Indian J.Sci.Res. 16 (1): 34-37, 2017 ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

LIFE PARAMETERS OF WHITEFLY (*Bemisia tabaci,* GENN.) ON DIFFERENT HOST PLANTS

SWATI TOMAR[1a],SEEMA SHARMA[b]AND KAMLESH MALIK[c]

[ab] Department of Zoology, Meerut College, Meerut,U.P.,India

[c]Plant Protection, Central Potato Research Institute Campus, Modipuram, Meerut,U.P.,India

ABSTRACT

***Bemisia tabci* is most damaging insects known in world agricultural because of its direct feeding, contamination of plant products with honeydew and ability to vector plant viruses. A comparison study was conducted on the duration of incubation period to oviposition period, and the fecundity of *B. tabaci* on cotton, potato, tomato and chilli plants species. Results in this study showed that the time required *B. tabaci* complete development from egg to adult was influence by the host plant on which the whitefly was reared. The investigations indicated that cotton and potato were the most suitable host plant for development and reproduction of *B. tabaci*, with tomato and chilli least suitable. *B. tabaci* produces many generations in a year on different host plants. *B. tabaci* is adapted to warm areas. In the context of global warming, it would appear that *B. tabaci* has a greater chance of survival, consequently it may widen its geographical distribution and pose a new threat to agro ecosystems, as a result of a greater access to new host plants. Hence, one should consider the susceptibility of the host plants when designing pest management program for the *B. tabaci* in Meerut region. The result of the study is expected to help in developing a simulated ecological based plan of pest management through habitat management. This will provide a base for long-term management to reduce pest incidence is a continuous cropping system.**

Bemisia tabaci(Gennadius) (Hemiptera: Aleyrodidae) is a phloem-feeding insect that lives predominantly on herbaceous species. It is a pest of ornamental, vegetable, grain legume, and cotton production, causing damage directly through feeding (Oliveira *et al*., 2001) and indirectly through the transmission of plant pathogenic viruses, primarily begomoviruses (Jones, 2003).Whitefly is polyphagous in nature, feeding on many cultivated and uncultivated host plants (Attique, *et al.,* 2001) and new hosts continue to be identified (Simmons *et al.,* 2008). Over 900 host plants have been recorded for *B. tabaci* (Perring, 2001) belonging to more than 63 plant families (Buxton, 2005). Itis a serious pest on field crops like cotton, tobacco, tomatoes, sweet potato and cassava in tropical and subtropical areas. The life cycle of the sweet potato whitefly has six life stages- the egg, four nymphal stages and the adult, requires 2 to 3 weeks in warm weather, but take as long as 2 months under cool conditions. The development time of this insect from egg to adult may range from 15-70 days dependent upon temperature and plant host. *Bemisia tabaci* can produce an average of 11-15 generations in one year (Gerling, 1990). The longevity of *B. tabaci* adults in the field 8\was 10-15 days during summer (temperature in the high twenties), and 30-60 days in winter (temperature around 10^{o} C) (Gerling*et al.,* 1986). The average is 160 eggs per female (with an approximate range of 50 to 400). This high reproductive potential explains in part how whitefly populations can increase so rapidly. *B. tabaci* produces many generations in a year and reaches high population densities (Chandel *et al.,* 2010). Keeping this in view, Life cycle studies would help us to know which crop is most suitable for its development and how quickly it can establish itself on a new vegetables crop. This will provide a base for long-term management to reduce pest incidence is a continuous cropping system.

MATERIALS AND METHODS

The culture of *Bemisia tabaci* was initiated with few pairs of adults procured from potato fields maintained in potted potato plants with cage in the laboratory. The culture was maintained in control conditions viz. 28 ± 1^{0}c temperature 75±5% relative humidity. A total of 10 plant of four different plant species viz. potato (*Solanum tuberosum*), tomato (*Lycopersicanesculentum*), cotton (*Gossypium hirsutum*) and chilli (*Capsicum annum*) belonging to different plant families were infested and maintained in cages covered nylon. The experiment for each host plant was replicated for five times. This experiment was performed at room temperature (27^{0}C to 29^{0}C) and humidity (60% to 70%) during September-October. Each replication of each host plant was examined every 24 hr. for recording the nymphal period, nymphal survival (%), per cent pupation, pseudo-pupal period, per cent adult emergence, fecundity, longevity of adult and total life span.

From these observations, the growth indices were calculated on the basis of following formulae:

[1]Corresponding Author

$$Growth\ index\left(G.I.\right)=\frac{Percent\ pupation}{Nymphal\ period}$$

$$Survial\ index=\frac{The\ No.of\ adults\ emerged\ from\ the\ nymphs\ reared\ on\ test\ plant}{The\ No.of\ adults\ emerged\ from\ the\ nymphs\ reared\ on\ potato}$$

RESULTS AND DISCUSSION

Various aspects of biology of *B. tabaci* were studied for two years on potato, cotton, tomato and chilli.There was significant difference in the duration of instar on the host plants. On account of various parameter studies it is evident that out of four food plants evaluated, cotton and potato revealed higher host suitability to *B. tabaci*. These plants exhibited shorter larval and pseudo purpal period, higher fecundity and short total life span and high growth index as compared to tomato. Chilli was inferior in food suitability on all parameters and proved to be least suitable food for its growth and development are concerned.

The total nymphal period was numerically more (12.93 days) on tomato followed by chilli (11.75days). However, both were statistically at par. The total nymphal period was less (8.14 days) on cotton, being at par with potato (8.62days). The data on duration of different nymphal instars suggested that cotton and potato were most promising food plants as evident by fact that on these plants the duration of different instar was shortest. The insect took long period in completion of nymphal development on tomato was classified as least suitable plant while chilli had an intermediate position in response to nymphal development. The host suitability of different host plants taking nymphal period units considered could be depicted as follows:Cotton >Potato> Tomato >Chilli.

The results indicated that the development of *B. tabaci* completed in shortest duration on cotton (12.52 days) followed by on potato (14.71 days). Both differed significantly from each other in developmental duration. On account of various parameter studies it is evident that out of four food plants evaluated, cotton and potato revealed higher host suitability to *B. tabaci*. These plants exhibited shorter larval and pseudo purpal period, higher fecundity and short total life span and high growth index as compared to tomato. Chilli was inferior in food suitability on all parameters and proved to be least suitable food for its growth and development are concerned. Female lived longer as compared to male reared on these host plants. The longevity of female differed significantly among the host plants. The similar observations also recorded in case of male fed on different host plants (Table 2). The data on number of eggs laid by a female have shown that all food plants were statically different from each other. The results have suggested that the female reared on cotton laid maximum eggs is proved to be very good host for growth and development of *B. tabaci* followed by potato. Female reared on chilli produced less 117 numbers of eggs indicated inferior in food suitability.

The data clearly showed that out of four host plants, cotton and potato had higher growth index (more than 9) and did not differed statistically from each other. Tomato and chilli exhibited growth index lower than 9. However, chilli was also statistically not different from tomato. The result revealed that cotton and potato were more preferred plants than that of tomato and chilli.

In order to assess relative suitability of food plants it was thought desirable to use potato as standard reference, because it appeared to be good food plant on the basis of shorter nymphal and pupal period and more fecundity. Survival index of *B. tabaci* on different host plants revealed that it was lowest in case of potato, tomato and chilli which were approximately similar. It is thus, evident that cotton provided comparatively better nutritional requirements for survival of *B. tabaci*.

The life cycle of *B. tabaci* was completed in short duration (20.68 days) on cotton and it completed in long duration on tomato. Takahashi *et al.,* (2008); Naik (2001) and Naik and Muniyappa (2004) also observed that tomato is least suitable host plant for development of whitefly. Variation in number of eggs laid by a female on different host plants was also reported by Khan *et al.,* (2011). Similar results were also obtained in present study carried at Modipuram.

Fekrat and Shishebor (2007) reported that whitefly took long duration in completion of nymphal development on tomato as compared on potato which in accordance to present findings. Survival of whitefly *B. tabaci* on healthy hosts ranked as follows: zucchini > cantaloupe > cotton > pumpkin > lettuce > tomato. Eggplant is one of the most preferred hosts of *B. tabaci* for oviposition as

a well as for the development (Naik, 2001; Naik and Muniyappa, 2004).

Host plant	Incubation (Days)	Nymphal Periods(Days)				Total	Pseudo Pupal Periods (Days)	Total Developmental Period (Days)
		1st	2nd	3rd	4th			
Potato	3.44 (2.10)	1.63 (1.61)	2.74 (1.75)	2.03 (1.73)	2.21 (1.79)	8.62 (3.10)	2.68 (1.91)	14.71 (3.96)
Cotton	2.47 (1.86)	2.07 (1.75)	2.11 (1.82)	1.87 (1.69)	2.13 (1.76)	8.14 (3.02)	1.94 (1.71)	12.52 (3.67)
Tomato	2.16 (1.77)	2.84 (1.95)	3.36 (1.89)	3.38 (2.08)	3.34 (2.08)	12.93 (3.73)	3.48 (2.11)	18.58 (4.42)
Chili	2.29 (1.82)	2.49 (1.86)	2.67 (1.81)	3.27 (2.06)	3.35 (2.08)	11.75 (3.57)	3.23 (2.05)	17.26 (4.27)
SE(m)±	(0.039)	(0.038)	(0.032)	(0.038)	(0.033)	(0.049)	(0.033)	(0.0517)
LSD at 0.05%	(0.12)**	(0.19)**	(0.10)**	(0.19)**	(0.10)*	(0.15)**	(0.10)**	(0.16)**

Table 1:Nymphal development of *B. tabaci* on different host plants

Host plant	Longivity (days)		Eggs/Females (No.)	Total Complete life cycle (days)
	Female	Male		
Potato	6.37 (2.71)	4.01 (2.45)	153.3 (12.41)	21.19 (4.71)
Cotton	7.55 (2.91)	6.94 (2.80)	174.3 (13.23)	20.93 (4.68)
Tomato	8.56 (3.09)	7.10 (2.84)	125.5 (11.24)	25.72 (5.16)
Chili	9.95 (3.31)	6.99 (2.82)	117 (10.85)	26.56 (5.24)
SE(m)±	(0.051)	(0.037)	(0.144)	(0.049)
LSD at 0.05%	(0.16)**	(0.12)*	(0.45)**	(0.15)**

Table 2. Total Life cycle in days of *B. tabaci* on different host plants

Parameter/ Hosts	Potato	Tomato	Chilli	Cotton
Growth Index	9.34	6.16	6.94	9.74
Survival index	0.92	0.94	0.93	-

Table 3. Life table parameter of *B.tabaci* on different host plants in 2011-2012

REFERENCES

Attique, A. K., Muammad, R., Abdul, G. and Ahmad, Z. 2001**.**Host preference of *Bemisiatabaci*Genn.(Homoptera: Aleryrodoidae) for oviposition, development period and survival.Pakistan. J. Zool. 33:275-278

Buxton, J. 2005, Control of whiteflies on protected ornamental crops. Factsheet 14/05. Horticultural Development Council in coop. with DEFRA.Bradbourne House.UK

Chandel, R. S., Banyal,D. K., Singh,B. P., Malik, K. and Lakra,B. S. 2010. Integrated Management of Whitefly, *Bemisia tabaci* (Gennadius) and Potato Apical Leaf Curl Virus in India. Potato Research,**53**(2):129-139.

Fekrat, L. and Shishehbor, P. 2007. Some biological features of cotton whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae) on various host plants in Pakistan. J.of Biological Sciences. **10**(18): 3180-3184.

Gerling, D., Horowitz, A.R. and Baumgartner, J. 1986**.** Autecology of *Bemisia tabaci*.Agriculture Ecosystem and Environment.**17**: 5-19.

Gerling, D. 1990. Whiteflies: Their bionomics, pest status and management Andover: Intercept. Golding, F.D., Nigeria Empire Cotton Gr. Rev., 1930, 7,120.Govt. of the Punjab. Assessment of damage due to Cotton Leaf Curl Virus in the Punjab. Report, Govt. of the Punjab, 1992.

Jones, D.R. 2003. Plant viruses transmitted by whiteflies. European J. Plant Pathol.**109**: 195-219.

Khan, M.R., Ghani, I.A., Khan, M.R., Ghaffar, A. and Tamkeen, A. 2011.Host plant selection and oviposition behavior of whitefly *Bemisia tabaci* (Gennadius) in a mono and simulated polyculture crop habitat.Afr. J. biotechnol**.10**(8): 1467-1472.

Naik, R.G. ,2001.Host preference and management of Tomato Leaf Curl Virus Disease.Ph.D thesis Univ.Agri. Sci., Bangalore, India:154.

Naik, R.G. and Muniyappa, V. 2004.Host preference of *Bemisia tabaci*-vector of Tomato Leaf Curl Geminivirus Disease.J. Mycol. Pl. Pathol., **34**:346-348.

Oliveira, M. R. V., Henneberry, T. J. and Anderson, P. 2001. History, current status, and collaborative research projects for *Bemisia tabaci*. Crop Prot. **20**: 709-723.

Perring, T.M., 2001.The *Bemisia tabaci* species complex.Crop Prot. **20**: 725-737.

Simmons, A.M., Harrison, H. F. and Ling, K. S. 2008. Forty-nine new host plant species for *Bemisia tabaci*(Hemiptera: Aleyrodidae*)*. Entomol Sci. **11**: 385-390.

Takahashi, K.M., Filho, E.B. and Lourencao, A.L. 2008.Biology of *Bemisia tabaci* (Genn.) B–biotype and parasitism by *Encarsia formosa* (Gahan) on collard, soya bean and tomato plants. Scientia Agricola. **65**: 639-642.