FAUNAL AND BIOLOGICAL STUDIES ON THE INSECTS OF PADDY FIELDS IN ASIA. IV. AQUATIC AND SEMIAQUATIC HETEROPTERA FROM THE PHILIPPINES

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FAUNAL AND BIOLOGICAL STUDIES ON THE INSECTS OF PADDY FIELDS IN ASIA. IV. AQUATIC AND SEMIAQUATIC HETEROPTERA FROM THE PHILIPPINES

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Abstract

Aquatic and semiaquatic Heteroptera collected from the Philippine paddy water in 1979 are enumerated. A total of 17 species (717 specimens) belonging to 11 families are listed with notes including 2 new species, Paraplea davaoensis Miyamoto (Pleidae) and Anisops yanoi Miyamoto (Notonectidae). Previous records of these bugs from the paddy water of the world are also reviewed.

Aquatic species of Heteroptera dwelling in paddy fields have hardly been accorded any attention in insect pest control which has been carried up to the present in the rice areas of the world. Fragmental records on their occurrence in paddy water, however, have been presented. Yet no extensive works have been done before anywhere else. Several papers such as Moretti (1932) in Italy, Fernando (1959) in Sri Lanka, Service (1973, 1977) in Kenya, Heckman (1974, 1979) in Laos and Thailand and Polhemus and Reisen (1976) in the Philippines reported around 15 species from the respective localities, and these are the prominent ones among the papers concerned. Among the species concerned, Microvelia species may be the only exception to have been observed by several authors as predators of plant- and leafhoppers in paddy fields. Aquatic fauna of paddy water covering fishes and other animals including insects, however, have been reported by Fernando (1956) and others. It is still true that the aquatic insect fauna of the environment has not been

1) Partial result of Grant-in-Aid for Overseas Scientific Survey, No. 40412 (Principal investigator: Prof. Y. Hirashima) from the Ministry of Education, Science and Culture.
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Acknowledgement. is made to the Ministry of Education, Science and Culture, Japanese Government, for the grants mentioned above.
focussed well on Heteroptera as stated above.

During the field surveys on the plant- and leafhoppers injurious to rice and their natural enemies made in the Philippines in 1979 (Hirashima, 1981), aquatic and semiaquatic Heteroptera found in paddy water were collected by the first author in cooperation with the third author, and identified by the second author who is also responsible for the descriptions of new species. It is known that these groups of Heteroptera are mostly predaceous and feed on various insects including plant- and leafhoppers. The work has been done consequently along the purpose of the project and as planned by the first author (Yano, 1978). Though the collection is not big and informations on the biology were scarcely obtained, the result is enumerated here for further studies with a bibliographical review on the occurrence of the groups from the paddy water of the world. Aquatic Coleoptera collected along with the present material will be treated elsewhere.

The first author wishes to express his sincere gratitude to Dr. Y. Hirashima of Kyushu University, project leader, for his kind arrangement in joining the project. He is thankful to Dr. K. Aizawa, Dr. K. Morimoto, Dr. C. R. Baltazar, Mr. P. W. Resma and Mr. L. E. Padua for their help in collecting material and other ways. The kind help of Dr. K. Yasumatsu and Dr. C. H. Fernando for the literature and other ways is also greatly appreciated. Further, he is also grateful to entomologists and other officials who kindly cooperated to our field works in the Philippines.

Materials and localities visited

Field surveys mentioned above have been done in Luzon and Mindanao of the Philippines in 1979. Many places were visited for the project, and collections on the aquatic insects of paddy water were made at the following four places on the dates enclosed in parentheses. Collections were made by an insect net (42 cm in diameter and 30 cm in depth) which was reformed from ordinary sweep net by cutting its length.

**Luzon.**
- Banaue, Ifugao (July 27-31 and August 1)
- Bay, Laguna (August 14)

**Mindanao.**
- Tugbok, Davao City (August 28-30)
- Bislig, Surigao del Sur (September 1-4)

General situations of these places are partly referred to Yasumatsu et al. (1975). The following additional notes on these places are mentioned here especially for the aquatic insect collections concerned.

**Banaue** (Fig. 1). This is the place famous for its rice terraces situated on rather steep slopes of mountains at an elevation of about 1300 meters or more above sea level. Narrow paddy fields are terraced by stone walls, and native variety of rice have been cultivated without applying insecticides and fertilizers. Paddy fields around Banaue were in the midst of harvest when the surveys were done. Almost all paddies regardless of
harvest hold water owing to the rainy season. Collections on aquatic insects were made at several paddies which were not harvested and had some vegetation of weeds.

**Bay.** The rice plants of paddy field where collections on aquatic insects were done were about 60 cm in height. Almost all paddy fields around there contain so much water. The paddy water investigated was partly running very slowly to the exit irrigation ditch owing to current heavy rains.

**Tugbok** (Fig. 2). Three paddy fields in a row were selected for collections. Irrigation water was flowing to these paddies for the next crop of rice, and no rice plant was planted then, and no weed was seen except for some floating debris. Nurseries were seen near the place. Rice plants of paddies around the place were in their tillering and flowering stages.

**Bislig** (Fig. 3). Paddy fields belonging to PICOP (Paper Industries Corporation of the Philippines) were visited for the project. Rice plants there were in the tillering stage to mature. The paddies where the collections of the aquatic insects were made were with rice plants of tillering stage and were almost drying up owing to poor rain-fall except for one tiny spot where paddy water still contained with many aquatic insects. Irrigation ditch by the paddy field mentioned above kept water, and collectings were made also at the ditch.

As mentioned above, these four places investigated are quite different from each other in terms of the condition of paddy water, growing stages of rice plants, and its surrounding environment. So, the notes in some respects in this paper such as distribution, abundance and others for the species collected is limited to a certain extent.

**Former record on the aquatic and semiaquatic Heteroptera from paddy water of the world**

So far as we are aware, the following records on the aquatic and semiaquatic Heteroptera collected from paddy water were seen. These are summarized in Table 1. Some references quoted in the table (Reference B) mention the general knowledge on the paddy dwellings of respective species without giving any collecting data. Former records are reviewed chronologically in the following lines. Original scientific names are cited in parentheses when it is different from the present usage. Those not mentioned in the following lines are referred to the footnotes of Table 1.

1900-1949. Okada (1900) mentioned *Sigara substriata* attacking planthoppers in paddy fields in Shizuoka, Japan. He also observed a species attacking planthoppers and running on water surface of Japanese paddy fields. According to him this species belongs to Reduviidae, but his notes reveal species belonging to Veliidae and Hebridae also. His description almost fits to the character of Hebridae except for the ovipositor. Ito (1918) recorded that *Nepa rubra* (*N. cinema*) cut through the base of the young rice-plant in Argentina. Nawa (1924) mentioned that 4 aquatic Heteroptera, *Ochterus marginatus flavomarginatus* (*Pelogenus flavomarginatus*), *Saldula recticollis* (*Salda recticollis*), *Parablea indistinguenda* (*Plea indistinguenda*) and *Hydrometra albolineata* (*H. vittata*), are predaceous to planthoppers in Japanese paddy fields. He also indicated the occurrence of *Lethocerus decyrolei* and *Loc-
cotrephes japonensis in paddy water. Sakai (1932, 1933) reported Microvelia douglasi feeding on leafhoppers in Japan. Moretti (1932) mentioned about 12 species belonging to 8 families of aquatic Heteroptera occurring in paddy field of Italy, and gave brief descriptions on their larvae and/or adults. Lundblad (1933) recorded 13 species belonging to 8 families of aquatic Heteroptera collected from paddy fields of Sumatra (12 species) and Java (1 species). Sawá (1935) studied the soil fauna of levee by paddy field in the winter (December to April) near Mito City, Japan, and found 25 individuals of Veliiidae (specific name was not given but probably Microvelia species) from the soil mainly within 3 cm from the surface. Hutchinson (1940) reported 3 species of Mirconecta, quadrundrigata, scutellaris scutellaris and thyesta, collected from Indian paddy fields. Esaki (1941) recorded three aquatic Heteroptera, Ranatra unicolor, Diplonychus japonicus and Ilyocoris cimicoides (Naucoris cimicoides) from the paddy field of N. China. Yago (1943) mentioned that Lethocerus deyrollei (Kirkaldyia deyrollei) is injurious to rice seedlings and young fishes in Japan. Rice seedlings are uprooted by the bug, he stated.

1950-1969. Brooks (1951) described Anisops nodulata from the Philippines which was collected from paddy fields of Pangasinan. Esaki and Miyamoto (1955) mentioned that Microvelia douglasi in Japan attacks Recilia dorsalis and probably Nephotettix cincticeps and Sogatella furcifera al s o. Oho and Fuzii (1956) found the rather high population density of Microvelia douglasi in less sprayed paddy fields of Saga Prefecture, Japan, when they made investigations on the influence of chemical control. Oho and Miyahara (1957) also reported that Microvelia douglasi is a predator of Nephotettix cincticeps in Kyushu, Japan. Weerekoon and Samarasinghe (1958) studied soil fauna of a paddy field in Sri Lanka and found one species each of the following genera: Microvelia, Mesovelia, Ranatra, Diplonychus and Mirconecta. Fernando (1959) listed 13 species belonging to 7 families of aquatic Heteroptera taken in paddy fields in Sri Lanka, but no collecting data were given. Fernando (1961) noted that Diplonychus rusticus (Sphaerodema rusticum) was common in paddy fields of Sri Lanka. Kobayashi (1961) listed 8 aquatic Heteroptera predaceous to plant- and leafhoppers in Japanese paddy fields based on the previous knowledge. These are Hebrus nipponicus, Hydrometra albolineata, Microvelia douglasi, M. horvathi, Saldula saltatoria, Saldula recticollis (Saldula recticollis), Ochterus marginatus flavomarginatus and Paraplea indistinguenda. In the paper he also reported the change of population density of Microvelia douglasi by the insecticide applications against rice stem borer. Ito et al. (1962) recorded Gerris Zucustris lafiabdominis (G. lacustris latabdominalis), Gerris (Aquarius) paluduminsularis (Aquarius paludum), Microvelia douglasi and Hydrometra sp. from paddy fields in Japan, and observed the first species attacks the rice stem borer larvae and the third one plant- and leafhoppers. Fernando (1963) mentioned that the following were species common in paddy fields near Nugegoda, Sri Lanka. They are Microvelia longicornis, Mirconecta quadrundrigata, M. flavus, M. punctinotum, M. siva, M. fasciolarus and Anisops nivea. Fernando and Leong (1963) recorded Anisops kuroiwaee (A. batillifrons) from paddy fields in Sri Lanka. Lansbury (1964) recorded Anisops breddini collected from shallow large muddy pools on uncultivated rice fields of Viet Nam. Miyamoto (1964a) recorded two Microvelia species, douglasi and morimotoi, from paddy fields in the Nansei Is. Miyamoto (1964b) also recorded six aquatic species from paddy fields in the Nansei Is. They are Saldoida armata, Mesovelia vittigera (M. orientalis), M. japonica, Limnogonus (L.) fossarum, Hydrometra annanama and H. yasumatsui. Three females and one nymph of Saldoida armata among them were collected under stone in dried paddy field. Miyamoto (1965a) illustrated and mentioned that 15 species belonging to Salididae (1 sp.), Hebridae (1 sp.), Hydrometridae (3 spp.), Veliiidae (3 spp.), Gerridae (3 spp.), Belostomatidae (2 spp.), Notonectidae (1 sp.) and Corixidae (1 sp.) are found on or in paddy water in Japan. No collecting data, however, are presented for these species. Miyamoto (1965b) gave a note on the Japanese Mirconecta, and mentioned that 3 species, sedula, salibergi and orientalis, dwell in paddy fields, but no data were given. Fernando (1965) mentioned that Tropocorixa prathiana and Mirconecta quadrundrigata occur in paddy fields in
Fig. 1. Rice terraces of Banaue, Ifugao, Luzon. July 28, 1979.

Fig. 2. Paddy field of Tugbok, Davao City, Mindanao, where collecting of aquatic insects were made. August 30, 1979.

Fig. 3. Paddy field and irrigation ditch of Bislig, Surigao del Sur, Mindanao, where collecting of aquatic insects were made. September 4, 1979.
Table 1. Former records on the aquatic and semiaquatic Heteroptera from paddy water in the world.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Locality recorded from paddy water</th>
<th>(A) With data</th>
<th>Reference</th>
<th>(B) Without data</th>
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<td>Saldidae</td>
<td><em>Saldidae ornata</em> Horváth</td>
<td>Japan</td>
<td>Miyamoto, 1964b</td>
<td>Miyamoto, 1965a; Hiera, 1977</td>
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<td><em>Saldidae ornata</em> (Reuter)</td>
<td>Japan</td>
<td>Kohayashi et al., 1973</td>
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<td></td>
<td></td>
<td>Philippines</td>
<td>Pawar, 1974</td>
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<td><em>Saldula recticollis</em> (Horváth)</td>
<td>Japan</td>
<td></td>
<td>Nawa, 1924&lt;sup&gt;a&lt;/sup&gt;; Kobayashi, 1951&lt;sup&gt;b&lt;/sup&gt;; Nasu, 1969&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
<td><em>Saldula saltatoria</em> (Linnaeus)</td>
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<td></td>
<td>Kobayashi, 1961; Nasu, 1969</td>
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<td>Heckman, 1979</td>
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<td><em>Mesovelia japonica</em> Miyamoto</td>
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<td>Miyamoto, 1964b</td>
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<td>Heckman, 1979&lt;sup&gt;0&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td>Sumatra</td>
<td>Lundblad, 1953&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>Kenmore, 1979</td>
<td>Chandra, 1978</td>
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<td></td>
<td><em>Mesovelia</em> sp.</td>
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<td>Weerekoon &amp; Samarasinghe, 1958</td>
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<td>Veliidae</td>
<td><em>Micravelia diluta</em> Distant</td>
<td>Philippines</td>
<td>Polhemus &amp; Reisen, 1976</td>
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<td></td>
<td><em>Micravelia douglasi</em> Scott</td>
<td>Japan</td>
<td>Sakai, 1932; 1933; Easai &amp; Miyamoto, 1955; Oho &amp; Fuzii, Hiera, 1977</td>
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<td></td>
<td>Sumatra</td>
<td>Lundblad, 1983</td>
<td>Yasumatsa et al., 1980</td>
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<td><em>M. d. atrolineata</em> Bergoth</td>
<td>Philippines</td>
<td>Kermore, 1979&lt;sup&gt;0&lt;/sup&gt;; Polhemus &amp; Reisen, 1976&lt;sup&gt;0&lt;/sup&gt;</td>
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</table>
Microvelia sp. (nr atrolineata) Philippines
Microvelia horvathi Lundblad Japan Kobayashi et al., 1973
Microvelia longicornis Bue no Sri Lanka Miyamoto, 1964a
Microvelia morimotoi Miyamoto Japan Moretti, 1932
Microvelia pygmaea Duf our Italy Miyamoto, 1965a
Microvelia reticulata Burmeister Japan Fernando, 1959
Microvelia sinhalensis Kirkaldy Sri Lanka

Gerridae
Gerris adelaidis Do hn Thailand Sawa, 1935
G. adelaidis Do hn Malaya Polhemus & Reisen, 1976
Gerris aterus (Re tzius) Italy Moretti, 1932
Gerris lacustris (Linnaeus) Italy Moretti, 1932
G. j. latiabdominis Miyamoto Japan Miyamoto, 1965a; Hiura, 1977
Gerris paludum (Fabricius) Italy Moretti, 1932
G. p. insularis Motsch. Japan Ito et al., 1962a
Limnogonus fossarum (Fabricius) Japan Miyamoto, 1964b
L. fossarum Fabricius Malaya Fernando & Cheng, 1974
Limnogonus hangerfordi Andersen Philippines Polhemus & Reisen, 1976
Limnogonus leptocerus Reuter Egyptian El-Sherif et al., 1976
Limnogonus nitidus (Mayr) Sri Lanka Fernando & Cheng, 1974
L. nitidus (Mayr) Malaya Lundblad, 1933
Limnogonus parvulus (Stål) Malaya
Limnogonus severini (Kirkaldy) Thailand Fernando 1959a
Limnogonus severini (Kirkaldy) Malaya Cheng & Fernando, 1969
Rhagadotarus krasepelini Breddin Philippines Miyamoto, 1965a

Yasumatsu et al., 1980

Cheng & Fernando, 1969
Tenagophorus (Limnometra) sp. Philippines Polhemus & Reisen, 1976
Genus sp. 1 Laos Heckman, 1974
Genus sp. 2 Laos Heckman, 1974
Hydrometra albolineata Scott Japan Kobayashi et al., 1973

Hydrometra annamana H. et E. Japan Miyamoto, 1964b
Hydrometra lineata Eochacholtz Philippines Pavar, 1974(13); Polhemus & Reisen, 1976
Hydrometra orientalis Lundblad Philippines Thailand Polhemus & Reisen, 1976
Hydrometra procera Horváth Japan Heckman, 1979
Hydrometra stagnorum (Linnaeus) Italy Miyamoto, 1965a
Hydrometra yasumatsui Miyamoto Japan Moretti, 1932
Hydrometra sp. Japan Miyamoto, 1964b
Hydrometra sp. Laos Ito et al., 1962
Ochteridae Ochterus marginatus (Latreille) Philippines Heckman, 1974
O. m. favomarginatus Scott Japan Pavar, 1974

Naucoridae Helocoris bengdensis Montandon Sri Lanka Nawa, 1924(11); Kobayashi, 1961;
Ilyocoris cimicoides (Linnaeus) China Nasa, 1969; Hiura, 1977
Naucoris obscuractus kenyalis Poisson Kenya Ferrando, 1959
Genus sp. Laos Moretti, 1932(12)

Pleidae Paraplea indistinguenda (Matsumura) Japan Nawa, 1924(11); Kobayashi, 1961;
Paraplea japonica (Horváth) Japan Nasa, 1969
Paraplea liturata (Fieber) Sumatra Lundblad, 1933(15)
Paraplea quinquemaculata (Lundblad) Thailand Heckman, 1979(16)
Paraplea sobrina (Stål) Philippines Heckman, 1979(17)
Plea atomaria (Pallas) Italy Polhemus & Reisen, 1976(18)

Moretti, 1932(19)
Notonectidae

**Anisops breddini** Kirkaldy
- Laos
- Thailand
- Viet Nam

**Anisops crinita** Brooks
- Sri Lanka

**Anisops kuroiwae** Matsumura
- Japan
- Philippines
- Sri Lanka
- Thailand

**Anisops nivea** (Fabricius)
- Sri Lanka
- Thailand
- Sri Lanka
- Sumatra

**Anisops nodulata** Brooks
- Sri Lanka
- Thailand
- Sri Lanka
- Sumatra
- Philippines

**Anisops ogasawarensis** Matsumura
- Japan

**Anisops philippinensis** Brooks
- Philippines

**Anisops sardea** Herrich-Schäffer
- Egypt

**Anisops** sp. (? *worthingtoni* Jaczewski)
- Kenya

**Anisops** sp. 1
- Laos

**Anisops** sp. 2
- Laos

**Enithares genitalis** Lundblad
- Java

**Enithares mandalayensis** Distant
- Thailand

**Enithares sobria** Stål
- Kenya

**Enithares uncata** Lundblad
- Sumatra

**Notonecta glauca** Linnaeus
- Italy

**Notonecta triguttata** Motschulsky
- Japan

**Notonectidae**

**Cercotmetus** sp.
- Laos

**Laccotrephes ater** (Linnaeus)
- Kenya

**Laccotrephes brachialis** Gerstäcker
- Kenya

**Laccotrephes fabricii** Stål
- Kenya

**Laccotrephes grossus** (Fabricius)
- Laos
- Sri Lanka

**Laccotrephes japonensis** Scott
- Japan

Heckman, 1974

Fernando, 1955

Polhemus & Reisen, 1976

Fernando & Leong, 1963

Heckman, 1973

Fernando, 1963

Lundblad, 1933

Brooks, 1951; Polhemus & Reisen, 1976

Hiura, 1977

Polhemus & Reisen, 1976

El-Sherif et al., 1976

Service, 1973

Heckman, 1974

Heckman, 1974

Lansbury, 1968

Heckman, 1979

Service, 1973

Lundblad, 1933

Moretti, 1932

Watanabe et al., 1968

Lange et al., 1970

Heckman, 1974

Service, 1977

Service, 1977

Heckman, 1974

Fernando, 1959
Laccotrephes maculatus (Fabricius)
Laccotrephes robustus Stål

Laccotrephes similisus Montandon
Laccotrephes sp.

Nepa rubra Linnaeus

Ranatra bottegoi Montandon
Ranatra chisensis Mayr
Ranatra diminuta Montandon
Ranatra elongata Dohrn
Ranatra linearis (Linnaeus)
Ranatra longipes Stål
Ranatra sordidata Dohra
Ranatra unicolor Scott
Ranatra varipes Stål
Ranatra vicina Signoret
Ranatra sp.
Ranatra sp.
Ranatra sp.

Belostomatidae
Diplopychus grasseli (Poisson)
Diplopychus japonicus (Vuillefroy)

Diplopychus major Esaki
Diplopychus molestus (Dafour)
Diplopychus rusticus (Fabricius)

Diplopychus urinator (Dafour)
Diplopychus sp.

Lathocerus doyrollei (Vuillefroy)

Sri Lanka
Philippines
Thailand
Sumatra
Kenya
Argentina
Italy
Kenya
Japan
Philippines
Sri Lanka
Italy
Malaya
Sri Lanka
China
Thailand
Egypt
Philippines
Laos
Sri Lanka

Polhemus & Reisen, 1976
Heckman, 1979
Lundblad, 1933
Service, 1977
Ito, 1918
Moretti, 1962
Service, 1977
Watanabe et al., 1968
Polhemus & Reisen, 1976
Fernando, 1959
Moretti, 1962
Fernando & Cheng, 1974
Fernando, 1960

Esaki, 1941
Heckman, 1979
El-Sherif et al., 1974
Polhemus & Reisen, 1976
Heckman, 1974
Weerakoon & Samarasinghe, 1958
Servive, 1977

Miyamoto, 1965; Hiura, 1977
Fernando, 1959; 1961
Fernando, 1960

Fernando, 1959

Hiura, 1977
Fernando & Cheng, 1974
Pawar, 1974; Polhemus & Reisen, 1976

Fernando, 1959; 1961

Fernando, 1959

Nawa, 1924; Yago, 1943
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<td>Egypt</td>
<td>Egypt</td>
<td>El-Sherif et al., 1976</td>
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<td>Thailand</td>
<td>El-Sherif et al., 1976</td>
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<td>Kenya</td>
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<td>USA</td>
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<td><em>Agraptocorixa kyalinipennis</em> (F.)</td>
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<td><em>Agraptocorixa sweistrai</em> Hutchinson</td>
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<td><em>Hesperocorixa distanti</em> (Kirkaldy)</td>
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<td><em>Micronecta fascioclavus</em> Chen</td>
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<td><em>Micronecta scutellaris</em> (Stål)</td>
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<td>Laos</td>
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<td><em>Micronecta sp.</em></td>
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Miyamoto, 1965a; Hiura, 1977
Fernando, 1959
Lange et al., 1970
Hiura, 1977
Fernando, 1959
Fernando, 1963
Fernando, 1963
Moretti, 1982
Miyamoto, 1965b
Fernando & Cheng, 1974
Fernando, 1963
Fernando & Cheng, 1974
Fernando, 1959, 1963, 1965
Miyamoto, 1965b
Fernando, 1965a, b; Hiura, 1977
Fernando, 1963
Heckman, 1974
Weerakoon & Samarasinghe, 1958
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<th><strong>Genus</strong></th>
<th><strong>Species</strong></th>
<th><strong>Locality</strong></th>
<th><strong>Reference</strong></th>
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<td>hedenborgi</td>
<td>Kenya</td>
<td>Service, 1977</td>
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<td>lateralis</td>
<td>Egypt</td>
<td>El-Sherif et al., 1976</td>
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<td>pectoralis</td>
<td>Kenya</td>
<td>Service, 1977</td>
</tr>
<tr>
<td></td>
<td>striata</td>
<td>Italy</td>
<td>Moretti, 1932</td>
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<td></td>
<td>substriata</td>
<td>Japan</td>
<td>Watanabe et al., 1968</td>
</tr>
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<td></td>
<td>sp.</td>
<td>Japan</td>
<td>Okada, 1900</td>
</tr>
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<td>Tropocorixa</td>
<td>pruthiana</td>
<td>Sri Lanka</td>
<td>Fernando, 1965</td>
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<td>Genus sp.</td>
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<td>Laos</td>
<td>Heckman, 1974</td>
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<td>Corixidae</td>
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<td>USA</td>
<td>Lange et al., 1970</td>
</tr>
</tbody>
</table>

1. References marked by a superior number used scientific names different from the present usage, and the original ones are cited in the footnote.

Nasu (1969) listed natural enemies of rice leafhoppers according to Kobayashi (1961), Hinckley (1963) and O'Connor (1952). Aquatic Heteroptera among them are probably cited from Kobayashi (1961) and not from others judging from the contents of the latter two articles. So, the species of Nasu (1969) in this table are listed under Japan.

2. References with collecting or observing data including primarily locality name, date and collector or observer name. Some literature gave no exact dates but rather restricted locality names were given.

**References:**
- **Salda recticolli** Horvath
- **Mesovelia orientalis** Kirkaldy
- **Gerris lacustris latabdominalis**
- **Gerris nitta** (Mayr)
- **Hydrometra lineata** Eschscholtz
- **Naucoris cimicoides** (Linnaeus)
- **Plea (Paraplea) liturata** (Fieber)
- **Ple quinquemaculata** Lundblad
- **Ple minutissima** Fabricius
- **Anisops batillifrons** Lundblad
- **Lacostrophesruber** Linnaeus
- **Nepa cinerea** (Linnaeus)
- **Sphaerodema molestum** (Duf our)
- **Sphaerodema urinator** Duf our
- **Kirkaldia deyrolli** Vuill.
- **Sigara minutissima** Leach
- **Micronecta quadriseignata** Breddin

**References:**
- **Salda recticolli** Horvath
- **Microvelia atrolineata** Bergroth
- **Aquarius paludum**
- **Hydrometra vittata** Stål
- **Pelagonus flavomarginatus** Scott
- **Ple quinquemaculata** Matsumura
- **Ple nitidula** Fieber
- **Ple sobrina** Stål
- **Ple distinguenda** Matsumura
- **Ple sobrina** Stål
- **Fernando and Cheng (1963) mentioned this species is A. exigera** Horvath.
- **Anisops genii** Hutchinson
- **Nepa cinerea** (Linnaeus). Cited indirectly. It has not as- certained about exact data.
- **Sphaerodema grassei** Poisson
- **Sphaerodema rusticum** (Fabricius)
- **Sphaerodema sp.**
- **Belostoma indica** Lep. et Serv.
- **Micronecta (Basileonecta) quadriseignata** Breddin
- **Corisa striata** Linnaeus
Sri Lanka. Watanabe et al. (1968) surveyed on the natural enemies of Culex *tritaeniorhynchus* *summorosus* of paddy field in Okayama, Japan. They collected adults and nymphs of the following 5 species of 4 families: *Ranatra chinensis*, *Laccotrephes japonensis*, *Notonecta tritiguttata*, *Paraplea japonica* and *Sigara substrata*. These authors checked the feeding of these species by giving larvae of Culex *tritaeniorhynchus* *summorosus* and found *Notonecta tritiguttata*, *Ranatra chinensis* and *Laccotrephes japonensis* are active in feeding the larvae, and *Paraplea japonica* and *Sigara substrata* are not active. Lansbury (1968) recorded 6 specimens of *Enithares genitalis* collected from paddy fields near Bogor, Java. Cheng and Fernando (1969) noted the occurrence of 4 Gerrid species from Malayan paddy fields. These are *Limnogonus fossarum*, *L. parvulus*, *L. nitidus* and *Gerris adelaidis*. Miura (1969) collected 3 specimens of a species of Saltidae by sweeping nurseries in Matsue, Japan. Nasu (1969) cited 8 species of aquatic Heteroptera predatory on rice leafhoppers based on the record of Kobayashi (1961).

1970–1980. Lange et al (1970) mentioned the occurrence of Belostomatidae, Notonectidae and Corixidae in paddy fields of California. They stated that the Corixidae cause some damage to rice seedlings. Service (1973, 1977) made researches on the mortalities of the larvae of *Anopheles gambiae* complex in Kenya, and used 17 species including 3 unidentified species of aquatic Heteroptera dwelling in paddy fields for it. These species are *Hydrometra egyptica*, *Limnogonus severini*, *Micronecta scutellaris*, *Sigara hedenborghi*, *S. pectoralis*, *Sigara* spp., *Agraptocorixa sweistrai*, *Laccotrephes brachialis*, *L. ater*, *L. fabricii*, L. sp., *Ranatra bottegoi*, *Diplonychus grassei* (*Sphaerodema grassei*), *Anisops* sp. (? *worthingtoni*), *Enithares sobira* and *Naucoris obscuratus kenyalis*. Kobayashi et al. (1973) collected the paddy dwelling insects in Tokushima, Japan, and listed the following 4 aquatic Heteroptera: *Hydrometra albolineata*, *Microuelia douglasi*, M. *horvathi* and *Saldula ornatula*. Pawar (1974, mimeographed) presented a terminal paper to IRRI on the insects of rice in the Philippines. He listed 6 species of aquatic Heteroptera collected from paddy fields. They are *Micronecta quadristrigata*, *Saldula ornatula*, *Hydrometra lineata* (H. *Zineatus*), *Ochterus marginatus*, *Diplonychusrusticus* (D. *rusticus*) and *Anisops kuroiwai* (A. *kuroiwai*). Pawar listed one more species, *Lethocerus indicus*, which was collected by light trap in paddy field. Heckman (1974) studied on the seasonal succession of species in a paddy field in Laos. He observed 14 aquatic Heteroptera including 12 unidentified species. Fernando and Cheng (1974) stated in their paper on the aquatic Hemiptera in Malaya and Singapore that 6 families of 4 species were found in Malayan paddy fields. They are *Limnogonus fossarum*, *L. nitidus*, *Ranatra longipes*, *Diplonychus noletus* (*Sphaerodema noletus*), *Micronecta quadristrigata* and M. punctata. Locality names in Malaya were given for the first 4 species and no data were presented for the last 2 species. El-Sherif et al. (1976) made surveys on aquatic insects of rice nurseries in Egypt, and collected the following species of Heteroptera. They are *Limnogonus leptocerus*, *Micronecta plicata*, *Sigara lateralis*, *Ranatra vicina*, *Lethocerus niloticus*, *Limnogeton fieberi*, *Diplonychus urinatar* (*Sphaerodema urinatar*) and *Anisops sardea*. According to them, *Micronecta plicata*, *Diplonychus urinatar* (S. *urinatar*) and *Anisops sardea* are rather common among these species concerned. Polhemus and Reisen (1976) reported the aquatic Hemiptera of the Philippines mainly based on the material collected from the Luzon and some from other islands. Among the species reported, 17 species and 1 unidentified species belonging to 8 families were collected from paddy fields including adjoining irrigation ditches. Hiura (1977) stated in a colored illustration book that 13 species of aquatic Heteroptera are seen in paddy fields of Japan, but no collecting data are available. These 13 species are same to those of Miyamoto (1965a) except for 5 species. *Hesperocorixadistanti*, *Ochterus marginatus flavomarginatus*, *Laccotrephes japonensis*, *Diplonychus major* and *Anisops ogasawarenisis* (A. *genji*). In 1978, Chandra reported that *Microvelia* sp. nr *atrolineata* and *Mesovelia* sp. attack the rice leaf- and planthoppers in the Philippines. Kenmore (1979, mimeographed) mentioned that *Microvelia douglasi* *atrolineata* (M. *atrolineata*) is a predator of the brown planthopper, white backed planthopper, and rice green leafhopper, and *Mesovelia*
Table 2. Known prey records of aquatic and semiaquatic Heteroptera from paddy water of the world*.

<table>
<thead>
<tr>
<th>Family</th>
<th>Predaceous species</th>
<th>Prey insect recorded</th>
<th>Locality recorded</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saldidae</td>
<td><em>Saldula recticollis</em> (Horváth)</td>
<td>planthoppers</td>
<td>Japan</td>
<td>Nawa, 1924</td>
</tr>
<tr>
<td></td>
<td><em>Saldula saltatoria</em> (Linnaeus)</td>
<td>plant- and leafhoppers</td>
<td>Japan</td>
<td>Kobayashi, 1961</td>
</tr>
<tr>
<td>Hebridae</td>
<td><em>Hebrus nipponicus</em> (Horváth)</td>
<td>plant- and leafhoppers</td>
<td>Japan</td>
<td>Kobayashi, 1961</td>
</tr>
<tr>
<td>Mesoveliidae</td>
<td><em>Mesovelia s. p.</em></td>
<td>plant- and leafhoppers</td>
<td>Philippines</td>
<td>Chandra, 1978</td>
</tr>
<tr>
<td>Veliidae</td>
<td><em>Microvelia douglasi</em> Scott</td>
<td>leafhoppers</td>
<td>Japan</td>
<td>Sakai, 1932; Kobayashi, 1961; Ito et al., 1962</td>
</tr>
<tr>
<td></td>
<td></td>
<td>planthoppers</td>
<td>Japan</td>
<td>Kobayashi, 1961; Ito et al., 1962</td>
</tr>
<tr>
<td></td>
<td></td>
<td>plant- and leafhoppers</td>
<td>Thailand</td>
<td>Yasumatsu et al., 1980</td>
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<td><em>Recilia dorsalis</em> Motschulsky</td>
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<td>Japan</td>
<td>Esaki &amp; Miyamoto, 1955</td>
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<td><em>Nephotettix cineticeps</em> Uhler</td>
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<td>Japan</td>
<td>Oho &amp; Miyahara, 1957</td>
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<td><em>M. d. atrolineata</em> Bergroth</td>
<td><em>Nilaparvata lugens</em> (Stål)</td>
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<td>Kenmore, 1979</td>
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<td><em>Sogatella furcifera</em> Horváth</td>
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<td>Kenmore, 1979</td>
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<td></td>
<td><em>Nephotettix cineticeps</em> Uhler</td>
<td>Philippines</td>
<td>Kenmore, 1979</td>
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<td><em>Microvelia sp.</em> (nr atrolineata)</td>
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<td>Chandra, 1978</td>
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<td><em>Gerris adelaidis</em> Dohrn</td>
<td>plant- and leafhoppers</td>
<td>Thailand</td>
<td>Yasumatsu et al., 1980</td>
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<td></td>
<td><em>Gerris lacustris</em> latiabdominis Miyamoto</td>
<td>plant- and leafhoppers</td>
<td>Japan</td>
<td>Ito et al., 1962</td>
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<td><em>Limnogonus parvulus</em> (Stål)</td>
<td><em>Chilo suppressalis</em> Walker</td>
<td>Thailand</td>
<td>Yasumatsu et al., 1980</td>
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<td>Hydrome tridae</td>
<td><em>Hydrometa albolineata</em> Scott</td>
<td>planthoppers</td>
<td>Japan</td>
<td>Nawa, 1924</td>
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<td>Japan</td>
<td>Kobayashi, 1961</td>
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<td>Ochteridae</td>
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<td>Nawa, 1924; Kobayashi, 1961</td>
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<td>leafhoppers</td>
<td>Japan</td>
<td>Kobayashi, 1961</td>
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<td>Corixidae</td>
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<td>Japan</td>
<td>Okada, 1900</td>
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</table>

* Scientific names of this table are present usage and the original ones are referable to the footnotes of Table 1.
sp. is also predaceous to the brown planthopper in the Philippines. Heckman (1979) reported the occurrence of 15 aquatic Heteroptera in northern Thailand. These species belong to Hebridae (2 spp.), Mesoveliidae (1 sp.), Hydrometridae (1 sp.), Gerridae (1 sp.), Corixidae (1 sp.), Nepidae (2 spp.), Belostomatidae (2 spp.), Notonectidae (3 spp.), and Pleidae (2 spp.). Yasumatsu et al. (1980, mimeographed) listed Microvelia douglasi, Gerris adelaidis and Limnogonus pavulus as nymphal or adult predators of plant- and leafhoppers in Thailand.

One hundred and fourteen species and five subspecies belonging to 13 families including species without no definite data and excluding unidentified ones have been recorded from paddy water in the world. Dominant families may be Corixidae, Nepidae, Notonectidae, Belostomatidae, Gerridae, Veliidae and Hydrometridae among the families concerned. Most species were recorded without any biological informations such as food habits, seasonal abundance, and so on. About ten species have been reported with their food habit as shown in Table 2. It is apparent that very limited species are reported with their exact host species compared with the known species. Host insects recorded are mostly plant- and leafhoppers except for two cases of rice stem borer and midge larva. Only 6 species of host have been recorded by their specific names for 4 predaceous species. Host insects reported under the name of plant- and/or leafhoppers without giving specific name are required to be checked for its exact host name. Other insect and animal groups which have not recorded before are also attacked by aquatic Heteroptera in paddy ecosystem (Yano, unpublished data), but it has not been reported so far as we are aware. Apart from paddy water, however, these aquatic Heteroptera have been reported to attack various organisms. Further studies on their food habits may probably make their status in biological control in paddy field ecosystem more clear. It may also reveal the habit attacking other predaceous species as seen in other environment (Riley, 1922).

Two species, Nepa rubra and Lethocerus deyrollei, have been reported to be injurious to rice plant as cited above. Some damage by the Corixidae have been reported also (Lange et al., 1970) but it is not serious. Only three families, Nepidae, Belostomatidae and Corixidae among the all families recorded from paddy fields include some species injurious to rice seedlings. It is consequently noted here that the aquatic Heteroptera in paddy fields are negligible as pest insects of rice. It is obvious that the expected figure of paddy dwelling species in each country is bigger than that of the known data. These figures, known or expected, are too big to neglect their presence in the paddy field ecosystem. Fauna1 and biological studies on the group are thus expected.
Species collected in the Philippines with descriptions of new species

A total of 717 specimens of 17 species belonging to 11 families were collected and enumerated in the following lines. All specimens were collected by the first author, and from paddy water unless otherwise stated. Among the material collected by sweep net made above water level in Pila, Laguna, 2 specimens of the family Ochteridae were found and included here. Eight specimens of *Saldoida armata* Horvath collected by Dr. K. Morimoto from levee by paddy field of Banaue were included here also through his courtesy. The material collected from irrigation ditch water by paddy field in Bislig, Mindanao, are also included here with indication of irrigation ditch. Locality based on the paddy water material is shown with an asterisk. All measurements in the descriptions of new species are in mm.

**SALDIDAE**

*Saldoida armata* Horvath


_Distribution_: Philippines*, Japan, Nansei Is., Taiwan, India.

These specimens were collected at levee by paddy field which contained water.

**HEBRIDAE**

*Hebrus bergrothi* Horvath (Fig. 11)

_Specimen Examined_: 1 adult, Banaue, Ifugao, 1. viii. 1979.

_Distribution_: Philippines* (endemic).

This is the first record from paddy water of the world and the first record of the family Hebridae from the Philippine paddy water.

**MESOVELIIDAE**

*Mesovelia vittigera* Horvath (Fig. 12)


_Distribution_: Philippines*, Taiwan, Japan*, Nansei Is., Sumatra*, Thailand*, Korea, India, S. E. Asia, New Guinea, Guam, Middle East, S. Europe, Africa.

This is the species formerly known as *M. orientalis* Kirkaldy in Japan and its adjacent territories. It is not certain that an unidentified species of *Mesovelia* recorded by Chandra (1978) and Kenmore (1979) from the Philippines are identical with this species or not. This species seems to be common in the Philippine paddy water.

**VELIIDAE**

*Microvelia douglasi atrolineata* Bergroth, stat. nov. (Figs. 5, 6, 13)


_Distribution_: Philippines*.

Polhemus and Reisen (1976) separated *atrolineata* from *douglasi* by the coloration and a lateral compression of the female abdomen. But *douglasi* (Fig. 4) is grayish as well as
brown in coloration, and the former colour is dominant, and some specimens of atrolineata are quite brown-coloured. Lateral compression at the base of female abdomen may be a good character for atrolineata, but sometimes Japanese douglasi also shows the same tendency. Male genital segments and parameres of the two forms are seen in the Figures 6-8. According to the Lundblad's system of douglasi (1933: 347-357), these differences may be within a range of species. General shape of atrolineata is rather shorter and broader than in douglasi.

Many specimens including immature stages were collected at Bay. It is obvious that this is one of the most common species with numerous individuals among the paddy dwelling aquatic Heteroptera in the Philippines. It may be due to the different condition of paddy water that less specimens were collected at Tugbok and Bislig. The water at Tugbok was then flowing into the paddy fields where collectings were made and time had not been passed from the water was let in. The paddy water at Bislig was not enough but extremely limited into tiny spot. It is unknown, however, why no specimens were collected from Banaue. M. diluta Distant was recorded by Polhemus and Reisen (1976) from Lubang Island, but no specimens were collected by the present survey.
GERRIDAE

*Limnogonus fossarum* (Fabricius) (Fig. 14)


This species is distributed up to the Nansei Islands, Japan. Five specimens were collected previously from paddy water of Ishigaki I., Nansei Is. Cheng and Fernando (1969) mentioned that this is the commonest and most widespread among Malayan Gerridae. They examined 2 specimens from Malayan paddy fields, and many from other aquatic habitats.

*Limnogonus nitidus* (Mayr) (Fig. 15)


Cheng and Fernando (1969) noted this species is the least common of *Limnogonus* species in Malaya, occurring only in paddy fields and temporary pools. Judging from the present collection, this species may be distributed throughout the Philippine paddy fields of the plain area.

*Limnogonus parvulus* (Stål) (Fig. 16)


This species was not collected from plain areas of Luzon and Mindanao where the following species was collected. So far as the present knowledge is concerned, however, this species seems to be distributed most widely in S. E. Asian paddy water among the known species of this family.

HYDROMETRIDAE

*Hydrometra lineata* Eschscholtz (Fig. 17)


Most specimens of the present material were collected from Tugbok. These individuals were found associating with debris on water surface or near levee.

*Hydrometra orientalis* Lundblad (Fig. 18)


Distribution: Philippines*, Sumatra, Java, Malaya, Burma, Thailand, Viet Nam.

OCHTERIDAE

*Ochterus marginatus* (Latreille) (Fig. 19)


Distribution: Philippines*, Taiwan, China, India, Middle East, S. Europe, N. Africa.

These two specimens were collected by sweeping made above water level. Japanese subspecies, *O. marginatus flavomarginatus*, is rather common around boundary between paddy water and levee.
PLEIDAE

*Paraplea davaoensis* Miyamoto, *sp. nov.* (Figs. 9, 20, 21)

Size, female. Body length 1.70 mm., greatest width across abdomen 0.93 mm.

General colour brownish; head stramineous, somewhat brown centrally, without markings, with eyes reddish brown and rostrum dark brown; pronotum brownish, with anterior and lateral margins broadly, distinctly pale and posterior margin obscurely pale; the disc with one pair of dark brown spots and an additional one near anterior margin, one black spot near each humeral angle, and with a median black spot near posterior margin; scutellum brown, with postero-lateral margins stramineous; hemelytra brown with pale markings, each at base and center of corium and at center of clavus. Legs stramineous. Body beneath dark brown.

Body shape ellipsoid; dorsal surface covered with distinct punctures, those on head and scutellum smaller than on the rest. Head, seen from above, short, about one sixth as long as wide (.13 : .80), with the apical margin evenly rounded; in frontal view, head wider than tall (.34 : .80). Rostrum reaching apices of anterior coxae, with the apical segment slightly longer than the preceding (.12 : .10). Pronotum, in median length, a little longer than half the width between humeri (.53 : .93), with humeral angles rather prominent; lateral margins divergent; posterior margin convex, with median portion somewhat emarginate; scutellum shorter than wide (.35 : .50). Abdomen almost equal to length from head to scutellum, and widest at level of tip of scutellum.

Relative lengths of leg segments:

<table>
<thead>
<tr>
<th></th>
<th>Femur</th>
<th>Tibia</th>
<th>Tarsus (tarsal segments combined together)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior leg</td>
<td>.50</td>
<td>.35</td>
<td>.20</td>
</tr>
<tr>
<td>Middle leg</td>
<td>.45</td>
<td>.32</td>
<td>.18</td>
</tr>
<tr>
<td>Posterior leg</td>
<td>.43</td>
<td>.45</td>
<td>.42</td>
</tr>
</tbody>
</table>

Median sternal keels of thorax and abdomen characteristic, and figured [Fig. 9-A]; prosternal keel largest with ventral apex rounded; mesosternal keel nearly of equal width from near base to apex, with antero-ventral angle projected; metasternal keel triangular. Subgenital plate (operculum or seventh abdominal sternum) (Fig. 9-B) somewhat triangular, as wide as long (.25 : .23), broadest before middle, with postero-lateral margins wavelly sinuate and furnished with a tuft of hairs on each side near apex.
Holotype female (Type No. 2236, Kyushu Univ.), Tugbok, Davao City, 28-30. viii. 1979, paddy water. K. Yano leg. The type is preserved in the Entomological Laboratory, Kyushu University.

The present species is easily separated from *P. sobrina* Stål, an only known species from the Philippines, in the smaller size, black spots on pronotum and peculiar structure of the sternal keels of thorax and abdomen, but *davaoensis* may be closely related to *P. liturata* (Fieber), which is variable in size and colour pattern, but distinguished from the latter by the different structure of sternal keels of thorax and abdomen (compared with the Lundblad’s drawings, 1933, fig. 42 on p. 133).

This is the first record of this family from the Philippine paddy water.

**NOTONECTIDAE**

*Anisops kuroiwae* Matsumura (Fig. 22)

**Specimens Examined:** 1 adult, 1 nymph, Bay, Laguna, 14. viii. 1979, 9 adults, 26 nymphs, Bislig, Surigao del Sur, 1-4. ix. 1979, 3 adults, ditto, 1-4. ix. 1979, irrigation ditch.

**Distribution:** Japan*, Nansei Is., Philippines*, Thailand*, Hainan Is., China, Taiwan, Burma, Assam, India.

This species was known as *A. batillifrons* Lundblad and seems to be distributed rather widely over Southeast Asian paddy water. It is a preliminary view that the species of this family will not be dominant at the starting period of paddy water ecosystem. Other groups on water surface dwellers such as Veliidae and Gerridae will be dominant from that time.

*Anisops nodulata* Brooks (Fig. 23)

**Specimens Examined:** 1 adult, Banaue, Ifugao, 27-31. vii. 1979, 3 nymphs, ditto, 1. viii. 1979.

**Distribution:** Philippines* (endemic).

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**Fig. 10. Anisops yanoi, sp. nov. ♂.** A: Head, oblique dorsal view to the body axis. B: Head with prothorax, lateral view. C: Frons, full view. D: Left-hand anterior leg, E: Apical segment with claws of left-hand middle leg.
Anisops yanoi Miyamoto, sp. nov. (Figs. 10, 24)

Size. Males, length 7.3-7.5 mm., greatest width 1.9-2.0 mm; females, length 6.8-7.2 mm., greatest width 2.0 mm.

General color somewhat stramineous. Eyes brown, anterior margin of vertex in male darkened, and antennae dark brown. Hemelytra hyaline and appearing stramineous towards base and gray near apex depending on the underlying body surface. Legs stramineous; all coxae widely dark brown; anterior femora with trochanters and middle femora broadly dark brown on dorsal surface, anterior tibiae each with a dark brown, distinct stria on dorsal side. Venter blackish brown with median keel and segmental margins of connexivum stramineous.

Male: Viewed from above, lateral outline of head rounded with vertex extending beyond anterior margins of eyes to form a short cephalic horn (Fig. 10); head about nine tenths as broad as pronotal humeral width (1.65 : 1.90) and almost four times the anterior width of vertex (1.65 : .44); synthlipsis narrow, nearly one fourth the anterior width of vertex; head slightly less than pronotum in median length (.90 : 1.00). Pronotum approximately twice as wide as long (1.90 : 1.00); lateral margins diverging and more than half the median length; posterior margin convex, medially emarginate. Frons medially sulcate throughout (Fig. 10-C); apex rounded viewed from above or below, but emarginate as seen obliquely to body axis; each side bordered by two carinae, the inner ones not meeting with each other. Labrum short, about twice as broad as long at base, apex rounded, and furnished with a tuft of long erect hairs near each basal corner (Figs. 10-B, C). Rostral prong (Fig. 10-B) shorter than the third rostral segment, with apex acute.

Stridulatory comb (Fig. 10-D) of about fifteen teeth, the second to sixth teeth somewhat larger than others. Middle tarsal claws (Fig. 10-E) strongly curved inwards at base, posterior claw much thicker but shorter than anterior one. Chaetotaxy of anterior leg as shown in Fig. 10-E, without large spines.

Relative lengths of leg segments:

<table>
<thead>
<tr>
<th></th>
<th>Femur</th>
<th>Tibia</th>
<th>Tars. seg. 1</th>
<th>Tars. seg. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior leg</td>
<td>1.28</td>
<td>1.40</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(or 100 : 109 : 66 : -)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle leg</td>
<td>2.48</td>
<td>2.04</td>
<td>1.12</td>
<td>.40</td>
</tr>
<tr>
<td></td>
<td>(or 100 : 82 : 45 : 10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior leg</td>
<td>2.80</td>
<td>2.20</td>
<td>.80</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td>(or 100 : 70 : 29 : 29)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Female: Viewed from above, outline of head rounded, nine tenths as broad as pronotal humeral width (1.65 : 1.90) and about four times the anterior width of vertex (1.64 : .40); synthlipsis less than one half the anterior width of vertex (.18 : .40); head, along the median axis, about two thirds the pronotal length (.56 : .81). Humeral width of pronotum slightly more than twice its median length (.90 : .81); lateral margins divergent and slightly more than one half the median length: posterior margin convex, medially emarginate.

Relative lengths of leg segments:

<table>
<thead>
<tr>
<th></th>
<th>Femur</th>
<th>Tibia</th>
<th>Tars. seg. 1</th>
<th>Tars. seg. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior leg</td>
<td>1.12</td>
<td>1.32</td>
<td>.62</td>
<td>.40</td>
</tr>
<tr>
<td></td>
<td>(or 100 : 118 : 54 : 36)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle leg</td>
<td>2.00</td>
<td>1.68</td>
<td>.86</td>
<td>.48</td>
</tr>
<tr>
<td></td>
<td>(or 100 : 84 : 43 : 24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior leg</td>
<td>2.65</td>
<td>2.32</td>
<td>.80</td>
<td>.78</td>
</tr>
<tr>
<td></td>
<td>(or 100 : 88 : 30 : 29)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Holotype male (Type No. 2237, Kyushu Univ.), and 6 paratypes (1 male and 5 females), Banaue, Ifugao, 27-31. vii and 1. viii. 1979, all from paddy water, K. Yano leg. The holotype is preserved in the Entomological Laboratory, Kyushu University. The combination of characters such as the grooved frons, a pair of tufts of long hairs on labrum and poorly developed chaetotaxy on the anterior legs of the male may be peculiar to the present species. *Yanoai* is superficially resembling to *kuroiwa* Matsumura (=*batillifrons* Lundblad) but easily separated by the more distinct coloration of legs, larger size of the body, entirely grooved frons, a pair of tufts of long hairs on labrum, different structure of stridulatory comb, chaetotaxy on anterior legs, and others.

*Enithares martini* Kirkaldy (Fig. 25)

**Specimens examined**: 2 adults, 2 nymphs, Banaue, Ifugao, 27 31. vii. 1979.

**Distribution**: Philippines* (endemic).

This is the first record of this genus from the Philippine paddy water.

**BELOSTOMATIDAE**

*Lethocerus indicus* (Lepeletier et Serville)

**Specimens examined**: 5 nymphs, Tugbok, Davao City, 28-30. viii. 1979.


This species was formerly recorded from paddy water of Thailand. *Pawar* (1974) recorded this species from the Philippines based on the material collected at light in paddy fields.

**CORIXIDAE**

*Micronecta quadrigata* Breddin (Fig. 26)


**Distribution**: Philippines*, Sri Lanka*, India*, Malaya, Sumatra*, Java, Celebes, Viet Nam, Thailand, Hong Kong, Taiwan, Iran.

This species is probably one of the most widely distributed and common species of the Corixidae in S. E. Asian aquatic habitats as well as *Agraptocorixa hyalinipennis*. Many specimens of this species were collected at Bislig from a small amount of water. Thus, it seems probable that this species is tolerable to a high population density.

From the Philippines, 18 species and 4 unidentified species belonging to 11 families have been known from paddy fields previously (cf. Table 1). This figure, however, contains the records of Polhemus and Reisen (1976) who mixed the data from paddy and irrigation ditch. Present records add 9 species (*Saldoidea armata*, *Hebrus bergrothi*, *Mesovelia vittigera*, *Limnogonous nitidus*, *Limnogonous parvulus*, *Paraphe a davaoensis*, *Anisops yavoii*, *Enithares martini* and *Lethocerus indicus*) and now total 27 species and 4 unidentified species of 12 families are known from the Philippine paddy water.

Some preliminary notes on the abundance of species concerned mentioned below are provided by the present knowledge which is certainly far from expected level. Following species seems to be major among the known species. They are *Micronecta douglasii atromaculata*, *Micronecta quadrigata* and *Anisops kuroiwa*. *Mesovelia vittigera*, *Limnogonous nitidus* and *Hydrometra lineata* may stand next.

Species of Naucoridae have not been recorded from the Philippine paddy water, though it is expected to be collected by the future surveys.
AQUATIC AND SEMIAQUATIC HETEROPTERA FROM PHILIPPINES
EXPLANATION OF FIGURES

References


Kenmore, P. E. 1979. Limits of the brown planthopper problem: implications for integrated pest management. IRRI Saturday Seminar, June 30, 1979, pp. 1-33. (Mimeographed)


Addendum

We overlooked the record of the following subspecies from paddy water.

Gerridae

*Gerris (Aquarius) paludum amamiensis* Mi yamot 0

1♀, Ishigaki I., Nansei Is., Japan. (Miyamoto, 1964b)