

# *Limnometra palawanensis* spec. nov. (Heteroptera: Gerridae), and a synopsis of the Philippine species of *Limnometra*

ENTOMOLOGY  
LIBRARY

H. ZETTEL & P. P. CHEN

JUN 21 2000

ITHACA, NY 14853

ZETTEL, H. & P. P. CHEN, 2000. *LIMNOMETRA PALAWANENSIS* SPEC. NOV. (HETEROPTERA: GERRIDAE), AND A SYNOPSIS OF THE PHILIPPINE SPECIES OF *LIMNOMETRA*. – *ENT. BER., AMST.* 60 (5): 73-83.

**Abstract:** *Limnometra palawanensis* spec. nov. is described from Palawan and Busuanga Islands (Philippines). Morphological, biological and faunistical notes on the other Philippine *Limnometra* species are presented and a key for the Philippine species is provided. Notes on the holotypes of *Limnometra ciliata*, *L. femorata*, *L. inermis*, and *L. nigripennis*, all described by Mayr (1865) and deposited in the Natural History Museum Vienna, are given.

Naturhistorisches Museum, 2. Zoologische Abteilung, Burgring 7, A-1014 Vienna, Austria.

## Introduction

Three Philippine species of the genus *Limnometra* Mayr, 1865, already have been described by Mayr (1865): *Limnometra femorata* (type species), *L. nigripennis*, and *L. inermis*, which is a synonym of *L. ciliata* Mayr, 1865, described from "Java" (specimens probably from Ambon, see Remarks under *L. ciliata*). Two of these species, *L. femorata* and *L. ciliata*, are widespread in the Malayan Archipelago; *L. ciliata* occurs as far eastward as Guam, Solomon, and Fidji Islands (Andersen & Weir, 1997). Lundblad (1933) has catalogued the Indian species *L. anadyomene* (Kirkaldy, 1901) for the Philippines, probably based on records by Banks (1909) and Distant (1903). These records are obviously erroneous, and *L. anadyomene* has been excluded from the Philippine fauna (Andersen, 1995).

Hungerford & Matsuda (1958) have presented the first revision of the genus *Limnometra*, with descriptions of three new species, including *L. rossii* from the Philippine Islands. Andersen (1964) has described *L. hungerfordi* from "Isle Palaos, Philippines", probably Palau Island, and not belonging to the Philippines. *Limnometra hungerfordi* is synonym with *L. pulchra* Mayr, 1865, and has been excluded from the Philippine fauna (Andersen, 1995). Polhemus & Reisen (1976)

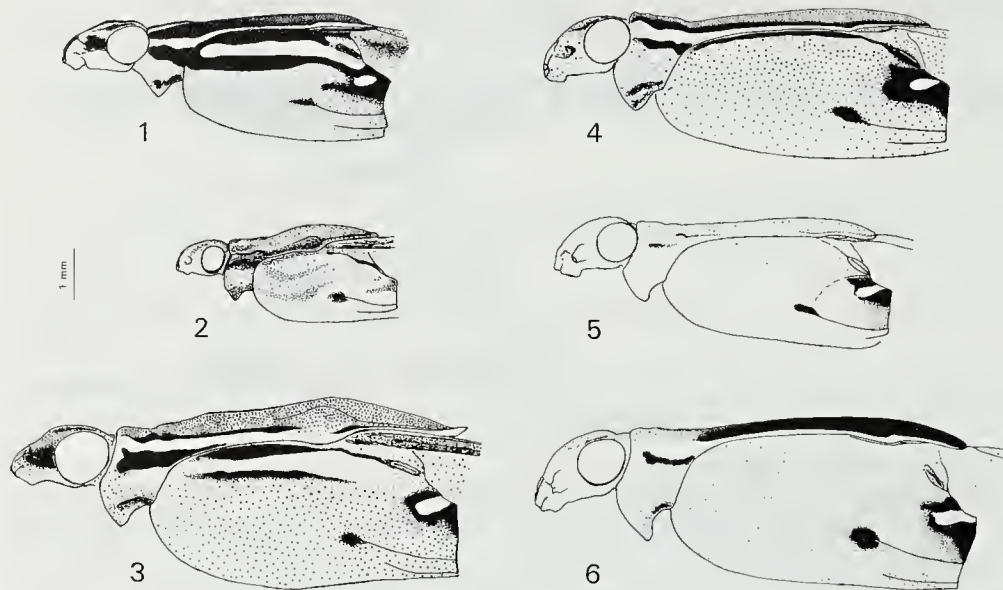
have presented new Philippine records of *L. ciliata*, *L. femorata*, and *L. nigripennis*. Nieser & Chen (1992) have keyed the species of Malesia, including three of four Philippine species (but not *L. rossii*).

Material of *Limnometra palawanensis* spec. nov. has been treated as *L. nigripennis* by several authors (Andersen, 1967; Hungerford & Matsuda, 1958; Nieser & Chen, 1992).

The generic status of *Limnometra* is in discussion for a long time, because of its close relationship with the palaeotropical genus *Tenagogonus* Stål, 1853. We follow the opinion of recent studies (Andersen, 1995; Andersen & Weir, 1997; Nieser & Chen, 1992) by treating *Limnometra* as a genus distinct from *Tenagogonus*. However, the monophyly of *Tenagogonus* in the present sense seems doubtful and will be discussed in another prospective study.

Abbreviations. HZ: Herbert Zettel legit (with sampling number); macr.: macropterous; micr.: micropterous; \*: new island record.

Depositories. CCBC: Coll. Pingping Chen, Beijing, China; CZWA: Coll. Herbert Zettel, Vienna, Austria; JTPC: Colorado Entomological Museum [= Coll. John T. Polhemus], Englewood, Colorado, U.S.A.; MZFI: Museo Zoologico de "La Specola", Firenze, Italy; NCTL: Coll. Nico Nieser, Tiel, The Netherlands; NHMW: Natural History Museum



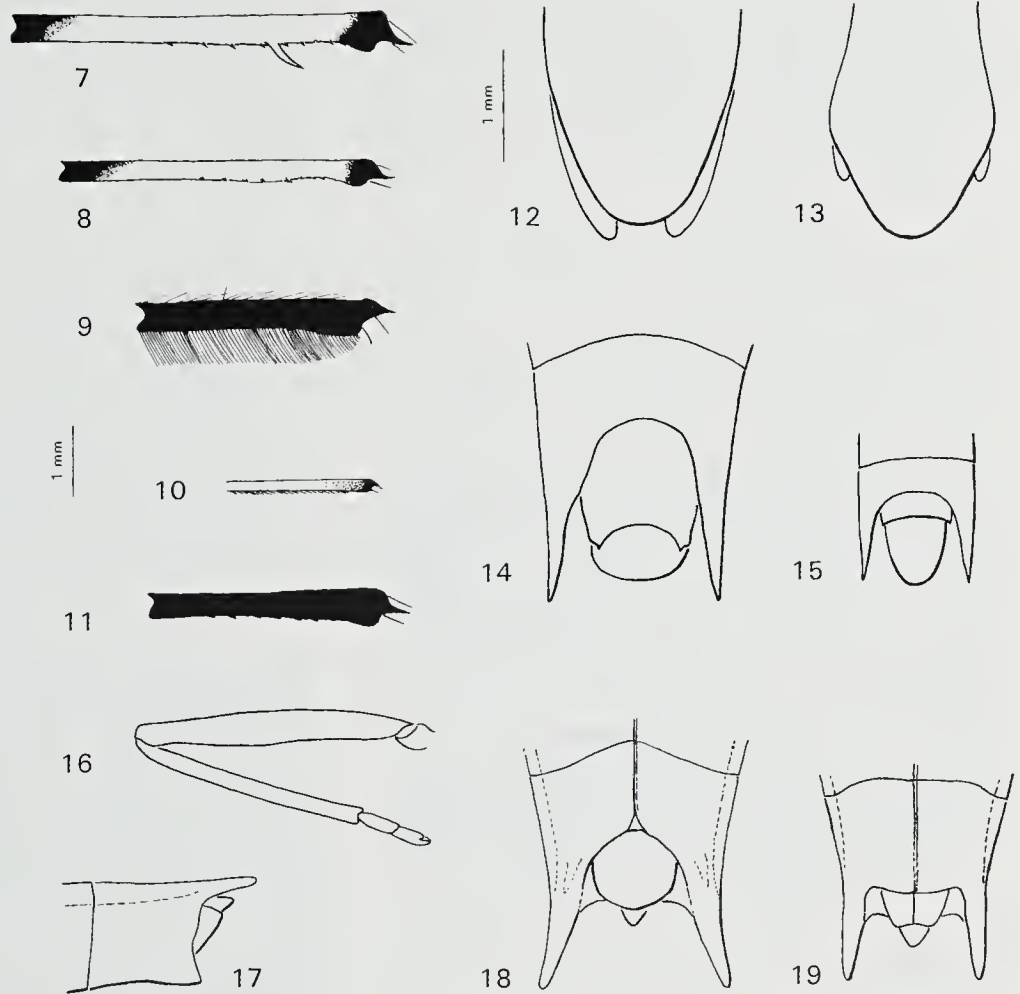
Figs. 1-6. Colour pattern on head, pro- and mesothorax, lateral view (mouth parts and legs omitted). 1, *Limnometra ciliata*, micropterous female; 2, *L. rossii*, macropterous female; 3, *L. femorata*, macropterous male; 4, *L. nigripennis*, micropterous male (Luzon); 5, *L. nigripennis*, micropterous male (Cebu), 6, *L. palawanensis* spec. nov., micropterous female.

Vienna, Austria; UPLB: Museum of Natural History, University of the Philippines, Los Baños, Laguna, Philippines.

### Key to the species of the Philippine Islands

1. Mesopleura with two or three black longitudinal stripes, which may be faded (figs 1-3); forewing uniformly dark or with brownish costal margin; macropterous, in *L. ciliata* also micropterous with wing rudiments reaching or surpassing hind margin of pronotal lobe (fig. 12) ..... 2
- Mesopleura at most with one black stripe at upper margin (figs 4-6); forewing with yellowish costal margin; macropterous or (more commonly) micropterous with wing rudiments reduced to very small remnants postero-laterally of the pronotal lobe (fig. 13), or completely covered by the pronotal lobe, not surpassing hind margin of pronotal lobe (except in one specimen of *L. nigripennis*) ..... 4
2. Antenna, meso- and metafemora partly whitish; mesofemur of male with antapical spine (fig. 7, rarely reduced as in fig. 8), without a fringe of ciliae; sternite 7 of female distinctly keeled, elevated; pronotum (not pronotal lobe!) with thin black lateral and median stripes ..... *L. femorata*
- Antenna, meso- and metafemora without whitish areas; mesofemur of male without antapical spine, with fringe of long (fig. 9) or rather short (fig. 10) ciliae; sternite 7 of female flattened without or with indistinct keel; pronotum (not pronotal lobe!) either with very broad black lateral stripes, or with brown marks between lateral and median stripes ..... 3
3. Small species, body length less than 8 mm; colour pattern of mesopleura as in figure 2; male: profemur enlarged, distinctly broader than mesofemur (fig. 16); fringe of ciliae on mesofemur short (fig. 10); segment 8 without triangular ventrolateral processes (fig. 15) ..... *L. rossii*
- Larger species, body length at least 12 mm, usually much larger, up to 20 mm; colour pattern of mesopleura as in figure 3; male: profemur slender, subequal to mesofemur; fringe of ciliae on mesofemur long (fig. 9); segment 8 with two triangular ventrolateral processes (fig. 14) ..... *L. ciliata*
4. Sclerites of vesicula as in figures 20a-c; ground colour of pronotal lobe distinctly darker than that of mesopleura (fig. 6); black lateral stripes on pronotal lobe broad and in apterous morph medially faded, so that the whole posterior portion of the lobe is darkened; mesopleura always without black upper margin (fig. 6); meso- and metafemur at least distally blackish; wings brown ..... *L. palawanensis* spec. nov.
- Sclerites of vesicula as in figures 21a-c; except in populations from South Luzon, Marinduque, Catanduanes, and the East

Figs 7-19. Philippine *Limnometra*. 7-11, Distal part of mesofemur of males. 7-8, *L. femorata*; 9, *L. ciliata*; 10, *L. rossii*; 11, *L. palawanensis* spec. nov. 12-13, posterior part of pronotal lobe and wing rudiments, dorsal view, in micropterous specimens. 12, *L. ciliata*; 13, *L. palawanensis* spec. nov. 14-15, male abdominal segments 7-9, ventral view. 14, *L. ciliata*; 15, *L. rossii*. 16, fore leg of *L. rossii*, male. 17-19, *L. palawanensis* spec. nov. 17, tip of abdomen of micropterous female, lateral view; 18, tip of abdomen, ventral view, of large micropterous male; 19, same of micropterous female.



Visayas, colour pattern obviously different: pronotal lobe and mesopleura of same or similar ground colours, which both may vary from yellowish to brownish (figs 4-5); black lateral stripes on pronotal lobe narrow and sharp; mesopleura usually with thin black stripe at upper margin (fig. 4), except in many specimens from the Western and Central Visayas (fig. 5); meso- and metafemur reddish, rarely brownish; wings usually blackish (except in many specimens from the Western and Central Visayas)..... *L. nigripennis*

***Limnometra femorata* Mayr, 1865**  
(figs 1, 7, 8, 22)

*Limnometra femorata* Mayr, 1865, Verh. zool.-bot. Ges. Wien 15: 443 ("Philippinen").  
*Limnometra femorata*: Hungerford & Matsuda, 1958: 413 - Andersen, 1967: 261 - Polhemus & Reisen, 1976: 269 - Nieser & Chen, 1992: 12, 15 - Andersen, 1995: 118.

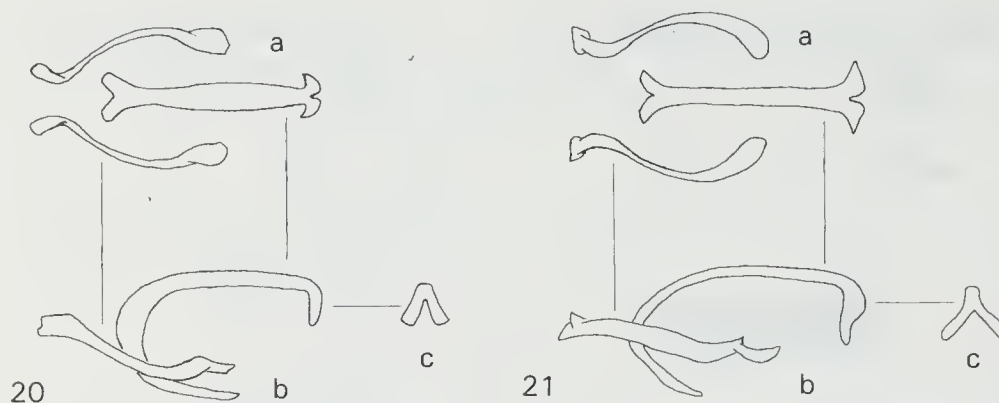
**Material examined**

Holotype: ♂, macr., "femorata\ det. Mayr", "HOLOTY-

PUS\ Limnometra\ femorata MAYR 1865\ Verh.Zool.-Bot.Ges. 15: 443\ des. H. ZETTEL 1993\ Inv. Nr. GERR.66/1" (NHMW). Further material: Luzon: 1♂ macr., Laguna, Los Baños, Mt. Makiling, 18.xi.1993, leg. Schillhammer (7) (NHMW); 2♂, 3♀ macr., Laguna, Los Baños, Mt. Makiling, Mud Springs, 1.xi.1996, HZ (88) (NHMW, UPLB); 1♀ macr., Laguna, Mt. Makiling, stream above Mud Springs, 700 m, 22.xi.1995, leg. J. Kodada (NHMW); Bohol: 2♂, 3♀ macr., 9 km NE Tagbilaran, Corella, 26.xi.1996, HZ (110a) (NHMW, UPLB); 1♂, 2♀ macr., 3 km SW Bilar, Man Made Forest, 24.xi.1996, HZ (108) (NHMW, UPLB); Palawan: 2♂ macr., 10 km NE Quezon, Tumarbon Falls, 4.iv.994, HZ (58a) (NHMW); 1♀ macr., ibid., 3-4.iv.1994, HZ (58) (NHMW); 1♀ macr., 9 km W P. Princesa, Iwahig, Balsahan riv., 24.iii.1994, HZ (48) (NHMW); 1♂ macr., W Sabang, 0-30 m, 29.iii.1994, HZ (52e) (NHMW); 1♂, 1♀ macr., Central Palawan, Sabang env. 30.xi.1995, 100 m. stream in degraded forest, leg. J. Kodada (NHMW).

**Remarks**

A macropterous male without locality label, but identified by Mayr and deposited in NHMW fits perfectly the original description, and is regarded to be the holotype. Antennae and parts of legs are lacking.



Figs 20-21. Vesicula sclerites, dorsal sclerite and paired lateral sclerites (a: dorsal view; b: lateral view; c: apical view of dorsal sclerite). 20, *Limnometra palawanensis* spec. nov.; 21, *L. nigripennis*.

One small male from Palawan (site no. 58a) is lacking the mesofemoral spine. As this spine is used as a key character in all published identification keys (Hungerford & Matsuda, 1958; Chen & Nieser, 1992), special attention should be paid to this variety when identifying *Limnometra* specimens from areas where *L. femorata* occurs. A second, probably undescribed, species with mesofemoral spines is known from Java and West Malaysia.

#### Distribution

Peninsular Malaysia, Sumatra, Borneo, Philippines, Taiwan, Ryukyu Islands (Andersen, 1995).

Philippines: Luzon (Cagayan, Laguna), Sibuyan, Samar, Bohol\*, Mindanao (Zamboanga, Iligan, Davao, Surigao), Basilan, Palawan\*, Balabac (Hungerford & Matsuda, 1958; Polhemus & Reisen, 1976; Andersen, 1967; and new records) (fig. 22).

#### Habitat preferences and biology

In spite its wide distribution, *Limnometra femorata* is rather rarely collected. In the Philippines this species is much rarer than *L. nigripennis*. This fact is due to the unusual habitats of *L. femorata*. All specimens collected by the first author have been found in stagnant, shallow, not permanent waters of small size, mainly in forested areas. Because of this preference, all specimens are macropterous to change their site when the water is gone. A few specimens of this species have been observed in a secondary forest in Bohol (site no. 99): the habitat has been an about two square

meters (4 x 0.5 m) large, shaded puddle on a trail, with maximum depth about 5 cm. It has contained probably one male, two females and a few nymphs of different stages. When the specimens have been disturbed, they have fled to the edge of the water, usually with forelegs already on land. After more serious disturbing (coming closer) the adults quickly have fled away and landed on some elevated points in the vegetation from where they have observed the "predator". Only if they have "feeled secure", they have returned to the puddle. In contrast to that behaviour, macropterous specimens of *L. nigripennis* usually remain on the water, fleeing from one edge to another, and rarely fly away, only if they find no way to escape. *Limnometra ciliata*, normally found in larger stagnant waters, flees to the centre of the pond. Probably *L. femorata* is territorial, because usually single males are found.

#### *Limnometra ciliata* Mayr, 1865

(figs 3, 9, 12, 14, 22)

*Limnometra ciliata* Mayr, 1865, Verh. zool.-bot. Ges. Wien 15: 444 ("Jaŕa").

*Limnometra inermis* Mayr, 1865, Verh. zool.-bot. Ges. Wien 15: 444 ("Manilla").

*Limnometra ciliata*: Hungerford & Matsuda, 1958: 409 - Andersen, 1967: 261 - Polhemus & Reisen, 1976: 268 - Nieser & Chen, 1992: 12, 14 - Andersen, 1995: 118 - Andersen & Weir, 1997: 245.

#### Material examined

Holotype of *L. ciliata* (♂, macr.): "Dr/ Doleschal\ 1859.\ Amboina.", "*ciliata*\ det. Mayr" (NHMW); holotype of *L. inermis* (♀, macr.): "inermis\ det. Mayr", Novara Exp.\ Manilla" [Luzon], "HOLOTYPUS\ *Limnometra*\ inermis MAYR 1865\ Verh.Zool.-Bot.Ges. 15: 444\ des. H.

ZETTEL 1993\ Inv.Nr.GERR.64/1" (NHMW). Further material (from Philippines): Mindoro: 1♂, 9♀ micr., 1♀ macr., Mindoro Oriental, Puerto Galera, S Big La Laguna, 25.xi.1993, HZ (33); Bohol: 1♀ micr., 9 km NE Tagbilaran, Corella, 26.xi.1996, HZ (110a) (NHMW); Busuanga (Palawan Province): 1♂ macr., Conception, Conception Falls, 27.ii.1996, HZ (83) (CZWA); 1♂, 3♀ macr., 13 (road-)km WNW Coron, Balulu Falls, 24.ii.1996, HZ (81) (CZWA); 5♀ macr., ibid., 2.ii.1999, HZ (171) (CZWA, UPLB); 2♀ micr., 2 km W Coron, 23.ii.1996, HZ (80a) (CZWA, UPLB); Palawan: 7♂, 5♀ macr., 17 km WSW Puerto Princesa, Tagbuna river, 26.iii.1994, HZ (51) (NHMW); 1♀ macr., W Sabang, 0-30 m, 29.iii.1994, HZ (52d) (NHMW); 1♀ macr., ibid., 29.iii.1994, HZ (52e)" (NHMW); 2♀ macr., 10 km NE Quezon, Tumarbon Falls, 3-4.iv.1994, HZ (58) (NHMW).

### Remarks

The holotype of *L. inermis* is a winged, strongly damaged female from Manila, which has been redescribed by Hungerford & Matsuda (1958). The synonymy with *L. ciliata* is confirmed. The specimen has been thought to be a male by Mayr (1865), a mistake, which probably has been the reason for describing this synonym. The winged male with locality label "Amboina" (= Ambon, Moluccas) and identified by Mayr as "*ciliata*" agrees exactly with the original description of *L. ciliata*; it is regarded to be the holotype, although Mayr (1865) has stated that the type is from "Java". Antennae are lacking (except segment 1 of left antenna), legs are nearly complete (except left mid leg partly missing). The provenances of some *Limnometra* specimens collected by Dr. Carl Ludwig Doleschall and deposited in the collection of NHMW and those mentioned by Mayr (1865) are contradictory. This is true for the holotype of *L. ciliata* and also for the syntype series of *Limnometra pulchra*, which are all labeled "Amboina", but have been recorded from "Java" by Mayr (1865). Doleschall has studied in Vienna, lived as a medical doctor first at Java, and later at Ambon, where he has died in 1859 at the age of 32. His entomological work and interest has been concentrated on Diptera (Horn & Kahle, 1935; Horn & Schenkling, 1928-1929; Stagl, 1999). Doleschall's insect collections originate from Central Java and Ambon (Stagl, 1999), but insects of the main

shipment, which has reached the NHMW in December 1859 (Stagl, 1999), are either from Ambon or of unstated provenance (acquisition book of NHMW: unstated for Hemiptera). At that time the insects have been probably unlabeled, eventually even a few years later, when Mayr has studied the Gerridae, so that the collecting locality may have been unclear for him. The position of the locality label below the identification label of one *L. pulchra* syntype would indicate this. *Limnometra pulchra* is regarded as an endemic species of the Moluccas and Palau Island and does not occur in Java (Andersen, 1995; Nieser & Chen, 1992). The origin of the holotype of *L. ciliata* is probably Ambon, too.

### Habitat preferences and biology

Typical habitats of *Limnometra ciliata* are the edges of larger, shallow stagnant waters. In streams *L. ciliata* is only found, when the water velocity is very low and large lentic areas are available. Because of the larger microhabitats, aggregation is not so obvious as in *L. nigripennis*.

### Distribution

Thailand, Vietnam, Peninsular Malaysia, Sumatra, Borneo, Sumbawa, Sumba, Sulawesi, Moluccas, New Guinea, New Britain, Solomon Islands, Fidji Islands, Guam (Andersen, 1995; Hungerford & Matsuda, 1958; Nieser & Chen, 1992).

Philippines: Luzon (Manila, Laguna, Pangasinana), Marinduque, Mindoro\* (Oriental), Bohol\*, Busuanga\*, Palawan\*, Balabac (Andersen, 1967; Hungerford & Matsuda, 1958; Polhemus & Reisen, 1976; and new records) (fig. 22).

### *Limnometra rossii* Hungerford & Matsuda, 1958

(figs 2, 10, 15, 16, 22)

*Limnometra rossii* Hungerford & Matsuda, 1958, Kans. Univ. Sci Bull. 39: 408 ("San José, Mindoro, Philippine Islands").

*Limnometra rossii*: Andersen, 1995: 118.

### Material examined

1 ♂, 1 ♀ macr. "MINDORO, P.I:\ San Jose\ II-1945\ E. S. Ross" (JTPC).

### Comparative notes and discussion

Specimens examined have been collected together with the type series, their status as paratypes is uncertain. *Limnometra rossii* is not closely related with any other Philippine species, but very similar to *L. borneensis* Hungerford & Matsuda, 1958, from Borneo (Sarawak). Both species share the thickened profemur (fig. 16) and the shortly ciliated mesofemur (fig. 10) of males. They are to separate by different colour patterns and sizes (Hungerford & Matsuda, 1958).

Although the fauna of Mindoro Island is mainly influenced from Luzon, there are some relationships with the fauna of Palawan and subsequently with that of Borneo. The best example is *Metrocoris tenuicornis* Esaki, 1926, a species widely distributed in South-east Asia, which northwards is reaching Palawan, the Calamianes Islands, and Mindoro, but is apparently absent from Luzon and the other Philippine islands. Habitat preferences and biology of *L. rossii* are unknown.

### Distribution

Probably endemic to the Philippines: Mindoro Occidental (only known from the type locality, fig. 22).

### *Limnometra nigripennis* Mayr, 1865 (figs 4, 5, 21, 23)

*Limnometra nigripennis* Mayr, 1865, Verh. zool.-bot. Ges. Wien 15: 443 ("Philippinen").

*Limnometra nigripennis*: Hungerford & Matsuda, 1958: 415 (partim) - Polhemus & Reisen, 1976: 269 - Nieser & Chen, 1992: 13, 15 (partim) - Andersen, 1995: 118.

### Material examined

Holotype: ♂, macr., "nigripennis\ det. Mayr", "Dohrn\ Philipp.", "♂", "HOLOTYPUS\Limnometra\ nigripennis MAYR 1865\ Verh.Zool.-Bot.Ges. 15: 443\ des. H.

ZETTEL 1993\ Inv.Nr.GERR.67/1" (NHMW). Further material: Mindoro: 12 ♂, 15 ♀ micr., 4 ♀ macr., Mindoro Occidental, Mindoro Beach, 10 km W, Puerto Galera, small tributary, 24.xi.1992, HZ (17) (NHMW, NCTL, CCBC); 1 ♀ micr., ibid., 23.xi.1993, HZ (31a)" (NHMW); 1 ♂, 2 ♀ micr., Mindoro Oriental, Tamaraw Beach, Talipanan River, W Puerto Galera, 1992, HZ (19) (NHMW); 1 ♂, 2 ♀ micr., ibid., 23.xi.1993, HZ (30) (NHMW); 1 ♀ micr., 1 ♂ macr., Mindoro Oriental, 4 km S Puerto Galera, Big Tabinay River, 27.xi.1993, HZ (36) (NHMW); 1 ♂ macr., ibid., 12.xi.1994, HZ (62) (CZWA); 1 ♂ micr., Mindoro Oriental, Balete, 28 km S Calapan, 100-700 m, 27-28.xi.1992, HZ (18) (NHMW); 1 ♂ micr., Mindoro, leg. H. Nijland (NCTL); Luzon: 2 ♂, 1 ♀ macr. Mountain Province, S Sagada, Bagnen, slopes of Mt. Polis, 1600 m, 26.ii.1999, HZ (189) (NHMW); 1 ♀ micr., Mountain Province, 5 km S Bontoc, Balitian River, 900 m, 27.ii.1999, HZ (190) (NHMW); 1 ♂, 2 ♀ macr., Zambales, Olongapo, Subic Bay, "Riding Stable", 30.xi-5.xii.1993, HZ (37d) (NHMW); 1 ♂ 1 ♀ micr., 1 ♂ macr., ibid., "Jungle Survival", 4.xii.1993, HZ (37h) (NHMW); 4 ♂, 2 ♀ micr., 1 ♂ macr., Bataan, 10 km E Olongapo, Roosevelt Park, 1.xii.1993, stream, HZ (38) (NHMW); 2 ♀ micr., 2 ♂, 5 ♀ macr., ibid., small streamlet, HZ (38a) (NHMW); 1 ♂ micr., 1 ♂ macr., Laguna, Los Baños, Rest Area, stream from Tampalit Falls, 17.xi.1992, HZ (1a) (NHMW); 2 ♂, 4 ♀ micr., 5 ♀ macr., ibid., 15.xi.1993, HZ (22b) (NHMW, UPLB); 4 ♂, 2 ♀ micr., 3 ♂, 2 ♀ macr., Laguna, Los Baños, Mt. Makiling, Molawin Creek, College of Forestry, 8.ii.1996, HZ (CZWA, UPLB); 3 ♂, 3 ♀ macr., Laguna, Los Baños, Mt. Makiling, Mud Springs, 8.ii.1996, HZ (73) (CZWA, UPLB); 1 ♂, 4 ♀ micr., Laguna, Mt. Makiling, stream above Mud Springs, 700 m, 22.xi.1995, leg. J. Kodada (NHMW, CCBC); 1 ♂, 1 ♀ micr., 1 ♂, 2 ♀ macr., Laguna, Los Baños, Mt. Makiling, Mud Springs, 1.xi.1996, HZ (88) (NHMW, UPLB); 1 ♂, 1 ♀ macr., Laguna, SE San Pablo, Mt. Banahaw, Kinabuhayan, 16.xi.1993, leg. H. Schillhammer (5) (NHMW); 1 ♀ macr., Laguna, Mt. Banahaw, above Kinabuhayan, 800 m, creek in degraded rainforest, 25.xi.1995, leg. J. Kodada & B. Rigová (NHMW); 1 ♀ micr., Quezon, 30 km E Lucena City, Quezon NP 23.xi.1993, leg. Jäch (11) (NHMW); 2 ♀ macr., Quezon, Atimonan, Old Zigzag Road, Quezon NP, 16.iii.1999, HZ (202) (NHMW); 5 ♂, 4 ♀ micr., 1 ♂ macr., Quezon, Lucena, Site, Botanical Garden, 11.ii.1996, HZ (78) (CZWA, UPLB); Camarines Sur, Lake Buhi area, Twin Falls, nr. Itbog, 22.iii.1998, HZ (164) (CZWA); 2 ♂, 3 ♀ micr., Camarines Sur, 20 km E Naga, 5 km E Carolina, Mt. Isarog, nr. Malabsay Falls, 4.iii.1999, HZ (192) (NHMW); Marinduque: 3 ♂, 8 ♀ micr., NE Boac, 7 km SE Mogpog, Bocboc, Paadyan Falls, 17.ii.1998, HZ (140) (NHMW, UPLB); Catanduanes: 2 ♂ micr. N Bato, S San Miguel, Balongbong Falls, 7.iii.1999, HZ (195) (NHMW); 1 ♂, 4 ♀ micr., E San Andres, 11-12.iii.1999, HZ (200) (NHMW, UPLB); Samar: 3 ♂ micr., Northern Samar, Veriato, El Amigo, Veriato Falls, 16.iii.1998, HZ (162) (CZWA, UPLB); Ticao: 2 ♂, 6 ♀ micr., W San Fernando, Mag-Kaipit Spring, 27.ii.1998, HZ (148) (NHMW, UPLB); Sibuyan (Romblon Province): 1 ♂, 2 ♀

micr., S Magdiwang, Jao-asan, Fato-o river, 18.xi.1994, HZ (67a) (CZWA); 1 ♀ macr., E Magdiwang, Silum, 19.xi.1994, HZ (68a) (CZWA); 2 ♂, 1 ♀ macr., *ibid.*, HZ (68c) (CZWA); Tablas (Romblon Province): 3 ♂, 4 ♀ micr., San Agustin, Dubduban, Busai Falls, 23-25.xi.1994, HZ (70) (CZWA, UPLB); Panay: 1 ♂ micr., Antique (North), Libertad, 21-22.i.1994, leg. Seyfert & Graindl (NHMW); 1 ♀ micr., Antique (North), Sebaste, 19-23.i.1994, leg. Seyfert & Graindl (NHMW); 3 ♂, 2 ♀ micr., 1 ♂, 2 ♀ macr., Antique (South), 50 km NE San Jose de Buenavista, San Remigio, Napula Falls, 20.iii.1994, HZ (43) (NHMW); 1 ♀ micr., *ibid.*, 20.iii.1994, leg. S. Schödl (6) (NHMW); 3 ♀ micr., 3 ♂, 1 ♀ macr., Ilo-Ilo, 10 km NE Igbaras, Nadsadan Falls, 500 m, 22.iii.1994, HZ (47) (NHMW); 1 ♀ micr., 1 ♂, 1 ♀ macr., *ibid.*, ca. 400 m, 22.iii.1994, leg. Schödl (8) (NHMW); Negros: 4 ♂, 2 ♀ micr., Negros Occidental, Mambucal, Pula River, 11.ii.1994, leg. Seyfert & Graindl (NHMW); 1 ♂, 2 ♀ micr., Negros Oriental, W Dumaguete, Valencia, Banica Valley Resort, 25.ii.1997, HZ (117) (CZWA); 1 ♂, 1 ♀ micr., 2 ♀ macr., Negros Oriental, W Dumaguete, Valencia, Casaroro Falls, 26.ii.1997, HZ (118) (CZWA, UPLB); Cebu: 7 ♂, 24 ♀ micr., S Badian, Matutinao, Kawasan Falls, 2-50 m, 29-30.xi.1996, HZ (112) (NHMW, UPLB, NCTL, CCBC); 5 ♂, 3 ♀ micr., *ibid.*, 24.ii.1997, HZ (116) (CZWA, UPLB); Biliran: 1 ♀ micr., 7 km N Almeria, Masagongsong, 13.iii.1998, HZ (160) (CZWA); 1 ♀ micr., SE Almeria, Balagombong Falls, 14.iii.1998, HZ (161) (CZWA); Leyte: 1 ♂, 2 ♀ micr., E Ormoc, Lake Danao, small streamlet, 11.iii.1998, HZ (158) (CZWA, UPLB); Bohol: 1 ♂, 2 ♀ micr., 1 ♀ macr., Antequera, Mag-Aso Falls, 22.xi.1996, HZ (104) (NHMW); 2 ♂, 7 ♀ micr., 2 km NE Jagna, 23.xi.1996, HZ (106) (NHMW); Camiguin: 1 ♂, 5 ♀ micr., 3 km N Mambajao, 19.xi.1996, HZ (103) (NHMW); 1 ♂, 1 ♀ micr., env. Mambajao, 4.ii.1994, leg. Seyfert & Graindl (NHMW); 3 ♂, 5 ♀ micr., W Mambajao, Katibawasan Falls, 15.xi.1996, HZ (96) (NHMW); 2 ♂, 1 ♀ micr., S Mambajao, 18.xi.1996, HZ (101) (NHMW); 4 ♂, 11 ♀ micr., Tupsan, Macao (Cold) Spring, 18.xi.1996, HZ (99) (NHMW); Mindanao: 1 ♀ micr., 1 ♀ macr., Zamboanga del Sur, 14 km N Pagadian, Datagan, Kendis Cave, 10.iii.1997, HZ (127) (CZWA); 1 ♂, 2 ♀ micr., Zamboanga del Sur, 25 km NW Pagadian, Deborok-Lourdes, Tubangan River, 11.iii.1997, HZ (128) (CZWA, UPLB); 6 ♂, 8 ♀ micr., 2 ♂, 2 ♀ macr., Misamis Occidental, W Ozamiz, Tangub, Lumban, 6.iii.1997, HZ (124) (CZWA, CCBC, UPLB); 1 ♀ apt., 1 ♂, 2 ♀ macr., Misamis Occidental, W Ozamiz, Tangub, Gala, Lobo River, 7.iii.1997, HZ (125) (CZWA, UPLB); 4 ♀ micr., 1 ♂, 2 ♀ macr., Zamboanga del Sur, 8 km NE Pagadian, Manga Falls, 12.iii.1997, HZ (129) (CZWA, UPLB); 1 ♂, 5 ♀ micr., Bukidnon, Malaybalay, Kaamulan Site, 650 m, 6-7.ii.1996, HZ (90c) (NHMW); 3 ♂, 2 ♀ micr., *ibid.*, 12.xi.1996, HZ (90e) (NHMW); 4 ♀ micr., *ibid.*, 6.xi.1996, HZ (90a) (NHMW); 6 ♀ micr., Bukidnon, Malaybalay, Woodstock, 650 m, 5.xi.1996, HZ (89) (NHMW); 1 ♂, 1 ♀ micr., Bukidnon, Malaybalay, Spring Site, 650 m, 7.xi.1996, HZ (91) (NHMW); 1 ♀ macr., Sarangani, Lake Sebu area, 10.xii.1993, hilly stretch,

mountain stream, Bakdolong, leg. N. Nieser (N9377) (NCTL); 2 ♂, 1 ♀ micr., Sarangani, Lake Sebu area, 10.xii.1993, pothole and pool exposed to sun, leg. N. Nieser (N9380) (NCTL); 1 ♀ micr., Sarangani, Lake Sebu area, mountain stream, barangay Bakdolong, 4.xii.1993, leg. N. Nieser (N9366a) (NCTL).

### Remarks

The holotype is a winged male (antennae and legs partly missing), which has been re-described by Hungerford & Matsuda (1958).

*Limnometra nigripennis* varies strongly in colouration and size, but is uniform in male vesicula sclerites (fig. 21). Ground colour can vary from light yellowish to middle brown. Usually specimens from one population are similarly coloured. Black stripes on the thorax are differently developed and may be reduced to a high degree. The black lateral stripes on the pronotal lobe are usually thin, rarely broader, and usually well defined towards middle. Tergites are typically black, but may be brownish or even yellowish. Specimens from North and Central Luzon, Mindoro, and Mindanao are usually rather dark and represent the typical form (fig. 4). In the following, two distinct variations are described.

All specimens from Cebu belong to an extremely lightly coloured variation: the ground colour is yellowish, sometimes slightly brownish. The lateral stripes on the pronotum are reduced, at least partly lacking, and those on the pronotal lobe are usually weakly developed as a thin line, or lacking in the anterior part. The mesopleura usually lack a dark upper margin (fig. 5). The tergites are yellowish to brownish, never black. Further, the connexival spines of males are slightly stouter and more divergent than in typical *L. nigripennis* males. On Cebu also other Gerromorpha species have a lighter ground colour than on other Philippine islands (e.g. *Rheumatogonus luzonicus* Kirkaldy, 1909, *Rhagovelia cotabatoensis* Hungerford & Matsuda, 1960, and *Pseudovelia* sp.). Specimens from Panay (with brownish wings), Negros, and Camiguin have an intermediate colouration.

A remarkably dark variety, which strongly resembles *L. palawanensis* spec. nov., inha-

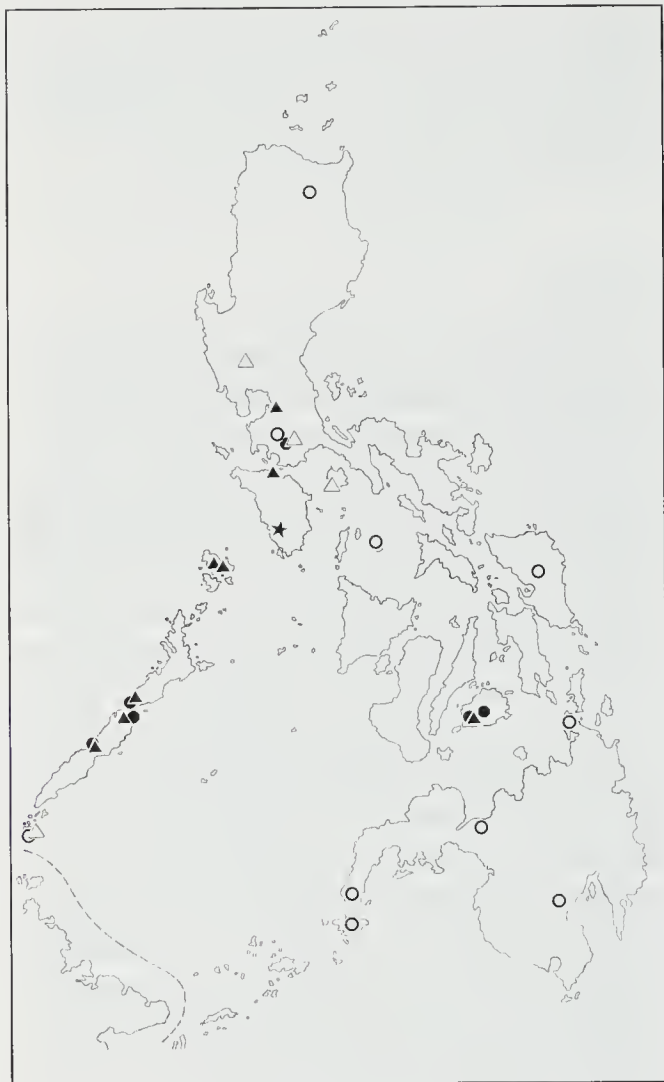


Fig. 22. Distribution of *Limnometra femorata* (circles), *L. ciliata* (triangles), and *L. rossii* (asterisk) in the Philippines (full signs after material examined, empty signs after records from literature cited in the text).

bits a relatively restricted area in South Luzon (Camarines Sur), Marinduque, Catanduanes, and Samar: The pronotal lobe is blackish with a pair of thin yellowish lines bordering the narrow black mid-line and more or less extended posteriad (not present in specimens from Marinduque). In Catanduanes, however, specimens with a colour pattern of the pronotal lobe intermediate between this and the typical form occur together with dark specimens. The dark stripe on the upper margin of the mesopleura is usually faded, sometimes indistinct. The colour of the mesofemora varies from reddish to dark brown. The wing colour of this variety is blackish brown, according to the single macropterous specimen from Camarines Sur. Specimens from Leyte and Biliran are intermediate in colour

between the typical form and the dark variation.

In all colour varieties the black marks surrounding the bright yellow "eye marks" on mes- and metacetabula are well developed (figs 4-5). These strongly contrasting marks are probably important for intraspecific optical communication.

Sizes vary considerably, especially in micropterous males: body lengths of micropterous males 11-18 mm, of macropterous males 13-16 mm, of micropterous females 12-14 mm, of macropterous females 12.5-14.5 mm. No regional differences in size have been obvious.

Micropterous specimens have extremely small wing rudiments which are situated laterally of the pronotal lobe (fig. 13). Only in one male from Panay, Antique Prov. (site no. HZ 43) the wing rudiments are surpassing the end of the pronotal lobe; this specimen is regarded an aberration.

#### *Habitat preferences and biology*

*Limnometra nigripennis* belongs to the most widespread and abundant Gerromorpha of Philippine running waters. It is tolerating environmental disturbances to a higher degree than most other species which live in streams. Typical habitats are lentic parts of very small to middle sized streams and pools associated with running water. Shaded areas are obviously preferred. Lotic parts of the streams are strictly avoided. *Limnometra nigripennis* tends to aggregate in suitable microhabitats, and is often found in larger numbers. Adults and all stages of nymphs live together.

#### *Distribution*

*Limnometra nigripennis* is probably endemic to the Philippines where it has been found in all areas except the Palawan region: Luzon (Cagayan, Mountain Province, Zambales, Bataan, Laguna, Quezon, Camarines Sur), Mindoro\* (Occidental, Oriental), Marinduque, Polillo, Catanduanes\*, Samar\*, Ticao\*, Sibuyan\*, Tablas\*, Panay\* (Antique, Ilo-Ilo), Guimaras, Negros (Oriental, Oriental), Cebu\*,



Bohol\*, Biliran\*, Bohol\*, Camiguin\*, Mindanao (Zamboanga del Norte, Zamboanga del Sur, Misamis Occidental, Bukidnon, Davao, Sarangani) (Hungerford & Matsuda, 1958; Polhemus & Reisen, 1976; and new records); (fig. 23).

*Limnometra palawanensis* spec. nov.

(figs 6, 11, 13, 17-20, 23)

*Limnometra nigripennis*: Hungerford & Matsuda, 1958: 417 (partim) - Andersen, 1967: 262 - Nieser & Chen, 1992: 15 (partim).

*Type material*

Holotype: ♂, micr., "PHILIPPINEN: Palawan\ Brook's Point\ Mate, 31.3.1994\ leg. H. Zettel (54)" (NHMW); paratypes: Palawan: 4♂, 10♀ micr., 2♂, 2♀ macr., same locality data as holotype (NHMW, JTPC, CCBC, NCTL); 2♂, 1♀ micr., 20 km W Puerto Princesa, Tacduan Area, Tacduan river, 25.iii.1994, HZ (49d) (NHMW); 3♂, 7♀ micr., 1♀ macr., 9 km W Puerto Princesa, Iwahig, Balsahan River, 24.iii.1994, HZ (48) (NHMW, NCTL); 1♂, 1♀ micr., ibid., 7.iv.1994, HZ (60) (NHMW); 2♂ macr., 7 km N Narra, Estrella Falls, 2.iv.1994, HZ (57) (NHMW); 1♂ micr., ibid., 5.iv.1994, HZ (59) (NHMW); 1♂, 2♀ micr., W Sabang, 0-30 m, 29.iii.1994, HZ (52e) (NHMW); 1♂, 2♀ micr., 1♂, 1♀ macr., Central Palawan, Sabang env. 30.xi.1995, 100 m, stream in degraded forest, leg. J. Kodada (NHMW); 1♂, 1♀ micr., Mantalingajan, Pinigasan, 600 m, 14.ix.1961, Noona Dan Exp. 61-62 (NCTL); Busuanga (Palawan Province): 4♂ micr., Conception, Conception Falls, 27.ii.1996, HZ (83) (CZWA, UPLB); 2♀ micr., 2♂, 2♀ macr., 13 (road-)km WNW Coron, Balulu Falls, 24.ii.1996, HZ (81) (CZWA, UPLB); 3♂, 4♀ micr., 7♂, 8♀ macr., 5 km NW Coron, Mabintangin Forest Reserve, Mabintangin River, 25-29.ii.1996, HZ (82) (CZWA, UPLB, NHMW); 1♂, 3♀ micr., 3♀ macr., ibid., small stream, 1-7.ii.1999, HZ (170) (CZWA, UPLB); 1♀ micr., 1♂ macr., W Borac, 31.i.1999, HZ (169) (CZWA); 1♀ micr., Balisungan, 14-15.iii.1991, leg. M. Borri & C. Volpi (MZFI).

*Description*

Male: dimensions (in mm): body length of micropterous males 12.0-16.3, of macropterous males 14.4-17.2; head width 1.98-2.38.

Colour: ground colour orange, ventrally lighter than dorsally, where it tends to brownish; head more or less darkened along inner eye margin; pronotum with thin black median and lateral stripes, pronotal lobe of micropter-

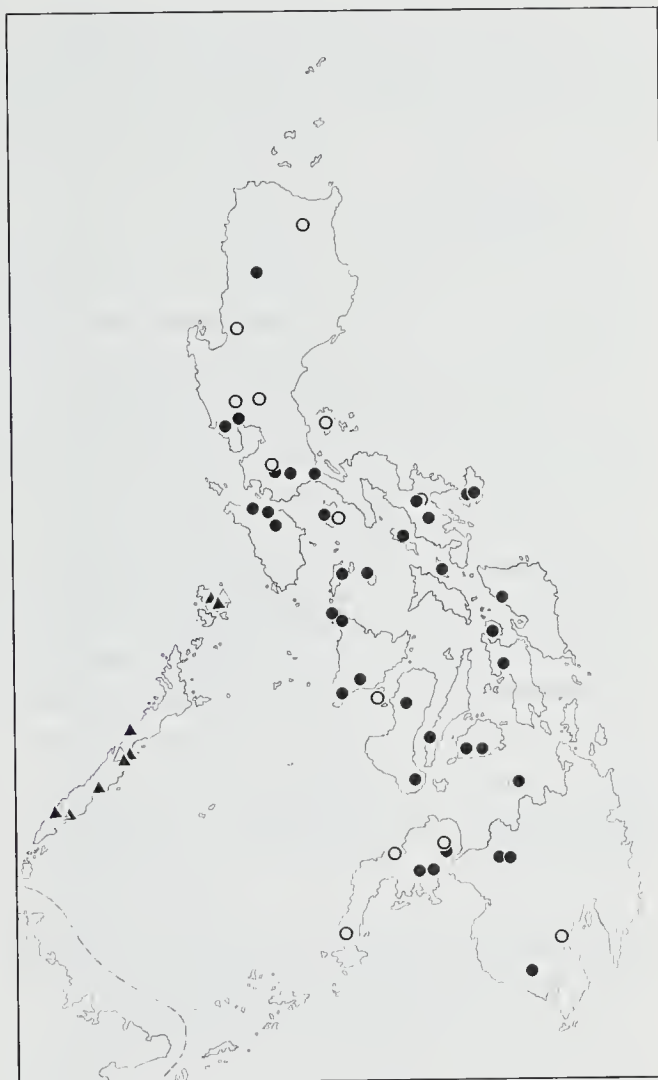


Fig. 23. Distribution of *Limnometra nigripennis* (circles) and *L. palawanensis* spec. nov. (triangles) (full signs after material examined, empty signs after records from literature cited in the text).

ous morph blackish or dark brownish, especially laterally, where the black lateral stripes (not continuous with those of the pronotum) indistinct towards middle; in macropterous morph usually brownish, with more distinct median and lateral stripes; in both morphs with narrow yellow lateral and posterior margins; proacetabula with blackish mark; mesopleura without blackish dorsal stripe, with blackish mark postero-ventrally (fig. 6); mes- and metacetabula with blackish marks surrounding yellow spots; metanotum postero-medially, and all tergites blackish; laterotergites yellow; forewing (dark) brownish with orange costal margin; antenna annulate: segment 1 orange, sometimes with darkened apex, segments 2 and 3 yellowish white with blackish base and apex, segment 4 yellowish

white with blackish base; coxae and trochanters yellowish, those of middle and hind legs dorsally with blackish marks; femora, tibiae, and tarsi blackish; or femora brownish and distally blackish.

Structural characters: length of antennal segment (of holotype, in mm) 4.6, 3.7, 4.9, 5.6; segment 2 distinctly longer than width of head; lengths of leg segments (of holotype, in relation to length of mesofemur = 100 = 20.2 mm): profemur 37, protibia 33, protarsus 5+4, mesotibia 85, mesotarsus 22+4, metafemur 98, metatibia 80, metatarsus 6+2; profemur without subapical indentation, more slender than mesofemur (0.9 times), with inconspicuous short pilosity on ventral surface; mesofemur without longer pilosity, distinctly longer than body, subapically with row of 3-11 short spines on inner surface (fig. 11); metasternum and sternites 2-7 with continuous median keel; connexival spines distinctly diverging (mainly in large males, fig. 18) or nearly pointed straight backwards (fig. 19), distance of their tips distinctly longer than their length.

Genitalia: segment 8 relatively small, slightly depressed; pygophore simple; proctiger pointed; paramere elongate, straight; vesicula sclerites (fig. 20a-c) of diagnostic importance: dorsal sclerite proximally curved in a wide arch, apically split into two stout, short branches (fig. 20c); lateral sclerite slender, distally bent, in dorsal view proximally evenly curved to middle and then indistinctly hooked (fig. 20a).

Female: dimensions: body length of micropterous females 11.5-13.6, of macropterous females 11.4-14.6; head width 1.82-2.08.

Colour as in male; structural characters differing as follows: antenna shorter, segment 2 subequal to width of head; mesofemur slightly shorter than body, without row of spines on inner surface; segment 7 in lateral view ventroapically elevated and with concave hind margin (fig. 17).

#### *Comparative notes and discussion*

*Limnometra palawanensis* spec. nov. is very

similar and closely related to *L. nigripennis*, from which it has not been separated by several authors (see synonymy). Differences are found in colouration (see key), except for a most similar variety of *L. nigripennis* from South Luzon, Marinduque, and Catanduanes. The decision to treat *L. palawanensis* spec. nov. as a distinct species, and not as a subspecies of *L. nigripennis*, is justified by constant differences of the dorsal and lateral sclerites in the vesicula of males: the dorsal sclerite of *L. palawanensis* spec. nov. splits in two short arms (fig. 20c), which are longer and more slender in *L. nigripennis* (fig. 21c). In dorsal view, the lateral sclerites of *L. palawanensis* spec. nov. are more evenly curved mediad, and then apically with an indistinct short hook laterad (fig. 20a), whereas those of *L. nigripennis* are more evenly S-curved (fig. 21a).

Palawan and its adjacent islands are zoogeographically isolated from the remaining Philippine Islands; the fauna of Palawan is closer related to that of Borneo. *Limnometra palawanensis* spec. nov. is also closely related with *L. submarginalis* Miyamoto, 1967, from North Borneo, e.g. these species and *L. nigripennis* share the yellowish (or orange) coloured costal margin of the forewings. Unfortunately, no material of *L. submarginalis* has been available for this study, so that differences are based only on the original description by Miyamoto (1967): *Limnometra submarginalis* has a similar light colouration as *L. nigripennis* (meso- and metafemora, pronotal lobe), the connexival spines are similar divergent (Miyamoto, 1967: figs 18, 23), and the lateral sclerites are more slender than those of both Philippine species (Miyamoto, 1967: figs 21, 22).

#### *Habitat preferences and biology*

No differences in habitat preference between *L. palawanensis* spec. nov. and *L. nigripennis* have been observed.

#### *Distribution*

Philippines: Palawan and Busuanga Islands

(probably endemic to the Palawan Region) (fig. 23).

### Acknowledgements

The authors are deeply indebted to Dr L. Bartolozzi, Dr Nico Nieser, and Dr John T. Polhemus for making specimens from their collections available for this study. For important comments on the manuscript we thank Nico Nieser. Some collecting trips of the first author have been financially supported by the Austrian Ministry of Sciences, the Austrian Ministry of Education and Arts, and by the society of the "Freunde des Naturhistorischen Museums in Wien". The first author especially thanks Mrs Jessamyn Recuenco-Adorada, Prof. Dr Victor P. Gapud, and Prof. Dr Augusto C. Sumalde (all in UPLB) and his many other Philippine friends who supported his field work.

### References

- ANDERSEN, N. M., 1964. The genus *Tenagogonus* Stål in the Collections of the Zoological Museum of Copenhagen. – *Entomologiske Meddelelser* 32: 321-334.
- ANDERSEN, N. M., 1967. A contribution to the knowledge of Philippine semiaquatic Hemiptera. Heteroptera. – *Entomologiske Meddelelser* 35: 260-282.
- ANDERSEN, N. M., 1995. Cladistics, historical biogeography, and a check list of gerrine water striders (Heteroptera, Gerridae). – *Steenstrupia* 21: 93-123.
- ANDERSEN, N. M. & T. A. WEIR, 1997. The gerrine water striders of Australia (Hemiptera: Gerridae): taxonomy, distribution and ecology. – *Invertebrate Taxonomy* 11: 203-299.
- BANKS, CH. S., 1909. *Rhynchota Palawanica*, Part. I: Heteroptera. – *Philippine Journal of Science* (A) 4: 553-593.
- DISTANT, W. L., 1903. *The fauna of British India including Ceylon and Burma. Rhynchota* 2 (1): i-x, 1-242. Taylor & Francis, London.
- HORN, W. & I. KAHLE, 1935. Über entomologische Sammlungen, Entomologen & Entomo-Museologie. – *Entomologische Beihefte Berlin-Dahlem* 2: i-vi, 1-160.
- HORN, W. & S. SCHENKLING, 1928-1929. *Index Literaturae Entomologicae I. Die Welt-Literatur über die gesamte Entomologie bis inklusive 1863. I-IV*: i-xxi, 1-352. Selbstverlag W. Horn, Berlin-Dahlem.
- Hungerford, H. B. & R. Matsuda, 1958. The *Tenagogonus* – *Limnometra* complex of the Gerridae. – *Kansas University Science Bulletin* 39: 371-457.
- LUNDBLAD, O. 1933. Zur Kenntnis der aquatilen und semiaquatilen Hemipteren von Sumatra, Java und Bali. – *Archiv für Hydrobiologie*, Suppl. 12: 1-195, 263-489, 21 Tafeln.
- MAYR, G. L., 1865. Diagnosen neuer Hemipteren II. – *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* 15: 429-446.
- MIYAMOTO, S., 1967. Gerridae of Thailand and North Borneo taken by the joint Thai-Japanese Biological Expedition 1961-62. – *Nature and Life in Southeast Asia* 5: 217-257.
- NIESER, N. & P. P. CHEN, 1992. Revision of *Limnometra* Mayr (Gerridae) in the Malay Archipelago. – *Tijdschrift voor Entomologie* 135: 11-26.
- POLHEMUS, J. T. & W. K. REISEN, 1976. Aquatic Heteroptera of the Philippines. – *Kalikasan Philippine Journal of Biology* 5: 259-294.
- STAGL, V., 1999. Carl Ludwig Doleschall - Arzt, Forscher und Sammler. – *Quadriřina* 2: 195-203.

Accepted 10.xi.1999.