

**BIONOMICS OF *DIAPHORINA CITRI* KUWAYAMA
(HEMIPTERA: PSYLLIDAE), ON *CITRUS SINENSIS* IN
JAMMU REGION OF J & K STATE**

Monika Chhetry*, Ruchie Gupta* and J. S. Tara*

* Department of Zoology, University of Jammu, Jammu (Tawi) - 180006, J & K, INDIA. E-mails: monikachhetry@gmail.com, E-mail.ruchiegupta18@gmail.com

[Chhetry, M., Gupta, R. & Tara, J. S. 2012. Bionomics of *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), on *Citrus sinensis* in Jammu Region of J & K State. Munis Entomology & Zoology, 7 (1): 304-308]

ABSTRACT: The objective of this work is to study the biology of Asian Citrus psyllids, *Diaphorina citri* Kuwayama on *Citrus sinensis* in Jammu and Kashmir, India having varied agro-climatic conditions ranging from tropical, sub-tropical to temperate conditions. *C. sinensis* (Sweet Orange) is a cherished and economically important fruit in Jammu region of J & K State which is severely attacked by Asian citrus psyllids, a very serious pest of citrus in India. Both adults and nymphs suck sap of citrus plants, reduce their vigour and kill tender shoots. Citrus psylla has also been established as a vector of the 'greening disease'. Thus, an attempt was made to study the biology of *D. citri* in Jammu. The insects were reared in the laboratory at room temperature (10.84°C-32.87°C) and relative humidity of 26%-80% on *C. sinensis* plantlets. Eggs were laid in clusters on the half opened tender leaves and tender twigs. There are five nymphal stages with length varying from 0.26-2.96 mm. The incubation, nymphal and adult longevity were 2.28±0.18, 14.86±1.07 and 10±1.23 days respectively. Thus, the psyllid has a total life span of 20 to 36.5 days (27.14±2.34 days). The present study is an important step in future to record the no. of generations of Asian Citrus psyllids on *C. sinensis* and for the timely management of the pest.

KEY WORDS: *Diaphorina citri*, biology, *Citrus sinensis*, Asian Citrus psyllid, morphometric measurements, life cycle.

Psyllids can cause damage to their host plants in various ways; the removal of large quantity of plant sap, when psyllid populations are high; it cause induction of leaf necrosis or abortive terminal buds by inserting their mouth parts into plant tissue; deformation of leaves, buds or flowers including induction of galls; soiling of leaves, flowers or fruits by secreting honeydew which may stimulate fungal growth. The most serious damage is caused by larvae or by adults transmitting plant diseases (Yana et al., 2010). Amongst different species of psyllids, *Diaphorina citri* Kuwayama is recorded to cause extensive damage to plants of family Rutaceae. The importance of the pest is due to its role in spreading Citrus greening disease (da Graca, 1991; Halbert and Manjunath 2004) which is one of the most devastating diseases of Citrus in the world. This insect is known to be the most efficient vector of phloem-inhabiting bacterium *Candidatus Liberobacter asiaticus* that causes Citrus greening disease known as 'Huanglongbing' throughout Asia and Far East (Pande, 1971). Symptoms of Citrus greening include yellowing of shoot, mottling and chlorosis of the leaves (Capoor et al., 1967). Infected trees are stunted, sparsely foliated and may bloom off-season. In addition, there is twig dieback, leaf and fruit drop, and production of small lopsided hard fruit with small, dark, aborted seeds. Given high reproductive potential of this vector during the period of favorable weather conditions and food availability (Tsai & Liu, 2000), this pest is expected to spread throughout citrus producing areas in Florida.

Biology of *Diaphorina citri* on *Citrus jambhiri* has been studied by Khan et al. (1989) in India. Tsai & Liu (2000) also studied the biology of *D. citri* on four

commonly grown Citrus and related plants (*C. jambhiri*, *C. aurantium*, *C. paradisi* and *Murraya paniculata*) in laboratory conditions in Florida. Nava et al. (2007) studied the biology of *D. citri* in Brazil on different host plants namely *C. limonia* (Rangpur lime), *Murraya paniculata* (Orange Jessamine) and *C. sunki* (Sunki mandarin) in Brazil. The authors made an attempt to study the biology of the pest on *C. sinensis* cv. Jaffa, a commercially cultivated fruit in J & K, India.

MATERIALS AND METHODS

Adult psyllids were collected by hand-held aspirators from citrus groves located at Udheywalla (District Jammu). Potted *C. sinensis* cv. Jaffa plants were used for the oviposition by the adult females. The branches were regularly pruned whenever new shoots were required. After oviposition the adults were removed from the cage and eggs were counted by using the stereomicroscope. Eggs laid on the potted plants were allowed to hatch in situ and then the freshly hatched nymphs were transferred individually by the help of fine paint brush to young tender shoots. Nymphs were reared in normal room temperature and were checked daily for ecdysis. A single shoot was held in glass vial (8cm X 2.5cm) containing water, the mouth plugged with cotton. Vial was then placed in a disposable cup so as to collect the exuviae released by the developing instars which was finally placed inside a glass chimney, the mouth of which was covered by a muslin cloth. *D. citri* rearing system consisted of a nymphal development cage (60 X 60 X 60 cm). About 30 plantlets were placed in the cage.

Observations were recorded daily. Morphometric measurements of eggs, different instars and adults were recorded and analyzed statistically. Measurements of morphologically important body parts were recorded by using stage and ocular micrometer scales. Duration of different stages in the lifecycle was also calculated and analyzed statistically. During the period under observation, the average maximum and minimum temperature was 32.87°C and 10.84°C respectively, and morning and afternoon relative humidity of 80% and 26% respectively.

RESULTS

Newly emerged adults did not mate immediately and took 2-4 days for becoming sexually mature. During copulation, male approached female from side and held her with its leg of one side while balancing with the leg of other side with female slightly lifting its wings. Copulation lasted for 5-10 min. and a single male copulated with more than one female during its lifetime. The mean number of eggs was 17 ± 0.56 eggs/10 cm twig laid by gravid females on the half opened tender leaves with a hatching rate was $56 \pm 1.46\%$. Eggs were elongate, almond-shaped with a round basal portion and a slender stalk for thrusting the egg into plant tissues. Light yellow when freshly laid, turned bright yellow and finally bright orange with transparent stalks. Average length of egg along with stalk was 0.28 ± 0.02 mm (0.26-0.31 mm), width 0.13 ± 0.02 mm (0.12-0.14 mm) and stalk length was 0.04 ± 0.01 mm (0.04-0.05 mm). Incubation period lasted for 2.28 ± 0.18 days.

Asian Citrus psyllid nymphs varied in length from 0.26–2.96 mm. Body generally yellowish orange with five nymphal stages with similar looks but increase in size after each moult. Except first instar, all other instars develop wing pads. Nymphs moved in a slow and steady manner. There was gradual increase in the body length from first to second instar but showed a steady increment from

second to first instar stage. Antennae were two segmented in first three instars, and became three segmented afterwards. Antennal tip became black from third instar onwards. Survival rate from first to third instar was significantly lower $28 \pm 0.45\%$ than the survival rate from third to fifth instar $68 \pm 0.47\%$ ($t = 3.03$, $P \leq 0.01$, $df = 47$). Body of fifth instar was broadly oval, about 2.5 times as long as wide. General body color was yellow to yellowish brown, third antennal segment turned entirely black and eyes became deep red. The first, second, third, fourth and fifth instar stage lasted for 3.42 ± 0.17 days, 2.71 ± 0.21 days, 2.50 ± 0.18 days, 3.14 ± 0.32 days, and 3.07 ± 0.31 days respectively.

Adult psyllids were small insects with general color brown. Average body length (head to tip of forewing) was 3.02 ± 0.17 mm (2.87mm-3.56mm). Average length of head, antennae, thorax and abdomen measured 0.40 ± 0.04 mm, 0.42 ± 0.03 mm, 0.79 ± 0.09 mm and 1.21 ± 0.17 mm respectively. Average length and width of forewing was 2.17 ± 0.10 mm and 0.84 ± 0.05 mm respectively. Average adult longevity was 10.00 ± 1.23 days (7 days-16 days). The survival rate from egg to adult stage was $46 \pm 1.02\%$. Thus, the average nymphal period was of 14.86 ± 1.07 days (11-17.5 days) with a total life span of 27.14 ± 2.34 days (20 days-36.5 days) in summer when the average maximum and minimum temperature recorded was 35.87°C and 10.84°C respectively, and morning and afternoon relative humidity of 90% and 26% respectively.

DISCUSSION

Pande (1971) observed that mating immediately occurred after emergence. Shivankar et al. (2000) observed that adults reached sexual maturity 2-6 days after emergence. Tsai & Liu (2000) recorded egg length of 0.31 mm and width of 0.15 mm in Florida. According to Hussain and Nath (1927) total nymphal period of the insect studied in Pakistan varied from 11 to 25 days, each instar lasting for 3 days in summer and 4 days in winter and the total life cycle was completed in 15-42 days, however, Khan et al. (1989) observed the incubation period of 2 to 4 days in July-August and 5 to 11 days in November and total life cycle of 15 to 18 days in September and 23 to 27 days in November in Maharashtra. Mathur (1975) observed body length in males as 1.7 mm and in female as 2.4 mm, width of head with eyes was 0.55 mm, length of forewings in male was 2.1 mm, in females it was 2.4 mm and length of abdomen was recorded as 0.58 mm. These variations in the life stage durations may be due to differential environmental factors.

ACKNOWLEDGEMENTS

The authors are thankful to Prof. Baldev Sharma (Retd. Professor, Division of Entomology) for his keen interest and encouragement, and to Prof. Subash Gupta, Head, Department of Zoology, University of Jammu for providing necessary facilities.

LITERATURE CITED

- Bindra, O. S.** 1957. Insect pests of citrus and their control. Indian Journal of Horticulture, 14: 89-98.
- Capoor, S. P., Rao, D. G. & Viswanath, S. M.** 1967. *Diaphorina citri* Kuway., a vector of the greening disease of citrus in India. Indian Journal of Agricultural Sciences, 37 (6): 572-576.
- Halbert, S. E. & Manjunath, K. L.** 2004. Asian citrus psyllids (Sternorrhyncha: Psyllidae) and greening disease: a literature review and assessment of risk in Florida. Florida Entomologist, 87: 330-353.

Hussain, H. A. & Nath, D. 1927. The citrus psylla, *Diaphorina citri* (Psyllidae: Homoptera). Memoirs of Department of Agricultural Entomology and Sericology, 10 (2): 5-27.

Khan, K. M., Radke, S. G. & Borle, M. N. 1989. Studies on the biology of citrus psylla, *Diaphorina citri* Kuwayama in the Vidharbha region. Bulletin of Entomology, 30 (1): 1-6.

Mathur, R. N. 1975. Psyllidae of the Indian Subcontinent. Indian Council of Agricultural Research, New Delhi, p. 20.

Nava, D. E., Torres, M. L. G., Rodrigues, M. D. L., Bento, J. M. S. & Parra, J. R. P. 2007. Biology of *Diaphorina citri* (Hem., Psyllidae) on different hosts and at different temperatures. Journal of Applied Entomology, 131 (9-10): 709-715.

Pande, Y. D. 1971. Biology of citrus psylla, *Diaphorina citri* Kuw. (Hemiptera: Psyllidae). Israel Journal of Entomology, 6: 307-311.

Shivankar, V. J., Rao, C. N. & Singh, S. 2000. Studies of citrus psylla, *Diaphorina citri* Kuwayama: A review. Agriculture review, 21 (3): 199-204.

Tsai, J. H. & Liu, Y. H. 2000. Biology of *Diaphorina citri* (Homoptera: Psyllidae) on four host plants. Journal of Economic Entomology, 93 (6): 1721-1725.

Yana, W., Tamesse, J. L. & Burckhardt, D. 2010. Jumping Plant-Lice of the family Psyllidae Latreille (Hemiptera: Psylloidea) from the Center region of Cameroon: Faunistics, Phenology and host Plants. Journal of Entomology, 7 (1): 1-18.

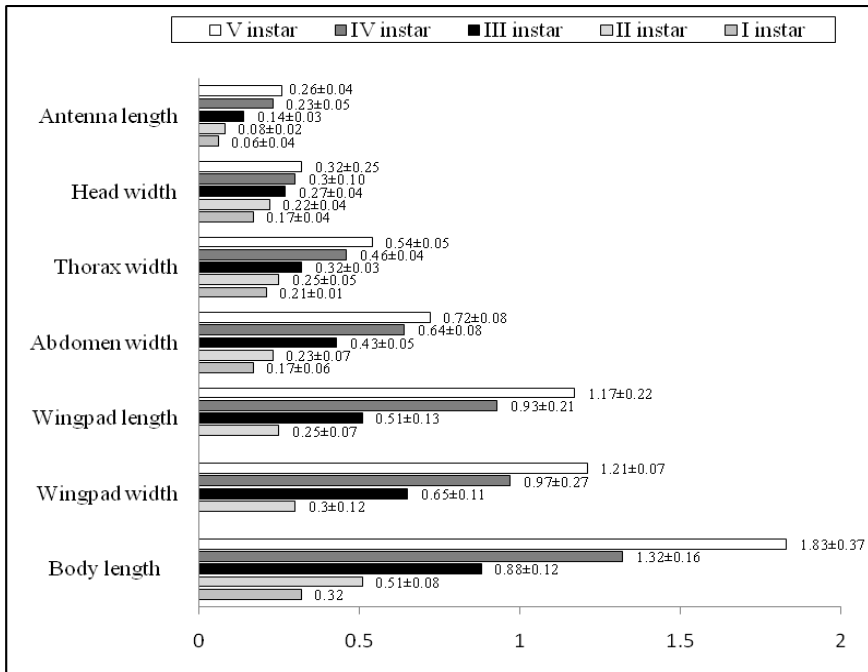


Figure 1. Measurements of body parts of different nymphal stages of *Diaphorina citri* Kuwayama.

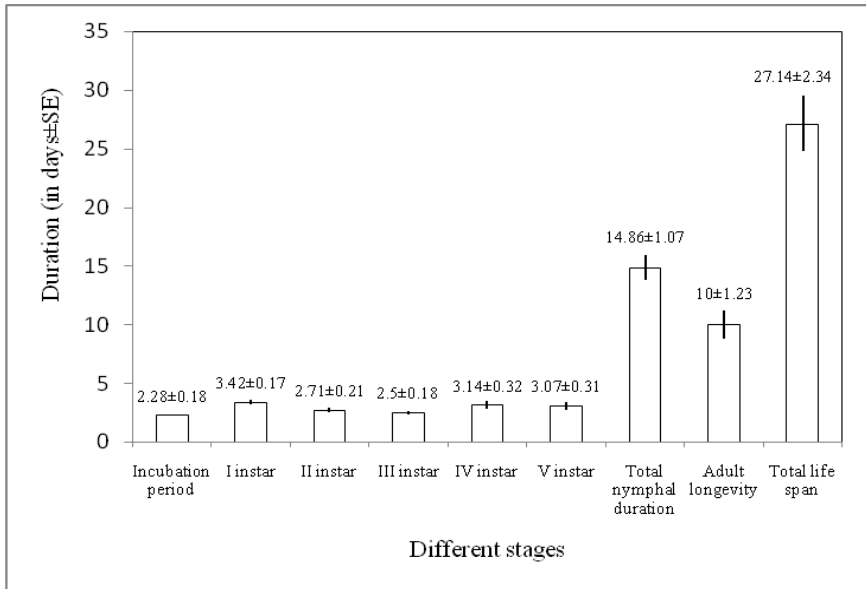


Figure 2. Duration (in days±SE) of different stages in the life cycle of *Diaphorina citri* Kuwayama.