



Received: 08-04-2014
Accepted: 15-05-2014

ISSN: 2321-4902
Volume 2 Issue 1



Online Available at www.chemijournal.com

International Journal of Chemical Studies

Studies on the Population Dynamics of citrus psylla (*Diaphorina citri* Kuwayama) in Nagpur Mandarin

PN Dawane¹, UP Barkhade¹ and RM Wadaskar¹

1. Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author: PN Dawane, Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Studies on the seasonal occurrence of citrus psylla (*Diaphorina citri* Kuw.) in Nagpur Mandarin were the focus of the current inquiry, which was carried out in Ambia Bahar in 2010–2011. At Futala Farm, College of Agriculture, Nagpur, an eight-year-old Nagpur mandarin orchard that was chosen for imposing treatments was planted at a spacing of 6.0 m x 6.0 m. The current investigation included research into the seasonal occurrence of citrus psylla (*Diaphorina citri* Kuw.). On the twigs of the 5-cm-fresh development of the shoot, the number of citrus psylla nymphs and adults was counted. Every seven days during Ambia bahar 2010–11, the population dynamics of the citrus psylla (*Diaphorina citri* Kuw.) were monitored. The Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Meteorological Observatory provided the weather information for 2010–2011. Citrus psylla abundance was quite low in January, but when the temperature rose in late February and early March, adult activity increased. In parallel, a large rise in the nymphal population was noted in February and March. It was mostly connected to the flushing cycle, suggesting the pest's desire for a fresh flush. Citrus psylla enjoys moderate temperatures and a low humidity level, as seen by the increase in population during the months of February and March.

Keyword: *Diaphorina citri*, Citrus psylla, Akola

Introduction

Nagpur Mandarin is considered as "Green gold" and Nagpur city is generally known as the "Orange City". Kinnow Mandarin has thrived in semi-arid irrigated zones of Punjab and its neighboring states, as well as in the Nagpur and Akola areas of Maharashtra. A detailed analysis in Maharashtra indicated a loss of roughly 30% of the citrus group owing to insect pest damage (Bindra, 1970) [5]. In Maharashtra, eight of the 14 recorded citrus bug pest species are of substantial importance (Anonymous, 1994) [1]. The presence of these pests is also common in the Vidarbha area (Anonymous, 1995) [2]. Citrus psylla *Diaphorina citri* is the most devastating insect pest, causing significant damage to the citrus sector. Citrus psylla, *Diaphorina citri*, is a severe citrus pest in North India (Punjab, Haryana, and Himachal Pradesh) and Maharashtra, but of minor importance in South

India (Randhawa and Srivastava, 1986) [16]. During 1960–62, Nagpur Mandarin in central India saw a significant "outbreak" of psylla. Since then, this insect has become endemic, inflicting significant harm to the citrus crop (Thakre et al., 1985) [21]. Citrus psylla is a viral vector that spreads citrus Tristeza colescterovirus and citrus leaf talter viruses, which cause citrus greening disease (Su et al., 1991) [20]. The Asian citrus psylla, *Diaphorina citri* Kuwayama (Homoptera: Psyllidae), was identified as a significant pest after it was shown to be the vector of citrus Huanglongbing (HLB), or greening disease (Capoor et al., 1967; Martinez and Wallace, 1967) [6, 14]. Adults of *Diaphorina citri* are grey in colour and normally repose on the leaves with their wings folded and their rear ends arched higher. Adults achieve sexual maturity between 2 and 6 days after hatching. Females live longer (13.77–80.22 days) than males

(10.41-74.0 days) and deposit 500–800 eggs on average (Hoy and Nguyen, 1996; Bhagat and Nehru, 1999) ^[9, 3] and up to 900 eggs over their 190-day winter and 12-26-day summer lives. The eggs are elongate and almond-shaped, with rounded basal sections and a short stalk for piercing plant tissue. The eggs are light yellow after oviposition but gradually turn orange as they hatch. During the summer and winter, incubation takes 3-6 and 10-20 days, respectively, while nymphs (5 instars) require 15 and 47 days. Adults who overwinter may survive for more than 6 months (Mangat, 1966) ^[13]. In a year, the pest has nine to ten or even up to 16 overlapping generations (Khan et al., 1989) ^[11]. Psylla also targets the Curry Leaf Plant (*Murraya koenigii* Unn.), Orange Jasmine, *M. paniculata* (L.), and Jackfruit in addition to citrus. On *Muaaya koenigii*, the pest has the highest rate of fertility, the quickest development, the lowest nymphal mortality, and the biggest nymphs (Hussain and Nath, 1927) ^[10]. Citrus psylla nymphs and adults suck the cell sap with their sharp, piercing mouth parts, causing curling, defoliation of leaves and blossoms, and dieback of branches from the tip downward, resulting in premature fruit falling (Shah and Saleem, 2000) ^[18]. The fruits suffer in both number and quality since they are small, have low juice quality, and have a bland taste (Bindra, 1969) ^[4]. The nymphs excrete white crystalline waxy pellets on which black sooty mould might grow, reducing the photosynthetic area and so decreasing the bloom, fruit set, and market value of such fruits (Pruthi and Mani, 1945) ^[15]. (Shivankar et al., 2000) ^[19]. Citrus psylla infection causes losses ranging from 83 to 95%. (Randhawa, 1974) ^[23]. Citrus plantations in Assam and Punjab have suffered greatly as a result of greening disease. Citrus psylla is most active in the spring and after the monsoon, while it is less active in the winter.

Materials and methods

The current study, "Studies on the Seasonal Incidence of Citrus Psylla (*Diaphorina citri* Kuw.) in Nagpur Mandarin," was carried out in Ambia Bahar in 2010–2011. An eight-year-old Nagpur mandarin orchard that was chosen for imposing treatments was planted at Futala Farm, College of Agriculture, Nagpur, with a 6.0 m x 6.0 m spacing between the trees. Studies on the seasonal occurrence of citrus psylla were included in the current analysis (*Diaphorina citri* Kuw.). The descriptions of each component of the material used

and the procedures used for this investigation are provided below. Four Nagpur mandarin trees were used to record the seasonal prevalence of citrus psylla. Four branches from each chosen plant were picked at random from the top, middle, and bottom regions on all four sides of the plant, and they were then marked with tags. On twigs with a new growth of 5 cm, the citrus psylla population was enumerated, including both nymphs and adults. Throughout Ambia Bahar in the years 2010–11, population dynamics of the citrus psylla (*Diaphorina citri* Kuw.) were monitored every seven days. The Meteorological Observatory at the College of Agriculture in Nagpur and the Dr. Panjabrao Deshmukh Krishi Vidyapeeth in Akola provided the weather data for 2010–2011.

Result and Discussion

Incidence of citrus psylla

The observations on seasonal incidence of citrus psylla were recorded on four Nagpur mandarin trees. From each selected plant four branches were selected at random and tagged. The population of citrus psylla both nymph and adult were counted on the twigs of 5 cm fresh growth of the shoot from top, middle and bottom portions from all the four sides of the plant. For population dynamics of citrus psylla, the data was recorded after every 7 days during *Ambia bahar* of 2009-10.

Seasonal incidence of citrus psylla (*Diaphorina citri*) nymphs

The citrus psylla nymphal population (Table 1) was recorded for eleven consecutive weeks from 15th January to 01st of April 2010. Fourth MW had psylla population of (7.6 psylla nymphs per twig) with drop in population (6.8 psylla nymphs twig⁻¹) 5th MW. Psylla nymph population again recorded drop from 6th to 8th MW from 8.4 to 6.8 psylla nymphs per twig. 9th to 14th MW recorded consistently increasing trend in psylla nymphs population from 8.5 to 19.0 psylla nymphs per twig.

Seasonal incidence of citrus psylla (*Diaphorina citri*) adults

In case of citrus psylla adults abundance recorded over same period (depicted in Table 2), consistently increase in psylla adults population/twig was observed from 4th MW (3.8 psylla adults per twig) to 8th MW (9.0 psylla adults per twig). Slight drop in population was observed in 9th MW and 10th MW

with 8.3 and 6.9 psylla adults per twig, respectively. Eleventh MW again had higher psylla adult abundance (7.9 psylla adults per twig) followed by drop in psylla adults abundance to 7.4 and 6.6 psylla adults per twig in 12th and 13th MW. Fourteenth MW population again registered higher counts of psylla with 8.5 psylla adults twig⁻¹.

In 2010-11 the psylla adults attained peak (10.4 adults per twig) in 13th Met week in the month of March. Psylla nymphs counts revealed increasing trend from the month of February to march with a peak (17.7 nymphs per twig) in 13th Met week.

Khan et al., (1984)^[11] studied the seasonal activity of the aphalarid, *Diaphorina citri* in five orange orchards situated in and around Nagpur, Maharashtra, India. Negligible populations were recorded by the end of October. The population increased by the end of December with application of 'bahar' treatment, and high populations were maintained until the end of February. Findings of Dadmal et al., (2000)^[7] about seasonal abundance of psylla (*Diaphorina citri*) which synchronized with new flushing periods i.e. June-July, October-November, and January-February under Akola conditions, Maharashtra tallies with present observations.

Tsai et al., (1984)^[22] reported that the populations were highest in March and April and lowest in July, on *Murraya paniculata*, an alternative food-plant. Similar trend was also reported by other scientists, outside Maharashtra. Sahu and Mandal, (1997)^[17] studied population fluctuations of citrus psylla,

Diaphorina citri, at Mohanpur, Nadia, West Bengal. The pest remained active during second week of February to the end of April, during which the nymphal population peaked in mid-April. Only adults were recorded during winter (first week of January to the first week of February), which falls in line with the findings of present study for Ambia bahar. This finding was also strengthened by findings of Maheshwari and Sharma, (1978)^[12] who reported highest incidence of *Diaphorina citri* on citrus from mid-February to mid-April. They found Nagpur orange with highest susceptibility amongst five citrus cultivars studied, emphasising the importance of pest and present study. Gupta and Bhatia, (2000)^[8] reported peak activity of nymphs was observed during March-April (45-50/shoot) whereas, the adults assumed peak during April (20-23/shoot) on mandarin cv. Nurgpur local in the lower-hill region of district Kangra, Himachal Pradesh, India.

Conclusions

The citrus psylla abundance was very low during January but with the increase in temperature in the end of February and March, the activity of adults increased. At the same time significant increase in nymphal population was observed during February and March. It was mostly associated with the flushing cycle indicating the preference of the pest for new flush. Citrus psylla prefers warm conditions with lower humidity regime which is evident from population rise in month of February and March.

Table 1: Incidence of citrus psylla (*Diaphorina citri*)

MW	Period	Adults/twig	Nymphs/twig	T-Max	T-Min	RH I	RH II	RF	RD	Eva	BSH
4	15 to 21 Jan 2009	3.8	7.6	27.2	9.2	58.0	32.0	0.0	0	2.6	8.7
5	22 to 28 Jan 2009	5.4	6.8	28.9	9.2	52.0	22.0	0.0	0	3.4	9.2
6	29 Jan to 04 Feb 2009	5.7	8.4	29.8	13.1	60.0	34.0	0.0	0	3.4	8.3
7	05 to 11 Feb 2009	7.3	7.4	29.8	14.0	69.0	32.0	0.0	0	2.6	5.4
8	12 to 18 Feb 2009	9.0	6.8	31.6	17.9	68.0	34.0	7.4	1	3.9	6.5
9	19 to 25 Feb 2009	8.3	8.5	32.0	16.0	43.0	25.0	0.0	0	4.5	8.3
10	26 Feb to 04 Mar 2009	6.9	10.2	35.7	16.6	39.0	16.0	0.0	0	5.4	9.6
11	5 to 11 Mar 2009	7.9	11.8	36.3	19.8	45.0	22.0	18.6	1	7.1	9.3
12	12 to 18 Mar 2009	7.4	13.0	36.0	18.5	53.0	28.0	28.0	1	4.8	7.3
13	19 to 25 Mar 2009	6.6	15.1	39.8	20.5	36.0	16.0	0.0	0	6.1	9.1
14	26 Mar to 01 Apr 2009	8.5	19.0	40.2	23.4	39.0	18.0	0.0	0	6.9	8.1

T-Max: Maximum temperature, T-Min: Minimum temperature, RH-I: Relative humidity-I, RH-II: Relative humidity-II, RF: Rainfall, RD: , Eva: Evaporation, BSH:

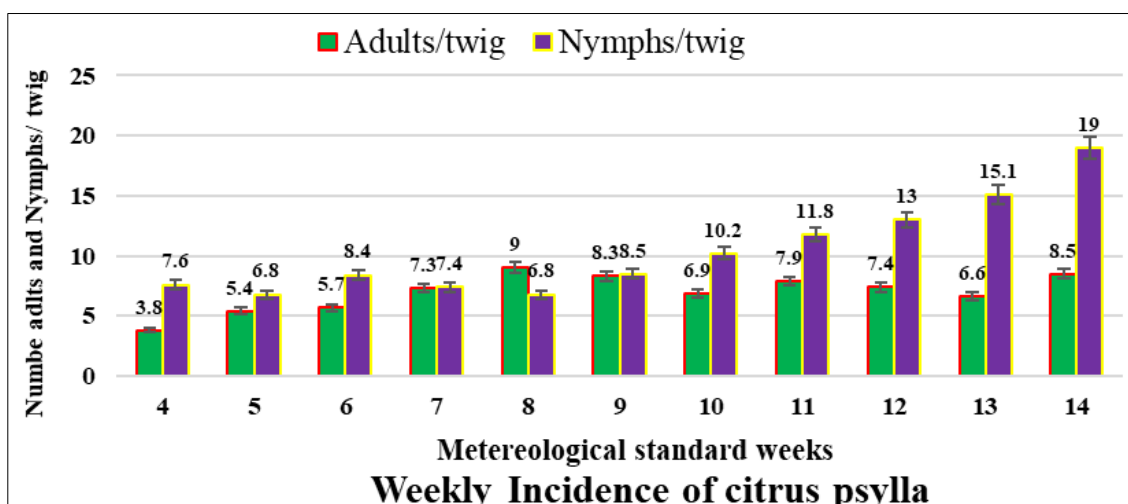


Fig 1: Graphical representation of incidence of citrus psylla (*Diaphorina citri*)

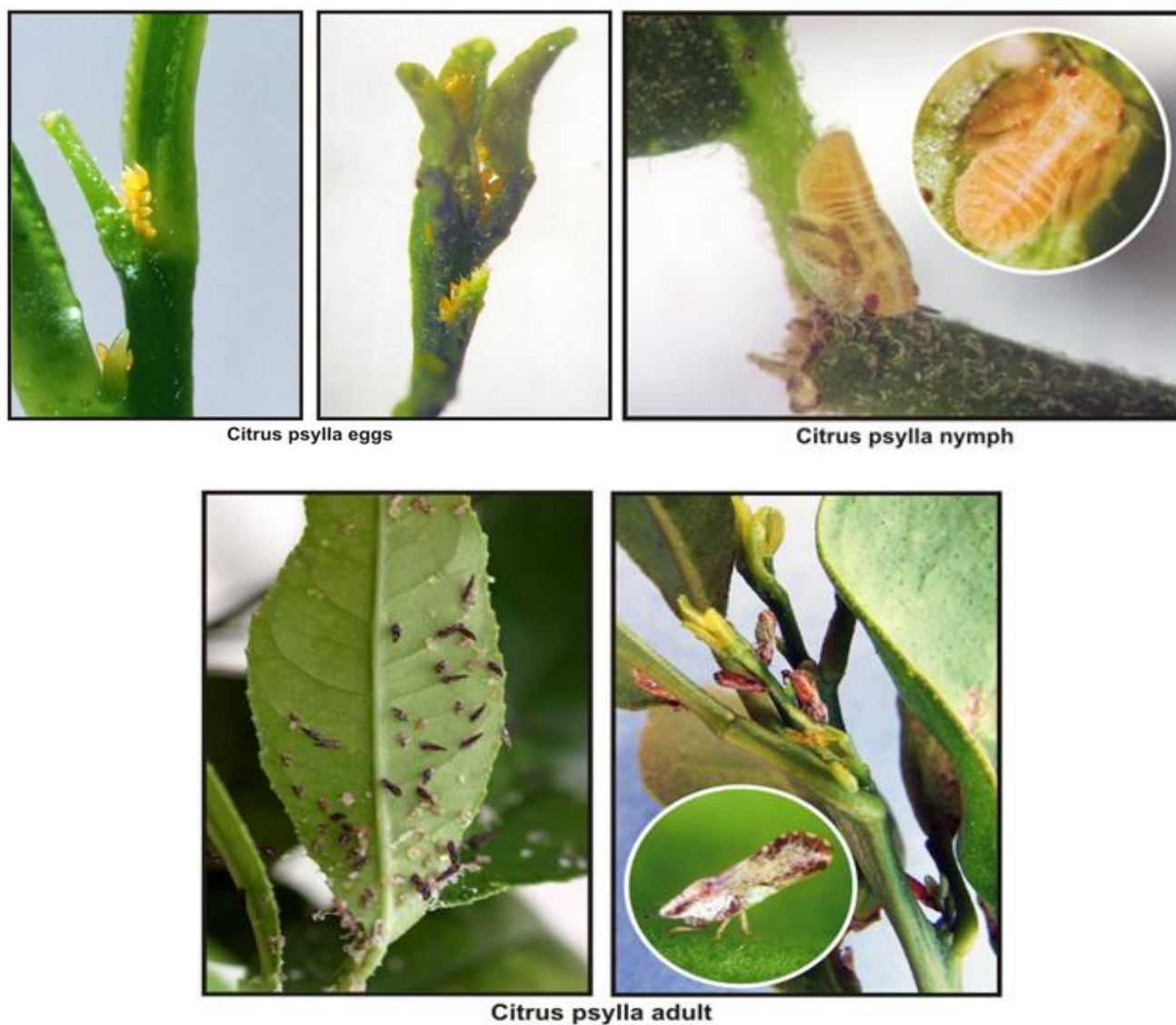


Plate 1: Eggs nymphs and adults of citrus psylla



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International Journal of Chemical Studies

Acknowledgement

Authors are thankful to the Head, Department of Entomology and Director of Research, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola for providing necessary facilities.

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