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Research Note

Biology of sugarcane woolly aphid predator, *Dipha aphidivora* Meyrick (Lepidoptera: Pyralidae)

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ABSTRACT: **A laboratory study was carried out on biology of sugarcane woolly aphid (SWA) predator, *Dipha aphidivora* Meyrick (Lepidoptera: Pyralidae). *Dipha aphidivora* occupied 5.6 ± 0.81, 24.61 ± 3.41, 7.80 ± 0.51, 1.65 ± 0.54 and 3.89 ± 0.74 days for incubation, total larval period, pupation, longevity of adult male and female, respectively. The total life cycle lasted for 43.27 ± 5.84 days. During its total larval period of 24.61 ± 3.41 days, a single *D. aphidivora* consumed on an average 6,074.84 ± 87.6 sugarcane woolly aphids.**

KEY WORDS: Biology, *Dipha aphidivora*, sugarcane woolly aphid

All around the world 47 natural enemies have been recorded on sugarcane woolly aphid (SWA). Among these natural enemies, predators (37) are predominant, followed by parasitoids (7) and entomopathogens (3) (Joshi and Viraktamath, 2004). Out of these 37 predators, belonging to six orders (Coleoptera, Neuroptera, Diptera, Lepidoptera, Hemiptera and Araneae), only three predators *viz.*, *Dipha aphidivora* Meyrick, *Micromus igorotus* Banks and syrphids are found more potential (Anon., 2004) in Karnataka. *Dipha aphidivora* is one of the most effective predators on SWA as reported by many workers (Cheng *et al.*, 1994; Liu *et al.*, 1985; Arakaki and Yoshiyasu, 1988; Tripathi, 1992 and 1995; Mote and Puri, 2003; 2004). The present investigation was undertaken to study the biology of *D. aphidivora* and its feeding potential on SWA in order to utilize this predator as one of the biological control agent in the management of SWA. A laboratory investigation was carried out at Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad during 2003-04.

The pupae of *D. aphidivora* were collected from the SWA infested field and allowed to adult emerge in the cages with glass front cages (35 x 24 x 30 cm). The emerged adults were fed with ten per cent honey solution wad in cotton swab. Moths were released in cage with the sex ratio of 1:2 (male: female) based on the abdominal size. The cage was provided with sugarcane leaf bits of 5cm infested with SWA placed in conical flask with water for deposition of eggs. The eggs deposited were counted and transferred individually to separate glass vials (3.0 x 2.5cm). The time that lapsed

between the egg deposition and hatching was recorded as incubation period. The freshly hatched larvae were enclosed separately in glass vials and stoppered with cotton plugs. Woolly aphids were provided *ad libitum* to the developing larvae. The time taken for each molt was recorded for each instar to determine the larval duration. Likewise, pupal period and adult longevity were also recorded. The biology of *D. aphidivora* was studied by maintaining fifty larvae. Further, parameters like length and breadth of different stages were measured with stereo binocular microscope at 0.9x magnification with stage and occular micrometer.

The first instar larvae of the *D. aphidivora* were enclosed in glass vials (3.0 x 2.5cm) and provided with 10 aphids every day, which included all instars. Such 25 vials were maintained. Every day the number of aphids remaining in the vial was counted and the difference in these two readings gave the day wise and the instar-wise aphid consumption. Number of aphids provided to second to fifth instars was 25 to 70 aphids per day, respectively. The total and number of aphids consumed by each instar was worked out per day, per instar and for total larval duration.

Biology of *D. aphidivora*

Studies carried out on the biology of *D. aphidivora* revealed that it undergoes five larval instars. The detailed morphometric characters of each stage are as below.

Egg: The female moth laid eggs individually or in groups in a straight line of 4 to 12, on the ventral surface of the leaf in the colonies of SWA. The egg is elongate oval and rounded at both the end. The freshly laid egg is cream to yellowish in colour and a day before hatching it turn to black. The length and breadth of the egg measure between 6.6 -7.7 mm with a mean of 7.59 ± 1.03 mm and 3.3 - 4.6 mm with a mean of 4.51 ± 0.77 mm, respectively. The incubation period is 5 - 7 days with a mean of 5.60 ± 0.81 days.

First instar: The freshly hatched larva is white to creamy white in colour with smooth body. The head capsule is light brown in colour. The length of larva varies between 15.4- 7.6 mm with a mean of 16.17 ± 0.70 mm and width varies from 2.2 to 3.3 mm with a mean of 2.53 ± 0.49 mm. The head capsule width range from 2.8 to 3.3 mm with a mean of 3.24 ± 0.16 mm. The duration of the first instar range between 2 to 3 days with a mean of 2.40 ± 0.61 days.

Second instar: The second instar larva is whitish in colour with dark brown head and brownish patch on the thoracic region. The tenth abdominal segment becomes slightly prominent in the second instar. The length and width of the larvae ranges from 18.7 to 22.0 mm with a mean of 20.02 ± 1.65 mm and 2.5 to 4.4 mm with the mean of 3.08 ± 0.44 mm, respectively. The head capsule width ranges between 4.95 to 5.61 mm with a mean of 5.50 ± 0.62 mm. The duration of the second instar is 3 to 4 days with a mean of 3.71 ± 0.53 days.

Third instar: The body of the larva is light brown with greenish tinge and head capsule was brown in colour. Sparsely distributed setae are present on the body with prominent constrictions. The larva measures 35.2 to 38.5 mm with a mean of 36.52 ± 1.21 mm in length and 5.5 to 7.7 mm with a mean of 6.60 ± 0.12 mm in width. The head capsule width ranges from 7.7 to 8.8 mm with a mean of 8.25 ± 0.69 mm. The duration of third instar larva is 5– 9 days with a mean of 6.82 ± 0.98 days.

Fourth instar: Fourth instar larva is light green in colour; head and thorax are brown and with a brown patch on the thorax. Body is constricted deeply with prominent setae. The length of the body varies between 75.1 – 81.1 mm with a mean of 79.90 ± 6.05 mm and width of 14.3 – 16.5 mm with a mean of 14.52 ± 2.97 mm. The head capsule width ranges from 8.8 to 9.9 with a mean of 9.24 ± 0.52 mm. The duration of fourth instar larva is 6 – 12 days with a mean of 7.93 ± 0.83 days.

Fifth instar: The head of fifth instar is brown in colour with green body covered by long setae. Distinct longitudinal mid dorsal line is found on the body which is green in colour. The body was fusiform and wider at the central region. The length of the body varies between 82.3 – 87.9 mm with a mean of 85.30 ± 5.13 mm and width of 17.6 – 22.0 mm with a mean of 18.70 ± 2.64 mm. The head capsule

width varies between 9.9 – 11.0 mm with a mean of 10.17 ± 0.47 mm. The duration of fifth instar is 3 – 5 days with a mean of 3.75 ± 0.46 days.

Total larval period: The total larval period of *D. aphidivora* varies from 19 to 33 days with a mean of 24.61 ± 3.41 days.

Pupa: Pupation occurred in the boat shaped, white, fine and tightly woven silken cocoon. The pupa is obtect type, dark brown colour; anterior end is blunt and posterior end conical. Pupal length varies between 69.3 – 71.5 mm with the mean of 69.85 ± 2.55 mm and width of 18.7 – 19.9 mm with a mean of 19.55 ± 0.44mm. The pupal period varies between 7 – 10 days with a mean of 7.8 ± 0.51 days.

Adult: Adult moth is with brown thorax and abdomen. Forewings are brown in colour whereas, hind wings are light brown with fringed margins. In case of male moth, on an average 54.30 ± 0.78 antennal segments are present whereas, in female it was 58.63 ± 1.91. The average antennal length of male was 40.70 ± 0.74 mm that of female is 46.20 ± 0.88 mm. The mean body length of male and female are 63.80 ± 2.05 mm and 65.3 ± 1.01mm, respectively. In male, the mean length and width of forewings are 63.80 ± 2.11 and 18.70 ± 1.67 mm, respectively. Whereas, in female the length and width are 68.20 ± 2.30 mm and 19.80 ± 0.67 mm, respectively. The mean hind wing length and width in male is 50.60 ± 1.31 mm and 23.10 ± 0.95 mm respectively. In female mean length and width are 52.37± 0.96 mm and 24.20 ± 0.61 mm, respectively. Longevity of male and female moths is 1.65 ± 0.54 and 3.89 ± 0.74 days, respectively. The mean oviposition period and fecundity of female moth is 3.05 ± 0.15 days and 93.25 ± 6.54 eggs per female, respectively.

The present findings are in close agreement with findings of Tripathi (1992) from India, who reported incubation period of 5-7 days, larval period of 20 – 26 days and pupal period of 5.6– 9.8 days. Mote and Puri (2003) reported incubation, larval and pupal period of *D. aphidivora* lasted for 6.1, 23.5, and 7.2 days, respectively with total life cycle of 35.2 days and a female laid on an average 110.1 eggs. However, Anon (2004) reported that *D. aphidivora* required 2.44, 17.72, 7.00 and 2.00 days of incubation, larval, pupal and adult periods with 30.72 days of total life cycle.

Feeding potential of *Dipha aphidivora*

The data generated on the feeding potential of different instars of the predator are presented below.

First Instar: On an average the first instar larva consumed 5.48 ± 1.44 aphids / day. A total of 13.52 aphids were consumed by first instar larva during the period of 2.4 ± 0.61 days.

Second instar: The second instar larva consumed 103 – 117 aphids per day with a mean of 115.48 ± 3.45 aphids per day. A total of 428.43 aphids during the period of 3.71 ± 0.53 days during second instar.

Third instar: The third instar larvae consumed 220 to 266 aphids per day with a mean of 264.36 ± 10.73 aphids per day, and a total of 1802.93 aphids during the period of 6.82 ± 0.98 days in third instar.

Fourth instar: The fourth instar larva consumed 331 – 371 aphids per day with a mean of 364.36 ± 7.84 aphids per day and a total of 2889.37 aphids during the fourth instar spread over a period of 7.93 ± 0.83 days.

Fifth instar: The fifth instar larva consumed 247 – 253 aphids per day with a mean of 250.92 ± 2.23 aphids per day and a total of 940.95 aphids during the period of 3.75 ± 0.46 days in fifth instar.

Total consumption: The total number of aphids consumed during the entire larval period (24.61 ± 3.41 days) was 6,074.84 ± 87.6

Average daily consumption during larval stage: The mean number of aphids consumed per day during the entire larval period (24.61 ± 3.41 days) was 246.84 ± 34.88 aphids per day.

The present findings revealed that a single *D. aphidivora* is sufficient to clear heavily infested leaf of sugarcane, where in 4000 – 6000 SWA are found. Present findings are in agreement with Anon. (2004) who reported that *D. aphidivora* larva

consumed on an average 5,967 SWA during its larval period.

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