Proceedings of the Nature Reserves Survey Seminar.
Gardens' Bulletin Singapore ***49*** *(1997) 313–319.*

Semi-aquatic Bug (Heteroptera: Gerromorpha) Fauna in the Nature Reserves of Singapore

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Abstract

A total of 37 species of semiaquatic bugs were recorded from the forest during the survey of the Nature Reserves. 78% were found in the Nee Soon Swamp Forest that also has the highest percentage of the rare or threatened species on the island. Bukit Timah Nature Reserve has the lowest diversity. Three forest-dependent species, *Cylindrostethus malayensis, Ventidius hungerfordi* and *Esakia fernandoi* previously recorded from Singapore were not found and hence are, presumed extinct. Eight species are new records for Singapore.

Introduction

Early studies on the Singapore's freshwater bugs were scattered in some reports (van Martens, 1876; Esaki, 1926, 1930). After 1960, substantial studies on Malaysian fauna were carried out by the University of Singapore. Researchers documented a total of 15 species of Gerridae and two species of Veliidae in Singapore (Cheng, 1965; Cheng & Fernando, 1969; Fernando & Cheng, 1974). Murphy (1990) reviewed the fauna and increased the species list to 19 Gerridae, eight Veliidae, two Hydrometridae and two Mesoveliidae from freshwater habitats. However, he also failed to record three species (*Cylindrostethus malayensis, Ventidius hungerfordi* and *Esakia fernandoi*) previously recorded by Cheng and Fernando.

In view of changes in the forest habitats caused by development and other human activities in recent years, this study was conducted to provide a present-day checklist of the semiaquatic bugs (Gerromorpha) found in the forest. It is also to record the diversity and distribution of the fauna of the Bukit Timah Nature Reserve and Central Catchment Nature Reserve that are separated by the Bukit Timah Expressway.

As the true aquatic bugs (Nepomorpha) are rarely found in the forest because of the poor vegetation growth in and along streams and the lack of natural standing waters, they are not discussed in this report.

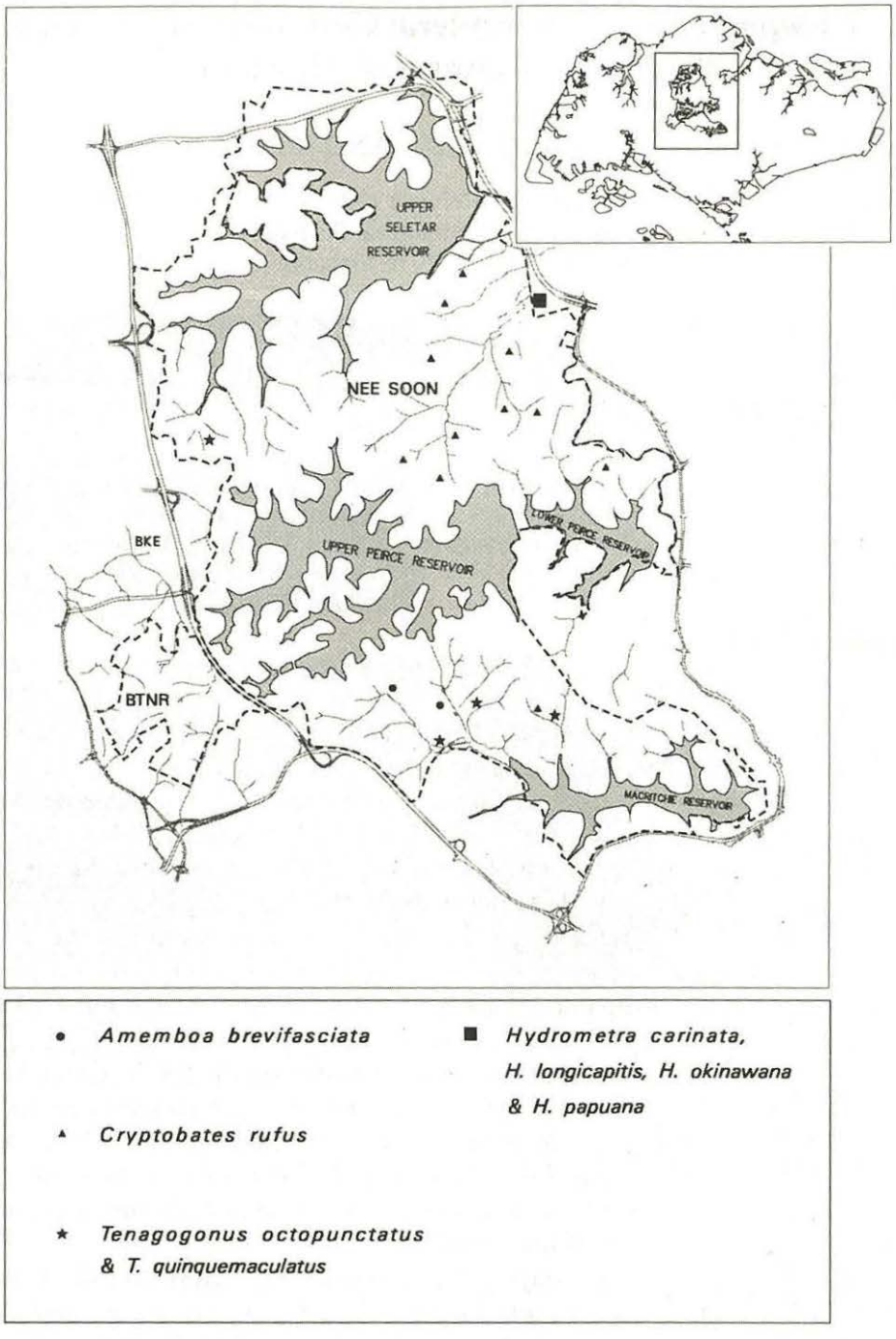

Figure 1. Distribution of some rare heteropteran bugs in the Nature Reserves. Inset shows the location of the Nature Reserves in Singapore. BTNR: Bukit Timah Nature Reserve, BKE: Bukit Timah Expressway, ------ : Boundary of Nature Reserves.

Materials and Methods

The survey area (Figure 1) covered in this study included all the water drainages found in the Central Catchment Nature Reserve and the Bukit Timah Nature Reserve from 1992 to 1995. Specimens were collected by hand nets or by hand and then either preserved in 75% alcohol or pinned dry. They were deposited in the Zoological Reference Collection of the National University of Singapore.

Results and Conclusions

A total of 37 species of semiaquatic bugs were recorded from the reserves during this survey (Table 1), with 36 species found in the Central Catchment Nature Reserve and 17 species in the Bukit Timah Nature Reserve. Of the 24 forest species, 13 are considered rare in Singapore and they are mostly distributed in the Central Catchment Nature Reserve. Eight species; *Tenagogonus octopunctatus, Ventidius modulatus, Microvelia albolineolata, Neoalardus typicus, Hydrometra carinata, H. longicapitis, H. okinawana* and *H. papuana* were recorded from Singapore for the first time. Several other recently published records were also based on the materials collected in the Nature Reserves notably, *Cryptobates rufus, Rhagovelia singaporensis* and *R. rudischuhi* (Polhemus & Polhemus, 1995a; Yang & Polhemus, 1994).

Table 1. Distribution of Gerromorphan bugs in the Singapore Nature Reserves. S : Seletar; M : MacRitichie; N : Nee Soon; J : Jungle Fall Valley; P : Peripheral (F : forest species; R : rare, restricted distribution; C : common; U : uncommon; 1 : moderate/fast flowing water; 2 : slow flowing water; 3 : swamp forest; 4 : pool and puddle; 5 : margin of water or bank;
* : new record; + : present; - : absent.)

Species	Status	Habitat	Central Catchment			Bukit Timah	
			S	M	N	J	P
Family **GERRIDAE**							
1. *Amemboa brevifasciata* Miyamoto, 1967	FR	2,5	-	+	-	-	-
2. *Amemboa riparia* Polhemus & Andersen, 1984	FU	2,5	+	+	+	-	+
3. *Aquarius adelaides* (Dohrn, 1860)	U	4	+	+	-	-	-
4. *Cryptobates rufus* J & D Polhemus, 1995	FR	3	-	+	+	-	-
5. *Limnogonus fossarum* (Fabricius, 1775)	U	4	+	+	+	-	+
6. *Metrocoris tenuicornis* Esaki, 1926	FC	2	+	+	+	+	+

Species	Status	Habitat	Central Catchment			Bukit Timah	
			S	M	N	J	P
7. *Neogerris parvulus* Stal, 1860	U	4	+	+	+	-	+
8. *Ptilomera tigrina* Uhler, 1860	FC	1,2	+	+	+	-	+
9. *Rheumatogonus intermedius* Hungerford, 1933	FC	1	+	+	+	-	-
10. *Rhagodotarsus kraepelini* Breddin, 1905	U	4	+	+	+	-	-
11. *Tenagogonus (Limnometra) ciliatus* Mayr, 1865	U	4	+	+	+	-	-
12. *Tenagogonus (L.) insularis* Hungerford & Matsuda, 1958	FC	3	+	+	+	+	+
13. **Tenagogonus (L.) octopunctatus* Hungerford, 1955	FR	3,5	+	+	+	-	-
14. *Tenagogonus quinquemaculatus* Miyamoto, 1967	FR	3,5	+	+	+	-	-
15. *Ventidius harrisoni* Cheng, 1965	FC	2	+	+	+	-	-
16. **Ventidius modulatus* Lundblad, 1933	FR	2	-	+	-	-	-
Family **VELIIDAE**							
17. **Microvelia albolineolata* Torre Bueno, 1927	FU	4	-	-	-	-	+
18. *Microvelia diluta* Distant, 1909	U	4	+	+	-	-	+
19. *Microvelia douglasi* Scott, 1874	U	4	+	+	-	-	+
20. *Microvelia plumbea* Lundblad, 1933	FR	3,4	+	+	-	-	-
21. *Microvelia genitalis* Lundblad, 1933	FR	3,4	+	+	+	+	+
22. *Microvelia* sp. 1	FU	3,4	+	+	+	+	+
23. *Microvelia* sp. 2	FU	3,4	+	+	+	-	+
24. **Neoalardus typicus* (Distant, 1903)	R	2	+	-	-	-	-
25. *Rhagovelia sumatrensis* Lundblad, 1933	FC	1,2	+	+	+	+	+
26. *Rhagovelia singaporensis* Yang & D Polhemus, 1994	FC	1,2	+	+	+	-	-
27. *Rhagovelia rudischuhi* Zettel, 1993	FC	2	+	+	+	+	+
28. *Strongylovelia* sp.	FC	2,5	+	+	+	-	-
Family **HYDROMETRIDAE**							
29. **Hydrometra carinata* J & D Polhemus, 1995	FR	3,5	-	-	+	-	-
30. *Hydrometra insularis* Hungerford & Evans, 1934	R	3,5	-	+	+	-	+
31. **Hydrometra longicapitis* Torre Bueno, 1927	FR	3,5	-	-	+	-	-
32. *Hydrometra maidli* Hungerford & Evans, 1934	U	3,5	+	+	+	-	+
33. **Hydrometra okinawana* Drake, 1951	FR	3,5	-	-	+	-	-
34. **Hydrometra papuana* Kirkaldy, 1901	FR	3,5	-	-	+	-	-

Species	Status	Habitat	Central Catchment			Bukit Timah	
			S	M	N	J	P
Family **MESOVELIIDAE**							
35. *Mesovelia horvathi* Lundblad, 1933	C	4,5	+	+	+	+	+
36. *Mesovelia vittigera* Horvath 1895	U	4,5	+	+	+	-	-
Family **HEBRIDAE**							
37. *Hebrus* sp.	U	4,5	-	+	+	-	-
Rare species (13)			**5**	**8**	**9**	**1**	**2**
Forest species (24)			**16**	**19**	**20**	**6**	**10**
Total species (37)			**27**	**31**	**29**	**7**	**17**

The poor diversity of Gerromorphan bugs in the Bukit Timah Nature Reserve was due to the small and relatively short streams with poorly grown aquatic vegetation and total absence of swamp. The middle and lower reaches of the streams were either at the edge of the forest or in the open country habitats. Inside the forest, parts of the streams dried up easily during the dry season as these were exposed due to a large number of fallen big trees in recent years. They probably also suffered from the drying effects of the numerous walking trails constructed in the reserve (Corlett, 1988). The isolated location and the small stream at a higher elevation in Jungle Fall Valley probably accounted for the lowest number of forest species of (6 out of 24) found in this primary forest.

The Central Catchment Nature Reserve has many swampy forest streams under well-shaded forest and these provide different microhabitats that are not available in the Bukit Timah Nature Reserve. Ten forested species found in the forest of the Central Catchment Nature Reserve, *Amemboa brevifasciata, Cryptobates rufus, Rheumatogonus intermedius, Tenagogonus* (L.) *octopunctatus, T. quinquemaculatus, Ventidius harrisoni, V. modulatus Microvelia plumbea, Rhagovelia singaporensis* and *Strongylovelia* sp. were not found in Bukit Timah Nature Reserve. With exception of *R. intermedius* (moderate to fast flowing water species), the other nine species were either found on swampy puddles or in slow flowing streams (Table 1). Four species of water measurers, *Hydrometra carinata, H. longicapitis, H. okinawana* and *H. papuana*, were collected from a weedy pool, in a semi-open country habitat, near the Nee Soon swamp forest. These were new records for Singapore and found only in this location. *H. papuana* is very rare in Peninsular Malaysia and was only recorded from lowland swamp forests (Polhemus & Polhemus, 1995b).

The Nee Soon Forest has the highest species diversity recorded in this study. Twenty (83%) of the 24 forest species and 9 (69%) of the 13

rare species were found in this location. This swamp forest was also the type locality for two recently described species, *Rhagovelia singaporensis* Yang & Polhemus (1994) and *Cryptobates rufus* Polhemus & Polhemus (1995a). The latter is rare (Figure 1) and distributed only in a few swampy streams, under well shaded forest, either near headwaters or in areas with iron hydroxide deposits (Murphy, 1990).

Metrocoris tenuicornis, *Rhagovelia sumatrensis* and *R. rudischuhi* were very common and were widely distributed in all forest streams, along with the less common *Tenagogonus insularis* at the swampy or quiet edges of the streams in all forested areas. *Ptilomera tigrina* was also common in most flowing forest streams with the exception of the stream at the Jungle Fall Valley.

Three gerrids, *Cylindrostethus malayensis* Polhemus, 1994 *(= C. costalis* Cheng & Fernando, 1969*), Esakia fernandoi* Cheng and *Ventidius hungerfordi* Cheng, previously collected from Sungei Seletar in 1965 (Cheng, 1965; Cheng & Fernando, 1969) were not found in this study. Sungei Seletar was the biggest stream in the Central Catchment Nature Reserve before it was converted into a reservoir in the early 1970s. The interruption of the water system probably accounted for the possible extinction of these three species that inhabited larger flowing water bodies. The survival of the present-day swamp forest species, especially those rare and localized ones will, therefore, be threatened by the change, loss or pollution of the swamp forest.

Entomovlia doversi, previously recorded from the MacRitchie forest (Murphy, 1990) was also not found in this study. It could have been carried over through the pipeline from the river in Johore (Malaysia) to the Upper Peirce Reservoir. Only a single specimen was collected after a heavy downpour that could have caused the water from the reservoir to flow into the forest stream. This species is common in pristine forest streams in Peninsular Malaysia. The single record of *Ventidius modulatus* was also from the same area.

Acknowledgments

We would like to thank Kelvin Lim and all student assistants (too many to name individually) for their hard work on the field and in the laboratory, and to S. Greasi and several colleagues for their help. Thanks are also extended to the Director and staff of the National Parks Board for their cooperation and assistance during the period of this study. We are indebted to Prof. D.H. Murphy for his advice on this survey and very useful comments during the preparation of this manuscript. This study has been partially

supported by research grant RP 830064 from the National University of Singapore.

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