Species composition of *Culicoides* (Diptera: Ceratopogonidae) found at Chilanga near Lusaka, Zambia

ザンビア、ルサカ近郊チランガにおけるヌカカの種構成

北 岡 茂 男 ・ F. P. ズル

SHIGEO KITAOKA* and F. P. ZULU**

* School of Veterinary Medicine, University of Zambia, Lusaka, Zambia.

**Livestock and Pest Research Centre, National Council for Scientific Research, Chilanga, Zmabia.

* Present address: Niigata Sangyo University, Karuigawa 4730, Kashiwazaki, Japan 945−13. Project funded by Japan International Cooperation Agency, Japan.

ABSTRACT. Species composition and seasonal incidence of the *Culicoides* spp. were studied using light-trap at Chilanga near Lusaka, Zambia. Twenty-nine species of *Culicoides* collected in one year's survey period from February, 1986 to February, 1987 and this included five new species. The results obtained by this and related surveys suggested that *C. imicola* is a complex of morphologically similar species.

Key words : *Culicoides, C. imicola, C. zuluensis,*
seasonal incidence, Zambia

INTRODUCTION

The genus *Culicoides* Latreille is a group of blood sucking ceratopogonids which is the largest genus in the family, comprising of more than 1,000 species in the world, and out of which about 140 species are found in Africa south of the Sahara (Wirth et al, 1980).

Culicoides biting midges are potential vectors of protozoa and Nematoda parasites in man and animals (Linley, 1985). They are also very important vectors of various animal viruses particlarly in Africa. Du Toit (1944) proved that *Culicoides* were responsible for bluetongue of sheep and horsesickness in South Africa. Later bovine ephemeral fever, Nyabira, Palyam and Akabane viruses were isolated from *Culicoides* spp. (Theodridis et al, 1979). Akabane virus can cause outbreaks of abortions and epidemics of congenital arthrogryposis-hydroencephaly syndrome in cattle. Such outbreaks of the disease have been reported from Japan, Australia and the Middle East. Recently Blackburn et al (1985) made four isolates of the Akabane virus from *C. imicola* in Zimbabwe. Wirth and Dyce (1985) reviewed world wide information on the relationship between *Culicoides*

spp. and bluetongue viruses.

No information is available on either the *Culicoides* or *Culicoides*-borne diseases in Zambia. Therefore, this study was conducted in order to observe the main zoophilic species of *Culicoides* and their seasonal incidence and to provide a basis for future work related to *Culicoides*-borne diseases of livestock in this country.

METHOD

Sampling

Collections were made at the Livestock and Pest Research centre of National Council for Scientific Research at Chilanga (15° 54'S, 28° 35'E) near Lusaka, Zambia. To select a suitable setting site, preliminary catches were made between 7 February and 7 March, 1986 between 17.00 hours and 08.00 hours the next day in the following places; a chicken run, rabbity, animal house with several steers, guineapig run and cattle paddock. The guineapig run proved to the best site in insect catches and therefore collections were made here once a week for 52 nights between 7 February, 1986 and 24 February, 1987. Besides, extensive light-trap collections were carried out to obtain representative samples of the *Culicoides* in different localities throughout Zambia.

For sample collection a light trap designed by the senior worker was employed. The apparatus consists of a cylinder 22.5 cm diameter, with both ends open. Near the top of the cylinder is a wire mesh of 12 grids, and close to the bottom is a 80-mesh stainless gauze small enough to hold microscopic insects. Attached to bottom of the cylinder is a suction fan and at the very top is a blacklight fluorescent tube (National, FL6BLB).

As the insects get attracted to the light, they are sucked into the cylinder by the fan. The larger insects remain on the top mesh whereas the finer ones go to the bottom. The cylinder part is detachable to carry to the laboratory. The samples of the total catch were preserved in 70 % alcohol, but in general the midges in those samples are active the next morning and can serve for laboratory culture and/or for virus isolation.

Identification of species

Culicoides species were sorted out under a stereo-microscope and were identified to species level primarily on body size and wing characters using the keys of Khamala and Kettle (1971) and Boorman and Dipeolu (1979). Selected or unidentifiable specimen were mounted in balsam by the method of Wirth and Marston (1968). Mounted specimens were identified by comparison with original descriptions as well as with the holotypes, paratypes and reference specimens offered or loaned by several workers.

RESULTS AND DISCUSSION

Table 1 is the summarized data of number of unfed and fed females of the main 13 species caught in the 52 trap-nights and the total number of species recorded per month. The names of the remaining 16 species are shown under the table in order of abundance. Only 45 male specimens were collected and these were sproradically recorded.

Species diversity was greatest in February and least in June. *C. zuluensis* de Meillon, 1935 and *C. imicola* Kieffer, 1913 were the most abundant species around the guineapig run and they constituted about 40.8%, and 34.8%, respectively of the total population of *Culicoides* spp. The population of *C. zuluensis* generally seemed to decline gradually

throughout the year from a peak around February and March and appeared to rise again slightly the next February (Table1). The population of *C. imicola* was also highest around February, then declined sharply until Decemder, rising slightly again the next February. However, to evaluate the results on the abundance and seasonal of the two species, extra information such as the larval habitats, meteorological data, etc. is required.

Nevertheless correlation between habitats, seasonal variations, etc, and the abundance of *Culicoides* spp. could still be inferred. For example, Braverman and Phelps (1981) reported that *C. imicola*, *C. zuluensis* and *C. milnei* were dominant species in a poultry farm near Harare, Zimbabwe in March, and the largest numbers were caught in March, April and May. Braverman (1978) also recorded a rather limited number of *C. imicola* and and *C. zuluensis* from the edge of water bodies in the Harare area. Therefore all habitats found required a source of water, in most cases rain water, although the connection with rainfall was often delayed.

The present survey started in the midst of the rainy season and no rain was observed between 23 April and 9 October. The decrease in the population density of *C. zuluensis* and *C. imicola* might be related to the completely dry weather between June and September. However, it is thought that some limited stable habitats may sustaining the larval population of the two species throughout the year. Minimum temperatures were recorded between June and August. These were constantly less than 10℃, getting to as low as 3.6℃ on 4 June, the day of the catch-night. Low temperatures could be inhibitory to breeding and/or flying activity of midges as shown by the few catches and least species diversity between

June and July.

The results in Table 1 show that most species collected fed on the host animals, possibly on guineapigs. *C. zuluensis* and *C. imicola* are known to feed on large animals (Walker, 1976 ; Braverman and Phelps, 1981). A similar habit was observed in the preliminary collections in the cattle shed.

Wirth and Dyce (1985) recently reviewed on the texonomic problem of the *Colicoides* related with bluetongue worldwide. They concluded that *C. imicola* is the most important species on cattle, followed by *milnei* and *schultzei* groups in Africa. *C. zuluensis*, *C. krameri* and *C. moreli* are species of *milnei* group. Earlier workers in *Culicoldes* in Africa used the name *C. schultzei* for the common species of this group. However, Cornet (personal communication) recognized 6 species in this group including 3 new species which have been temporarily designated as *C.* CE, *C.* CN and *C.*CS by us. Wirth and Dyce (1985) also noticed that the so-called *imicola* is a complex of many species which are extremely similar morphologically and also probably in their breeding and feeding habits as in their ability to transmit the bluetongue virus. Meiswinkel (personal communication) identified 17 species in the subgenus *Avaritia* or *imicola* group in South Africa, including 10 new species. The senior author recorded 15 species in the subgenus *Avaritia* in Zambia, including Meiswinkel's two new species and other 5 new species. Three of our new species *C.* A−1 *C.* A−10 have been collected from Chilanga. *C.* A−1 and *C.* A−10 and members of *brossetti* subgroup of the subgenus *Avariria* together with Meiswinkel's *C.* #70, which have two yellowish vittae on thorax. *C.* A−2 is closely related to *C. imicola*, but it has wider 1st and 2nd dark costal markings and a non-interrupted dark streak over vein m_2. In all about 25 new

species have been recorded in Zambia are expected to be described by the senior author elsewhere in future.

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Table 1. Monthly number of dominant 13 species of *Culicoides* caught with light trap around guineapig run at Chilanga between February 1986 and February 1987 and name list of lesser 16 species recorded.
*Number of catch night **Number of fed females

	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	Total
	2*	4	4	4	4	5	4	5	4	4	5	3	4	52
1. *zuluensis*	1517(16)**	415(12)	318	489(18)	188	260(1)	91(7)	130	58	47	145	33	293(14)	3984(68)
2. *imicola*	887(30)	568(16)	41	404(12)	105	94(1)	106(17)	68	473(2)	86	113	8	385	3338(78)
3. *krameri*	394	101	0	32(12)	0	41(1)	7(1)	10	0	0	1	1	7(1)	594(15)
4. *moreli*	161(24)	121(30)	1	90(6)	0	3	85(15)	1	0	1	0	0	2	465(75)
5. A−1 sp. n.	112(16)	56	8	82(8)	1	9	35	9	0	1	1	5	25	344(24)
6. *brucei*	22	8	18	13(2)	4	5	4	15	27	23	38	5	16	198(2)
7. CE	77	30	2	36(2)	0	8(1)	13	0	1	0	1	0	15	183(3)
8. *leucostictus*	66	17	1	0	0	9	1	2	10	2	2	0	2	112
9. A−2 sp. n.	52	16	5	1	0	0	1	0	0	0	1	0	5	81
10. *fulvithorax*	44	24	0	6(2)	0	0	1(1)	0	0	0	2	0	2	79(3)
11. *grahamii*	21	22(4)	0	0	0	0	0	2	0	0	1	0	0	46(4)
12. *pycnostictus*	11	6	0	0	0	0	0	3	4	3	2	0	0	29
13. *nivosus*	7	5	0	2	0	0	6	3	1	1	1	0	0	27
Number of species	22	14	9	12	4	9	12	17	11	10	19	5	15	

14. CN
15. *gulbenkiani*
16. *coarctatus*
17. *dekeyseri*
18. *neavei*
19. *translucens*
20. *gambiae*
21. *nigripennis*
22. *walkeri*
23. *accraensis*
24. *exspectaror*
25. *huambensis*
26. *ravus*
27. F sp. n.
28. A−10 sp. n.
29. T−1 sp. n.