

Honeydew-Feeding Behavior of Salt Marsh Horse Flies (Diptera: Tabanidae)

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ABSTRACT Salt marsh horse flies were observed feeding on aphid honeydew located on the leaves of marsh elder, *Iva frutescens* L. Most feeding individuals were males. Onset of feeding activity of *Tabanus nigrovittatus* Macquart occurred when hovering and mating activity ended. Because males and females have not been observed previously to feed on floral nectar, honeydew may represent a major source of carbohydrates for flight.

KEY WORDS Insecta, *Tabanus nigrovittatus*, honeydew, feeding behavior

ALTHOUGH MORE THAN 50% of field-caught females of *Tabanus nigrovittatus* Macquart test positive for the presence of plant-derived sugars (Magnarelli et al. 1979), and both sexes require carbohydrates for flight (Hocking 1953), the source of these sugars remains unknown. Bosler & Hansens (1974) presumed that the source was nectar, but this species has not been observed to visit flowers (Magnarelli et al. 1979). Pollen found on the bodies of females was primarily from marsh grasses (Magnarelli et al. 1979) and could have been acquired incidentally during resting or oviposition. The same authors suggested that *T. nigrovittatus* might utilize aphid honeydew but indicated the need for further studies to identify sugar sources. In the present study, we observed males and females of several *Tabanus* species feeding on aphid honeydew on marsh elder (*Iva frutescens* L.) leaves.

Materials and Methods

Observations were made on a salt marsh in Bass River State Forest near Mystic Islands, N.J., on 25, 28, 29, and 30 June 1987. Males hovering along a transect (3 by 30 m) were counted at 10-min intervals from sunrise until 0900 hours EST. The number of flies feeding at four marsh elder bushes at the intersection of a creek and a mosquito ditch was counted at 15-min intervals beginning at sunrise and continuing until late morning (until sunset on 29 June). Because feeding flies were approached easily, we visually identified the sex and species of most individuals.

Results

Males and females of four *Tabanus* species (Table 1) were observed on the upper surface of marsh elder leaves, below aphid concentrations located on upright terminal shoots. Honeydew droplets were clearly visible, and flies were seen walking on the

upper surfaces of the leaves, moving their forelegs from side to side and stopping to probe these droplets with their labella. A total of 200 horse flies was observed feeding on the four observation dates, 82% of which were males (Table 1). In four summers of field studies on hovering, we never observed horse flies feeding on flowers on or near the marsh.

Honeydew feeding by *T. nigrovittatus* appeared to have a distinct time of onset, though this time varied by more than 30 min over the four sample dates. Males exhibited two morning periods or "waves" of hovering and mating activity, the timing of which was dependent on temperature (Gaugler & Schutz in press). Feeding began toward the end of, or after, the second hovering period (Fig. 1). On 29 June, feeding activity peaked between 0900 and 1200 hours EST and then decreased sharply, with no activity observed after 1530 hours. During the period between the end of hovering and the onset of feeding, we observed many individuals engaged in "dipping" behavior, during which they flew rapidly 1-2 m above the creek surface and descended to make momentary contact with the water.

Discussion

Downes & Dahlem (1987) stated that honeydew produced by aphids and other Homoptera represents an important and often overlooked source of carbohydrates for many Diptera. They also suggested that the pseudotracheate labellum of Diptera may have arisen as an adaptation to dissolving and ingesting dried honeydew droplets. Our observations showed that several salt marsh horse fly species make use of aphid honeydew. The lack of observations of flower feeding indicated that honeydew may be a major source of energy for flight for these species. It is likely that other sources of honeydew are available on or adjacent to the marsh,

Table 1. Number of flies observed feeding on honeydew during June 1987

Species	♂♂		♀♀	
	n	%	n	%
<i>T. nigrovittatus</i> - <i>T. conterminus</i> (Walker) ^a	127	(85)	23	(15) ^a
<i>T. conterminus</i>	5	—	—	—
<i>T. hinellus</i> (Phillip) ^b	30	(68)	14	(32)
<i>T. atratus</i> (F.)	1	(100)	0	(0)
Total	163	(82)	37	(18)

^a Females of *T. nigrovittatus* and *T. conterminus* could not be distinguished visually.

^b Sensu Schutz et al. (1989).

and that the flies are opportunistic, feeding on the most abundant or available source at any particular time. We have observed tabanids walking up and down the blades of the salt marsh cordgrass, *Spartina alterniflora* Loos., during the late morning and early afternoon, probing the leaf surface with their labella. Magnarelli et al. (1979) observed the deer fly *Chrysops fuliginosus* Wiedemann probing aphid honeydew on leaves of *Phragmites australis* (Cav.) Trin. ex Steudel. As delphacids, cicadellids, and other Homoptera are extremely abundant on marsh grasses (Denno 1977), grass blades represent potential honeydew sources, as would leaves of deciduous trees along the marsh-forest ecotone.

Although blood-seeking females of *T. nigrovittatus* and other species were abundant at our study site, predominantly males were observed feeding on honeydew. Honeydew is probably important as a source of energy for the hovering flight of male horse flies. Because several studies have shown that female tabanids also use carbohydrates in addition to blood (Bosler & Hansens 1974, Magnarelli et al. 1979, Vorob'eva 1986), host-seeking females may acquire their sugars elsewhere, presumably in upland areas where they seek deer and other blood sources.

The onset of honeydew feeding by *T. nigrovittatus* followed the end of male hovering activity. It is logical that males seek to replenish their carbohydrate reserves after hovering. We do not know whether the two hovering waves of *T. nigrovittatus* consist of the same or different individuals. If they are different individuals, the lack of observed feeding activity after the first hovering period may be because of the relatively lower density of first-wave males at our study site. The dipping behavior at the beginning of the feeding period may serve to fill the crop with water, which can be regurgitated to aid in ingestion of concentrated or dried honeydew.

The mechanism by which tabanids locate honeydew sources bears investigation. The unusual walking motion of tabanids, during which the forelegs move from side to side and tap the substrate, might serve the same function as the "dancing" of blowflies (Dethier 1957) in location of honeydew droplets on the leaves.

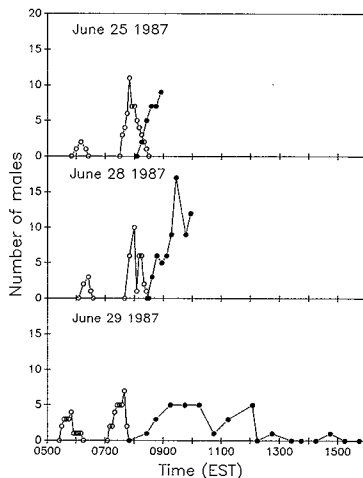


Fig. 1. Number of male *T. nigrovittatus* observed hovering (O) and feeding on honeydew (●).

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References Cited

- Bosler, E. M. & E. J. Hansens. 1974. Natural feeding behavior of adult saltmarsh greenheads, and its relation to oögenesis. *Ann. Entomol. Soc. Am.* 67: 321-324.
- Denno, R. F. 1977. Comparison of the assemblages of sap-feeding insects (Homoptera-Hemiptera) inhabiting two structurally different marsh grasses in the genus *Spartina*. *Environ. Entomol.* 6: 359-372.
- Dethier, V. G. 1957. Communication by insects: physiology of dancing. *Science* 125: 331-336.
- Downes, W. L. & G. A. Dahlem. 1987. Keys to the evolution of Diptera: role of Homoptera. *Environ. Entomol.* 16: 847-854.
- Gaugler, R. & S. J. Schutz. In press. Environmental influences on hovering behavior of *Tabanus nigrovittatus* and *T. conterminus* (Diptera: Tabanidae). *J. Insect Behav.*
- Hoeking, B. 1953. The intrinsic range and speed of flight of insects. *Trans. R. Entomol. Soc. Lond.* 104: 223-345.
- Magnarelli, L. A., J. F. Anderson & J. H. Thorne. 1979. Diurnal nectar-feeding of salt marsh Tabanidae (Diptera). *Environ. Entomol.* 8: 544-548.

- Schutz, S. J., R. Caugler & R. C. Vrijenhoek. 1989. Genetic and morphometric discrimination of coastal and inland *Tabanus lineola* (Diptera: Tabanidae). Ann. Entomol. Soc. Am. 82: 220-224.
- Vorob'eva, E. V. 1986. Carbohydrate nutrition of the horsefly *Haematopota italica* Mg. (Diptera, Tabanidae). Entomol. Obozr. 3: 487-488 (in English).
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