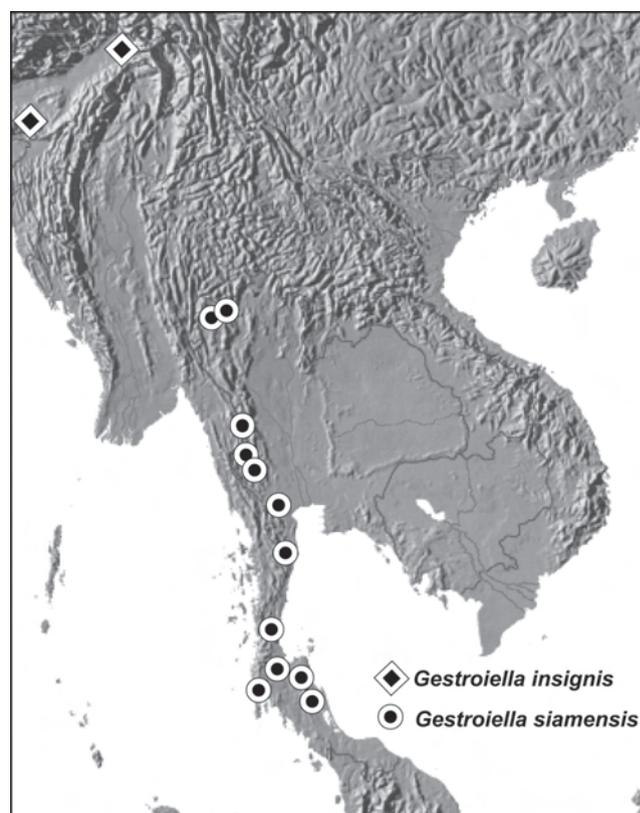
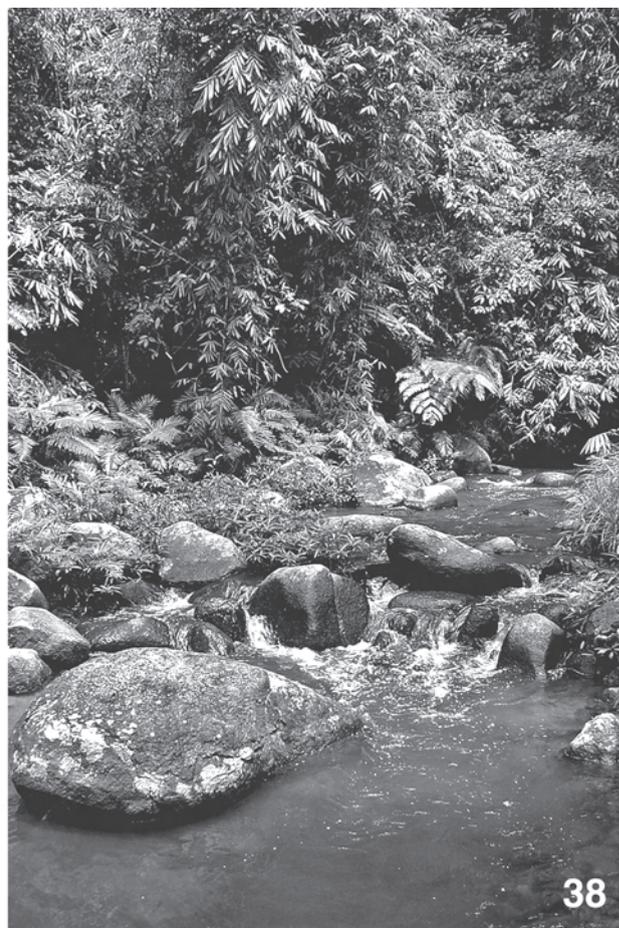


Fig. 35. Distributions of *Gestroiella* species in Indochina : diamonds = *G. insignis*; circles = *G. siamensis*.

(USNM); 1 macropterous female, Tonkin, Lao Kay, E. Le Mout (RMNH); 1 brachypterous female, Tonkin, Ban Nam Coum, Aug. 1917, R. V. de Salvaza (RMNH); 1 brachypterous female, Tonkin, Ban Nam Coun., Aug. 1917, R. V. de Salvaza (BMNH); 1 brachypterous male, Tonkin, Bao Ha [along Red River, SE of Lao Cai], Sept. 1901, Ardouin; label below with notation "Gestroiella limnocoroides comp. au type Montandon de Mus. Civ. de Genoa, J. Martin, det. 1902" (MHNP). **Hòa Bình Prov.:** 1 brachypterous female, Tonkin, Hoabinh, Aug. 1918, R. V. de Salvaza (JTPC); 2 brachypterous females, Tonkin, reg. de Hoa Binh, A. de Cooman, 1928 (MHNP); 6 brachypterous males, 5 brachypterous females, Tonkin, Hoa Binh, Aug. 1918, R. V. de Salvaza (BMNH). **Nghê An Prov.:** 1 brachypterous female, Annam, Phuc Son, XI.XII, H. Rolle, Berlin, S. W. 11 (holotype, MHNP); 2 brachypterous females, same data as preceding (SEMK); 6 brachypterous males, 4 brachypterous females, Pu Mat Nature Reserve, SW of Con Công, Khe Moi stream, 235 m, water temp. 71°F (22°C), 1 Apr. 2000, CL 4382, J. T. Polhemus and P. Nguyen (USNM); 5 brachypterous males, 1 brachypterous female, Choang River, nr. edge of Pu Mat Nature Reserve, 165 m, water temp. 78°F (26°C), 2 Apr. 2000, CL 4387, J. T. Polhemus and P. Nguyen (USNM). **Quang Ngai Prov.:** 1 macropterous male, 1 macropterous female, 3 brachypterous males, 3 brachypterous females, Nuoc Xi stream, 123 km NE of Kontum on Hwy. 24, 120 m, 14°43'10"N 108°35'48"E,

water temp. 26°C, 18 Mar. 2001, CL 4299, D. A. Polhemus, J. T. Polhemus and P. Nguyen (USNM). **Kontum Prov.:** 1 brachypterous female, stream in dry forest hills 29 km NE of Kontum on Hwy. 24, 565 m, 14°27'01"N 108°09'12"E, water temp. 69°F (21°C), 7–9 and 19 Mar. 2001, CL 4284, D. A. Polhemus, J. T. Polhemus and P. Nguyen (USNM); 1 brachypterous female, Ialing Rapids, 64 km SW of Kontum, 4 km W. of Ialy, 500 m, 14°12'02"N 107°48'42"E, water temp. 76°F (24°C), 8 Mar. 2001, CL 4285, J. T. Polhemus and P. Nguyen (USNM); 1 brachypterous male, 3 brachypterous females, rocky stream 84 km NE of Kontum on Hwy. 24, 1145 m, 14°39'03"N 108°25'14"E, water temp. 22°C, 20 Mar. 2001, CL 4305, D. A. Polhemus, J. T. Polhemus and P. Nguyen (USNM). **Lâm Đông Prov.:** 4 brachypterous males, 5 brachypterous females, Pongour Falls, 62 km SW of Dalat, 915 m, water temp. 78°F (26°C), 13 May 1998, CL 3091, J. T. Polhemus (JTPC). **Province uncertain:** 1 brachypterous male, Tonkin, E. le Mout, 1910; label below with notation in Montandon's hand "Gestroiella limnocoroides var? Montandon, det. Montandon 1910" (MHNP). **COUNTRY UNCERTAIN:** 1 brachypterous male, 1 brachypterous female, Indo-China [det. as *G. limnocoroides* by Hoberlandt] (JTPC); 1 brachypterous male, 1 brachypterous female, Kouy-Tcheou, reg. de Pin-Fa, Père Cavalerie, 1908 (MHNP); 1 macropterous female, Keng Trap, May 1917, R. V. de Salvaza (BMNH).



Figs. 36–38. Typical habitats for *Gestroiella limnocoroides* in central Vietnam (for detailed locality information see text): 36, Nuoc Xi stream, 120 m elevation, Quang Nai Province; 37, Stream 29 km northeast of Kontum, 565 m elevation, Kontum Province; 38, Stream 84 km northeast of Kontum, 1,145 m elevation, Kontum Province.

***Gestroiella insignis* Distant**

(Figs. 26, 31, 35)

Gestroiella insignis Distant, 1910: 318.**Supplemental redescription. – Brachypterous male:**

General colouration medium reddish-brown, with dark brown hemelytra; head dark yellowish-brown with darker, posteriorly opening U-shaped mark centrally on frons, eyes black; pronotum medium brown, narrowly margined with darker brown laterally and posteriorly; hemelytra dark brown except for narrowly along claval suture and basal 2/3 of embolium dark yellow; visible sections of abdominal tergites medium to dark yellow. Overall form elongate-ovate, size moderate for genus, body length 19.25, maximum width (across basal abdomen) 12.80; head length/width 3.80/5.10, anterior/posterior interocular 3.25/3.60, eye length/width 1.40/0.80; pronotum length (midline)/width 2.40/10.60; scutellum length/width 3.10/5.40. Hemelytra brachypterous, reaching to tip of abdomen, venation obscure, corium finely and shallowly rugose, membrane absent, hemelytral apices acutely rounded.

Brachypterous female: Similar to brachypterous male in general size and colouration; body length 19.00, maximum width (across basal abdomen) 11.90.

Discussion. – This species is similar in overall size and general habitus to *G. limnocoroides*, but has the medial process of the male genital capsule bifurcate at the tip. The male paramere is also less thickened basally, has a smaller, less shelf-like basal lobe, and has a slightly more slender apex (compare Figs. 26, 27). The female subgenital plate is apicomediaally notched in *G. insignis*, versus only slightly indented in *G. limnocoroides*, and is bordered basally by a small medial tuft of setae (compare Figs. 31, 32). In addition, the few specimens at hand have the hemelytra predominantly dark, with only the basal 2/3 of the embolium dark yellow, in contrast to *G. limnocoroides* where typically the entire embolium (and often the confluent posterolateral section of the corium) is dark yellow. To date, *G. insignis* has been taken only in the upper Brahmaputra drainage basin of far northeastern India.

Material examined. – INDIA, **Assam:** 1 brachypterous male, Sadiya (holotype, BMNH). **Meghalaya:** 2 brachypterous males, 2 brachypterous females, Shillong, A. K. Ahmed (JTTC).

***Gestroiella siamensis* new species**

(Figs. 18, 28, 30, 33, 35)

Description. – **Brachypterous male** (n = 10): Length: 12.78–14.11 mm, width: 8.22–9.13 mm maximum width across embolium or abdominal segment 3. Overall appearance ovate (Fig. 18).

Head yellowish. Greatest width at posterolateral angles of eyes, 4.10 mm. Head length 3.03 mm. Interocular space at

middle of eye, 2.42 mm. Eye length 1.36 mm. Head extends anteriorly in front of eyes 0.82 mm. Paired dark brown lines confluent at anterior margin on midline, diverging posteriorly. Anterior margin dark brown in some specimens, especially dense just anterior to eyes. Midventral carina extending 4/5 length of head posterior to rostrum, contiguous with prosternal carina. Tuft of elongate golden setae on posterior margin at base of carina. Ratio of antennal segment lengths: 7-5-14. Rostrum dark brown, directed ventrad, short, 0.6 mm (not including protruding stylets). First visible rostral segment recessed into head capsule, not surpassing margins of genae. Ratio of 3 visible rostrum segment lengths: 5-10-16.

Thorax with pronotum yellowish throughout with broad, dark brown posterior margin, dark brown markings at anterior margin near posterolateral angles of head convexity, dark brown punctation in patterns (Fig. 18). Posterolateral angles narrowly rounded. Pronotum width 7.72 mm, length 2.01 mm. Scutellum yellowish, punctate. Scutellum width 3.98 mm, length 2.30 mm. Forewings mottled with yellow and medium brown, entirely yellow in embolar regions and at midline posterior to scutellum, medium brown stripe where wings overlap at midline. Anterior and lateral margin of embolium evenly rounded and with dense row of erect yellow setae; otherwise, devoid of setae other than short peglike setae. Hemelytra extending posteriorly to middle of tergum VII, apices narrowly rounded. Hemelytra width 4.71 mm, length 8.88 mm (width measured from apex of scutellum to lateral margin of wing, length from lateral margin of scutellum directly posteriorly to wing apex).

Thoracic venter orange-yellow throughout. Carina produced to acute tip extending posteriorly to midlength of mesocoxa. Metepisternum mostly pruinose, series of ridges extending laterad, appearing regularly rugulose, posterior margin deeply sinuate. Metasternal plate between meso- and metacoxae carinate, broadly rounded posteriorly.

Legs yellowish, scattered pale setae on most segments. All coxae pruinose, differentially beset with short, dark, recumbent setae. All legs with trochanter through tarsus shining. Distal end of femur, entire tibia and tarsus medium brown. Length of profemur 3.85 mm, protibia 2.75 mm, protarsus 0.82 mm. Lengths of mesofemur, mesotibia, 3 tarsomeres I–III 3.40, 2.71, 0.22, 0.44, 0.86 mm. Lengths of metafemur, metatibia, 3 tarsomeres I–III 4.51, 4.63, 0.30, 0.76, 0.96 mm.

Dorsal abdomen yellowish with light brown posterolateral angles of terga III–V, posterior margins of terga IV–VI and most of tergite VII. Pair of abdominal scent gland openings at posterior margin of tergite III, 1/5-distance to lateral margin from midline. Posterolateral angle of segment II rounded, III acutely spinose with secondary spine anterior to posterolateral angle, spines of IV similar to those of III, but slightly smaller, V with secondary spine reduced to rounded lateral protruberance, posterolateral angles of V–VIII rounded.

Ventral abdomen with scattered pale recumbent setae

throughout. Sternites II–IV generally yellowish, medium brown posterolaterally, V–VII medium brown posteromedially. Genital capsule and mesal portion of VI and VII orange brown. Posterior margins of sternites IV–V concave medially. Sternite VI with posterior margin convex at midline, produced to blunt point. Posterior margins of sternite VII straight at middle, of genital capsule evenly rounded.

Genitalia with pygophore produced medially into broad triangular point between parameres and covered with conspicuous mat of brown setae in middle half. Parameres symmetrical; devoid of vestiture; crossing phallosome of aedeagus; concave, wrapping dorsad toward aedeagus; elongate, gradually tapering toward apex (Fig. 28); apex slightly deflexed mesad; middle of lateral margin with broad, rounded lobe. Aedeagus with phallosome parallel-sided until just beyond tips of parameres where lateral margins flare laterad slightly before converging toward base of vesica. Phallosome abruptly produced laterally and broadly ovate. Dorsomedial process of male genital capsule broadly triangular, slightly produced at apex (Fig. 30).

Brachypterous female (n = 10): Length: 13.78–14.44 mm, width: 8.80–9.13 mm. Colouration and setation generally same as for male. Subgenital plate broadly triangular, sides evenly concave, apex bilobate (Fig. 33), width 1.46, length 1.60, clothed with fine, light coloured pubescence in basal half. Paratergite VII medium brown with light distal margin, pointed apically. Posterior margins of sternite V straight in middle third, concave laterally; of sternite VI evenly convex. Sternites IV–VI each with brush of brown hairs in posterior 1/3 at midline. Female subgenital plate Fig. 33.

Macropterous form: Male (n = 10): Length: 13.78–14.94 mm, width: 8.30–9.13 mm. Female (n = 10): Length: 14.11–15.11 mm, width: 8.30–9.13 mm. Similar to brachypterous forms with the following differences: Slightly more elongate; head and pronotum with colour pattern darker; head in front of eyes shorter; pronotum with posterolateral corners truncate; scutellum larger, raised, width and length 4.84, 3.12 mm (males), 4.92 mm, 3.28 (females); mesosternal carina reduced to rounded tumescence; each hemelytron with clavus and claval suture well defined; longitudinal suture within clavus extending from near base to apex; embolium with lateral margin sinuate.

Types. – Holotype, male, and allotype, female: THAILAND, **Kanchanaburi Prov.**, Amphur Sangkhla Buri, Heuy Kob, 15°13'N 98°22'E, 289 m, gravel stream, 13 Apr.2002, L-339, collected by UMC and CMU teams (UMC). Paratypes: THAILAND, **Kanchanaburi Prov.:** 26 males, 28 females, same data as holotype (UMC NMNH, RFDB); 2 males, 1 female, river at Pong Phu Rawn, 14°38'N 98°31'E, 24 Feb.2002, G. W. Courtney (UMC). **Phang Nga Prov.:** 2 brachypterous males, 2 brachypterous females, Amphur Kapong, Ban Tha Na, gravel stream, 8°40'N 98°25'E, 32 m, 28 May 2003, A. Vitheepadit and Ferro (JTFC).

Additional Material Examined (not paratypes). – THAILAND, **Chumpon Prov.:** 16 brachypterous males,

9 brachypterous females, 1 nymph, Amphur Phato, Heuy Pa Ti Ma, 40.1 km NE intersection Hwy 4 x 4006, 9°49'N 98°47'E, 47 m, L-373, 26 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 8 brachypterous males, 8 brachypterous females, 2 macropterous females, 7 nymphs, Amphur Phato, Klong Nhag, 44.1 km NE intersection Hwy 4 x 4006, 9°53'N 98°53'E, 51 m, L-372, 26 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 5 brachypterous males, 10 brachypterous females, 5 macropterous males, 2 macropterous females, 6 nymphs, Amphur Phato, Klong Tab Khon, 33.1 km NE intersection Hwy. 4 x 4006, 9°49'N 98°41'E, 47 m, L-374, 26 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC). **Kanchanaburi Prov.:** 5 brachypterous males, 8 brachypterous females, Amphur Sai Yok, Thong Pha Phum Reforestation Station, Mae Nam Noi, 14°31'N 98°37'E, 204 m, L-335, 12 Apr.2002, UMC and CMU teams (UMC); 15 brachypterous males, 15 brachypterous females, 2 macropterous males, 1 macropterous female, Amphur Thong Pha Phum, Huey Pak Kog, gravel stream, 14°39'N 98°32'E, 184 m, L-336, 12 Apr.2002, UMC and CMU teams (UMC); 3 brachypterous males, 3 brachypterous females, 2 macropterous females, Amphur Thong Pha Phum, Heuy Ou Long, stream, 14°46'N 98°40'E, 139 m, L-332, 11 Apr.2002, UMC and CMU teams (UMC); 1 brachypterous male, 1 macropterous male, 1 macropterous female, Amphur Sangkhla Buri, Heuy Song Ka Lia, gravel stream, 15°13'N 98°26'E, 204 m, L-340, 13 Apr.2002, UMC and CMU teams (UMC); 1 brachypterous male, 1 brachypterous female, Amphur Sangkhla Buri, Heuy Li Jia, gravel stream, 15°04'N 98°33'E, 169 m, L-338, 13 Apr.2002, UMC and CMU teams (UMC). **Mae Hong Son Prov.:** 6 brachypterous males, 3 brachypterous females, Huai Pha, 18 km N. of Mae Hong Son, 19°25'N 97°59'E, 340 m, L-306, 19 Mar.2002, Sites, Vitheepadit, Kirawanich (UMC); 1 brachypterous adult, ca. 20 km N. of Mae Hong Son, Tam Pla Resort at Tam Pla River, 19°25'34.2"N 97°59'16.7"E, 8 Aug.1997, W. Ullrich; 2 brachypterous adults, ca. 25 km N of Mae Hong Son, Ban Na Pla Chia, at Mae Nam Sangel River, 19°30'31"N 98°00'5.7"E, 9 Aug.1997, W. Ullrich (USNM); 1 brachypterous adult, Mai Di Kom Village, Mae Kong River, ca. 50 km NNE of Mae Hong Son, 19°35'2.2"N 98°06'41.9"E, 24 Dec.1997, W. Ullrich (USNM); 1 brachypterous female, Pai River, Mae Surin, Headquarters, schnellfliessendes Wasser, 15 April 1999, D. Kovac G10/99 (JTFC); 1 brachypterous male, Pangmapa, Nam Khong Fluss, 9 May 1999, D. Kovac, G43/99 (JTFC); 1 brachypterous male, 17 rd. km N. of Mae Hong Son, Mok Cham Pae nr. Fish Cave, 11 Nov.1995, H. Zettel (NHMW); 1 brachypterous male, 17 rd. km N. of Mae Hong Son, Mok Cham Pae nr. Fish Cave, 11 Nov.1995, H. Zettel (NHMW). **Nakhon Si Thammarat Prov.:** 11 brachypterous males, 9 brachypterous females, 14 nymphs, Noppitam, Ban Pitam, Tumbon Krung Ching, gravel stream, 6.7 km SW intersection Hwy. 4186 x 4188, 8°44'N 99°39'E, 98 m, L-382, 30 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 6 brachypterous males, 3 brachypterous females, 2 nymphs, Noppitam, Ban Pitam, gravel stream, 10.7 km NW intersection Hwy 4140 x 4186, 8°47'N 99°41'E, 127 m, L-384, 30 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 1 brachypterous male, 1 brachypterous female, 1 nymph, Noppitam, Ban Pitam, gravel stream, 14.9 km NW intersection Hwy 4140

x 4186, 8°47'N 99°39'E, 98 m, L-383, 30 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 1 brachypterous male, 6 brachypterous females, 2 nymphs, Chawang Rd., ca. 8 km S. of Khao Luang Nat. Park, roadside stream, L-139, 12 Jul.1997, R. W. Sites and S. Permkam (UMC); 10 brachypterous males, 7 brachypterous females, 20 nymphs, stream from Khao Luang Nat. Pk., under bridge, L-140, 12 Jul.1997, R. W. Sites and S. Permkam (UMC). **Phang Nga Prov.:** 3 brachypterous males, 2 brachypterous females, Amphur Kura Buri, Tumbon Bang Won; gravel stream, 9°59'N 98°26'E, 45 m, 27 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 4 brachypterous males, 2 brachypterous females, 3 nymphs, Amphur Muang, gravel stream, 3.9 km N. intersection Hwy 4090 x 4240, 8°33'N 98°26'E, 38 m, L-379, 28 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 5 brachypterous males, 7 brachypterous females, 2 nymphs, Amphur Kapong, stream, 5.4 km N. of intersection Hwy 4090 x Ban Kradi Ban Lum Roo Road, 9°39'N 98°26'E, 69 m, L-380, 28 April 2002, A. Vitheepadit and K. Kirawanich (UMC); 2 brachypterous males, 1 brachypterous female, 1 nymph, Amphur Muang, gravel stream, 6.9 km N. of intersection Hwys. 4090 x 4240, 8°32'N 98°28'E, 38 m, L-378, 28 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC). **Phattalung Prov.:** 2 brachypterous males, 2 brachypterous females, 27 nymphs, Mom Jui Waterfall, 4 km W. of Tamote Village, rocky stream, L-134, 11 Jul.1997, R. W. Sites and S. Permkam (UMC). **Prachuap Khiri Khan Prov.:** 5 brachypterous males, 1 brachypterous female, 8 nymphs, Amphur Hua Hin, Tumbon Heuy Pheung, Ban Sak Yai, stream, 12°30'N 99°34'E, 121m, L-358, 21 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 2 brachypterous females, 14 nymphs, Amphur Hua Hin, 10.5 km E. of Nam Tok Pa La Or on Hwy. 3219, 12°31'N 99°33'E, 134 m, L-356, 20 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 5 brachypterous males, 2 brachypterous females, 32 nymphs, Amphur Bang Sapam, Tumbon Tong Mongkol, Moo Ban Tong Mongkol, 11°14'N 99°22'E, 73 m, L-362, 23 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 10 brachypterous males, 18 brachypterous females, 7 nymphs, Amphur Kui Buri Forest Plantation Station, gravel & rock stream, 12°4'N 99°43'E, 147 m, L-360, 22 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC). **Ratchaburi Prov.:** 5 brachypterous males, 3 brachypterous females, 7 nymphs, Amphur Suan Pheung, 9 km SW Suan Pheung, stream, 19°30'N 99°17'E, 156 m, L-350, 17 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC). **Songkhla Prov.:** 20 brachypterous males, 15 brachypterous females, many nymphs, Ton Nga Chang Wildlife Sanctuary, stream at Buddhist temple, L-127, 6 Jul.1997, R. W. Sites (UMC); 1 brachypterous male, 10 nymphs, same locality, L-65, 8 Jan.1995, R. W. Sites and B. J. Nichols (UMC); 1 brachypterous female, 14 nymphs, Ton Nga Chang Wildlife Sanctuary, waterfall levels 2 and 3, L-66, 6 Jan.1995, R. W. Sites and B. J. Nichols (UMC). **Surathani Prov.:** 5 brachypterous males, 6 brachypterous females, 2 nymphs, Amphur Phanom, Klong Bang Tan, gravel stream, 8°54'N 98°35'E, 45 m, L-376, 27 Apr.2002, A. Vitheepadit and K. Kirawanich (UMC); 8 brachypterous males, 8 brachypterous females, 7 nymphs, Amphur Phanom, 20 km N. of Amphur Thap Put on Hwy. 4118, 8°40'N 98°42'E, 49 m, L-377, 27 Apr.2002, A. Vitheepadit and

K. Kirawanich (UMC). **Tak Prov.:** 3 brachypterous males, 5 brachypterous females, Mae Nam Moi, Salween basin, 19 Mar.1996, S. H. Tan and N. Sivasothi (ZRC).

Etymology. – The specific epithet “siamensis” is in reference to the extensive latitudinal range of this species in Thailand, which was known formerly as Siam.

Discussion. – This species is substantially smaller and more elongate in comparison to both *G. limnocoroides* and *G. insignis*, and has the dorsomedial process of the male genital capsule more broadly triangular and less produced than in either of those two species (Fig. 30). The lateral spines of abdominal segments III and IV are also substantially less prominent than those of *G. limnocoroides*. In males, the posterior margin of abdominal sternite VI is distinctly convex in the middle, whereas in *G. limnocoroides* it is truncate to distinctly concave; and the opposable surfaces of the profemur and tibia are evenly arcuate, whereas in *G. limnocoroides* the inner margin of the tibia is sinuate to varying degrees (see Figs. 21, 24). The brachypterous form has the yellow mottled colour pattern of the hemelytra. The macropterous form is distinguished by the presence of light colouration at the claval commisure and embolar suture, whereas in both morphs of *G. limnocoroides* the hemelytra are entirely black except for yellowish-brown colouration at the lateral margin of the embolium. In addition, the mesosternal keel of the brachypterous form of *G. siamensis* is well developed and about as wide as it is displaced ventrad, whereas it is poorly developed in *G. limnocoroides* such that it is substantially wider than displaced ventrad. The aedeagus is more abruptly narrowed beyond the tips of the parameres, the parameres are more slender (compare Figs. 27, 28), and the mat of dark hairs on the phallobase is not present in *G. limnocoroides*.

Gestroiella siamensis occupies an elongate north-to-south range extending from the southern Shan Plateau southward through the entire mountain spine of the Thai-Myanmar border area to the Isthmus of Kra (Fig. 35). Specimens of *G. siamensis* previously collected in southern Thailand were provisionally identified as *G. limnocoroides* by Sites et al. (1997), but should now be referred to *G. siamensis*.

Gestroiella siamensis has been collected in clear, rocky-bottomed streams with a wide range of current velocities, although it is absent from sluggish or stagnant reaches in such streams. It has been taken syntopically with *G. limnocoroides* in western Thailand in Kanchanaburi and Tak provinces, indicating that the eastern margin of the Shan Plateau may be a zone of contact between these two otherwise allopatric species.

Symbiotic associations. – An ectosymbiotic chironomid, *Nanocladius (Plecopteracoluthus) asiaticus* Hayashi was found on >50% of both *G. siamensis* and *G. limnocoroides* throughout the range of the naucorids in Thailand. The chironomid was attached to various body parts, although usually middle and hind legs. More specifically, larvae and pupae were attached usually to the mesofemur but also to mesotibia, metafemur, metatibia, mesosternum, between

bases of meso- and metacoxae, between pronotum and mesoscutum or scutellum. There was a tendency for earlier instars of the chironomid to occur on earlier instars of the naucorids. As many as three *N. asiaticus* were found on some adult naucorids. This species of chironomid was previously recorded from corydalid larvae in Japan, Taiwan, and Malaysia, and the relationship was characterized as commensal (Hayashi 1998). Although other species of *Nanocladius* have been reported as phoretic on Odonata (Dosdall and Parker 1998), Megaloptera (Gotceitas and Mackay 1980), and Plecoptera (Dosdall et al. 1986), an undescribed species of *Nanocladius* was shown, using stable-isotope ratios, to be parasitic on a stonefly (Doucett et al. 1999). Thus, until this relationship is studied in more detail, we conservatively refer to the association between *N. asiaticus* and both species of *Gestroiella* as ectosymbiotic. The only other recorded association between chironomids and naucorids was *Eukiefferiella* sp. on *Cryphocricos peruvianus* DeCarlo (Roback 1977).

ACKNOWLEDGMENTS

The following curators kindly provided access to specimens held under their care (collection abbreviations are those used in the text): W. R. Dolling, British Museum (Natural History), London (BMNH); D. Pluot, Muséum National d'Histoire Naturelle, Paris (MNHN); Dr. P. H. van Doesburg, Rijksmuseum Van Natuurlijke Historie, Leiden (RHNL); Dr. V. Ranieri, Museo di Storia Naturale "Giacomo Doria", Genoa (MSNG); Herbert Zettel, Naturhistorisches Museum Wien (NHMW); Chang Man Yang, National University of Singapore (NUS); Gordon Nishida, Bishop Museum, Honolulu (BPBM); Norman Penny, California Academy of Sciences, San Francisco (CAS); Robert Brooks, Snow Entomological Museum, Lawrence, Kansas (SEMK).

DAP and JTP also wish to give special thanks to the late Dr. Cao Van Sung of the Institute of Ecology and Biological Resources, Hanoi, and to Phong Nguyen, Nam Cat Tien National Park, who facilitated survey work in Vietnam; to Mr. Surasek and Mr. Wewat, Fang Horticultural Station, for assistance with surveys in Thailand; and to Dr. Chris Wemmer, National Zoological Park, Smithsonian Institution, Dr. U. Uga, Nature & Wildlife Conservation Dept., Yangon, and Harry Schillhammer, Naturhistorisches Museum Wien, for assistance during surveys in Myanmar (Burma). These authors also thank Doug Currie for the gift of specimens collected in Vietnam and the late Masataka Sato for the gift of specimens collected in Laos.

RWS wishes to thank Peter Cranston, University of California-Davis, for identification and information concerning the phoretic chironomid. We also thank Akekawat Vitheepradit, University of Missouri-Columbia, for graciously sharing his distribution data for species of *Gestroiella* in Thailand. We are grateful to the National Research Council of Thailand and the Royal Forestry Department, Bangkok, for permission for RWS to conduct field work in Thailand. Support for RWS has been provided in part by NSF project number DEB-0103144 and by MU project number PSSSL0232.

The holotype, allotype, and some paratypes of *Gestroiella siamensis* are deposited in the Enns Entomology Museum, University of Missouri – Columbia, U.S.A. (UMC), with additional paratypes in the United States National Museum (USNM) and the Royal Forestry Department, Bangkok, Thailand (RFDB). Holotypes of all new *Cheirochella* species described herein are deposited in the U. S. National Museum of Natural History, Washington, D. C. (USNM); paratypes are held in that collection, in the J. T. Polhemus collection, Englewood, Colorado (JTPC), and in the collections of the institutions listed above as noted.

Faunal survey work by DAP and JTP upon which much of this research was based was made possible in part by the Smithsonian Institution's Drake Fund, and by a grant from the National Geographic Society, Washington, D. C. We thank these organizations for their continuing support of research on the taxonomy and zoogeography of aquatic Heteroptera.

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