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PHYSIOLOGICAL AGE OF TABANID (DIPTERA) POPULATIONS IN SWITZERLAND[1]

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Abstract. Physiological age was determined for 464 females of 10 tabanid species captured in Manitoba traps in the Swiss Jura. Based on a parity study, *Haematopota pluvialis, Haematopota crassicornis* and *Hybomitra kaurii* appear to be autogenous in this locality. Parity was also determined for *Hybomitra bimaculata, Hybomitra micans* and *Tabanus bromius* to discern temporal variations. At the beginning of the season the number of nulliparous specimens was too small in comparison to the number of parous females captured later. This suggests the coexistence of autogenous and anautogenous individuals of the same species.

Studies on physiological age of tabanid populations provide important information on the reproductive biology of the species. Examination of the ovarioles may reveal the number of completed gonotrophic cycles and, in turn, whether females have potential as vectors. From parity studies, significant progress has been made in determining whether females are autogenous or anautogenous in the 1st gonotrophic cycle (Saito 1967, Rockel 1969, Thomas 1969).

A further question arises: Are there tabanid species among which autogeny is facultative (i.e., occurs only under certain conditions or for some individuals)? Such a situation has been documented for mosquitoes (Corbet 1967) and suggested but not demonstrated for tabanids (Troubridge & Davies 1975, Lake & Burger 1980).

The present paper is concerned with the ovarian cycles of 10 European species captured in a rough, mountainous region. Because of frequently cold temperatures, tabanids have limited flight activity. Blood meals are therefore difficult to obtain and these species would theoretically benefit from facultative or obligatory autogeny. The objective of this study was to determine the prevalence of autogeny in *Hybomitra* and *Tabanus* species.

MATERIALS AND METHODS

Tabanids were captured daily between 1 June and 31 August 1976 in 5 modified Manitoba traps (Auroi 1978). These traps were placed in and around a peat bog at Le Cachot, in the valley of La Brévine (canton of Neuchâtel), Jura Mountains, Switzerland. The study area (previously described by Auroi 1978) is about 0.5 km^2 at an altitude of 1040 to 1100 m.

The valley of La Brévine has a cold, damp climate. Average monthly temperatures range from −4.1 °C in January to 13.3 °C in July. Average yearly precipitation amounts to about 1446 mm. Daytime temperatures in summer seldom exceed 25 °C, whereas night temperatures generally drop below 5 °C. During 1976, there was an exceptional period of constantly warm weather (mean daytime temperature never below 15 °C) between 2 June and 20 July. There was no rainfall between 2 June and 3 July.

After capture, all specimens were immediately frozen at −15 °C. Ovaries were subsequently removed and examined within 6 months. Parity was determined using Polovodova's method (in Detinova 1962). Bertram's terminology (Detinova 1962) was followed when describing ovarian structures.

RESULTS AND DISCUSSION

No nulliparous specimens were observed for *Hybomitra kaurii* Chvála & Lyneborg, *Haematopota pluvialis* (L.) and *Haematopota crassicornis* Wahlberg (Table 1). According to Thomas (1972) this suggests autogeny. Our results confirm those of Ivanishchuk (1977) for *H. pluvialis* and *H. crassicornis.* On the other hand, the autogeny of *H. kaurii* has not previously been reported.

Parous horseflies captured in Manitoba traps probably were seeking blood. Thus, they have potential for mechanical and biological transmission of pathogens. Since the majority of parous individuals (74%) had ovarioles with distended follicular tubes, these females began seeking vertebrate hosts shortly (48–72 h) after oviposition. With the exception of *Tabanus bromius* L., the proportions of individuals with contracted follicular tubes were less than 37%. The duration between oviposition

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TABLE 1. Physiological age, egg retention and number of blooded ♀ tabanids, Le Cachot, Swiss Jura, 1976.

	Total ♀ examined	No. (%)				
		Nullipars	Unipars	Pars with egg retention	Pars with blood	Pars with contracted follicular tubes
Hybomitra						
aterrima (Meig.)	4	1 (25)*	3 (75)*	1 (33)**	0 (0)**	1 (33)**
bimaculata (Macq.)	38	13 (36)	25 (64)	2 (8)	0 (0)	4 (16)
distinguenda (Verr.)	15	10 (67)	5 (33)	0 (0)	1 (20)	1 (20)
kaurii Chv. & Lyn.	89	0 (0)	89 (100)	6 (7)	2 (2)	16 (18)
lundbecki Lyn.	7	1 (14)	6 (86)	1 (17)	0 (0)	0 (0)
micans (Meig.)	39	10 (26)	29 (74)	5 (17)	2 (7)	4 (14)
Tabanus						
bromius L.	104	50 (48)	54 (52)	9 (13)	3 (6)	30 (56)
maculicornis Zett.	6	1 (17)	5 (83)	1 (20)	0 (0)	1 (20)
Haematopota						
pluvialis (L.)	151	0 (0)	151 (100)	14 (9)	4 (3)	39 (26)
crassicornis Wahl.	11	0 (0)	11 (100)	0 (0)	0 (0)	4 (36)

* % of total.
** % of pars.

and the search for hosts is possibly longer in *T. bromius,* or the rate of contraction of follicular tubes in this species may be faster than in the other species.

Biparity was not observed in the autogenous *H. pluvialis.* Females have been observed biting humans and cattle, and 4 specimens with partial blood meals were collected. The absence of biparous females suggests that there is either heavy mortality after the 2nd oviposition or that follicular relics do not form and remain separated after each gonotrophic cycle, as apparently happens in *Tabanus nigrovittatus* Macquart (Magnarelli & Stoffolano 1980).

Seasonal parity for *Hybomitra bimaculata* (Macquart), *Hybomitra micans* (Meigen) and *T. bromius* is illustrated in Fig. 1. The duration of the periods considered (10 days) was chosen in accordance with Wyniger (1953), who noted for *T. bromius* that 10–15 days elapse between the blood meal and oviposition under temperature conditions similar to those measured at Le Cachot. Therefore, a nulliparous individual having a blood meal in one 10-day period will oviposit and be uniparous only in the next period. This is assumed to be true for the 3 species studied.

If we assume that the individuals examined form a representative sample of the total population, then Fig. 1 depicts the variations in the number of parous females in the total population. (The reduction of the total population through capture is negligible.) Following this, it was found that in each species the number of nulliparous individuals caught in the 1st 10-day period was too small to account for the number of uniparous females in the 2nd. Likewise, the nulliparous females in the 2nd period were not numerous enough to account for the great number of uniparous individuals in the 3rd period.

The paucity of uniparous individuals in *H. bimaculata, H. micans* and *T. bromius* is unusual because, in time, we would expect to have an increase in the number of parous females equal to or less than the number of nulliparous horse flies observed in the previous period. This was clearly demonstrated, for example, by Magnarelli (1976) for *Hybomitra lasiophthalma* (Macquart) in New York State, USA, even though he worked with shorter periods (7 days).

If we assume that our results are significant in spite of the small number of captures, it would be an interesting hypothesis to imagine a facultative autogeny (i.e., affecting only a part of the population) in the 1st ovarian cycle of the species studied. At the nulliparous stage, autogenous females would not be attracted by Manitoba traps, whereas at the uniparous stage they would appear in the traps, causing the unexpectedly high numbers of uniparous females that were observed.

Facultative autogeny has been suggested for tabanids (Troubridge & Davies 1975) and, according to these authors, the proportion of parous flies in obligate, anautogenous species is low, increasing slowly at the beginning of the season, then faster

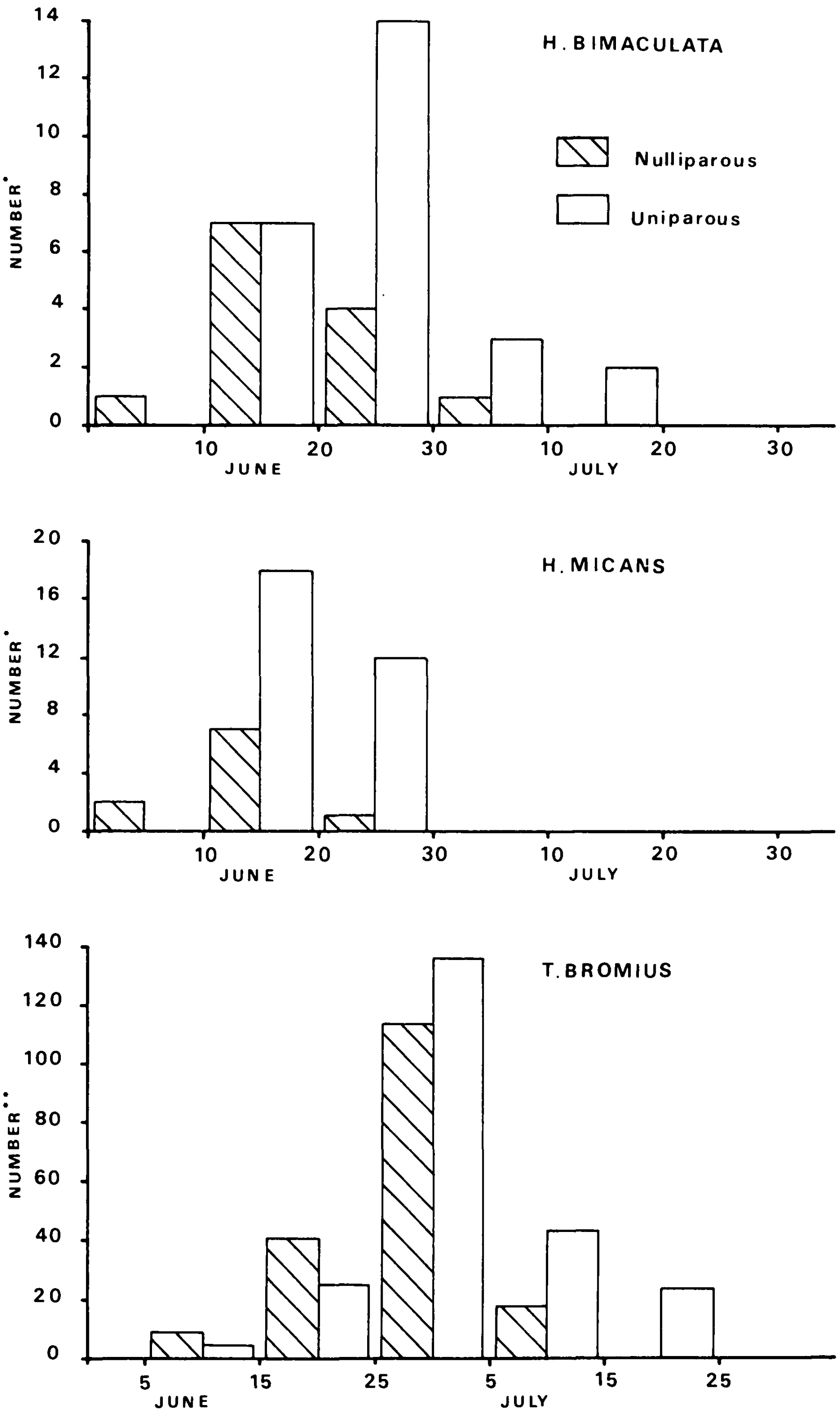

FIG. 1. Number of nulliparous and uniparous horse flies captured in 10-day periods, using modified Manitoba traps, Le Cachot, Swiss Jura, 1976. * All captured ♀ were examined. ** Only 104 of the 421 captured ♀ were examined. Values in the figure were calculated for each 10-day period, according to the ratio of nullipars : unipars among the examined ♀.

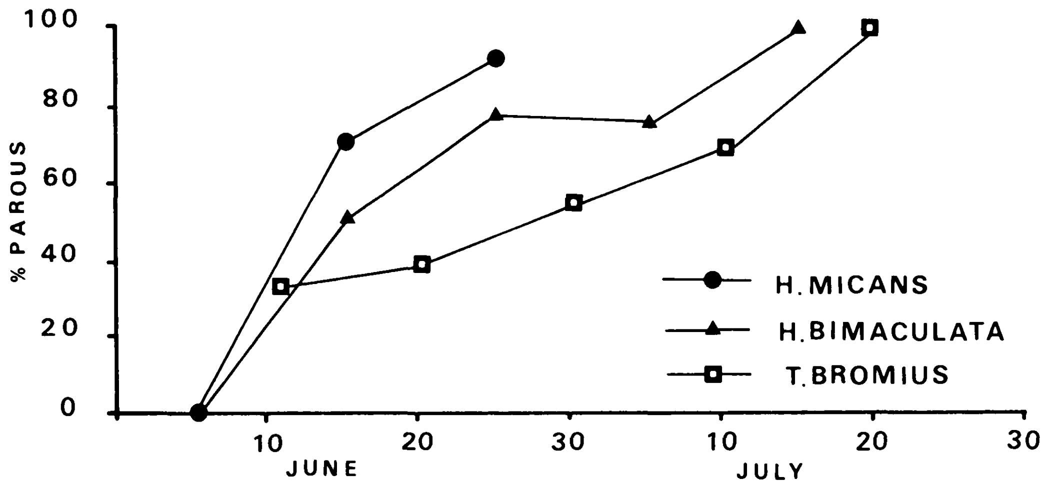

FIG. 2. Variation in the proportion of parous horse flies captured in 10-day periods, using modified Manitoba traps, Le Cachot, Swiss Jura, 1976.

at the end. In facultatively autogenous species, the proportion of parous specimens increases very quickly at the beginning of the season and remains at high levels thereafter.

According to the above criteria, *H. micans* and *H. bimaculata* appear to be facultatively autogenous (Fig. 2), while *T. bromius* would seem to be anautogenous. This result seems to reveal a weakness in the criteria set by Troubridge & Davies (1975), based on proportions where the variations in the total number of captures were not taken into account. Hence, according to these authors, *H. lasiophthalma* is facultatively autogenous. However, if we consider the total number of nulliparous and parous individuals they observed, we note that the number of nulliparous females captured during 1 week is always greater than the number of unipars captured the next week (with the only exception in the 1st week). From my point of view, this tends to indicate that *H. lasiophthalma* is anautogenous, as is generally assumed.

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