

Biting of anthropophilic *Culicoides fulvithorax* (Diptera: Ceratopogonidae), a vector of *Mansonella perstans* in Nigeria

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Abstract: Anthropophilic *Culicoides* were investigated in a rural community endemic for *Mansonella perstans* in Ijebu North area of western Nigeria between December 2003 and October 2004. Three hundred and fifty-nine adults of *Culicoides fulvithorax* collected by human bait in the morning were dissected for *Mansonella perstans* larvae, and 1.95% of infection rate was found. Seasonal abundance of *C. fulvithorax* was investigated by monthly biting rates, and showed that higher prevalence was observed in rainy season, with peak in September. *Culicoides* prevalence was positively correlated with rainfall and relative humidity, but not temperature. Human perceptions on the behavior of these biting midges were determined by interviewing 854 self-selected villagers, of which 86.5% of the interviewees confessed having experienced *Culicoides* bites. Between 76.5 and 99.1% of the various age groups complained body reactions to *Culicoides* bites. Itching was the most frequent body reaction. No interviewees associated *Culicoides* with transmission of any parasitic infections. The results showed need to adequately control *Culicoides* in the community.

Key words: anthropophilic *Culicoides*, midge, biting rates, human perceptions, itching, swelling, ignorance, Nigeria

INTRODUCTION

Culicoides biting midges are hematophagous ceratopogonid insects which occur throughout most of the inhabited world, transmitting some disease-causing pathogens of humans, and domestic or wild animals (Muirhead-Thomson, 1982; WHO, 1984). Therefore, literature is replete with information on studies on

these insects from different parts of the world (Noireau et al., 1990; Conte et al., 2003; Mercer et al., 2003). To the best of our knowledge, most of the previous *Culicoides* studies from Nigeria were associated with wild or domestic animals (Dipeolu, 1976a, 1976b; Dipeolu and Ogunrinade, 1977; Udonsi, 1988), and none assessed human biting rates.

Perstans filariasis, caused by *Mansonella perstans*, occurs in Africa and South America (Heyneman, 2004) and has been reported from many parts of Nigeria. In the northern part of Nigeria, Wijeyaratne et al. (1982) reported 14.6% prevalence of *M. perstans* from the

• Received 19 April 2005, accepted after revision 6 October 2005.

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Malumfashi district. Anosike (1994) reported 1.4% prevalence from the north-western zone of Bauchi State, northern Nigeria. In the eastern part of Nigeria, Arene and Atu (1986) reported 47% prevalence of *M. perstans* from the Niger Delta area. In the Igun River basin (eastern Nigeria), Udonsi (1988) reported 13.4% prevalence of *M. perstans*. In the central part of Nigeria, Ufomadu et al. (1991) reported 6.8% prevalence of *M. perstans*. In the western part of Nigeria, Oyerinde et al. (1988) reported 0.8% prevalence of *M. perstans* in a hospital-based filariasis survey in metropolitan Lagos. In a relatively recent study, *M. perstans* infection (3.2% prevalence) was reported for the first time from Ijebu North area of western Nigeria (Agbolade and Akinboye, 2001).

In view of the veterinary and medical importance of *Culicoides*, the need for a longitudinal study to understand the biting rates and human perception of the biting midges in Ijebu North area of western Nigeria cannot be over-emphasized since this will enhance establishment of meaningful control strategies. Due to the problem of inaccessibility to many villages in the area, the decision to use one of the villages for case study was taken. The present study aimed at determining the monthly biting rates, filarial infection rate and human perception on the behavior and bites of anthropophilic *Culicoides* in a rural community endemic for *M. perstans* in Ijebu North area of western Nigeria.

MATERIALS AND METHODS

Study area and sampling sites

This study was carried out in Mamu village in Ijebu North Local Government area of Ogun State, western Nigeria. The village has abundance of shrubs, grasses and banana plants which flanked several residences, schools and other places of human activities. The village lies between latitudes 7° 04' and 7° 06' N, and longitudes 3° 52' and 3° 55' E in the rainforest zone and has been previously described (Agbolade and Akinboye, 2001). Four *Culicoides* sampling sites, located at 4 different areas of the village, were chosen (Fig. 1). Site A was located near the community health cen-

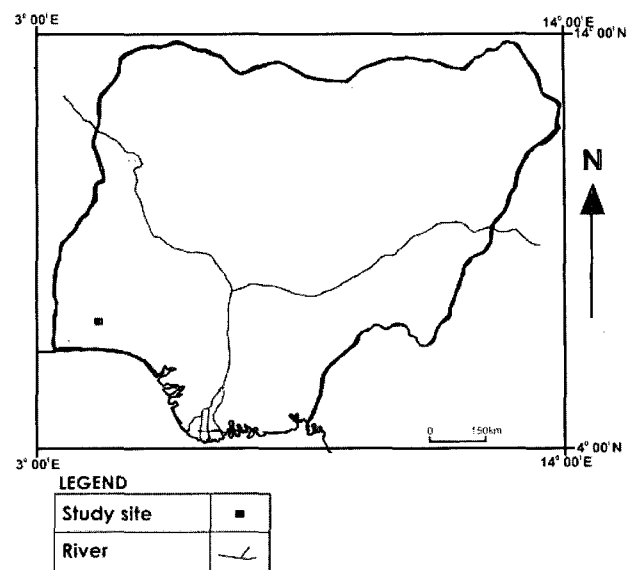


Fig. 1. Map showing the *Culicoides* study site in Ijebu North, Western Nigeria.

tre, Site B was located near the market, Site C was the immediate vicinity of a primary school, and Site D was the premises of the community's secondary school.

Sample collection and examination

Samples of *Culicoides* biting midges were collected fortnightly between 6:00 and 9:00 in the morning from December 2003 to October 2004 using human bait method as previously-described (Agbolade, 2002). The *Culicoides* samples were immediately transported to the laboratory, where they were identified, dissected and examined for filarial larvae using a dissecting microscope. Monthly biting rate (MBR) was calculated using the formula:

$$\text{MBR} = \frac{\text{No. of } \textit{Culicoides} \text{ caught} \times \text{No. of days in mo}}{\text{No. of catching days in mo}}$$

Determination of human perception on *Culicoides* behavior

This was done by interviewing 854 (431 males, 423 females) self-selected villagers using questionnaires. Information obtained through the questionnaires included age and sex of each interviewee, local names of *Culicoides*, and perception on the resting and biting behavior of the insects.

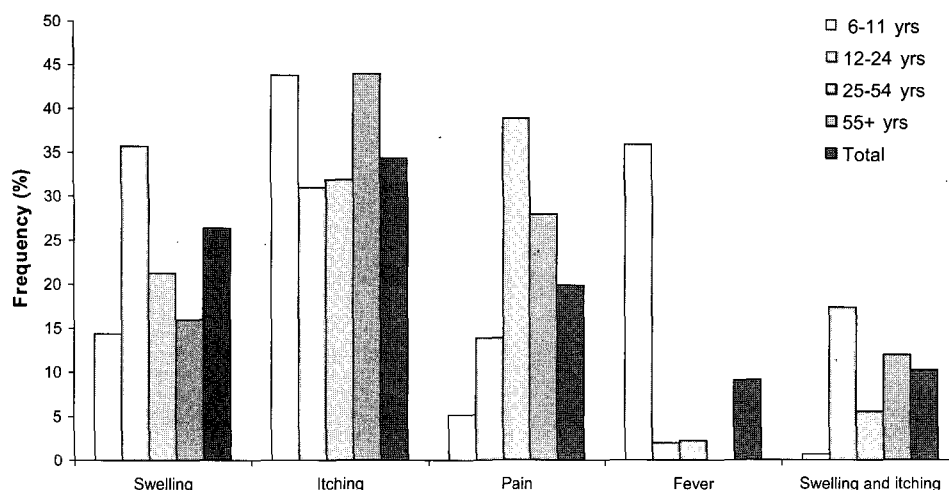


Fig. 2. Frequency of body reactions to *Culicoides* bites among age groups in Mamu, Ijebu North, Nigeria.

Statistical analysis

The chi-square (χ^2) was used to determine significant differences between rates or percentages, while correlation co-efficient was used to examine relationship between biting rates and climatic factors.

RESULTS

A total of 359 specimens of *Culicoides* adults identified as *C. fulvithorax* were recorded in this study. Monthly biting rates of *C. fulvithorax*, mean rainfall, relative humidity and temperature in the study area

are given in Table 1. The monthly biting rate was highest in September 2004 and lowest in December 2003 ($P < 0.001$). There was a positive correlation between monthly biting rates and mean rainfall ($r = 0.94, P < 0.001$). Similarly, a positive correlation occurred between monthly biting rates and mean relative humidity ($r = 0.85, P < 0.01$). However, there was no correlation between monthly biting rates and mean temperature.

Total 359 specimens of *C. fulvithorax* were dissected, and the third stage of filarial larvae (L_3) were found in 7 (1.95% of infection rate), which were collected in July, September and October 2004. The arithmetic and

Table 1. Monthly biting rates of *Culicoides fulvithorax* in relation to mean rainfall, relative humidity and temperature in Mamu, Ijebu North, western Nigeria

Month/Year	Biting rate (<i>Culicoides</i> /man)	Mean rainfall (mm) ^{a)}	Mean relative humidity (%) ^{a)}	Mean temperature (°C) ^{a)}
Dec 2003	31.0	0.1	79	26.7
Jan 2004	54.3	0.3	82	26.5
Feb 2004	70.7	3.3	80	27.1
Mar 2004	36.8	1.8	77	28.5
Apr 2004	60.0	3.8	84	28.2
May 2004	89.1	10.1	86	27.4
Jun 2004	82.5	8.3	86	26.6
Jul 2004	86.4	6.9	88	25.5
Aug 2004	116.3	2.8	89	25.3
Sep 2004	130.7	11.8	87	26.0
Oct 2004	104.6	7.8	86	26.9

^{a)} Source: Federal Department of Meteorological Services, Ijebu-Ode, Nigeria.

geometric mean intensity of the filarial L₃ infections were 1.6 L₃/Culicoides and 1.3 L₃/Culicoides, respectively.

Of 854 villagers interviewed, 325 (38.1%), 122 (14.3%), 62 (7.3%), 90 (10.5%), 29 (3.4%), and 18 (2.1%) referred to anthropophilic *Culicoides* as 'finfin', 'kotonkan', 'amukuru', 'tintin', 'yanyan' and 'yanmuyanmu', respectively. Two hundred and ninety-two (43.2%), 260 (30.4%), 142 (16.6%), 39 (4.6%), 25 (2.9%), and 12 (1.4%) of the interviewees believed that *Culicoides* adults were found in bushy area, everywhere, on farm, inside houses, on playing field, and by the stream side, respectively. The interviewees who professed that *Culicoides* were more prevalent in wet season than in dry season were 69.6%, whereas 19.2% of the interviewees professed that they prevailed in dry season. Three hundred and thirty-seven (39.5%) answered that *Culicoides* midges enter houses, and among them 85 (25.2%) and 215 (63.8%) answered that they enter in the morning and in the evening, respectively. Among total 854 interviewees, 13.2% (113) claimed that *Culicoides* got annoyed, 89.0% (760) knew that they were biting insects, 86.5% (739) had experienced of been bitten by them, and 363 (42.5%) believed that anthropophilic *Culicoides* transmit diseases, such as fever (45.2%), headache (1.4%) and rash (2.2%).

Among the age groups, 76.5% (153), 84.8% (345), 99.1% (216), and 86.1% (25) of 6-11, 12-24, 25-54, and > 55 years, respectively, experienced body reactions to *Culicoides* bites. These frequency occurrences of body reactions to *Culicoides* bites were statistically similar among the age groups ($P > 0.05$). The frequencies of the body reactions are summarized in Fig. 2. Itching was the highest (34.4%) while fever was the lowest (9.1%) ($P < 0.001$). Among 739 villagers who had experience of body reactions to *Culicoides* bites, 84.6% (625) usually treated themselves with palm oil, kerosene, pain-relieving ointments or tablets.

DISCUSSION

The anthropophilic habit of *C. fulvithorax* in the present study area conformed with the previous report of

White (1977). *C. fulvithorax* had also been associated with domestic animals in Nigeria (Dipeolu, 1976b). In this study, the monthly biting rates of *C. fulvithorax*, which reached at their peak in September, were generally higher in rainy season than in dry season. Similar observations had been reported on some Nigerian *Culicoides* species associated with wild animals (Dipeolu, 1976a). The study area has abundance of banana plants, shrubs and decaying plant matters which are known to favour the breeding of *Culicoides* (Muirhead-Thomson, 1982; Mercer et al., 2003). The greater availability of water from rainfall which moistens soil, rotting banana plants and other plant matters might have contributed to the higher abundance of *C. fulvithorax* in the rains. It is well known that there is higher occurrence of indiscriminate bush-burning in dry season in Nigeria. This might have contributed to the recorded low abundance of *C. fulvithorax* in dry season in the study area. Results from the questionnaires administered also revealed that anthropophilic *Culicoides* are more prevalent in the rainy season in the study area. During some previous visits, anthropophily of *C. fulvithorax* was observed from some other parts of Ijebu North (Agbolade, personal observation). The presence of anthropophilic *C. fulvithorax* in both seasons in the study area is noteworthy.

The monthly biting rate of *C. fulvithorax* increased with relative humidity in this study. This finding corroborated an earlier opinion that relative humidity influenced *Culicoides* breeding in Nigeria (Dipeolu and Ogunrinade, 1977). However, the monthly biting rate of *C. fulvithorax* was not correlated with temperature in this study. A previous study showed that temperature and relative humidity, vis-à-vis *Culicoides* occurrence, are independent variables (Conte et al., 2003).

Infection of some examined *C. fulvithorax* specimens with filarial L₃ possibly indicates that *C. fulvithorax* is an important vector of *M. perstans* in the study area which is endemic for *M. perstans* (Agbolade and Akinboye, 2001, 2005). However, some other possible *Culicoides* vector species might have been inadvertently excluded from the catches since only early morning

collections were made in this study. Results from questionnaires showed that anthropophilic *Culicoides* seek blood meal in both morning and evening in the study area and this agrees with established phenomenon (Muirhead-Thomson, 1982). The filarial infection rate of *C. fulvithorax* in this study is similar to that reported for *C. grahamii* in the forest region of Congo (Noireau et al., 1990). The occurrence of filarial infection coincided with period of high biting rate in this study. Possible occurrence of *M. streptocerca* cannot be ruled out in the study area as *Culicoides* species equally transmit this parasite (Heyneman, 2004). Further studies are needed to establish the filarial species in *C. fulvithorax* using experimental animals.

The commonest local name of *Culicoides* in the study area is 'finfin'. However, it is noteworthy that some of the villagers erroneously refer to anthropophilic *Culicoides* as 'yanmuyanmu', a popular name for mosquitoes in the western part of Nigeria. This indicates serious level of ignorance among the villagers. This is corroborated by the claim of some interviewees that anthropophilic *Culicoides* make noise when seeking blood meal which has never been recorded as a behavior of *Culicoides* (Muirhead-Thomson, 1982). Ignorance has been identified as one of the major factors enhancing the endemicity of many parasitic diseases in tropical African countries (Ukoli, 1992). The ignorance of the villagers is further emphasized by the fact that none of the villagers knew *Culicoides* biting midges as a vector of filarial parasites.

Responses from interviewees showed that most of the villagers have experienced *Culicoides* bites several times with occurrence of noticeable body reactions among all the age groups. The most frequent body reactions to *Culicoides* bites in the study area was body itching which was often coupled with swelling. The other reactions were pain and fever. These reactions are attributable to inflammatory response (Ward, 1980). The treatment of victims necessitated by the side reactions of *Culicoides* bites demonstrated the negative socio-economic impact. This is because the victims had to spend substantial proportion of their meager income on treatment.

This study has shown that the presence of anthropophilic *C. fulvithorax* in both rainy and dry seasons in the study area constitutes serious threat to the socio-economic lives of the villagers. Unfortunately, there is no *Culicoides* control program in Nigeria. Therefore, both health education and application of effective control measures against *Culicoides* biting midges are urgently required for health promotion in Ijebu North area of western Nigeria.

ACKNOWLEDGMENTS

We sincerely thank the staff of Federal Department of Meteorological Services, Ijebu-Ode Station, Ogun State, Nigeria for providing rainfall, relative humidity and temperature data.

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