



ISSN (E): 2277- 7695
 ISSN (P): 2349-8242
 NAAS Rating: 5.23
 TPI 2022; SP-11(3): 724-728
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www.thepharmajournal.com

Received: 04-01-2022

Accepted: 06-02-2022

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Study the different species of mango hoppers: A review

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Abstract

The mango hopper is the most important insect pest of mango in India, causing significant crop losses. During the months of February and March, the mango hoppers (adults) began to appear together with the panicle emergence. This definitely suggests that the species is a bivoltine species that breeds twice. The insect then hibernated in tree trunk cracks and fissures. This work aids in the development of realistic models for seasonal hopper distribution, as hoppers are a major obstacle during flowering season.

Keywords: Bivoltine, February, mango hopper, trunk and panicle

1. Introduction

Mango (*Mangifera indica* Linn.) is a popular fruit all over the world and is referred to as the "King of Fruits." It is the most profitable fruit that can be cultivated in tropical and sub-tropical climates (Abdullah and Shamsulaman, 2008) ^[1]. Hoppers is a polyphagous, cryptic pest with a short life cycle, strong mobility toward the development of pesticide resistance, and the ability to infest a wide range of host plants (Global Pest and Disease Database (GPDD), 2011; Kumar *et al.*, 2012) ^[16, 23]. Cicadellidae is the most important family of leafhoppers in the world. It consists of 22,000 described species and 36 described subspecies (Zahniser and Dietrich, 2008) ^[45]. Hoppers species such as *Amritodus atkinsoni* (Lethierry), *Idioscopus clypealis* (Lethierry), and *Idioscopus nitidulus* (Walker) are still active and inflict up to 100% losses at each crop stage of mango from appearance of new flush to flowering cum fruit setting stages (Bana *et al.*, 2016; CABI, 2003; Rahman and Kuldeep, 2007) ^[6, 9, 32]. Both nymph and adult hoppers have been seen sucking cell sap from young leaves, fragile shoots, inflorescences or panicles, and the rachis of young fruits, preventing flowers from blooming and immature fruits from falling. Hoppers also excrete large amounts of honey dew, which causes the production of sooty mould, which interferes with the plant's photosynthesis. *Amritodus atkinsoni*, one of the hoppers infesting mango trees, prefers the trunk area and new vegetative flush, whereas two *Idioscopus* species, *Idioscopus clypealis* and *Idioscopus nitidulus*, prefer the flowering season (Gundappa *et al.*, 2014) ^[17]. Hoppers, are a significant yield limiting factor (Bana *et al.*, 2015; CABI, 2003; Kumar *et al.*, 1994) ^[5, 9, 22]. These hoppers cause heavy damage to mango crop during flowering season resulting in 25-60% yield loss (Patil *et al.*, 1988) ^[30]. The hoppers leave the blossoms after the flowering season and go on to the new leaves and main trunk. The hoppers' peak activity, however, was limited to the flowering season (Patil *et al.*, 1988; Babu *et al.*, 2002) ^[30, 4]. In mango, hopper activity coincides with the peak of flowering and the appearance of new branches (Zagade and Chaudhari, 2010) ^[44]. According to Sohi & Sohi, (1990) ^[37] leaf hoppers are the most serious of the mango pests, causing a 20-100 percent loss of inflorescence and thus yield. Most of these subfamilies are not properly categorized (Oman *et al.*, 1990; Dietrich *et al.*, 2001; Dietrich and Rakitov, 2002) ^[27, 14, 15] Cicadellidae considered as 10th biggest groups of insects in the world and the samples from Amazon rainforest shows that leafhoppers consist of almost 100,000 species (Dietrich, 2006) ^[13]. India has been home to 188 of these species (Kumar *et al.*, 1985) ^[20]. Cicadellidae is the largest subfamily with 50 subfamilies (Muhlethaler, 2008) ^[26]. Subfamily Idiocerinae is most important family consist of destructive pests. As for the Pakistan fauna, documented 6 species from the district including three innovative species by (Ahmed *et al.*, 1980) ^[2] *Amritodus saeedi*, *Idioscopus karachiensis* and *Idioscopus freytagi*, all reproducing on Mango from Karachi. The Idiocerinae leafhoppers are conspicuous by the blend of characters; the body slim and wedge-formed; head more extensive than pronotum; ocelli on face, reference section substantial. The subfamily Idiocerinae species mostly feed and breed on trees and it is the serious pest of Mango fruit (*Mangifera indica*) in the region of

Indian subcontinent from 43 species and 10 genera have been recorded (Viraktamath, 2007) [42]. These leafhoppers can be perceived by their wedge-moulded appearance with short and expansive head, ocelli on the face, facial sutures stretching out past the antennal pits nearly to the ocelli, forewing with wide index and male genitalia with the style prolong and the connective rather T-formed. Up to the here and now fifteen genera of Idiocerinae have been portrayed from the Indian subcontinent see key by (Viraktamath, 2007) [42]. Mango leafhopper *Amritodus atkinsoni* is the most destructive pest of Mango in Asia (Kumar, 2015) [24]. Honeydew is excreted by the hoppers, which coats the inflorescence, leaves, and fruits, promoting the growth of *Meliola mangiferae* (Earle), a black sooty mould that affects the photosynthetic activity of the leaves and the market quality of the fruits (Verghese and Kamala Jayanthi, 2001) [41]. Adults and nymphs both drink sap from sensitive leaves, buds, flowers, flower stalks, and fruits. The leaves of severely diseased plants curl and the inflorescence dries off (Kannan and Venugopal, 2006) [19].

2. Nature of damage

By piercing and sucking the sap from vulnerable portions, nymphs and adults reduce the vigour of the plant, resulting in the shedding of flower buds, blooms, and early fruits. Sooty mould develops on leaves as a result of honey dew discharge, giving them a blackish look. Reduced fruit setting and premature fruit drop have been reported by (Singh and Mandal, 1969; Chari *et al.*, 1969; Bindra *et al.*, 1971) [36, 10, 8]. Due to hopper attack, Sathiyandam *et al.*, (1972) [34] observed withering of flower buds and blossoms, as well as wilting in severe cases. Patel *et al.*, (1975) [29] investigated the seasonal prevalence of *Amritodus atkinsoni*. Hoppers hibernate in the cracks between the tree's bark. The clicking sounds of leaf hoppers can be heard during periods of significant infestation. The climate is most pleasant when it is warm, humid, and cloudy. Males of *Amritodus atkinsoni* favoured the lower portion of the mango tree, whereas females chose the higher portion, according to Patel *et al.*, (1990) [28]. On two cropping seasons of mango, Corey *et al.*, (1989) [11] determined the economic injury levels of the clypealis and found an average of 4.21, 4.30, 4.45 and 4.55 adults/ panicle at 2, 10, 18, and 26 days after flower bud break. Ramkrishna Ayyar, (1963) [33] finding that orchards that were heavily infested looked ill. The trees lacked buds, the leaves were lustrous and covered in sooty moulds, and thousands of exuviae were discovered on the shoots and leaves. Infestation by hoppers gave afflicted trees a burnt appearance and caused sooty mould to impede with photosynthetic activity, according to CABI, (2003) [9].

2.1. *Idioscopus niveosparsus/nitidulus* (Peninsular India) (MOHD *et al.*, 1995) [25]



(Source: google)

Fig 1: Mango hopper, *Idioscopus niveosparsus/nitidulus* (Source: google)

The newly emerging nymph remained immobile for 20 ± 5.5 minutes before moving on to find a feeding spot. The shape and size of the sheath enclosing the stylet could be used to determine the nymph's sex. The tip of the stylet is wider in men. Rudimentary wing pads emerged on inflorescence in the third instar, and by the fourth and final instar, it resembled the adult. The breadth of head capsules was used to determine the number of nymphal instars for both males and females. On branches, there were five nymphal instars opposed to only four inflorescence. Scutellum with three dots and a white stripe across the wing.

2.2. *Idioscopus clypealis* (South Gujrat, Karnataka and Maharashtra)

It is mostly distributed from Pakistan, India, Philippines, Australia, Belgium, China, Japan, Sri Lanka and the Philippines (Bashir *et al.*, 2020).



(Source: google)

Fig 2: Mango hopper, *Idioscopus clypealis* (Source: google)

Two black stains on the vertex and two spots on the scutellum. The colour is darker and the size is larger. Males are 4.2 to 4.8mm length and females are 4.7 to 5.1mm long. Female 3.5- 4mm; Male 3-3.5mm length (Bashir *et al.*, 2020; Sharma and Tara, 2014) [7, 35]. Paler and darker, with white and green eyes. The face is dark with a dark focus that fades to ivory down the side and dark towards the ante clypeus. Among the simple eyes of females, there are two pointed black dots. On the apex, there are two dark coloured patches, and the eyes are closed to the head. Males do not have these types of markings. Tegmen is a light brown translucent material with an ivory coastline edge (Bashir *et al.*, 2020; Hiremath and Thontadarya, 1991; Pezhman and Radjabi, 2002; Sharma and Tara, 2014) [7, 18, 31, 35]. The first instar has a larger head than the body and bulging red compound eyes. On the abdomen, there are black and long bristles that last 2 to 3 days (Hiremath and Thontadarya, 1991; Rahman and Kuldeep, 2007; Sharma and Tara, 2014) [18, 32, 35]. Second instar- Initially yellow, then greyish-yellow with huge compound bulged eyes after 2 to 3 days, with reasonably large compound bulged eyes (Sharma and Tara, 2014) [35]. In the third instar, the colour shifts from yellow to darker on the lateral sides. On the vertex, two black specks become extremely noticeable. Wing pads About 3 to 4 days later, the rudiments of two pairs of wings arise in the shape of wing pads (Hiremath and Thontadarya, 1991; Sharma and Tara, 2014) [18, 35]. The fourth instar is a pale yellow colour. Compound eyes with a dark red colour. The wing pads have been expanded. Sexes can be distinguished for 3 to 4 days (Sharma and Tara, 2014) [35]. Fifth instar- Initially pale yellow, the nymph develops light grey and subsequently dark grey wing pads, and the nymph is quite busy for 2 to 3 days

(Sharma and Tara, 2014) [35]. Head: *Idioscopus clypeus* has a yellowish head, pronotum, and scutellum, as well as two black spots on the anterior margin of the vertex, which are absent in males. Two black specks on the ocelli's base. Thorax: Scutellum on the thorax is yellowish in colour with triangular black dots. Scutellum is a short scutellum. The forewings are ochraceous in colour. The back tibiae have a lot of spines. An aedeagus with two pairs of long appendages is found in the genitalia. Pygofer is a short, hooked, and pointed pygofer (Bashir *et al.*, 2020) [7].

2.3. *Idioscopus/Amritodus atkinsoni* (More common in North India)

It is reports from India: Chhattisgarh: (Bastar); West Bengal; Delhi; Maharashtra. Sri Lanka. Pakistan: Punjab, Sindh (Bashir *et al.*, 2020) [7].



(Source: google)

Fig 3: Mango hopper, *Idioscopus/Amritodus atkinsoni* (Source: google)

Scutellum has two locations. It's getting smaller and slimmer. Males are 3.4 to 3.7mm length and females are 3.6 to 3.9mm long (Bashir *et al.*, 2020) [7]. The vertex is rounded at the front, and the colour is smoky. Clypeus' form has been flattened and heavily changed with black stripes. Pronotal has a brown anterior edge with two spots and a dark brown stripe, and a dark brown streak on the scutellum. On the prosternal disc, there are two black patches. *Amritodus Atkinsoni* adults are generally dark brown in colour. In dorsal perspective, the head is made up of a vertex with eyes on the side. The head is the most widespread, followed by the pronotum and vertex, which can be defined as the entire dorsal surface of the head bearing the eyes. A sulcus is a notch or centre line on the vertex. Leafhoppers are typically made up of two ocelli that can be found on the vertex or near the eyes. The entire cephalic region of the head is referred to as the face. Parallel frontal sutures divide it from the basal focal region. Clypeus that is separated from the rest of the clypeus by a transverse suture into a small apical zone. Lora refers to the semi-circular plates that border the clypellus, while Genae refers to the remaining parallel sections. The clypeus and clypellus are also known as the front. The antennae are composed of a basal scape and pedicel with a long string-like flagellum that may show characteristics of division basally. They emerge anterior to the eyes close to the frontal sutures and consist of a basal scape and pedicel with a long string-like flagellum that may show characteristics of division basally. Hemipteran mouthparts and piercing-sucking mouthparts are the most common. Thorax: Thorax, like all other insects, is made up of three parts. Thorax is made up of three parts: pro meso, metathorax, and two pairs of wings and three pairs of legs, just like any other insect. The 35 mesonota's scutellum, scutal,

and pronotum sutures can be seen from the dorsal side (Bashir *et al.*, 2020) [7]. The scutellum has a triangular form with a transverse suture in the middle and is generally pointed with a straight extension posteriorly. Wings could be brachypterous and not fully formed. The forewings are thicker than the hindwings and are darkly coloured in nature. The median, radial, cubital, and venal veins are the longitudinal veins found in the wings. Every leg has the same elements, but the hind pair is unique because the femora and tibiae are extended, allowing the leafhopper to jump. The abdomen is made up of eleven separate parts. Eight pregenital segments (9th, 10th, and 11th segments from anal tube) may be reduced in size and sclerotized in male mango hoppers. Body length: 5.166 mm, with a vertex length of 0.278 mm, a breadth across the eyes of 2.003 mm, and a pronotum length of 0.697 mm. length 0.933 mm, width 1.422 mm; width 1.735 mm; scutellum length 0.933 mm, width 1.422 mm (Bashir *et al.*, 2020) [7].

Mango hoppers are deadly monophagous pests that wreak havoc on inflorescences, blooms, young fruits, and fragile foliage. The current findings are consistent with previous research (Venkatesan, 1990; Talpur *et al.*, 2002; Talpur and Khuro, 2003) [40, 39, 38] that found a phenological link between *Idioscopus* spp. and the presence of inflorescence and fruits in mango. *I. nitidulus* breeds on inflorescence throughout January, according to Viraktamath *et al.*, (1996) [43], which explains the abundance of hoppers on inflorescence. The appearance of new leaves and flowers on the mango tree is definitely the important event for the hoppers' movement. Dalvi and Dumbre, (1994) [12] investigated the seasonal incidence of mango hoppers in Dapoli, Maharashtra, and found that the pest multiplied profusely on flower panicles from mid-December onwards, reaching a peak in the third week of March and the second week of February, respectively, followed by a gradual decline until the end of March or early April. Those same findings of Ashok Kumar *et al.*, (2014) [3], who observed a significant decrease in the hopper population from April to May in Jhansi (UP), were similarly consistent with the current findings.

3. Conclusion

Hoppers are still active and inflict up to 100% losses at each crop stage of mango from appearance of new flush to flowering cum fruit setting stages. Both nymph and adult hoppers have been seen sucking cell sap from young leaves, fragile shoots, inflorescences or panicles, and the rachis of young fruits, preventing flowers from blooming and immature fruits from falling. Hoppers also excrete large amounts of honey dew, which causes the production of sooty mould, which interferes with the plant's photosynthesis. *Amritodus atkinsoni*, one of the hoppers infesting mango trees, prefers the trunk area and new vegetative flush, whereas two *Idioscopus* species, *Idioscopus clypealis* and *Idioscopus nitidulus*, prefer the flowering season. The insect then went to tree trunk cracks and fissures to hibernate.

4. Acknowledgment

The authors thank Dr. Anand Kumar Panday (Scientist/Asistance professor, Department of Entomology, PC Unit Seame & Niger, JNKVV, Jabalpur, Madhya Pradesh-482004) for help valuable discussions on this topic.

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