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BIONOMICS OF APHID, *APHIS GOSSYPII* GLOVER INFESTING CORIANDER

AHEIBAM RANILA, P. K. BORAD* AND M. K. KANANI
Department of Entomology, B. A. College of Agriculture,
Anand Agricultural University, Anand - 388 110, Gujarat, INDIA
e-mail: pkb5458@yahoo.com

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***Corresponding author**

ABSTRACT
Studies on the bionomics of *Aphis gossypii* Glover on coriander were carried out in laboratory condition. The results showed that it passed through four nymphal instars before attaining the adult stage. The oval shaped greenish brown or yellowish brown first instar nymph subsequently changed to yellowish green to bottle green on development. The average developmental periods of first, second, third and fourth nymphal instar were 1.46 ± 0.51, 1.75 ± 0.62, 1.68 ± 0.63 and 1.60 ± 0.64 days, respectively and the total nymphal period was 6.83 ± 1.39 days. The pre-reproductive, reproductive and post-reproductive periods were noted as 1.66 ± 0.47, 8.53 ± 1.97 and 3.53 ± 0.68 days, respectively. Each adult of *A. gossypii* could produce 11 to 46 nymphs with an average of 30.76 ± 7.61 nymphs. The rate of reproduction was on an average of 3.86 ± 2.87 nymphs per day. The average longevity of adult aphid was 12.01 ± 1.66 days. The generation period ranged from 18.25 ± 2.97 days.

INTRODUCTION

Coriander (*Coriandrum sativum* Linnaeus) commonly known as 'Dhania' is a very important seed spice which is used both as green vegetables as well as spice and medicine. The consumption of this spice crop is almost round the year in almost all parts of the country. In view of its increasing importance as medicine, its demand is increasing both in domestic and exports market. The sucking insect pests are the limiting factors for higher production and good quality seeds. *Aphis gossypii* Glover was recorded as a pest of coriander for the first time under Gujarat conditions (Ghetiya and Butani, 1995) and plays major role in making huge quantitative and qualitative losses. It has been found to attack about 220 host plants belonging to 46 families throughout the world (Roy and Behura, 1983). Both the nymphs and adults feeds by sucking the cell sap from inflorescence/ umbel. Due to their fast multiplication, aphid covers the entire surface of apical shoots.. It exudates honeydew, which favour the growth of sooty mould and inhibit photosynthetic activity of the plants. Owing to the high rate of reproduction of this pest and continuous desapping of the flowers, grain formation is very much reduced or shriveled seeds are formed. While in less infested one the seeds are deformed resulting in poor yield. In addition to this they are known to be the vectors of various diseases. (Kenndy *et al.*, 1962).

The study of the bionomics of *Aphis gossypii* would help to understand the proper life cycle of it which would be useful for its efficient management practices. But the literature on the bionomics of *Aphis gossypii* are limited. So, the present study was undertaken to observe the bionomics of *Aphis gossypii* on coriander under the laboratory conditions.

MATERIALS AND METHODS

The bionomics of *A. gossypii* was studied during 2013 under laboratory conditions. The aphid was collected from the unsprayed coriander field of B. A. College of Agriculture, AAU, Anand and reared on potted coriander plants order to supply necessary insects for the experiments. The standard mass rearing technique for the aphids as described by Ghetiya (1992) was adopted. The potted coriander plant was covered with a chimney and the upper end of the chimney was covered with muslin cloth.

For studies on different aspects, the aphid was reared individually in Petri dish (10 cm diameter; 2 cm height) lined with filter paper. The fresh twigs of coriander were provided as food daily. The cut end of petiole of coriander twigs was wrapped with wetted cotton wool to keep the twigs fresh and turgid for a long period of time. The aphids were transferred to the fresh coriander twigs with the help of fine camel hair brush.

The bionomics of aphid was carried out on Gujarat Coriander 2 variety of coriander. To study the nymphal duration, newly emerged nymphs were transferred individually to Petri dishes containing fresh coriander twigs. The coriander twigs were changed daily in the morning. The change of instar was recorded based on the presence of exuviae casted by the nymphs. Growth of nymphs, moulting and passing into next instar and the number of nymphs laid per female were also observed.

After fourth moulting, the nymphs attained to adult stage. In order to study the adult longevity on coriander, the newly

developed adults were reared individually in Petri dishes. Thus, longevity of adult, entire life span, pre-reproductive, reproductive and post-reproductive period and fecundity were worked out.

Different stages of *A. gossypii* were examined under binocular microscope and critically for their colour and shape, whereas length and breadth were measured by using software Magnus-pro.

RESULTS AND DISCUSSION

Nymphs

Aphis gossypii passed through four nymphal instars when reared on coriander. The present findings is in accordance with the reports of Ghetiya (1992), Rathod and Bapodra (2006) and Patil and Patel (2013).

First instar

Freshly borned first instar nymph was wingless, delicate, transparent and oval in shape, dorsally convex, greenish brown or yellowish-brown in colour with three pairs of legs. Antennae were observed as five segmented, fairly long, setaceous and light black in colour. The antennal length measured with an average of 0.23 + 0.01 mm, while cornicles length measured with an average of 0.04 ± 0.01 mm (Table 1). Compound eyes were small, placed just behind the base of the antennae and were blackish in colour. Three pairs of thoracic legs were well developed, colourless and thickly and uniformly covered with hairs and measured with an average of 0.29 ± 0.01, 0.36 ± 0.02 and 0.47 ± 0.01 mm, respectively (Table 1). The head width measured with an average of 0.12 ± 0.06 mm. The body length of first instar nymph varied from 0.32 to 0.56 mm with an average of 0.51 ± 0.06 mm and breadth was 0.22 to 0.30 mm with an average of 0.25 ± 0.03 mm (Table 1). The duration of first instar nymph varied from 1 to 2 days with an average of 1.46 ± 0.51 days (Table 2).

Second instar

Freshly moulted second instar nymph differed from first instar in its comparative size and appearance. The nymph was oval in shape and greenish brown to willow green in colour. The second instar nymph varied from 0.65 to 0.80 mm with an average of 0.70 ± 0.09 mm in length and 0.30 to 0.41 mm with an average of 0.38 ± 0.03 mm in breadth (Table 1). The cornicles were quite distinct and cylindrical in shape and measured with an average of 0.08 ± 0.01 mm in length. The length of fore, middle and hind legs measured with an average of 0.37 ± 0.01, 0.44 ± 0.01 and 0.56 ± 0.01 mm, respectively. Head width measured with an average of 0.16 ± 0.02 mm. The five segmented antenna measured with an average of 0.35 ± 0.02 mm in length (Table 1). The duration of second instar varied from 1 to 3 days with an average of 1.75 ± 0.62 days (Table 2).

Third instar

The colour of third instar nymph remained more or less similar to that of second instar nymph, but differed in its size. The compound eyes were round, slightly bigger than the second instar and brownish in colour. The morphometric study of third nymphal instar indicated that each nymph varied from 0.86 to 1.05 mm with an average of 0.95 ± 0.06 mm in length and 0.42 to 0.61 mm with an average of 0.53 ± 0.07 mm in breadth (Table 1). The length of cornicles measured with an average of 0.10 ± 0.01 mm. The average length of fore, middle and hind legs were 0.50 ± 0.02, 0.66 ± 0.04 and 0.88 ± 0.02 mm, respectively. Head width measured with an average of 0.25 + 0.03 mm. The average antennal length was 0.50 ± 0.05 mm (Table 1). Duration of third instar nymph varied from 1 to 3 days with an average of 1.68 ± 0.63 days (Table 2).

Fourth instar

Fourth instar nymph was yellowish-green in colour and elongated in shape. The compound eyes were enlarged and dark black in colour. The nymph was very active and looked like adult except that it possessed wing pads in the thoracic region and did not acquire deep green colour and fully developed wings. The values recorded from the morphometric study of fourth nymphal instar revealed that the length of body varied from 1.04 to 1.30 mm with an average of 1.16 ± 0.09 mm and 0.60 to 0.71 mm with an average of 0.67 ± 0.02 mm in breadth (Table 1). The cornicles were clearly visible with naked eyes and measured with an average of 0.19 ± 0.01 mm. The average length of fore, middle and hind legs varied were 0.81 ± 0.04, 0.91 ± 0.02 and 1.18 ± 0.03 mm, respectively. Head width measured with an average of 0.35 ± 0.02 mm. The antennal length measured with an average of 0.58 ± 0.03 mm (Table 1). The duration of fourth instar nymph varied from 1 to 3 days with an average duration of 1.60 ± 0.64 days (Table 2). The present findings on length, width and duration of different instars are more or less similar with the earlier reports of Ghetiya (1992), Rathod and Bapodra (2006) and Patil and Patel (2013) on coriander, cotton and isabgol, respectively.

Total nymphal period

Total nymphal period was considered from birth of first instar to the end of fourth instar. It ranged from 4 to 8 days with an average of 6.83 ± 1.39 days (Table 2). More or less similar duration (4 to 9 days) reported by Ghetiya (1992) on coriander,

Table 1: Measurements of different stages of aphid, *A. gossypii*

Developmental Stages	Mean + S.D. (mm)							
	Body length	Body breadth	Cornical length	Head width	Antenna	Fore leg	Middle leg	Hind leg
I instar	0.51 + 0.06	0.25 + 0.03	0.04 + 0.01	0.12 + 0.06	0.23 + 0.01	0.29 + 0.01	0.36 + 0.02	0.47 + 0.01
II instar	0.70 + 0.09	0.38 + 0.03	0.08 + 0.01	0.16 + 0.02	0.35 + 0.02	0.37 + 0.01	0.44 + 0.01	0.56 + 0.01
III instar	0.95 + 0.06	0.53 + 0.07	0.10 + 0.01	0.25 + 0.03	0.50 + 0.05	0.50 + 0.02	0.66 + 0.04	0.88 + 0.02
IV instar	1.16 + 0.09	0.67 + 0.02	0.19 + 0.01	0.35 + 0.02	0.58 + 0.03	0.81 + 0.04	0.91 + 0.02	1.18 + 0.03
Apterate adult	1.29 + 0.08	0.70 + 0.08	0.27 + 0.01	0.40 + 0.03	1.12 + 0.03	0.94 + 0.01	1.21 + 0.03	1.42 + 0.05
Alate adult	1.10 + 0.09	0.60 + 0.02	0.17 + 0.02	0.34 + 0.02	0.72 + 0.02	0.87 + 0.04	1.15 + 0.03	1.34 + 0.06

Table 2: Duration of different stage(s) of *A. gossypii*

Stages	Duration (days) Minimum	Maximum	Mean + S. D.
Nymph			
I instar	1.0	2.0	1.46 ± 0.51
II instar	1.0	3.0	1.75 ± 0.62
III instar	1.0	3.0	1.68 ± 0.63
IV instar	1.0	3.0	1.60 ± 0.64
Total nymphal period	4.0	8.0	6.83 ± 1.39
Adult longevity	9.0	14.0	12.01 ± 1.66
Total life span	*13.0*	*22.0*	*18.25 ± 2.97*
Reproduction parameters (days)			
Pre-reproduction	1.0	2.0	1.66 ± 0.47
Reproduction	6.0	12.0	8.53 ± 1.97
Post-reproduction	2.0	4.0	3.53 ± 0.68
Adult longevity	9.0	14.0	12.01 ± 1.66
Total life span	*13.0*	*22.0*	*18.25 ± 2.97*
Fecundity (Nymphs/ female)	*11.0*	*46.0*	*30.76 ± 7.61*
Rate of reproduction (Nymphs/ female/ day)	*1.0*	*11.0*	*3.86 ± 2.87*

Desai (2000) on okra, Patel (2002) on isabgol, Patima (2002) on tomato and Rathod and Bapodra (2006) on cotton.

The adult

The adult of *A. gossypii* was yellowish green to bottle green in colour with somewhat pear shaped elongated pyriform body. It possessed a well developed and conspicuous black coloured pair of cornicles, a pair of antennae and three pair of legs. More or less similar appearance was observed by Ghetiya (1992). The compound eyes were dark black in colour and were bulged. Cauda was prominently visible in adult. Wings when present were in two pairs and transparent with black veins.

The antenna of apterate adult composed of six segments and shorter than the body length which measured with an average of 1.29 ± 0.08 mm but it was longer (1.12 ± 0.03 mm) than the body width which measured with an average of 0.70 ± 0.08 (Table 1). Legs were rather stout, long and covered with small hairs. Third pair of leg was longer than first and second ones. The average length of fore, middle and hind legs was 0.94 ± 0.01, 1.21 ± 0.03 and 1.42 ± 0.05 mm, respectively. The average length of cornicles was 0.27 ± 0.01 mm. Average head width measured with an average of 0.40 ± 0.03 mm (Table 1).

Alate adult was comparatively smaller in size than that of apterate adult and measured with an average of 1.10 ± 0.09 mm in length and 0.60 ± 0.02 mm in breadth, respectively (Table 2). The antennal and cornicles length measured with an average of 0.72 ± 0.02 mm and 0.17 ± 0.02 mm, respectively. Wings have hyaline and the hind wings were shorter than fore wings. The body size was 1.00 ± 0.001 mm in length and 0.55 ± 0.13 mm in width. Head capsule was somewhat blackish in colour and its width measured with an average of 0.34 ± 0.02 mm. The average length of fore, middle and hind legs were 0.87 ± 0.04, 1.15 ± 0.03 and 1.34 ± 0.06 mm, respectively (Table 1).

Pre-reproduction, reproduction and post-reproduction periods

The pre-reproduction, reproduction and post reproduction periods varied from 1 to 2, 6 to 12 and 2 to 4 days, respectively with an average of 12.01 ± 1.66, 1.66 ± 0.47, 8.53 ± 1.97 and 3.53 ± 0.68 days. (Table 2).

Fecundity

Each female of *A. gossypii* produced minimum of 11 and maximum of 46 individuals with an average of 30.76 ± 7.61 individuals (Table 2) on coriander. The fecundity of *A. gossypii* on coriander (29.31 ± 8.965 nymphs/female) and cotton (25.32 ± 5.78 nymphs/female) reported by Ghetiya (1992) and Rathod and Bapodra (2006), respectively.

Rate of reproduction

The young ones produced by a single adult aphid per day varied from 1 to 11 with an average of 3.86 ± 2.87 nymphs (Table 2). Ghetiya (1992) and Rathod and Bapodra (2006) also recorded 1 to 11 nymphs (3.68 ± 2.12) and 1 to 12 nymphs (4.32 ± 2.14) per female per day when reared on coriander and cotton, respectively.

Adult longevity

The adult lived for 9 to 14 days with an average of 12.01 ± 1.66 days (Table 2). Nair (1975) reported that whole life cycle of *A. gossypii* was completed in 7 to 9 days on cotton. According to Sureja (1990), the average longevity of adult aphid was 11.52 ± 1.446 days on okra. Ghetiya (1992) mentioned the average longevity of aphids as 11.759 ± 1.662 days on coriander.

Total life span

The entire life period varied from 13 to 22 days with an average of 18.25 ± 2.97 days (Table 2). Ghetiya (1992) and Rathod and Bapodra (2006) noted the total life span varied from 11 to 21 days with an average of 18.34 ± 2.46 days on coriander and 12 to 21 days with an average of 17.98 ± 2.39 days on cotton, respectively.

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