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GUIDE TO THE AQUATIC HETEROPTERA OF SINGAPORE AND PENINSULAR MALAYSIA. IX. INFRAORDER NEPOMORPHA, FAMILIES OCHTERIDAE AND GELASTOCORIDAE

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ABSTRACT. — This is the ninth part in a series of papers constituting a Guide to the Aquatic Heteroptera of Singapore and Peninsular Malaysia, and treats the families Ochteridae and Gelasotocoridae, constituting the superfamily Ochteroidea in the infraorder Nepomorpha. Species treatments and keys are provided for the multiple species of *Ochterus* and *Nerthra* occurring in the region under study, and for several widespread extralimital species. The following new species are described: *Ochterus pseudomarginatus* new species from Singapore and Peninsular Malaysia, *Ochterus signatus* new species from Peninsular Malaysia and Vietnam, and *Ochterus singaporensis* new species from Singapore. New distributional records for Singapore and Peninsular Malaysia are also provided for *Ochterus marginatus* and *Nerthra macrothorax*. Colour habitus photos and line drawings of male genitalic structures are provided for all *Ochterus* species treated; a colour habitus photo is also provided for *Nerthra macrothorax*, accompanied by line drawings of key characters for *Nerthra* species found in Singapore and Peninsular Malaysia. An updated checklist is provided for species of *Ochterus* occurring in Southeast Asia and the Malay Archipelago.

KEY WORDS. — Ochteridae, Gelastocoridae, *Ochterus*, *Nerthra*, Singapore, Peninsular Malaysia, keys, new species

INTRODUCTION

This contribution is the ninth in a series of papers constituting a Guide to the Aquatic Heteroptera of Singapore and Peninsular Malaysia (Cheng et al., 2001a, 2001b; Andersen et al., 2002; Nieser, 2002, 2004; Yang & Zettel, 2005; Yang & Murphy, 2011; Zettel et al., 2011; J. Polhemus & D. Polhemus, 2012), and treats the families Ochteridae and Gelastocoridae. Multiple phylogenetic analyses of the infraorder Nepomorpha have consistently resulted in placement of the families Ochteridae and Gelastocoridae as sister taxa within a discrete clade, the superfamily Ochteroidea (Rieger, 1976; Mahner, 1993; Andersen & Weir, 2004; Li et al., 2012). As such, they are considered to represent a monophyletic group, but one that also retains a number of plesiomorphic characters in the context of the Nepomorpha, including ocelli and simple, unmodified antennae. Both families also possess primarily riparian ecological preferences, and have strongly asymmetrical male genitalia, with the right paramere much larger and more elaborate than the left. This latter character is of fundamental importance for discrimination of individual species, as discussed in more detail below.

MATERIAL AND METHODS

Keys, diagnoses, and figures are provided for the species of Ochteridae (*Ochterus*) and Gelasotocoridae (*Nerthra*) occurring in the region. The geographic scope of this work includes the island of Singapore, and Peninsular Malaysia south of the Isthmus of Kra. Because the island of Sumatra is in close proximity to Singapore, widespread Greater Sunda Island species in the groups under study have also been included, given that certain species previously known only from Sumatra have proven to be present in southern Peninsular Malaysia.

New and clarified distributional records are provided under the individual treatments for each species, including in some cases new extralimital records included to establish broader distributional context; the latter are listed under “Extralimital material examined”. Most of the specimens listed are housed

in the collections of the Zoological Reference Collection, Raffles Museum of Biodiversity Research, Singapore (ZRC), with additional records from the J. T. Polhemus Collection in Englewood, Colorado, USA (JTPC), the National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM), and the Bishop Museum, Honolulu, Hawaii, USA (BPBM).

In the Material Examined sections local conventions have been used in regard to geographic names without translation to English, so that the Malay "Sungai Gombak"is retained, rather than being translated to "Gombak River". The most common of these retained Malay terms are: *sungai* = river, *gunung* = mountain, *bukit* = hill, and *kampong* = village. In certain cases additional notations have been added in brackets to provide clarity in cases where label data was insufficiently detailed. For material in JTPC, the CL numbers following localities refer to a collection locality numbering scheme allowing cross-referencing of photographs and other metadata to specific collecting localities.

All measurements are given in millimeters. Synonymies provided under species are nomenclatural only.

Family OCHTERIDAE Kirkaldy

Discussion. — The Ochteridae, or velvet shore bugs, comprise a small family containing three extant genera: the widespread *Ochterus*, which is pantropical and the only genus occurring in Singapore and Peninsular Malaysia; *Megaochterus*, endemic to Australia; and *Ocyochterus*, confined to the Neotropical region. As a whole, the Ochteridae exhibit two major geographic foci of species radiation, in South America (Schell, 1943) and Melanesia (Baehr, 1990a, 1990b; Kormilev, 1971, 1973) respectively. In the Eastern Hemisphere, species richness diminishes markedly west of Huxley's Line (Schell, 1943; Kormilev, 1971, 1973; Gapud & San Valentin, 1977; Gapud, 1981, 1995; Baehr, 1990a, 1990b; Nieser & Chen, 1992), although the fauna of Singapore and Malaysia is undersampled and contains new species, as described below.

Ochteridae are recognised among the nepomorphan families by their large eyes, presence of ocelli, slender four-segmented antennae, transversely rugose frons and clypeus, long labium with segment III much longer than the others, slender legs with the fore femora enlarged, a tarsal formula of 2-2-3, the forewing membrane with several closed cells but no anastamosing veins, and unique genitalia with the right paramere greatly enlarged in relation to the left and bearing distal appendices. Despite being superficially similar in external appearance to members of the Leptopodomorpha, and inhabiting similar littoral and hygropetric habitats, the Ochteridae possesses a suite of character states typical of Nepomorpha, including the short, ventrally inserted antennae and asymmetrical male genitalia, as well as a tubular spermatheca (Schuh & Slater, 1995). The primary characters currently used for species separation are the shape of the male right paramere (Figs. 5–7, 10, 11, 13, 14, 17, 18, 23, 24, 26, 27), the shape of the medial process on the male pygophore (Figs. 8, 9, 12, 15, 19, 25, 28), the striations on the frons and clypeus (Figs. 29–34), and the dorsal colour pattern (Figs. 1–4, 21, 22).

Ochterids are usually beautifully marked with spots and flecks of blue, lavendar, green, orange, or yellow on a darker background, and such markings are often distinctive among species and useful in taxon separation. The markings consist of two distinct types: depigmented integument (as in the case of yellowish or whitish spots), and pruinose patches of bluish, purplish, or greenish structural colouration occurring on the surface of the integument. The former can become less conspicuous over time in specimens stored for many decades in alcohol, which fades dark colors, while the latter can be degraded or lost in specimens killed by use of ethyl acetate, or pinned through the body so that internal greases and oils spread across the body surface, thereby compromising the structural colors. The best preservation of colour patterns is therefore obtained by collecting specimens directly into 80% ethanol, and then drying them under a lamp in the lab and point-mounting them for long-term vouchering as dry pinned specimens. The photographs of dorsal colour patterns in this work are taken from specimens prepared using such methods.

The family name Ochteridae was first proposed by Kirkaldy (1906). Because Latreille (1809) had earlier proposed the unnecessary replacement name *Pelogonus* for *Ochterus*, this family is treated under the name Pelogonidae in many works published prior to Kirkaldy's checklist.

Genus *OCHTERUS* Latreille

Discussion. — *Ochterus* species form two distinct ecological groups, those inhabiting horizontal littoral substrates of mud and sand along lowland lakes and rivers, and those occurring on vertical seeping rheocrenes and wet rocks in the highlands. The latter guild has radiated extensively in the mountains of New Guinea (Baehr, 1990b) and to a lesser extent in the Philippines (Gapud, 1981, 1995, 2003; Gapud & San Valentin, 1977), Sulawesi (Nieser & Chen, 1992, 1999), and the Greater Sunda Islands (Jaczewski, 1935; Baehr, 1990a; Nieser & Chen, 1992; Zettel & Lane, 2010); as shown below, certain continental Asian species also share this ecology. With the exception of widespread species such as *O. marginatus*, which occurs along the margins of ponds and rivers, ochterids tend to be poorly represented in collections, being active, agile insects which fly readily when disturbed and are challenging to capture. This, combined with their utilisation of frequently undersampled rheocrene habitats, means that they may often be overlooked by general collectors (Jaczewski, 1935). The species inhabiting rheocrenes are often best collected by applying a light pyrethrin fog and then capturing the insects thus slowed in their movements.

As currently interpreted, four species of Ochteridae occur in Singapore and Peninsular Malaysia, three of which are newly described below. The key also includes two additional

widespread species known from the Greater Sunda Islands that could also conceivably occur in the region under study (see Appendix 1 for an updated regional checklist of *Ochterus* species occurring in Southeast Asia and the Malay Archipelago).

KEY TO SPECIES OF *OCHTERUS*
occurring in Singapore, Peninsular Malaysia, Sumatra, and Java

1. Hemelytral margins bearing 2–3 yellowish patches on each side (Figs. 1, 4) 2
– Hemelytral margins without yellowish patches, instead bearing at least 3 bluish to lavendar patches on each side (Figs. 2, 3, 21, 22) 3
2. Appendages of male right paramere short, lacking asperities, with apices angulate (Figs. 17, 18); posterior margin of pronotum narrowly margined with dark yellow, but lacking a yellowish patch posteromedially (Fig. 4); frons and clypeus with only a few weak striations (Fig. 34); small species, length of males less than 4.0 mm, length of females less than 5.0 mm; ..... *O. singaporensis* new species
– Appendages of male right paramere elongate, unequal in size, apices bidentate, larger of these appendages bearing small asperities (Figs. 5, 7); posterior margin of pronotum bearing a yellowish patch posteromedially (Fig. 1); entire frons and clypeus densely striate (Fig. 29); larger species than above, length of males greater than 4.0 mm, length of females greater than 4.5 mm ..... *O. marginatus* (Latreille)
3. Large species, body length in both sexes equal to or exceeding 5.0 mm; inner section of corium bearing a large, prominent orange-brown patch (Fig. 2); frons bearing broad, transversely striate channels parallel to inner eye margins (Fig. 31); male right paramere with both appendages large, boot-shaped (Fig. 10, 11) ..... *O. signatus* new species
– Moderate sized to small sized species, body length in both sexes less than 5.0 mm; inner section of corium lacking a prominent orange-brown patch, ground color instead brown to black, flecked with bluish or lavendar markings (Figs. 3, 21, 22); frons bearing narrow channels parallel to inner eye margins, these channels lacking transverse striations except for a few at extreme anterior extremities (Figs. 30, 32, 33); male right paramere with appendages smaller, frequently unequal in size, not boot-shaped (Figs. 13, 14, 23, 24, 26, 27) 4
4. Length in both sexes less than 4.5 mm; ground colouration brown to orange-brown, flecked with lavendar patches (Fig. 22); lavendar flecks on wing membrane confined to posterior half (Fig. 22); superior appendage of male right paramere with a deep concavity at apex (Figs. 26, 27)... *O. noualhieri* Baehr
– Length in both sexes greater than or equal to 4.5 mm; ground colouration black, flecked with bluish or lavendar patches (Figs. 3, 21); lavendar flecks present on entire wing membrane, not confined to posterior half (Figs. 3, 21); superior appendage on male right paramere lacking a deep concavity at apex (Figs. 13, 14, 23, 24) 5
5. Pronotum with a yellowish patch posteromedially (Fig. 3); appendices of male right paramere subequal in size, inner margins lacking teeth (Figs. 13, 14) .... *O. pseudomarginatus* new species
– Pronotum lacking a yellowish patch posteromedially (Fig. 22); appendices of male right paramere markedly unequal in size, inner margin of larger appendage with several small teeth (Fig. 23, 24) ..... *O. thienemanni* Jaczewski

Ochterus marginatus marginatus (Latreille)
(Figs. 1, 5–9, 29)

Acanthia marginata Latreille, 1804: 242
Ochterus marginatus: Latreille, 1807: 143
Ochterus marginatus marginatus: Jaczewski, 1934: 602
Ochterus marginatus insularis: Rieger, 1977: 213

Material examined. — SINGAPORE: 2 males, 3 females, Selatar Reservoir park, 3 Jan.1991, coll. K. L. Yeo, YKL0723 (ZRC); 2 males, 1 female, same data as previous, except 7 Nov.1990, coll. K. L. Yeo, YKL705 (ZRC); 1 male (head and thorax missing), Nee Soon Swamp Forest, outflow creek, on sand banks, 1 Jan.1986, coll. D. H. Murphy (ZRC); 1 male, Bukit Panjang, wet sandy area in bright sun, 19 Jan.1976, coll. D. H. Murphy (ZRC). MALAYSIA, **Terengganu**: 1 female, Rantau Abang, 18 Mar.1992, coll. H. K. Lua, LHK 177 (ZRC). **Selangor**: 1 male, Kepong, FRIM, Sungai Kroh, 15 Jan.2002, coll. H. H. Tan (ZRC). **Pahang**: 1 male, 1 female, Selompok, pond, 12 Aug.1926, coll. C. Dover (ZRC); 1 male, Cheroh River, 6 km. E. of Tapah, 18 Aug.1985, CL 2072, coll. D. A. and J. T. Polhemus (JTPC).

Extralimital material examined. — GREECE: 1 male, 1 female, Cyprus, Ayia Irini River, on banks under stones, 28 Nov.1947, coll. G. Mavromoustakis (USNM). ISRAEL: 3 males, 'Enot Zuqim ('EnFashka) shore, Dead Sea, 23 Aug.1990, coll. W. N. Mathis (USNM). TANZANIA: 1 male, Ilonga, 11 Feb.1963, light trap, coll. I. A. D. Robertson (USNM). INDIA, **Tamil Nadu**: 1 male, South India, Coimbatore, Jan.1956, coll. P. Susai Nathan (det. as *O. marginatus* by N. Kormilev, 1974, USNM). **Assam**: 1 male, 3 females, 10 mi. N. of Tinsukia, 5 Apr.1944, coll. G. F. Johnstone (USNM). **West Bengal**: 2 males, 3 females, Calcutta [Kolkata], 1 Aug.1944, coll. D. E. Haredy (USNM). SRI LANKA, **Uva Prov.**: 4 males, 4 females, Badulla, Dist., 5 mi. E. of Mahiyangana, 1 Apr.1971, coll. P. & P. Spangler (USNM). THAILAND, **Khon Kaen Prov**.: Ban Nam Pong, T 92, 10 Mar.1971, coll. P. & P. Spangler (USNM). VIETNAM, **Cao Bang Prov**.: 2 males, 2 females, Ba Be National Park, south end of Ba Be Lake at river inflow, 170 m., 21 Mar.2000, CL 4368, coll. J. T. Polhemus & P. Nguyen (JTPC). INDONESIA, **Bali Prov**.: 3 males, Bali, Kabupaten Bangli, Melangit River, 400 m., 17 Oct.1985, CL 2170, coll. D. A. & J. T. Polhemus (JTPC).

Diagnosis. — Male body length 4.10–4.60, maximum width (across hemelytra) 2.40–2.60; female body length 4.75–4.80, maximum width (across hemelytra) 2.60–2.62. Colouration reddish brown, with each hemelytral margin bearing three prominent, evenly spaced, dark yellow spots (Fig. 1). Frons and clypeus densely striate (Fig. 29). Male genitalia with male right paramere bearing appendages of unequal width (Figs. 5–7), process of pygophore with medial process prominent, posterior margin weakly sinuate (Figs. 8, 9).

Distribution. — Widespread in the Eastern Hemisphere, from the Mediterranean south into Africa, and eastward to India, Ceylon, China, Japan, Taiwan, Thailand, Laos, Vietnam, Malaysia, the Philippines (Luzon, Mindanao), Sumatra, Java, Bali, Borneo, and Sulawesi. This species has not been recorded from New Guinea or Australia, despite extensive collecting for *Ochterus* in those areas, and apparently does not occur there.

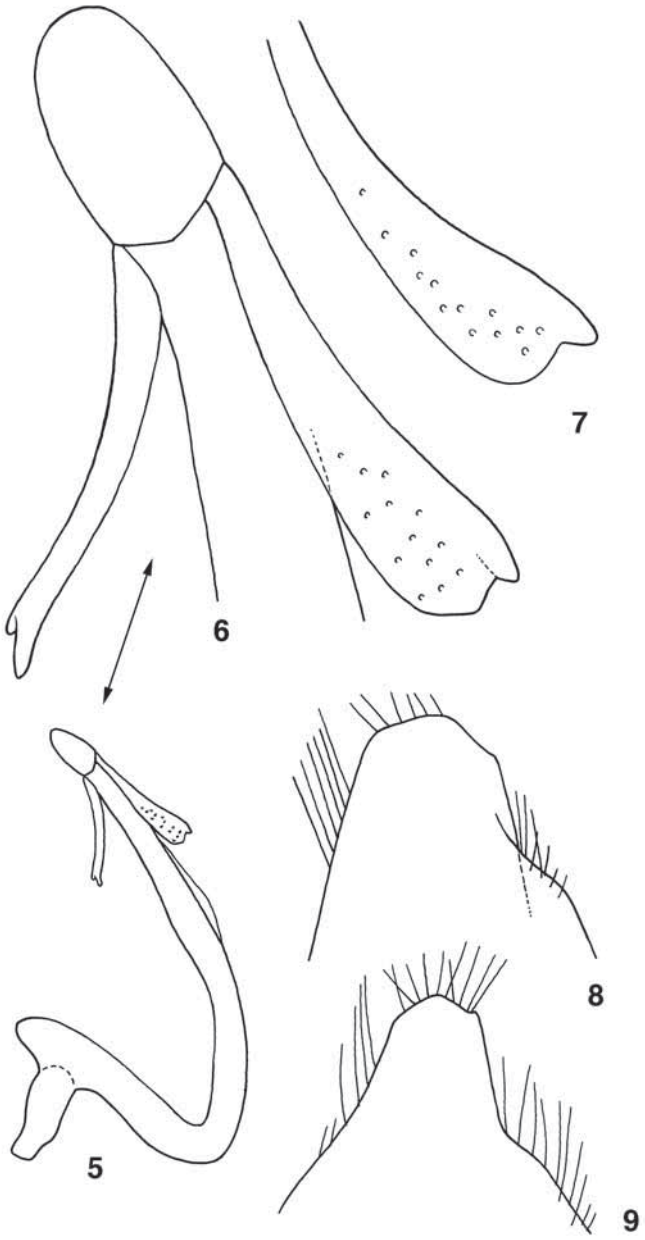
Discussion. — This species is widespread in the lowlands of Southeast Asia, and exhibits a degree of intraspecific

Figs. 1–4. *Ochterus* species, colour photographs of dorsum. 1, *O. marginatus* (Latreille), specimen from Thailand, Chonburi Prov. 2, *O. signatus*, new species, specimen from Malaysia, Perak, CL 2081. 3, *O. pseudomarginatus*, new species, specimen from Malaysia, Pahang, CL 2072. 4, *O. singaporensis*, new species, specimen from Singapore, Bukit Timah.

morphological variation across this range, but can be recognised by the very slender inferior appendage on the male right paramere. The male genitalia of specimens from Singapore and Malaysia are structurally similar to those from India, and other extralimital areas to the west (see Extralimital Material Examined for populations used in this comparison). Moving eastward into the Malay Archipelago, specimens from Bali are smaller than those from continental Southeast Asia, with lengths of 4.20–4.25, widths of 2.20–2.25, have slightly different shapes of the superior appendage on the male right paramere (compare Figs. 6, 7), and a somewhat differently shaped process of the male pygophore (compare Figs. 8, 9). These more eastern populations may be assignable to the subspecies *O. marginatus insularis*, originally described by Rieger (1977) from Mindanao, but an analysis of further material from throughout the Malay Archipelago region is necessary to properly determine the subspecific designations that should be applied to these insular forms.

Rieger (1976) provided a detailed study of the exoskeletal morphology and musculature of this species.

***Ecological notes*.** — Occurs on open, sandy or muddy substrates along the margins of lowland streams or rice paddies. Many specimens in major collections have label data indicating that they were taken at light traps.



Figs. 5–9. *O. marginatus* (Latreille), male, structural details. 5, Male right paramere, specimen from Vietnam, CL 4368. 6, Superior appendage of right paramere, specimen from Vietnam, CL 4368. 7, Superior appendage of right paramere, specimen from Indonesia, Bali, CL 2170. 8, Medial process of pygophore, specimen from Vietnam, CL 4368. 9, Medial process of pygophore, specimen from Indonesia, Bali, CL 2170.

Ochterus signatus, new species

(Figs. 2, 10–12, 31)

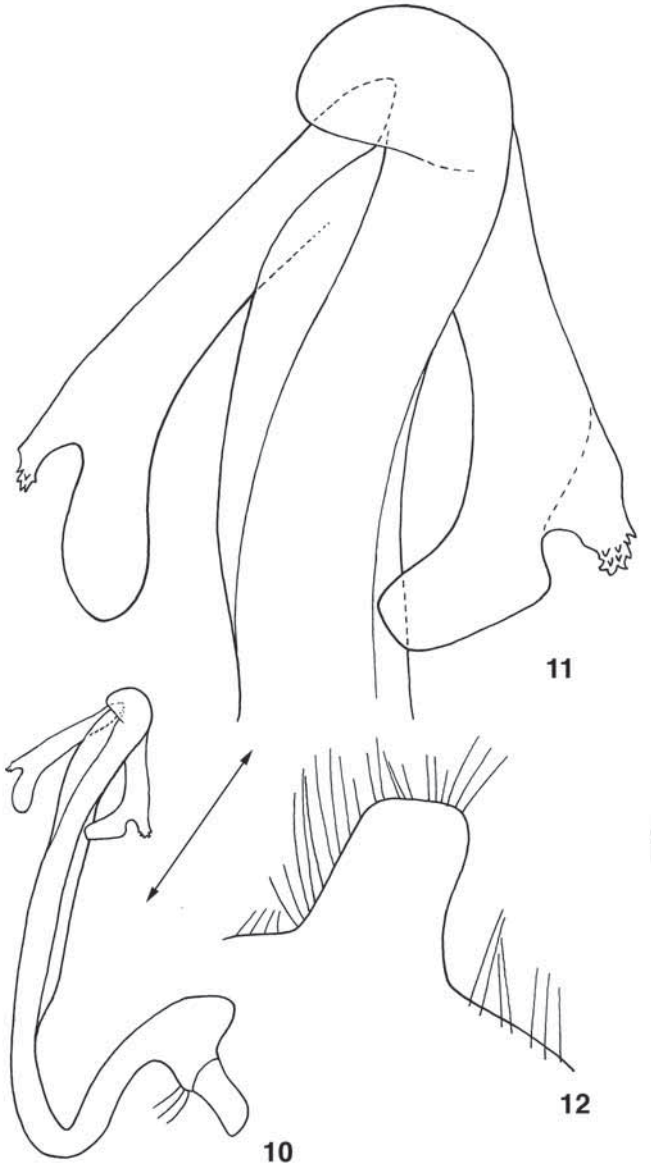
***Material examined*.** — Holotype, male, VIETNAM, **Lam Dong Prov.**, tributary stream to main river at Suoi Vang hydro, 1430 m, 11°59'26"N, 108°22'06"E, water temp. 21°C., 18 May 1998, CL 3085, coll. J. T. Polhemus (BPBM).
Paratypes: VIETNAM, **Lam Dong Prov.**: 5 males, 1 female, same data as holotype (JTPC). Kontum Prov.: 1 male, stream 63 km. NE of Kontum on Hwy. 24, 1050 m, 14°36'14"N, 108°18'22"E, 6 Mar.2001, CL 4281, coll. J. T. Polhemus and P. Nguyen (JTPC). MALAYSIA, **Perak**: 1 male, waterfall and rocky stream 60 km W. of Jeli, 20 Aug.1985, CL 2081, coll. D. A. & J. T. Polhemus (JTPC).

***Diagnosis*.** — Easily recognisable by the large, pale yellow patch on the posteromedial section of the pronotum, the large, orange-brown patches on the inner sections of each hemelytral corium (Fig. 2), and the distinctive male genitalia (Figs. 10–12).

***Description*.** — **Male**. General form broadly ovate, body length 5.15–5.50, maximum width (across hemelytra) 2.87–3.00 (Fig. 2). Colouration dark brown; anterolateral flanges of pronotum whitish-yellow; posterolateral angles of pronotum and extreme base of hemelytral embolar margin dark yellow; posteromedial area of pronotum broadly and transversely pale yellow; inner corial area of hemelytron adjacent to posterior half of embolium broadly orange-brown; scattered pruinose lavender markings as follows: small, transverse patches along posterolateral sections of pronotum immediately behind eyes, two pairs (2+2) of small irregular patches laterally on each side of pronotum, a pair (1+1) of roughly crescentic patches on anterior portion of pronotum to either side of midline around inner bases of calli, small, longitudinally elongate patch medially at anterior margin of scutellum, 7–8 small, irregular patches arranged symmetrically on clavus and corium of each hemelytron consisting of 3 large, roughly circular patches spaced equally along central portion of forewing margin plus 5 smaller patches on more inner sections of clavus and corium; scattered pruinose grey markings as follows: broadly on basal 1/3 of clavus, irregularly on adjacent inner corium along claval suture, irregularly along inner curve of embolium, small roughly circular patch immediately behind and inside of

posterior terminus of embolium, irregularly along posterior margin of forewing membrane. Head shining black; eyes silvery; clypeus shining dark blackish brown, narrowly transversely dark yellow along anterior margin; labrum and rostrum both black basally, chestnut brown distally; antennae with segments I and II dark yellow, segments III and IV dark brown; thoracic venter dull pruinose blackish brown; abdominal venter orange-brown, infuscated centrally; legs pale yellowish-brown, fore coxae broadly marked with medium brown, fore femur with longitudinally elongate brown patch centrally on inner face, fore tibia with broad brown annulation on basal half, all tibiae with extreme bases and apices infuscated, hind tibiae bearing very small dark brown spots at bases of spines, all tarsi with apices of terminal segments infuscated.

Head glabrous, length (along midline as measured from directly above)/width (across eyes) = 0.35/1.50, angled downward at greater than 45° when viewed laterally; frons with coarse striations, these striations becoming somewhat finer and more numerous on clypeus, inner margins of eyes bordered by broad channels bearing numerous short, transverse striations (Fig. 31); eyes large, protruding, projecting posterolaterally beyond vertex; antennae with segments I and II short, globose, segments III and IV slender, filiform, lengths of segments I–IV = 0.10, 0.12, 0.35, 0.30; rostrum long, length = 3.10, exceeding hind coxae and extending onto basal half of abdominal venter.



Figs. 10–12. *O. signatus*, new species, male, structural details, specimen from Malaysia, Perak, CL 2081. 10, Male right paramere. 11, Superior appendage of right paramere. 12, Medial process of pygophore.

Pronotum length (midline)/width = 1.10/2.68, bearing numerous small punctations; anterior collar prominent, flat; anterolateral margins explanate, well demarcated from disk; calli barely tumescent; posterior margin multisinuate, posteriorly concave centrally above base of scutellum. Scutellum triangular, length/width = 1.05/1.60, weakly tumescent, bearing numerous small punctations centrally plus a row of slightly coarser, more closely spaced punctations along lateral margins. Hemelytra long, attaining tip of abdomen, with corium, clavus and embolium well defined, surfaces set with scattered punctations, these punctations frequently pruinose; anterolateral embolar margin narrowly explanate; length of clavus along outside margin 1.80; membrane venation evident, defining 6 closed cells.

Ventral surface of thorax smooth and pruinose, lacking patches of long, upright, golden setae; scattered tiny, dark punctations present on pro- and mesoepisterna, a single diagonal line of punctations present on each metepisternum; abdominal venter covered with very short, fine, appressed silvery setae, this setal covering interrupted by ovate glabrous patches surrounding spiracles laterally on paratergites.

Legs with all segments covered by short, fine, recumbent pale setae; all coxae bearing long, pale setae ventrally; fore and middle trochanters and basal halves of fore and middle femora with very long, erect, slender, pale setae ventrally, remainder of ventral margins bearing moderate length, upright, slender, pale setae; hind femur broadly and gently bowed downward when viewed laterally; all tibiae bearing numerous short, bristly golden setae, these setae becoming more numerous distally; hind tibia with about 14 long, stout, semi-erect, spine-like golden setae on posterior margin, these setae more numerous on distal third of tibia; claws golden, gently curving, arolia long, exceeding length of claws when viewed laterally. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.30/1.25/0.03/0.27; middle femur/tibia/tarsal 1/tarsal 2 = 1.40/1.30/0.03/0.27; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 1.50/2.45/0.05/0.30/ 0.20.

Genital segment well retracted into abdomen; subgenital plate with V-shaped indentation medially on posterior margin. Pygophore with caudal tip quadrate, apex transverse, lateral lobes well removed from apex (Fig. 12). Right paramere with head of moderate height, evenly domed and convex; appendices moderately long, nearly symmetrical, apices "boot-shaped", indented to form two stout apical processes, one of these processes large, with tip rounded, the other smaller, with the tip serrate (Fig. 11); paramere shaft stout, broadened distally (Fig. 10).

Female. Similar to male in general structure and coloration, body length 5.50, maximum width (across hemelytra) 3.02. Head length (along midline as measured from directly above)/width (across eyes) = 0.55/1.50; lengths of antennal segments I–IV = 0.10, 0.08, 0.30, 0.30; rostrum length = 3.05, exceeding hind coxae and extending onto middle of abdominal venter. Pronotum length (midline)/width = 1.40/2.90. Scutellum length/width = 1.00/1.70. Hemelytra with length of clavus along outside margin 2.40. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.50/1.30/0.03/0.27; middle femur/tibia/tarsal 1/tarsal 2 = 1.70/1.30/0.04/0.36; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 1.90/2.70/0.01/0.30/0.20.

***Etymology*.** — The name "*signatus*" is derived from the Latin "*signum*", meaning "mark", and refers to the distinctive markings on the hemelytra of this species.

***Distribution*.** — Peninsular Malaysia and Vietnam

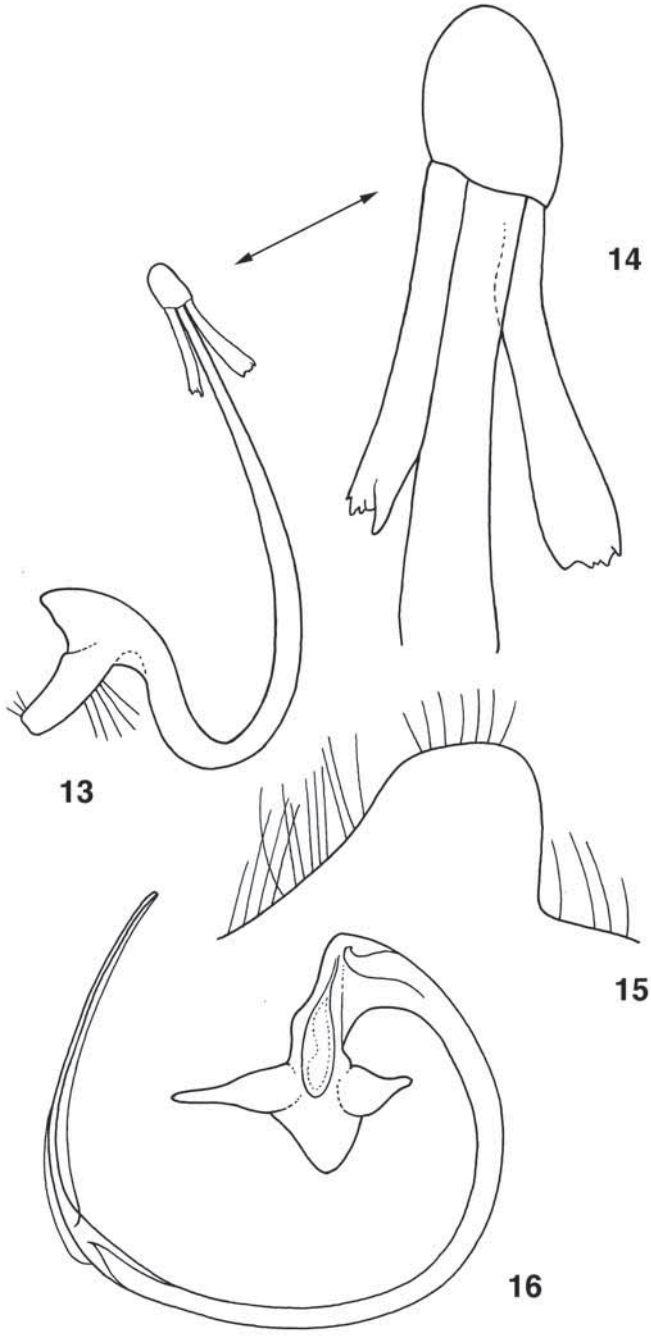
***Discussion*.** — The terminal section on the appendage of the male paramere in *O. signatus* most closely resembles the character state seen in *O. stysi* from Mauritius and *O. seychellensis* from Mahé (see Figs. 3, 4 in D. Polhemus & J. Polhemus, 2008), indicating that these insular Indian Ocean taxa are sister to a Southeast Asian stock.

Ochterus pseudomarginatus, new species
(Figs. 3, 13–16, 32)

***Material examined*.** — Holotype, male, MALAYSIA, **Johor**, Endau Rompin, Sungai Pantai Burung, off Sungai Endau, 13 Jul.2001, YCM0259, coll. C. M. Yang (BPBM). Paratypes: MALAYSIA, **Johor**: 1 male, 1 female, same data as holotype (ZRC); 5 males, 2 females, Lombong [NW of Kota Tinggi], 16 Sep.1975, coll. D. H. Murphy (ZRC); 1 male, Sungai Rengit, 11 mi. from Pengarang, 9 Dec.1961, coll. K. J. Kucheria (BPBM); 1 female, Kota Tinggi Waterfall, 16 km. N. of Kota Tinggi, 200 ft., 15 Oct.1986, CL 2217, coll. D. A. & J. T. Polhemus (JTPC). **Selangor**: 1 female, Kepong, FRIM, Sungai Kroh, 15 Jan.2002, coll. H. H. Tan (ZRC); 2 males, Gombock River, 24 km. E. of Kuala Lumpur on old Kuantan hwy., 16 Aug.1985, CL 2068, coll. D. A. & J. T. Polhemus (JTPC); 1 male, small stream and waterfalls at Templer Park, N. of Kuala Lumpur, 110 m., 3°18'03"N, 101°37'10"E , 17 Aug.1985, CL 2070, coll. D. A. & J. T. Polhemus (JTPC). **Pahang**: 1 male, Kuala Tahan [4°23'N, 102°24"E], 4 Dec.1958, sweeping air at daytime, coll. T. C. Maa (BPBM); 1 female, Cheroh River, 6 km. E. of Tapah, 18 Aug.1985, CL 2072, coll. D. A. & J. T. Polhemus (JTPC). **Perak**: 1 female, Kerunai River, 9 km. N. of Grik, 19 Aug.1985, CL 2078, coll. D. A. & J. T. Polhemus (JTPC); 1 male, wet roadside rock face, 57 km. E. of Grik, 20 Aug.1985, CL 2080, coll. D. A. & J. T. Polhemus (JTPC). **Kelantan**: 1 male, Pergau River at upper bridge, 24 km. W. of Jeli, 560 m., 5°37'37"N, 101°42'31"E, 20 Aug.1985, CL 2082, coll. D. A. & J. T. Polhemus (JTPC). SINGAPORE: 1 male, Bukit Timah forest, JFV stream side, 18 Jul.1979, coll. D. H. Murphy (ZRC); 1 male, Bukit Timah forest, Tabon Valley, 1 Apr.1976, coll. D. H. Murphy (ZRC); 1 female, Bukit Timah Nature Reserve, Jungle Falls Valley, 100 m., 12 Oct.1986, CL 2212, coll. D. A. & J. T. Polhemus (JTPC). INDONESIA, **Bengkulu Prov.**: 2 males, 2 females, Airgedang River, 23 km. E. of Bengkulu on Curup rd., 90 m, 3°45'29"S, 102°24'42"E water temp. 31.5°C., 6 Sep.1991, CL 2581, D. A. & J. T. Polhemus (JTPC, BPBM).

***Diagnosis*.** — Similar to *O. marginatus* in having a yellow patch centrally on the posterior margin of the pronotum. Differs in having the alternating pale patches along the lateral hemelytral margins pruinose lavendar rather than dark yellow, in having more distinct and less diffuse lavender pruinose markings on the central hemelytra (Fig. 3), and in the distinctive male genitalic structures (Figs. 13–16).

***Description*.** — **Male**. General form broadly ovate, body length 4.80, maximum width (across hemelytra) 2.60 (Fig. 3). Colouration dark blackish-brown; anterolateral flanges of pronotum, extreme posterolateral margins of pronotum, and small, transverse, roughly rectangular patch on posteromedial



Figs. 13–16. *O. pseudomarginatus*, new species, male, structural details, specimen from Malaysia, Perak, CL 2078. 13, Male right paramere. 14, Superior appendage of right paramere. 15, Medial process of pygophore. 16, Endosoma.

pronotum dark yellow; scattered pruinose lavender markings as follows: small, transverse patches along posterolateral sections of pronotum immediately behind eyes, 6 small irregular patches arranged transversely across central portion of pronotum; small, longitudinally elongate, semi-triangular patch medially at anterior margin of scutellum; 3 prominent, roughly circular patches equally spaced along central portion of outer forewing margin on each hemelytron with 2 on posterior half of embolium and one on posterior corium, 7–8 small, irregular patches arranged symmetrically on clavus and corium; punctations of head, scutellum and hemelytra marked with grey pruinosity, entire wing membrane also irregularly flecked with such pruinosity. Head shining black; eyes silvery; clypeus, labrum, and rostrum shining, dark blackish-brown, anterior margin of clypeus narrowly dark yellow, terminal segment of rostrum chestnut brown; antennae with segments I and II dull brownish yellow, segments III and IV dark brown; venter dull pruinose black; legs with femora pale yellowish white, hind tibiae pale yellowish brown, bearing very small dark brown spots at bases of spines, apices of femora, tibiae and terminal tarsal segments infuscated.

Head glabrous, length (along midline as measured from directly above)/width (across eyes) = 0.50/1.50, angled downward at greater than 45° when viewed laterally; frons and clypeus with coarse striations, inner margins of eyes bordered by narrow channels, these channels lacking transverse striations except at extreme anterior ends (Fig. 32); eyes large, protruding, projecting posterolaterally beyond vertex; antennae with segments I and II short, globose, segments III and IV slender, filiform, lengths of segments I–IV = 0.10, 0.20, 0.33, 0.40; rostrum long, length = 2.80, exceeding hind coxae and extending onto base of abdominal venter.

Pronotum length (midline)/width = 1.05/2.60, bearing numerous small pruinose punctations; anterior collar prominent, flat; anterolateral margins explanate, well demarcated from disk; calli barely tumescent; posterior margin multisinuate, posteriorly concave centrally above base of scutellum. Scutellum triangular, length/width = 1.02/1.50, weakly tumescent, bearing numerous small punctations centrally plus a row of slightly coarser, more closely spaced punctations along lateral margins. Hemelytra long, attaining tip of abdomen, with corium, clavus and embolium well defined, surfaces set with scattered pruinose punctations; anterolateral embolar margin narrowly explanate; length of clavus along outside margin 1.80; membrane venation evident, defining 6 closed cells.

Ventral surface of thorax smooth and pruinose, lacking patches of long, upright, golden setae; scattered tiny, dark punctations present on pro- and mesoepisterna, a single diagonal line of punctations present on each metepisternum; abdominal venter covered with very short, fine, appressed silvery setae, this setal covering interrupted by ovate glabrous patches surrounding spiracles laterally on paratergites.

Legs with all segments covered by short, fine, recumbent pale setae; all coxae bearing long, pale setae ventrally; fore and middle trochanters and basal halves of fore and middle femora with very long, erect, slender, pale setae ventrally, remainder of ventral margins bearing moderate length, upright, slender, pale setae; hind femur broadly and gently bowed downward when viewed laterally; all tibiae bearing numerous short, bristly golden setae, these setae becoming more numerous distally; hind tibia with 8 long, stout, semi-erect, spine-like golden setae on posterior margin, 5 of these setae occurring on distal third of tibia; claws golden, gently curving, arolia long, exceeding length of claws when viewed laterally. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.25/1.15/0.05/0.20; middle femur/tibia/tarsal 1/tarsal 2 = 1.50/1.30/0.03/0.27; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 1.60/2.30/0.01/0.30/0.18.

Genital segment well retracted into abdomen; subgenital plate with V-shaped indentation medially on posterior margin. Pygophore with caudal tip blunt, broadly rounded, lateral lobes well removed from apex (Fig. 15). Right paramere with head of moderate height, domed and convex; appendices of similar size, moderately long, apices multiserrate, one of these processes with apex bearing numerous small serrations, the other with the apex bearing a large tooth plus additional smaller serrations (Fig. 14); paramere shaft stout basally, evenly tapering distally (Fig. 13); phallotheca with distal process bearing lateral flanges, shape as in Fig. 16.

Female. Similar to male in general structure and colouration, body length 4.80–5.20, maximum width (across hemelytra) 2.70–2.90. Head length (along midline as measured from directly above)/width (across eyes) = 0.30/1.50; lengths of antennal segments I–IV = 0.08, 0.20, 0.40, 0.30; rostrum length = 2.90, exceeding hind coxae and extending onto base of abdominal venter. Pronotum length (midline)/width = 1.25/2.55. Scutellum length/width = 0.90/1.50. Hemelytra with length of clavus along outside margin 1.95. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.30/1.20/0.11/0.11; middle femur/tibia/tarsal 1/tarsal 2 = 1.40/1.20/0.14/0.07; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 1.65/2.20/0.07/0.35/0.20.

Etymology. — The name "*pseudomarginatus*" refers to the superficial similarity in appearance of this species to *Ochterus marginatus*, with which it has been previously confused in various collections.

Distribution. — Peninsular Malaysia, Singapore, and Sumatra

Discussion. — *Ochterus pseudomarginatus* is, as its name implies, superficially similar in general appearance to *O. marginatus*, a species widespread in the Paleotropical Region. Externally, the two species may be separated by their colour patterns, with the prominent pale spots along the hemelytral margin being dark yellow in *O. marginatus* (Fig. 1) and pruinose lavendar in *O. pseudomarginatus* (Fig. 3). In particular, if *O. marginatus* specimens are examined while in alcohol one can see the depigmented sections of the lateral hemelytron where the pale marginal patches lie, while by contrast specimens of *O. pseudomarginatus* examined under similar conditions show no such depigmented

patches, with the lateral markings on the hemelytra being the result of surface pruinosity rather than depigmentation. In addition, the violet pruinose markings on the dorsum of *O. pseudomarginatus* consist of distinct, relatively solid patches and spots, whereas on *O. marginatus* such markings are more diffusely scattered as many small dots and diffuse patches (compare Figs. 1, 3).

Internally, males of *O. pseudomarginatus* may be easily separated from those of *O. marginatus* by the structure of the right paramere (compare Figs. 5–7 and 13, 14), in particular the superior appendage, which is multidentate and lacks asperities in the former species (Fig, 14), while being unidentate and bearing small asperities in the latter (Figs. 6, 7).

Ecological notes. — *Ochterus pseudomarginatus* occurs along rocky streams in hill forest areas, in contrast to *O. marginatus* which occurs on sand bars and mud flats in the lowlands.

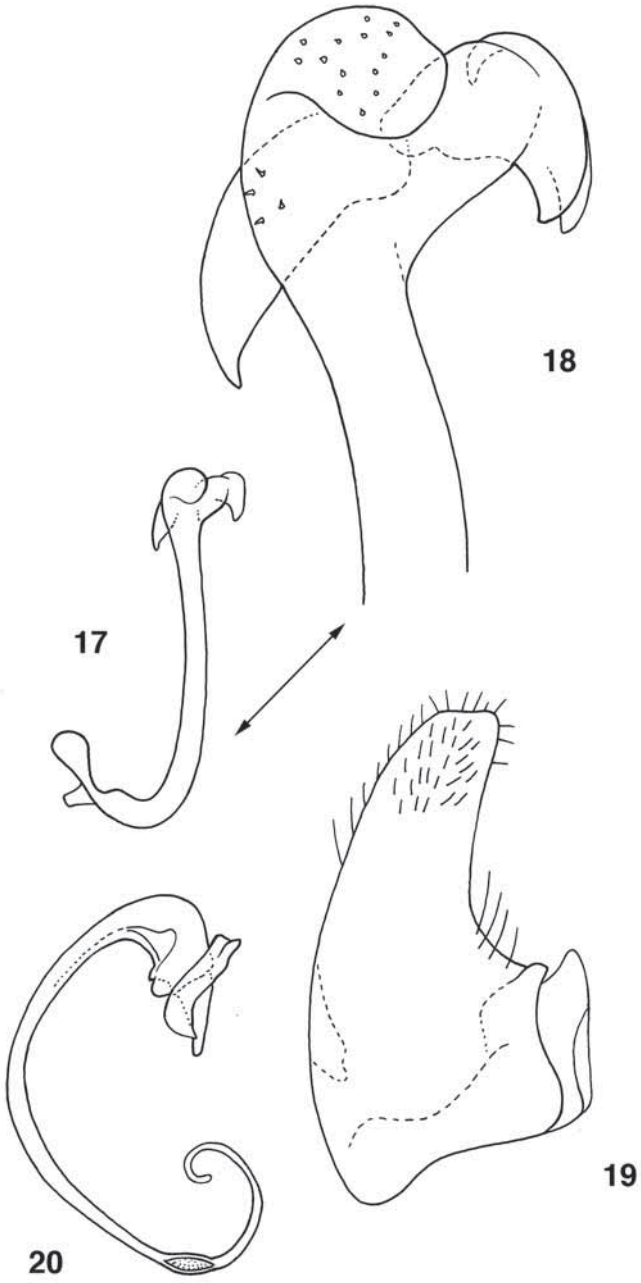
Ochterus singaporensis, new species
(Figs. 4, 17–20, 34)

Material examined. — Holotype, male, SINGAPORE, MacRitchie Catchment Reservoir, NS 123B #G (stream towards reservoir), 20 Apr.1994 (ZRC). Paratypes: SINGAPORE: 1 female, Bukit Timah forest, Lower Jungle Falls stream, 12 Oct.1973, coll. D. H. Murphy (ZRC); 1 female, Bukit Timah Nature Reserve, Jungle Falls Valley, 100 m., 12 Oct.1986, CL 2212, coll. D. A. & J. T. Polhemus (JTPC).

Diagnosis. — Recognised by its small size, with the body length of males less than 4.0 mm, and of females less than 5.0 mm; the yellowish-brown ground colour of the hemelytra, the relatively limited pruinose lavendar markings on the hemelytra (Fig. 4), and the short, angulate appendages of the male right paramere (Figs. 17, 18).

Description. — **Male**. General form broadly ovate, body length 3.70, maximum width (across hemelytra) 2.20 (Fig. 4). Colouration orange-brown; head, pronotum and scutellum dark brown to black; narrowly along posterior margins of eyes, anterolateral flanges of pronotum, narrowly along extreme posterior margin of pronotum dark yellow; scattered pruinose lavender markings as follows: 4 small irregular patches arranged transversely across central portion of pronotum on lateral and posterior margins of calli; tiny patch basomedially on scutellum; 3 prominent, roughly circular patches equally spaced along central portion of outer forewing margin on each hemelytron with 2 on posterior half of embolium and one on posterior corium, 5–6 small, irregular patches arranged symmetrically on clavus and corium, entire wing membrane also irregularly flecked with such pruinosity; punctations of hemelytra black.

Head shining black; eyes silvery; ocelli bright red; clypeus shining black, anterior margin broadly and transversely dark orange-yellow, labrum dark orange-yellow basally, black distally, rostrum shining dark orange-yellow, with basal joints black on dorsal surfaces; antennae with all segments pale whitish-yellow; venter of head and thorax dull pruinose black, abdominal venter brown; legs pale yellowish white, extreme apices of femora, tibiae and terminal tarsal segments infuscated. Head length (along midline as measured from directly above)/width (across eyes) = 0.30/1.33, angled downward at nearly 90° when viewed laterally; frons with coarse striations, these striations becoming somewhat finer and more numerous on clypeus, inner margins of eyes bordered by narrow channels, these channels lacking transverse striations (Fig. 34); eyes large, protruding, projecting posterolaterally beyond vertex; antennae with segments I and II short, globose, segments III and IV slender, filiform, lengths of segments I–IV = 0.10, 0.10, 0.20, 0.35;



Figs. 17–20. *O. singaporensis*, new species, male, structural details, specimen from Singapore, Bukit Timah. 17, Male right paramere. 18, Superior appendage of right paramere. 19, Medial process of pygophore. 20, Endosoma.

rostrum long, length = 1.90, exceeding hind coxae and extending onto base of abdominal venter.

Pronotum length (midline)/width = 1.05/1.90, bearing numerous small pruinose punctations; anterior collar prominent, flat; anterolateral margins explanate, well demarcated from disk; calli barely tumescent; posterior margin multisinuate, posteriorly concave centrally above base of scutellum. Scutellum triangular, length/width = 0.75/1.15, weakly tumescent, bearing numerous small punctations centrally plus a row of slightly coarser, more closely spaced punctations along lateral margins. Hemelytra long, attaining tip of abdomen, with corium, clavus and embolium well defined, surfaces orange brown, flecked with lavendar and set with numerous black punctations, these punctations denser on embolium and basal portion of corium, sparse on posterior portion of corium; anterolateral embolar margin narrowly explanate; length of clavus along outside margin 1.55; membrane venation evident, defining 6 closed cells.

Ventral surface of thorax smooth and pruinose, lacking patches of long, upright, golden setae; scattered tiny, dark punctations present on pro- and mesoepisterna, a single diagonal line of punctations present on each metepisternum; abdominal venter covered with very short, fine, appressed golden setae, this setal covering interrupted by ovate glabrous patches surrounding spiracles laterally on paratergites.

Legs with all segments covered by short, fine, recumbent pale setae; all coxae bearing long, pale setae ventrally; fore and middle trochanters and basal halves of fore and middle femora with very long, erect, slender, pale setae ventrally, remainder of ventral margins bearing moderate length, upright, slender, pale setae; hind femur broadly and gently bowed downward when viewed laterally; all tibiae bearing numerous short, bristly gold setae, these setae becoming more numerous distally; hind tibia with about 8 long, stout, semi-erect, spine-like gold setae on posterior margin, these setae more numerous on distal third of tibia; claws golden, gently curving, arolia long, exceeding length of claws when viewed laterally. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 0.90/0.80/0.02/0.28; middle femur/tibia/tarsal 1/tarsal 2 = 1.00/0.95/0.02/0.18; hind femur/tibia/tarsal 1/tarsal 2 /tarsal 3 = 1.10/1.50/0.03/0.15/0.12.

Genital segment well retracted into abdomen; subgenital plate with V-shaped indentation medially on posterior margin. Pygophore with caudal tip slender, apex truncate, lateral lobes weakly produced (Fig. 19). Right paramere with head not highly expanded, domed and convex; appendices of similar size, short, apices angulate, margins lacking serrations (Fig. 18); paramere shaft uniformly slender, lacking lateral flanges (Fig. 17); phallotheca with distal process slender, coiled, shape as in Fig. 20.

Female. Similar to male in general structure and coloration, body length 4.70, maximum width (across hemelytra) 2.60. Head length (along midline as measured from directly above)/width (across eyes) = 0.35/1.50; lengths of antennal segments I–IV = 0.10, 0.10, 0.30, 0.30; rostrum length = 2.60, exceeding hind coxae and extending onto base of abdominal venter. Pronotum blackish-brown on anterior half, dark reddish-brown on posterior half, anterolateral margins

Figs. 21–22. *Ochterus* species, colour photographs of dorsum. 21, *O. thienemanni* Jaczewski, specimen from Indonesia, Bali, CL 2170. 22, *O. noualhieri* Baehr, specimen from Indonesia, Celebes, CL 2127.

explanate, pale yellow, length (midline)/width = 1.20/2.55. Scutellum dark reddish-brown, narrowly black along basal and lateral margins, length/width = 1.00/1.52. Hemelytra medium orange brown with numerous tiny dark punctations, length of clavus along outside margin 1.70. Lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.10/1.00/0.02/0.18; middle femur/tibia/tarsal 1/tarsal 2 = 1.30/1.10/0.02/0.18; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 1.40/2.00/0.05/0.25/0.20.

Etymology. — The name "*singaporensis*" refers to the type locality, the island of Singapore.

Distribution. — Known at present only from the island of Singapore

Discussion. — *Ochterus singaporensis* is a small, orange-brown species that is most similar in size and colouration to *O. noualhieri*, which occurs in the Malay Archipelago, and from which it may be separated by the structures of the male genitalia (compare Figs. 17–20 and 26–28). It may be separated from *O. marginatus* by its smaller size; predominantly orange-brown colouration; the absence of both a yellow patch posteromedially on the pronotum and obvious alternating yellow-and-black patches on the anterolateral margins of the hemelytra (Fig. 4); possessesion of much stouter appendages on the male right paramere (Figs. 17, 18); and in having the middle tibia shorter than the middle femur.

Based on the structure of the appendages on the male right paramere, *O. singaporensis* appears to be most closely related to *O. homorfos* Nieser & Chen from Celebes, but may be separated from that species by the details of the male genitalic structures and its more orange-brown colouration.

Ochterus thienemanni Jaczewski
(Figs. 21, 23–25, 30)

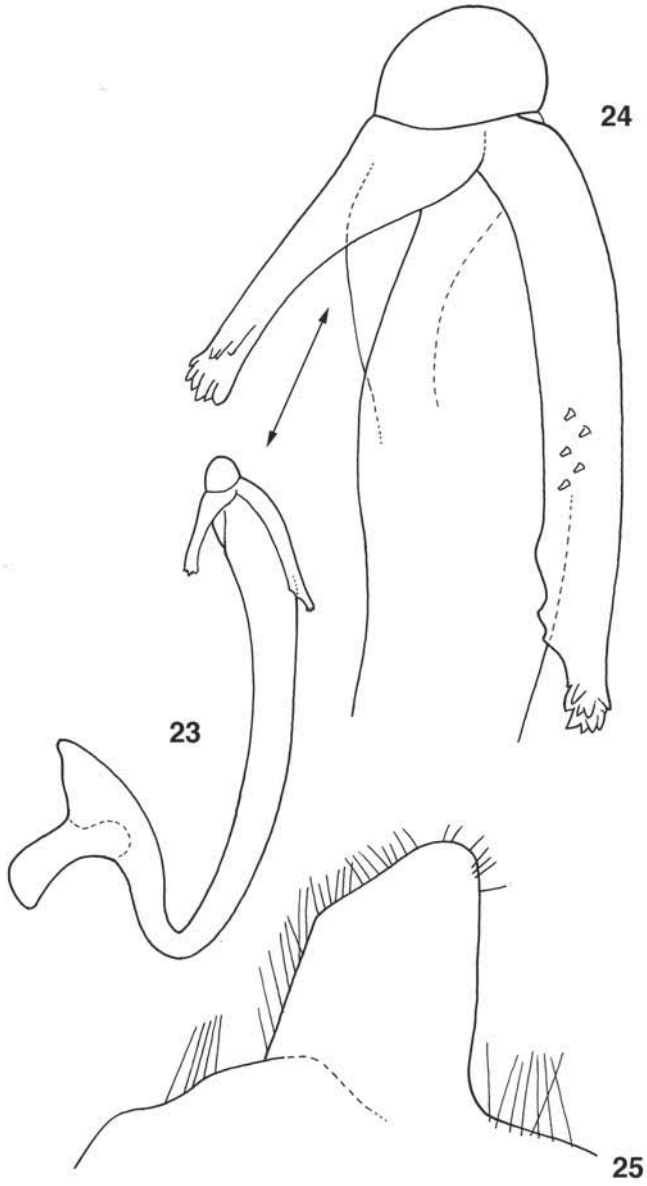
Ochterus thienemanni Jaczewski, 1935: 480

Material examined. — INDONESIA, **Bengkulu Prov.**: 1 male, Sumatra, Ketelang River, 39 km. SE of Muaraaman, 720 m., 3°19'48"S, 102°26'32"E, water temp. 21.5°C., 8 Sep.1991, CL 2585, D. A. & J. T. Polhemus (JTPC). **Jawa Barat Prov.**: 1 male, 1 female , Java, Preanger N. O. I., Bandoeng [Priangan district, N. of Bandung], 750 m., 19 Apr.1936, FCD 29, coll. F. C. Drescher, det. *Ochterus thienemanni* by N. Kormilev, 1973 (JTPC); 2 females, Kabupaten Cianjur, small stream on Gede trail, Gede-Pangrango National Park, above Cibodas, 1350 m., 3 Nov.1985, CL 2185, coll. D. A. & J. T. Polhemus (JTPC); 1 female, Kabupaten Cianjur, swift rocky stream at Cibodas, 1300 m., 3 Nov.1985, CL 2186, coll. D. A. & J. T. Polhemus (JTPC). **Bali Prov.**: 2 males, 1 female, Bali, Kabupaten Bangli, Melangit River, 400 m, 17 Oct.1985, CL 2170, coll. D. A. & J. T. Polhemus (JTPC).

Diagnosis. — Male body length 4.50, maximum width (across hemelytra) 2.50; female body length 4.90, maximum width (across hemelytra) 2.85. Colouration dark brown to black, flecked with pale blue markings on the hemelytra; posterior margin of pronotum narrowly dark yellow, this colouration not expanded into a larger patch medially (Fig. 21). Head with frons and clypeus bearing coarse striations, inner margins of eyes bordered by narrow channels, these channels lacking transverse striations except at extreme anterior ends (Fig. 30). Male genitalia with right paramere with appendages of uneven length, the longer of these multidentate along inner margin (Figs. 23, 24); male pygophore with medial process prominent, broadly angulate (Fig. 25).

Distribution. — Originally described from Sumatra, and also recorded from the adjacent Greater Sunda Islands of Java and Bali (Jaczewski, 1935), and subsequently from Celebes (Nieser & Chen, 1992). Previous records of this species from New Guinea (Kormilev, 1971; Baehr, 1990b) represent misidentifications.

Discussion. — This is a moderate sized, rather rotund species, with a body length of 4.5–4.9 mm. The holotype came



Figs. 23–25. *O. thienemanni* Jaczewski, male, structural details, specimen from Indonesia, Bali, CL 2170. 23, Male right paramere. 24, Superior appendage of right paramere. 25, Medial process of pygophore.

from Sumatra (Panjingahan Waterfall, near Singkarak), and the original description also recorded this species from the adjacent Greater Sunda Islands of Java and Bali (Jaczewski, 1935). The misinterpretation of this species by Kormilev (1971), and subsequently Baehr (1990b), has greatly hindered its proper recognition in more recent decades. While preparing his work on the Ochteridae of the Australasian region, Kormilev (1971) did not examine any specimens from the Greater Sunda Islands, but instead based his redescription on two specimens from Papua New Guinea. In this he was followed by Baehr (1990b), who re-examined one of the two New Guinea specimens used by Kormilev, noting that the holotype of *O. thienemanni* had been in the Warszava [Warsaw] Museum, but might have been lost during World War II (Jaczewski, in a personal communication to the second author, also noted that most of his collection had been destroyed in the war, thus supporting the suggestion that the holotype may be lost). In spite of this, the figure of the male right paramere provided by Jaczewski (1935), though small in scale, shows sufficient distinctive structural details, particularly of the dentation on the inner margin of the superior appendage, to permit unequivocal identification within the regional suite of Greater Sunda Island *Ochterus* species.

We have now re-examined one of the New Guinea specimens in the Bishop Museum determined as *O. thienemanni* by Kormilev, and subsequently Baehr, and found that it does not represent *O. thienemanni*, but rather a superficially similar Papuan species. This is not surprising, given the overwhelmingly insular and endemic nature of the New Guinea ochterid biota. By contrast, new material is now at hand from the Greater Sunda Islands that completely matches the original description of *O. thienemanni* by Jaczewski. This material includes several specimens determined as this species by Kormilev in 1973, subsequent to the publication of his 1971 revision. A redescription and re-illustration has been provided herein based on these more recent specimens.

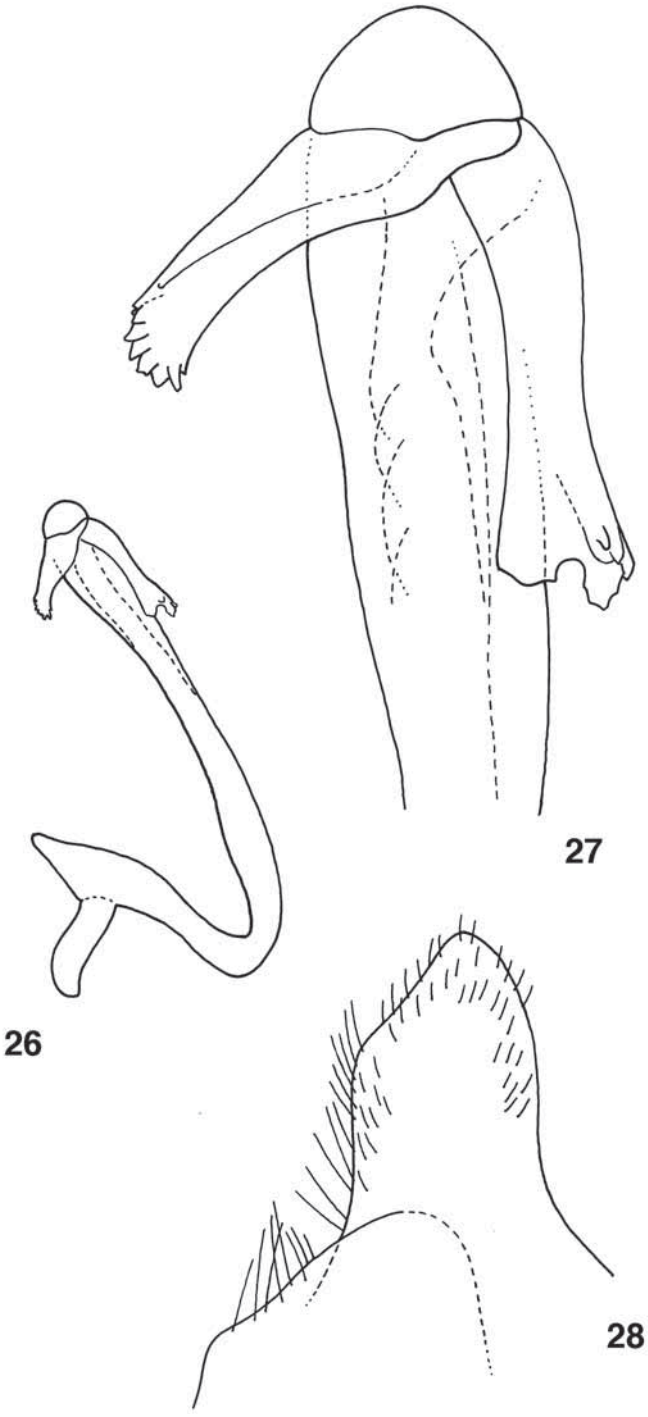
Ecological notes. — On the basis of the original collection locality data provided in Jaczewski (1935), as well as the subsequent sites from which this species has been collected, *O. thienemanni* appears to prefer vertical rheocrenes or wet rocks along upland streams in hill forests, in contrast to *O. marginatus* which is found on littoral habitats such as sand or mud bars along the marigns of reserviors or slow streams in the lowlands.

Ochterus noualhieri Baehr
(Figs. 22, 26–28, 33)

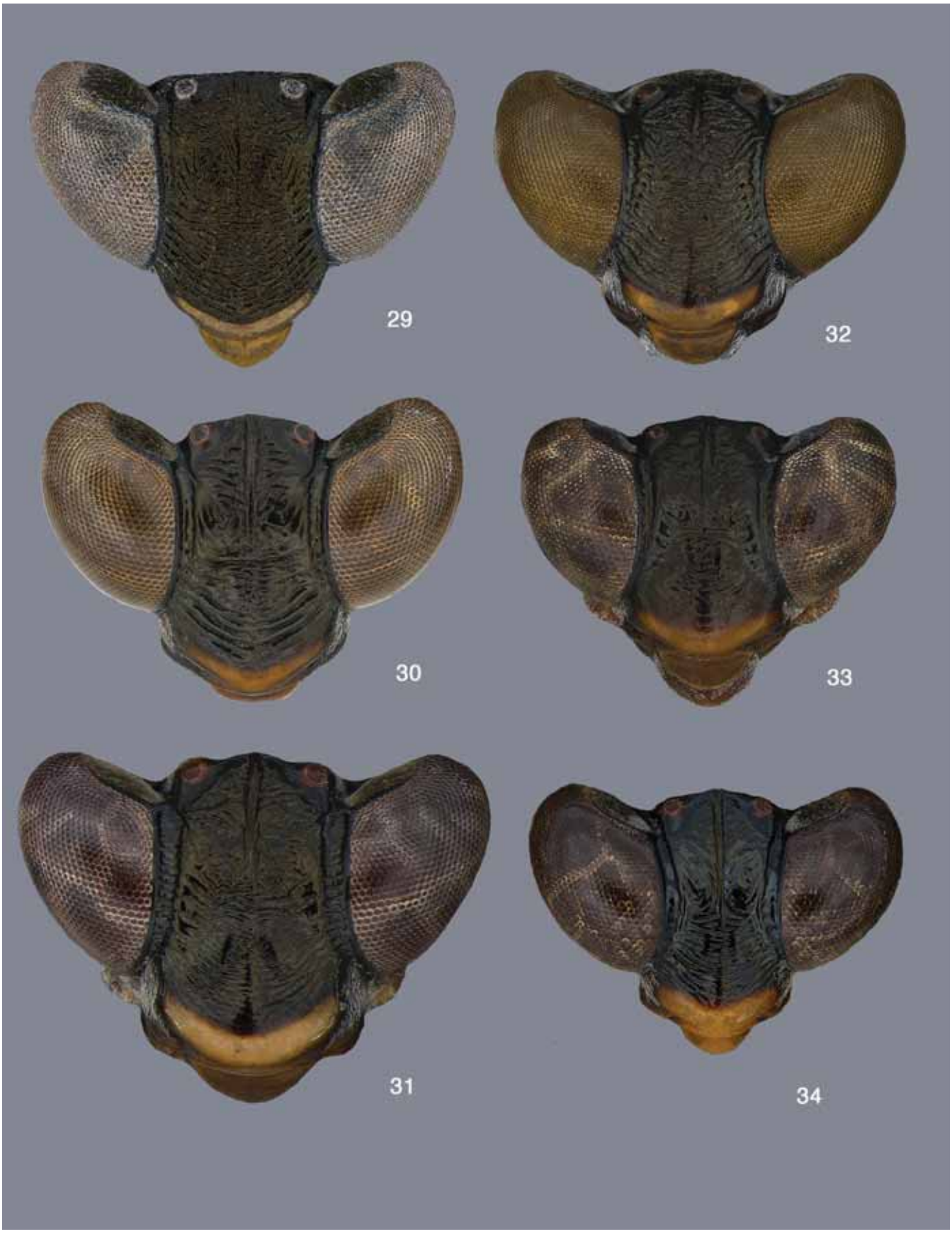
Ochterus noualhieri Baehr, 1990a: 91

Material examined. — INDONESIA, **Sulawesi Utara Prov.**: 12 males, 20 females, Celebes, Tondano River tributary, S. of Airmadidi, 20 Sep.1985, CL 2127, coll. D. A. & J. T. Polhemus (JTPC); 7 males, 15 females, 1 immature, Kab. Bolaang Mongondow, Kec. Modayag, forest streamlet above Lake Mooat, 1100 m., 0°44'N, 124°27'E, 10 Sep.1985, CL 2114, coll. D. A. & J. T. Polhemus (JTPC).

Diagnosis. — Male body length 3.95–3.98, maximum width (across hemelytra) 2.20–2.28; female body length 4.10–4.20, maximum width (across hemelytra) 2.45–2.50. Colouration reddish brown, flecked with small lavendar patches, head and scutellum black (Fig. 22). Head with frons bearing coarse striations, these striations becoming obscure on clypeus, inner margins of eyes bordered by narrow channels, these channels lacking transverse striations (Fig. 33). Male genitalia with right paramere bearing appendages of unequal size, inferior appendate with apex multidentate, superior appendage with



Figs. 26–28. *O. noualhieri* Baehr, male, structural details, specimen from Indonesia, Celebes, CL 2127. 26, Male right paramere. 27, Superior appendage of right paramere. 28, Medial process of pygophore.



Figs. 29–34. *Ochterus* species, colour photographs of head, anterior view, showing pattern of striations on frons. 29, *O. marginatus* (Latreille), female, specimen from Vietnam, Cao Bang Prov., CL 4368. 30, *O. thienemanni* Jaczewski, female, specimen from Indonesia, Bali Prov., CL 2170. 31, *O. signatus*, new species, female, specimen from Vietnam, Lam Dong Prov., CL3085. 32, *O. pseudomarginatus*, new species, female, specimen from Malaysia, Perak, CL 2078. 33, *O. noualhieri* Baehr, female, specimen from Indonesia, Sulawesi Utara Prov., CL 2114. 34, *O. singaporensis*, new species, male, specimen from Singapore, Bukit Timah.

apex deeply incised (Figs. 26, 27); male proctiger with medial process angulate (Fig. 28).

Distribution. — Originally described from two specimens taken on Gunung Gede, in western Java, and subsequently reported by Nieser & Chen (1999) from Sulawesi, and possibly Bali (the latter record based on a female specimen only). Because of this geographic proximity, and its broad distribution in the Malay Archipelago, this species may potentially be found in Singapore or Malaysia, and is included in the current regional treatment.

Discussion. — In his description of this species, Baehr (1990a) noted that *O. noualheieri* is similar to *O. thienemanni*, but differs in having the shaft of the male right paramere widened in the middle, and the appendages less assymmetrical and more tapered at their apices (compare Figs. 23, 24 and 26, 27). This species is also small in comparison to others in the region, with the body length of 4.20 mm or less in both sexes, and the ground colour is more reddish brown (compare Figs. 21 and 22).

Family GELASTOCORIDAE Kirkaldy

Discussion. — Gelastocoridae, or **"**toad bugs**"**, are easily recognised among the nepomorphan families by their rough and sculptured body surface, large eyes, presence of ocelli, the broad and flap-like labrum, four-segmented antennae lacking finger-like projections, enlarged raptorial fore femora, the tarsal formula of 1-2-3, unequal development of the claws on the forelegs, and asymmetrical genitalia with the right paramere large and often elaborated, and the left reduced or absent. As noted earlier, a number of these character states, as well as a riparian ecology, are shared with the Ochteridae. Among the local assemblage of Southeast Asian species, characters of particular use in individual species discrimination include the arrangement of tubercles on the head, the shape of the pronotum, and the shape of the male right paramere (Figs. 36, 38). In contrast to Ochteridae, dorsal coloration is not a particularly useful species-specific character, and is in any case often obscured by mud and dirt, which covers many mature specimens and further serves to camouflage living individuals in the field.

Fig. 35. *Nerthra macrothorax*, colour photograph of dorsum, female, specimen from USA, Saipan.

The Gelastocoridae are also similar to the previously treated Ochteridae in being a pantropical family with two distinct foci of species radiation in the Neotropical and Melanesian regions, and limited species richness elsewhere. Three genera are currently recognised: the Neotropical *Gelastocoris* and *Montandonius*, and the widespread *Nerthra* (see Todd, 1955). Only the latter genus occurs in Singapore and Malaysia. The gelastocorid species occurring on continental Southeast Asia and the proximal Greater Sunda Islands were recently treated by Kment & Jindra (2008), and the reader is referred to that work for a more comprehensive treatement of the Asian fauna. The family is probably more diverse and widespread in tropical Asia than is currently understood, with many of the species occurring in this region being known from very limited material. Pitfall trapping is a particularly effective method for collecting gelastocorids, and more concerted effort in this regard, particularly in areas of relatively undisturbed rainforest, has the potential to yield valuable insights related to the distribution and ecological associations of these unusual insects.

Subfamily NERTHRINAE Kirkaldy

Genus *NERTHRA* Say

KEY TO THE SPECIES OF *NERTHRA*
occurring in Singapore and Peninsular Malaysia

1. Front of head bearing 2 large, pointed tubercles; pronotum with lateral margins multilobate; scutellum bearing 2 prominent tubercles; hemelytron with membrane fully developed .... *O. lobata* (Montandon)
– Front of head bearing 3 large, rounded tubercles; pronotum with lateral margins evenly curving, not multilobate; scutellum lacking tubercles; hemelytron with membrane reduced or entirely coriaceous (Fig. 29).....*N. macrothorax* (Montrouzier)

Nerthra lobata (Montandon)
(Figs. 36, 37)

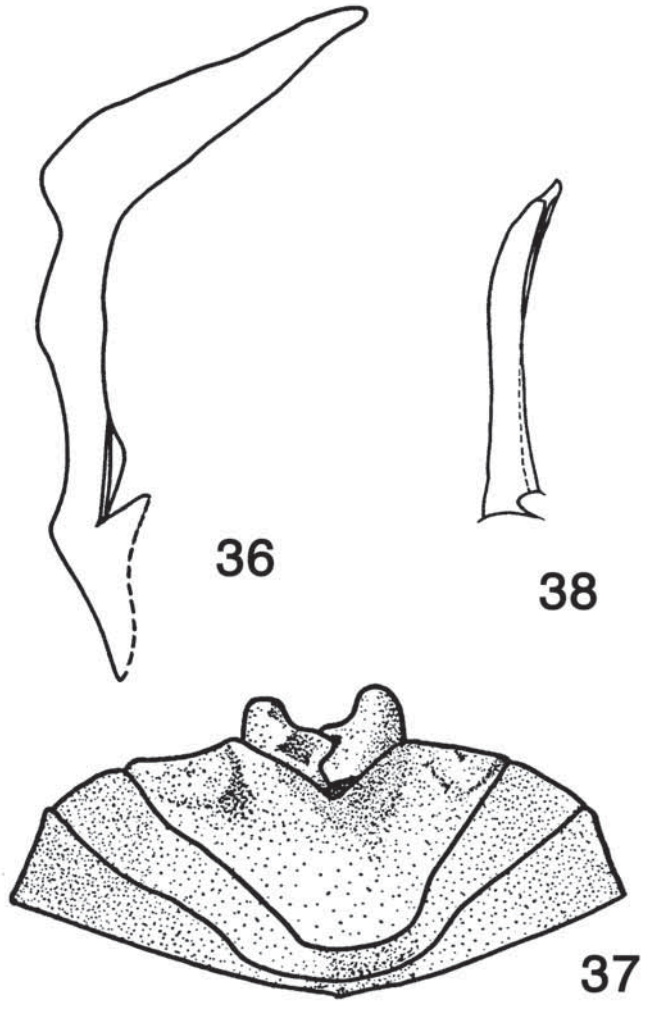
Mononyx lobatus Montandon, 1899: 394
Nertha lobata Todd, 1955: 350

Material examined. — INDONESIA, **Sumatera Selatan Prov.**: 1 female, South Sumatra, Pagaralam [E. of Mt. Dempo], Jul.1937, coll. C. T. & B. B. Brues (JTPC). In addition, two very early instar immatures that probably represent this species are at hand with the

following data: MALAYSIA, **Johor**: Layong-Layong, Stream 1, 2 Jun.1991, coll. H. K. Lua, 144A (ZRC).

Diagnosis. — Length 8.6–10.5 mm, maximum width (across abdomen) 6.2–7.4 mm. General colouration dark reddish brown, with yellowish markings on posterior portions of abdominal paratergites. Anterior margin of head bearing 2 large, pointed tubercles; pronotum widest on anterior third, lateral margins multisinuate, bearing three small lobes on each side, posterior margin of disc with 9 low, longitudinal carinae; scutellum bearing a pair (1+1) of prominent lateral tubercles to either side of depressed medial portion; abdomen expanded laterally, width subequal to width of pronotum. This species may be recognised by the pair of pointed tubercles at the front of the head, the pair of prominent tubercles on the scutellum, the relatively broad abdomen with a width subequal to that of the pronotum, the pair of prominent posterior process on the female abdomen (Fig. 37), and by the shape of the male paramere, which is is bent into a broad V-shape and widened distally to form a tapering head (Fig. 36).

Distribution. — Originally described from Sumatra, and subsequently recorded from Malaysia (Pahang), and Java. Given that the range of this species includes both Peninsular Malaysia and Sumatra, it might logically occur in intervening Singapore as well.



Figs. 36–38. *Nerthra* species, structural details (after Todd, 1955). 36, *N. lobata*, male right paramere. 37, *N. lobata*, female terminal abdomen, ventral view showing paired processes. 38, *N. macrothorax*, male right paramere, apical section.

Discussion. — Very few specimens of this taxon are reported in the literature, and Kment & Jindra (2008) provide no supplemental discussion of the species. Being a cryptic, ground-dwelling insect, *N. lobata* is easily overlooked and may be present in the remaining original forest patches on Singapore. The most effective method of searching for this species would be the use of pitfall traps set into the ground or amid leaf litter in the rainforest understory.

Nerthra macrothorax (Montrouzier)

(Figs. 35, 38)

Galgulus macrothorax Montrouzier, 1855: 110
Scylaecus macrothorax Stål, 1861: 201
Peltopterus macrothorax Stål, 1863: 408
Nerthra macrothorax Todd, 1955: 348

Material examined. — SINGAPORE: 1 male, Pulau Hantu, in rotten wood, 8 Oct.1989, coll. K. Lim (ZRC); 1 immature, Mandai mangrove, at base of intertidal tree, 26 Oct.1987, coll. D. H. Murphy (ZRC); 1 immature, Sungai Buloh mangrove, lower area, 19 Sep.1988, coll. D. H. Murphy (ZRC).

Extralimital material examined. — JAPAN: 2 males, 2 females, Ogasawara Islands, Chichi Jima Is., Miyanohama, 24 Nov.1977, M. Tomokuni coll. (JTPC); 1 male, 1 female, Ryukyu Islands, Iriomote Is., near mangroves, sea level, CL 2945, 25 Mar.1995, J. T. Polhemus (JTPC). INDONESIA, **Papua Prov**.: 1 female, Maffin Bay, Dutch N. Guinea, 1 Jul.1944, E. S. Ross (JTPC).

Diagnosis. — Length 7.9–10.6 mm, maximum width (across pronotum) 6.0–8.2 mm. General colouration light brown, with slightly darker markings on central pronotum, hemelytral carinae, and basal portions of abdominal paratergites. Front of head bearing 3 large, rounded tubercles; pronotum with lateral margins gently curving, lacking sinuosities or lobes, posterior section lacking longitudinal carinae; body covered with short, broadly clavate bristles; abdomen moderately expanded laterally, but width less than that of pronotum. This species may be recognised by the relatively narrow abdomen, the width of which is less than the width of the pronotum, and by the shape of the male paramere, which is straight, slender and not widened distally (Fig. 38).

Distribution. — Originally described from Woodlark Island, east of New Guinea (Montrouzier, 1855). The extensive range of this species, which extends from eastern Africa to Australia, was listed in detail by Kment & Jindra (2008), and only new Singapore records are given here. In the region under study the species is documented from Taiwan, the Philippines, Borneo, Sulawesi, the Lesser Sunda Islands and New Guinea. Interestingly, there are currently no records from the coasts of continental Southeast Asia, with all captures having instead come from island coasts. The Singapore records provided above represent a new country record.

Discussion. — *Nethra macrothorax* occurs amid organic marine debris along tropical coastlines, and may apparently

be transported by rafting on floating wood and logs (Todd, 1959, 1960; Polhemus, 1976). As a result, it has an extremely wide distribution in the Indo-Pacific region. Specimens should be sought by turning over logs and vegetative debris at the strand line along beaches, or amid leaf litter in immediately adjacent coastal forests.

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Appendix 1. Checklist of *Ochterus* species occurring in Southeast Asia and the Malay Archipelago (exclusive of New Guinea and the Philippines)

breviculus Nieser & Chen, 1992: 9	China (Tibet, Yunnan)
bruneiensis Zettel & Lane, 2010: 98	Borneo (Brunei)
homorfos Nieser & Chen, 1999: 91	Celebes (North and Central)
grandiusculus Nieser & Chen, 1992: 11	Celebes (Kendari Peninsula)
marginatus (Latreille), 1804: 242	Widespread (Europe eastward to Bali)
noualhieri Baehr, 1990: 91	Java, Bali, Celebes (North and Southwest)
pseudomarginatus, new species	Singapore, Peninsular Malaysia
singaporensis, new species	Singapore
signatus, new species	Peninsular Malaysia, Vietnam
thienemanni Jaczewski, 1935: 480	Sumatra, Java, Bali
trichotos Nieser & Chen, 1999: 92	Celebes (South)
xustos Nieser & Chen, 1992: 12	Borneo (Sabah)