

# THE OVIPOSITION TIME OF *SIMULIUM DOWNSI* TRAPPED OVER A BREEDING STREAM IN GUATEMALA (DIPTERA, SIMULIIDAE)

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**ABSTRACT.** *Simulium downsi* were trapped by a modified Malaise trap over an oviposition site during 4 days from 0700–2000 hrs. A total of 871 *S. downsi* were captured, mostly between

One of the species of Guatemala black flies, *Simulium (Psilopelmia) downsi* Vargas, Martínez Palacios and Díaz Nájera, has special interest for those working on black fly-borne human diseases. It is distributed in areas endemic for onchocerciasis, the principal filarial disease transmitted by simuliids, and has anthropophilic proclivities. It was included on the list of man-biting species compiled by Travis et al. (1974), given as one of the anthropophilic species in Guatemala by Dalmat (1955) and Garms (1975), was included among the species coming to human attractants by Wilton and Collins (1978), and its potential as a vector of onchocerciasis was discussed by Collins (1979). One of the authors (MEM) has been bitten by this species at elevations of 900 and 1400 m in Guatemala. *Simulium downsi* does not, however, exhibit this trait throughout its geographical range, for Vargas and Díaz Nájera (1957) reported it to be very common in Chiapas State, Mexico; however, it was not anthropophilic there.

In the course of studying black fly trapping devices, an opportunity was afforded to observe one feature in the biology of *S. downsi*, its diurnal oviposition pattern, the subject of this report.

## METHODS AND MATERIALS

The investigation was conducted at Finca Los Tarrales, Department of

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1500–1800 hours; 85.9% of the flies collected were females. A large proportion of these were gravid, demonstrating that the females were ready to oviposit in the late afternoon.

Suchitepequez, Guatemala, on Rio San Pedro. This stream is about 150 cm wide and 12 cm deep at the study site. Many leaves of *Dieffenbachia* spp. are trailing in the water at its margins and were used by *S. downsi* as substrate for oviposition, as well as attachment for larvae and pupae. The velocity and flow rate of the stream were 30.5 cm/sec and 49.8 liters/sec, respectively, during the dry season when the observations were made.

The trap used for the study was a Malaise trap, Malaise (1937), as somewhat modified by Townes (1962), and shown to be a valuable collecting tool for medically important insects by Breeland and Pickard (1965). Service (1977) further suggested that this trap could be useful to study adult emergence or movements of gravid females. A commercial model of this trap was further modified by shortening the internal, crossed panels to be even with the base of the external cone. In this way it was used as an emergence trap to collect adult black flies as they emerged from the pupae without wetting the panels; however, large numbers of gravid females were captured. After initial trials proved that it was capturing adults, hourly collections were made from 0700–1800 hr during February 9–10 and March 16–17, 1978. On March 16 and 17 the trap was continued for longer periods, i.e., to 1900 hr and 2000 hr, respectively.

All adult females were anesthetized and dissected in normal saline (0.85%) with 10% glycerine added and examined

under a dark-contrast phase microscope. The condition of the ovary and the modified Christopher's stage of the follicles, as defined by Cupp and Collins (1979), were recorded. Additional females were reared from pupae to check ovarian development of newly emerged individuals.

## RESULTS.

During the 4 days of collecting, 871 *S. downsi* were captured in the trap, of which 748, or 85.9% were females (Table 1, Fig. 1). Although trapping started at 0700 hr, no *S. downsi* were captured until the 0800–0900 hr and none were caught after 1900 hr. Only 28 were collected in the 1800–1900 hr.

In all, 624 or 83% of all females, were fully gravid, apparently ready to oviposit. Only 43 (5.7%) had ovaries with follicles in Christopher's stages I and II; and although they were captured throughout the day, 76.7% of these were captured in the trap after mid-day. Another 17 were found to have the ovarian follicular tube in the sac stage, indicating recent (1–2 hr) oviposition (Cupp and Collins 1979). A total of 64 (8.5%) of the females examined had ovaries infected with an un-

known pathogen that appeared to be similar to a fungus mentioned by Garms (1975, Fig. 5B) and Collins et al. (1981). It was impossible to determine their follicular development. The diurnal distribution of infected females was roughly proportional to the total number of females collected during each hr and 89% of them were encountered between 1300 and 1900 hr.

## DISCUSSION

The preferred oviposition time is suggested by the number of gravid females collected each hr. The vast majority of the females were ostensibly ready to oviposit between 1500 and 1800 hr. Of all the gravid females captured, 93% were captured in this 3-hr period in the environs of the stream. Small numbers of gravid females were trapped during most other hr of the day, except 0800–0900 and 1200–1300 hr. Therefore, not all the females were on the same rhythm as the majority.

Although this is the 1st report of oogenetic activity of *S. downsi*, the customs of other species have been reported in the literature. Davies and Peterson (1956) re-

Table 1. Hourly trapping record of *S. downsi* in a modified Malaise trap, Rio San Pedro, Finca Los Tarrales, Guatemala, February–March 1978.

Time	Total Trapped		Number of Females			
	Female	Male	Gravid	Ovary stages I–II	Sac Stage	Ovaries Infected
0800–0900	2	5	0	2	0	0
0900–1000	4	9	4	0	0	0
1000–1100	11	8	4	4	0	3
1100–1200	11	3	1	4	2	4
1200–1300	3	3	0	3	0	0
1300–1400	8	5	2	4	0	2
1400–1500	16	2	8	5	1	2
1500–1600	134	18	116	5	2	11
1600–1700	266	30	236	8	7	15
1700–1800	265	24	231	7	4	23
1800–1900*	28	15	22	1	1	4
1900–2000**	0	1	0	0	0	0
Total	748	123	624	43	17	64

\* Operated for 2 days only.

\*\* Operated for 1 day only.

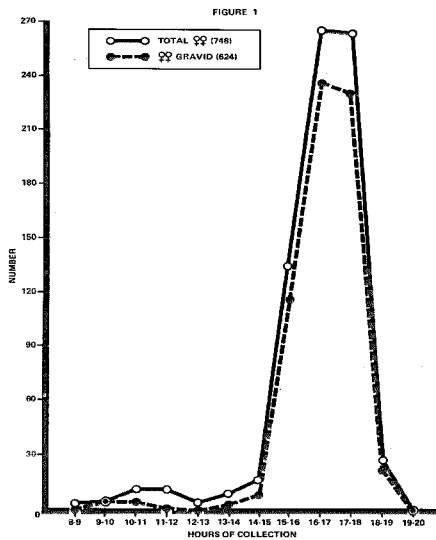


Figure 1. The number of *S. downsi* collected hourly in a modified Malaise trap, Finca Los Tarrales, Guatemala, 1978.

ported that *Prosimulium hirtipes* Fries was ovipositing at 1530–1545 hr, *Simulium pictipes* Hagen at 1930 hr, *Simulium venustum* Say at 1700–2030 hr, and *Simulium vittatum* Zetterstedt reached maximum egg-laying activity at 1930 hr. Likewise, Dalmat (1955) recorded the activity of Central America species; e.g., *Simulium callidum* (Dyar and Shannon) oviposits at 1530–1730 hr, *S. metallicum* Bellardi at 1700–1800 hr and *S. ochraceum* Walker at 1200–1400 hr. This latter observation was confirmed by Garms (1975). Except for *S. ochraceum*, the late afternoon hr are preferred by most of the black fly species investigated.

Davies and Peterson (1956) have observed that some species of black flies, e.g., *Cnephia dacotensis* (Dyar and Shannon) and *Gymnopsis dichopticus* Stone, emerge from the pupal stage with eggs fully developed. Since, in this study, the modified Malaise trap was used as an adult emergence trap, the possibility

existed that the gravid *S. downsi* trapped were newly emerged. Evidence points to the contrary, however. A total of 54 *S. downsi* females have been individually reared from pupae and all had ovaries with follicles in the N stage.

Gravid females of *S. downsi* are obviously strongly attracted to this type of Malaise trap. Since the trap was over the stream where *S. downsi* are known to oviposit in large numbers, it is assumed that they were in that locale for the purpose of laying eggs. Evidence of this can be drawn from the hourly catch of females with the ovarian follicular tube in the sac stage. Of the total in that stage, 76.5% were caught in the 1500–1800 period; this peak coincides with the peak numbers of gravid females trapped (Table 1). It is probable that more females that had recently oviposited were not captured because they have a strong host-seeking motivation and, therefore, were much more attracted to the bovine animals pastured in the vicinity of the stream than to the trap.

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