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Swine farm infestation with *Culicoides* species (biting midges) in Zaria, Nigeria

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Abstract

Collection of biting midges within a piggery farm using black-light suction traps revealed the presence of diverse species of *Culicoides*. Out of a total of one thousand four hundred and five (1,405) midges caught, one thousand three hundred and sixty-six (1,366) were identified as species in the genus *Culicoides* while the remaining thirty-nine (39) were unidentified members in the family Ceratopogonidae. The identified *Culicoides* were further classified into eight species based on their morphological characteristics as *C. imicola*, *C. pycnostictus*, *C. oxystoma*, *C. milnei*, *C. subschultzei*, *C. enderleini*, *C. nevilli* and *C. krameri*. There was dominance of females (93.67%) over the males (6.33 %) from the total collection. The presence of *Culicoides* species infesting pigs was established and the identified *Culicoides* species were incriminated to be mammophilic in feeding. Recommendation is made to determine the blood meal source and possibility of disease transmission.

Keywords: *Culicoides* species, Ceratopogonidae, Light-trap, Nigeria, Piggery, Zaria
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Introduction

Most *Culicoides* species exhibit some level of host preference and this has direct implication with respect to their potential role as agents of disease transmission. Most species have preference for birds (ornithophilic) while others preferred to feed on mammals (mammophilic). Some species preferred to feed on cattle, horses, deer and sheep (Service *et al.*, 1986; Raich *et al.*, 1997).

Members of the family Ceratopogonidae can be identified by their 15-segmented antennae and their distinguishing wing venation. The majority of *Culicoides* species have wing pattern that is composed of grey and white patches and each species has a unique pattern useful for identification as can be easily observed under dissecting microscope (Meiswinkel *et al*., 2004). However, about 10 % of *Culicoides* species found in Africa do not have any wing pattern and their identification is based on dissection and microscopic examination of specimens on slides (Labuschange *et al*., 2015).

The distribution and activity of the *Culicoides* species is associated with presence of suitable habitats for breeding, availability of hosts and also due to suitable climatic factors (Jenkins & Young, 2010). The majorities of *Culicoides* of economic importance are crepuscular (i.e. active just before the dusk to just after the dawn). Their bites may produce irritation and allergic reaction which subsequently leads to intense itching (pruritus). The blood-feeding behaviour of female biting midges predisposes them to vectoring disease pathogens. This research was aimed to establish the presence and species composition of *Culicoides* in the piggery unit of the National Animal Production Research Institute

(NAPRI) Zaria.

Materials and Methods

Sampling site

This was conducted in the piggery unit of the National Animal Production Research Institute (NAPRI) located in Shika, Kaduna state, Nigeria. The piggery unit of the Institute is a fenced area of about 500 metres away from paddocks of ruminants' grazing lands.

There were sixty-two pigs on the farm (3 boars, 3 young boars, 1 nursing sow, 20 pregnant sows, 2 in-gilts, 1 gilt, 5 finishers, 9 growers, 13 weaners and 5 piglets). The pigs were reared under an intensive management system in two open-sided concrete buildings with an extension of iron rods and wire mesh (Plate I). The building is made up of two blocks of ten pens each. There were four different breeds of pig on the farm as at the time of this research which includes: Landrace, Large white, Duroc and Petrain.

Sample collection

Samples were collected weekly for the period of three months (October to December, 2015) using the methods previously described by (Dipeolu, 1978; Oke *et al*., 2016). Light suction insect traps; Miniature downdraft black-light (UV) trap – (Model 1212) and New Jersey standards light trap – (Model 912) were employed. The traps were operated at night (Plate I) at 11.196^{o}N, 7.594^{o}E and 11.196^{o}N, 7.595^{o}E locations on the pens.

Insect samples were collected and preserved in 70% alcohol and transported to the Entomology unit in the Department of Veterinary Parasitology and Entomology, College of Veterinary Medicine, University of Agriculture Makurdi, Benue state Nigeria. They were differentiated into sex and counted according to their morphological characteristics using binocular stereomicroscope and microscopic examination (using Celestron® LCD digital microscope) of permanent slide preparation of *Culicoides* samples mounted with Canada balsam in xylene was carried out. Pictures of various segments including the characteristic wing pigmentation, antennae, palpal segments, female spermathecae and male genitalia of the mounted specimens captured at different magnifications and compared with the reference identification keys for members of the family Ceratopogonidae were used for morphological identification of the species trapped.

Results and Discussion

A total of one thousand four hundred and five (1,405) biting midges were trapped and were found to belong to eight morphologically identified *Culicoides* species (Plate II *a-h*) and the unidentified members in the family Ceratopogonidae (Plate II *i-k*). One thousand three hundred and sixty-six (1,366) biting midges were morphologically identified to species level while the remaining thirty-nine (39) were unidentified members in the family Ceratopogonidae. The unidentified species could be members of the genera *Forcipomyia* or *Leptoconops* in the family Ceratopogonidae which also feed on the blood of vertebrate hosts or could even be among the few species in the genus *Culicoides* in which the wing pattern is poorly defined or absent (Wirth & Hubert, 1989).

Plate I: Sites of sample collection showing the traps (red arrows) in position, the pen design and the pigs in the pen

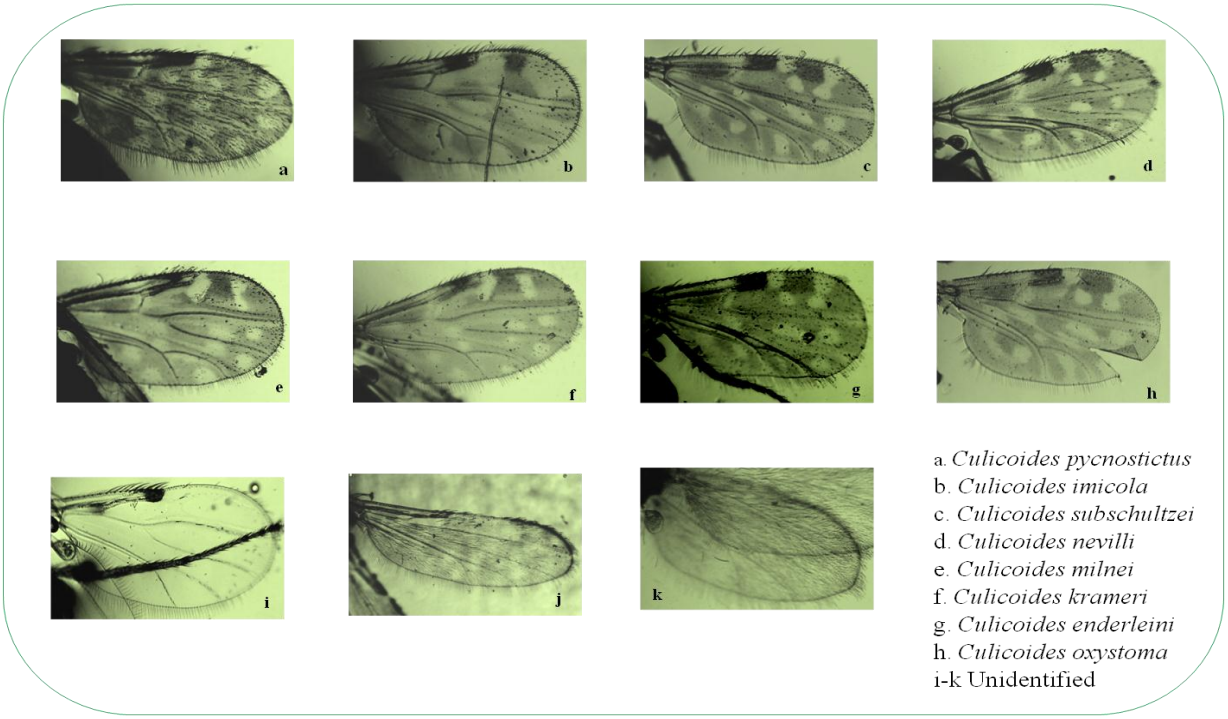

Plate II: A representative wing venation of each of the *Culicoides* species trapped around piggery in Zaria, Nigeria

The species identified include: *C. imicola* (551), *C. pycnostictus* (261), *C. oxystoma* (198), *C. milnei* (108), *C. subschultzei* (89), *C. enderleini* (76), *C. nevilli* (38), *and C. krameri* (35) (Figure 1). Irrespective of where (location) and how (method) the insects were collected, all the species identified in this study have been previously reported by Oke *et al.* (2016) and Dipeolu (1976) with the exception of the unidentified species. The presence of *C. imicola* and *C. oxystoma* among the samples collected should be considered potential threat as these species have been incriminated as vectors of various viral pathogens (Mellor *et al*., 2000; Wittmann & Baylis, 2000; Meiswinkel *et al*., 2004; Borkent 2005; Rasmussen *et al*., 2012) responsible for various diseases in cattle, sheep and horses. Their detection will be vital to the implementation of integrated control measures, disease risk analysis and the effective management of these diseases. The finding of *C. imicola* in this study is in agreement with the report of Service *et al*. (1986) who documented that *C. imicola* is a mammophilic species. Among the species trapped during this study, only *C. imicola* and *C. oxystoma* were reported by Archana (2014) in a similar study from India. The author found these species around cattle, buffalo, sheep and goat and concluded that *C. imicola* is the most prevalent species, which concur with our findings.

Of the total midges trapped, 1,316 (93.67%) were females while the remaining 89 (6.33%) were males.

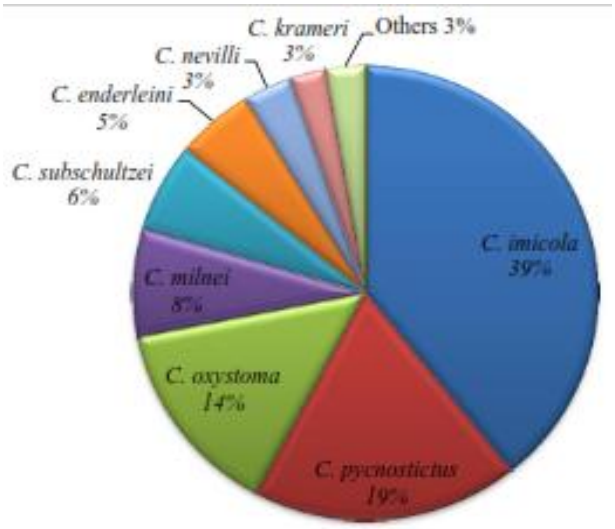

Figure 1: Percentage of *Culicoides* species trapped around piggery farm

This result is consistent with the previous report by Dipeolu (1976) and Oke *et al*. (2016) in Ibadan and Makurdi, Nigeria and several others from other countries, Reddy & Hafeez (2008), Kim *et al*. (2012), and Archna *et al*. (2014) of different geographical locations who also reported higher percentage of females over males. This could also establish the fact that only females are blood feeders, as previously anticipated by (Chitra, 2002) hence their presence around the vicinity of the hosts in large numbers.

This further ascertains the possible roles of female midges in disease transmission.

The total monthly collections were seven hundred and sixty-two (762), three hundred and eighty-three (383) and two hundred and sixty (260) for October, November and December 2015 respectively. This is in agreement with the findings of Dipeolu (1976) who also reported highest peak in the month of October in Ibadan, Nigeria.

The findings of this study have established the presence of diverse *Culicoides* species around pigs and the possibility of incriminating them as mammophilic in nature. Further work to determine that the actual source of blood meals of the identified species was from the pigs and any possibility of diseases transmission is recommended. There is also need to further identify the other morphologically un-identified members in the study area.

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