

Status of stone weevil, *Aubeus himalayanus* Voss (Curculionidae: Coleoptera) in India: An emerging pest of *ber* (*Ziziphus mauritiana* Lamk)

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Abstract

The Indian jujube, popularly known as *ber* (*Ziziphus mauritiana* Lamarck), is an important fruit crop grown in arid and semi arid regions of India and worldwide. Nutritionally, the fruits are rich in protein, phosphorus, calcium, carotene and vitamin C. In India, there are various factors responsible for yield losses in terms of quantity as well as quality. Of these, biotic stresses such as pests and diseases are of prime importance. Among the various insect-pests infesting *ber*, the stone weevil *Aubeus himalayanus* Voss (Curculionidae: Coleoptera) seems to be a new threat to *ber* cultivation in India as in recent years severe infestation has been reported in different *ber* growing region viz., Anantapur (Andhra Pradesh), Rahuri (Maharashtra), Jobner (Rajasthan), Bijapur (Karnataka) and Bikaner (Rajasthan). In addition, the infestation of this pest was also reported from Bangladesh. The adult female weevil, characterized by dark brown snout, usually lays eggs on the styler end of fruits and rarely on the distal end. The newly emerged white colour grubs enter into seed by making puncture in endocarp at immature stage and starts feeding on soft seed coat. Later it enters into endosperm moving downward and starts feeding upon inner content of the seed, and pupates within the seed by making hollow galleries. The weevil completes its life within a single fruit. The infestation results in severe fruit drop at initial stage of fruit set. The damage intensity of stone weevil varies with cultivars as varieties with larger stone are preferred over those, which have higher pulp content. Periodical monitoring of orchard for weevil incidence is essential for devising suitable strategies for efficient management of pest in time. Detection at advance stages of infestation would render it difficult to manage as pests enters into the seed.

Keywords: *Ber*, *Ziziphus mauritiana*, stone weevil, *Aubeus himalayanus*

Introduction

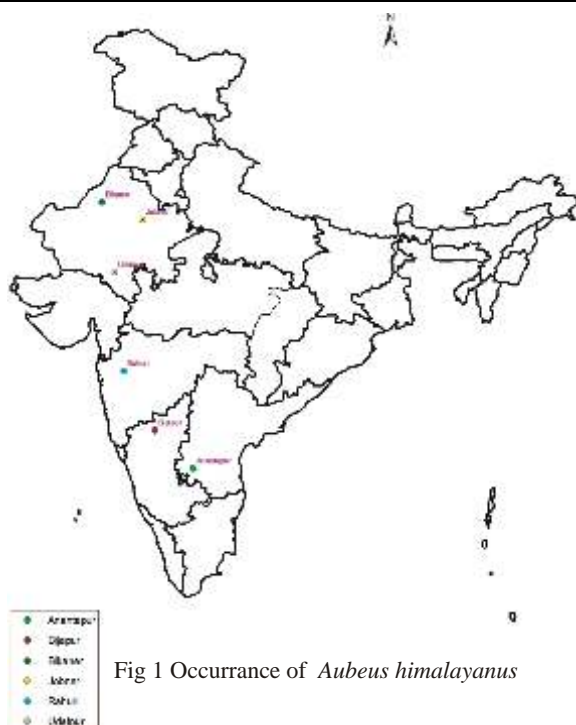
The Indian jujube or *ber* (*Ziziphus mauritiana* Lamarck) also called as desert apple, jujube, *Chines apple*, *Badari* (Sanskrit), *Kul* or *Boroi*, *Dongs*, *Boroi*, *Bor*, *Beri*, Indian plum, *Permseret* (Anguilla) is a tropical fruit tree species, belonging to the family *Rhamnaceae* (Balikai, 2013). In India, it occupies large area (22,000 ha) and/ is a popular dry land fruit crop for arid and semi-arid regions of India (Jamandar *et al.*, 2009). Most of the cultivated areas are confined to Rajasthan, Haryana, Punjab, Gujarat, Maharashtra and Uttar Pradesh states of India. To some extent, its cultivation is also practiced in the states of Tamil Nadu, Andhra Pradesh, Karnataka, Bihar, Chhattisgarh, Madhya Pradesh, Assam and West Bengal. The fruits are quite nutritious, rich in vitamin C, second only to aonla and guava and much higher than citrus and apple (Khera and Singh, 1976). The crop is gaining popularity among the growers because of its adaptability to adverse climatic condition and good returns. However, the avoidable loss is more due to insect-pests and diseases (Singh, 2008). The

introduction of improved varieties and irrigation leads unpredictable change in insect-pests in this eco-system. In India, more than 130 species of insect-pests are reported infesting *ber* (Lakra and Bhatti, 1985); however, very few have attained the pest status in terms of economic loss. Jothi and Tandon (1995) reported 17 insect species, while Balikai (1999) reported a total of 22 insects and non-insect species from Karnataka. Likewise, Kavitha and Savithri (2002) documented about 23 insect species on *ber* from Andhra Pradesh state of India. However, the pests such as fruit fly, *Carpomyia vesuviana* Costa; chafer beetles, *Holotrichia consanguinea* Blanch and bark eating caterpillars, *Indarbela tetraonis* Moore; *Indarbela quadrinotata* Walker and *ber* butterfly, *Tarucus theophrastus* Fabricius are the major pests of *ber* in India, which cause significant yield losses (Sharma and Bal, 2009; Karuppaiah *et al.*, 2010). Besides, in recent years stone weevil seem to be an emerging pest of *ber*, which has been reported from various regions of India (Balikai *et al.*, 1998; Karuppaiah *et al.*, 2010; Balikai *et al.*, 2013). The pest is an emerging threat for *ber* production in India, especially, in northern regions. However, the available literature indicates that in India only very few studies have been made on its management.

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Table 1 . Details of stone weevil incidence reported from different regions of India and Bangladesh

S.No.	Location	Reference
India		
1	Anantpur (Andhra Pradesh)	Gour and Sriramulu (1994)
2	Rahuri (Maharashtra)	Pareek and Nath (1996)
3	Bijapur (Karnataka)	Balikai <i>et al.</i> (1998)
4	Jobner (Rajasthan)	Pareek and Nath (1996) ; AICRP (2004)
5	Udaipur (Rajasthan)	Srivastava and Nanada (1983)
6	Bikaner, (Rajasthan)	Karuppaiah <i>et al.</i> (2010)
7	Bangladesh	Qumruzzaman <i>et al.</i> (2009)



Therefore, there is a need to systematically investigate bio-ecology of pest so as to devise a successful management strategy to counter this notorious pest. Keeping these facts in view, here authors have attempted to review the available information about this emerging pest, which would be useful to formulate suitable management strategies against this menacing pest in near future.

Distribution

The heavy occurrence of *ber* stone weevil, *Aubeus himalayanus* has been reported from major *ber* growing region of the India (Fig 1). At first it was recorded as a new pest of *ber* for the first time from Andhra Pradesh state of India (Gour and Sriramulu, 1994). Later, from Rahuri, Maharashtra and Jobner, Rajasthan of India in 1996 (Pareek and Nath, 1996; AICRP, 2003) Karnataka state of India (Balikai *et al.*, 1998) and recently in Bikaner district of



Fig 2 Damage symptoms of stone weevil, *Aubeus himalayanus*

Rajasthan, India during 2010 (Karuppaiah *et al.*, 2010 & 2012). Apart from India, the severe damage of this pest at early stage of fruit development has also been reported from Bangladesh (Qumruzzaman *et al.*, 2009) (Table 1).

Nature of damage

The adult weevils are small dark in colour with snout. The grubs are white in colour with red colour marking on the body, which harbor inside the seeds (Balikai *et al.*, 2009; Karuppaiah *et al.*, 2010 & 2011). Grubs directly damage the fruits by tunneling inside seeds, while egg laying by adult weevil also blemishes mature fruit. The activity of adult beetle could be observed in the field during morning and evening hours. The adult female weevil lays their eggs mostly on the stylar end; rarely on the distal end of fruits and egg laid punctures covered with brown encrustation. Upon hatching, the grubs enter into seed by puncturing endocarp at immature stage and starts feeding on

soft seed coat. Later it enters into endosperm moving downward. After entering the seed, it starts feeding on inner content of the seed, and pupates within the seed by making hallow galleries. The weevil completes its life within a single fruit (Karuppaiah *et al.*, 2010) (Fig 2). The developing soft seed was completely eaten away by the pest. At the time of fruit maturity, in the hollowed area, infested fruits had a grub, a pupa or an adult. The infestation occurs in all the fruit stages; however, it is prevalent in pea to pebble size fruits. They are abnormal shape and nearly half portion of the fruit towards stalk turns reddish brown with rough surface and the remaining half portion towards stylar region remains greenish colour. The infested fruits fail to attain full maturity and never attain size more than the pebble. This is because of the fact that the pest feeds only on the seeds of developing fruit and arrests further development of infested fruit. The entry hole heals up and closes, while the exit hole remains open and can be seen easily. While looking onto the nature of damage and its incidence pattern, it can be concluded that the pest enters into the fruits at early stage of fruit development and the entry holes gets healed up subsequently (Balikai *et al.*, 2009), making it difficult to control the pest. The biology of this pest has not been studied so far.

Seasonality

The activity of adult weevil starts from month of September and adults start egg laying from blooming stage onwards and severe damage could be observed during October month. The incidence could be noticed still at the end of fruiting i.e. till February. In western Rajasthan of India, the pest was initially recorded during the first fortnight of October on cv. Seb and second fortnight of October on cv. Gola. The greatest infestation was registered during the first fortnight of December. Immature fruit drop was most pronounced on the second fortnight of November. The damage was severe in cv. Seb (Karuppaiah *et al.*, 2010). The damage was noticed during July to August in Karnataka and maximum damage was observed during July to August months. Irrespective of varieties, the incidence was recorded during the months of July to November (Balikai, 2009). The extent of damage also found to be associated with the pruning dates. Severe infestation of stone weevil among early pruned *ber* cultivar Umran reported by Biradar *et al.* (2001). The intra tree distribution pattern of stone weevil incidence revealed non-significant difference with different directions of the plant; however, the incidence in different stratum of the plant showed significant difference. The branches which are examined just above the ground (0-1m), showed maximum (33%) infestation as compared to the branches at 1-2m and above 2m height from the ground. The branches near the ground might be suitable for adults, emerging from residues or surviving population on the tree. Generally infestation decreased from lower branches to top branches (Karuppaiah *et al.*, 2010). Correlation analysis

with abiotic factors reported to have the negative correlation between per cent infestation and temperature and positive correlation with the relative humidity and rainfall (Karuppaiah *et al.*, 2014).

Varietal preference

The influence of biophysical factors of *ber* fruits plays a major role on the intensity of damage by *ber* stone weevil. The variety with high pulp: stone ratio is attracted more than the lower pulp: stone ratio and fruit shape also could be a reason. The varieties like Umran and Seb are preferred more for the egg laying. The mean damage was up to 23.63% in Gola and 43.28% in Seb. The fruit dropping was more in Seb (73.48%) than the Gola (48.52%) (Karuppaiah *et al.*, 2010). The maximum infestation of stone weevil was recorded in the cultivar Seb followed by Mundia and Umran and it caused about 10.3% loss in fruit yield (Srivastava and Nanda, 1983). The damage was severe in the cultivar Umran and the per cent abnormal fruits due weevil damage were up to 5 to 10. The higher seed content probably could be the reason for higher damage (Balikai, 2009). The severe infestation of nut weevil during the early stages of development in *Z. mauritiana* cv. Thaikul had also been reported from the Bangladesh (Qumruzzaman *et al.*, 2009). Among the seven different cultivars observed for fruit weevil incidence, the maximum infestation was recorded in the cultivar Umran (38.9%) followed by Thar Sevika (35.75%), Seb (35.08%), Thar Bhuhraj (28.18%), Gola (24.59%), Goma Kirti (21.65%) and Banarasi Kadaka (7.05%). The correlation between the bio-physical characters, pulp: stone ratio (PSR) of *ber* fruits reveals positive correlation with weevil infestation. The varieties with higher proportion of stone are more preferred by the adult weevil for egg laying and results suggests bio-physical characters of cultivars play major role in fruit weevil infestation (Karuppaiah *et al.*, 2014).

Management

The pest feeds only on the seed portion of developing fruits and arrest further development of attacked fruit. The entry hole is healed up and closed while the exit hole can be clearly seen. As the damage is hidden in nature, the periodical monitoring of adult weevil activity will pave the way to detect the infestation at an early stage of infestation. For its management, the spray schedule must be started from flowering to fruit set stage only. Spraying of Carbaryl 50 WDP 0.1% just before the fruit setting and repeat the sprays at three weeks interval was found effective and showed least adverse effect on honey bees activity (AICRP, 2003). Collection and destruction of adult weevil immediately after detection can also reduce the population. Infested dropped fruits should be collected and burned to break the generation cycle (Karuppaiah, 2013). Application of spinosad 2.5 SC found to give significant reduction in weevil incidence and indoxacarb 14.5 EC, NSKE 5% and

azadirachtin 2000ppm and 1000ppm also found to be superior over control treatment in minimizing the weevil incidence (AICRP, 2012)

Conclusion

Ber stone weevil is a new threat to *ber* production in India as it causes direct loss to the fruit yield. In last few decades, the sporadic incidence of this pest has been reported from various parts of the *ber* growing region of India. However, presently it seems to be regular pest of *ber* and severe damage has also been reported in few cultivation pockets. The distribution of stone weevil incidence reveals that the transport of planting material from one place to another place could be the reason for the pest dissemination and establishment in new areas (Qumruzzaman *et al.*, 2009). In India, very few studies have been conducted and little information is available about this notorious pest. While looking nature and intensity of damage, it needs to be studied critically and being the emerging issue, the detailed investigation on the biology and management protocol need to be developed for the successful management under changing climatic scenario.

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