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DIVERSITY OF GERROMORPHA (HETEROPTERA : HEMIPTERA : INSECTA) IN THE WESTERN GHATS STATES, INDIA.

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INTRODUCTION

The infraoder Gerromorpha comprises of semi-aquatic bugs characterised by long conspicuous antennae, longer than head and inserted in front of eyes, distributed in all kinds of climatic zones of the world, except the coldest and driest parts of the world (Andersen, 1982). These bugs are the most successful group living on the surface of water, occupying almost every kind of aquatic habitat. This infraoder contains 'water striders' or 'pond skaters' (Family Gerridae); 'small water striders' or 'water measurers' (Family Veliidae); 'marsh treaders' or 'water measurers' (Family Hydrometridae); 'water treaders' or 'pond weed bugs' (Family Mesoveliidae); 'velvet water bugs' (Family Hebridae) and bugs pertaining to the families Macroveliidae, Paraphrynoveliidae and Hermatobatidae. The last three families do not occur in India.

Aquatic and semi-aquatic bugs play an important role in fresh water ecosystems, as polyphagous and carnivorous insects in different trophic levels. These water bugs serve as zoogeographical indicators for diverse habitats due to their poor dispersal capability. Besides, the role of these bugs as predator in biological control of mosquito is well known (Jenkins, 1964). Knowledge on the ecological aspects of the bugs is essential to study (a) fish biology, due to reversals in prey-predator relationship and (b) food web as prey to higher vertebrates like newts, salamanders, water snakes and birds. Further, studies indicate that the quality of aquatic environment is partially dependent on aquatic bug population dynamics. (Thirumalai & Raghunathan, 1988).

The present day knowledge of Indian Gerromorpha is because of the contribution of Distant (1903; 1906; 1910 a, b), Annandale (1919), Paiva (1919 a, b), Hafiz & Mathai (1938), Hafiz & Ribeiro (1939), Hafiz & Pradhan (1947), Pradhan (1950 a, b), Selvanayagam (1981), Thirumalai (1986; 1989; 1992; 1994 a, b, 1996, 1999 a, b, c), Polhemus & Starmuhlner (1990), Thirumalai Dam (1996), Thirumalai & Radhakrishnan (1999), Ghosh *et al* (1989), Bal & Basu (1994, 1997), Zettel (1998) and Chen & Zettel (1999).

The political states of Karnataka, Kerala, Maharashtra and Tamilnadu falling within 8^0 & 22^0 N and 73^0 & 81^0 E have a geographical feature in common, the Western Ghats traversing them at one part or the other (Goa not included). Since taxonomy holds the key to biodiversity studies, this work has been undertaken to document diversity of semi-aquatic bugs of the four states. The similarity and biotal dispersity of these insects are taxonomically analysed by applying Sorensen and Koch's Indices.

SYSTEMATIC LIST OF GERROMORPHA OF KARNATAKA

Infraorder GERROMORPHA
Family GERRIDAE
Subfamily CYLINDROSTETHINAE
Genus ***Cylindrostethus*** Mayr, 1865

1. ***Cylindrostethus productus*** Spinola, 1940

Subfamily EOTRECHINAE
Genus ***Amemboa Esaki***, 1925
Subgenus ***Amemboa Esaki***, 1925

2. ***Amemboa (Amemboa) dentata*** Polhemus & Andersen, 1984
3. ***Amemboa (Amemboa) kumari*** (Distant), 1910

Subgenus ***Amemboides*** Polhemus & Andersen, 1984

4. ***Amemboa (Amemboides) perlata*** Polhemus & Andersen, 1984

Genus ***Onychotrechus*** Kirkaldy, 1903

5. ***Onychotrechus rhexenor*** Kirkaldy, 1903
6. ***Onychotrechus rupestris*** Andersen, 1980
7. ***Onychotrechus spinifer*** Andersen, 1980

Genus ***Tarsotrechus*** Andersen, 1980

8. ***Tarsotrechus polhemi*** Andersen, 1980

Subfamily GERRINAE
Genus : ***Aquarius*** Schellenberg, 1800

9. ***Aquarius adelaidis*** (Dohrn), 1860

Genus ***Neogerris*** Mastumura, 1913

10. ***Neogerris parvula*** (Stal), 1859

Genus ***Limnogonus*** Stal, 1868
Subgenus ***Limnogonus*** Stal, 1868

11. ***Limnogonus (Limnogonus) fossarum fossarum*** (Fabricius), 1775
12. ***Limnogonus (Limnogonus) nitidus*** (Mayr), 1865

Subgenus ***Limnogonoides*** Poisson, 1965

13. ***Limnogonus (Limnogonoides) pectoralis*** (Mayr), 1865

Genus : ***Limnòmetra*** Mayr, 1865

14. ***Limnometra anadyomene*** (Kirkaldy), 1901
15. ***Limnometra fluviorum*** (Fabricius), 1798

Genus : ***Tenagogonus*** Stal, 1853

16. ***Tenagogonus ceylonensis*** Hungerford & Matsuda, 1962

Subfamily : HALOBATINAE

Genus : ***Metrocoris*** Mayr, 1865

17. ***Metrocoris communis*** (Distant), 1910
18. ***Metrocoris indicus*** Chen & Nieser, 1993
19. ***Metrocoris malabaricus*** Thirumalai, 1986
20. ***Metrocoris variegans*** Thirumalai, 1986

Genus : ***Ventidius*** Distant, 1910

Subgenus : ***Ventidius*** Distant, 1910

21. ***Ventìdius (Ventidius) aquarius*** Distant, 1910

Subfamily : PTILOMERINAE

Genus : ***Pleciobates*** Esaki, 1930

22. ***Pleciobatus tuberculatus*** Esaki, 1930

Genus : ***Ptilomera*** Amyot & Serville, 1843

Subgenus : ***Ptilomera*** Amyot & Serville, 1843

23. ***Ptilomera (Ptilomera) agroides*** Schmidt, 1926

Subfamily : TREPOBATINAE

Genus : ***Gnomobates*** Polhemus & Polhemus, 1995

24. ***Gnomobates kuiterti*** (Hungerford & Matsuda), 1958

Genus : ***Naboandelus*** Distant, 1910

25. ***Naboandelus signatus*** Distant, 1910

Family : VELIIDAE

Subfamily MICROVELIINAE

Genus . ***Baptista*** Distant, 1903

26. ***Baptista angulata*** Andersen, 1989

Genus ***Microvelia*** Westwood, 1834

Subgenus ***Microvelia*** Westwood, 1834

27. ***Microvelia (Microvelia) douglasi douglasi*** Scott, 1874

Genus ***Pseudovelia*** Hoberlandt, 1950

Subgenus ***Pseudovelia*** Hoberlandt, 1950

28. ***Pseudovelia (Pseudovelia) sexualis*** (Paiva), 1917

Subfamily RHAGOVELIINAE

Genus : ***Rhagovelia*** Mayr, 1865

Subgenus ***Rhagovelia*** Mayr, 1865

29. ***Rhagovelia (Rhagovelia) tibialis*** Lundblad, 1936

Genus : ***Tetraripis*** Lundblad, 1936

30. ***Tetraripis asymmetricus*** Polhemus & Karunaratne, 1979

Family : HEBRIDAE

Subfamily : HEBRINAE

Genus ***Neotimasius*** Andersen, 1981

31. ***Neotimasius orientalis*** Andersen, 1981

Genus ***Timasius*** Distant, 1909

32. ***Timasius splendens*** Distant, 1909

Family MESOVELIIDAE

Subfamily MESOVELIINAE

Genus : ***Mesovelia*** Mulsant & Rey, 1852

33. ***Mesovelia vittigera*** Horvath, 1895

Family HYDROMETRIDAE

Subfamily HYDROMETRINAE

Genus ***Hydrometra*** Latreille, 1796

34. ***Hydrometra butleri*** Hungerford and Evans, 1934

35. ***Hydrometra greeni*** Kirkaldy, 1898

SYSTEMATIC LIST OF GERROMORPHA OF KERALA

Infraorder : GERROMORPHA
Family : GERRIDAE
Subfamily : CYLINDROSTETHINAE
Genus : ***Cylindrostethus*** Mayr, 1865

1. ***Cylindrostethus productus*** Spinola, 1940

Subfamily : EOTRECHINAE
Genus : ***Amemboa*** Esaki, 1925
Subgenus : ***Amemboa*** Esaki, 1925

2. ***Amemboa (Amemboa) kumari*** (Distant), 1910

Genus : ***Onychotrechus*** Kirkaldy, 1903

3. ***Onychotrechus major*** Andersen, 1980
4. ***Onychotrechus rhexenor*** Kirkaldy, 1903
5. ***Onychotrechus spinifer*** Andersen, 1980

Genus : ***Tarsotrechus*** Andersen, 1980

6. ***Tarsotrechus polhemi*** Andersen, 1980

Subfamily : GERRINAE
Genus : ***Aquarius*** Schellenberg, 1800

7. ***Aquarius adelaidis*** (Dohrn), 1860

Genus : ***Neogerris*** Matsumara, 1913

8. ***Neogerris parvula*** (Stal), 1859

Genus : ***Limnogonus*** Stal, 1868
Subgenus : ***Limnogonus*** Stal, 1868

9. ***Limnogonus (Limnogonus) fossarum fossarum*** (Fabricius), 1775
10. ***Limnogonus (Limnogonus) nitidus*** (Mayr), 1865

Genus : ***Limnometra*** Mayr, 1865

11. ***Limnometra anadyomene*** (Kirkaldy), 1901
12. ***Limnometra fluviorum*** (Fabricius), 1798

Subfamily HALOBATINAE

Genus ***Metrocoris*** Mayr, 1865

13. ***Metrocoris indicus*** Chen & Nieser, 1993
14. ***Metrocoris malabaricus*** Thirumalai, 1986
15. ***Metrocoris variegans*** Thirumalai, 1986
16. ***Metrocoris velamentus*** Chen & Nieser, 1993

Genus ***Ventidius*** Distant, 1910

Subgenus ***Ventidius*** Distant, 1910

17. ***Ventidius (Ventidius) aquarius*** Distant, 1910

Subfamily : PTILOMERINAE

Genus ***Pleciobates*** Esaki, 1930

18. ***Pleciobates indicus*** Thirumalai, 1986
19. ***Pleciobates nostras*** Thirumalai, 1986

Genus ***Ptilomera*** Amyot & Serville, 1843

Subgenus ***Ptilomera*** Amyot & Serville, 1843

20. ***Ptilomera (Ptilomera) agroides*** Schmidt, 1926

Genus ***Rheumatogonus*** Kirkaldy, 1909

21 ***Rheumatogonus custodiendus*** (Distant), 1910

Subfamily RHAGADOTARSINAE

Genus ***Rhagadotarsus*** Breddin, 1905

Subgenus ***Rhagadotarsus*** Breddin, 1905

22. ***Rhagadotarsus (Rhagadotarsus) kraepelini*** Breddin, 1905

Subfamily TREPOBATINAE

Genus ***Cryptobates*** Esaki, 1929

23. ***Cryptobates raja*** (Distant), 1910

Family HEBRIDAE

Subfamily HYRCANINAE

Genus ***Hyrcanus*** Distant, 1910

24. ***Hyrcanus reichli*** Zettel, 1998

Family : HYDROMETRIDAE
Subfamily : HYDROMETRINAE
Genus : ***Hydrometra*** Latreille, 1796

25. ***Hydrometra butleri*** Hungerford & Evans, 1934
26. ***Hydrometra greeni*** Kirkaldy, 1898

Family : MESOVELIIDAE
Subfamily : MESOVELIINAE
Genus : ***Mesovelia*** Mulsant & Rey, 1852

27. ***Mesovelia vittigera*** Horvath, 1895

Family : VELIIDAE
Subfamily : MICROVELIINAE
Genus : ***Microvelia*** Westwood, 1834
Subgenus : ***Microvelia*** Westwood, 1834

28. ***Microvelia (Microvelia) douglasi douglasi*** Scott, 1874

Subfamily : RHAGOVELIINAE
Genus : ***Rhagovelia*** Mayr, 1865
Subgenus : ***Rhagovelia*** Mayr, 1865

29. ***Rhagovelia (Rhagovelia) ceylanica*** Lundblad, 1936
30. ***Rhagovelia (Rhagovelia) tibialis*** Lundblad, 1936

SYSTEMETIC LIST OF GERROMORPHA OF MAHARASHTRA

Infraorder : GERROMORPHA
Family : GERRIDAE
Subfamily : CYLINDROSTETHINAE
Genus : ***Cylindrostethus*** Mayr, 1865

1. ***Cylindrostethus productus*** Spinola, 1940

Subfamily : EOTRECHINAE
Genus : ***Onychotrechus*** Kirkaldy, 1903

2. ***Onychotrechus major*** Andersen, 1980
3. ***Onychotrechus rhexenor*** Kirkaldy, 1903
4. ***Onychotrechus spinifer*** Andersen, 1980

Subfamily GERRINAE

Genus ***Aquarius*** Schellenberg, 1800

5. ***Aquarius adelaidis*** (Dohrn), 1860

Genus : ***Limnogonus*** Stal, 1868

Subgenus : ***Limnogonus*** Stal, 1868

6. ***Limnogonus (Limnogonus) fossarum fossarum*** (Fabricius), 1775

Genus ***Limnometra*** Mayr, 1865

7. ***Limnogonus fluviorum*** (Fabricius), 1798

Subfamily : HALOBATINAE

Genus ***Halobates*** Buchanan-White, 1883

8. ***Halobates elephanta*** Andersen & Foster, 1992

9. ***Halobates formidabilis*** (Distant), 1910

10. ***Halobates galatea*** Herring, 1961

Genus : ***Metrocoris*** Mayr, 1865

11. ***Metrocoris communis*** (Distant), 1910

Subfamily PTILOMERINAE

Genus ***Ptilomera*** Amyot & Serville, 1843

Subgenus ***Ptilomera*** Amyot & Serville, 1843

12. ***Ptilomera (Ptilomera) agroides*** Schmidt, 1926

Family : VELIIDAE

Subfamily MICROVELIINAE

Genus ***Microvelia*** Westwood, 1834

13. ***Microvelia (Microvelia) diluta*** Distant, 1909

14. ***Microvelia (Microvelia) douglasi douglasi*** Scott, 1874

Subfamily RHAGOVELIINAE

Genus : ***Rhagovelia*** Mayr, 1865

Subgenus ***Rhagovelia*** Mayr, 1865

15. ***Rhagovelia (Rhagovelia) ceylanica*** Lundblad, 1936

Family : HEBRIDAE
Subfamily : HEBRINAE
Genus : ***Hebrus*** Curtis, 1833

16. ***Hebrus bombayensis*** Paiva, 1919

Family : MESOVELIIDAE
Subfamily : MESOVELIINAE
Genus : ***Mesovelia*** Mulsant & Rey, 1852

17. ***Mesovelia vittigera*** Horvath, 1895

Family : HYDROMETRIDAE
Subfamily : HYDROMETRINAE
Genus : ***Hydrometra*** Latreille, 1796

18. ***Hydrometra greeni*** Kirkaldy, 1898

SYSTEMATIC LIST OF GERROMORPHA OF TAMIL NADU

Infraorder : GERROMORPHA
Family : GERRIDAE
Subfamily : CYLINDROSTETHINAE
Genus : ***Cylindrostethus*** Mayr, 1865
Subgenus : ***Cylindrostethus*** Mayr, 1865

1. ***Cylindrostethus productus*** Spinola, 1840

Subfamily : EOTRECHINAE
Genus : ***Amemboa*** Esaki, 1925
Subgenus : ***Amemboa*** Esaki, 1925

2. ***Amemboa (Amemboa) kumari*** (Distant), 1910

Genus : ***Onychortrechus*** Kirkaldy, 1903

3. ***Onychotrechus rhexenor*** Kirkaldy, 1903

Subfamily : GERRINAE
Genus : ***Aquarius*** Schellenberg, 1800

4. ***Aquarius adelaidis*** (Dohrn), 1860

Genus : ***Limnogonus*** Stal, 1868

Subgenus : ***Limnogonus*** Stal, 1868

5. ***Limnogonus (Limnogonus) fossarum fossarum*** (Fabricius), 1775

6. ***L. (L). nitidus*** (Mayr), 1865

Genus : ***Limnometra*** Mayr, 1865

7. ***Limnometra anadyomene*** (Kirkaldy), 1901

8. ***L. fluviorum*** (Fabricius), 1798

Genus ***Neogerris*** Matsumura, 1913

9. ***Neogerris parvula*** (Stal), 1859

Subfamily : HALOBATINAE

Genus : ***Asclepios*** Distant, 1915

10. ***Asclepios annandalei*** Distant, 1915

Genus : ***Halobates*** Buchanan-White, 1883

11. ***Halobates flaviventris*** Eschscholtz, 1822

Genus : ***Metrocoris*** Mayr, 1865

12. ***Metrocoris communis*** (Distant), 1910

13. ***M. communoides*** Chen & Nieser, 1993

14. ***M. indicus*** Chen & Nieser, 1993

15. ***M. malabaricius*** Thirumalai, 1986

16. ***M. velamentus*** Chen & Nieser, 1993

Genus : ***Ventidius*** Distant, 1910

Subgenus : ***Ventidius*** Distant, 1910

17. ***Ventidius (Ventidius) aquarius*** Distant, 1910

Subfamily PTILOMERINAE

Genus ***Pleciobates*** Esaki, 1930

18. ***Pleciobates tuberculatus*** Esaki, 1930

Genus : ***Ptilomera*** Amyot & Serville, 1843

Subgenus ***Ptilomera*** Amyot & Serville, 1843

19. ***Ptilomera (Ptilomera) agroides*** Schmidt, 1926

Subfamily : RHAGADOTARSINAE
Genus : ***Rhagadotarsus*** Breddin, 1905
Subgenus : ***Rhagadotarsus*** Breddin, 1905

20. ***Rhagadotarsus (Rhagadotarsus) kraepelini*** Breddin, 1905

Subfamily : TREPOBATINAE
Genus : ***Naboandelus*** Distant, 1910

21. ***Naboandelus signatus*** Distant, 1910

Family : HEBRIDAE
Subfamily : HEBRINAE
Genus : ***Neotimasius*** Andersen, 1981

22. ***Neotimasius orientalis*** Andersen, 1981

Genus : ***Timasius*** Distant, 1909

23. ***Timasius spinifer*** Andersen, 1981
24. ***T. splendens*** Distant, 1909

Family : HYDROMETRIDAE
Subfamily : HYDROMETRINAE
Genus : ***Hydrometra*** Latreille, 1796

25. ***Hydrometra bifurcata*** ? Hungerford & Evans, 1934
26. ***H. butleri*** Hungerford & Evans, 1934
27. ***H. greeni*** Kirkaldy, 1898

Family : MESOVELIIDAE
Subfamily : MESOVELIINAE
Genus : ***Mesovelia*** Mulsant & Rey, 1852

28. ***Mesovelia horvathi*** Lundblad, 1934
29. ***M. indica*** Horvath, 1915
30. ***M. vittigera*** Horvath, 1895

Family : VELIIDAE
Subfamily : HALOVELIIDAE
Genus : ***Strongylovelia*** Esaki, 1924

31. ***Strongylovelia*** sp.

Genus ***Xenobates*** Esaki, 1927

32. ***Xenobates*** sp.

Subfamily MICROVELIINAE

Genus ***Microvelia*** Westwood, 1834

Subgenus ***Microvelia*** Westwood, 1834

33. ***Microvelia (Microvelia) annandalei*** Distant, 1909
34. ***M. (M). diluta*** Distant, 1909
35. ***M. (M). douglasi douglasi*** Scott, 1874
36. ***M. (M). javadiensis*** Thirumalai, 1989
37. ***M. (M). santala*** Hafiz & Ribeiro, 1939

Subfamily PERITTOPINAE

Genus ***Perittopus*** Fieber, 1861

38. ***Perittopus campbelli*** Lundblad, 1933
39. ***P. horvathi*** Lundblad, 1933

Subfamily : RHAGOVELIINAE

Genus ***Rhagovelia*** Mayr, 1865

Subgenus ***Neorhagovelia*** Matsuda, 1956

40. ***R. (Neorhagovelia) nilgiriensis*** Thirumalai, 1994

Subgenus : ***Rhagovelia*** Mayr, 1865

41. ***Rhagovelia (Rhagovelia) ceylanica*** Lundblad, 1936
42. ***R. (R). tibialis*** Lundblad, 1936

Genus : ***Tetraripis*** Lundblad, 1936

43. ***Tetraripis asymmetricus*** Polhemus & Karunaratne, 1979

TAXONOMIC ANALYSIS

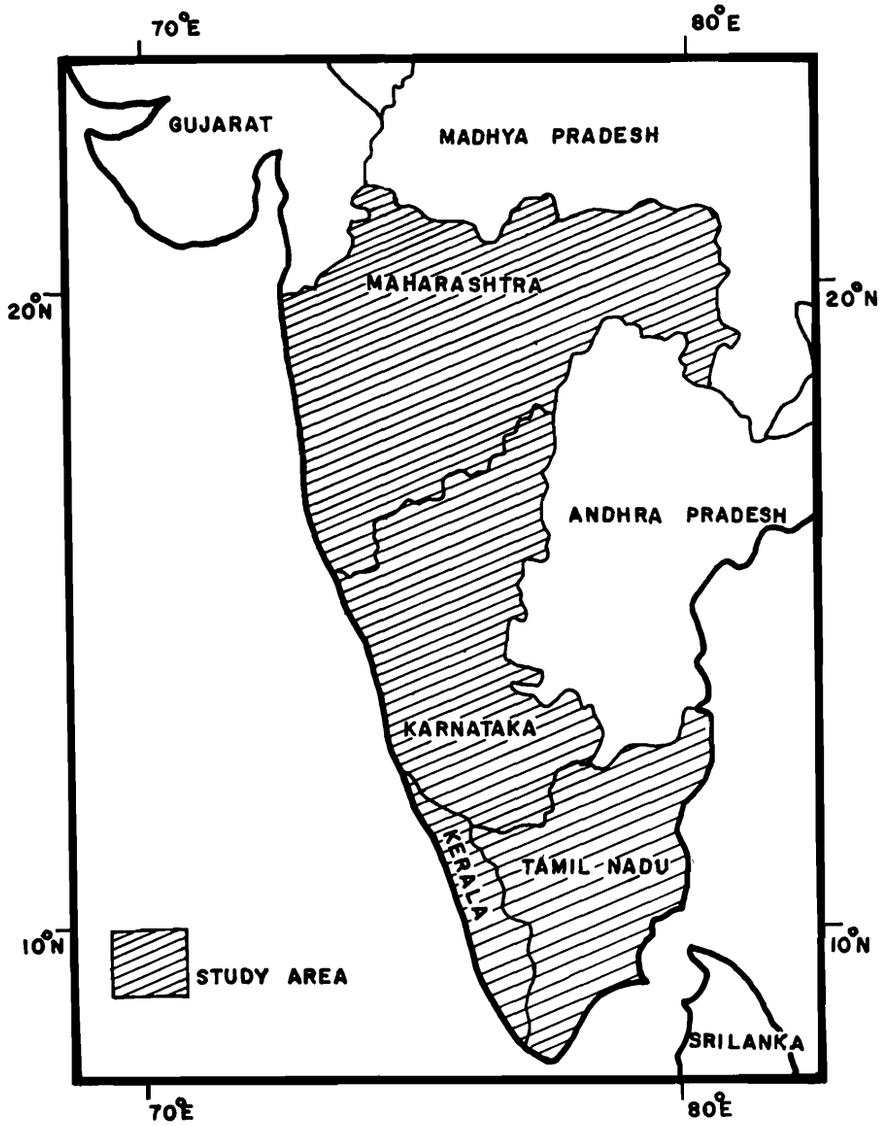
Out of the total 64 species so far recorded from the study area, 35 species accommodated in 24 genera under 5 families; 30 species, 19 genera, 5 families; 18 species, 13 genera, 4 families and 43 species, 25 genera, 5 families occur in Karnataka, Kerala, Maharashtra and Tamil Nadu respectively. Common to all four states are 8 species (*Cryptobates raja*, *Hyrcanus reichli*, *Pleciobates indicus*, *P. nostras* and *Rheumatogonus custodiendus*) in Kerala, 4 species (*Halobates elephanta*, *H. formidabilis*, *H. galatea* and *Hebrus bombayensis*) in Maharashtra and 14 species (*Asclepios annandalei*, *Halobates flaviventris*, *Hydrometra bifurcata* ?, *Mesovelia horvathi*, *M. indica*, *Microvelia annandalei*, *M. javadiensis*, *M. santala* ?, *Perittopus campbelli*, *P. horvathi*,

Rhagovelia nilgiriensis, *Strongylovelia* sp., *Timasius spinifer* and *Xenobates* sp.) in Tamil Nadu enjoy exclusive distribution. Among the 14 genera of the study area, 4 in Kerala, 1 in Maharashtra and 5 in Tamil Nadu have exclusive existence.

To study the similarity and dispersity of the semi-aquatic bugs of the four states. Sorensen Index of similarity (1948) and Index on Biotal Dispersity (IBD) of Koch (1957) have been applied on the formulae :

Sorensen Index (S) = 2 C/a+b X 100 where 'C' is the number of species common to both the associations; 'a' the number of species in one association and 'b' the number of species in the other association.

Index of Biotal Dispersity (IBD) = T-S X 100/S (n-1) where 'T' is the arithmetical sum of species living in each of 'n' compared association and 'S' is the total list of species in 'n' compared association. If the Sorensen Index is 100, it indicates absolute similarity and if the IBD is '0', 'T' will be equivalent to 'S', indicating a completely different set.



Map 1 : Western Ghats States

Fig. 1. Total Common and Percentageof Gerromorpha

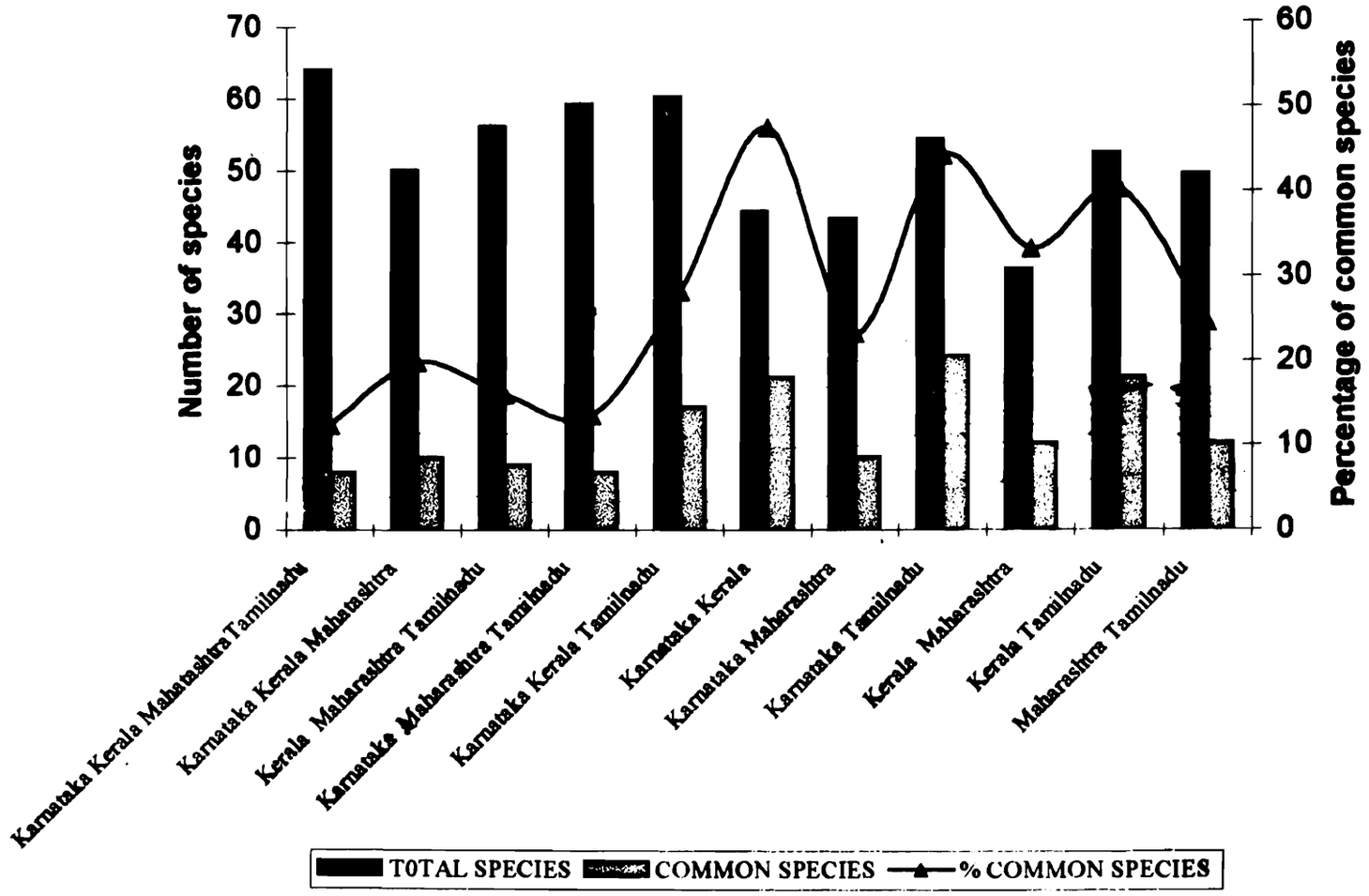
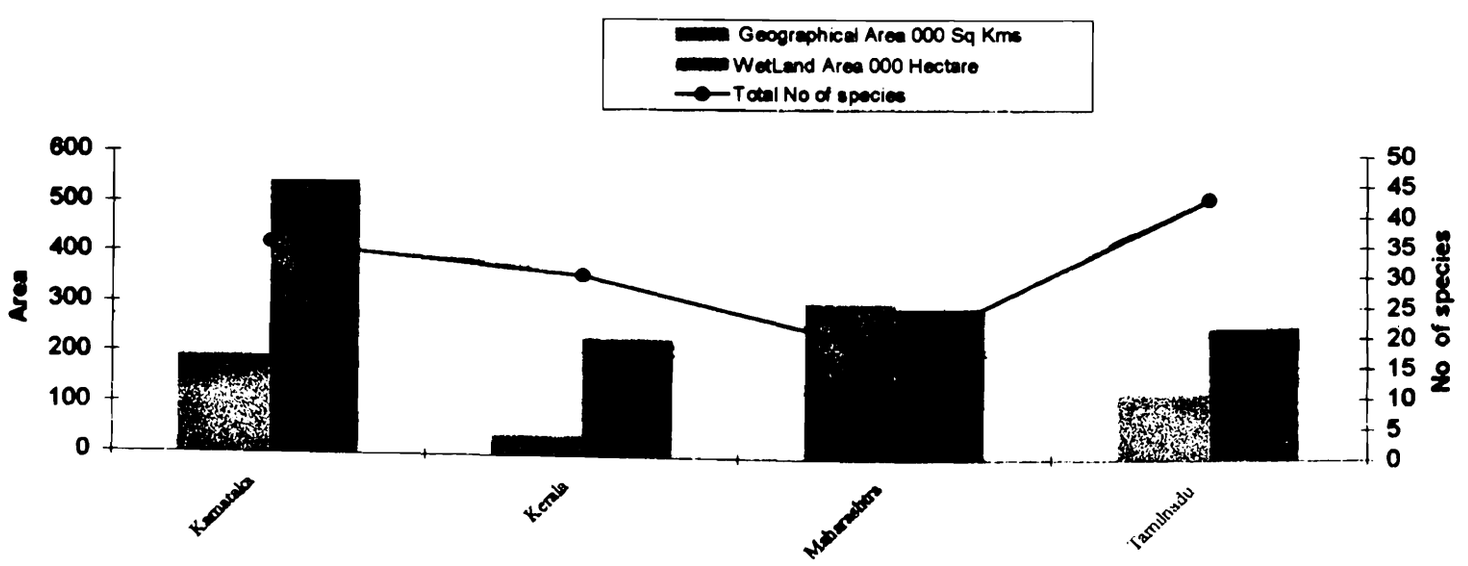


Fig. 2. Geographical Wetland areas and numberof species



Sorensen Indices and Koch's Indices of Biotal Dispersity are presented in table 2 and 3. The highest of Sorensen Indices is found for Karnataka-Kerala (65) and the lowest for Karnataka-Maharashtra (38). The highest of IBD is for Kerala-Maharastra (54) where as the lowest for Karnataka-Tamil Nadu (21). The total, common and percentage of common occurence of species in all the combination of states are projected in Fig. 1. To render the data more useful, comparison has been made between the geographical and wetland areas of the four states with the total number of species in each state (Fig. 2.).

DISCUSSION

The aquatic and semi-aquatic groups of insects represent a significant level of diversity (Ghosh, 1996). In India, 123 species of Gerromorpha constituting 8.3% of global occurence command taxonomic work. It is further felt that every effort should be made to have data bases of local and provincial biodiversity especially of globally important areas like Western Ghats (Daniels, 1997). In this context, the present work signifies the necessity to authentically record 64 species from the province consisting of Karnataka, Kerala, Maharastra and Tamil Nadu to dispel taxonomic uncertainties existing at various levels (Daniels, 1997) in Western Ghats biodiversity. It is interesting to note that more than 50% of the known Gerromorpha species of India are found in this province where Western Ghats run through. There is little doubt that the Ghats states have an array of various forest types and complex assemblages of ecosystems providing home to diverse gerromorphan faunistic constituents. Besides, the original fauna of peninsula constitute the true Indian elements derived from the Indian part of Gondwana land (Mani, 1974). Hence, inventorisation of aquatic insect resources becomes a high priority area to study the functional aspects of community structure incorporated in food webs that provide information on energyflow (Ananthakrishnan, 1999).

The highest number of species in common is in Karnataka-Tamil Nadu sector (24 species) where as the Sorensen Index is the highest for the Karnataka-Kerala sector (65). On the contrary, the lowest number of species in common is in the Karnataka-Maharashtra sector (10 species) and Sorensen Index is also the lowest for the same area (38). Even though Karnataka-Kerala and Kerala-Tamil Nadu have a similar numerical strength (21 species), the Sorensen indices differ. The same trend is seen in Kerala-Maharashtra and Maharashtra-Tamil Nadu sectors also (Table 2). The highest of IBD for Kerala-Maharashtra sector (54) indicates the possibilities of less exploration, diverse habitats and different biogeographic conditions (Table 3). It is evident from Fig. 2 that, though wetland area is more in Karnataka and Maharashtra states, the number of species reported is less than Tamil Nadu which ranks third in wetland availability. Hence, it invites more efforts for systematic exploration of this group in Maharashtra intensively.

As has been aptly pointed out by Ganeshaiah *et al* (1997), variety of indices quantifying biodiversity treat all species as equivalent, ignoring taxonomy, morphological and biological differences among species of community. Thus, one will have to rely on hard core taxonomy for a meaningful approach to understand issues concerning bio-diversity.

SUMMARY

Diversity of semi-aquatic bugs of the infraorder Gerromorpha in the Western Ghats states, Karnataka, Kerala, Maharashtra and Tamil Nadu has been studied and taxonomically analysed.

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Table 1 : Distribution of Gerromorpha

S. NO.	GERROMORPHAN SPECIES	KARNATAKA	KERALA	MAHARASHTRA	TAMILNADU
1.	*Amemboa (Amemboa) dentata*	P?			
2.	*Amemboa (Amemboa) kumari*	P	P		P
3.	*Amemboa (Amemboides) perlata*	P			
4.	*Aquarius adelaidis*	P	P	P	P
5.	*Asclepios annandalei*				P
6.	*Baptista angulata*	P			
7.	*Cryptobates raja*		P		
8.	*Cylindrostethus productus*	P	P	P	P
9.	*Gnomobates kuiterti*	P			
10.	*Halobates elephanta*			P	
11.	*Halobates flaviventris*				P
12.	*Halobates formidabilis*			P	
13.	*Halobates galatea*			P	
14.	*Hebrus bombayensis*			P	
15.	*Hydrometra bifurcta ?*				P
16.	*Hydrometra butleri*	P	P		P
17.	*Hydrometra greeni*	P	P	P	P
18.	*Hyrcanus reichli*		P		
19.	*Limnogonus (Limnogonus) fossarum fossarum*	P	P	P	P

S. NO.	GERROMORPHAN SPECIES	KARNATAKA	KERALA	MAHARASHTRA	TAMILNADU
20.	*Limnogonus (Limnogonus) nitidus*	P	P		P
21	*Limnogonus (Limnogonus) pectoralis*	P			
22.	*Limnometra anadyomene*	P	P		P
23.	*Limnometra fluviorum*	P	P	P	P
24.	*Mesovelia horvathi*				P
25.	*Mesovelia indica*				P
26.	*Mesovelia vittigera*	P	P	P	P
27.	*Metrocoris communis*			P	P
28.	*Metrocoris communoides*	P			P
29.	*Metrocoris indicus*	P	P		P
30.	*Metrocoris malabaricus*	P	P		P
31	*Metrocoris variegans*	P	P		
32.	*Metrocoris velamentus*		P		P
33.	*Microvelia (Microvelia) annandalei*				P
34.	*Microvelia (Microvelia) diluta*			P	P
35.	*Microvelia (Microvelia) douglasi douglasi*	P	P	P	P
36.	*Microvelia (Microvelia) javadiensis*				P
37.	*Microvelia (Microvelia) santala*				P?
38.	*Naboandelus signatus*		P		P

S. NO.	GERROMORPHAN SPECIES	KARNATAKA	KERALA	MAHARASHTRA	TAMILNADU
39.	*Neogerris parvula*	P	P		P
40.	*Neotimasius orientalis*	P			P
41.	*Onychotrechus major*		P	P	
42.	*Onychotrechus rhexenor*	P	P	P	P
43.	*Onychotrechus spinifer*	P	P	P	
44.	*Onychotrechus rupestris*	P			
45.	*Perittopus campbelli*				P
46.	*Perittopus horvathi*				P
47.	*Pleciobates indicus*		P		
48.	*Pleciobates nostras*		P		
49.	*Pleciobates tuberculatus*	P			P
50.	*Pseudovelia (Pseudovelia) sexualis*	P			
51.	*Ptilomera (Ptilomera) agroides*	P	P	P	P
52.	*Rhagadotarsus (Rhagadotarsus) kraepelini*		P		P
53.	*Rhagovelia (Rhagovelia) ceylanica*		P	P?	P
54.	*Rhagovelia (Rhagovelia) nilgiriensis*				P
55.	*Rhagovelia (Rhagovelia) tibialis*	P?	P		P
56.	*Rheumatogonus custodiendus*		P		
57.	*Strongylovelia sp.*				P
58.	*Tarsotrechus polhemi*	P	P		
59.	*Tenagogonus ceylonensis*	P			

S. NO.	GERROMORPHAN SPECIES	KARNATAKA	KERALA	MAHARASHTRA	TAMIL NADU
60.	*Tetraripis asymmetricus*	P			P
61.	*Timasius spinifer*				P
62.	*Timasius splendens*	P			P
63.	*Ventidius (Ventidius) aquarius*	P	P		P
64.	*Xenobates sp.*				P
	TOTAL	35	30	18	43

Table 2 : Sorensen indices for Gerromorpha from four states.

STATES	KARNATAKA	KERALA	MAHARASHTRA	TAMIL NADU
KARNATAKA	0	65	38	62
KERALA	65	0	50	58
MAHARASHTRA	38	50	0	39
TAMIL NADU	62	58	39	0

Table 3 : Koch's IBD for Gerromorpha from four states.

STATES	KARNATAKA	KERALA	MAHARASHTRA	TAMIL NADU
KARNATAKA	0	31	46	21
KERALA	31	0	54	24
MAHARASHTRA	46	54	0	36
TAMIL NADU	21	24	36	0