

Short Report

The bionomics of *Anopheles funestus* and its role in malaria transmission in a forested area of southern Cameroon

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Keywords: malaria, vector, *Anopheles funestus*, bionomics, Cameroon

The earliest studies on the bionomics of *Anopheles* in Cameroon were carried out some 40 years ago (ADAM, 1956; MOUCHET & GARIOU, 1961; MOUCHET, 1962). These studies showed that *A. nili* and *A. moucheti* were the principal malaria vectors in the rural forested areas of the country. Although *A. gambiae s.l.* was present, it had a minor role in malaria transmission in those areas. Very low densities of *A. funestus* were reported (LIVADAS *et al.*, 1958), indicating the limited epidemiological importance of this vector; hence, its bionomics in the forested zone were not well known. Recent studies on malaria vectors and transmission dynamics in the rural areas of southern Cameroon have confirmed these observations (CARNEVALE *et al.*, 1992; NJAN NLOGA *et al.*, 1993; MANGA *et al.*, 1995). The discovery of high densities of *A. funestus* in some villages in the forested zone made it possible for the bionomics of this species to be clarified, and its involvement in malaria transmission in those villages to be studied.

Etoa, Simbock and Nsimalen are villages near Yaoundé, the capital city of Cameroon. They are irrigated by 2 rivers, Biyeme and Mefou, which flow through a network of swamps. The swampy areas of the villages are separated by about 100 m. The vegetation is semi-deciduous equatorial forest, and the climate is guinean with 2 rainy seasons and 2 dry seasons per year; the annual rainfall is about 1700 mm.

Mosquito larvae were searched for along the Biyeme and Mefou rivers banks, in the swamps, and in pools. *Anopheles* larvae collected were reared separately to the adult stage and then identified. Indoor, all-night catches on human bait were made at Etoa twice a month for 4 months, from February to May 1996 (from the end of the long dry season to the end of the short rainy season). The *Anopheles* mosquitoes collected were identified and dissected to determine their physiological age and to search for *Plasmodium* sporozoites. The gonotrophic cycle was studied in June 1996, during the short rainy season, and its duration was determined using the following mark-recapture technique. For 3 consecutive nights, blood-fed mosquitoes were caught on human bait, marked with fluorescent powder (a different colour was used each night), and then released inside the dwellings. The duration of stage I (the period between egg laying and taking the next blood meal) was evaluated by examining follicle relics. The length of stage II (from blood meal to maturation of the oocytes) was determined by performing a series of delayed dissections; the oocyte stages were classified according to CHRISTOPHERS (1911).

At Etoa, *A. funestus* larvae were collected from the small grassy bays in the Biyeme and Mefou rivers. Of 78 adults that were identified, 38 (49%) were *A. funestus*; the other species present were *A. nili* and *A. moucheti*. At Simbock, *A. funestus* were collected in smaller numbers: 4 specimens (6.5%) were collected from the Mefou river, again with *A. moucheti* and *A. nili*. *A. funestus* was

also collected from the swamps together with *A. obscurus* and *A. namibiensis*. This is the first record of *A. namibiensis* from Cameroon. At Nsimalen, *A. funestus* was found in the Mefou river, once again together with *A. moucheti* and *A. nili*, mainly (in large numbers) in a weedy pool with *A. namibiensis*. *A. funestus* bred in a variety of sites: rivers (like *A. nili* and *A. moucheti*), swamps and pools. The presence of vegetation (not always erect) seemed to be the common factor in all these breeding sites.

A total of 913 mosquitoes was caught indoors at night at Etoa. *Anopheles* spp. formed 97.3% of this sample, and *A. funestus* constituted 71.2% of the *Anopheles* collected. The other *Anopheles* species were *A. nili*, *A. moucheti* and *A. gambiae s.l.* The average biting rate was 31.7 bites per person per night for all species of *Anopheles*, with an average of 22.6 for *A. funestus*.

A. funestus had a parity rate 83.1% (among 243 dissections) and its sporozoite index was 3.27% (336 dissections). The average entomological inoculation rate was 1.3 infective bites per person per night, representing 41 infective bites per person per month. *A. funestus* was responsible for 55% of these bites (0.7/night), while the 3 other species shared the remaining 45%. These findings led to the conclusion that *A. funestus* could be considered as a major local vector of malaria in forested areas, together with *A. nili* and *A. moucheti*.

A total of 158 *A. funestus* was marked and released, and 2 were recaptured the second night after release (a recapture rate of 1.3%). Thus, the duration of the gonotrophic cycle could be about 48 h. Dissection of 36 unfed female mosquitoes showed that 48% of them still had open follicle sacs, 36% had partially contracted follicle sacs, and only 17% had their follicle sacs completely contracted.

These findings indicated that most females took their next blood meal a few hours after egg laying. Twelve hours after the blood meal, 7 of 12 *A. funestus* had oocytes in stage III; at 24 h, 6 of 25 mosquitoes had oocytes at the beginning of stage IV; at 36 h, 60% (of a total of 33) had oocytes at stage V; and at 40 h, the maturation of the ovaries was complete: all 17 mosquitoes examined were at stage V. The duration of the gonotrophic cycle of *A. funestus* was therefore similar in the forested zone and in the savannah (BRENGUES & COZ, 1973).

Acknowledgements

This study was carried out with the technical support of Marc Nkou, Ivette Bella, Simon Mbingue and Marc Ngollo, from the Higher Teachers' Training College (ENS), Cameroon. It was funded by the French Ministry of Co-operation.

References

- Adam, J. P. (1956). Note faunistique et biologique sur les anophèles de la région de Yaoundé et la transmission du paludisme en zone forestière du sud Cameroun. *Bulletin de la Société de Pathologie Exotique*, 49, 210-220.
- Brengues, J. & Coz, J. (1973). Quelques aspects fondamentaux de la biologie d'*Anopheles gambiae* Giles (sp. A) et d'*Anopheles funestus* Giles, en zone de savane humide de l'Afrique de l'Ouest. *Cahiers ORSTOM, Série Entomologie Médicale et Parasitologie*, 11, 107-126.
- Carnevale, P., Le Goff, G., Toto, J. C. & Robert, V. (1992). *Anopheles nili* as the main vector of human malaria in villages of southern Cameroon. *Medical and Veterinary Entomology*, 6, 135-138.
- Christophers, R. (1911). The development of egg follicles in anophelines. *Paludisme*, 2, 73-88.
- Livadas, G., Mouchet, J., Gariou, J. & Chastang, R. (1958). Peut-on envisager l'éradication du paludisme dans la région forestière du Cameroun? *Actes du VI Congrès de Médecine Tropicale et du Paludisme, Lisbonne*, pp. 230-255.
- Manga, L., Toto, J. C. & Carnevale, P. (1995). Malaria vectors and transmission in an area deforested for a new international airport in southern Cameroon. *Annales de la Société Belge de Médecine Tropicale*, 75, 43-49.
- Mouchet, J. (1962). Influence des fleuves sur la biologie d'*Anopheles gambiae* pendant la saison sèche dans le sud du

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Cameroun. *Bulletin de la Société de Pathologie Exotique*, 55, 1163-1171.
 Mouchet, J. & Gariou, J. (1961). Répartition géographique et écologique des anophèles au Cameroun. *Bulletin de la Société de Pathologie Exotique*, 34, 102-118.
 Njan Nloga, A., Robert, V., Toto, J. C. & Carnevale, P. (1993). *Anopheles moucheti*, vecteur principal du paludisme au Sud-

Cameroun. *Bulletin de Liaison et de Documentation de l'OCEAC*, 26, 63-67.

Received 6 January 1997; revised 26 February 1997; accepted for publication 27 February 1997

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ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE Manson, Chalmers and Mackay Medals 1998

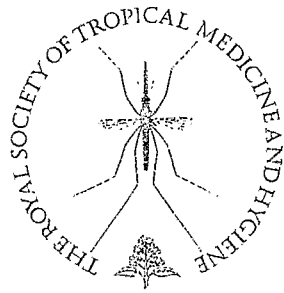
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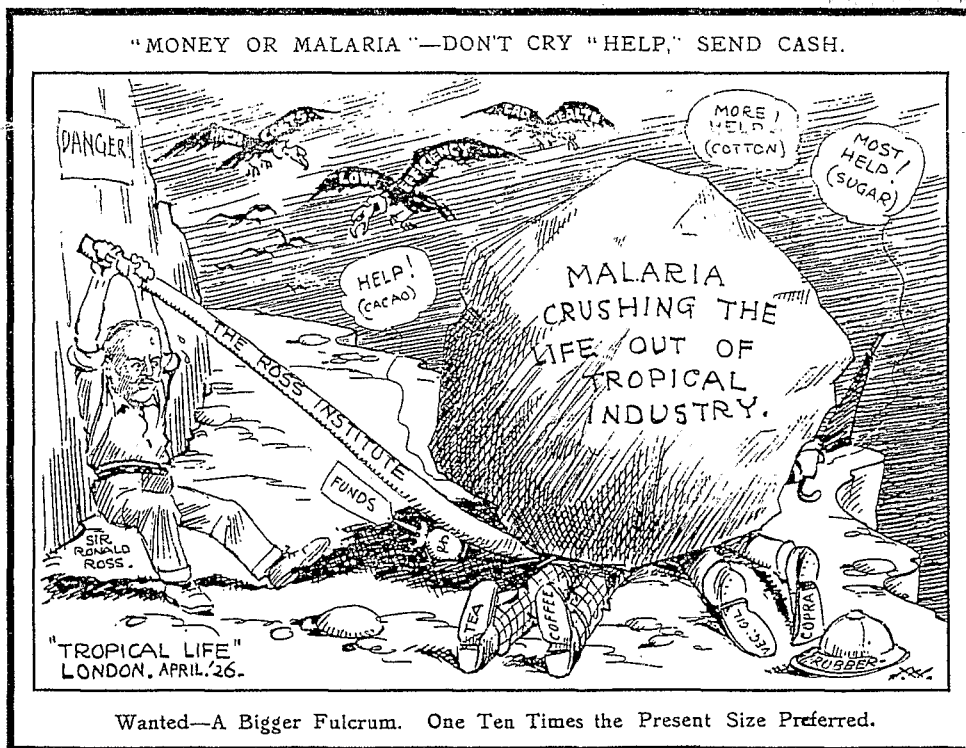
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Vol. 91 No. 4, pp. 369-496
July-August 1997

ISSN 0035-9203

Transactions of the

Royal Society of Tropical Medicine and Hygiene



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