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Mango Hoppers and their Management Strategies

(*Dharanikota Lalithambica Devi and Dr. Sunil Kumar Mandal)
Department of Entomology, RPCAU, Pusa, Bihar
*Corresponding Author's email: dharanikota.lalitha13@gmail.com

Abstract
Mango is the most important commercial fruit crop grown in tropical and subtropical countries of world. Various insect pests damage the crop coming severe yield losses (60 -70 per cent) in absence of control measure. Four species of mango hoppers *viz., Amritodus atkinsoni lith. and Gelioscopus nitidulus Lith, Idioscopus niveosparsus Lith and gelioscopus nitidulus lith* , are commonly found all over the India and are serious sap sucking pests of mango at both flowering and fruiting stages. Various studies on bionomics, population mobility and damage symptoms of mango hoppers have been undertaken. Cultural, Mechanical, Botanical, biological and chemical management measures have been adopted for their management. No doubt all the management tactics efforts are good, but the chemical control measure is extensively adopted by the mango growers and has some harmful effects on the environment and natural enemies in the mango orchards. Therefore, there is a need to a combination attempt of cultural, mechanical, botanical and biological fauna as well as utilizing judicious manner with their timely application in mango. Ecosystem which gives decreased pest intensity and also helps quality fruit production.

Key words: Mango, Hoppers, Identification, Management

Introduction
Mango, *Mangifera indica* Linn. also known as the king of fruits, with choist fruit crop of tropical and subtropical region of india for wide adaptability, attractive colour, delicious taste, exotic flavor, high nutritive value, richness in variety attractive appearance and popularity among people (Patel et al, 2021). Therefore, it is a premier status among the commercial fruits grown in India for over 600 years back ago. India shares about 56 per cent total mango production in world. In India the production of mango is 20946.3 thousand metric tonnes in 2021-22 with area of 2370.8 thousand hectares (Indiastat, 2021). Inspite of all these good aromatic characters/ practices, this crop suffers regularly to a colossal loss due to ravages of pests, which is considered to be a serious threat to mango production. Over 200 insect pest species have been reported on mango, of which only a handful of pests are one of major importance(Flitcher, 1977, Vcvai, 1969, Tandan and Shrivastava, 1982). Among different insect pests, Jassids are recorded as major sucking pests in mango ecosystem and popularly known as mango hopper and it is the most devastating pests occurring throughout the year. Dalvi *et al, 2010* considered it as major pest of mango, and is directly responsible in reducing the yield with qualitatively and quantitively.

Species
Mango leaf hoppers are the most destructive and sucking pests. Over 15 species of hoppers have been recorded to exit/ damaging on mango ecosystem throughout Asia. Dalvi *et al*., 1992 reported 22 species of mango hoppers. Among which four species are *Idioscopus*

niveosparsus, Idioscopus clypealis, Amritodus atkinsoni , Idioscopus nitidulus. Viraktamath and Virakamath (1998) also reported three new species *Busoniominus manjunathi, Gelioscopus anastryae and Gelioscopus jayshriae* on mango in Karnataka.

Distribution

These hoppers have also been recorded from Philippines, Taiwan, Indonesia, Vietnam, Sri Lanka, Burma, Bangladesh and Pakistan. They are found across the country's mangop growing regions (Veeresh, 1989 and Wait, 2002). *Amritodus atkinsoni* is comparatively more common specially in North India. *Idioscopus clypealis* through found all over India and is more predominant in South Gujarat, Maharashtra and Karnataka, while *Idioscopus niveosparsus* has been recorded from peninsular India. But, *Idioscopus nitidulus* and *Idioscopus nagpurenis* are common in southern India (Veeresh, 1989).

Host Range

These hoppers have been found on citrus spps. and calophyllus inophytum but these plants do not serve as alternate hosts (uppal and wagle 1944). Whereas, Purthi and Batra (1960) branded this pest as a monophagous on mango but also recorded sucking the sap of fig (Ficus carica). Nayur *et al.* (1976) has also reported these hoppers on sapota.

Identification: Eggs and nymphs of the three species are difficult to distinguish from each other but adult can be easily distinguished with naked eye with certain morphological characteristics. The bigger one among the species of mango hoppers is A. atkinsoni (4.2-5.0 mm) long which is dark grey in colour and having two prominent spots on abdomen and scutellum. Smallest one is *Idioscopus clypealis* (3.5 mm long) having two spots on the scutellum (Butani 1979). *I. nitidulus,* is smaller than A. atkinsoni and larger than *Idioscopus clypealis* having three spots on scutellum with prominent white band across wings and generally occur throughout the year.

Bionomics / Life history

Adults are available throughout the year under bark of the tree. With the onset of winter, in short appear in large numbers. Female lays 100 eggs singly in the tissue of flowering shoots, flower buds or tender leaves from end January till march and which hatch in adult 4-7 days. After moulting thrice, the nymphs turn into adults in 1-13 days. The total life cycle from egg to adult varies from 18-20 days. These are two broods in a year viz. spring brood (February to April) and summer brood (June to August). The spring brood is more destructive as the hopper feed on inflorescence. Hoppers prefer damp and shady places and multiply in large numbers in neglected orchards. The pest hibernates in adult stage. In north India, these are two distinct generations in year. In summer total life time/span of hopper lasts for 2-3 weeks. The adult go hibernation during winter. Critical stage of infestation of *I. clypealis* is past bloom, marble size fruit and largely preharvest stages (Abraham and Prasad 1987).

Damage symptoms

The damage is inflicted by both nymphs and adults through sucking cell sap. The nymphs are found clustering on the inflorescence, tender foliage, shoots, ventral surface of leaves, flower buds and young fruits and suck the sap during spring. The infested flowers shrivel, turn brown and ultimately fall off. These hoppers also excrete honey dew, which encourages the growth of sootymould on leaves, branches and even on fruits.

Due to this infested plant parts turn black which adversely affect photosynthesis activity. As a result, severly damaged plants show withering and drooping symptoms and lead to failure of fruit setting (Butani, 1979). These hoppers can cause a loss up to 80-100 percent when the infestation occurs during flowering and fruiting stage (Rahman and Kuldeep, 2001).

Impact of environmental factors

The orchards with close plantation (less than 10×10 meters spacing) having tall plants with vigorous growth and shade, attracting high hopper population and causes lot of damage (Srivastava and vergheese, 1987). Peak population of *I. clypealis* during March-April and smallest population during December-January have been recorded. Sushil Kumar (2002) determined ETL of three species of mango hoppers as 5 nymphs/ adults or their combined population/ twig/ vegetative stage and past flowering stage) or panicle.

Causes of outbreak:

1. The adults survive throughout the year by hiding on tree bark. However, the population increasing during the month of February to march (mango flowering and fruiting stage).
2. Depending on the spacing mango leaf hopper adult flies lay eggs in flower and new flushes of leaves and may have nearly 2-3 generations during flowering period.
3. The mango leaf hopper prefers high humidity with the shade condition for multiplication.
4. The poorly managed orchards with very close planting distance favours the multiplication of mango leaf hopper.
5. More water logged conditions lead to the outbreak of mango leaf hopper.

Management Strategies and Tactics

Pest management strategy is the overall plan to eliminate pest problem. It depends on pest life cycle and type of crop. Hence the strategies has been developed for pest management tactics given below.

Cultural Control Measure: Control of insect pest through adoption of different mode of cultivation and management practices which serve dual purpose of being useful for both crop production and protection.

Varietal Resistance: Amrapali, Dasheri, Neelam as highly susceptible while Langra, Bombay Green and Sindhura were considered susceptible. The varieties Ratna and mallika should moderate resistance. Alphonso was most susceptible to hoppers, Dasheri, Langra, Rajapuri and Keshar moderately resitant and Totapuri as almost free from hopper incidence. It was further observed that Sonpari was most susceptible to mango happer, but Arka punit, Arka Aruna, Mehmood bahar, A.U. Rumani, Mallika, Nilesham - Gujarat, Neelphonso, Nelishwani, Neeluddin, prabhashankar, Ratna, Sangareddy mango, Sindhu and Suvarnjahangir were tolerant to these hoppers (Srivastava 1995).

- Avoid dense planting, maintain clean orchards, prune overlapping branches and infested shoots after rainy season.
- Leave a untrail opening on the top of the tree for better penetration of the sunlight.
- Collect and destroy affected inflorescence during the flowering and fruiting stage.
- Avoid waterlogged or damp condition.
- Do not encourage plants to put intermittent flushes by regular imigation of nitrogenous fertilizers.
- Remove weeds from orchards which get as additional help for pest.
- Smoking of orchards by burning of crop residues / cow dung cake during evening hours if the hoppers multiplication fast.

Biological Control Measure: Protecting and encouraging natural enemies.

Predators: *Mallada boninensis, chrysopa lecciperda.*

Egg parasite: polynema spp., *Gonatocirus spp*. and *tetrastichus spp.*

Fungus*: Lecanicillium lecanii.*

- Application of bio-agents:

Metarhizium anosopliae @ 10^8 cfu/ml or *Beavaria bassiana* @ 10^8 cfu/ml on tree trunk once during off season and twice at 7 days interval during flowering season.

- Application of neem- based insecticides:

Azadirachtin 3000 ppm @2ml/L can be utilized at initial stage of hopper population.

- Application of insect growth regulators:

Buprofezin is an insect growth regulator which causes nymphs to die at moulting stage and suppress oviposition of hoppers. (Buprofenzin 95% EC @1.25 ml/L of water)

- Application of microbial / bio rational insecticides:

1. Thiomethoxam 25 WP @ 0.3 gm/L.
2. Imidacloprid 17.8 SL @ 0.3 ml/L.
3. Acedamiprid 20 SP @ 0.5 gm/L of water.

Chemical Control Measure: (Judicious use of chemical insecticides)

Need based application depending on pest intensity,

- First spray before flowering with cypermethrin 25 EC @0.5 ml/L or Deltamethrin 2.8 EC @ 1ml/L.
- Second spray at panicle initiation stage with quinalphos 25 EC @ 2 ml/L subsequent spray with imidacloprid 17.8 SL @ 0.3 ml/L, thiomethoxam 25 WP @ 0.3 gm/L or dimethoate 30 EC @ 1 ml/L of water.

Conclusion

Bio-intensive management strategies are the most efficient methods in minimizing hopper incidence without effecting the environment as well as human beings. The changing climatic scenario at different mango growing areas of the country and develop location specific tools and strategies need to manage the pest for improving management practices resulting in higher fruit yield with better quality.

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