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BIOLOGY OF CITRUS PSYLLA, DIAPHORINA CITRI KUW.
(HEMIPTERA: PSYLLIDAE)

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S U M M A R Y

Studies were conducted on the biology of Diaphorina citri, Kuw., a serious pest of citrus. Copulation started soon after emergence. Fecundity was 180 - 520 eggs per female. The incubation period lasted 4 - 18 days. There were 5 nymphal instars which took 10 to 30 days. The adults were long-lived. The complete life-cycle took 14 - 48 days. Ten overlapping generations were recorded in a year. The insect was most active during March-April.

The citrus psylla, Diasphorina citri Kuw., has been reported as a serious and specific pest of Citrus spp. from China, Taiwan, Japan (Crawford, 1912, 1917); Burma, Ceylon and the East Indies (Clausen, 1931, 1933). In India this insect has been recorded as a serious pest in Punjab (Hussain and Nath, 1927; Pruthi and Mani, 1945; Rahman and Ansari, 1945; Mangat and Singh, 1960; Atwal, 1962; Sethi, 1967), Uttar Pradesh (Lai, 1950), Madhya Pradesh (Bindra, 1957) and West Bengal (Banerjee and Mookerjee, 1962).

This insect has become extremely abundant in recent years in semi-arid and arid-irrigated regions of Rajasthan and has attracted the attention of growers throughout the citrus areas. Moreover, this psylla also acts as the vector of the greening disease of citrus in India (Capoor et al., 1967). Yet no detailed information is available on the biology of the pest. Some results of studies carried out in and around Udaipur in the years 1965-66 are briefly discussed in the present paper.

MATERIALS AND METHODS

Adults of the citrus psylla were collected in large numbers from citrus orchards. The adults were confined to glass chimneys with non-infested tender twigs of citrus for oviposition studies. The newly-hatched nymphs were transferred to Petri dishes. The food, consisting of tender twigs, was renewed twice daily (morning and evening) during the early instars, and once a day in the later instars.

OBSERVATIONS

Life-History

Copulation: The adults copulate 12 to 60 hours after emergence.

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Copulation takes place on tender shoots. It may occur at any time during the day or night, and takes 10 to 30 minutes (average: 18 min.). The copulating pair walks very slowly on the surface of the twig. Normally, mating occurs only once, but when the temperature is low it may occur 3 or 4 times.

Oviposition: Oviposition starts 8 to 20 hours after copulation. Before laying eggs the female becomes restless and actively wanders on the tender twig of the host plant in search of a suitable place for oviposition. It then settles on tender parts of young shoots, touching the surface with the tip of her abdomen, and thrusts the slender egg stalk inside the host tissue with the help of her ovipositor. It then flies to another leaf, bud or twig. Eggs are laid singly or in small groups of up to 10 eggs. The egg stalk helps in firmly attaching the eggs to the tissues. Oviposition usually occurs during daytime. The oviposition period varies from 10 to 40 days.

In laboratory rearing, eggs were found mainly inside half-folded leaves of the buds (68.5 per cent). Next preference was given to leaf axils (10.5 per cent) petioles of fresh leaves (10.1 per cent) and axillary buds (8.0 per cent) and least to tender branches (2.9 per cent).

Hussain and Nath (1927) recorded that a female may lay 400 to 1900 eggs. In the present investigation the number of eggs laid per female varied from 180 to 520. The average number of eggs was greater during March - April (300), lower during May - September (210) and lowest during October - January (185).

Developmental stages.

Egg: The egg is elongate, almond-shaped, thicker at the base and tapering toward the distal end, 0.33 mm. long and 0.13 mm. wide. The average length of the egg-stalk is 0.039 mm. A freshly laid egg is transparent, shining and pale-yellow but turns yellow after some time.

At the time of hatching the colour of the egg turns orange and two brick-red spots appear at the anterior end. During hatching the nymph forms a long, narrow hole in the chorion at the anterior (apex) portion. First the head comes out and then the rest of the body is extricated by wriggling movements. The nymph comes out of the egg shell in 8 to 12 minutes. The egg-shell shrivels up and remains attached to the tissues for many days. The percentage of hatching varies from 48 per cent during the winter season to 85 per cent during the spring and rainy seasons; the average being 71 per cent.

Hussain and Nath (1927) and Pruthi and Mani (1945) reported that the incubation period took 4 to 20 days, whereas Mangat and Singh (1960) recorded 3 to 12 days. In the present investigation the eggs hatched out within 4 to 6 days from June to September, 8 to 18 days from October to January and 5 to 8 days from February to May. This variance in egg incubation period, as well as the variability in the lengths of the subsequent developmental stages

(reported below), should in fact be expected since the various observations were made at different temperatures.

Nymphs: The nymph passes through five instars. The first-instar nymph is flat and wingless, and is 0.25 mm. long. General body colour pale-orange, with brick-red eyes. Antenna 0.03 mm. long, segmentation not clear. Wing-pads are not visible. Legs short; the forelegs bear one tarsal seta, whereas the middle and hind legs have two tarsal setae. The number of lanceolate setae present around the abdomen varies from 8 to 12.

The second-instar nymph is similar to the first instar but larger about 0.4 mm. long. Antenna 0.06 mm. long, its segments difficult to distinguish. Wing-pads visible but rudimentary. Legs are similar to first instar, but the tarsus is fused with the tibia. The abdomen is fringed with 10 to 15 lanceolate setae.

The third-instar nymph is lighter in colour, 0.75 mm. long. Antenna 0.08 mm. long, 4-segmented, the two basal segments quite distinct. Wing-pads well marked. The legs are increased in size but the shape and structure remain the same as in the second instar. The number of lanceolate setae in the abdomen varies from 20 to 35.

The fourth-instar nymph is either pale-yellow or light yellow orange. It is elongate, flat, 0.9 mm. long. Antenna about 0.1 mm. long, segmented, but the proximal segmentation is more clear than the distal portion. Wing-pads well developed. Legs resemble the previous stage. The number of lanceolate setae increases in the abdomen and their number varies from 35 to 55.

The fifth-instar nymph is flat, yellowish orange, 1.5 mm. long. Antenna 0.3 mm. long, segmentation more evident than in the previous stage. Wing-pads cover most of the area of the thorax. The number of lanceolate setae of the outer margin of the abdomen varies from 45 to 65.

The total duration of the nymphal stages varies in different months. Atwal (1962) reported the nymphal period to last 10 - 36 days. In the present investigation this period varied from 10 to 15 days during July to September, 12 to 15 days during February to June and 18 to 30 days during October to January.

Adult: The newly-emerged adult is light brown-grey but gradually turns darker. The head is narrower than the thorax and lighter in colour. The tip of the antenna is black. The wings are membranous, semi-transparent, light brown with a broad, beige longitudinal band in the centre of the forewing. When at rest, the wings are placed vertically over the back in a roof-like manner and extend beyond the posterior part of the body, which is raised upward. The forewings completely cover the hind wings. The male and female measure 2.8 mm. x 0.9 mm. and 3.4 mm. x 10 mm. respectively.

Adults longevity varies in different months. Hussain and Nath (1927) reported it to be 20 days in summer and 89 days in winter. In the present investigation the life-span of the adult was 25 - 30 days from March to September and 35 - 75 days from October to February. Females always lived longer (average 45 days) than the male (average 40.5 days).

Sex ratio: In the laboratory, females always outnumbered the males in all the seasons and the ratio between male and female varied from 1 : 1.3 to 1 : 2.55.

Seasonal cycle: The various stages usually overlap. The most active period was found to be during March-April and July-August when the new and tender leaves are available. In the present investigation 10 overlapping generations were recorded from July 1965 to June 1966.

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