

CONTRIBUTION TO THE BIOLOGICAL STUDY OF  
GLOSSINA PALPALIS PALPALIS R.D.  
IN THE POPULAR REPUBLIC OF THE CONGO

P. CARNEVALE\* and J.P. ADAM\*\*

Laboratory of Medical Entomology-Parasitology of the ORSTOM  
Center of Brazzaville (Congo)

Implementation of a cattle ranch in the loop of the Niari, gave us the opportunity to make the following observations on the Glossina population.

The species in question is *Glossina palpalis palpalis* R.D. almost exclusively present. In effect, during the six studies, each of three weeks to a month, of more than 7,000 flies caught, only one belonged to another species (*G. schwetzi*).

The zone studied, the plain of Dihessé, is a long depression, with a fairly smooth bottom, located between the Niari on the east and north and a group of hills reaching a maximum height of 400 m in the west. The average altitude is 150 m. The coordinates are approximately 3°30' to 4°10' latitude South and 12°30' to 13°0' longitude East. The climate of this region is the driest in the Congo with 1,151.9 mm. average yearly rainfall. The dry season is from the end of May to the beginning of October.

This plain, with soil which is sandy-clay to clay, is covered with an herbaceous carpet with a grassy predominance: *Hyparrhenia diplandra* and *lecomtei* with a high proportion of *Imperata cylindrica*.

Coming from the western hills, the streams cross the plain from west to east before emptying into the Niari or forming pools and swampy depressions or disappearing into karstic soil.

The study of two standard habitations, the wooded areas of Makassa and the one of Mouindi, produce the following figures:

	Makassa	Mouindi
April-May	7.68	2.26
July	11.12	4.73
September	5.20	3.06
December	3.02	3.34

These variations show a concentration of the populations of Glossinae in the permanent habitations during the dry season (July). During the rainy seasons (April-May), the flies scatter over a larger area. In September, in the permanent habitations, the populations of Glossinae are slightly reduced because of the reduction of food resources. In December the dispersal has already started.

\* In charge of Research of ORSTOM.

\*\* General Inspector of Research ORSTOM.

In a permanent habitation the sex-ratio remains constantly higher than the unit  $\left(\frac{\text{number of } \text{♀}}{\text{number of } \text{♂}}\right)$ . It varies little during the year. Therefore, in Mouindi it was found:

in April-May	at 1.45
in July	at 1.63
in September	at 1.24
in December	at 1.29

We have studied the hourly variations of the frequency of the attacks during the day. Eight collectors were used in order to reduce the influence of the personal factor. There are two maxima which change during the year: the absolute maximum being:

in July between	1100 h & 1200 h
in September between	0900 h & 1000 h
in December between	1000 h & 1100 h.

The aggressiveness of males and females differ; females showing their maximum aggressiveness about one hour before males. In actual practice, calculations show that 93.92% of the captures are made between 0900 and 1,600 hours.

We have studied the nocturnal resting-places of the Glossinae by releasing marked flies in a section of wooded area, artificially isolated, and with small paths. The marking was made by pasting pellets on the *scutum* (2×3 mm) covered over with fluorescent paint: orange for the females, yellow for the males. The search for flies at rest was made between 2,000 and 2,100 hours with a 175 W black light projector (Wood light), powered by a portable electric generator. The marked flies were easily located up to five or six meters from the projector.

A total of 880 Glossinae were marked and released (499 females and 381 males) on nine occasions. Fifteen nocturnal searches resulted in a recapture of 216, 78 females and 138 males. The large majority of tsetse was testing on top of the support (100% of the females and 97.8% of the males).

In 178 cases we have measured the height of the resting place in relation to the ground. Thus, 90.3% of the males and 79.6% of the females were observed between 0 and 50 cm (87.6% of the recaptures Glossinae). Only one per cent of the females was above 2 m (2.30 m) and no male higher than 1.70 m.

The chosen resting places were in this order:

Dead leaves	26.3%
Twigs	24.0%
Liana	15.2%
Green leaves	13.4%
Branches	7.4%
Tendrils	6.4%
Roots	3.7%

Trunks	1.8%
Plant stems	0.9%
Dead wood	0.4%

We have also noted that on the leaves, more than 40% of the flies found were holding onto vertical leaves, 25% on horizontal leaves, 22% on leaves lying on the ground and 11.6% on oblique leaves.

The dispersal of Glossinae, was studied in the Makassa habitat. The habitat is a long wood formed by enlargement of the forest-area of the Makassa at its junction with several streams flowing from the nearby hills. Eight sectors were demarcated by paths traced around important points (great Kaporteis). Sector 8 is the farthest upstream, near the hills, where the wood is widest on a terrain threaded with many fast-moving rocky streams. The soil is fine and the forest consists of large trees with no undergrowth, as far as the edges of the streams. An open area of 400 m, separates this sector from the following, where, in contrast, dense, low vegetation covers thick wet soil. The streambeds have narrow sandy beaches. This area, unlike the preceding one, is densely populated.

The Glossinae which were collected each day, and put in "Roubaud" cages during the night, were released in the morning after individual marking by colored points using the technique perfected by Jackson (1953).

The release was effected in sectors 8-7 and 1 in order to study the modalities of passage from the unwooded area, and those of dispersal, in the entire area. A total of 150 flies were released (71 males and 79 females) and 61 recaptures (29 males & 32 females) were made.

It was thus shown that the 400 m. of cleared area simply slow down the passage of those insects whose random movements are conditioned only by the search for food (males). The behaviour of the females, who clearly migrated downstream, confirms that sector 8 does not afford good conditions, for larviposition.

In the favorable areas of the habitat (sectors 2 to 7), the dispersal is equal in all directions. Finally, the females show a distinct tendency to leave sector 1 where the lack of shade makes the site less favorable for the deposit of pupae.

The marking, as much for the studies of dispersal as for the search of resting-places, allowed us to obtain some information on the extent of the movements of *G. Palpalis palpalis*. A fly was recaptured 3 km from its take-off point in open terrain. Assuming that it followed the wooded area, it travelled a distance of about 8 km. Another glossina (marked 006) was recaptured 12 km from take-off point and in following the wooded area the distance is almost identical.

In July 1971 we undertook a study of the population dynamics of the Glossina a standard habitat. The flies captured each day were dissected for examination of the ovaries and estimation of the physiological age.

The teneral gathered in this habitat, and in two others near-by, were released each day after individual marking. Within three weeks, one hundred and eighty flies were released out of which twenty one were recaptured in the

4th week (11.6%). The results of this study are based on examination of nineteen females recaptured at various times: ten less than a week after the release; six about eight to ten days after the release; one thirteen days after; one sixteen days and one twenty days after the release.

The stages of the maturation of the ovaries as we have observed, are the following:

— During the first week progressive maturation of the ovaries, according to sample 4213, that is to say, beginning with the right internal ovariol. On the 6th day this ovariol encloses an egg which is not entirely ripe. On the 9th day it is ready to drop into the uterus while the left internal ovariol begins its growth. On the 13th day the egg is still in the uterus; in place of the right internal ovariol is a follicular relic. The left ovariol is maturing. On the 16th day, the uterus contains a young larva, with well differentiated polyneustic lobes still surrounded by the longitudinally broken "shell" of the egg. The left internal ovariol contains a vitellus occupying from  $\frac{3}{4}$  to  $\frac{4}{5}$  of the ovocyte.

On the 20th day the uterus is empty again, the larva period III having been completed; the left internal ovariol contains an almost ripe egg ready to drop down, while the right external ovariol is developing (vitellus occupying  $\frac{1}{6}$  of the ovocyte). This stage, "empty uterus", according to Challier (1968), lasts one day. Thus the first laying of eggs seems to take place at about the 19th day of imaginal life; about ten days separate the stage "egg ready to drop into the uterus", starting from the right internal ovariol, from the similar stage of the left internal ovariol. This interval of ten days, between each ovulation, represents the length of the larval life *in utero*.

During the dry season, the 1st ovulation occurs about the 9th or 10th day of imaginal life and the 1st larviposition occurs around the 19th or 20th day. The length of the larval life being of ten days, the second egg-laying must occur about the 30th day.

These results from *Glossina palpalis palpalis*, correspond to those obtained for *Glossina palpalis gambiensis* by Challier (1968) who found, for the period of June to September (in Upper Volta) an interval of ten days between two ovulations, a first ovulation about the 9th day and the laying of the first larva about the 17th day. Dissection and examination of the ovaries of 284 females of *G. palpalis palpalis*, in which 100 known females were included, has enabled us to determine the status of the population. Using the Challier method (1965), we obtained the distribution in 8 age groups, from 0 to group VII+4n; 31.5%; 16.9%; 16.4%; 12.5%; 14.5%; 3.9%; 2.6%; 1.5%.

Applying the Saunders method (1967) to the same population, we were able to calculate its structure up to the age group XI+4n, and for the various groups: 31.5%; 16.9%; 16.4%; 12.5%; 14.0%; 3.1%; 2.3%; 1.3%; 0.5%; 0.5%; 0.2% and 0.

For the following groups XII+4n to XV+4n, calculation gives 0.250, 0.423, 0.177 and 0.0 which, brought back to the "whole fly", gives 0 for each category. Therefore, out of 384 females examined, 121 were nulliparous and 263 parous:

Among these last 111 (42.2%) had an egg in the uterus

77 (29.2%) contained a young larva  
(st. 1-2)

6 ( 2.2%) contained an old larva  
(st. 3)

and 69 (26.2%) had an empty uterus.

Analysis these results and obtained by the dissection of the marked and recaptured teneral females, we established a correlation between the chronological and physiological age. It appears then that, in the habitat of the Makassa and in the dry season, the survival of female flies may be three months and that the population holds high proportion of young females.

The survival curve and the estimation of the specific rate of growth ("weekly rate"  $r$ : 0.001458 for a "specific fertility rate of age"  $m_x$  maximum: 0.5) show that, in the habitat studied and for this time of the year, the population of Glossinae is practically stable with a small rate of growth.