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Biology, seasonal incidence and management of *Apsylla cistellata* Bucton. on mango in West Bengal

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A B S T R A C T

Mango is attacked by various insect pests among which mango shoot gall psylla *Apsylla cistellata* Bucton.(Psyllidae: Hemiptera) is the most important one in the district of Malda and Murshidabad, West Bengal. Adult females of the pest had been found to lay eggs at the sides of midribs during first week to end of March. Incubation period lasted from first week of March to middle of August. Eggs hatched in the middle of August and gall formation had been found to start from first week of September. Nymphal period lasted from mid of August to end of February. Adult emergence occurred from fourth week of February and continued up to third week of March. Nymphs initially fed from midrib of leaf and then entered into the gall which they formed on the emerging vegetative buds resulting in total failure of such buds to put forth inflorescence properly. Repeated spraying without proper knowledge on the life cycle did not give good result in managing the pest. Hence, application of insecticides had to be synchronized with the emergence of nymphs. To manage the shoot gall psylla, mechanical control (Pruning) and insecticidal control measure were taken up in the district of Murshidabad. In mechanical control, both pruning of 15 cm and 30 cm of affected shoots resulted in the formation of lower number of gall/shoot as compared to control. But pruning at 30c m had been found to be most effective in managing the psyllid gall. In insecticidal control, lowest number of galls were recorded per shoot on the branches treated with monocrotophos (0.35 galls/shoot) followed by quinalphos (0.73 galls/shoot) and imidacloprid (1.03 galls/shoot). However, the performance of all the three insecticides were statistically at par.

Keywords: Bio-ecology, management, psyllid gall, mango

Introduction

Mango (*Mangifera indica* L.) is one of the most important fruit crops of the tropical world and constitutes an important horticultural asset of India. In West Bengal, mango is grown in fifteen districts and the crop occupies an area of nearly 65.40 thousand hectare with the production of about 585.00 thousand tonnes (Anon. 2002-2003). Irregular and erratic bearing followed by the damage due to pests and diseases have been considered to be the important constraints in mango production.There are nearly 260 insect and mite pests on mango reported from Indian subcontinent of which 30 pests are serious, capable of causing losses to crop growth and yield (Kapadia, 2003). Among them the psyllids popularly known as psyllid galls or bud galls, are recognized as one of the most noxious insects. They affect the mango production by producing galls on leaf axil and apical parts. The buds get converted into hard conical galls inside which the psyllid nymphs develop into adults. Due to irritation caused by feeding of nymphs the buds develop into scaly leaves that imbricate the central axis. They suck the sap and exude whitish sticky droplets through their anal openings and these gradually dry after bursting resulting the dropping of scales. Due to transformation of reproductive and vegetative buds into galls practically no fruit is found to set. Studies on the bio-ecology of the pest from West Bengal has been found to be acarty and therefore this has been taken up in this study. As the nymphs of psyllid gall remain concealed inside the gall and feed there, it is very difficult to manage this pest. Hence application of insecticides has to be synchronized with the emergence of nymphs.

Material and Methods

Bio-ecology

Bio-ecology of *Apsylla cistellata* was studied in an orchard at Murshidabad,West Bengal during 2004-2007. Two plants were selected at random for each cultivar and ten shoots of each plant were marked with the help of aluminium tag. The infestation of psyllid gall was recorded by observing the galls formed on the apical part and on the leaf axil. Different stages of nymphs were studied under binocular microscope by cutting the galls at weekly intervals.

Management

Pruning

The experiment was conducted in the district of Murshidabad with three treatments including control. The treatments included pruning at 15 cm, 30cm and without any pruning of shoots which emerged in just previous flush. The operation was done in the month of May, 2005 and 2006.Galls could not be hand picked from very tall and old trees of 10-20 m height. In such case gall-bearing branches were pruned by secateur.

Insecticidal control

Experiments on the effects of insecticidal treatments were conducted during 2005 and 2006 in a 25-30 years old orchard at Natungram, in Murshidabad district of West Bengal with seven treatments including control. The treatments included spraying with monocrotophos 0.05%, chlorpyriphos 50% + cypermethrin [5%] 0.06%, quinalphos 0.05%, imidacloprid 0.05%, chlorpyriphos 0.05% and azadirachtin 0.3% (Table-2). In the year 2005, first spray was done on 20th August and followed by a second after 15 days on marked shoots. Spraying was done with the help of Knapsac sprayer. In second year, i.e., 2006, only one spray was done on 5th August. In all cases some sticker was used. Prior to spray 15 infested twigs per treatment were tagged. Observations were recorded on the number of nymphs present per 10 galls and number of galls per 15 shoots. From these data intensity of infestation and on percentage of nymph-free galls were calculated.

Results and Discussion

Seasonal incidence

From the study on the seasonal incidence of psyllid gall (Figure 2), it was found that the emergence of the adults took place during February- March and subsequently the insects laid eggs in March-April and gall formation started in August and became conspicuous in September. Egg stage remained within the midrib and there the insects passed their nymphal stage being partially embedded at the egg laying site and then within the galls. The adults had been found to emerge in the next March. Egg stage of this insect was found to remain in the midrib for about six months. The same life cycle could be recorded in both 2005-06 and 2006-07 but the level of population was higher (13.83 galls/shoot) in October, 2005 than (6.17 galls/shoot) in September, 2006.

Biology

Shoot gall psylla is a univoltine species, i.e., they complete only one generation in a year. Emergence of adults from the galls could be recorded from the last week of February, which continued up to third week of March. Oviposition commenced shortly after their emergence from galls which coincided with the emergence of new flash of leaves. The pre-oviposition period was very short ranging from a few hours to one day. Adults were very short lived and died soon after oviposition. Eggs were laid singly in slits dug by ovipositor and remained embedded in tissues of the midrib of the under side of the new flush of leaves. The eggs were inserted alternatively by puncturing the tissue along both sides of the on the dorsal face of the midrib in quick succession. The intensity of egg-laying depended on the availability of new flush of tender leaves and number of adults emerging at a particular time in an orchard/area. If large number of female adults got only a few leaves for egg laying; they laid eggs along both sides of side veins of the under surface of the leaves. These eggs became desiccated after a few days. On an average 54.4-79.1 eggs were observed on a single leaf. This is in conformity with the report of Singh (1959). He reported that on an average 65 eggs were found on a single leaf, the minimum being 73, the maximum being 126. Egg bearing portion of midrib turned dark brown after 10-15 days. The egg stage continued through out summer and rainy months, although the embryonic development proceeded with quicker pace towards the later part of the incubation period that was from the first week of July onwards. Colour of the egg spot appeared initially pale green which changed to olive green. On dissection of large number of egg spots, it was revealed that viable eggs could be found only from olive green spots, while blackish or brownish spots invariably contained dead or dried ones.

Egg hatching commenced from the middle of August and continued up to the first week of September. It was at this time the new vegetative buds appeared which eventually differentiated either into shoot bud or developed into conical shoot gall. Growth of apical and axillary buds which gave rise to galls could be observed after about three weeks second week of August to first week of September of feeding by nymphs of *A. cistellata* at the ovipositional sites. First instar nymphs remained in the ovipositional site and second instar nymphs entered into the gall where they sucked the sap. Wing pads started to develop from the first week of December as was observed by cutting open the galls at weekly interval and examining nymphs under binocular microscope. Thus incubation period lasted from first week of March to middle of August and the nymphal period from mid August to end of February. Nymphs transformed into adults inside the galls. Five instars were completed in six months. The adults pressed open the overlapping scales of the galls causing their gradual unfolding from the top when the adults made their final exit one after another.

Management

Pruning

From the two years' pooled data it was observed that both pruning of 15 cm and 30 cm affected shoot resulted in the formation of lower number of gall/shoot in the following year as compared to control. From the result (Table 1) it was found that lowest number of nymphs (1.05/gall) was recorded in galls where the shoots had been pruned at 30cm, followed by that at 15 cm (3.25 /gall), while it was 11.0/gall in unpruned shoots. Significantly lower number of galls were recorded on shoots pruned at 30 cm (1.67 galls/shoot) followed by those at 15 cm (4.80 galls/shoot). While the gall population on unpruned shoots were 13.93/shoot.

Insecticidal control

From the two years data it was found that lowest number of nymphs could be recorded in galls on branches treated with imidacloprid (0.15 nymphs/gall) followed by monocrotophos (0.30 nymphs/gall), quinalphos (.65 nymphs/gall), chlorpyriphos + cypermethrin (1.40 nymphs/gall), chlorpyriphos (1.80 nymphs/gall) and azadirachtin (2.85 nymphs /gall). Significantly lowest number of galls were recorded per shoot on branches treated with monocrotophos (0.53 galls/shoot) and quinalphos (0.13 galls/shoot) and imidacloprid (1.03 galls/shoot) were at par statistically with monocrotophos but other treatments were significantly less effective. Percentage of nymph free galls were found to be highest in imidacloprid (90%) followed by monocrotophos (85%), quinalphos (75%), chlorpyriphos + cypermethrin (55%), chlorpyriphos 45% and Azadirachin 35%, whereas in control it was 15% (Table 2).

Singh (1995) reported that lowest number of nymphs could be recorded in galls on branches treated with deltamethrin and monocrotophos (0.1/gall) followed by cypermethrin (0.4), dimethoate (0.8) and fenvalerate (1.0). Singh (2006) reported that single spray of monocrotophos @0.12%, dimethoate 0.27%, thiamethoxam 0.025% and quinalphos @0.3% were found to give up to 80% control of gall formation when sprayed in the end of july. These reports are more or less in conformity with the present findings. From the table 2 and figure 2, it is found that highest benefit cost ratio could be obtained in the treatment of monocrotophos 36% SL (2.75) followed by imidacloprid 17.8% SL (2.50) and quinalphos 25% EC (2.48). The treatments, chlorpyriphos 20% EC and chlorpyriphos 50% + cypermethrin 5%, also showed to some extent better result as compared to contro.

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Table 1

Effect of pruning on psyllid galls

Year	Treatment (Av. of 10 galls)	Gall/shoot (Av. of 10 galls)	Nymphs/gall (Av. of 15 shoots)	Gall length (Av. of 15 shoots)	No. of shoots infested	Nymph free gall %
2005	15cm Pruning	0.8b (0.97)	2.0 b (1.40)	12.50 b	3	50
	30cm Pruning	0.13b (0.77)	0.40 b (0.85)	2.00 c	1	90
	Control (Without Pruning)	14.07a (3.62)	12.70 a (3.39)	20.50 a	13	10
2006	15cm Pruning	8.80ab (2.60)	4.50 ab (2.03)	14.70 b	9	20
	30cm Pruning	3.20b (1.53)	1.70 b (1.33)	13.90 b	6	50
	Control (Without Pruning)	13.80a (3.49)	9.30 a (2.88)	17.10 a	12	20
Pooled	15cm Pruning	4.80b (1.78)	3.25 b (1.72)	13.60 b	6	35
	30cm Pruning	1.67c (1.67)	1.05 c (1.09)	7.95 c	3.5	70
	Control (Without Pruning)	13.93a (3.56)	11.0 a (3.14)	18.80 a	12.5	15

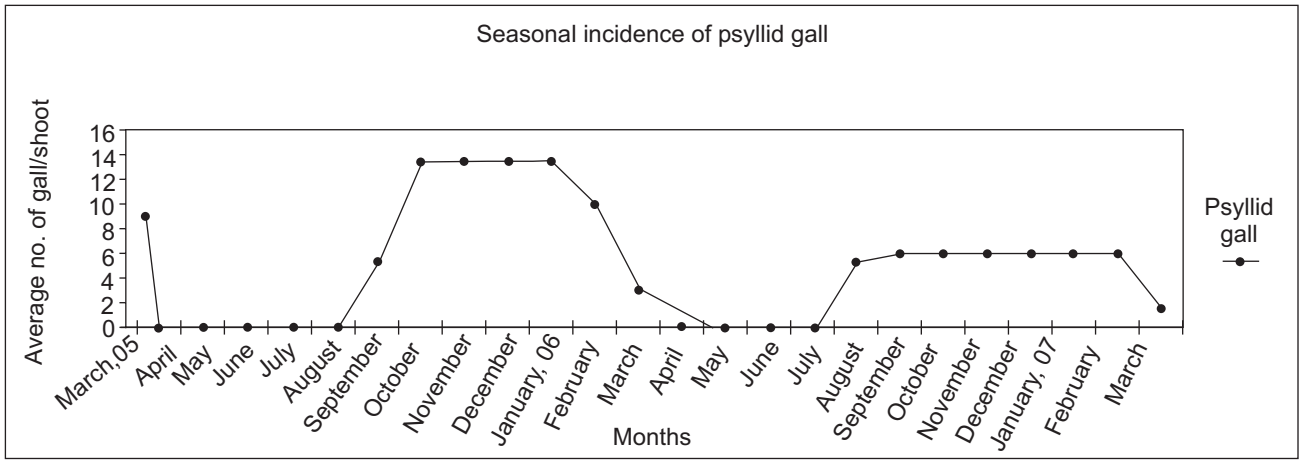

Table 2

Effect of different insecticides on *A. cistellata* in Murshidabad

Treatments	Concentration (%)	Av. no. of gall per 15 shoots	Mean no. of Nymphs /10 galls	Mean Gall length (mm) 10 galls	No. of shoots infested	Nymph free gall	Benefit cost ratio
Monocroptophos 36% SL	0.05	0.53 d (0.91)	0.30 cd (0.83)	8.15 d	2.5	85	2.75:1
Chlorpyriphos 50% + cypermethrin 5%	0.06	4.27 (1.79)	1.40 bcd (1.22)	16.15 bc	7.0	55	1.56 :1
Quinalphos 25 EC	0.05	0.73d (0.95)	0.65 cd (0.96)	14.15 c	2.5	75	2.48 :1
Imidacloprid 17.8% SL	0.006	1.03 d (1.03)	0.15d (0.78)	8.40 d	3.0	90	2.50 :1
Chlorpyriphos 20% EC	0.05	8.43 b (2.66)	1.80 bc (1.36)	14.55 c	10.0	45	1.17 :1
Azadirachtin 3000 EC	0.3	9.53 b (2.69)	2.85 b (1.62)	17.55 ab	9.5	35	0.84 :1
Control		15.60 a (3.79)	11.75 a (3.14)	19.60 a	13.0	15	0.32 :1