

Swarm-Feeding by the Damselfly
Hetaerina americana (Odonata: Calopterygidae)
on Mayfly Hatches*

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ABSTRACT

An interesting and unusual instance of swarm-feeding was observed when large numbers of the damselfly, *Hetaerina americana*, fed on hatches of mayfly subimagos over riffle areas of the White River in Indiana. The phenomenon of swarm-feeding in Odonata is reviewed and delineated and the behavior observed for *H. americana* differs considerably from previously observed patterns.

Congregations of large numbers of adult Odonata for the purpose of feeding have been noted by several authors (Walker, 1912; Kennedy, 1917; Wright, 1944a, b, 1945; Kormondy, 1959; Corbet, 1963). The term "swarm-feeding" was used by Corbet (1963) to denote this type of predatory behavior and to distinguish it from the process of swarming itself which involves interaction between individuals and is not strictly for the purpose of feeding. Moore (1953) in his study of dragonfly population densities concluded that when densities of adults are highest (when not involving any type of swarming activity) the average length of stream occupied by an individual is approximately equal to their range of perception. I would suggest that in those instances when adults occur in large numbers, in much closer proximity to each other than might otherwise be allowed for by their range of perception, and for the purpose of feeding, that "swarm-feeding" be applied as an appropriate descriptor of this phenomenon.

Previously reported observations of swarm-feeding have identified single or mixed species of dragonfly (Anisoptera only) predators and the following prey insects — midges (Chironomidae): Walker (1912); mosquitoes (Culicidae), sand flies (Ceratopogonidae): Wright (1944a); "gnats", crane flies (Tipulidae): Wright (1944b); stable flies (Muscidae): Wright (1945); stratiomyid flies and small Hymenoptera: Corbet (1963).

Details of the above reported cases have a number of common points among them and may justify some generalizations concerning swarm-feeding.

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(1) Swarm-feeding occurs when prey insects are in relatively high densities, emerging, and/or swarming. (2) Swarm-feeding occurs at dusk or dawn. (3) Swarm-feeding may often occur at locations different from the breeding habitats of the predator species. (4) Predator species tend to perceive and initiate attack of their prey while they themselves are in flight although they may perch to feed. (5) There is negligible interaction between individual predators while swarm-feeding.

Recent field observations of swarm-feeding involving the American ruby spot damselfly, *Hetaerina americana* (Fabricius), in Indiana provide an interesting and somewhat unusual case of this behavioral phenomenon, and indicate that mayflies are an important food source for these damselflies.

H. americana is a large, striking, and relatively well known damselfly which occurs along streams and rivers in much of the eastern, central and southwestern U.S., and Mexico. In the Midwest, adults occur relatively late in the season, from the middle of June through much of October (Garman, 1917), usually among emergent vegetation. The only report of the species occurring in large masses of individuals was by Kellicott (1899) where he noted that individuals of both sexes congregated in the afternoon and remained as such until the next day. I have not observed this presumed roosting behavior.

August 27, 1978, was spent sampling benthic insects with Messrs. A. V. Provonsha and D. W. Bloodgood at the Hindustan Falls area of the East Fork of the White River (Martin Co., Indiana). This is a large river and at this site has a variety of substrate types, and when it is low, distinctive riffle areas. During this cloudless and windless day a few *H. americana* adults had been casually observed occasionally along the banks or alighting on emergent objects in the river. These were the only Odonata seen on the wing that day.

As the sun began to set, just above the tree canopy level, mayfly subimagos began hatching in moderate numbers particularly over riffle areas. Those collected belonged to the genera *Isonychia* and *Baetis*, and these were probably the only mayflies coming off the water since the mature mayfly larvae found at the site included only the above two genera.

As the mayfly hatch began, *H. americana* individuals began appearing and feeding on the mayflies. Most of this activity was restricted to a riffle area approximately 20m across by 70m long. The northeast bank of this riffle area is a large bare rock outcropping which is often submerged during parts of the year. The opposite bank was lower and contained mixed vegetation.

Interestingly, *H. americana* individuals (only males were seen) began congregating on the bare outcropping in large numbers, about one every 25cm or less and totaling perhaps 200 or more perched individuals at one time. All perched individuals oriented in exactly the same manner; they faced across the riffle area directly into the sun. As subimagos appeared, one or more of the damselflies would attack from the perch. They evidently perceived prey as silhouettes against the setting sun since they did not occur on other adjacent areas or on the opposite bank which would not have offered the same vantage over the riffle. After capturing a mayfly the damselflies would land to feed but not necessarily in the same restricted area from which attacks were initiated. The

damselflies were so adept at capturing the mayflies that it was difficult to net the mayflies before they were preyed upon. Mayflies were perceived and attacked up to about 10m distance by perched damselflies. Swarm-feeding continued to be observed until the sun set.

Birds and top-feeding fish are well documented as major predators of winged mayflies (e.g., Needham et al., 1935) and swarming mayflies are reported to be an important prey item for some species of insectivorous biting midges (Downes, 1978), but Odonata have not been observed to be detrimental to large numbers of mayflies. *Isonychia* mayflies range from about 13-16 mm in length not including cerci, and subimagos being fed upon, although about half or more as large as their predators, appeared helpless as they were held and devoured by the damselflies. Although it could not be verified, midges which were also emerging in small numbers were probably also being taken by the damselflies along with the small *Baetis* mayflies.

This swarm-feeding of *H. americana* is atypical of other patterns of swarm-feeding previously discussed for Odonata in several respects and is therefore behaviorally significant. It is the first instance of damselflies (Zygoptera) rather than Anisoptera being involved. Prey are perceived and attacked from a perched position rather than an inflight position. And furthermore, hatching riffle insects, obviously within the breeding area of the predators, serve as target organisms and possibly elicit such swarm-feeding behavior.

LITERATURE

- CORBET, P. S. (1963): A biology of dragonflies. Quadrangle Books, Chicago. 247 p.
- DOWNES, J. A. (1978): Feeding and mating in insectivorous Ceratopogoninae (Diptera). Mem. Entom. Soc. Can. No. 104: 62 p.
- GARMAN, P. (1917): The Zygoptera, or damsel-flies, of Illinois. Bull. Ill. St. Lab. Nat. Hist. 12: 411-587.
- KELLCOTT, D. S. (1899): The Odonata of Ohio. O. Acad. Sci. Spec. Pap. 2: 116 p.
- KENNEDY, C. H. (1917): Notes on the life history and ecology of the dragonflies (Odonata) of central California and Nevada. Proc. U.S. Nat. Mus. 52: 483-635.
- KORMONDY, E. J. (1959): The systematics of *Tetragoneuria*, based on ecological, life history, and morphological evidence (Odonata: Corduliidae). Misc. Publ. Mus. Zool. Univ. Mich. 17: 1-79.
- MOORE, N. W. (1953): Population density in adult dragonflies (Odonata-Anisoptera). J. Anim. Ecol. 22: 344-359.
- NEEDHAM, J. G., J. R. TRAVER, and Y-C. HSU (1935): The biology of mayflies. Comstock Publ. Co., Ithaca. 759 p.
- WALKER, E. M. (1912): The North American dragonflies of the genus *Aeshna*. Univ. Toronto Stud., Biol. Ser. 11: 212 p.
- WRIGHT, M. (1944a): Notes on dragonflies in the vicinity of New Smyrna Beach, Florida. Fla. Entom. 27: 35-39.
- (1944b): Some random observations on dragonfly habits with notes on their predaceousness on bees. J. Tenn. Acad. Sci. 19: 295-301.
- (1945): Dragonflies predaceous on the stablefly *Stomoxys calcitrans* (L.). Fla. Entom. 28: 11-13.

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