



Diversity and damage of weevil species on fruit crops in Punjab, India

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ABSTRACT: Surveys and surveillances were carried out during 2004 to 2022 to record the biodiversity of weevil species on the fruit crops in the Punjab state, India. A total of eight species of weevils viz., *Arrhenodes* sp., *Deporaus marginatus* (Pascoe), *Hypolixus truncatulus* (Fabricius), *Mecopus hopei* Rosenschoeld, *Myloccerus undecimpustulatus* Faust, *Peltotrachelus cognatus* Marshall, *Rhynchaenus mangiferae* Marshall and *Xanthochelus major* (Herbst) were observed to occur on seventeen fruit crops viz., kinnow mandarin, guava, mango, pear, litchi, ber, peach, plum, grapes, jamun, pomegranate, loquat, fig, bael or wood apple, phalsa, papaya and apple in different districts of Punjab. Highest number of species were observed in mango (5), followed by guava, ber, jamun and fig (2 each) while only one species was observed in kinnow mandarin, pear, litchi, peach, plum, grapes, pomegranate, loquat, bael, phalsa, papaya and apple. These weevils were observed to damage leaves, stem, bark, flowers and fruits. The damage caused by these weevils on different hosts ranged between 2-3 per cent for most species except, *D. marginatus* (10%) and *R. mangiferae* (8%). Further studies on their biology, life cycle, population dynamics and management are needed.

Keywords: Diversity, Survey, Fruit crops, Weevils, Punjab, Damage

INTRODUCTION

Fruit crops exhibit an area of 86673 ha and production of 1850259 million tonnes (MT) in Punjab, India. The major fruit crops of Punjab are Kinnow mandarin, guava, mango, pear, Sweet Orange, litchi, peach and ber while the minor fruit crops are limes/lemons, amla, grapes, plum, banana, pomegranate, phalsa, sapota and papaya (Anonymous, 2019). These fruit crops are attacked by number of insect pests such as borers, sucking insects, mealybugs, leaf rollers, leaf miners, fruit flies etc.

Among these pests, weevils are important insect-pests that belong to family Curculionidae, the largest family of the animals (Zaragoza and Lyal, 1999). Weevils are successful dwellers in the world, inhabiting almost all ecosystems, from Arctic to the Sub-ant-arctic and deserts. These weevils include several serious pest species of agriculture, fruits, stored grains and forest trees (Oberprieler *et al.*, 2007). These insects have long snout bearing mandibulate type of mouthparts and antennae are geniculate type. They feed on internal tissues of plants with the help of snout. Snout is also used to prepare oviposition sites on plant parts. Nearly, all the species of weevils are phytophagous and feed on every part of plant from root to seed (Tara *et al.*, 2010; Srivastava *et al.*, 2020). Despite their importance, weevil diversity, distribution and biology have been little studied. There is lack of information about the weevil diversity of the fruit

crops in Punjab. So, the present study was undertaken to study the biodiversity of weevil species occurring on different fruit crops in the Punjab, India.

MATERIALS AND METHODS

Rapid roving surveys were conducted since 2004 till date in the fruit growing areas of the Punjab, India (31.1471°N latitude and 75.3412°E longitude) to record the diversity of weevils along with their host plants. All the major fruit growing districts of Punjab were surveyed in all the agro-climatic regions such as submontane zone, central plain zone and arid-irrigated zone along with *Kandi* and *Bet* areas. The observation of weevil pests associated with fruits, flowers, leaves and trunk of fruit trees was done while collection. The observations were recorded at monthly intervals during each year. The weevils were collected by different methods as hand picking, hand nets and by stem beating. The collected weevils were then killed, pinned and labelled.

Population of weevils from different fruit plants was observed and percent damage was also recorded on various plant parts *i.e.* flowers, leaves and fruits from twenty five trees/plants. Activity period of weevils on different hosts was observed based on their presence or absence on the tree. Various stages of these weevils were reared in the Fruit Entomology laboratory in the Department of Fruit Science, Punjab Agricultural University (PAU),

Ludhiana, Punjab (India). Adult specimens were sent for identification to Division of Germplasm Collection and Characterization, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, Karnataka (India). The specimens were identified based on key of provided by Marshall (1916), Ramamurthy and Ghai (1988), Pajni (1990) and also compared with authentically identified

specimens at National Insect Museum, ICAR-NBAIR, Bengaluru.

RESULTS AND DISCUSSION

Details of weevils recorded in the fruit crops grown in various districts of Punjab, India since 2004 till date have been discussed below and compiled in Tables 1 and 2.

Table 1. List of weevil species observed on fruit crops in Punjab since 2004

Common name of the weevil	Scientific name of the weevil	Host plants
Grey weevil	<i>Mylocherus undecimpustulatus</i> Faust	Kinnow mandarin, guava, mango, pear, litchi, peach, plum, grapes, jamun, pomegranate, loquat, fig, bael, phalsa, apple
Long brown weevil	<i>Xanthochelus major</i> (Herbst)	Guava, ber, papaya
Weevil	<i>Peltotrachelus cognatus</i> Marshall	Mango
Mango flea weevil or mango leaf weevil	<i>Rhynchaenus mangiferae</i> Marshall	Mango, jamun
Leaf cutting weevil	<i>Deporaus marginatus</i> (Pascoe)	Mango
Straight-snouted weevil	<i>Arrhenodes</i> sp.	Mango
Small brown weevil	<i>Hypolixus truncatulus</i> (Fabricius)	Ber
Weevil	<i>Mecopus hopei</i> Rosenschoeld	Fig

Table 2. List of fruit crops infested by various weevil species in Punjab since 2004

Common name of the host plant	Scientific name of the host plant	Common name of the weevil	Scientific name of the weevil	Plant part infested	Activity period	Location
Kinnow mandarin	<i>Citrus reticulata</i>	Grey weevil	<i>Mylocherus undecimpustulatus</i> Faust	Leaves	April to July	Many districts in Punjab
Guava	<i>Psidium guajava</i>	Grey weevil	<i>Mylocherus undecimpustulatus</i> Faust	Leaves	August to October	Many districts in Punjab
		Long brown weevil	<i>Xanthochelus major</i> (Herbst)	Leaves	November	Ludhiana
Mango	<i>Mangifera indica</i>	Weevil	<i>Peltotrachelus cognatus</i> Marshall	Leaves	June to December	Ludhiana and Hoshiarpur
		Mango flea weevil or mango leaf weevil	<i>Rhynchaenus mangiferae</i> Marshall	Leaves	June to December	Ludhiana, Hoshiarpur and Mohali
		Leaf cutting weevil	<i>Deporaus marginatus</i> (Pascoe)	Leaves	May to August	Ludhiana and Hoshiarpur
		Grey weevil	<i>Mylocherus undecimpustulatus</i> Faust	Leaves	April to July	Many districts in Punjab
		Straight-snouted weevil	<i>Arrhenodes</i> sp.	Wood borer	June	Hoshiarpur

Pear		Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	April to July	Many districts in Punjab
Litchi	<i>Litchi chinensis</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	March to June	Many districts in Punjab
Ber	<i>Zizyphus jujube</i>	Long brown weevil	<i>Xanthochelus major</i> (Herbst)	Leaves and fruits	September and January	Ludhiana
		Small brown weevil	<i>Hypolixus truncatulus</i> (Fabricius)	Adult on leaves; larvae on stem	September	Ludhiana
Peach	<i>Prunus persica</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	April to July	Many districts in Punjab
Plum	<i>Prunus domestica</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	April to July	Many districts in Punjab
Grapes	<i>Vitis vinifera</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	November-December	Many districts in Punjab
Jamun	<i>Syzygium cumini</i>	Flea weevil or leaf weevil	<i>Rhynchaenus mangiferae</i> Marsahall	Leaves	June to September	Many districts in Punjab
		Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	May	Many districts in Punjab
Pomegranate	<i>Punica granatum</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	September and February-March	Ludhiana, Patiala
Loquat	<i>Eryobotrya japonica</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	March, September-November	Ludhiana, Pathankot
Fig	<i>Ficus carica</i>	Weevil	<i>Mecopus hopei</i> Rosenschoeld	Bark	October	Ludhiana
		Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	November-December	Ludhiana
Bael or wood apple	<i>Aegle marmelos</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	November	Ludhiana, Patiala
Phalsa	<i>Grewia robusta</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	September	Ludhiana
Papaya	<i>Carica papaya</i>	Long brown weevil	<i>Xanthochelus major</i> (Herbst)	Flowers	September	Ludhiana
Apple	<i>Malus domestica</i>	Grey weevil	<i>Myllocerus undecimpustulatus</i> Faust	Leaves	April	Ludhiana

***Myllocerus undecimpustulatus* Faust (Entiminae: Curculionidae)**

Synonym:

*Myllocerus*11-*pustulatus* Faust (1891)

*Myllocerus*11-*pustulatus* var. *pistor* Faust (1897)

Myllocerus maculosus Desbrochers des Loges (1899)

Myllocerus maculosus Stebbing (1914)

Myllocerus marmoratus Faust (1897)

Diagnostic: Body black in colour with pale grey scaling; Antennal second funicle segment very much longer than

first; distance between the eyes greater than the distance between the scrobes; Prothorax basal margin more or less bisinuate and subparallel laterally; each elytron with black spots on the shoulder, one on interval fourth and ninth before the middle, one on eighth just behind the middle, one still further back on interval three and one at apex of fifth; sometime one or more these spots absent; hind femur tridentate (Ramamurthy and Ghai, 1988).

Nature of damage: This weevil feeds on leaves, starting from leaf margins to inwards and causing typical leaf notching type of symptoms. Adults were found to feed

on both new flush and mature leaves. Intense feeding by numerous weevils may cause plant decline or stunting (Neal, 2013). Larvae feed on the roots of plants and later pupate in soil (George *et al.*, 2019). This weevil is a poor flier (Srivastava *et al.*, 2020).

Host plant: Rice, maize, pigeonpea, cotton, jute, sunflower, mango, pomegranate, *ber*, strawberry, apple, lucerne and Shisham (*Dalbergia sisoo*) (Ramamurthy and Ghai, 1988), litchi (Neal, 2013; Srivastava *et al.*, 2020), avocado, peach, ornamental plants and palms (Neal, 2013).

Distribution: India, Indonesia, Pakistan (CABI, 2020).

India: Throughout India, especially tropical regions (Ramamurthy and Ghai, 1988), Delhi, Karnataka, Uttar Pradesh (CABI, 2020).

Seasonal activity: Damage was observed on the leaves of Kinnow (Fig. 1A), peach, plum and pear in many places in Punjab during April to July. On guava, severe damage of grey weevil was observed on leaves at Fruit Research Farm (FRF), PAU, Ludhiana during September-October. On mango, damage was observed during April to July at FRF, PAU, Ludhiana and during May-June in district Gurdaspur. Adult weevils were observed in large number on leaves of litchi plants and young fruits at FRS Gangian, Govt. Garden and Fruit Nursery, village Bhunga, and village Budhabar, district Hoshiarpur during March-June. Severe damage and high population of weevil was observed on new leaves of litchi at Ranjit Baag, district Gurdaspur in June. On grapes, damage was observed on leaves at FRF, PAU, Ludhiana during November-December. On *jamun*, damage and adults of weevil were observed on leaves at Govt. Garden and Fruit Nursery, Wazidpur, district Patiala during May. Minor attack of this weevil was observed on pomegranate leaves during September and February-March in the FRF, PAU, Ludhiana. On loquat, this weevil was observed during March and September to November. Damage was observed on *bael* leaves during November at FRF, PAU, Ludhiana and on fig, damage was observed in college orchard, PAU, Ludhiana during last week of August and again during November-December. On *phalsa*, damage was observed on the leaves in the FRF, PAU, Ludhiana during September and on leaves of apple during 3rd week of April at FRF, PAU, Ludhiana. The damage caused by this weevil ranged between 2-3 per cent on different fruit plants (Fig. 2).

Kumar (2017) reported *M. undecimpustulatus* as minor pest of *Dalbergia sissoo* during May to September. On litchi, this weevil was observed from August to April, with peak activity during September-October (Srivastava

et al., 2015). It was reported that infestation of this weevil started with new flush growth and continued upto last week of December. Due to unavailability of food, weevil undergoes hibernation during winter months and again appeared in April. This weevil has also been recorded on cotton from April to November (Atwal, 1976). Mazumder *et al.*, (2014) recorded incidence of *Mylocerus discolor* during March to May on litchi in Assam. *M. discolor* was also observed on *ber* in Jammu and Kashmir region (Tara *et al.*, 53). Peach and avocado are preferred host plants of *M. undecimpustulatus* over litchi and citrus (George *et al.*, 2019).

***Xanthochelus major* (Herbst) (Lixinae: Curculionidae)**

Synonym:

Xanthochelus faunus (Olivier 1807)
Curculio major Herbst (1784)

Diagnostic: Adults stout, about 8 to 18 mm size; body ovate; rostrum convex dorsally; scrobes not reach the apex; prothorax broader than long, base much broader than apex; Elytra with strong shoulder, parallel side beyond the middle; protibial mucronate apically in both the sex. Female slightly larger than male and has dark brown snout. Legs similar in size and structure. Coxa large, globular, small trochanter, long femur, tibi short, thin, slender, four-segmented tarsi. Adults respond quickly to even a slight disturbance.

Larvae are whitish, apodous, C-shaped and pass through five instars. Teneral adults remain in the pupal chamber made within the gall for 5-7 days (Azam *et al.*, 2009).

Nature of damage: Leaves get distorted, with various shaped holes in the middle of leaf lamina. The margins of leaves are eaten up. Adult weevils cause severe damage both to mature and immature leaves (Mazumder *et al.*, 2015). They nibbled on leaves starting from the margin and ate small patches of leaves.

Host plant: *Ber* (*Ziziphus mauritiana* Lamk) (Tara *et al.*, 2010), Kaliziri (*Saussurea heteromalla*) (Azam *et al.*, 2009), Falconer's thistle (*Cirsium falconeri*) (Bhagat, 2016), Arjun (*Terminalia arjuna*), Indian Laurel (*T. tomentosa*).

Distribution: India: North East Himalaya (Lefroy, 1909), Uttar Pradesh (Gupta, 1980), Jammu and Kashmir (Azam, 2007; Azam *et al.*, 2009), Rajouri (Iqbal, 2010), Samba, Sagal, Khandwal, Rajpura (Tara *et al.*, 2010), Jharkhand (Singh *et al.*, 2014b).

Seasonal activity: Adults of *X. major* were observed on leaves of guava during November and severe damage on

ber was observed during September at PAU, Ludhiana, farmers' orchard in village Hambran, district Ludhiana and at FRF, PAU, Ludhiana during first week of January. Adults and damage was observed on *ber* leaves (Fig. 1B) and fruits (Fig. 1C) during first week of March at FRF, PAU, Ludhiana. Attack of this weevil was also observed to occur on flowers of papaya in polyhouse at Village Badal, district Sri Muktsar Sahib during September. The damage caused by this weevil on different hosts varied between 2-3 per cent (Fig. 3). Azam *et al.* (2009) reported that the adults remain active from third week of March to August and population reaches its peak during May, coinciding with the host availability, and a mean incidence of $76.57 \pm 4.59\%$ recorded. Total life-cycle takes about 63-70 days and at least two generations observed from March to August. Incidence of leaf eating weevil, *X. faunus* in *ber* (Shah *et al.*, 1990; Tara *et al.*, 2010; Mazumder *et al.*, 2015), tropical pine (Gupta, 1980), medicinal plant (*Saussurea heteromalla*) (Mohammad *et al.*, 2009), lac production system (Singh *et al.*, 2014b) have also been reported. Mazumder *et al.* (2015) recorded its incidence on *ber* during June-September in Assam. Azam *et al.* (2009) observed its breeding in the flower buds of *S. heteromalla*.

***Rhynchaenus mangiferae* Marshall (1915)**
(Rhynchaeninae: Curculionidae)

Diagnostic: Adults about 2.5 to 2.8 mm size; body ovate; antennae with short scape, six segmented funicle; with three segmented oval club; Prothorax broader than long, broadest at base surface closely punctate with white setae; Elytra closely punctate and covered with white setae; striae 7 and 8 not reach the base of the elytra; Hind femur enlarged.

Nature of damage: Grubs of this weevil bore into the leaves and as many as 20-30 grubs can be found in one leaf and such leaves dry up completely (Marshall, 1915). Adult weevils feed on leaves and result in skeletonization of leaves (Reddy *et al.*, 2018). Tender leaves are most attacked by this weevil (Sathe *et al.*, 2015). Grubs are also reported to bore into florets while adults nibbled florets and young fruits resulting in drying (Singh, 1988).

Host plant: Mango (Kannan and Rao, 2006), litchi, *jamun*

Distribution: India: Maharashtra, Tamil Nadu, Uttar Pradesh, Punjab, Karnataka (Peter and Balasubramanian, 1984), Andhra Pradesh (Kannan and Rao, 2006)

Seasonal activity: *Rhynchaenus mangiferae* was recorded on nursery plant of mango in college orchard and FRF, PAU, Ludhiana during June to September.

Severe damage of this weevil was observed on leaves of mango (Fig. 1D) at Kairon Farm, Zirakpur, district Mohali and FRS Gangian, district Hoshiarpur during last week of April. On *jamun*, weevil was recorded from nursery plant in college orchard and new orchard, PAU, Ludhiana during June to September. This weevil caused up to 8 per cent damage on mango leaves and 6 per cent damage on *jamun* leaves (Fig. 4).

Young plants of mango (0-5 year) are preferred by *R. mangiferae* (Kannan and Rao, 2006). This weevil is considered as a minor pest of mango (Reddy *et al.*, 2018). Sathe *et al.*, (2015) reported this weevil damaging tender leaves on mango trees in Maharashtra.

***Mecopus hopei* Rosenschoeld (Baridinae: Curculionidae)**

Diagnostic: Adults are 7-13 mm in size. This weevil is spider like with grey and black colour dorsally and black, grey and white ventrally.

Nature of damage: The adults feed on barks of both living and dead trees. This weevil is active throughout the year.

Host plant: Fig (*Ficus* sp.), Jackfruit (*Artocarpus integrifolia*), Sal (*Shroea robusta*) (Sheikh, 1996).

Distribution: India

Seasonal activity: Adults were observed in fig plantation in college orchard, PAU, Ludhiana during October. This weevil caused up to 2 per cent damage to the fruits (Fig. 5). Grubs were observed inside the fig fruits.

***Arrhenodes* sp. (Brentidae: Curculionoidea)**

Diagnostic: Slender, very elongate rostrum and body, head abruptly excised almost direct behind the eyes and very small mandible and non-geniculate antennae. Larvae possess legs unlike most other weevils' larvae, and are very elongate.

Nature of damage: Larvae feed on wood (Fig. 1E) and result in small worm holes in the trunk of tree. Frass and sawdust is expelled from oviposition hole at the beginning of the gallery (EFSA, 2019). The diameter of galleries increases with the size of larvae. These holes almost reach the opposite side of the trunk of tree and then make a sharp U-turn toward the entrances. Weevils are attracted to wounds on the living trees (Thomas, 2007). Adults feed on the sap oozing from the trees and observed to congregate under loose bark at wounds (EFSA, 2019).

Host plant: They are found under the barks of various dead and decaying wood/ trees e.g. Maple (*Acer negundo*),

Honey locust (*Gleditsia triacanthos*) (Solomon, 1995), oak trees (*Quercus* sp.) (Thomas, 2007), Elm (*Ulmus* sp.), Beech (*Fagus* sp.) and Aspen (*Populus* sp.) (EFSA, 2019).

Distribution: Canada, USA (Thomas, 1996).

India: Usually found in tropical regions, Kerala (Tom and Kaippallil, 2016).

Seasonal activity: *Arrhenodes* sp. was observed on mango trees at Govt. Garden and Fruit Nursery, Bhunga, district Hoshiarpur, Punjab, India during June-July. About 3 per cent damage to trunks of mango trees was observed (Fig. 5). Solomon (1995) reported *Arrhenodes minutus* (Drury) as a vector of oak wilt

fungus, *Ceratocystis fagacearum* (Bretz) Hunt) in North America. In Florida, adult weevils were observed during February to November (Thomas, 1996) while EFSA (2019) reported its presence from early May to August. In Kerala, *Arrhenodes* sp. was observed during January to April (Tom and Kaippallil, 2016).

***Peltotrachelus cognatus* Marshall (Eremninae: Curculionidae)**

Diagnostic: Body black in colour with whitish scaling; whitish scale arranged in three transverse irregular bands on elytron; stria punctures of each elytra small and shallow; antennae with second funicle segment distinctly longer than first; prothorax broader than long, widest at base and deeply bisinuate (Pajni, 1990).



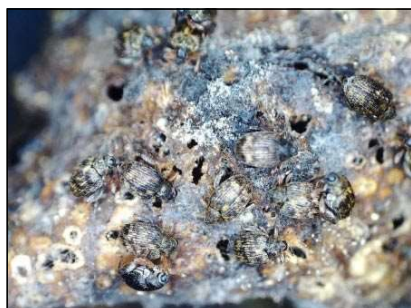
A. *Myllocerus undecimpustulatus* on Kinnow mandarin



B. *Xanthochelus major* on ber twig



C. *Xanthochelus major* on ber fruit



D. *Rhynchaenus mangiferae* on mango



E. *Arrhenodes* sp. on mango



F. *Peltotrachelus cognatus* on mango



G. *Deporaus marginatus* on mango

Fig 1. Different weevils observed feeding on fruit crops in Punjab. A. *Myllocerus undecimpustulatus*, B. *Xanthochelus major* on ber twig, C. *Xanthochelus major* on ber fruit, D. *Rhynchaenus mangiferae*, E. *Arrhenodes* sp., F. *Peltotrachelus cognatus*, and G. *Deporaus marginatus*.

Nature of damage: Adult weevils are known as defoliators of fruit trees (Siddappaji and Lingappa, 1977). The weevils start feeding from leaf margins to inwards leaving thick veins and midrib in an irregular fashion. Adults have the habit to congregate on the lower leaf surface during sunny hours and scatter during cool hours. Weevils prefer brittle leaves to tender ones (Siddappaji and Lingappa, 1977). Sometimes, weevils make round holes or C shaped cut on the leaves (Singh *et al.*, 2014b).

Host plant: Cashew, sapota, mango, guava, pomegranate, peach, pear, plum, apple, cherry, mulberry (Singh *et al.*, 2014a), teak, The Bombay ebony (*Diospyros montana*), The Indian elm (*Holoptelea integrifolia*), Takoli (*Dalbergia lanceolaria*) and the Indian rosewood (*D. latifolia*) (Siddappaji and Lingappa, 1977).

Distribution: India: Puducherry; Karnataka, Tamil Nadu, Kerala (Pajni, 1990).

Seasonal activity: This weevil was observed damaging mango leaves (Fig. 1F) at FRS, Gangian, district Hoshiarpur during June, and at PAU, Ludhiana and FRS Gangian during December. Only, up to 3 per cent damage was recorded on leaves (Fig. 5). Siddappaji and Lingappa (1977) observed the activity of *P. cognatus* from May to November. Severe infestation on mango grafts was observed during September-October. This weevil has been reported as pest on mulberry (Singh *et al.*, 2014a) and on Kusum tree (Singh *et al.*, 2014b). On Kusum trees, adult weevils appear during March and remain active till October-November.

Hypolixus truncatulus (Fabricius)

Synonym: *Lixus truncatulus* Fabricius (1798)

Diagnostic: Medium sized weevil, adults with black in colour elytra, prothorax and head reddish brown. Eyes very prominent, snout straight, gradually widened at apex.

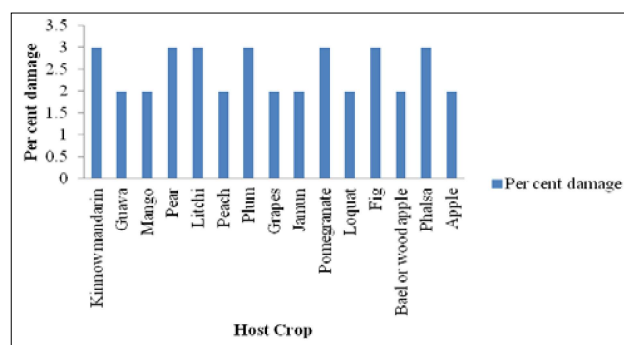


Fig 2. Per cent damage of *Myllocerus undecimpustulatus* on fruit crops

Antennae geniculate type, funicle and club segments gradually increase in size. Body covered with whitish hairy setae. Legs slender, femora basal part brownish and remaining segments black (Tara *et al.*, 2009).

Nature of damage: Larvae make tunnels in the stem of the tree in a zig-zag manner (Tara *et al.*, 2009). Feeding by larvae result in the gall formation in the stem and adult weevils feed on leaves and epidermis of tender stem (Tara *et al.*, 2010). Stem become weak and may breakdown in heavy winds (Kalia and Lal, 1999). At the place where larva forms its pupal chamber, galls are formed due to thickening of stem walls. Adults emerge from these galls by biting holes. The eaten leaves with deeply incised, irregular margins indicate the presence of adults (Tara *et al.*, 2009).

Host plant: Polyphagous e.g. *Dalbergia sissoo* (Kalia and Lal, 19), *Amaranthus* spp. (Rajeshkanna *et al.*, 2017), Gum Arabic tree, *Acacia nilotica* (Misra *et al.*, 1994) and *Ziziphus mauritiana* (Singh *et al.*, 2014b).

Distribution: India, Mexico, Pakistan, Thailand (Jackson, 2019).

India: Tamil Nadu, Kerala, Karnataka, Orissa, Arunachal Pradesh, Jharkhand, Bihar, Himachal Pradesh, Madhya Pradesh (Kalia *et al.*, 1994), Uttar Pradesh (Agarwal, 1985), New Delhi (Phogat *et al.*, 1994; Butani and Jotwani, 1983), Uttarakhand, Jammu (Tara *et al.*, 2009).

Seasonal activity: Adults were observed on leaves of *ber* plants during September in PAU, Ludhiana and in farmers orchard in village Hambran, district Ludhiana, Punjab and damage upto 3 per cent was noticed (Fig. 5). This weevil has been considered as major pest of *Amaranthus* sp. in many countries (Aragon *et al.*, 2011; Kagali *et al.*, 2013). Maximum population of this weevil on *Amaranthus* sp. was observed during June-July by Tara *et al.* (2009). The weevil remains active from April to October and overwinters in the cracks and crevices

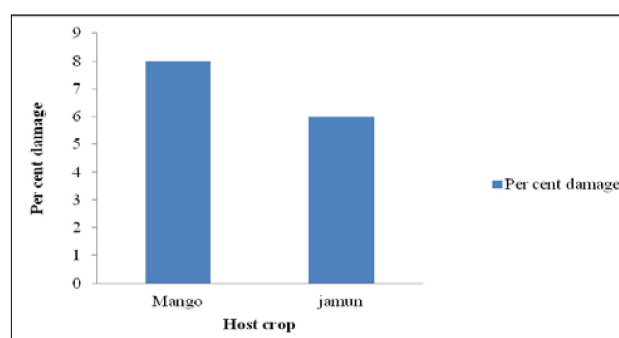


Fig 4. Per cent damage of *Rhynchaenus mangiferae* on fruit crops

of the walls or in dead, harvested stems or in stumps in the soil. Maximum oviposition was observed during June to September (Tara *et al.*, 2009). This weevil was recorded from Jammu and Kashmir region by Tara *et al.* (2010) and by Singh *et al.* (2014b) as a pest of *ber* from Jharkhand.

***Deporaus marginatus* (Pascoe) (Attelabidae: Curculionoidea)**

Synonym: *Eugnamptus marginatus* Pascoe

Diagnostic: Very small weevil, adults with black in colour elytra, prothorax and head reddish brown (Fig. 1G). Eyes very prominent, snout straight, gradually widened at apex. Antennae non-geniculate type, funicle and club segments gradually increase in size. Body covered with whitish hairy setae. Legs slender, femora basal part brownish and remaining segments black.

Nature of damage: Adult weevils feed on the epidermis of young leaves and the affected leaves turn brown, curly and crumpled (Singh, 2014). Feeding by this weevil produces conspicuous ‘windowpane’ symptoms on the leaves and the infested shoots become almost leafless. The gravid female excavates small cavities on either side of midrib for egg laying and then cut the leaf near the base from one edge through the midrib to the other. Larvae mines into the tissues of fallen leaves. The most obvious symptom of attack by this pest is the presence of young leaf bits below the tree (Rashid *et al.*, 2017).

Host plant: Mango (Kannan and Rao, 2006; Rashid *et al.*, 2017) and cashew (NBAIR, 2019).

Distribution: India (Butani, 1979; Rafiquzzaman *et al.*, 1999; Singh, 2014), Bangladesh (Uddin *et al.*, 2003; Uddin *et al.*, 2014), Sri Lanka (Hutson and Alwis, 1934) and Malaysia (Soh and Khoo, 1983; Tigvatnnon, 1988).

India: Andhra Pradesh (Kannan and Rao, 2006), Tamil Nadu, Kerala, Karnataka, Orissa, Arunachal Pradesh, Jharkhand (Singh, 2014), Bihar.

Seasonal activity: Adult weevils as well as damage of leaf cutting weevil, *D. marginatus* was observed on mango at Fruit Research Station (FRS), Gangian, district Hoshiarpur, Punjab during May-June and during last week of August at college orchard, PAU, Ludhiana. This weevil resulted in about 10 per cent damage to the leaves of mango (Fig. 5). It is reported to be a pest of young trees (0-5 year) of mango (Kannan and Rao, 2006). This pest is more active in the rainy season and its attack delays the growth of rootstock which hinders the development of new grafts. In Jharkhand state, the activity of this weevil started from June on *ber* (Singh, 2014). The activity

was recorded in the form of egg laying in the cavities of leaves resulting in defoliation. Development of weevil synchronized with initiation of new leaves of mango in grafted young plants and more prevalent from June to October (Mukherjee *et al.*, 2016). Tom and Kaippallil (2016) also recorded *D. marginatus* as pest of mango, observed during January to April in Kerala.

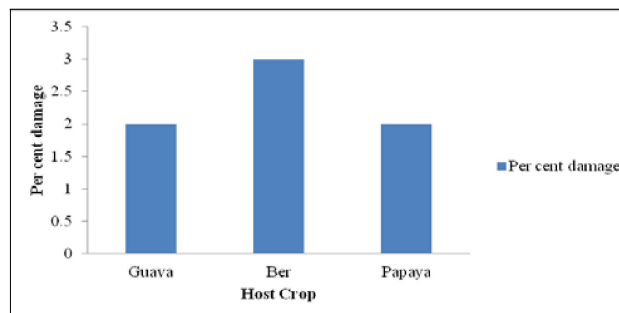


Fig 3. Per cent damage of *Xanthochelus major* on fruit crops

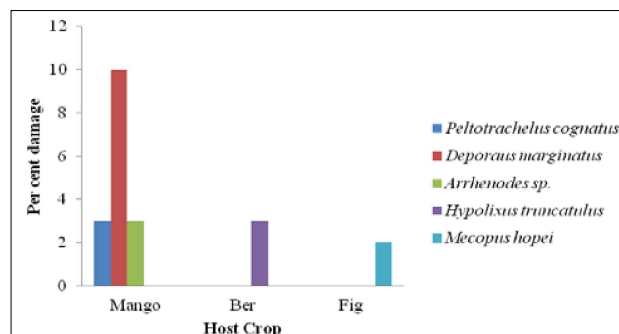


Fig 5. Per cent damage of different weevil species on fruit crops

CONCLUSION

This study reports the occurrence of eight species of weevils actively feeding on seventeen fruit crops of Punjab, India observed since 2004. Highest number of species were observed in mango (5), followed by guava, *ber*, *jamun* and fig (2 each) while only one species was observed in Kinnow mandarin, pear, litchi, peach, plum, grapes, pomegranate, loquat, *bael*, *phalsa*, papaya and apple. These weevils were observed to damage leaves, stem, bark and flowers. The average damage caused by these weevils ranged from 2-3 per cent on different hosts except *D. marginatus* (10% damage on mango) and *R. mangiferae* (8% damage on mango). Further investigations are needed to study their biology, population dynamics, incidence level and management practices.

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REFERENCES

- Agarwal, B. D. 1985. Biology of *Hypolixus truncatulus* (F.) (Coleoptera: Curculionidae) forming galls on the stem of *Amaranthus spinosus* Linn. in India. *Cecidologia-Internationale*, **6** (1/3): 83-90.
- Anonymous. 2020. *Package of Practices for Cultivation of Fruit Crops*. Punjab Agricultural University, Ludhiana.
- Aragon-Garcia, A., Damian-Huato, M. A., Huerta-Lara, M., Sáenz-de-Cabezón F. J., Pérez-Moreno I., Marco-Mancebon V. and Lopez-Olguin J. F. 2011. Insect occurrence and losses due to phytophagous species in the amaranth *Amaranthus hypocondriacus* L. crop in Puebla, Mexico. *African Journal of Agricultural Research*, **6**(27): 5924-5929.
- Atwal, A. S. 1976. *Agricultural Pests of India and Asia*. Kalyani Publishers, Delhi, India.
- Azam, M. 2007. Diversity, distribution and abundance of weevils (Coleoptera: Curculionidae) of districts Poonch and Rajouri (Jammu). Ph.D. Thesis, University of Jammu, Jammu, India.
- Azam, M., Tara, J. S., Ayri, S., Feroz, M. and Ramamurthy, V. 2009. Bionomics of weevil *Xanthochelus faunus*, a pest of medicinal plant (snow lotus) *Saussurea heteromalla*. *Indian Journal of Agricultural Sciences*, **79**: 1050-1053.
- Bhagat, R. C. 2016. Biodiversity and Annotated Checklist of Coleopteran-Fauna (Insecta) associated with Agricultural Crops (Cereals, Vegetables) and Medicinal Plants of Jammu & Kashmir State (India). *International Journal of Current Research in Biosciences and Plant Biology*, **3**(7): 95-103.
- Butani, D. K. 1979. *Insects and Fruits*. Indian Agricultural Research Institute. New Delhi.
- Butani, D. K. and Jotwani, M. G. 1983. Insects as a limiting factor in vegetable production. *Pesticides*, **17**(9): 6-13.
- CABI. 2020. Invasive species compendium. <https://www.cabi.org/isc/datasheet/34385>. Accessed 25 May 2020.
- EFSA Plant Health Panel (EFSA PLH Panel), Bragard, C., Dehnen-Schmutz, K., Di Serio, F., Gonthier, P., Jacques, M. A., Jaques, M. J. A., Justesen, A. F., MacLeod, A., Magnusson, C. S., Navas-Cortes, J. A., Parnell, S., Potting, R., Reignault, P. L., Thulke, H. H., Van der Werf, W., Civera, A. V., Yuen, J., Zappala, L., Gregoire, J-C., Kertesz, V. and Milonas, P. 2019. Scientific opinion on the pest categorisation of *Arrhenodes minutus*. *EFSA Journal*, **17**(2): 5617.
- George, J., Shareef, S. and Lapointe, S. L. 2019. Biology, chemical ecology and sexual dimorphism of the weevil, *Myloccerus undecimpustulatus undatus* (Coleoptera: Curculionidae). *Florida Entomologist*, **102**(3): 464- 468.
- Gupta, B. K. 1980. New pest of Tropical pines in India. *Indian Forest*, **106** (4): 312-313.
- Hutson, J. C. and Alwis, D. E. 1934. Two weevil pests of mango leaves. *Tropical Agriculturist*, **83**: 128-135.
- Iqbal, J. 2010. Phytophagous insects associated with *Cirsium arvense* in Jammu. M. Phil. Dissertation, University of Jammu, Jammu, India.
- Jackson, G. 2019. Pacific pests and pathogens – Factsheets. https://apps.lucidcentral.org/ppp/text/web_full/entities/amaranthus_stem_weevil_351.htm Accessed 25 May 2020.
- Kagali, R. N., Kioko, E. N., Osiemo, Z., Muya, S. and Wachera, C. 2013. Insect Abundance and Diversity on Cultivated *Amaranthus* Spp. (Amaranthaceae) in Meru County, Kenya. *American International Journal of Contemporary Research*, **3**: 110-116.
- Kalia, S., Joshi, K. C. and Pandey, D. K. 1994. *Hypolixus truncatulus*, F. (Coleoptera: Curculionidae) a new report on *Acacia nilotica* from India. *Indian Forester*, **120**(8): 743-744.
- Kalia, S. and Lal, R. R. 1999. Insect pests of *Dalbergia sissoo* Roxb. at and around Jabalpur. *Advances in Forestry Research in India*, **20**: 190-202.
- Kannan, M. and Rao, N. V. 2006. Influence of age and stage of the host plant on insect pests of mango (*Mangifera indica* L.). *International Journal of Agricultural Sciences*, **2**(2): 351-353.
- Kumar, A. 2017. The study of insect pests of *Dalbergia sissoo* Roxb. and their seasonal incidence in Jharkhand, India. *American Journal of Agriculture and Forestry*, **5**(5): 137-144.

- Lefroy, H. M. 1909. *Indian Insect Life: A manual of the insects of the plains (Tropical India)*. Thacker, Spink and Company, Kolkata, India.
- Marshall, G. A. K. 1915. Some injurious Indian weevils (Curculionidae). *Bulletin of Entomological Research*, **5**(4): 377-380.
- Mazumder, N., Dutta, S. K., Bora, P., Gogoi, S. and Purnima, D. 2014. Record of litchi weevil, *Myllocerus discolor* (Coleoptera: Curculionidae) on litchi (*Litchi chinensis* Sonn. (Sapindaceae) from Assam. *Insect Environment*, **20**: 29-31.
- Mazumder, N., Gogoi, S., Purnima, D. and Bora, P. 2015. A new record of ber weevil, *Xanthochelus faunus* Olivier (Coleoptera: Curculionidae) on young ber plant (*Ziziphus mauritiana* Lamk) from Assam. *Biotic Environment*, **21**(2 & 3): 21-23.
- Misra, K. K., Rai, P. N. and Jaiswal, H. R. 1994. *Hypolixus truncatulus* Fabricius (Coleoptera: Curculionidae) a new report on *Acacia nilotica* from India. *Indian Forester*, **120** (8): 743-744.
- Mohammad, A., Tara, J. S., Shaloo, A., Feroz, M. and Ramamurthy, V. V. 2009. Bionomics of weevil *Xanthochelus faunus*, a pest of medicinal plant (snow lotus) *Saussurea heteromalla*. *Indian Journal of Agricultural Sciences*, **79** (12): 1050-1053.
- Mukherjee, D., Singh, P. K., Kumari, A., Das, B. and Choudhary, J. S. 2016. Biology, morphology and seasonal population dynamics of mango leaf cutting weevil, *Deporaus marginatus* (Pascoe) (Coleoptera: Attelabidae). *Journal of Entomological Research*, **40** (3): 285-289.
- NBAIR. 2019. <https://www.nbair.res.in/Databases/insectpests/Deporaus-marginatus.php>. Accessed 27 May, 2020.
- Neal, A. 2013. Common name: Sri Lankan weevil (suggested name) scientific name:
Myllocerus undecimpustulatus undatus Marshall (Insecta: Coleoptera: Curculionidae: Entiminae). EENY-579, University of Florida, IFAS, Gainesville, Florida, USA. http://entnemdept.ufl.edu/creatures/orn/sri_lankan_weevil.htm. Accessed 27 May, 2020
- Oberprieler, R. G., Marvaldi, A. E. and Anderson, R. S. 2007. Weevils, weevils, weevils everywhere. *Zootaxa*, **1668**: 491-520.
- Pajni, H. R. 1990. *Fauna of India and adjacent countries: Coleoptera, Curculionidae, subfamily Eremninae, tribe Cyphicerini*. Zoological Survey of India, Calcutta.
- Peter, C. and Balasubramanian, R. 1984. New report of parasites on mango flea weevil, *Rhynchaenus mangiferae* (Coleoptera: Curculionidae). *Entomon*, **9**(1): 73.
- Phogat, B. S., Bhalla, S. and Mal, B. 1994. Seasonal incidence of stem weevil (*Hypolixus truncatulus* (F.) and its effect on growth and grain yield of *Amaranthus* (*Amaranthus hypochondriacus*). *Indian Journal of Agricultural Sciences*, **64**(4): 261-262.
- Rafiquzzaman, M. S., Mitra, and Chattopadhyay, A. 1999. Varietal susceptibility to the mango leaf cutting weevil, *Eugnamptus marginalis* Fst. (Coleoptera: Curculionidae). *The Horticulture Journal*, **12**: 91-95.
- Rajeshkanna, S., Sivaraga, N. and Mikunthan, G. 2017. Biology and management of *Amaranthus* stem borer (*Hypolixus truncatulus*) (Coleoptera: Curculionidae). *Annals of Sri Lanka Department of Agriculture*, **19**: 258-266.
- Ramamurthy, V. V. and Ghai, S. 1988. A study on the genus *Myllocerus* (Coleoptera: Curculionidae). *Oriental Insects*, **22**: 377-500.
- Rashid, M. H., Taj, H. F. and Jung, C. 2017. Life-table study of mango leaf cutting weevil, *Deporaus marginatus* Pascoe (Coleoptera: Curculionidae) feeding on four mango cultivars. *Journal of Asia-Pacific Entomology*, **20**: 353-357.
- Reddy, P. V. R., Gundappa, B. and Chakravarthy, A. K. 2018. Pests of Mango. In: Omkar (Ed.) *Pests and their management* (415-436). Singapore: Springer Nature.
- Sathe, T. V., Patil, S. S., Khamkar, A. G. and Khairmode, P. V. 2015. Biology, ecology and control of weevils (Curculionidae: Coleoptera) on mango, *Mangifera indica* Linn. from western Maharashtra. *Biolife*, **3**(4): 783-787.
- Shah, A. H., Jhala, R. C., Patel, Z. P., Patel, R. L. and Patel, G. M. 1990. First record of some pest on ber (*Zizyphus mauritiana* Lamark) cultivated in South Gujrat. *Indian Journal of Entomology*, **52**(1): 161-163.

- Sheikh, S. 1996. An ecological study of the insects related to the economic forest plants. Ph.D. Dissertation. Gauhati University. <http://hdl.handle.net/10603/69707>.
- Siddappaji, C. and Lingappa, S. 1977. *Peltotrachelous cognatus* MSHL. (Curculionidae: Coleoptera) a new pest of orchard crops. *Current Science*, **46**(9): 307-308.
- Singh, G. 1988. Management of major mango insects affecting flowering and fruiting with some newer insecticides. *Acta Horticulturae*, **231**: 607-611.
- Singh, H. S. 2014. Management of fresh leaf-cutting weevil, *Deporaus marginatus* (Pascoe) in mango. *Insect Environment*, **20**(1): 19-20.
- Singh, H. S., Mandal, S. and Hegde, M. R. 2014a. Insect pests of tropical and sub-tropical underutilized fruits. In: National seminar on strategies for conservation, improvement and utilization of underutilized fruits. Central Horticultural Experiment Station, ICAR-IIHR, Chettalli, Karnataka, December 1-3, 2014.
- Singh, J. P., Jaiswal, A. K. and Md. Monobrullah. 2014b. First record of some insect pests on commercial lac host plant, *Ziziphus mauritiana* from India. Proceedings of the National Academy of Sciences, India-Section B: Biological Sciences, **86**(2): <https://doi.org/10.1007/s40011-014-0400-1>.
- Soh, P. G. and Khoo, K. C. 1983. Field evaluation of four insecticides for the control of the mango leaf-cutting weevil, *Deporaus marginatus* Pascoe. Malaysia. *Pertanika*, **6**: 67-70.
- Solomon, J. D. 1995. *Guide to the insect borers in north American broadleaf trees and shrubs*. US Department of Agriculture Forest Service. Washington DC Agriculture Handbook AH-706.
- Srivastava, K., Patel, R. K., Kumar, A., Rai, R. R. and Nath, V. 2015. Seasonal incidence and management of ash weevil (*Myloecerus undecimpustulatus*) population on litchi. *The Ecoscan Special issue*, **8**: 161-165.
- Srivastava, K., Singh, S., Marboh, E. S. and Patil, P. 2020. Monograph on Litchi Insect Pests: Smart Management Options. ICAR-AIRCP on Fruits, ICAR-Indian Institute of Horticultural Research, Bengaluru, Karnataka (India).
- Tara, J. S., Azam, M., Ayri, S., Feroz, M. and Ramamurthy, V. V. 2009. Bionomics of *Hypolixus truncatulus* (Coleoptera, Curculionidae, Lixinae, Lixini), a major pest of *Amaranthus caudatus* L. *Munis Entomology & Zoology*, **4**(2): 510-51.
- Tara, J. S., Sharma, S. and Kour, R. 2010. A record of weevil (Coleoptera: Curculionoidea) diversity from District Samba (J&K) *The Bioscan*, **5**(3): 391-394
- Thomas, M. C. 1996. The primitive weevils of Florida (Coleoptera: Brentidae: Brentinae). *Entomology Circular*, 375.
- Thomas, M. C. 2007. http://entnemdept.ufl.edu/creatures/trees/beetles/primitive_weevils.htm. Accessed 28 May 2020.
- Tigvattnanont, S. 1988. Biological and autecological studies of the mango leaf cutting weevil, *Deporaus marginatus* Pascoe (Coleoptera: Attelabidea), *Kaen Kaset*, **16**: 51-52.
- Tom, H. and Kaippallil, J. D. 2016. A preliminary study on the diversity of coleopterans in a rural area in Changanacherry, Kerala. *Journal of Entomology and Zoology Studies*, **4**(5): 297-300.
- Uddin, M. A., Sikdar, B. and Sardar, M. A. 2014. Biological Investigation of the mango leaf cutting weevil, *Deporaus marginatus* Pascoe, in laboratory and nursery. *Indian Journal of Scientific Research*, **5**: 133-141.
- Uddin, M. A., Islam, M. S., Rahman, M. A., Begum, M. M. and Hasznuzzaman, A. T. M. 2003. Susceptibility of different varieties of mango to leaf cutting weevil, *Deporaus marginatus* Pascoe and its control. *Pakistan Journal of Biological Sciences*, **6**: 712-714.
- Zarzaga, M. A. A. and Lyal, C. H. C. 1999. *A World catalogue of Families and Genera of Curculionidae Insect: Coleoptera*. Entomopraxis, S. C. P. Spain.

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