The Potential Significance of Biting Midge (Culicoides Latreille) Population in Nigeria

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ABSTRACT

CULICOIDES **species are well-known as troublesome biters and transmitters of various diseases to man and animals. Surveys in Nigeria show** *Culicoides species* **to be well-distributed throughout the vegetational zones. The possible direct and indirect effects of such a distribution on production are discussed.**

GENERAL CONSIDERATIONS

Culicoides species are widespread in distribution in the World and are believed to be absent only in a few areas (Macfie, 1921; Ingram and Macfie, 1921). Surveys in Nigeria (Nicholas, Kershaw, Duke, 1953; Dipeolu 1976; Arbovirus Research Project Report 1968–1970) though sketchy, indicates the incidence of *Culicoides* spp. in all vegetational zones throughout the year. 39 species have been indentified in Nigeria (Dipeolu and Sellers, 1975). The species in Nigeria are probably multivoltine because of the tropical conditions as contrasted to European species which are univoltine (Onyia, 1971).

Culicoides spp. are able to feed on a wide variety of hosts which include well-known hosts such as human beings, goats, sheep, cattle, pigs, horses and other hosts such as chimpanzees (Nicholas *et. al.* 1953), African giant rat *Cricetomys gambianus* (Dipeolu, 1976) birds (Jellison and Phillip 1933), Lizards (Myers 1934), and even engorged mosquitoes (Sunton and Little 1925). The biting habits of midges had had considerable effect on human settlements and the tourist industry in the Carribean (Linley and Davis 1961) and Southern Scotland (Hill 1947). Kettle (1965) listed all the diseases known to be transmitted by *Culicoides* spp. which included viral, protozoan and filarial diseases. Some of these disease agents such as *Mansonella ozzardi,* Venezuelean equine encephalitis, Eastern-Equine encephalitis, 3-day-fever and Japanese-B-encephalitis transmitted by the closely-related *Lasiobelia* sp (Wu and Wu 1957), have not been reported in Nigeria. Others transmitted by *Culicoides* spp. such as onchocerciasis of cattle and horses (Buckly 1938, Steward 1933) and fowl pox (Tokunaga 1933) are rarely documented. Diseases such as *Acanthocheilonema* filariasis in man, Blue Tongue (BT) of sheep, African Horse Sickness (AHS) of horse, Leukocytozoonosis of birds, Haemoproteosis of poultry and wild birds have been reported (Nicholas *et. al.* 1953; Bida and Eid 1974; Taylor 1975; Adene and Dipeolu 1975; Gray 1964; Cowper 1968) in Nigeria. This paper highlights the possible role of *Culicoides* spp. as biters and transmitters of various diseases in Nigeria in the light of present findings and pin-points further neglected areas of research.

Biting-habits:

Culicoides species are known among the Yoruba-speaking people of Nigeria as "Kotonkan" (literally meaning—very small things). The disturbance and irritation following *Culicoides* bite is also well known among the populace. The bite of *C. austeni,* a West African species, has been described by Sharp 1928 as like '.....the prick of a needle.....there is little pain until 24 hours later when irritation may be considerable'. Perhaps the immitation following bite is a hypersensitivity reaction similar to a reaction noted in horses (Riek 1934). At the Y.M.C.A. camp, Eruwa, in the forest zone of Western Nigeria, activities are planned to coincide

with periods of low insect activity (Dipeolu and Ogunrinade 1976). In large areas of Nigeria where agriculture is unmechanised and based on the age-long hand hoe, the nuisance of biting insects such as *Culicoides* spp. could have a deleterious effect on effective working hours. Morning biting species like *C. grahami* (Nicholas *et. al.* 1953) could be of greater significance to the farmer in the warm tropics where morning hours are vital. Peak of midge abundance in Nigeria are March-April and October (Dipeolu and Sellers 1976). During such peaks, local farmers have been noticed to use leaves tied to a bunch to ward off the midges. From personal observations, animals during peaks of midge activity, appear restless, rub their body against fence posts and cattle switch their tails to ward off the insects. Such restlessness may reduce animal production and scratching may lead to lacerations, secondary bacterial infection and hide damage.

Disease transmission

The ability of *Culicoides* spp. to feed on a wide variety of hosts and to complete full engorgement on more than one host (Dipeolu 1976) has implications for mechanical and biological transmission of diseases.

Five filaria species are known to be transmitted to human and animal hosts by *Culicoides* spp. (Kettle 1965). Of these only 2 (*Acanthocheilonema* perstans, *Acanthocheilonema perstans*) having been reported in great detail in West Africa. *Acanthocheilonema perstans* is endemic along the West African coast (Sharp 1928; Nicholas *et. al.* 1953, Van der Berghe and Chardome 1952). is reportedly transmitted by *C. grahami* (Sharp 1927). This was challenged by Chardome and Peel (1949) and Henrard and Peel (1949) who showed that microfilaria of *A. perstans* was not taken up by *C. grahami*. It has now been established that *C. austeni* is the vector of *A. perstans* and *A. streptocerca* develop into mature forms in *C. grahami* (Duke 1954). The known vectors of *Acanthocheilonema* spp., *C. austeni* and *C. grahami* have been found in surveys in Nigeria (Arbovirus Research Project 1968; Ogunrinade, Dipeolu and Sellers 1976; Dipeolu and Sellers 1975).

Protozoans such as *Leutocytozoon* and *Haemoproteus* spp. have earlier been known to be transmitted by *Culicoides* spp. (Akiba 1960; Fallis and Wood 1957; Fallis and Bennett 1960). Following these studies, *Hepatocystis kochi*, a blood parasite of monkeys, whose vector long evaded workers, was shown to be transmitted by *Culicoides* species (Garnham, Heisch and Minter 1961).

Leucocytozoon and *Haemoproteus* occur in various birds in Nigeria and the ability of *C. fulvithorax, C. distinctipennis, C. grahami, C. endelini, C. quinquilineatus* and *C. imicola* to feed on some avian hosts (Dipeolu 1975) show a possible role of these species in transmission of the parasites.

Various viruses have been shown to be transmitted by *Culicoides* spp. (Kettle 1965). Blue-tongue virus have been demonstrated in the salivary glands of *Culicoides* spp. (Bowne and Jones 1966) and shown to be transmitted in Africa by *C. imicola* (Du Toit 1944), *C. tororoensis* (Walker and Davies 1971), *C. milnei* (Walker and Davies 1971). Blue tongue is a highly fatal disease of sheep leading to great economic loss in meat, milk and wool. *C. imicola,* and incriminated vector, has been found to be most abundant in different surveys in Nigeria (Arbovirus Research Project Reports 1968; Dipeolu and Sellers 1975; Ogunrinade *et. al.* 1976. Blue Tongue virus types 6, 7, 10 and 16 have been isolated in 74841 *Culicoides* put in 766 pools (Arbovirus Research Project Report 1968). Further isolates were made in 1969 and 1970 at the Arbovirus Research Project, Ibadan. Confirmed cases of Blue-Tongue in sheep have been reported in Nigeria (Anon 1943; Bida and Eid 1974). In an outbreak of BT at Dandawa, Northern Nigeria in 1943, 500 out of 750 sheep died (reported in Bida and Eid 1974). More recently at Kotokorshi in N.W. Nigeria, strain 10BT virus caused 31–53% mortality in imported sheep (Bida and Eid 1974). Serological evidence of previous contact with BT were found by gel-diffusion tests in 49.7% cattle, 28.9% sheep, and 29.4% goats sampled (Taylor 1975). Blue-tongue is

probably endemic in Nigeria and could be a limiting factor in breeding programmes involving importation of exotic stock. Of long term concern, is the fact that BT is impossible to eradicate once it has been established in animal population (Erasmus 1975).

African Horse Sickness (AHS) was shown to be transmitted by *Culicoides* spp. (Du Toit 1944). Further evidence of multiplication of type 9 AHS virus has been shown in *Cuicoides* spp. (Mellor, Boorman, Jennings 1974). Type 9 AHS virus caused an outbreak in 1959/60 spreading through Middle East and S.W. Asia causing the death of up to 300,000 horses (Howells 1963). Sporadic outbreaks of AHS have occured in Nigeria. Death of horses in 1951 at Maiduguri, N.E. Nigeria and in 1966 at Kaduna were traced to AHS (Arbovirus Research Project Report 1970). More recently, type 9 AHS virus has been isolated in a horse that died of the acute disease at Zaria (Kemp, Humberg and Athaji 1971), and 20 imported Shire horses died of AHS in Kano (Taylor 1975). Serological evidence of AHS antibodies have been found in about 40% of 151 horses sampled in Nigeria (Kemp 1974). These findings have serious implications for horse breeding programmes, racing, polo games and other activities involving movement of animals across national frontiers of Nigeria. The previously unreported virus in West Africa, Rift Valley Fever (RVF) virus, was isolated in *Culicoides* pools in Nigeria (Arbovirus Research Project Report 1970). RVF is highly fatal to sheep in East Africa. Other viral isolates from *Culicoides* spp. include Simbu group, Congo Shuni, Dugbe (Arbovirus Research Project Report 1968), Kotonkan virus (Tomori, Fagbemi and Kemp 1974) Sabo and Samonda virus isolated from *C. imicola* and Abadina virus from *C. schultzet* (Arbovirus Research Project Reports 1970). Other unknown fungi, ciliates and flagellates have been isolated in wild caught *Culicoides* spp. in West Africa (Sharp 1928). The pathogenic significance of some of these isolates are as yet unknown.

CONCLUSION

Very little work had been done on *Culicoides* spp. in Nigeria, consequently, little is known about their role as vectors of various human and animal diseases in this country. The viral isolates made by the Arbovirus Research Projects, Ibadan, including Blue-tongue, Congo, Shuni, Dugbe and others were not traced to specific *Culicoides* species since pools were used. Knowledge about specific vectors is therefore incomplete and conjectural.

Host preference studies in *Culicoides* spp. which are being developed through blood meal analysis, by the author will perhaps aid in determining vectors. The various outbreaks of endemic diseases among exotic stock is cause for concern in the light of current plans to import exotic stock to upgrade indigenous stock. Control of midges therefore require more emphasis to be placed on the biology, seasonal variations, and distribution of *Culicoides* spp. in each vegetational zone especially since present knowledge is limited and largely confined to Ibadan, in the rain forest zone.

REFERENCES

ADENE, D. F. and DIPEOLU, O. O. (1975) Survey of blood and ectoparasites of domestic fowls in Ibadan, Western State of Nigeria. Bulletin of Animal Health and production in Africa **23** (3) (In pres)

AKIBA, K. (1960) Studies on the Leukocytozoon found in chicken III. On the transmission of *L. Caulleryi* by *Culicoides arakawas* Jap. J. vet. Sci. **22**, 309–317.

ANNON, J. (1943) Annual report of veterinary department, Nigeria p. 5.

ARBOVIRUS RESEARCH PROJECT, University of Ibadan Reports 1968–70.

BIDA, S. and EID, F. I. A. (1974) Blue tongue of sheep in Nigeria Journal of Nig. Vet. Med. Ass. **3** (1) 12–16.

BOWNE, J. G. and JONES, R. H. (1966) Observations on Blue tongue virus in salivary glands of an insect vector. *Culicoides vanipenis* Virology 30 (1) 127–133.

BRAY, R. S. (1964) Checklist of parasitic protozoa in West Africa Bull. Inst. Franc Afri. Noir **26**, AI 238.

BUCKLEY, J. J. C. (1934) On the development in *Culicoides furens* Pocy of filaria (= Mansonella ozzardi Manson 1897 J. Helminth. 12 (2) 99–118.

BUCKLEY, J. J. C. (1938). On *Culicoides* as a vector of *Onchocerca* gibsoni (Cleland and Johnston 1910). J. Helminth. **16** 121–158.

CHARDOME and PEEL (1949) La repartition des fibrias dams la region de Coqiul Latrille *et. al* transmission de Dipetalonema streptoceca par *culicoides grahami.* Ann. soc. belge med. trop. **29,** 99–119.

COWPER. S. G. (1968) Observations on parasites of primates, dogs and some other hosts in Nigeria, mainly in Ibadan area. Journal of W. A. Science Ass. 13 (1) 39–52.

DIPEOLU, O. O. (1975) Studies on *Culicoides* species of Nigeria VI. Species feeding on poultry. Nig. J. vet. Med. Ass. vol. 5 (1) (In press).

DIPEOLU, O. O. (1976) Studies on the *Culicoides* species of Nigeria. II. Species collected around wild animals at Ibadan. Vet. Parasitol. In press.

DIPEOLU, O. O. and SELLERS, K.C. (1975). Studies on the *Culicoides* spp. of Nigeria I. The *culicoides* Latreille (Diptera: Ceratopogonidae) of Ibadan with notes on the other Ceratopogonids collected by light trap Nig. J. sci. 9 (2) In press.

DUKE, B. O. L. (1954) The uptake of microfilaria of *A streptocerca* by *C. grahami* and their subsequent development Ann. trop. Med. Parasit. **48,** 416–420.

DU TOIT, R. M. (1944) The transmission of Blue. tongue and Horse Sickness by *Culicoides*-Ondersteeport J. vet. sci. **19,** 7–16.

ERASMUS,, B.J. (1974) Blue tongue in sheep and goats. Aust. Vet. Journal 51, 165–169.

FALLIS, A. M. and BANNET, G. P. (1960) Description of **Haemoproteus canichitis** sp. (Sporazoa Haemoprotenidae) in **Culicoides** (Diptera: Ceratopogonidae) as intermediate hosts for Haemproteus of ducks Can. J. Zool. **33** 455–464.

FALLIS, A. M. and WOOD, D. M. (1957) Biting midges (Diptera: Ceratopogonidae) as intermediate hosts for **Haemoproteus** of ducks. Can. J. Zool. **35** 425–435.

GARNHAM, P. C. C., HEISCH, R. B. and MINTER, D. M. (1961) The vector of **Hepatocystis** (Rdabinodium) Kochi. The successful conclusion of observations in many parts of (tropical Africa) Trans. Roy. Soc. trop. Med. Hyg. **55** 497–502.

HENRARD, & PEEL, (1949) **Culicoides** graham Austen. Vector de Dipet. streptocerca et non de A. perstans Ann. Soc. belge. med. trop. **29** 127–143.

HILL, M. A. (1947) The life-cycle and habits of **Culicoides impunctatus** Goetghebuer and **Culicoides obsoletus Meigeni,** together with some observations on the life-cycle of **Culicoides odibilis** Austen, **Culicoides pallidi cornis** Keiffer Culicoides cubitalis Edward and **Culicoides chropterus** Meigeri. Ann. trop, Med. Parasit. **41,** 55–115

HOWELL, P. G. (1963) Emerging Diseases of Animals, FAO Agric. Studies No. 61, pg. 71..

JELLISON and PHILLIP (1933) Quoted in Hill 1947.

KEMP, G. E. (1974) Antibody in Nigerian animals to African Horse Sickness serotple 9. vet. Rec. 95 (15) 345.

KEMP, G. E., Humberg, J. M. and ALHAJI, J. (1971) Isolation and identification of African Horse sickness virus in Nigeria. Vet. Rec. **89,** 127–128.

KETTLE, D. S. (1965) Biting midges as vectors of human and animal diseases. Acta. trop. **22** 356–362.

LINLEY, J. R. and DAVIES, J. B. (1961) Sandflies and tourism in Florida, and the Bahamas and Carribean area. J. econ. entomol. **64** (1) 264–278.

MACFIE (1921) Quoted in Hill 1947.

MELLOR, P. S., Boorman, J. and JENNING, M. (1975) The multiplication of African Horse Sickness virus in two species of **Culicoides** (Diptera: Ceratopogonidae) Archives of Virology, **47,** 351–356.

MYERS, J. G. (1934) The sand-fly pest **(Culicoides**: Tropical Agriculture (1935) **12** 71–73.

NICHOLAS, W. L., KERSHAW, W, E, and DUKE, B. O. L. (1953) Studies on the epidemiology of filarias with special reference to British Cameroons and Niger Delta VII. The distribution of **Culicoides** biting man in rain forest, forest fringe and mountain grass. Ann. trop. Med. Parasit. **47,** 95–111.

OGUNRINADE, A. F., DIPEOLU, O. O. and SELLERS, K. C. (1976) The distribution of **Culicoides** spp. on the University of Ibadan campus. Nig. med. Journal (In press).

ONYIA, J. A. (1971) Studies on biology and ecology of Ceratopogonid midges in Southern England Ph.DThesis, University of London.

RIEK, E. F. (1954) Studies on allergic dermatitis (Queensland itsh) or the horse aectiology of the disease. Ans. J. agric. Res. 5, 105–129.

SHARP, N. A. D. (1929) - Development of microfi. laria perstans in **C. grahami** - A prelim note-Trans. R. Soc. Trop. Med. Hyg. **21,** 371–396.

SHARP, N. A. D. (1928) Filariasis in Cameroons with special references to skin infection by microfilaria. Trans. Roy. Soc. trop. Med. Hyg. **21,** 143.

STEWARD, J. S. (1933) Onchocerca cervicalis (RAILLET and HENRY 1950) and its development in **Culicoides rubeculoris** Mg Dept. Univ. Camb. Inst. Anim. Path. 3 272–284.

TAYLOR, B. (1974) Blue tongue virus in Nigeria. An outline of Research required up to and including the production of a new vaccines. Fed. Dept. vet. Res. Vom, Nigeria.

TAYLOR, B. (1975) Reports Arthropod-borne virus Information exchange no 29 pp. 155.

TOMORI, O., FAGBAMI, A. and KEMP, G. (1974) Kotonkan virus, experimental infection of white Fulani calves Bull. ep. Dis. Afri. XXII (3) 195–198.

TOKUNAGA, 1937 Quoted in Kettle 1965.

VAN DE BERGHE and CHARDOME, M. (1952) The geographical distribution of *A. streptocerca* in Belgian Congo. Trans. R. Soc. Trop. Med Hyg. **46**, 99.

WALKER, R. R. and DAVIES, F. G. (1971) A preliminary survey of the epidemology of Blue Tongue in Kenya. J. Hyg. **69**, 47–60

WU and WU (1957) Isolation of virus of B. type Encephalitis from Lasiohelia taiwana shiraki in a blood sucking midge Acta. microbiol sinica **5** 22–26