

SUPPLRY

Culicoides were found to be very abundant in light trap collections made at a horse farm operated by the Red Cross Society of Thailand at Bang Phra, Choburi, Southeast Thailand. Twenty five species were found at Bang Phra, including three new species. There were distinct changes in the relative abundance of the various Culicoides species at Bang Phra during the nine months for which collections were examined. Culicoides peregrinus was the most abundant species during most of the months, but C. ananiensis was the most abundant species during June. There was a wide diversity of possible breeding sites at Bang Phra, as indicated by the relatively large number of species and large numbers of individuals collected. No biting collections were made at Bang Phra, but most of the species collected are believed to feed on large domestic animals. Some, such as C. arakawai, which feeds on domestic fowl, have other hosts as well.

Collections were also made from a number of other sites in Thailand, and in all thirty species of Culicoides were collected in the country. There are a number of other members of the genus which have been reported from the country which were not found in this study. Three species of Culicoides were collected biting man and one species was found attached to engorged Anopheles mosquitoes. The number biting man was relatively small in relation to the number collected in light traps. Collectors engaged in many hundreds of hours of mosquito biting tests for the SEATO Medical Research Laboratory while this study was in progress found very few Culicoides attacking them.

The genus does not appear to be a very important pest in Thailand, but this subject deserves additional study. No information was found on the possible disease importance of the genus in Thailand, although elsewhere Culicoides species are vectors of human and animal disease.

Twenty five of the species examined during the study were discussed in detail, and wing photographs and drawings of important taxonomic features were prepared. A key was also prepared for the species found at Bang Phra.

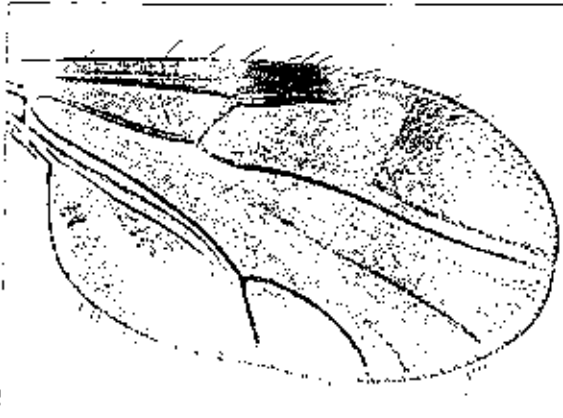
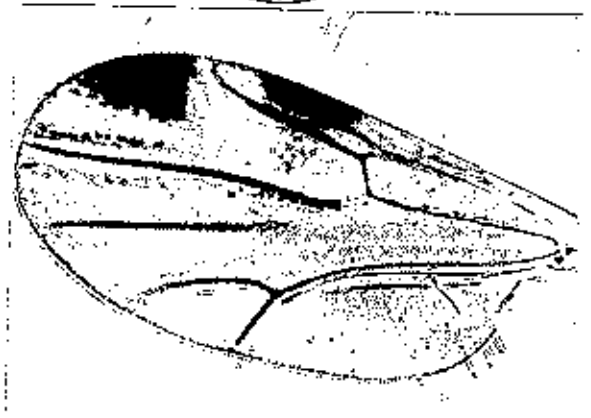
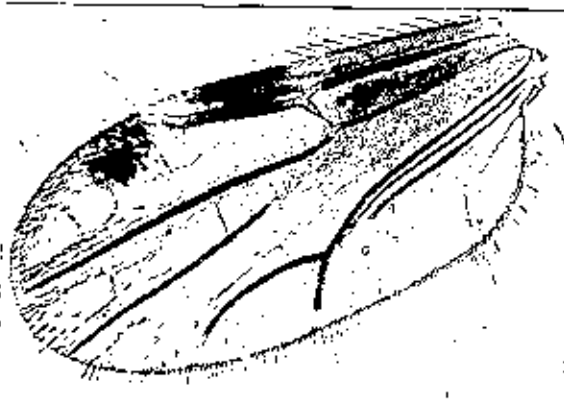
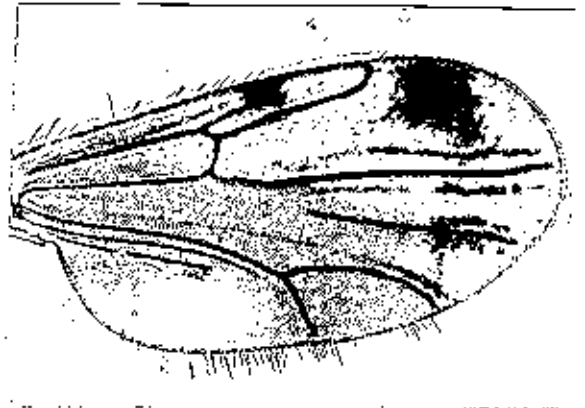
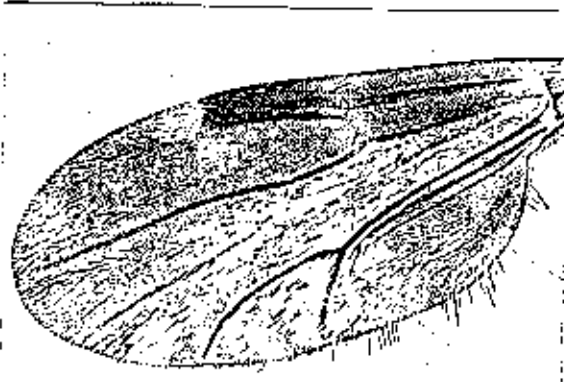
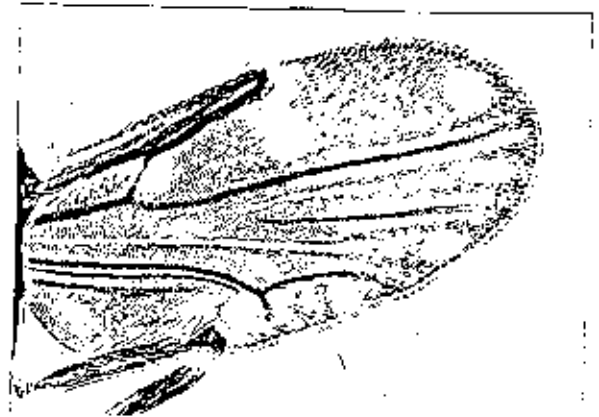
LITERATURE CITED

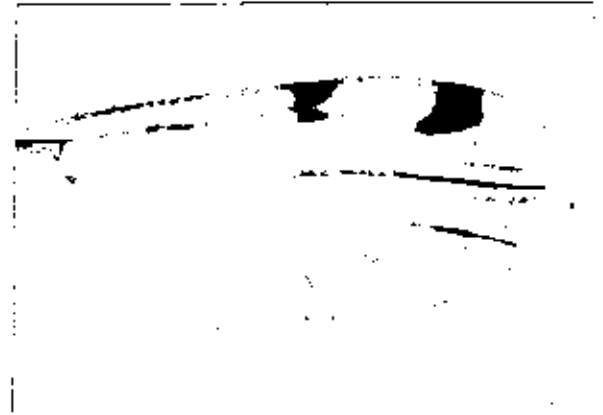
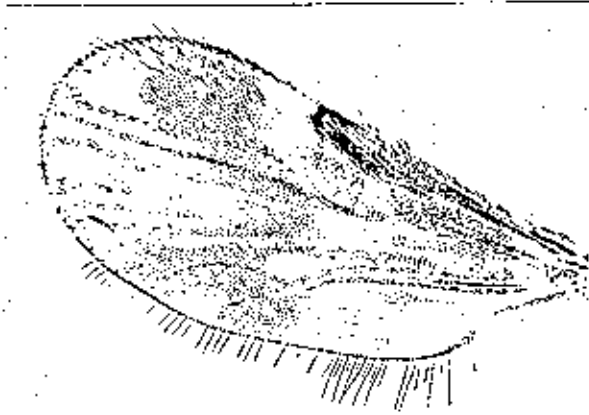
1. Anonymous 1963, Current Pest Control Recommendations. Armed Forces Pest Control Board, Washington, D.C.
2. Bennett, G.F. and Fallis, A.M.. 1960. Blood parasites of birds in Algonquin Park, Ontario, Canada, and a discussion of their transmission. *Canad. Jour. Zool.* 38 : 261 - 273
3. Causey, G.R. 1938. Culicoides of Siam with description of new species. *Amer. Jour. Hyg.* 27 : 399 - 416
4. Dove W.E., D.G. Hall and Hull, J.B 1932. The salt marsh sand fly problem. *Am. Entomol. Soc. Am.* 25(3) : 505 - 522
5. Du Toit, R.M. 1944. The transmission of blue-tongue and horse-sickness by Culicoides. *Onderstepoort Jour. Vet. Sci.* 19 : 7-16
6. Edwards, F.W. 1922. On some Malaya and species of Culicoides, with a note on the genus Lesiochelea *Bull. Ent. Res.* 13 : 161-167
7. Edwards, F.W. 1926. On the British biting midges. *Trans. Ent. Soc. Lond.* 1926 : 389-426.
8. Fallis, A.M. and Wood, F.M. 1957. Biting midges (Diptera : Ceratopogonidae) as intermediate hosts for Haemoproteus of ducks. *Can. J. Zool.* 35 : 425 - 435
9. Foote, Richard H. and Pratt, Harry D.. 1954. The Culicoides of the Eastern United States (Diptera, Heleidae). *Pub. Hlth. Mon.* 18 : 1-10
10. Goetghebuer, M., 1920, Ceratopogoninae de Belgique. *Mon. Mus. Hist. nat. Belg.* 8(3) : 1-116

11. Kettle, D.S., 1962, The binomics and control of Culicoides and Leptoconops (Diptera, Ceratopogonidae = Heleidae). Ann. Rev. Entomol. Soc. Am. 7:401-418.
12. Lawson, J.W.H., 1951, The anatomy and morphology of the early stages Culicoides nuberculosus Meigen (Diptera: Ceratopogonidae = Heleidae). Trans. Roy. Ent. Soc. London, 102 (9):511-574.
13. Lavoipierre, M.M.J., 1958, Studies on the host-parasite relationships of filarial nematodes and their arthropod host. Ann. Trop. Med. Parasite; Liverpool. 52:103-121.
14. Macfie, J.W.S., 1934, Report on collection of Ceratopogonidae from Malaya. Ann. Trop. Med. Parasitol. 28:177-194.
15. Macfie, J.W.S., 1937, Three new species of Culicoides (Diptera: Ceratopogonidae) from Malaya. Ann. Trop. Med. Parasitol. 31(4):469-472.
16. Malloch, J.R., 1955, The Chironomidae, or midges of Illinois, with particular reference to the species occurring in the Illinois River. Bull. Ill. Lab. Nat. Hist. 10:275-543.
17. Megahead, H.N., 1955, A culture method for Culicoides nuberculosus (Meigen), (Diptera: Ceratopogonidae) in the laboratory, with notes on the biology. 107-114.
18. Mukerji, S., 1931, On a new species of Culicoides (Culicoides clavipalpis sp. nov.) with notes on the morphology of the mouth-parts and male terminalia of an Indian Culicoides. Ind. Jour, Med. Res. 18:1051-1058.
19. Price, D.A. and Hardy, W.T., 1954, Isolation of the bluetongue virus from Texas sheep; Culicoides shown to be a vector, Journ. Amer. Vet. Med. Assoc. 124 :255-258.

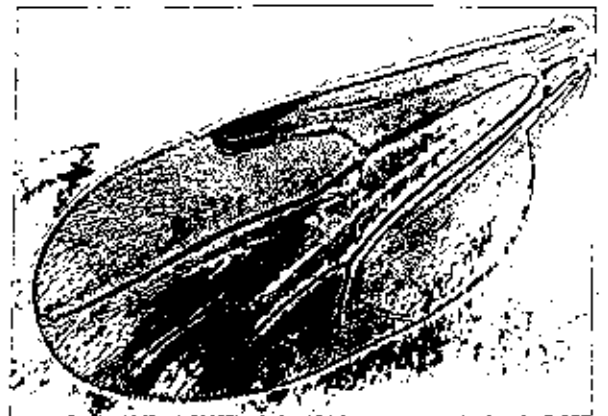
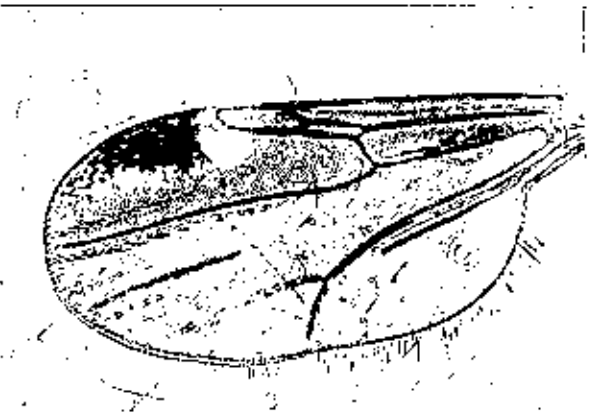
20. Scanlon, John E., 1960, The relationship of *Culicoides* (Diptera: Ceratopogonidae) to the transmission of the virus of eastern equine encephalitis. Unpublished. Ph.D. thesis, Entomology Department, University of Maryland, College Park, Maryland.
21. Sen, P. and Gupta S.K. Das, 1958, Males of *Culicoides anophelis* edw. Bull. Ent. Res. 49(3): 415-416.
22. Smith, R.O.A., 1929, Two species of *Culicoides* which feed on man. Ind. Journ. Med. Res. 17:255-257.
23. Smith, R.O.A. and Swaminath, C.S., 1932, Notes on some *Culicoides* from Assam. Ind. Med. Res. Mem. 25:182-186.
24. Thomson, L.C., 1937, Aquatic Diptera, pt. IV and V. Cornell University, New York.
25. Tokunaga, M., 1937, Sand flies (Ceratopogonidae, Diptera) from Japan Tenthredo 1:233-338.
26. Torre-Bueno, J.R. de la, 1937, A glossary of Entomology. Brooklyn Entomological Society. New York.
27. Wirth W.W. and Hubert A.A., 1959, *Trithecoides*, a new subgenus of *Culicoides* (Diptera, Ceratopogonidae). Pacific Insects 1:1-38.
28. Wirth W.W. and Hubert A.A., 1961, New species and records of Taiwan *Culicoides* (Diptera: Ceratopogonidae). Pacific Insects. 3(1): 11-26.
29. Wirth W.W., 1964, Personal communications.

APPENDIX 1

1. *Culicoides actoni* Smith, 19292. *Culicoides albibasis* Wirth & Hubert, 19593. *Culicoides amamiensis* Tokunaga, 19374. *Culicoides anophelis* Edwards, 19225. *Culicoides arakawai* (Arakawa), 19436. *Culicoides distinctus* Sen. & DasGupta, 1959 (♀)

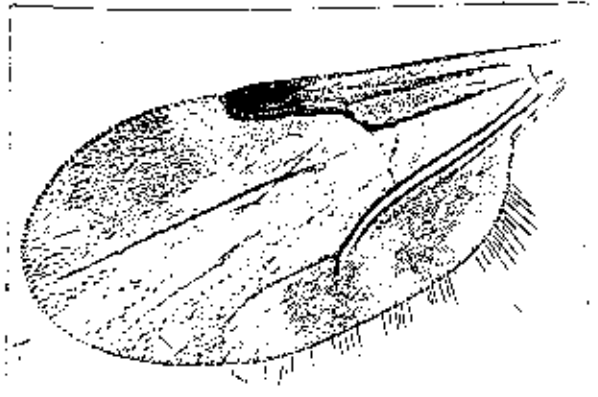
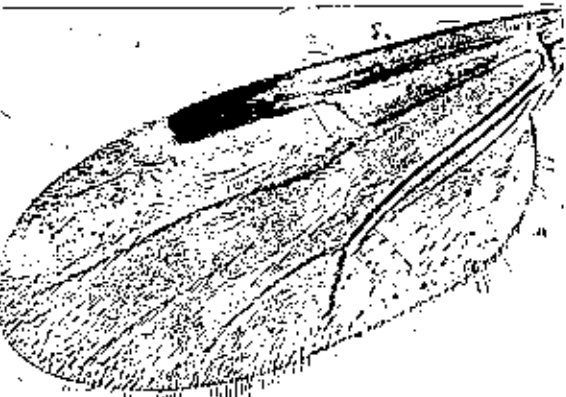


7. *Culicoides distinctus* Sen.&DasGupta, 1959(♂) 8. *Culicoides flavescens* Macfie, 1937



9. *Culicoides flaviscutatus* Wirth & Hubert, 1959

10. *Culicoides geminus* Macfie, 1937



11. *Culicoides guttifer* (Meijere)

12. *Culicoides huffi* Causey, 1938



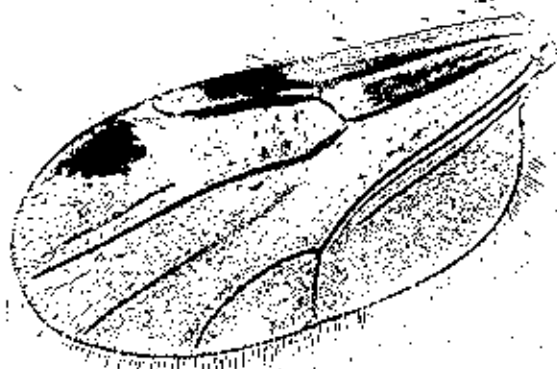
13. *Culicoides humeralis* Okada, 1941



14. *Culicoides mcDowelli* Delf., 1961



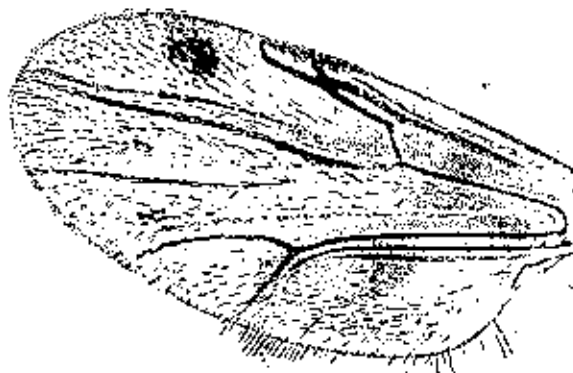
15. *Culicoides orientalis* Macfie



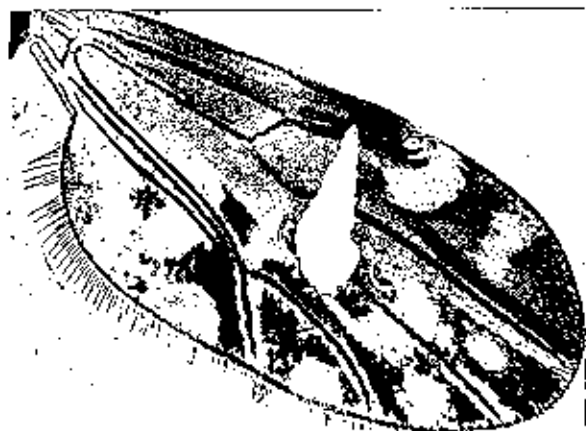
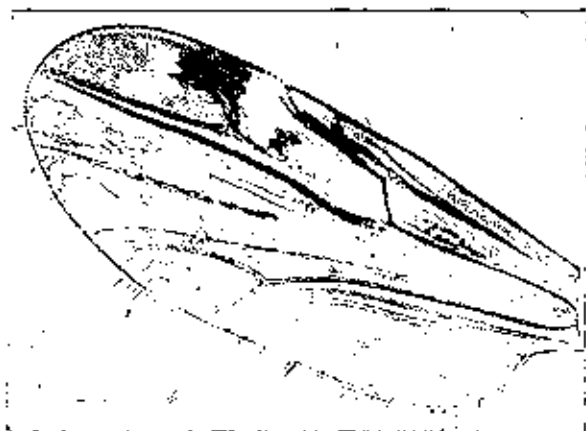
16. *Culicoides palpifer* DasGupta &
Ghosh, 1956



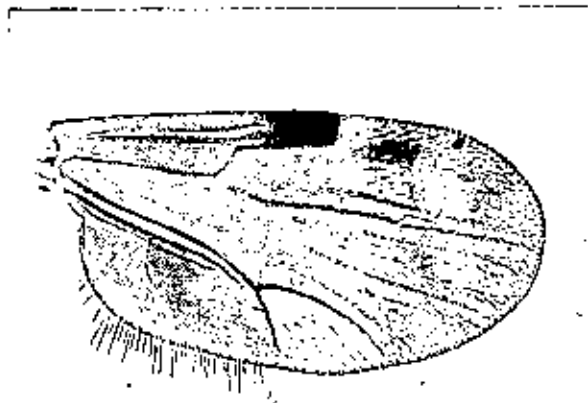
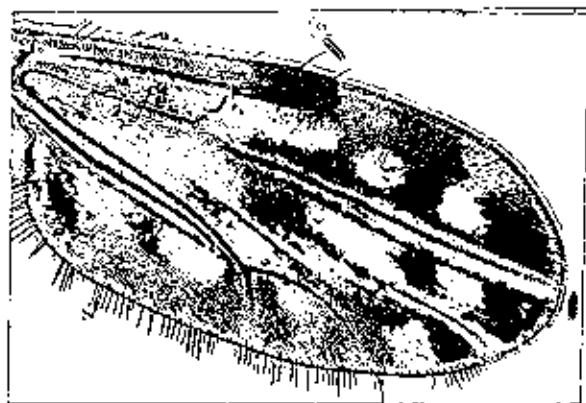
17. *Culicoides paraflavescens* Wirth &
Hubert, 1959



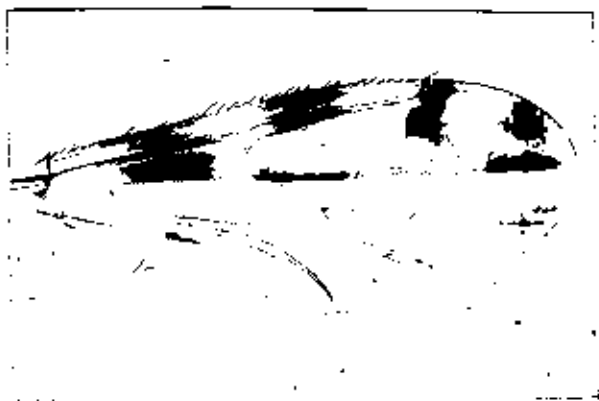
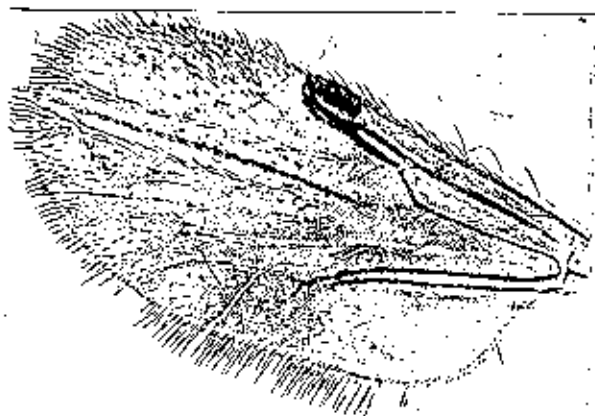
18. *Culicoides pellicouensis* Tokunaga,
1957



19. *Culicoides peregrinus* Kieffer, 1910 20. *Culicoides recurvus* Delfinals, 196

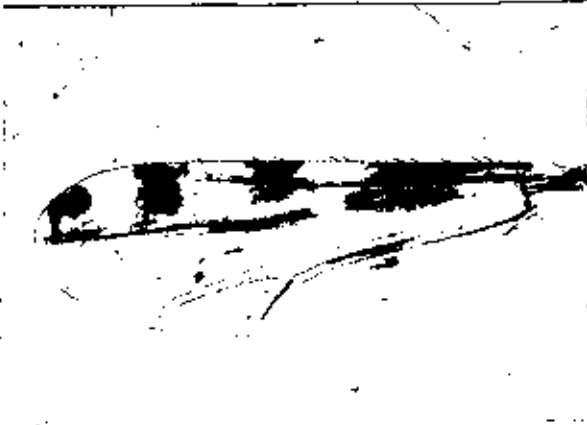


21. *Culicoides schultzei* Enderlein, 1908 22. *Culicoides shortti* Smith & Swaminat

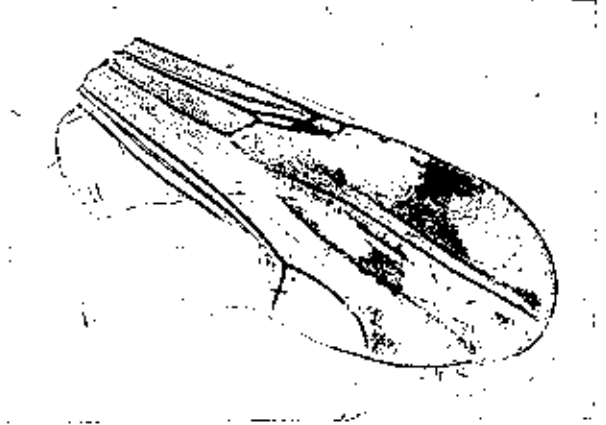


23. *Culicoides similis* Macfie

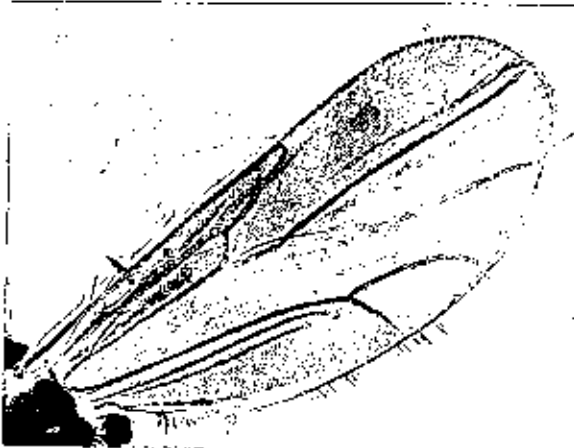
24. *Culicoides* sp. 1 (♀)



25. *Culicoides* sp. 1 (♂)

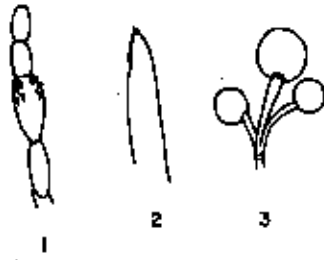
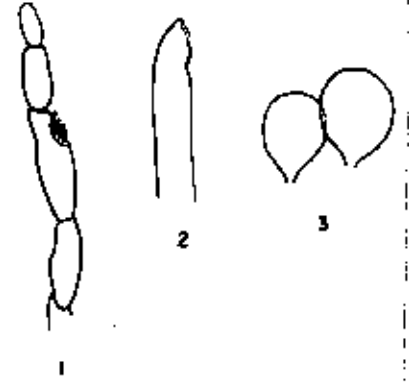
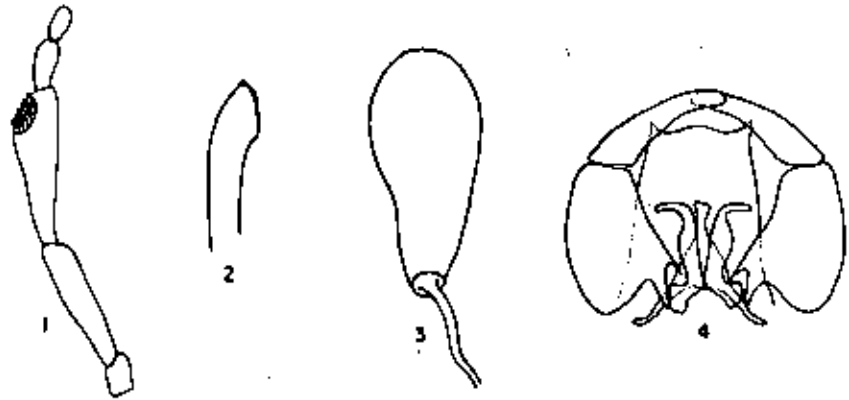
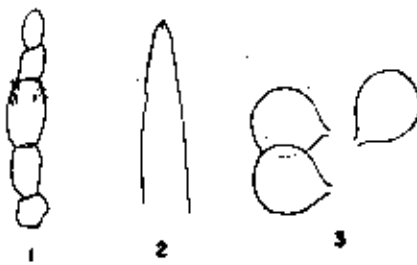
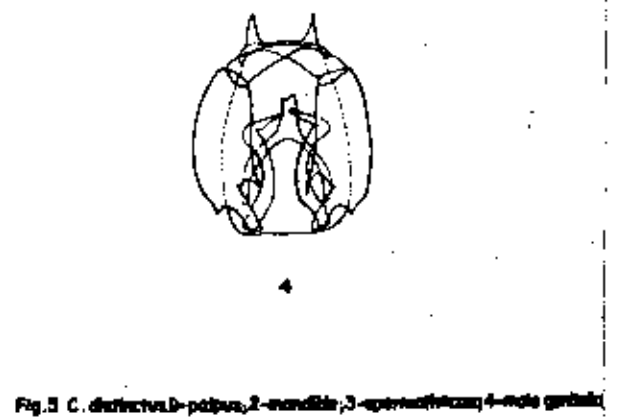
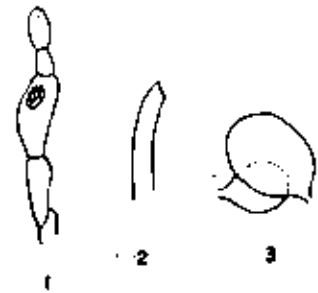
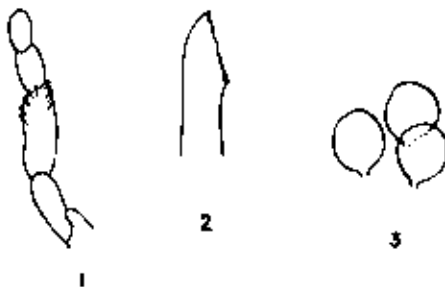


26. *Culicoides* sp. 2



27. *Culicoides* sp. 3

APPENDIX 2

Fig. 1 *C. albicollis* (1-palpus, 2-mandible, 3-spermathecae)Fig. 2 *C. anaminiensis* (1-palpus, 2-mandible, 3-spermathecae)Fig. 3 *C. arcturalis* (1-palpus, 2-mandible, 3-spermatheca, 4-male genitalia)Fig. 4 *C. anapheta* (1-palpus, 2-mandible, 3-spermathecae)Fig. 5 *C. distincta* (1-palpus, 2-mandible, 3-spermatheca, 4-male genitalia)Fig. 6 *C. flavescens* (1-palpus, 2-mandible, 3-spermathecae)

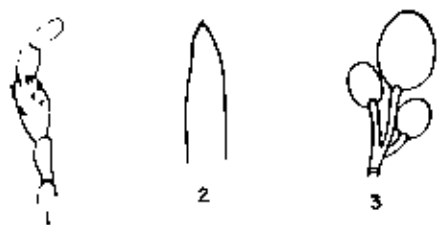


Fig. 7. *C. flavicinctus* (1-palpus, 2-mandible, 3-spermathecae)

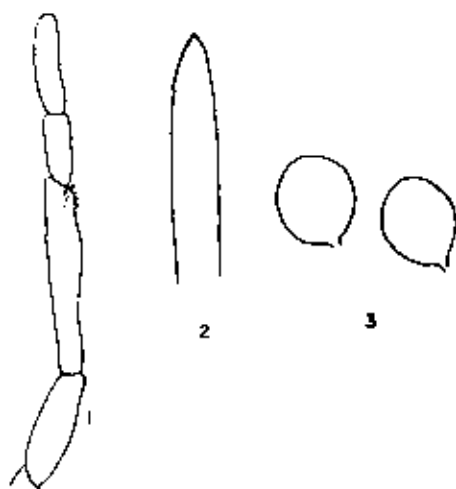


Fig. 9. *C. sp. 1* (gymnopterus group) (1-palpus, 2-mandible, 3-spermathecae)

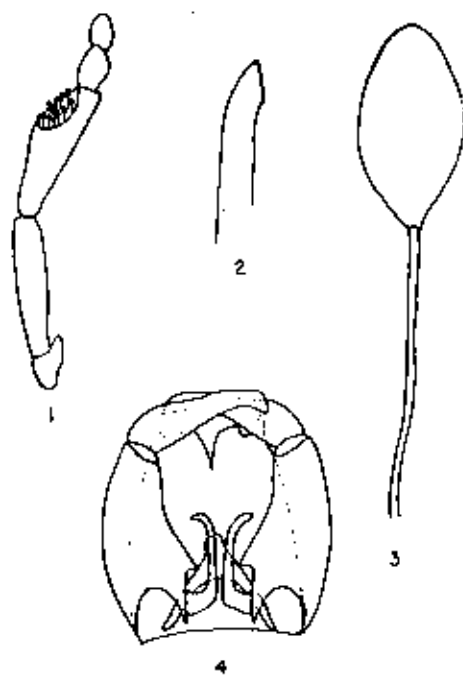


Fig. 8. *C. guttiger* (1-palpus, 2-mandible, 3-spermathecae, 4-male genitalia)

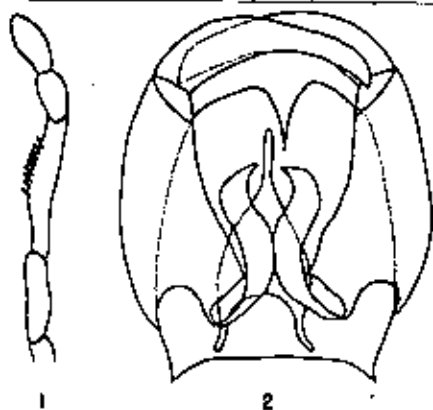


Fig. 10C. *sp. 1* (gymnopterus group) (1-palpus, 2-male genitalia)

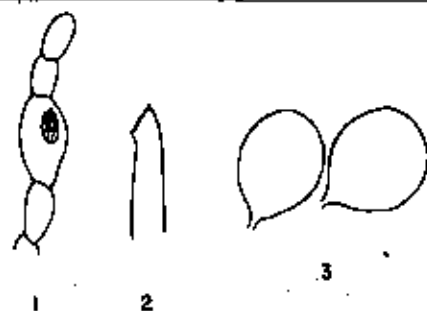


Fig. 12. *C. mcdoowell* (1-palpus, 2-mandible, 3-spermathecae)

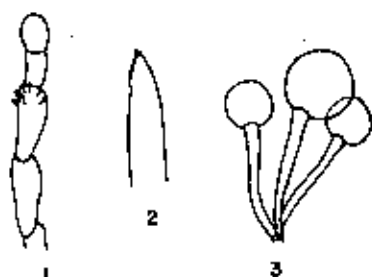


Fig. 11. *C. humeralis* (1-palpus, 2-mandible, 3-spermathecae)

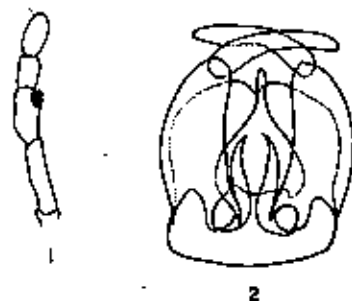


Fig. 13. *C. sp. 2* (orientalis group) (1-palpus, 2-male genitalia)

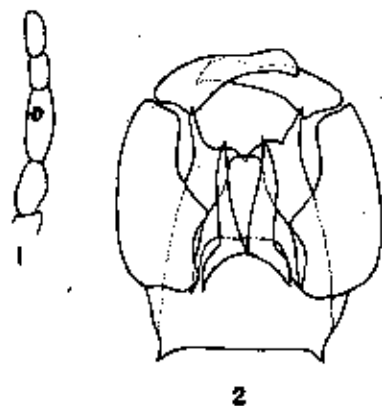


Fig. 14 *C. sp. 3* (arnatus group) (1-palpus, 2-male genitalia)

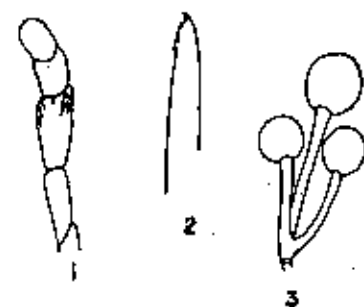


Fig. 15 *C. palifer* (1-palpus, 2-mandible, 3-spermathecae)

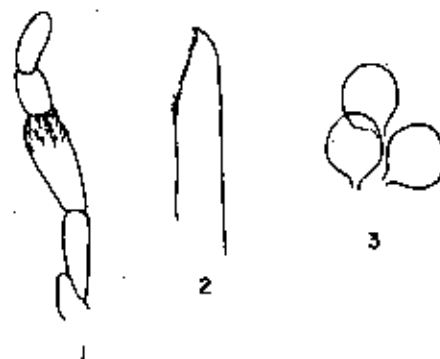


Fig. 16 *C. paraflorescens* (1-palpus, 2-mandible, 3-spermathecae)

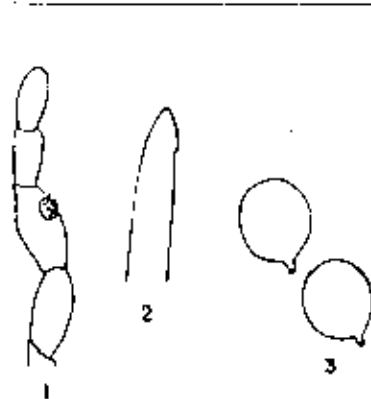


Fig. 17 *C. peregrinus* (1-palpus, 2-mandible, 3-spermathecae, 4-male genitalia)

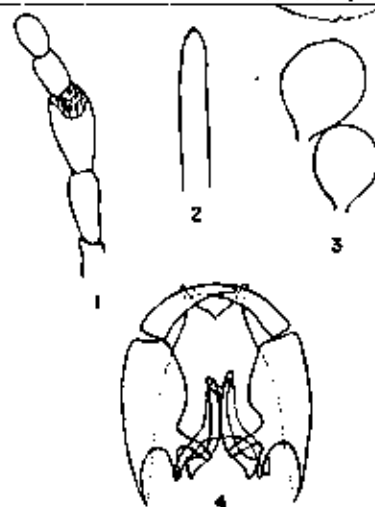
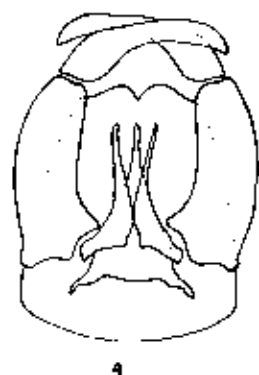


Fig. 18 *C. schultzei* (1-palpus, 2-mandible, 3-spermathecae, 4-male genitalia)

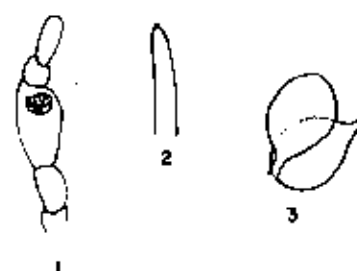


Fig. 19 *C. similis* (1-palpus, 2-mandible, 3-spermathecae)