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# SCIENTIFIC NOTE

# *ANOPHELES (CELLIA) CARNEVALEI* IN EQUATORIAL GUINEA (WEST-CENTRAL AFRICA)

J. CANO,[1] S. NZAMBO,[1] J. N. BUATICHE,[1] M. ONDO-ESONO,[1] F. MICHA[1] AND A. BENITO[2,3]

ABSTRACT. *Anopheles (Cellia) carnevalei* is described in the mainland region (Río Muni) of Equatorial Guinea. Anophelines collected were identical to *An. nili* with exception of some morphological characters found in wings, head, and legs.

**KEYS WORDS** *Anopheles carnevalei, Anopheles nili,* malaria vectors, tent traps, Equatorial Guinea

Several authors have reported morphological, ecological, and ethological variation among populations of *Anopheles (Cellia) nili* (Theobald) (Mouchet Gariou 1961, Gillies and De Mellion 1968, Gillies and Coetzee 1987, Carnevale et al. 1992) and have suggested that *An. nili* may be a complex of species (Brunhes et al. 1999). *Anopheles (Cellia) carnevalei* (Brunhes) is a species recently described from a few samples gathered in Ivory Coast (7 females), and from Cameroon (Brunhes et al. 1999). *Anopheles nili* s.s. is identified on the basis of the abundance and distribution of pale spots in the wing, whereas others consider it the "clear form" ("Congo form") of An. *nili* s.s. (Brunhes et al. 1999). Following this, some mosquitoes collected in Nigeria, Sierra Leona, and Ghana, described initially as the Congo form of *An. nili* s.s. (Gillies and De Meillon 1968), could be related to adults of *An. carnevalei.*

In the course of field studies in northern Equatorial Guinea, along the Cameroon border, samples of an anopheline species resembling *An. nili* were collected and identified as *An. carnevalei.* The objective of this paper is to report *An. carnevalei* in the mainland region (Río Muni) of Equatorial Guinea.

A total of 270 mosquitoes were collected in the village of Ncoho Mekah (02°13′ 23″N, 009°52′ 43″E) in the course of the field studies during the months of August and September 2001. This village is located in the forest, near the river Ntem along the border with Cameroon (Fig. 1). Three tent traps were used to make night captures. In each tent, a field worker acted as bait and collected incoming mosquitoes. Adults were identified by using the key of Hervy et al. (1998).

Segments 2 and 3 of the maxillary palps of collected adults were completely dark. Segment 4 also was dark, with the exception of a white ring in the apex and all of segment 5. Mosquitoes had disheveled scales on segment 2 and the scales were plastered down on segments 3–5 (Fig. 2). *Anopheles nili* s.s. does not have a white ring in the apex of segment 4, and segment 5 is completely white.

The costal margin of the wing had 4 white spots, including a prebasal white spot that is not present in *An. nili* s.s. in R1. Moreover, the median dark area is well defined and presents an isolated pale spot in R1. In the case of *An. nili* s.s., a white spot never appears in R1 (Fig. 3). White spots were pronounced in R3, M1, and M3+4 apex, and the CuP vein was almost completely white. Fringe pale spots, named after the vein at the end of which each occurs, are represented in Fig. 3 as 4, 5, 6, and 9.

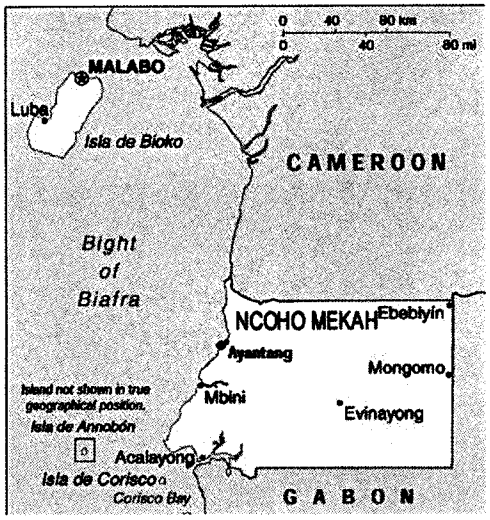


Fig. 1. Map of the mainland region of Equatorial Guinea and location of the capture station.

[1] Laboratorio de Salud Pública para el Control de Endemias (Guinea Ecuatorial), Centro Nacional de Medicina Tropical, ISCIII, Madrid, Spain.

[2] Laboratorio de Malaria, Servicio de Parasitología, Centro Nacional de Microbiología, ISCIII, Ctra. Majadahonda-Pozuelo Km 2, 28220, Majadahonda, Madrid, Spain.

[3] To whom correspondence should be addressed.

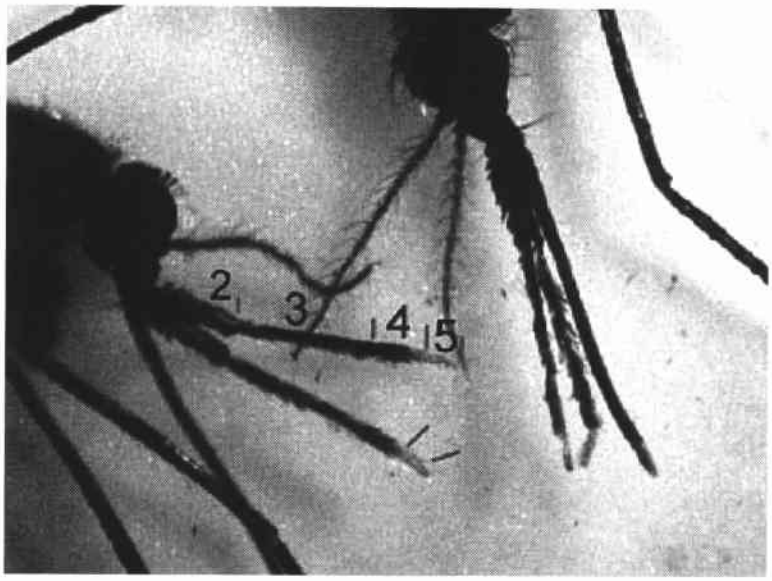


Fig 2. Representative head of mosquitoes collected.

Pale spot number 5 at the end of the vein is not present in *An. nili* (Fig. 3).

The three pairs of legs were evenly dark but some small white rings appeared in the apex of tarsomeres I and II. These white rings become more patent on leg III. A small white ring on leg III also was present apical to the tibia. These segments are completely dark in *An. nili* s.s. A comparison of characters of mosquitoes gathered in Ncoho Mekah and *An. nili* s.s. are listed in Table 1.

On the basis of these 3 sets of phenotypic characters, and the keys of Hervy et al. (1998), mosquitoes collected in this region of Equatorial Guinea were diagnosed as *An. carnevalei.*

Molecular or chromosomal research will allow us to determine if *An. carnevalei* is more closely related to the clear form or Congo form of *An. nili* s.s. of Central Africa, or if it is a different species present in the forest area of the western coast countries. The specimens collected in this study could represent a new species whose geographical distribution covers the forested areas along the Atlantic coast from Sierra Leona to Angola.

The samples of *An. carnevalei* gathered in this study are probably anthropophilic and endophagic. Other authors have also described *An. carnevalei* (like *An. nili* s.s.) as anthropophilic (Brunhes et al. 1999). Polymerase chain reaction methods to detect infection with *Plasmodium* in mosquitoes from Madrid are part of an ongoing study to assess the role of *An. carnevalei* in malaria transmission. We have examined the small pools that are formed in the banks of the river Ntem (along the border with Cameroon) as the possible breeding site for the *An. carnevalei* gathered in this study. We have captured anopheline larvae in these pools, but the morphology of larval *An. carnevalei* have not been described. We are uncertain whether *An. carnevalei* is only present in the border area with Cameroon

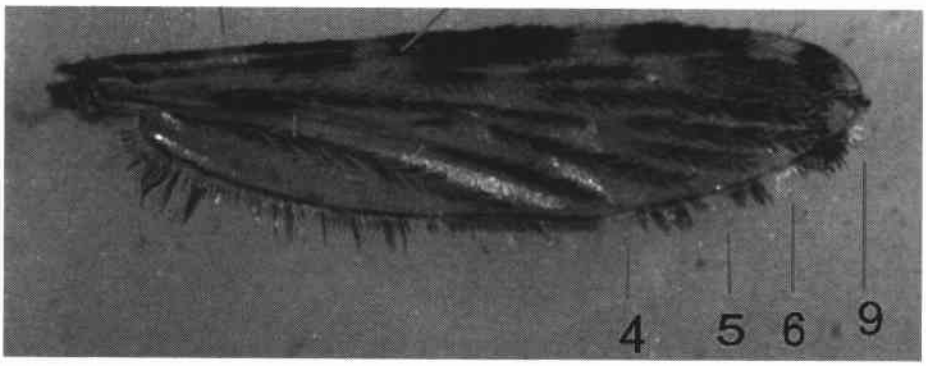


Fig. 3. Representative wing of mosquitoes collected.

Table 1. Characters differentiating *Anopheles carnevalei* from *An. nili* s.s.

| | Differentiating characters | *An. carnevalei*–collected | *An. nili* s.s. |
|---|---|---|---|
| Head | Coloration of segment 4 of the maxillary palps | White ring in the apex | Completely dark |
| Wings | Number of white spots of the costal margin | 4 white spots | 3 white spots |
| | Coloration of the median dark area o the costal margin | Well delimited with a white isolated spot in R1 | Well delimited and homogeneous |
| | Coloration of vein CuP | Mostly white | Only a small white spot |
| | Distribution of the fringe pale spots, named after the vein at the end | 4, 5, 6, 9[1] | 4, 6<br>4, 6, 9 |
| Leg I | Tarsomere I | With only 1 apical white ring (length ≤ diameter) | Completely dark |
| | Tibia | With only 1 apical white ring | Completely dark |
| Leg III | Tarsomere I | With only 1 apical white ring | Completely dark<br>One apical white ring |
| | Tarsomere III | With only 1 apical white ring (length ≤ diameter) | Completely dark |

[1] The alar fringe of *An. carnevalei* shows white spots on the apex in locations (4, 5, 6, 9).

or appears in other forest villages of the mainland region of Equatorial Guinea.

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