[Article ID : 01/X/02/1021]

INTEGRATED PEST MANAGEMENT PRACTICES IN MANGO AGAINST LEAFHOPPERS - A REVIEW

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Introduction

Mango is the national fruit of our country and also known as “King of fruits” due to its wide range of adoptability, taste, colour, flavor, nutritive value, attractiveness, fragrance and health promoting qualities etc. Among the tropical fruits, it is to be considered as the most ancient and supposed to have its origin around Indo-Burma region. India stood in world’s first place in the production of mango and has been in farming in the sub-continent for well over 4000 years. Mango tree is attacked by about 400-500 kinds of insects, 10-20 kinds of mites and 20-30 kinds of nematodes at the world level. Of these, about 188 kinds of insects have been recorded in India (Tandon PL and Verghese A., 1985). Nearly 250 insects and mites attack the trees of mango in different stages (Pena JE, Mohyuddin AI., 1997). Among them leaf hoppers are the harmful and economically important insects which they can cause losses of 20-100% of inflorescence (Verghese A, 2000). This pest is found in all the mango cultivated countries of the world like India, Bangladesh, Taiwan, Vietnam, Burma, Sri Lanka, Philippines and Pakistan. This pest is reported in all the mango cultivating areas of India but is highly widespread in Northern India. Among different species of mango hoppers *Amritodus atkinsoni*, *Idioscopus clypealis*, and *I. niveosparsus* are the major important which are persistent on leaves and panicles, causing about 50% yield losses in severe attack. They are the major yield limiting factors which reduce the productivity and quality of mango fruits.

Key words: Mango, Leaf hoppers, IPM

Identification of pest

They are having a wedge-shaped body with broad head and narrow abdomen towards the back. The hind legs are well adopted for quick hops. *Amritodus atkinsoni* is a dark grey in colored insect having two distinct dots on the scutellum and is comparatively bigger in size of all three species measuring about 4–5 mm in length while *I. niveosparsus* is somewhat smaller in size having three dots on the scutellum with a distinct white band over its light brown coloured wings. *I. clypealis* is the smallest among all the three species which is light brown in colour with two spots on the scutellum and measures about 3.5 mm in length (Butani, 1979).

Nature and symptoms of damage

Adult hopper lays eggs on inflorescence stalks and flower buds. Both nymphs and adults cause the damage by sucking the phloem sap from shoots, young leaves and inflorescences. Affected inflorescences turn brown and become dehydrated. Severely puncturing and continuous draining the sap from plant tissues cause curling and drying of the infested parts and resulted in non-setting of flowers and fruits, also dropping of immature fruits, thereby reducing the yield (Gundappa TA and Shukla PK, 2016). Moreover, hoppers secret honey dews during feeding which encourages fungi development namely *Meliola mangiferae* and *Copnodium mangiferum.* The black sooty moulds developed on leaves interfere with photosynthetic activity which adversely affected plant growth and yield.

Activity of hoppers of mango tree

The period of activity of hoppers coincides with maximum appearance of inflorescence, shoots and tender leaves (Zagade MV, Chaudhari JN, 2010). Usually hoppers were found colonized in both reproductive (on inflorescence) and vegetative (on newly emerging leaves) phases of the mango trees. Maximum numbers of hoppers is found at the time of flowering period (full bloom stage) and are active round the year in crevices and cracks of the tree trunk (Babu *et al*, 2002).

Control measures for mango hoppers

1. **Cultural control** : There seems to be short of systematic work on the effect of pruning, high-density planting, proper spacing and other cultivation practices on mango hoppers populations. Regulate the number of flushes by pruning of dense, overcrowded and overlapping branches in the month of November to December and also in rainy seasons in such a way that ample light is penetrated in to the trees. As darkness and dampness are associated with increased populations and quick multiplication of pest, keep the orchards neat with removal of weeds, regular ploughing, removal of excess, dead and diseased branches to increase supply of light to various parts of the trees are considered advantageous in minimizing the pest damage (Singh, 1993). Resistance in certain mango varieties could be due to the presence of higher potassium in the inflorescence (Nachiappan and Baskaran, 1983). Avoid plantings of alternate host plants like guava, custard apple and hibiscus etc. Avoid use of nitrogenous fertilizers in excess and burn the crop residues or cow dung cakes during evening hours to generate smoke in the orchards. The spacing between the trees moreover plays a main role in reproduction of the hoppers. So proper spacing should be maintained in orchards, as orchards with nearer spacing and also varieties having dense inflorescence attract more populations of hoppers (Srivastava 1997; Reddy and Dinesh 2005),

2. **Biological Control :** Application of bio-agents, *Metarhizium anisopliae* or *Beauveria bassiana* @ 1x 108 cfu/ml on tree trunks once during off season and two times at 7 days interval during flowering season and also conservation predator like *Coccinella septempunctata*, *C. transversalis*, *Chrysopa lacciperda*, *Menochilus sexmaculatus, Mallada boninensis,* and parasitoids like *Gonatocerus* sp., *Polynema* spp., *Tetrastichus* sp. and fungus like *Verticillium lecanii.*

3. **Host plant resistant :** Less using components in IPM are Host plant resistance and semio-chemicals which deserves immediate attention. Significant differences in the pest incidence among different genotypes were recorded indicating the scope for host plant resistance (Nachiappan and Bhaskaran 1983; Devi Thangam *et al*. 2013).

4. **Botanicals :** Botanicals possess different biological effects like repellent, antifeedant and juvenile hormone activity (Pradhan and Jotwani, 1971; Girish and Jain, 1974). Certain neem formulations and products have been therefore exploited for the management of these insects. At initial stages when the hopper population is less than 4 per panicle spraying botanicals like lemon grass oil (0.125%) nimbicidin (0.2%) citronella oil (0.25%) and neem oil (1%) give best results in controlling the hoppers (Verghese 2000).

5. **Chemical Control :** Chemical sprays have to be minimized and should be used on need base only after insect population crosses its ETL. Initial spray should be given at the early stages of panicle formation with Buprofezin 25% SC @ 1.25ml/ lit of water, 5- 15 lit per tree or Imidacloprid 17.8% SL @ 3ml / lit of water, 10 lit/ tree or Lambda-cyhalothrin 5% EC @ 0.5 - 1.0 ml/ lit of water or Oxydemeton–methyl 25% EC @ 600 - 800 ml in 600 - 800 lit of water/acre. If hopper population is more than 5-10 per panicle, next spray should be given

when panicles attain full-length stage but before full bloom and the final spray should be done after the fruits are set at pea size stage. A rational rotation of insecticides is desirable to counteract the tendency of pest to develop field resistance. Chemical sprays should be avoided at the time when trees are on full bloom stage to avoid killing of pollinators (Verghese and Devi Thangam 2011).

Conclusion

The recorded works on leaf hoppers of mango indicated that, with practices of IPM in mango fields, the hopper population can be minimized and well managed totally. On arrival of location specific commercial cultivation and different varieties, there was a considerable shift in the hopper populations of mango over many years. Orchards of mango hold a more numbers of local natural enemies which suppress the hoppers. They should be identified and conserved for biological control. Semio-chemicals and Host plant resistance utilization are less used components in IPM against hoppers in mango, so they deserve instant consideration. Growing mango trees to meet international principles demand residue-free product, and therefore there is a need to build up good agricultural practices and research in this path is necessary. Indiscriminate utilization of broad-spectrum insecticides alone has chances of threat to natural enemies which leads resistance development in hoppers.

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