Indian J. Appl. Ent. **32**(1) : 24–27 (2018)

IMPACT OF DIFFERENT MANAGEMENT SCHEDULES ON PARASITIZATION OF WHITEFLY, *BEMISIA TABACI* (GENNADIUS) BY *ENCARSIA* SPP ON COTTON

DEEPIKA KALKAL, KRISHNA ROLANIA, SWATI MEHRA, S S YADAV AND ARUN JANU
Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana.
E-mail: surinderyadav@rediffmail.com

ABSTRACT

The experiment on impact of different management schedules on parasitization of whitefly by its parasitoid was carried out on cotton crop during *kharif* 2014 at the Cotton Research Farm, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. Effects of seven insecticides were tested under field conditions on parasitization of whitefly. Parasitization ranged from 51.83 to 88.43 per cent during August to September. Mean pupal parasitization was maximum (74.79 %) in a management schedule consisting of six sprays of nimbecidine (azadirachtin 0.03% @ 1 L/ac) at five days interval and a yellow sticky trap placed in the plot followed by 70.82 % in a schedule of six sprays of nimbecidine at five days intervals only. The minimum parasitization (56.47%) was recorded in a schedule consisting of six sprays at five days interval each of dimethoate followed by imidacloprid, thiamethoxam, dimethoate, imidacloprid and thiamethoxam. It was concluded that different management schedules had significant effect on parasitization of whitefly pupae by *Encarsia* spp. and nimbecidine was found relatively less toxic and much safer to the natural enemies than other insecticidal treatments.

Key words: *Bemisia tabaci, Encarsia* spp., management schedule, parasitization

INTRODUCTION

The whitefly, *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae) is one of the most important and complex insect pests in agriculture crops because of its direct feeding, contamination with honeydew, ability to transmit plant viruses (Perring, 2001) and have wide host range of plant species including cotton, vegetables, ornamentals, and greenhouse crops (Simmons and Abd-Rabou, 2005 and Lanjar and Sahito, 2005). It recently emerged as a major pest of cotton and other crops in the tropical and subtropical regions of Asia, Africa and America. Due to whitefly outbreaks, there was widespread use of insecticides for its control (Agnihotri *et al.,*1999), which resulted in large-scale reductions of its natural enemies, resurgence of minor pests into major, environmental pollution and development of resistance to most of the synthetic insecticides (Mehrotra, 1991). This required the exploration of alternate methods of pests management that are not only effective but selective and safe also. Natural enemies are effective in suppressing whitefly population in ecosystem require conservation. Natural enemies of *B. tabaci* include predatory arthropods (Coleopteran, Neuroptera, Heteroptera, Diptera and Acarina) and parasitoids (Hymenoptera), besides a few records of entomopathogenic fungi (Basu, 1995). Goolsby *et al.* (1996 and 1998) evaluated 19 strains of parasitoids belonging to the genera *Eretmocerus* and *Encarsia as* potential biological control agents of *Bemisia tabaci* infesting melons. *E. sophia* (Heraty and Polaszek, 2000) *E. lutea and E. bimaculata* (Sharma *et al*., 2002 and Antony *et al.,* 2004*)* are the potentially useful parasitoids of *B. tabaci*. Kedar *et al.,* (2014) conducted afield survey to determine the natural enemies of *B. tabaci* in 14 cultivated crops in Hisar, Haryana. Six species of natural enemies of *B. tabaci* were observed, including 5 species of predators and one species of parasitoid. *Encarsia lutea* was the only nymphal parasitoid reported on seven crops. During the study, colour variations were observed in parasitized pupae. New insecticides with novel mode of action need to be tested which not only provide effective control of the pests but will also be safe to natural enemies and the environment. Therefore, effects of various insecticides were studied on parasitoid and safer insecticides were identified. Keeping in view the importance of the parasitoids in regulating *Bemisia* dynamics the following studies were carried out.

MATERIAL AND METHODS

The experiment was carried out on cotton crop

Table 1. List of chemical and biorational insecticides used during 2014

	Insecticides	Dose/acre in 200 litres water
1	Nimbecidine 300 ppm	1000ml
2	Dimethoate 30 EC	300ml
3	Thiamethoxam 25WG	40g
4	Triazophos 40 EC	600ml
5	Novaluron 10 EC	200 ml
5	Urea + DAP + Zn	2.5kg + 2.5kg + 0.5kg
6	Imidacloprid 17.8 SL	40ml
7.	Yellow sticky trap (3cm×5cm)(no.)	50/acre

Table2. Schedules of spray for management of whitefly during 2014

S_1	Spray of nimbecidine (six sprays at 5 days interval)
S_2	Spray of nimbecidine (six sprays at 5 days interval) + yellow sticky trap
S_3	First spray of nimbecidine followed by alternate spray of novaluron and nimbecidine (at 5 days interval) + yellow sticky trap
S_4	First spray of nimbecidine followed by dimethoate, triazophos, novaluron, nimbecidine and triazophos (at 5 days interval)
S_5	First spray of dimethoate followed by imidacloprid, thiamethoxam, dimethoate, imidacloprid and thiamethoxam (at 5 days interval)
S_6	Spray of urea+ DAP + Zn (2.5kg +2.5kg+ 0.5 kg/acre) (four sprays at 10 days interval)
S_7	Spray of nimbecidine (four sprays at 10 days interval)
S_8	First spray of nimbecidine followed by dimethoate, triazophos, novaluron (at 10 days interval)
S_9	First spray of dimethoate followed by imidacloprid, thiamethoxam, dimethoate (at 10 days interval)
S_{10}	Control (water spray) (six sprays at 5 days interval)
S_{11}	Control (water spray) (four sprays at 10 days interval)
S_{12}	Control (without spray)

during *kharif* season of 2014 at the Cotton Research Farm, CCS Haryana Agricultural University, Hisar. The observations on parasitization of whitefly by its parasitoids were recorded at 7, 14 and 28 days after spray schedules. Twelve treatment schedules were tested under field condition on parasitisation of whitefly. *Bt* cotton, Bio 6588 BG II was sown during second fortnight of May 2014 following the regular agronomic practices. The plot size was 81 m^2 with three replications for each schedule. The trial was laid out in a randomized block design (RBD). One yellow sticky trap of dimension 3×5cm/ plot was placed at one meter above the height of the crop. Spraying schedule was initiated as soon as the pest attained economic threshold level. Thirty cotton leaves per replicate of each treatment were plucked randomly and brought to the laboratory. These leaves (1 cm^2 area per leaf) were examined under stereozoom binocular microscope for presence of parasitized pupae of whitefly. Healthy and parasitized pupae were counted and per cent parasitization was worked out. The observations were recorded 7, 14 and 28 days after spray schedules to work out the percentage difference in parasitization of whitefly and to conclude the safer insecticide options to the parasitoids. The chemicals/ biorationals and treatment/ spray schedule evaluated are given in Table 1 and 2, respectively.

RESULTS AND DISCUSSION

The pupal parasitization was recorded at 7, 14 and 28 days after spray under different management schedules. Whitefly pupal parasitization by *Encarsia* spp ranged from 51.83 to 88.43 per cent in different spray schedules during August to September being minimum in S_9 (51.83%) at 14 days of spray (DAS) and maximum in S_{12} (88.43%) at 21 DAS. Similar findings were reported by Sharma *et al*. (2003) who reported 6.67 to 45.11 per cent parasitization of *B. tabaci* by *E. lutea* on cotton. The data presented in Table (1) indicated that at 7 days after spray, maximum pupal parasitization (82.17 %) was recorded in S_1 (plants sprayed with nimbecidine) while minimum 57.17 per cent in S_8 (plants sprayed with nimbecidine followed by dimethoate, triazophos and novaluron). S_1 was found statistically at par with S_{10}, S_2, S_9, S_{12} and S_{11}. However, it was found significantly superior over S_3, S_4, S_5, S_6 and S_8.

Table3. Effect of different management schedules on parasitization of whitefly pupae by *Encarsia* spp.

Sr. No.	Treatment	Per cent parasitization ($1cm^2$/leaf)after spray schedules			
		7	14	21	Pooled mean
S_1	Nimbecidine (6 sprays at 5 days interval)	82.17 (65.01)	62.50 (52.24)	67.80 (55.41)	**70.82** (57.29)
S_2	Nimbecidine (6 sprays at 5 days interval) + yellow sticky traps	73.27 (58.98)	65.10 (53.77)	86.00 (68.36)	**74.79** (59.86)
S_3	Nimbecidine followed by alternate sprays of novaluron &nimbecidine (at 5 days interval) + yellow sticky traps	66.63 (54.71)	60.20 (50.88)	64.63 (53.53)	63.82 (53.01)
S_4	Nimbecidine followed by dimethoate, triazophos, novaluron, nimbecidine & triazophos (at 5 days interval)	63.77 (52.98)	57.23 (49.15)	69.57 (56.51)	63.52 (52.82)
S_5	Dimethoate followed by imidacloprid, thiamethoxam, dimethoate, imidacloprid & thiamethoxam (at 5 days interval)	64.47 (53.47)	48.83 (44.31)	56.10 (48.58)	56.47 (48.69)
S_6	Urea + DAP + Zn (2.5 kg + 2.5 kg + 0.5 kg / acre) (four sprays at 10 days interval)	62.43 (52.54)	54.47 (47.54)	78.57 (62.56)	65.16 (53.81)
S_7	Nimbecidine (4 sprays at 10 days interval)	67.93 (55.50)	57.43 (49.26)	65.23 (54.49)	63.53 (52.87)
S_8	Nimbecidine followed by dimethoate, triazophos, novaluron (at 10 days interval)	57.13 (49.09)	54.10 (47.34)	67.97 (55.60)	59.73 (50.60)
S_9	Dimethoate followed by imidacloprid, thiamethoxam, dimethoate (at 10 days interval)	71.43 (57.67)	**51.83** (46.03)	60.47 (51.03)	61.24 (51.47)
S_{10}	Control with water spray (6 sprays at 5 days interval)	79.17 (62.85)	56.17 (48.57)	57.13 (49.10)	64.16 (53.24)
S_{11}	Control with water spray (4 sprays at 10 days interval)	69.27 (56.46)	58.10 (49.66)	71.03 (57.45)	66.13 (54.44)
S_{12}	Control (No water spray)	70.63 (57.23)	52.97 (46.69)	**88.43** (70.41)	**70.68** (57.22)
C.D. (p=0.05)		(8.04)	(5.07)	(7.98)	(3.57)
SE(m) ±		(2.72)	(1.72)	(2.70)	(1.20)

Figures in parentheses are the angular transformed values.

Similarly, significant differences in pupal parasitisation were observed among different management schedules after 14 days of spray. The maximum pupal parasitization (65.10 %) was observed in S_2 followed by 62.50 and 60.20 per cent in S_1 and S_3, respectively. The minimum pupal parasitization (48.83 %) was recorded in S_5. Data recorded at 28 days after spray also showed significant differences among the management schedules with respect to pupal parasitization. The maximum pupal parasitization (88.43 %) was observed in S_{12} (untreated control) which was statistically at par with S_2, S_6 and S_{11}. The minimum pupal parasitization (56.10 %) was observed in S_5 (Table 3).

Pooled mean of pupal parasitization of whitefly by *Encarsia* spp. showed that maximum pupal parasitization (74.79%) was observed in S_2 followed by S_1 (70.82%) and S_{12} (70.68%) being at par with each other. These were also found significantly superior over other management schedules. The parasitization was minimum in S_5 (56.47%) followed by S_8 (59.73%) (Table 3).

Based on the above results, it can be concluded that different management schedules had significant effect on parasitization of whitefly pupae by *Encarsia* spp. The pupal parasitization of whitefly by *Encarsia* spp. was lowest in insecticides treated plot (S_5) and highest in nimbecidine treated plots (S_2, S_7, S_1). These findings are similar to those of Joshi *et al*. (1982), who reported that neem products are safer for the parasitoids and prolonged the parasitoids life span Sharma *et al.* (2008) also reported that whitefly pupae parasitization was higher (28.8%) in neem treated plots than insecticide treated plots (3.1%). The study also revealed that nimbecidine was found relatively less toxic and much safer to natural enemies than the other insecticidal treatments. Current findings are in accordance with Natarajan (1991) who reported neem oil as harmless to hymenopterous parasitoids of cotton whitefly, e.g. *Eretmocerus mundus*, *Encarsia* spp.

REFERENCES

Agrihotri, N.P., Walia, S. and Gajbhiye, V.T. 1999. Green pesticides, crop protection and safety evaluation. Indian Agricultural Research Institute, New Delhi, p 253.

Antony, B., Palaniswami, M.S., Kirk, A.A. and Henneberry, T.J. 2004. Development of *Encarsia bimaculata* (Hymenoptera: Aphelinidae) in *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) nymphs. *Biological Control*, 30:546-555.

Basu, A.N. 1995. Bemisia tabaci (Gennadius) Crop Pest and Principal Whitefly Vector of Plant Viruses. Westview Press, Boulder, 173 p.

Goolsby, J.A., Ciomperlik, M.A., Legaspijr, B.C., Legaspi, J.C. and Wendel, L.E. 1998. Laboratory and field evaluation of exotic parasitoids of Bemisia tabaci (Gennadius) (Biotype "B") (Homoptera: Aleyrodidae) in the Lower Rio Grande Valley of Texas. *Biological Control,* 12:127-135.

Goolsby, J., Legaspi, J.C. and Legaspi Jr., B.C. 1996. Quarantine evaluation of exotic parasitoids of the sweet potato whitefly, *Bemisia tabaci* (Gennadius). *Southwestern Entomologist*, 21:13-21.

Heraty, J.M. and Polaszek, A. 2000. Morphometric analysis and descriptions of selected species in the *Encarsia strenua* group (Hymenoptera: Aphelinidae). *Journal of Hymenoptera Research,* 1:142-169.

Joshi, B.G., Ramaparsad, G. and Sitaramaiah, S. 1982. Effect of neem seed kernel suspension on *Telenomus remus*, an egg parasite of *Spodoptera litura*. *Phytoparasitica*, 10: 61-63.

Kedar, S.C., Saini, R.K., Kumaranag, K.M. and Sharma, S.S.2014. Record of natural enemies of whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) in some cultivated crops in Haryana. *Journal of Biopesticides*, 7: 57-59

Lanjar, A.G. and Sahito, H.A. 2005. Effect of some spring hosts on the life cycle of whitefly, *Bemisia tabaci* (Genn.) *Pakisthan Journal of Entomology,* 20 (1-2):13-18.

Mehrotra, K.N. 1991.Current status of pesticide resistance in insect pest in India. *Journal of Insect Science*, 4:1–14.

Natarajan, K. 1991. Natural enemies of *Bemisia tabaci* Gennadius and effect of insecticides on their activity. *Journal of Biological Control*,4: 86-88.

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

Sharma, S.S., Ram, P., Batra, G.R. and Jaglan, R.S. 2003. Parasitization of whitefly, *Bemisia tabaci* (Gennadius) by *Encarsia lutea* (Masi) on different crops. *Annals of Biology,* 19:103-104.

Sharma, S.S., Saini, R.K. and Ram, P.2008. Effect of insecticides on parasitization of whitefly, *Bemisia tabaci* (Gennadius) and aphid, *Aphis gossypii* Glover on cotton. *Journal of Cotton Research and Development*, 22: 97-100.

Simmons, A.M. and Abd-Rabou, S. 2005. Parasitism of *Bemisia tabaci* (Homoptera: Aleyrodidae) after multiple releases of *Encarsia sophia* (Hymenoptera: Aphelinidae) in three vegetable crops. *Journal of Agricultural Urban Entomology,* 22:73-77.

Received: 08.01.2018 Accepted: 29.05.2018