10. Animal filariae in anthropophilic Simulium spp. in North Cameroon. *A. Renz, J. Schibel, M. Eichner, P. Enyong.* Tropenmedizinisches Institut der Universität, Wilhelmstr. 31, D-7400 Tübingen, FRG; and Medical Research Station, P.O. Box 55, Kumba, Cameroon

In the Sudan savanna of North Cameroon, *Simulium damnosum* s.s., *S. sirbanum* and, in particular towards the southern Guinea savanna, *S. squamosum* are the main vectors of human onchocerciasis. However, besides infective larvae, morphologically indistinguishable from *Onchocerca volvulus*, other larvae of animal origin have been frequently observed in the local vector populations (Renz, 1987). At four fly-catching sites along the river Vina du Nord (Touboro, Kouman, Soramboum and Mbeing), flies were caught throughout one year from April 1987 to March 1988 in order to monitore the Annual Biting Rates (ABR) and filarial infection rates. First stage larvae were stained following peroxidase treatment to reveal the cephalic structures. The acid phosphatase staining pattern was examined in the developing and infective stage larvae. The length of the larvae was routinely measured and compared to the length of infective larvae of *O. volvulus* obtained by experimental infection of the flies (savanna strain: average length 660 ± 65 µm in dest. water). The ABR of *S. damnosum* s.l. varied from 24,000 flies/man/year near Mbeing to 47,544 near Touboro and the Annual Transmission Potentials including all infective larvae in the head thorax and abdomen of the flies from 1,055 to 4,190 respectively. According to the morphology of the infective larvae, 27 to 44% of all infective larvae were classed non-*O. volvulus*, mainly by their excessive length and the presence of a small tail at the end. Two types of infective larvae were distinguished from

those of *O. volvulus*: those of 'Type D', exceeding 900 µm in length, possessing a small tail and infective larvae only slightly longer than *O. volvulus* which we call 'Type G' following Duke's classification (Duke, 1967). Infective larvae of Type D were most frequent during the rainy season, when the fly-populations disperse far away from the rivers. This type, however, almost completely disappeared during the dry season (January/February) when only Type G was still present. This seasonality and the overall increase in the proportion of Type D infective larvae since 1973 (Duke et al., 1975; Renz 1987) may reflect changes in the zoophily of the vector population as well as variations in the availability of the animal host or seasonality of the microfilarial population. Flies bloodfed on cattle, harbouring microfilariae of *O. armillata, O. ochengi, O. dukei* and *O. gutturosa* developed infective larvae ressembling those of *O. volvulus* and Type G, but failed to produce those of Type D, which might therefore belong to a filaria of game. Microfilariae isolated from cattle and injected intrathoracically into *S. damnosum* s.l. developed to infective stage larvae (two larvae, 520 and 730 µm). *Simulium bovis* also frequently came to land on man (ABR up to 3,000). Although they were rather reluctant to bite, some ingested microfilariae of *O. volvulus* from the skin of an infected person, which developed up to at least the second stage larva. The infection rate was high in wild-caught flies and infective larvae of all three types were observed. – These investigations received financial support from the CEC and the WHO/TDR.

References

Duke, B. O. L.: Ann. trop. Med. Parasitol. 61 (1967) 200–205
Duke, B. O. L., J. Anderson, H. Fuglsang: Tropenmed. Parasit. 26 (1975) 143–154
Renz, A.: Ann. trop. Med. Parasitol. 81 (1987) 239–252

11. Onchocerca spp. of cattle and game in North Cameroon. *G. Wahl, A. Renz.* Tropenmedizinisches Institut der Universität, Wilhelmstr. 31, D-7400 Tübingen, FRG

The Sudan and Northern Guinee savanna areas of Cameroon between Garoua and Ngaoundere are endemic for human onchocerciasis. In search of the origin and identity of those non-*Onchocerca volvulus* infective larvae of Type D and G commonly found in local *Simulium damnosum* s.l. and *S. bovis* vector flies (Renz, 1987), our interest turned first to domestic bovidae and to game animals, which are abundant in these sparsely populated areas and might therefore constitute a major source of bloodmeals for the fly-populations. The biting rate on cattle was as high as on man. In a preliminary study at the abattoirs of Ngaoundere (7°20'N/13°34'E) and Touboro (7°45'/15°21'), adult worms of *Onchocerca* species were searched for at their predelection sites in cattle (six years and older), i.e. in the ligamentum nuchae or hind tarsal joints (*O. gutturosa*), the aorta wall (*O. armillata*) and intradermal/subcutaneous nodules in the ventral/inguinal region (*O. ochengi* and *O. dukei*, Table 1). Infection rates were very high, but *O. ochengi* and *O. dukei* were more frequent at Touboro (Sudan savanna, 500 m height) than at Ngaoundere (Guinee savanna, 1100 m). This might be explained by the higher age (over ten years) of the cattle there or by a higher rate of transmission. *Setaria* spp. were also frequently observed. A random survey of the most common game animals in the region of Touboro revealed the presence of at least two different species of unsheded skin microfilariae (probably *Onchocerca*) in antelops (*Ourebia ourebi* and *Cephalops* spp.). Two hides of the reedbuck (*Redunca redunca*) examined carried small flat subcutaneous nodules at the inguinal region, in which the adult worms were clearly visible. These were identified as *O.hamoni* (Dr. O. Bain, Paris). Microfilariae of various filariid species were also very common in birds, but *S. damnosum* s.l. was only rarely seen biting on a cock. (These investigations received financial support from the CEC and the WHO/TDR.)

Table 1 Prevalence of *Onchocerca* adult worms in cattle at slaughter in Cameroon (identification of adult worms by Dr. O. Bain, Paris)

Localization of adult worms (*Onchocerca* species)	Number of cattle infected/exam.	Prev. %
	Ngaoundere	
Ligamentum nuchae (*O. gutturosa*)	35/41	85.4 %
Hind tarsal joint (*O. gutturosa*)	–	–
Aorta wall (*O. armillata*)	33/51	64.7 %
Intraderm./ subcut. nodules (*O. ochengi* + *O. dukei*)	8/36	22.2 %
	Touboro	
Ligamentum nuchae (*O. gutturosa*)	17/17	100 %
Hind tarsal joint (*O. gutturosa*)	9/9	100 %
Aorta wall (*O. armillata*)	26/26	100 %
Intraderm./ subcut. nodules (*O. ochengi* + *O. dukei*)	22/29	75.8 %

12. Neuropharmacological actions of 2-tert-butyl-benzothiazole and nitro-diphenylamine derivatives in filarial parasites. *K. P. Davies, P. Köhler.* Institute of Parasitology, University of Zürich, Zürich, Switzerland

The interaction of the recently developed 2-tert-butyl-benzothiazole and 4-nitro-diphenylamine antifilarial drugs (CGPs 20376, 21835, 20308, 21306 and 6140) with mitochondrial respiration has been previously used to explain the in vitro toxicity of these drugs towards *Litomosoides carinii* (Davies et al., 1989). However, recent studies in our laboratory on *Acanthocheilonema viteae* showed that although inhibition of respiration in this filarial worm occurred with rotenone, a classical inhibitor of the mitochondrial respiratory chain, this did not result in an inhibition of motility. The observation that the above compounds inhibit both respiration and motility in *A. viteae* suggests a second site of action of the drugs in filariids, in addition to their effect on oxygen utilization. A direct interference of the drugs with neurotransmitter functions, as a possible additional or alternative target area, may be ruled out for two reasons. (1) The time required for drug-induced worm immobilization is too long when compared to that which would one expect for a drug interfering with neurotransmission, and (2) compounds known to interact with neuroreceptive sites (mecamylamine, atropine, curare) did not affect the drug-induced worm immobilization. Of the neurophysiologically active compounds tested only acetylcholine (ACh), at a 10 mM concentration, was able to partially restore the motility of the drug-induced immobilization of *L. carinii* macro- and microfilariae. No effect of the drugs was demonstrable on the biosynthetic pathway of the inhibitory neurotransmitter γ-aminobutyric acid. However, those benzothiazole antifilarials possessing either a piperazinyl (CGPs 21833, 20309 and 6140) or a piperidyl moiety (CGPs 24589 and 26702) product a significant inhibition of acetylcholinesterase (AChE). The Ki values of the enzyme from *L. carinii* for these compounds varied between 17 and 50 µM and were comparable to those of AChE from a vertebrate system, the electric eel. The mode of inhibition of AChE by these drugs was found to be competitive to the substrate used in the assay system (acetylthiocholine iodide). However, those CGP compounds most rapidly immobilizing filarial worms in vitro and most strongly inhibiting the parasite's respiration (CGPs 20376, 21835, 20308 and 21306) showed very little inhibitory effects on AChE. Since atropine, a com-