Bull. Zool. Surv. India, 2 (2 & 3) : 123-127, 1980

OBSERVATION ON THE RELATIVE INTENSITY OF INFECTION ON THREE SPECIES OF CULTIVATED CITRUS PLANTS BY *PSYLLA MURRAYI* MATHUR (HOMOPTERA : PSYLLIDAE) AT SHILLONG, MEGHALAYA*

A. R. LAHIRI AND S. BISWAS

Eastern Regional Station, Zoological Survey of India, Shillong

ABSTRACT

Nature of infection on three species of cultivated Citrus plants caused by *Psylla murrayi* Mathur (Homoptera : Psyllidae : Psyllinae) at Shillong, Khasi hills, in relation to seasonal change, competition from other citrus pests, parasite and predator has been discussed in this paper.

INTRODUCTION

Citrus cultivation has immense economic importance in India considered from the point of medical utility as well as production of nutritious edible fruits. Psyllid flies are one of a number of pests that cause severe damage to cultivated citrus plants resulting in a great national loss caused by depleted production.

The common Psyllid occurring almost exclusively on citrus plants all over South East Asia is *Diaphorina citri* Kuwayama (Psyllidae Psyllinae) and is more commonly known as Citrus Psylla. In India, it has been recorded on all species of Citrus plants besides a number of other plants of the family Rutaceae. However, while the Citrus Psylla has not yet been recorded from any part of Meghalaya so far, it was revealed in course of present investigation that a different species, *P. murrayi* Mathur, infects exclusively citrus plants in and around Shillong. First described from Dehradun, how *P. murrayi* Mathur turned out to be a citrus pest at Shillong replacing so to say the citrus Psylla has yet to be found out.

Infection of *P. murrayi* Mathur inflicts great loss to citrus cultivation in Shillong and around, since as much as 0% foliage of infected plants become deformed, resulting in a depleted photosynthetic activity over and above the loss caused by intake of plant sap by the growing larvae.

An investigation was carried out to ascertain the nature of injury caused by *P. murrayi* Mathur at Shillong in relation to host difference, seasonal change and outburst of other biological agents, either competitor, or even actual enemy of the Psyllid fly. Results of the investigation covering some basic informa-

* Part 13 of A preliminary study of the Insect fauna of Meghalaya.

tion for further investigation in future and suggestion for effective control of the pest have been incorporated in this paper.

Material and Methods

Three different species of cultivated citrus plants were selected for present investigation with an object to ascertain a comparative picture of nature of Psyllid infection on them. The three plants, henceforth referred to as 'A", "B" and "C", in the text are *citrus medica* Linnaeus (SOHMAD in Khasi), *C. acida* Korel (SOHNAIRANG in Khasi) and *C. auranticum* Linnaeus (SOHMYNTRA in Khasi) respectively. Observation was carried out separately on three plants, (one each of A, B, and C) standing in a row within a stretch of 11.5 m at Risha colony, Shillong (Alt. 1625 m), regularly every week between July 1976 to June 1977. Presence or absence of adult as well as nymphs of Psyllid and other pests nature and intensity of infection on foliage and periodicity of development of new foliage were noted for each plant Rate of infection was ascertained through random counting of leaves. Some specimens were collected and preserved in spirit for identification. The plants under study were under natural condition throughout, free of any external interference, *e.g.* application of insecticides or otherwise.

Observations

Nature of infection of Psyllid larvae : The adult flies deposit their eggs on the inner surface of tender leaves just emerging and still within the bud, on the mid rib. The nymphs on emerging, keep on growing within the folded leaves, devouring the plan sap and moul ing stage by stage. The leaves, thus infected by Psyl id nymphs become deformed and do not unfold or unfold only imperfectly for a prolonged period in comparison to normal, uninfected ones and still as long as they harbour the growing nymphs. The nymphs emerge into adult flies before the tender leaves turn old, thereby becoming thick and hardened. The leaves once infected by Psyllid nymphs remains variably curled ever afterwards, never being able to regain normal shape. Intensity of such deformed leaves is most noticeable in plant "B ' which is having a single foliation in course of year, between February and April. Since the Psyllid infection also reach a peak period in this season on this plant (Fig. 1), throughout the rest of the year the plant "B" can be seen with 0% deformed foliage. Although, the Psyllid infection on plants "A" and "C" are at times as heavy as on "B" (Fig. 1) they are able to regain their loss to a considerable extent, each being credited with new foliation almost throughout the year, except in winter.

The infecting Psyllid nymphs are, however, forced to change their normal site of infection aud thus to move away from inner to outer surfaces of leaves in the face of severe competition from other citrus pests when it so happens.

Several factors influence the periodicity of infection of the Psyllid nymphs as discussed below.

A. Sequence of issue of new foliage correlated with seasonal change : As noted in the foregoing observation, the basic necessity for the substance of Psyllid nymphs is the availability of tender leaves. As a result, periodicity of infection of Psyllid nymphs depends primarily upon the sequence of issue of new foliage of citrus plants, which in turn is largely correlated with climatic factors or seasonal changes. In Shillong, optimum condition of available warmth comes in after the passing away of winter by the middle of February, when like most other plants. the citrus plants too take to a start for new folia-

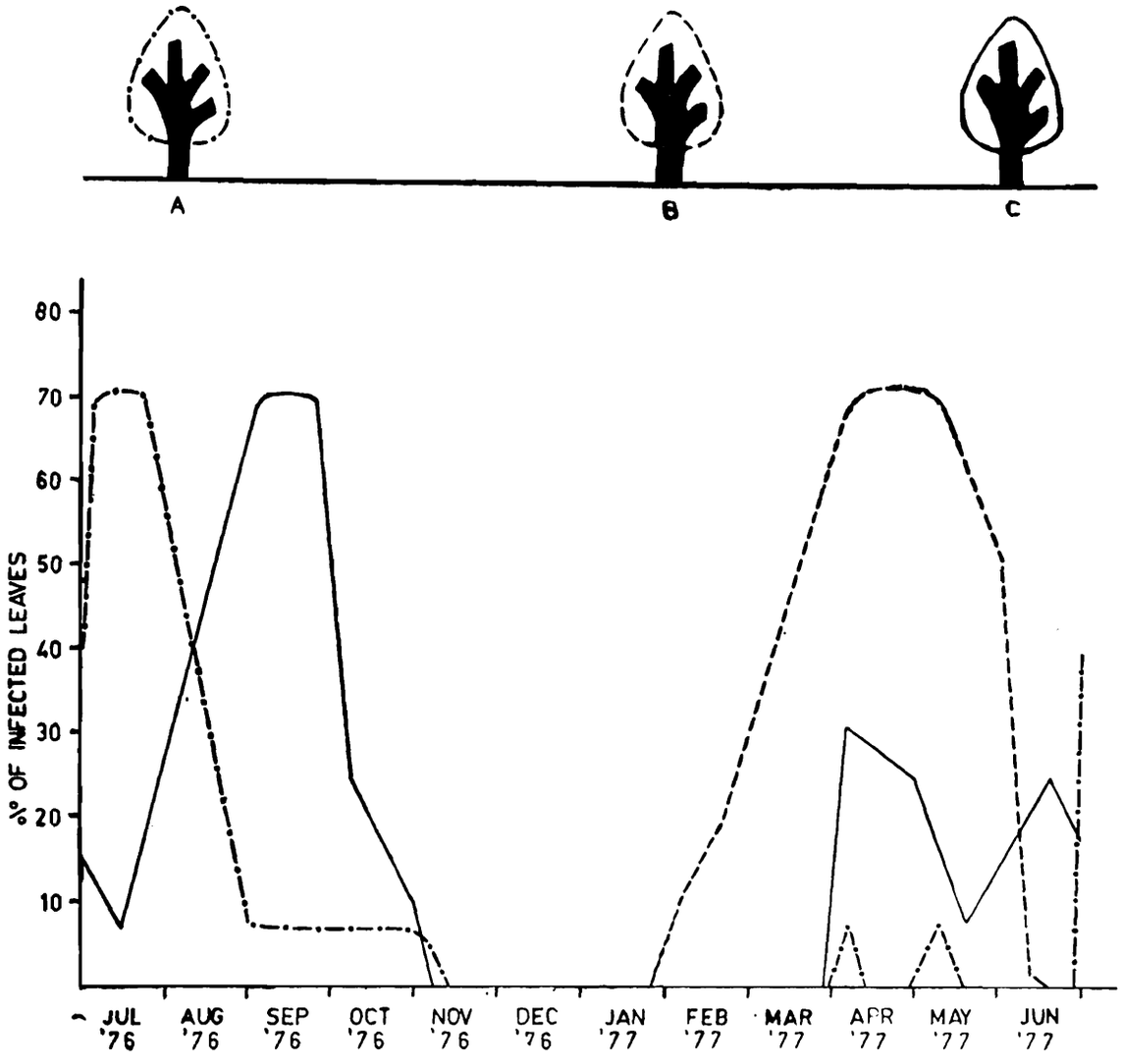
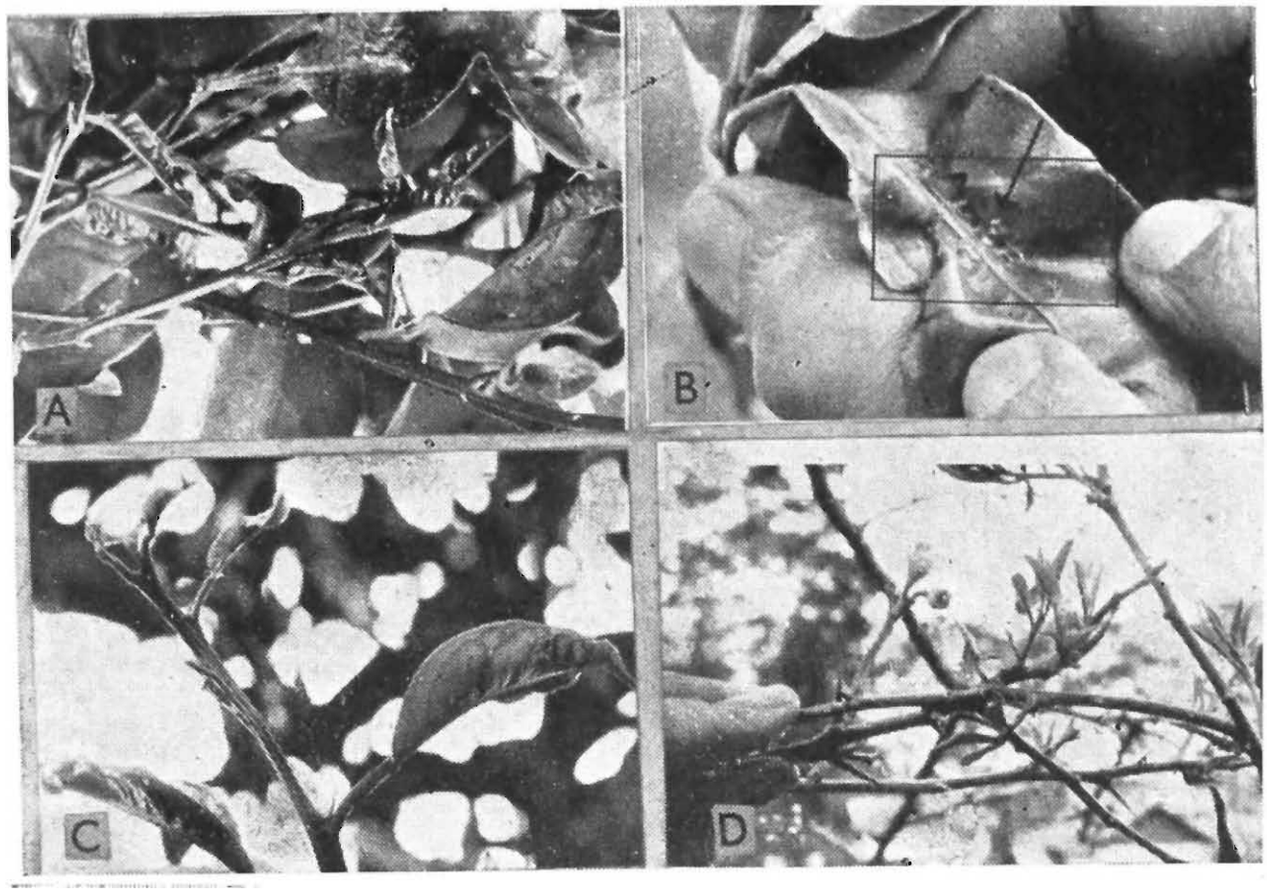


Fig. 1. Graphical representation of fluctuation in the intensity of infestation in course of investigation (from 1.7.'76 to 30.6.'77) caused by *P. murrayi* Mathur on different Citrus plants : A—*C. medica* L. B—*C. acida* Korel and C—*C. auranticum* L.

tion. The rate of issue of new foliage, however, take a luxurious shape with the availability of first few showers by the month of April. The rainy season, although heavy in the months of June and July is a prolonged one, sometimes lasting even beyond the month of October. This is followed by dry and severe winter, which is most predominant between November to middle of February. Issue of new foliage remains suppressed in all citrus plants in winter, is effective but for once in plant "B", between February and April, and continuous but of variable intensity for the rest of the year in plants "A" and "C" Keeping a sequence with the issue of new foliage the infection of *P. murrayi* Mathur also, remains suspended in winter, followed by a outburst in the month of April in all citrus plants and thereafter continuing on the plants "A" and "C" at variable intensity till the beginning of November.

Host preference : Periodicity of infection of Psyllid nymphs on different citrus plants



Figs. A—Twigs of *C. acida* Corel infected by *P. murrayi* Mathur. B—A pair of *P. murrayi* Mathur, in copula on a spreaded leaf of *C. acida* Korel, carrying mite infection. C—Photograph showing A twig of *C. aurantiicum* L. infected by *P. murrayi* Mathur. D—Twigs of *C. medica* L. with just emerging new foliage, already infected by *P. murrayi* Mathur.

is also correlated with different degree of choice for different *Citrus* spp. as host plant by the Psyllid fly. Plant "B" is apparently most choiced host plant (Pl. I, fig. A) for *P. murrayi* Mathur, followed by the plants "C" (Pl. I, fig. C) and "A" (Pl. I, fig. D) in sequence in this respect. This is evident from the differential intensiiy of infection caused by the Psyllid nymphs on the three different plants, (Fig. 1), most vividly exemplified in the month of April, when all the three *citrus* spp. took to issue of new foliage.

Competition from other citrus pests : *P. murrayi* Mathur is however, unable to monopolise the foliage of citrus plants due to competition from other citrus pests and also, the attack of a fungus, agents, which inflict more damage to citrus cultivation, over and above what is caused by the Psyllid fly. The effects of such agents as noted during the present investigation are discussed below.

Psylloenistis citrella Stainton
(Lepidoptera : Gracilariidae)

Tender foliage of the plants "A" and "C" were heavily infested in the months of July and August by the citrus leafminer, whose larvae would bore into the epidermis of citrus leaves, forming tunnels on their outer surfaces, these gradually growing into superimposed circles, till the emergence of the moth. The leafminer launched a serious competition for the Psyllid nymphs causing a lowered intensity of infection of the latter in either plant inspite of availability of tender foliage. Not uncommonly leaves were noticed, carrying either infection, the Psyllid nymphs on inner and those of leafminer on outer surface. An average of 50% psyllid nymphs succumbed to death due to competition from the leafminer larvae and in some of the doubly infected leaves the Psyllid nymphs were noticed wandering about on outer surface of leaves.

Plant "B" was, however not subjected to leafminer infection because of absence of tender foliage.

Dipteran larvae (unidentified) : Tender foliage of plant "A" was heavily infested in the month of April-May by one free living elliptical red larvae. These larvae at their early instars, were almost stationary while feeding the plant sap but, on maturity would become very agile and voluntarily fall into earth for pupation and subsequent emergence. A few of such larvai were also reared in the laboratory in petri dishes provided with moist soil. The small dipteran flies which emerged from these red larvae could not, however be identified. Comparatively low rate of intensity of infection of Psyllid nymphs on plant "A" in the months of April-May might have partly been caused due to competition from this Dipteran fly.

Citrus aphid : The common black aphid *Toxoptera citricidus* (Kirk) (Homoptera : Aphididae) infest citrus plants in winter months, when the infection of Psyllid nymphs remain suspended and therefore the two citrus pests do not normally render any competition to each other.

Other pests : The other pests were also noticed to infect the citrus plants, the citrus catterpillar, *Papilio demoleus* Linnaeus (Lepidoptera : Papilionidae), and two different Coccid (unidentified) species. However infection of either of these pests were only pericdic and of a very low intensity during the pericd of investigation, and normally noted to infect citrus leaves at bases, or on outer surfaces. Apparently, therefore, these pests also do not render any serious competion for the Psyllid nymphs.

Fungal infestation : All citrus plants under present investigation were subject to fungal infestation from the middle of August, spreading all over the plants by the end of August and continuing upto the end of September. It affected all terminal parts of branches including tender leaves and terminal buds, which were gradually covered by the overgrowing ashy white fungal layer, subsequently to get dried and fallen. Plants "C", "A" and "B" stand in order of lowering rate of intensity of fungal infestation. By the beginning of October the fungal infection having been over, the citrus plants looked quite barren, holding only the subterminal hardened leaves which alone could withstand the attack of fungal infestation. Due to fungal attack Psyllid infection was very low tn plant "A" during this period, while in plant "C" the same after attaining a peak period in the middle of September, rapidly depleted, and was terminated in either plant by the beginning of November. Fungal infection, however, did not effect Psyllids on Plant "B" where psyllid infection had terminated long before.

Predator : The small lady bird beetle *Telsimia* sp. (Coleoptera : Coccinellidae) a known predator of larvae of many insects including phytophagus insects *e.g.* scale insects, Coccids and Aphids were frequently noticed to harbour inside the folded citrus leaves carrying Psyllid nymphs. It was further noticed that leaves carrying the lady bird beetle invariably contained 50% or even less number of Psyllid nymphs in comparison to other Psyllid infected leaves. From this, the lady bird beetle appears to be a potential predator also of the Psyllid nymphs and thus act as a natural controlling agent for the same. However, for unknown reason, population of the lady bird beetle on the Citrus plants under study was never noticed to be a large one, in general appearing on not exceeding 10% of the Psyllid infected leaves.

Parasite : In the month of April, when there was a sudden outburst of Psyllid infection on all citrus plants, it was noticed that a red mite, *Bochartia* sp. (Acarina : Trombidiformis : Erythracidae) heavily parasitised externally the Psyllid population. Adults as well as nymphs of all stages of *P. murrayi* Mathur were subject to attack, but while the nymphs were attacked each by a single mite the adults (Pl. I, fig. B) were subject to attack by 1-3 mites each at a time The mites pierced into the body of their hosts generally on the thorax, but sometimes also on abdomen. The Psyllids attacked by 3 mites at a time become completely immobile, while the rest were partly so. Many adult Psyllids succumbed to death, the nymphs were also so before attaining maturity.

DISCUSSION

Attack of *P. murrayi* Mathur on Citrus plants initiates with the initiation of new foliage and therefore the pest can be effectively controlled by applying suitable insecticides at such stage. The same also applies for most other Citrus pests at Shillong. Cost of applying insecticides would evidently be less for plant "B" than in the other two plants, foliation period being restricted in the same. Further investigation is necessary to find out as to what extent biological control of *P. murrayi* Mathur is practicable by utilising the lady bird beetle and the red mite.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, Calcutta, for providing an opportunity to carry out this investigation ; to the Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong, for providing laboratory facilities ; to late Dr. R. N. Mathur, Dehradun, for identifying the Psyllid species ; to Dr. S. K. Gupta, Suptdg. Zoologist and Mr. A. R. Bhowmik, Asst. Zoologist, Zoological Survey of India, Calcutta, for identifying the mite and lady bird beetle respectively ; and finally to the Regional Botanist, Botanical Survey of India, Shillong for identifying the Citrus plants.