

Natural control of mealybug, *Nipaecoccus viridis* (Newstead) by coccinellid predator, *Nephus regularis* (Sicard) on Jujube (*Ber*)

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ABSTRACT: Regular surveys carried out in the *ber* growing regions of Punjab revealed a predatory coccinellid beetle, *Nephus regularis* (Sicard) on spherical mealybug, *Nipaecoccus viridis* (Newstead) infesting *ber* trees. On an average, 60 and 80 per cent mealybug infestation was recorded at Ludhiana and Amritsar, respectively whereas, 8 and 12 per cent predation of *N. regularis* was recorded in the respective districts. While rearing mealybug in laboratory, approximately 3-4 beetles were observed to emerge from pre-adult stages present in waxy covering of mealybug colony per 10-15 cm long mealybug infested twig with leaves collected from both the locations.

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KEYWORDS: Mealybug, *Nipaecoccus viridis*, predator, *Nephus regularis*, Jujube (*Ber*)

Jujube, *Zizyphus mauritiana* Lamarck, commonly known as *ber* is one of the archaic and common fruits of Punjab. It is an important part of religious and cultural history of Punjab. Commercial cultivation of *ber* is being done in the districts Sangrur, Patiala, Mansa, Bathinda, Fazilka and Ferozepur. *Ber* is rich in vitamin C, protein and minerals viz. calcium, phosphorus and iron. It is cultivated on 1802 ha area in Punjab and producing 29967 MT fruits with productivity of 16630 kg/ha and ranks sixth in area after Kinnow mandarin, mango, guava pear and litchi (Anonymous, 2015). *Ber* fruits are utilized for preparing *murabba*, pickle and *chutney*; juicy varieties are used to make beverages and fully mature fruits are often canned in sugar syrup.

So far, 37 insect and mite pests have been reported from Punjab infesting different parts of *ber* trees (Singh, 2016; Singh *et al.*, 2016). Among these,

spherical mealybug, *Nipaecoccus viridis* (Newstead) (Fig. 1) is an important insect pest of *ber* in Punjab. It is a polyphagous insect and is geographically distributed in Asia, Africa, North



Fig. 1 Mealybug, *Nipaecoccus viridis* (Newstead) on infested *ber* leaves and twigs

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Fig. 2 Beetle, *Nephus regularis* (Sicard)

America, Central America & Caribbean and Oceania. In India, it is present in Andhra Pradesh, Bihar, Delhi, Goa, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal (Anonymous, 2005). *Nipaecoccus viridis* is reported as an important pest of horticultural crops in Punjab (Sharma and Arora, 2009). This mealybug is also reported to attack grapes, citrus and guava in Punjab (Sharma, 2011). The pest attacks over 100 plant species in more than 30 families in different ber growing countries. Major crops include soybean, citrus, mango, tamarind, pomegranate and grapevines. It is a common pest of ornamentals such as Mimosaceae and Moraceae, *Hibiscus* spp. and *Ziziphus* spp. (Mendel and Bloomberg, 2015). *Alamella flava* (Agarwal, 1966) and *Anagyrus* sp. & *A. gunturiensis* [*A. mirzai* Agarwal] have been reared from *N. viridis* collected on coffee at Karnataka, India (Chacko and Singh, 1980). *Euryischomyia alami* Girault [*E. washingtoni*] has also been reported from Karnataka, India (Shafee, 1975). *Nephus ryuguus* have been reported as a natural enemy of *N. viridis* from Taiwan (Anonymous, 2008). Twenty eight biocontrol agents predating/parasitizing insect pests of Indian jujube from Punjab have been reported by Singh *et al.*,

2016 from the orders Coleoptera (7), Hymenoptera (5), Dictyoptera (3), Diptera (3), Odonata (2) and Aranae (8).

Survey and surveillance of jujube orchards were carried out to study the natural enemy complex on insect pests of jujube in the Punjab. Roving surveys were conducted in the three agro climatic zones i.e., South Western arid zone, central plain zone and sub montaneous zone along with fixed plot surveys in the Fruit Research Farm and College Orchard of the Punjab Agricultural University, Ludhiana. Different life stages of insect pests and natural enemies were collected and reared in the Fruit Entomology Laboratory, Department of Fruit Science of the University.

During these surveys, heavy mealybug infestation (Fig. 1) was recorded at district Ludhiana (60 %) and Amritsar (80 %). Observations on predation by *Nephus regularis* (Sicard) (Coleoptera: Coccinellidae: Scymninae: Scymnini) (Fig. 2), revealed 8 and 12 % predation in the field conditions at Ludhiana and Amritsar, respectively. During laboratory rearing of mealybug *N. viridis* infested *ber* twigs (collected from *ber* orchards of village Gurhe, District Ludhiana and from historical *ber* trees at Darbar Sahib, Amritsar), predatory beetles

N. regularis were recovered. From the pre-adult stages (eggs, larvae and pupae) in the waxy covering of mealybug colonies on collected infested samples emerged *N. regularis* beetles under laboratory conditions. On an average, 3 - 4 *N. regularis* beetles emerged per 10-15 cm long *N. viridis* infested twigs having leaves at room temperature during April-May of 2015 and 2016 from both the locations.

This predatory beetle is reported to be distributed in the states of Andhra Pradesh, Assam, Karnataka and Madhya Pradesh of India (Poorani, 2002; NBAIR, 2013). *Nephus regularis* is a foe of *N. viridis* from New Zealand (Rhode and Crosby, 2013). This short oval coccinellid predatory beetle was observed to be having an approximate body length of 1.5-1.7 mm and width 1.2-1.4 mm. Elytra were light brown with dark brown to blackish patch towards thorax. Head and pronotum were observed to be brown in colour. Antennae of this predatory beetle were 10-segmented. Maxillae having terminal segment cylindrical/parallel-sided and apical margins obliquely truncated. Prosternal processes are reported to be broader than long, without carinae and finely punctate. Postcoxal line is recorded to be incomplete, parallel to posterior margin of first abdominal ventrite for up to 4/5th of its length and then very slightly recurved, area enclosed by postcoxal line with evenly distributed punctures, slightly smaller near line. Median lobe of tegmen of male genitalia is slightly asymmetrical (NBAIR, 2013).

N. regularis has an abundance of 4.6 to 5.6 per cent on solenopsis mealybug, *Phenacoccus solenopsis* Tinsley on cotton (Neetan and Aggarwal, 2011; Kedar *et al.*, 2011). Highest population densities were recorded in last week of July for *N. regularis* associated with *P. solenopsis* on cotton (Kedar *et al.*, 2011a). *Nephus regularis* have also been reported from Solanum mealybug, *Phenacoccus solani* Ferris (Gautam *et al.*, 2007).

If multiplied and released in large number, this predatory beetle, *N. regularis* can effectively manage the mealybug *N. viridis* population on *ber* trees.

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