

IV. SUMMARY : SYSTEMATIC ARRANGEMENT  
OF CULICOIDES SPP., OF WEST BENGAL

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1. The 79 species of Culicoides, admitted in the present thesis as extant in the State of West Bengal, India, are alphabetically arranged in table 5, showing the species groups and subgenera to which those species belonged. The districtwise occurrence of the species, with indications if those concomitantly were distributed in other parts of India and in countries outside India alongwith sexes those were known, were also stated in the table.
2. It follows from the table that of the 79 West Bengal species, 18 species are described in the present thesis as new to science while of the remaining 61 species, 26 species were described by Majumdar and Dasgupta (1972) and those being yet known only by their manuscript descriptions ( op. cit. ), those were shown in the present species as new species accruing to the credit of those authors. The remaining 35 species are described previously by various authors as (no. of species described shown in parentheses after author's/ s' name): Arakawa (1), Carter et al. (1), Causey (3), Chu (2), Dasgupta and his other collaborators (13), Edwards (1), Kieffer (8), Mukerji (1), Smith and his collaborator (3),

and Wirth and Hubert (2). Another scrutiny reveals that of 79 species thus known, 54 species are described in both sexes, 20 species only in females and 5 species only in males. Again, species (18) described in only one sex in recent times are provided with enough descriptive points together with due illustrations of their morphology whereas those of earlier years (7) are not so; types of the recent times are also available for comparison whereas the types of the earlier times are not. An immediate contention, therefore can be that of the 79 West Bengal species, only 7 known species may pose difficulty in their recognition and re-collection from nature whereas the other species, the overwhelming majority, are not likely to pose a difficulty in the recognition and re-collection in future studies.

3. The allocation of 79 Culicoides species of West Bengal to species groups and subgenera are now done on a comprehensive basis, a summary position of the allocation being (subgenus name, no. of species in the subgenus/no. of species groups): Avaritia, 14/5; Beltrannya, 1/1; Culicoides, 9/2; Dipheonyia, 14/4; Hoffmania, 1/1; Meijershelea, 4/3; Monoculicoides, 1/1; Oecacta, 14/4; Trithecoidea 21/4. Thus, in terms of preponderance, the concerned subgeneric line-up is : Trithecoidea > Avaritia = Dipheonyia = Oecacta > Culicoides > Meijershelea > Beltrannya = Hoffmania = Monoculicoides.

The by-far greater specieswise diversity of the subgenus Trithacoidea in the study area is noteworthy and it is in no way in conflict with the finding that in the Gangetic plains of West Bengal, C. pyratona of the subgenus Oococcia comprised of 78.51% of the Gulicoidea populations (Dasgupta, 1961). One reason for this is perhaps due to the fact that in the present study an emphasis was given on that subgenus.

The inclusion of the Fortis and the Similis Group of species under subgenus Oococcia by Majumdar and Dasgupta (1972) is inept, in light of present day knowledge, and those are now included under the Neotropical subgenus Diphacovia. Similarly, their inclusion of their new species, C. distinctipalpis in the Sognis Group under subgenus Oococcia is unnecessary and the species is now included in the Similis Group of subgenus Diphacovia. Their placement of the Actoni Group of species under subgenus Oococcia was also changed now by including the Group under subgenus Avaritia following Dyce and Wirth (1983) who pointed out the Avaritian features of the species of the group so cogently. Wirth (1973) in his checklist of the Oriental Gulicoidea kept some 9 species occurring in India in the "Unplaced" category, the species involved being : clavipalpis, distinctus, fulvus, himalayae, huffi, inexploratus, molantior, odiceus and similis. Thus 9 species are now allocated to subgenus and group to which they should belong (vide table 5).

4. The analyses of species distribution in different districts of West Bengal having a variable soil and vegetational make up and differential meteorological factors make an interesting reading. Though the very limited studies at a very uneven level made now for different districts hardly equip us with comprehensive field data to advance any significant contentions, an indication, however, may be obtained about the species types of different localities. It follows from the work that districtwise occurrence of Culicoides species types are (no. of species shown in parentheses after district name): Bankura (4), Birbhum (3), Burdwan (16), Calcutta (19), Coochbehar (4), Darjeeling (44), Hooghly (16), Howrah (2), Jalpaiguri (2), Malda (4), Murshidabad (2), Nadia (2), Midnapore (?), Purulia (2), ~~24~~ Parganas (34) and West Dinajpur (3). The subhimalyan district of Darjeeling lying between 90 m to over 2000 m altitudinal height from sea level, composed both of hill soils and new alluvial soils and having annual rainfall to the extent of 360 cm and a cool temperature in its mountain area but hot, humid in its plains provides the highest record of 44 species of Culicoides of which a total of 29 species are exclusively described from that district. The Asterinervis Group of species (subgenus Culicoides), the Haematopetus Group of species (subgenus Birphaomyia), the Homotomus Group of species (subgenus Monoculicoides), and one of the Hegneri Group of

species (subgenus Heliocheilus), the Chaetophthalmus, the Heliophilus and most of the Heavel Groups of species (subgenus Cocacta) and 10 new species of subgenus Trithecoidea are found to occur in that district alone. Amongst them, the record of the Aterinervis Group of species and of the Chaetophthalmus Group of species, confirmed now, seems significant - the Darjeeling species of the Aterinervis Group are found to be comparable with those of the same group recorded by Belfinado (1961) in the mountain areas of the Philippines while those of the Chaetophthalmus Group of species occur in colder climate of the Northern Hemisphere and as their distribution extends southward, they occur only in the higher elevations.

As opposed to the faunal peculiarities observed now, as stated above, the Culicoides species of the southern plains also present many specialities. The dominant species C. oxytoma, and the abundant species C. peregrinus of the southern plains of West Bengal are either absent or in stray, occasional number in the Darjeeling area. The restricted records districtwise only of a number of Culicoides species is also noteworthy, and it needs further future studies, on a comprehensive scale, to show that these are truly regional, adapted to the special climatic conditions of their place of occurrence.

5. As per our present knowledge, some 14 species of the West Bengal Culicoides are known to occur in other States of India, the species being ; Actoni, anophelia, brevitarsis, distinctivalis, flaviscutatus, fortis, fulvus, mukerjii, oxytoma, palmifer, peracrinus, ravivalis, shortti and subnotatus. Again, a total of 23 species of West Bengal Culicoides are also known to be distributed in more than one country outside India (vide table 5), those most widely distributed being actoni, anophelia, arakawai, brevitarsis, circumscriptus, glavivalis, hesneri, imicola, oxytoma, palmifer, peracrinus and similis. Of course, it is apparent that as large areas in India and several other parts of southeast Asian countries are explored more intensively in future and new data on Culicoides distribution are added, one or two or a few little known species may be detected as to have a wider distribution within, however, the pattern that is now described.

Table - 5. Systematic arrangement of Gulicoides spp.,  
extant in the State of West Bengal\*

Subgenus	Species Group	Species, known sex, main district locations ( W. Bengal )	
1. <u>Avaritia</u>	1. Actoni Gr.	1. <u>actoni</u> Smith; f-m; Calcutta, Darjeeling, Hooghly, 24-Pargas.	
		2. <u>definitus</u> Sen and Dasgupta; f-m; Calcutta, 24-Pargas.	
	2. Autumnalis Gr.	3. <u>autumnalis</u> Sen and Dasgupta; m; Calcutta, 24-Pargas.	
		**4. <u>dumini</u> Sen and Dasgupta; m; Calcutta, 24-Pargas.	
		5. <u>inexploratus</u> Sen and Dasgupta, m; Calcutta, 24-Pargas.	
		3. Orientalis Gr.	**6. <u>brevitarais</u> Kieffer; f-m; Calcutta, 24-Pargas.
			7. <u>certus</u> Dasgupta; f; Calcutta.
	8. <u>fulvus</u> Sen and Dasgupta; f-m; Calcutta, 24-Pargas.		
	9. <u>himalayae</u> Kieffer; f-m, Calcutta, Darjeeling.		
	**10. <u>imicola</u> Kieffer; f-m; Calcutta, 24-Pargas.		
	11. <u>molestior</u> Kieffer; f-m; Calcutta, Darjeeling.		
	12. <u>odiosus</u> Kieffer; f; Calcutta, Darjeeling.		
	13. <u>paralini</u> Dasgupta; f; Calcutta, 24-Pargas.		
	14. <u>turridus</u> Sen and Dasgupta; f-m; Calcutta, Hooghly, Midnapur.		

\* f-m in the table denote female and male sex respectively in which the species is known; a species marked by double asterisks means it is also known from outside India.



Table 5. contd.

Subgenus	Species Group	Species, known sex, main district ( W. Bengal )
2. <u>Beltrannmyia</u>	4. <u>Circumscrip- tus Gr.</u>	**15. <u>circumscriptus</u> Kieffer; f-m; Burdwan, Hooghly, 24-Pargos.
3. <u>Culicoides</u>	5. <u>Aterinervis Gr.</u>	16. <u>leoresalis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling. 17. <u>neoresalis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling. 18. <u>pararesalis</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling. 19. <u>neandoresalis</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling. 20. <u>quasi-resalis</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling. 21. <u>resalis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling. 22. <u>subresalis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling.
	6. <u>Innoxius Gr.</u>	**23. <u>innoxius</u> Sen & Dasgupta, f-m; Burdwan, Coochbehar, Darjeeling, 24-Pargos. 24. <u>subinnoxius</u> Majumdar & Dasgupta, n.sp.; m; 24-Pargos.
4. <u>Diphaomyia</u>	7. <u>Clavipalpis Gr.</u>	**25. <u>candidus</u> Sen & Dasgupta; f-m; 24-Pargos. **26. <u>clavipalpis</u> Mukerji; f-m; Burdwan, Darjeeling, Hooghly, 24-Pargos. 27. <u>distinctus</u> Sen & Dasgupta; f-m; Calcutta, 24-Pargos. 28. <u>mukerjii</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling, 24-Pargos.

Table 5. conti.

Subgenus	Species Group	Species, known sex, main district locations (W. Bengal)
	8. <u>Racematotus</u> Gr.	29. <u>paculiaris</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling.
	9. <u>Shortti</u> Gr.	30. <u>shortii</u> Sen & Dasgupta; f-m; Darjeeling, 24-Parga.
		**31. <u>shortii</u> Smith & Swaminath; f-m; Burdwan, Darjeeling, 24-Parga.
		32. <u>smithi</u> Majumdar & Dasgupta, n.sp.; f-m; Burdwan, Hooghly, 24-Parga.
		33. <u>subrotatus</u> Majumdar & Dasgupta, n.sp.; f-m; Bankura, Burdwan, Hooghly, Purulia, 24-Parga.
		34. <u>swaminathi</u> Majumdar & Dasgupta, n.sp.; f-m; 24-Parga.
	10. <u>Similia</u> Gr.	**35. <u>cauceyi</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling, Hooghly, 24-Parga.
		36. <u>distinctinalpis</u> Majumdar & Dasgupta, n.sp.; f-m; Bankura, Burdwan, Darjeeling, Hooghly.
		**37. <u>huffi</u> Causey; f-m; Burdwan, Hooghly, 24-Parga.
		**38. <u>similia</u> Carter, Ingram & Macfie; f-m; Burdwan, Darjeeling, Hooghly, 24-Parga.
5. <u>Hoffmania</u>	11. <u>Peregrinus</u> Gr.	**39. <u>peregrinus</u> Kieffer; f-m; Birbhum, Calcutta, Hooghly, Howrah, Midnapur.
6. <u>Meiorenchela</u>	12. <u>Guttifer</u> Gr.	**40. <u>arakawai</u> (Arakawa); f-m; Burdwan, Hooghly, 24-Parga.

Table 5. contd.

Subgenus	Species Group	Species, known sex, main district locations ( V. Bengal )
	13. Hegneri Gr.	**41. <u>hegneri</u> Causey; f-m; Burdwan Darjeeling, Hooghly, 24-Pargos. 42. <u>namithecalis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling.
	14. Unicalatus Gr.	43. <u>unicalatus</u> , n.sp.; f-m; Burdwan.
7. <u>Monoculicoides</u>	15. Homotomus Gr.	44. <u>neohomotomus</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling.
8. <u>Oecacta</u>	16. Chaetophthalmus Gr.	**45. <u>majumdaris</u> Chu; f-m; Darjeeling. **46. <u>spinulosus</u> Chu; f-m; Darjeeling.
	17. Heliophilus Gr.	47. <u>shashi</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling
	18. Neavel Gr.	48. <u>marginatus</u> Majumdar & Dasgupta, n.sp.; f-m; Hooghly, 24-Pargos. 49. <u>basui</u> Majumdar & Dasgupta, n.sp.; f; 24-Pargos. 50. <u>bengalensis</u> Majumdar & Dasgupta, n.sp.; f-m; Bankura, Birbhum, 24-Pargos. **51. <u>hydnus</u> Wirth & Hubert, f-m; Hooghly, 24-Pargos. 52. <u>fortipalnis</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling. 53. <u>inornatus</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling. 54. <u>pateli</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling. 55. <u>gharnai</u> Majumdar & Dasgupta, n.sp.; f-m; Darjeeling.

Table 5. contd.

Subgenus	Species group	Species, known sex, main district localities ( W. Bengal )
		56. <u>shortipalpis</u> Majumdar & Dasgupta, n.sp.; f; Darjeeling.
		57. <u>submarginatus</u> , n.sp., m; Darjeeling.
19. Schultzel Gr.	**58.	<u>Oxytoma</u> Kieffer; f-m; Birbhum, Calcutta, Darjeeling, Midnapur.
9. <u>Trithicoides</u>	20. Anophelis Gr.	**59. <u>anophelis</u> Edwards; f-m; Calcutta, Coochbehar; Birbhum; Darjeeling; Hooghly; Malda; 24-Pargas, West Dinajpur.
		60. <u>insolens</u> , n.sp.; f; Darjeeling.
21. Macfieci Gr.	**61.	<u>macfieci</u> Causey; f-m; Burdwan, Midnapur.
		62. <u>pirus</u> , n.sp.; f; Darjeeling.
		63. <u>neopalifer</u> , n.sp.; f-m; Darjeeling.
	**64.	<u>palifer</u> Dasgupta & Ghosh; f-m; Burdwan, Calcutta, Darjeeling, Hooghly, 24-Pargas.
		65. <u>parapalifer</u> , n.sp.; f-m; West Dinajpur.
		66. <u>pseudopalifer</u> , n.sp.; f-m; Darjeeling.
		67. <u>quincipalifer</u> , n.sp.; f; Darjeeling.

Table 5. contd.

Subgenus	Species group	Species, known sex, main district, locations ( W. Bengal )
		68. <u>rariacantha</u> , n.sp.; f-m; Midnapur.
		69. <u>subpalpifer</u> , n.sp.; f; Darjeeling.
22. Flavesceus Gr.		70. <u>annarunguis</u> , n.sp.; f-m; Darjeeling.
		71. <u>maldaensis</u> , n.sp.; f; Malda.
		72. <u>pseudoflavescens</u> , n.sp.; f; Malda.
		73. <u>usitatus</u> , n.sp.; f; Darjeeling.
23. Haripalpis Gr.		74. <u>clarus</u> , n.sp.; f-m; 24-Pargos.
		**75. <u>flavocutatus</u> Wirth & Hubert; f-m; Darjeeling.
		76. <u>infrequens</u> , n.sp.; f-m; 24-Pargos.
		77. <u>pullus</u> , n.sp.; f; Darjeeling.
		**78. <u>paripalpis</u> Smith; f-m; 24-Pargos.
		79. <u>singularis</u> , n.sp.; f; Darjeeling.