NOTE

Observation on the Laboratory Life History of *Chrysops atlanticus, C. univittatus* and *C. vittatus* (Diptera: Tabanidae)[1]

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Reports on food requirements and rearing procedures for *Chrysops* Meigen larvae vary widely. Time of development of eggs following a blood meal and hatching time are not known for any species. Prior to 1936, there were no data on Nearctic species having been reared from egg to adult. However, data on various life periods of immature stages collected in the field had been reported (Schwardt, H. H. 1936. Univ. Ark. Agric. Exp. Stn. Bull. 332). Apparently *C. indus* Osten Sacken and *C. obsoletus* Wiedemann were the first Neartic species to be reared from egg to adult; general data on life periods were presented (Segal, B. 1936. N. Y. Entomol. Soc. J. 44: 51-78). Larvae of these two species were thought to be saprophagous, able to develop in a layer of moist soil rich in organic matter, but not cannibalistic.

Chrysops larvae are reported to feed on algae and debris (Mackerras, I. M. 1955. Austral. J. Zool. 3: 583-633), decaying organic matter (Lane, R. S. 1976. J. Med. Entomol. 12: 683-691), or vegetable matter (Oldroyd, H. 1973. Tabanidae (horseflies, clegs, deer-flies, etc.), pp. 195-202. *In* K. G. V. Smith [ed.], Insects and other arthropods of medical importance. British Museum [Natural History], London; Goodwin, J. T., B. A. Mullens, and R. R. Gerhardt. 1985. Univ. Tenn. Agric. Exp. Stn. Bull. 642). The latter authors report that these larvae also fed on dipteran larvae and were sometimes cannibalistic, although less so than tabanini larvae.

Chrysops vittata Wiedemann adults have been reared from field-collected eggs (Logothetis, C. and H. H. Schwardt. 1948. J. Econ. Entomol. 41: 335-336). Larvae were maintained in a layer of mud that had been heated sufficiently to kill all arthropods and then remoistened. Recently-hatched larvae were fed field-collected crane fly larvae; later, they were fed maggots of several species of blow flies. These *Chrysops* larvae exhibited no evidence of cannibalism. The life cycle was completed in ca. 1 year.

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Eleven Florida species of *Chrysops* were reared to adults by feeding field-collected larvae one or more of the following foods: earthworms, muscoid larvae, snails, beef muscle, and beef liver (Jones, C. M. and D. W. Anthony. 1964. U.S.D.A. Tech. Bull. 1295). The authors fed beef liver once or twice each week, and larvae of most species fed once each week. Length of the larval stage after collection and length of the pupal stage are given for each species.

Although the feeding habits of most *Chrysop*s larvae are unknown, evidence indicates that they are carnivorous, not herbivorous, and that some species are, in fact, cannibalistic (Pechuman, L. L. and H. J. Teskey. 1981. Tabanidae, pp. 463-478. *In* J. P. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. wood [coordinators]. Manual of Nearctic Diptera, Vol. 1. Research Branch Agriculture Canada, Monograph 27). Drawings presented by these authors show that *Chrysops* and *Tabanus* L. larvae have similar mouthparts; therefore, they should have similar feeding habits. The carnivorous feeding habits of *Tabanus* larvae are well documented.

We herein report data for all life stages for 3 species of *Chrysops* except time of development of eggs of *C. vittatus*. Previously, only the pupal period of *C. vittatus* was reported. Further, we describe a variation in the previously cited methods of rearing larvae.

A *Chrysops atlanticus* Pechuman female that fed on a human host at Morehead City, NC on June 13, 1990, deposited eggs on the side of a 7 × 20 cm laboratory cage 5 d later. The eggs hatched after 8 d. Ten larvae were placed in each of six 32 × 55 mm snap-cap vials containing stream sand that had been washed to remove organic matter, then heated at 60°C for 3 d. Tap water was added to the vials and the sand sloped to provide a gradient from moist to complete submergence. Vials were maintained at room temperature (18-26°C) throughout the study. Washed nematodes *Panagrellus redivivus* were added as food; after 28 d these were supplemented with *Drosophila* larvae which were used exclusively after 35 d. Vials were checked at 2-5-d intervals by washing the sand and counting the larvae. Numbers of larvae steadily decreased without a trace for the first 12 d, at which time the remaining larvae were divided into six additional vials. Five days later only three vials contained more than one larva, and these were separated into three additional vials. After 17 d the 60 original larvae in six vials were now 15 in 15 vials. Of these, five were lost in the washing process, and four died. The remaining six larvae pupated after 240, 245, 256, 279, 280, and 336 d. Two pupae died; four pupae produced one male and three females after 7, 9, 10 and 10 d. One larva was 14 mm long at 260 days. The four pupae were 9.5, 10.0, 10.0, and 11 mm long.

A *Chrysops univittatus* Macquart female that fed on a human host at Statesboro, GA, on May 24, 1990, laid eggs on the side of a laboratory cage 7 d later. The eggs hatched after 9 d. Initially, 4-5 larvae were placed in each of three snap-cap vials prepared and maintained in a manner similar to that for *C. atlanticus*. Larvae in two of these vials died within 18 d. Those in the other vial decreased, without trace, to one by the 22nd d. After 18 d, *Drosophila* larvae replaced nematodes as a food source. The remaining larva pupated after 318 d, and a female emerged 8 d later. At 266 d the larva was 12 mm long; the pupa was 10 mm long.

Chrysops vittatus eggs were collected on vegetation overhanging a small pool in a small stream at Statesboro, GA, on May 22, 1990. The eggs hatched in the laboratory 13 d later. Initially, 15-17 larvae were placed in each of four snap-cap vials prepared and maintained in a manner similar to that for *C. atlanticus*. Numbers of larvae steadily decreased without a trace, until, by the 23rd d, only one larva remained in each vial. After 17 d, *Drosophila* larvae were used as food instead of nematodes. One of the four remaining larvae died after 259 d. Three pupated after 259, 272, and 281 d. One larva was 12 mm long the day before pupation; the pupa was 10 mm long and produced a male after 9 d. The other two pupae died.

Early loss of larvae of each of the three species is attributed to cannibalism. The cause of death of pupae of *C. atlanticus* and *C. vittatus* pupae is unknown. The 9-d pupal period for *C. vittatus* compares favorably with a 10-d average for 21 pupae reared by Jones and Anthony (1964).