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Biology of Whitefly On Tomato Plants

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ABSTRACT

The female and male nymphs of Bemisia tabaci (Gennadius) was reared on leaves of potted tomato plants fitted with modified rearing glass vials, at 24-31 0C temperature and 80-85 % RH. The whitefly had six life stages as egg, four nymphal instars and adult. The developmental period of eggs, first, second, third and fourth instars of whitefly were 7.6±0.70, 6.6±0.52, 3.5±0.53, 4.1±0.57, 7.2±0.63 days respectively with total nymphal period was 26.4 ± 1.05 days. Pre-oviposition, oviposition and post ovipostion lasted 2.1± 0.57, 3 ± 0.67 and 0.80 ± 0.42 days respectively. Adult longevity lasted for 4.6 ± 0.52 Total life period was 33.00 ± 0.84 days. Average length of egg, 0.i8 ± 0.010; 1st instar, 0.26 ± 0.013; 2nd instar, 0.42 ± 0.026; 3rd instar, 0.63 ± 0.025 and 4th instar, 0.78 ± 0.018 mm. Average length of adults was 0.90 ± 0.031 mm respectively.

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INTRODUCTION

Tomato is native to Central and South America. It is a popular and versatile food ranking third in the world's vegetable production, next to potato and sweet potato and placing itself in first place among the processing crops. A wide range of insects attack tomato and forms major limiting factor in its successful cultivation and in improvement of yield. Among them whitefly is an important pest. Whiteflies belonging to the order Hemiptera and comprise a single super family, Aleyrodoidea, within the suborder Sternorrhyncha. They are all placed in a single family, Aleyrodidae, and are small sap-sucking insects whose adults bear a remarkable superficial resemblence to tiny moths. Adult
whiteflies are very small insects, most measuring 1 - 3 mm in body length. A structure
known as a 'vasiform orifice' is unique to aleyrodids, and comprises the anus, a 'lingula' which ejects excreta, and an 'operculum' which partially or wholly covers the orifice itself. The vasiform orifice is present in all larval stages, as well in the adults (Mound and Halsey, 1978; Gerling, 1990). whiteflies (*Bemisia tabaci*) act as a vector of many virus diseases. In addition to pests Viral diseases are also considered as a important factor which causes severe yield losses at most serious level. Accurate information on biological parameters on specific host plant is required for implementing sustainable management practices, which facilitate the present study to determine the development and reproduction of *B. tabaci* under laboratory conditions on tomato crop.

MATERIALS AND METHODS

The study was conducted in the laboratory at BCKV. The biology of *Bemicia tabaci* (Gennadius) was studied on tomato plant under Laboratory environmental conditions consisted of 24-31 ^{0}C temperature and 80±5% RH. Tomato seeds were sown in pots. One week after plant emergence, excess plants were eliminated, retaining only one plant per pot. The pots were then kept in sunshine daily upto 3-4 weeks. Afterward, the pots were shifted to the laboratory. In order to maintain whitefly population as buffer stock for laboratory studies, tomato plants were grown under polyhouse. To start the rearing program, whitefly adults collected from tomato field at BCKV with the help of springer type aspirator and then were introduced into the greenhouse where tomato plants were being grown. Adults were then collected from greenhouse plants and taken to the laboratory for biological studies on tomato host. For oviposition, two pairs of whitefly adults, collected from tomato plants were placed in a small cage (diameter of 2.5 cm on one side and other side was covered by muslin cloth); located on the lower surface of a leaflet. After 24 hours, the cage and the adults were removed from the leaves. And the leaf was examined under

microscope for eggs ,Excess eggs were removed from leaves, keeping only three-four eggs per leaf of plant. Total ten eggs from three leaves were observed by utilizing two plants of tomato. The insects were observed daily to record the developmental changes. When nymphs reached the 4th instar, the leaflet with nymphs was covered with cage until the adult emergence. After adult emergence, sex was determined by examining the body size and abdomen shape. Females were bigger and had a larger abdomen than the males. After death, the insects were observed under stereoscopic binocular microscope ZEISS stemi 2000-C to confirm the sex. developmental changes. Nymphal growth was observed by taking measurements of body width and length with a graduated ocular micrometer lens under a compound light microscope (ZEISS AXI0SK0P40) Other assessed biological parameters were: nymphal stage (duration, number of instars); adult stage (longevity of males and females, preoviposition, oviposition and post-oviposition period, number of eggs per female); egg stage (duration); total period of life cycle (period from egg to adult emergence and its period of survival).

RESULTS AND DISCUSSION

The whitefly had six life stages as egg, four nymphal instars and adult. Whitefly adults lay eggs on the under surfaces of young leaves. The eggs were oval in shape and somewhat tapered towards the distal end. The broader end had a short stalk that was inserted by the ovipositing female into the leaf. The eggs were pearly white when first laid and darkened over time. The distal end of the egg became dark brown just before the hatching. The average incubation period recorded was 7.6 ± 0.70 days (Table 38). This investigation was more or less similar with Lanjar and Sahito (2005) who reported that egg incubation period of whitefly in brinjal was 7.40 ± 0.67.The present finding also is in line with Lynch *et al*. (1993), Thomas *et al*. (2011), Ghahari and Hatami (2000) and Salinas *et al*. (1996).

Crawler: When the eggs hatched, greenish-yellow, flattened, oval shaped. Average length of egg, 0.i8 ± 0.010 mm first instar nymphs emerged. The first nymphal instar was capable of limited movement and was called as crawler. The crawler had three pairs of legs, a pair of antennae and small eyes. It was whitish-green in colour and had two yellow spots, visible in the abdomen through the integument. The crawlers usually moved only a few centimetres in search of a feeding site. Duration of crawler is 6.6 **±** 0.52, Average length of 1st instar, 0.26 ± 0.013mm They initiated feeding on the lower surface of a leaf. After starting feeding, they moulted to the second nymphal instar. (Table 14) which was more or lesssimilar with the finding of Lynch *et al.* (1993). The average duration of crawler (first instar) was 6.5 ± 0.50 days. The results are in agreement with Azab *et al*. (1971) who found that the duration of the first instar varied from 2 to 6 days on sweet potato under conditions close to ambient. Sharaf & Batta (1985) reported that the duration at 25 0C was 2.8 days, and 9.0 days at 14 0C. Thomas *et al*. (2011) and Ghahari and Hatami (2000) also reported the duration of first instar as 4.2±0.18 days and 3.37±0.52 days and respectively.

Second and third instars: Second and third nymphal instars were immobile. During this stationary stage they looked like soft scale insects, greenish-yellow in color, oval, flattened but slightly pointed towards the tail. They had no leg or any other distinguishing features, sucked sap from the plant throughout the period. The duration of instars was 3.5±0.53 and 4.1±0.57 days (Table 14). Average length is 0.42 ± 0.026; 0.63 ± 0.025 respectively. The present finding was in conformity with Salinas *et al*. (1996), Argov *et al*. (1999) and Han *et al*. (2009). They reported duration of second instar as 3.837.53, 4.09-8.64 and 5.5 days while duration of third instar was 4.09-8.64, 4.88±0.10 and 7.6 days, respectively.

Fourth instar nymphs or pupae: Late in the third instar and through the fourth instar nymphs developed obvious red eyes. They were referred to as red-eyed nymphs. The nymphs at this stage were yellowish white in body colour. Late in the fourth instar they stopped feeding and pupated, after that adults of yellowish white colour emerged. The sides of red-eyed nymphs were boat-shaped. The empty white cases, the adults emerged from could be seen under the leaf. The average duration recorded for fourth instar was 7.2±0.63 days, Average length is 0.78 ± 0.018 mm. The results were in agreements with Patel *et al.* (1992); Lynch *etal.* (1993); Salas and Mendoza (1995) and Thomas *et al*. (2011).

Adult: Adults emerged in the morning. Adults held their wings vertically tilted. They had white wings and yellow bodies. Adult whiteflies emerged through a T-shaped slit in the integument of the last nymphal instar. The remaining white, transparent shell is known the exuvia. The pre oviposition period lasted for 2.1±0.57 days, oviposition 3.0±0.67 days and post oviposition 0.80±0.42 days respectively. Average length is 0.90 ± 0.031 However, The findings were in agreement with Salas and Mendoza (1995), who reported pre oviposition period to last for 1.4±0.7days and oviposition 16.7±3.2 days. Fecundity was 194.9±59.1 eggs/female. pre oviposition period 1.4 ± 0.7 .

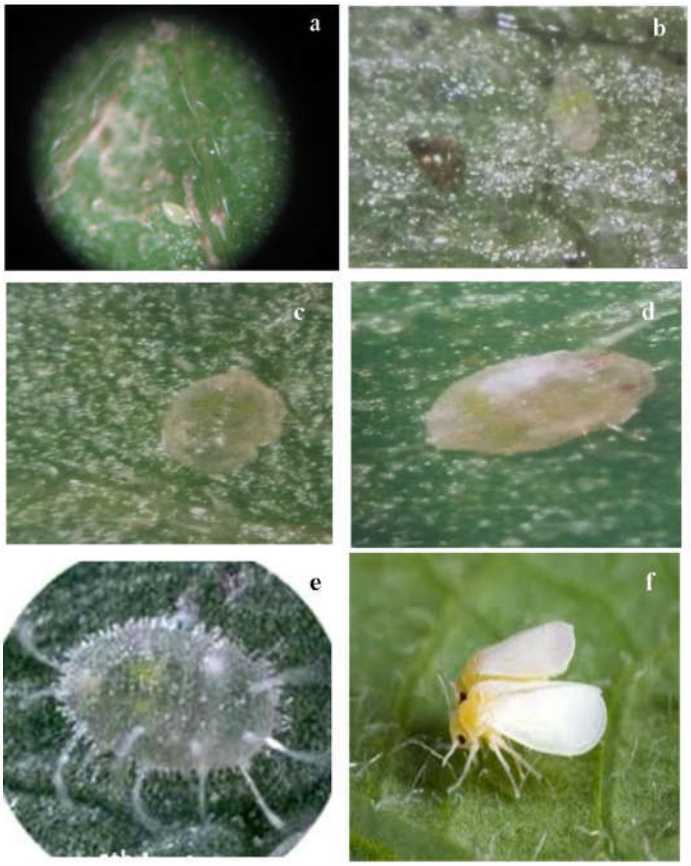

Plate 3 : a) Egg of whitefly b)First instar c) Second instar d)Third instar e) Fourth instar f) Adult whitefly

Table 1 Developmental period and morphometry of whitefly on tomato

S.NO	Life stages	Duration (days)		Morphometry	
		Mean	±SD	Mean	±SD
1	Pre oviposition	2.1	±0.57	-	-
2	Oviposition	3	±0.67	-	-
3	Post oviposition	0.8	±0.42	-	-
4	Eggs (incubation)	7.6	±0.70	0.18	0.010
5	Ist instar	6.6	±0.52	0.26	0.013
II	IIst instar	3.5	±0.53	0.42	0.026
II	IIIst instar	4.1	±0.57	0.63	0.025
III	IVst instar	7.2	±0.63	0.78	0.018
IV	Adult longevity	4.6	±0.52	0.90	0.031
6	Total nymphal period	26.4	±1.05	-	-
7	Total life cycle	33	±0.84	-	-

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