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SEASONAL ABUNDANCE AND PARITY OF *CULICOIDES* BITING MIDGES ASSOCIATED WITH LIVESTOCK AT ROMA, LESOTHO (DIPTERA: CERATOPOGONIDAE)

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ABSTRACT

VENTER, G. J. & SWEATMAN, G. K., 1989. Seasonal abundance and parity of *Culicoides* biting midges associated with livestock at Roma, Lesotho (Diptera: Ceratopogonidae). *Onderstepoort Journal of Veterinary Research*, 56, 173–177 (1989).

A light-trap survey was undertaken of the species composition, seasonal abundance and parity of *Culicoides* at Roma, Lesotho, to establish whether the likely vectors for bluetongue and African horse sickness occur in this area as well as the chance of transmission. A total of 34 catches was made between 21 September 1985 and 24 September 1986; 32 819 *Culicoides* were caught belonging to 19 species. *Culicoides* numbers rapidly built up from December to a peak in February which implies that this may also be the optimum time for virus transmission. The number of *Culicoides* dropped sharply in April with the onset of cooler conditions.

C. zuluensis was the dominant species forming 69,6 % of the totalled catches, followed by *C. pycnostictus* with 11,7 %. *C. imicola*, the only proven vector of bluetongue, was never abundant representing only 4,4 % of the midges caught. The parous rate for each of the 2 commonest species was low, implying a low vector capacity.

INTRODUCTION

Bluetongue and African horse sickness occurs yearly in Lesotho (Howell, 1963; Ozawa, 1985). Questionnaires to veterinarians have also shown that cases of bluetongue and African horse sickness are both common in areas adjacent to Lesotho (G. J. Venter, unpublished data, 1986).

Culicoides imicola is so far the only proven vector of bluetongue in South Africa (Du Toit, 1944). *C. imicola* is also the most abundant *Culicoides* species associated with livestock in the southern African summer rainfall region of which Lesotho also forms part (Nevill & Anderson, 1972; Nevill, 1967; Venter, Nevill & Meiswinkel, 1987). However, in the colder higher areas of South Africa where the climatic regimes are similar to that of Lesotho *C. imicola* is absent or relatively scarce (R. Meiswinkel, Veterinary Research Institute, Onderstepoort, personal communication, 1988). Although *C. imicola* (under the name of *C. pallidipennis*) has already been recorded by De Meillon (1959) from Lesotho no quantitative studies have yet been done.

The opportunity arose to collect in Lesotho when one of us (G.K.S.) accepted a contract to work there for a year. It was decided to undertake (i) a restricted survey of the *Culicoides* in the Roma area of western Lesotho to establish if *C. imicola* or other species of the subgenus *Avaritia* were prevalent, and (ii) to gain insight into the species composition, abundance and vector potential of those *Culicoides* present.

MATERIAL AND METHODS

Study area

Light-trap collections were made at St. Mary's High School in Roma, western Lesotho. Roma (29° 27′ S, 27° 45′ E) is situated on the temperate eastern plateau 35 km south-east of Maseru, the capital of Lesotho. The height above sea-level is 1 690 m with severe frost occurring in winter. During this study records of maximum and minimum temperatures and rainfall for 10 of the 13 months were kept by G.K.S. (Fig. 1). However, as long-term weather records were not available for Roma those for nearby Ladybrand (29° 10′ S, 27° 45′ E, Ht = 1 612 m), whose climate closely resembles that of Roma, were used for a description of the general climate for this area. The mean daily maximum and minimum January temperatures (summer) for this area as measured at Ladybrand are respectively 27,3 °C and 13,3 °C. The mean daily maximum and minimum winter temperatures as measured for July (winter) are respectively 15,4 °C and 0,1 °C. The mean daily minimum temperature for May to August is below 4 °C (S.A. Weather Bureau, 1986).

This is a sub-humid summer rainfall area and semi-arid. The mean annual rainfall for the area is 750 mm, with most rain falling in summer between November and April (Walton, 1984).

Acocks (1975) describes the natural vegetation of the area as *Cymbopogon-Themeda* veld (sandy). Roma, however, is situated near the border of the *Festuca*-Alpine veld. Both these are pure grassveld types.

Light-trap collections

A commercially available 220 volt down-draught suction light-trap equipped with an 8 W black-light tube was used. The trap was permanently sited under the eaves of an open barn which nightly housed 12 cattle. Within 300 m of the trap were a few sheep, chickens and pigs, but no horses.

Collections were made directly into water to which 0,5 % "Savlon"[1] antiseptic has been added. The "Savlon" acts as a wetting agent and as a cleansing and bactericidal agent (Walker & Boreham, 1976a). On trap nights the light-trap was run from before dusk until after dawn so that both twilight periods were sampled. The next morning the catch was transferred into 80 % ethyl alcohol and stored for later analysis.

A total of 34 catches was made between 21 September 1985 and 24 September 1986. The catches for June were very small and therefore no collecting was done in the mid-winter months of July and August. Collections were sorted by G.J.V. into species and sex. The females were categorized as to whether nulliparous, bloodfed, gravid or parous according to the method of Dyce (1969). Since gravid individuals are also parous these 2 categories were combined in the

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TABLE 1 Monthly variation in *Culicoides* species composition of light-trap catches at Roma, Lesotho, 1985–1986 (percentages)

Month	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Totals & means
No. of collections	2	2	6	3	4	3	4	3	3	1	0	0	3	34
Total number of midges	734	480	3 572	2 007	6 121	10 922	6 576	2 007	3	5	0	0	393	32 819
Species:														
C. zuluensis	41,2	76,9	54,7	74,5	66,0	79,4	82,4	85,0		80,0			89,4	69,61
C. pycnostictus	11,7	10,5	22,9	18,1	18,3	6,6	4,2	1,3		20,0			3,6	11,73
C. magnus	7,5	2,7	4,0	1,3	1,3	2,8	2,1	1,3					1,7	2,50
Culicoides sp. 35*	33,8	5,0	7,6	3,0	4,6	3,4	2,3	2,4					2,3	5,80
C. distinctipennis	0,2	3,2	1,7	1,4	1,9	1,1	0,7	0,1					0,3	1,07
C. nivosus		0,6	5,3	0,8	1,1	0,6	0,2						0,4	1,37
C. engubandei	5,2	0,3	0,2	0,2	4,5	1,6	2,5	0,3					1,7	1,47
C. neavei		0,7	1,8	0,2	0,7	0,7	0,1	0,03						0,54
C. imicola	0,3			0,1	0,7	2,3	1,9	6,5	100,0				0,2	4,44
C. bedfordi			0,8	0,1	0,1	0,1	0,1							0,19
C. bolitinos	0,1				0,3	0,9	3,2	2,7					0,2	0,82
C. brucei		0,3	0,1	0,03	0,1	0,1	0,3	0,3						0,12
C. cornutus			0,1		0,4	0,2	0,03	0,03						0,08
C. coarctatus					0,2	0,1	0,1							0,04
C. onderstepoortensis	0,3			0,1	0,1	0,04							0,1	0,05
C. nigripennis grp.			0,02		0,1		0,03							0,01
C. similis			0,8											0,15
C. exspectator					0,1									<0,01
C. gulbenkiani						0,01								<0,01

* *Culicoides* sp. 35 is a member of the *C. schultzei* group (R. Meiswinkel, Veterinary Research Institute, Onderstepoort, unpublished data, 1988)

histograms for easier comparison with the nulliparous category.

RESULTS AND DISCUSSION

Table 1 gives a list of the species which were present, their percentage relative abundance for each month and shows how many catches were made each month. Fig. 1 shows the actual numbers of *Culicoides* for each month compared with the mean monthly maximum and minimum temperatures and the total monthly rainfall for Roma for this period.

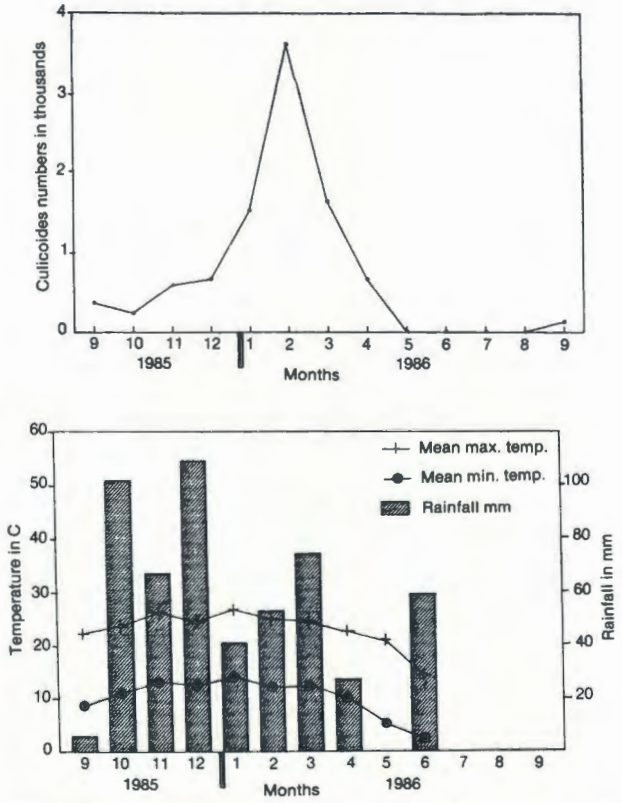

FIG. 1 Monthly variations in *Culicoides* numbers caught in a light-trap at Roma, Lesotho compared with the mean minimum and maximum temperatures and total rainfall, as measured at Roma, for each month.

A total of 32 819 *Culicoides* were caught giving a mean of 965 *Culicoides* per catch. Nineteen species were represented of which *C. zuluensis* (69,61 %) was the dominant species followed by *C. pycnostictus* (11,73 %). *Culicoides* numbers built up rapidly from December to a peak in February followed by a sharp drop in April with only very low numbers present in May and June. The peak in *Culicoides* numbers occurred about 2 months after the peak in rainfall while the drop in numbers coincided with the drop in temperature as winter approached. There was a seasonal increase in the number of species from only 9 species in September to 17 species in January.

Callot, Krêmer & Molet (1973) described 2 new species from Lesotho, namely *C. bassetorum* and *C. galliardi*. R. Meiswinkel (Veterinary Research Institute, Onderstepoort, personal communication, 1988) believes *C. bassetorum* to be a synonym for *C. onderstepoortensis* which was collected in small numbers in this study. *C. galliardi* was not collected. A discussion of the 2 dominant species and *C. imicola* follows.

C. zuluensis

This was the dominant species for the entire collection period ranging from 41,2 % in September 1985 up to 89,4 % in September 1986 (mean 69,61 %) (Table 1). There was a rapid build-up in *C. zuluensis* numbers from December until February followed by a drop (Fig. 2). *C. zuluensis* is one of the 10 most common species associated with livestock in South Africa (Venter *et al.*, 1987). It is the dominant species at Stutterheim in the eastern Cape and in the winter months at Stellenbosch.

It is seldom collected in the warmer Northern Transvaal (G. J. Venter, unpublished data, 1988).

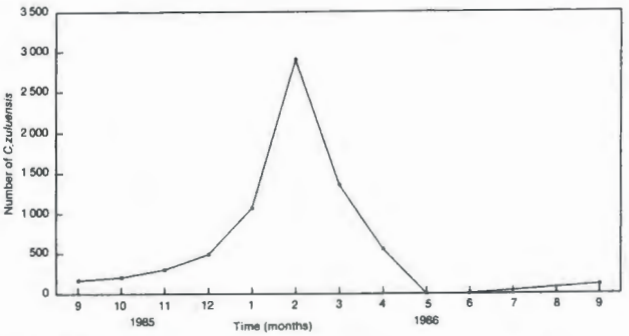

FIG. 2 Monthly variation in *C. zuluensis* numbers caught in a light-trap at Roma, Lesotho.

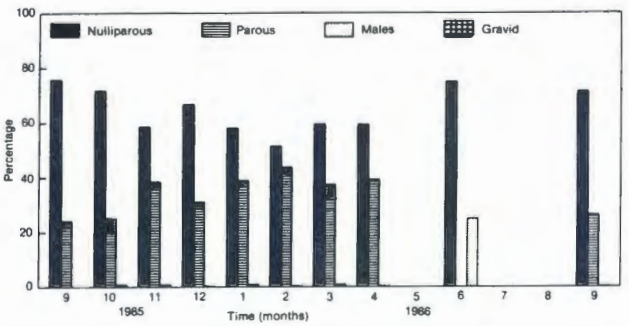

FIG. 3 Monthly variation in nulliparity, parous rate, gravid females and males of *C. zuluensis* caught in a light-trap at Roma, Lesotho.

Nulliparous individuals accounted for the major part of the catch, with a mean of 64,9 % for the entire collection period. This would reduce the chance of virus transmission. In September and October (spring) the percentage nulliparous was above the mean namely 73,9 % while the mean for January–April (summer/autumn) was only 57,0 % (Fig. 3). There was a corresponding increase in the percentage parous individuals from 21,0 % in September and October to 38,1 % in January–April. The continuous recruitment of nulliparous females into the host-seeking population throughout the season suggests that the population is multi-voltine and anautogenous (Mullens & Schmidtmann, 1982).

Akey & Barnard (1983) found for *C. variipennis* in North Colorado that the age structure of air-borne females changed from one composed principally of nulliparous females in April and May (spring) to one consisting mainly of parous females during June through August (summer), and finally the complete absence of nulliparous females in early October (autumn). The same trend was found here, but not as dramatic as there was only a slight drop in nulliparous females towards the end of the season.

The percentage males and gravid females was low during the entire period (Fig. 3). This suggests that they were not attracted to the light-trap or that the light-trap was not situated near a breeding-site for this species. The mean percentage of bloodfeds was 1,9 % which is higher than usual because for light-trap samples in general the percentage of bloodfed females is <1,0 (Walker & Boreham, 1976b). This can be because the trap was situated near cattle (Walker, 1977).

Virus isolations were not attempted in this study but to date no known viruses have been isolated from *C. zuluensis*. Phelps, Blackburn & Searle (1982) isolated a few unidentified viruses from *C. zuluensis* in Zimbabwe while in South Africa an undescribed orbivirus was isolated from *C. zuluensis* (B.J. Erasmus, unpublished data, Veterinary Research Institute, Onderstepoort, 1987).

C. pycnostictus

This was the 2nd most abundant species. The peak in numbers of *C. pycnostictus* was in March but the increase started in November and not in December as for *C. zuluensis* (Fig. 4). *C. pycnostictus* also has a wide distribution in South Africa (Venter *et al.*, 1987). It was the dominant species at Middelburg (Cape) and Ermelo in the Transvaal (G. J. Venter, unpublished data, Veterinary Research Institute, Onderstepoort, 1987). According to Jupp, McIntosh & Nevill (1980) this is also the dominant species in the Karoo.

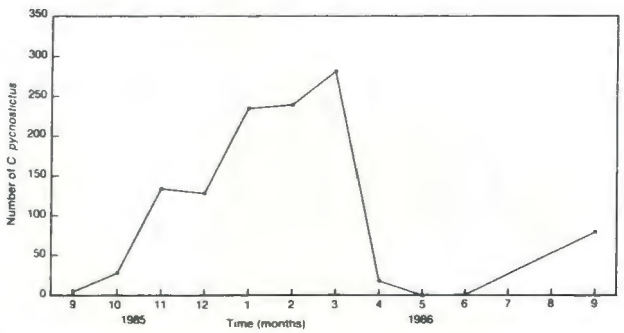

FIG. 4 Monthly variations in *C. pycnostictus* numbers caught in a light-trap at Roma, Lesotho.

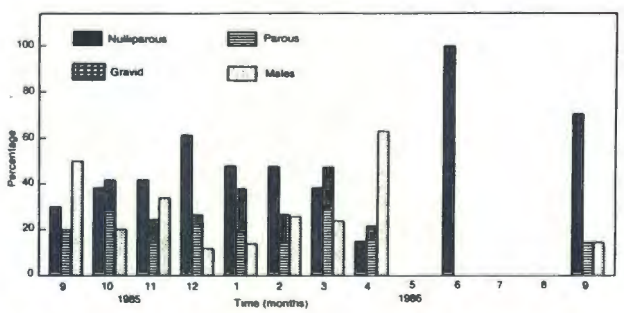

FIG. 5 Monthly variations in nulliparity, parous rate, gravid females and males of *C. pycnostictus* caught in a light-trap at Roma, Lesotho.

The overall percentage nulliparous *C. pycnostictus* was lower than for *C. zuluensis*, namely 49,1 % (Fig. 5). The average percentage parous individuals was 19,8 %, also lower than for *C. zuluensis*. The percentage males and gravid females was higher than for *C. zuluensis*, namely 9,2 % and 28,6 %. The reason for this can be that the light-trap was situated near the breeding site for this species or that the males and gravid females of this species are more attracted to the light-trap than are *C. zuluensis*. No bloodfeds were trapped.

Although bluetongue has been isolated from *C. pycnostictus* (B. J. Erasmus, Veterinary Research Institute, unpublished data, 1987), this species has been shown to feed predominantly on birds (Nevill, Van Gas & Kemp, 1987; Nevill & Anderson, 1972).

C. imicola

C. imicola was regularly present in collections from December up to May but never accounted for more than 6,5 % of the catch. In May 1986 it accounted for 100 % of the catch but seeing that a total of only 3 *Culicoides* were caught in 3 nights this figure can be ignored. Peak numbers were also found in February with the same build-up and sharp decline as was found for *C. zuluensis*.

The percentage nulliparous *C. imicola* for the whole period was 36,4 % and the percentage parous was 33,4 %.

CONCLUSIONS

Although there was no great variety in species composition, the numbers of *Culicoides* were relatively high. This can be because the light-trap was permanently stationed at one point in the vicinity of farm animals (Nevill, Venter, Edwardes, Pajor, Meiswinkel & Van Gas, 1988).

The peak in *Culicoides* numbers was found in February, which makes this the most likely time for virus transfer. The parous rate for the 2 most abundant species, namely *C. zuluensis* and *C. pycnostictus*, was low over the entire period although it increased slightly as the season progressed. Seeing that only parous *Culicoides* transfer virus (Nelson & Scrivani, 1972) the results of this study point to a low vector capacity for these 2 species. Furthermore, since *C. pycnostictus* is predominantly a bird-feeder this still further reduces the chance of this species being a vector of bluetongue and African horse sickness viruses, although it could be of importance as a vector of bird or poultry pathogens. The low numbers of the other species encountered make the calculation of the parous rates for them unreliable and their low numbers would in any case preclude them from playing a serious role in disease transmission.

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