



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2017; 5(5): 1450-1455

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Received: 07-07-2017

Accepted: 08-08-2017

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## Important longhorn beetles (Coleoptera: Cerambycidae) of horticulture crops

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**Abstract**

The longhorn beetles are distributed globally from sea level to mountain sites as high as 4,200 m altitude wherever their host floras are available. All the members of the family Cerambycidae are either phytophagous or xylophagous. Many species are important pests of forests, plantations, fruit and street trees. Usually, the adults are known to girdle twigs or branches to feed on foliage or blossoms. The longhorn beetles inflict damage to plants by feeding internally the heart wood or sapwood and sometimes acting as root borers or gall formers. In recent times extensive cultivation of crop combined with greenhouse effect causes many longhorn beetles to become serious pests in horticulture ecosystem. Mainly the plantations and fruit crops are threatened by longhorn beetle which results in reduced vigour and complete death of plants.

**Keywords:** Longhorn beetles, Horticulture crops, Serious Pest, Damage

**Introduction**

Of the estimated 1.088 million animal species (excluding synonyms and infra-species) described worldwide, insects represent 0.795 million (73%) of the species, and beetles account for about 0.236 million (30%)<sup>[1]</sup>. These include an estimated 33,140 species of Cerambycidae<sup>[2]</sup>. India contains 1555 species (4.54%) longhorn beetles<sup>[3]</sup>. It is widely accepted that tropical parts of the world on both sides of the equator are the richest in diversity<sup>[4]</sup> and hold much of the unknown or poorly known animal diversity which also includes longhorn beetles<sup>[5]</sup>. These beetles are distributed world-wide from sea level to mountain sites as high as 4,200 meter elevation wherever their host plants are found; cerambycids have long been a favorite with collectors<sup>[6]</sup>.

All the members of the family Cerambycidae are either phytophagous or xylophagous<sup>[7]</sup>. They also decompose dead-wood, incorporate plant parts to the ground and allowing the renewal of forests by opening spaces and consequent seed germination<sup>[8]</sup>. The larvae bore into trunks of trees belonged to various families and eat the internal content<sup>[9]</sup>. Usually the adults are known to girdle twigs or branches to feeding on foliage to blossoms. Adults are also known to imbibe fermenting sap or feed on fermenting fruit, pollen, nectar or fungal spores<sup>[10, 11]</sup>.

Adaptation to such a large variety of host plants has resulted in tremendous variation in the behaviour and ecology of these borers. Many species are important pests of forests, plantations, fruit and street trees. Different species attack various types of trees and shrubs. A few species attacks living trees, but most of them appear to prefer freshly cut woods or weakened and dying branches or trees. Conversely, some are beneficial insects through their role as insect pollinators on certain plant species<sup>[9, 12]</sup>.

Few species of them were used as biocontrol agents against some annual or perennial weeds in different parts of the world. Cerambycidae, *Alcidion cereicola* Fisher was approved for release in Queensland, Australia for the control of *Eriocereus martinii* Lab<sup>[13]</sup>.

The family Cerambycidae consist of many economically important pests among the recorded insects in the world. Chiefly, the larvae of longhorn beetles are phytophagous and inflict damage by acting as borers of sapwood or heart wood by feeding on bark or phloem, and acting as root borers or sometimes gall formers. Larvae are known to develop in dead wood, live woody plant or herbaceous stems. Larvae are infrequently noticed feeding on cones or seed pods or entirely within the seeds. Few start their life in lianas/woody climbers and later make their transition to the wood of the supporting tree<sup>[10, 11, 14]</sup>. Most of the longhorn larvae live in tunnels which are tightly packed behind with wood-dust but some species keep the tunnel clean by ejecting the frass through holes to the outside viz., *Aphrodisium*, *Apriona*, and *Celosterna*<sup>[11]</sup>.

### Longhorn beetle pest and their host range in horticulture crops

Beeson and Bhatia <sup>[15]</sup> documented 350 cerambycid species, associated with 568 species of trees, shrubs, and woody climbers. Kariyanna *et al.* <sup>[16]</sup> reported that, the intensive agriculture coupled with global warming has resulted in many longhorn beetle species becoming serious pests on agriculture and forest trees causing severe economic damage. A total of thirty-one species of beetles under 26 genera, 17 tribes of 4 subfamilies were considered as a pestiferous to agriculture crops. Among them few species are considered as a potential pest with extensive host range and have ability to cause loss up to 40-60 per cent in horticulture ecosystem is listed below.

#### 1. *Chelidonium cinctum* (Guérin-Méneville, 1844)

**Synonyms:** *Callichroma cincta* Guérin-Méneville, 1844: 220. *Polyzonus cinctus* White, 1853b: 171.

**Host range:** *Citrus aurantium*, *Citrus medica* <sup>[10, 16]</sup>.

**Distribution:** India (Southern India: Nilgiri Hills; India Orientalis).

#### 2. *Pseudonemophas versteegii* (Ritsema, 1881)

**Synonyms:** *Monohammus versteegii* *Monohammus albescens* Pic, 1920: 2. *Monochamus glabronotus* Pic, 1934: 34. *Monochamus albescens* v. *subuniformis* Pic, 1934: 34. *Anoplophora versteegi* m. *albescens* Breuning & Itzinger, 1943: 44. *Anoplophora* (*Anoplophora*) *versteegi* Breuning, 1944: 290. *Anoplophora* (*s. str.*) *versteegi* Gressitt, 1951: 372. *Anoplophora versteegi* Hayashi, 1971: 15. *Pseudonemophas versteegii* Hua, 2002: 227. *Anoplophora* (*s.s.*) *versteegi* subsp. *siamensis* Breuning, 1982: 17.

**Host range:** *Citrus* spp. *Citrus aurantium* and *Citrus medica* <sup>[16]</sup>. This pest can cause serious damage on citrus (41.4 to 62.3%) in many North-East Indian states.

**Distribution:** India (Assam; North Indian; Sikkim).

#### 3. *Neoplocaederus ferrugineus* (Linné, 1758)

**Synonyms:** *Cerambyx gigas* Fabricius, 1787: 132. *Cerambyx ferrugineus* Linné, 1758: 390. *Cerambyx gigas* Fabricius, 1787: 132. *Hammaticherus nitidus* White, 1853: 127. *Cerambyx versutus* Pascoe, 1859: 20. *Plocaederus ferrugineus* Gahan, 1890: 51. *Plocaederus ferrugineus* var. *niger* Gahan, 1890: 51

**Host range:** *Anacardium occidentale*, *Bombax malabaricum*, *Boswellia serrata*, *Buchanania latifolia*, *Diospyros melanoxylon*, *Hardwickia binate* and *Lannea grandis* <sup>[10, 16]</sup>.

**Distribution:** India (Kerala: Trivandrum; Indian Orientalis, West Bengal).

#### 4. *Xylotrechus quadripes* Chevrolat, 1863

**Synonyms:** *Clytus sappho* Pascoe, 1858: 239. *Clytus javanicus* Castelnau & Gory, 1841: 87. *Xylotrechus javanicus* Pascoe, 1869: 610. *Xylotrechus lyratus* Pascoe, 1869: 610. *Cucujus coffeophagus* Richter, 1876: 250. *Xylotrechus* (*s. str.*) *quadripes* Gressitt, 1951: 250.

**Host range:** *Coffea arabica*, *Cudrania javanensis*, *Jasminum dispernum*, *Premna pyramidata*, *Rhus semiciliata*, *Tectona grandis* <sup>[10, 16]</sup>. In coffee, white stem borer *Xylotrechus quadripes* cause economic damage up to 93.6 per cent on arabica variety.

**Distribution:** India (Assam; Karnataka: Coorg; Hill districts of southern India; Tamil Nadu; India Orientalis).

#### 5. *Batocera rufomaculata* (Degeer, 1775)

**Synonyms:** *Cerambyx rufomaculatus* Degeer, 1775: 107. *Cerambyx rubiginosus* Voet, 1778: 14. *Cerambyx* (*Stenocorus*) *cruentatus* Gmelin, 1790: 1863. *Batocera chlorinda* Thomson, 1857: 171. *Batocera thysbe* Thomson, 1878: 52. *Batocera polli* Gahan, 1890: 55. *Batocera diana* Nonfried, 1892: 276. *Batocera rubra* Ballou, 1916: 1. *Batocera rufomaculata* m. *flavescens* Breuning, 1950: 519. *Batocera* (*Batocera*) *rufomaculata* Duffy, 1960: 187. *Batocera rufomaculata rufomaculata* Ambrus & Grosser, 2012: 456

**Host range:** *Adina cordifolia*, *Albizia lebbek*, *Artocarpus integrifolia*, *Barringtonia acutangula*, *Bauhinia acuminata*, *Bombax malabaricum*, *Broussonetia papyrifera*, *Buchanania latifolia*, *Carica papaya*, *Cocos nucifera*, *Dalbergia sissoo*, *Dyera costulata*, *Erythrina indica*, *Eugenia jambolana*, *Ficus bengalensis*, *Ficus carica*, *Ficus elastica*, *Ficus glomerata*, *Ficus infectoria*, *Ficus religiosa*, *Ficus tjakela*, *Garuga pinnata*, *Hevea brasiliensis*, *Lannea grandis*, *Mangifera indica*, *Moringa pterygosperma*, *Morus indica*, *Platanus orientalis*, *Semecarpus anacardium*, *Shorea robltsta*, *Spondias mangifera*, *Sterculia colorata*, *Sterculia villosa* <sup>[10, 16]</sup>.

**Distribution:** India (Indian orientalis; Assam; Andaman Island; Tamil Nadu: Tiruchinapalli; Arunachal Pradesh)

#### 6. *Olenecamptus bilobus* (Fabricius, 1801)

**Synonyms:** *Saperda biloba* Fabricius, 1801: 324. *Olenecamptus bilobus dahl* Kriesche, 1926: 375. *Olenecamptus bilobus* m. *quinquemaculata* Breuning, 1940a: 555. *Olenecamptus bilobus* m. *confluens* Breuning, 1940a: 556. *Olenecamptus bilobus* m. *reductemaculatus* Breuning, 1969a: 665

**Host range:** *Artocarpus blumei*, *A. chaplasha*, *A. hirsuta*, *A. integrifolia*, *Bauhinia* sp., *Ficus bengalensis*, *F. carica*, *F. elastica*, *F. glomerata*, *F. infectoria*, *F. laccifera*, *F. religiosa*, *F. roxburghii*, *F. rumphii*, *F. tjakela*, *Litsaea polyantha*, *Mangifera indica*, *Morus indica* <sup>[10, 16]</sup>.

**Distribution:** India (Sikkim; Andaman and Nicobar Islands; Arunachal Pradesh)

#### 7. *Trirachys holosericea* (Fabricius, 1787)

**Synonyms:** *Ceramryx holosericeus* Fabricius, 1787: 135. *Hammaticherus holosericeus* White, 1853: 128. *Pachydissus velutinus* Thomson, 1865: 576. *Pachydissus similis* Gahan, 1890: 52. *Neocerambyx similis* Bates, 1891: 21. *Æolesthes holosericeus* Gahan, 1891: 20. *Aeolesthes* (*s. str.*) *holosericea* Gressitt & Rondon, 1970: 65. *Aeolesthes* (*Aeolesthes*) *holosericea* Makihara *et al.*, 2008: 99.

**Host range:** *Acacia arabica*, *Aegle marmelos*, *Alnus nitida*, *Anogeissus latifolia*, *Bauhinia acuminata*, *Bauhinia retusa*, *Bauhinia variegata*, *Bombax malabaricum*, *Bridelia retusa*, *Butea frondosa*, *Careya arborea*, *Cedrela toona*, *Chloroxylon swietenia*, *Duabanga sonnera*, *Eucalyptus robusta*, *Excaecacaria agallocha*, *Ficus bengalensis*, *Grewia oppositifolia*, *Hardwickia binata*, *Kydia calycina*, *Lagertsroemia parviflora*, *Lannea grandis*, *Mallotus philippinensis*, *Mangifera indica*, *Miliusa velutina*, *Morus alba*, *Myristica andamanica*, *Ougeinia dalbergioides*, *Pinus longifolia*, *Prunus communis*, *Psidium guajava*, *Pterocarpus marsupium*, *Pyrus communis*, *Quercus incana*, *Sapium sebiferum*, *Shorea assamica*, *Shorea robusta*, *Soymida febrifuga*, *Tamarix articulata*, *Tectona grandis*, *Terminalia belerica*, *Terminalia myriocarpa*, *Terminalia tomentosa*; *Terminalia arjuna*, *Albizia lebeck*, *Samanea saman*, *Acacia chundra*, *Artocarpus hirsutus*, *Malus domestica* [10, 16, 17, 18, 19, 20, 21].

**Distribution:** India (Arunachal Pradesh; Jammu; Maharashtra: Kolhapur District).

### 8. *Sthenias grisator* (Fabricius, 1787)

**Synonyms:** *Lamia grisator* Fabricius, 1787: 136.  
*Sthenias* (*Sthenias*) *grisator* Breuning, 1962: 430.

**Host range:** *Beaumontia grandiflora*, *Bougainvillea* sp., *Chloroxylon swietenia*, *Croton* sp., *Erythrina indica*, *E. lithosperma*, *Manihot utilissima*, *Moringa* sp., *Morus alba*, *Nerium odoratum*, *Rosa*, sp., *Tabernaemontana alba*, *Vitis vinifera*, *Wrightia tinctoria* [10, 16].

**Distribution:** India (Tamil Nadu: Nagapattinam, Coimbatore; Karnataka: Coorg; India Orientalis; Arunachal Pradesh)

### 9. *Acanthophorus serraticornis* (Olivier, 1795)

**Synonyms:** *Prionus serraticornis* Olivier, 1795: 14.  
*Acanthophorus* (*Acanthophorus*) *serraticornis* Lameere, 1910: 246.  
*Prionus damicornis* Bergier, 1941: 222.

**Host range:** *Bombax malabaricum*, *Mangifera indica*, *Morus alba* and *Shorea robusta* [10, 16].

**Distribution:** India (India Orientalis; Pondicherry; Tamil Nadu: Madras; Karnataka: Bangalore, Mysore; Maharashtra; Kerala: Trivandrum; Chhattisgarh; Andaman Island; Bihar; Madhya Pradesh; Odisha; Sikkim).

### 10. *Celosterna scabrator* (Fabricius, 1781)

**Synonyms:** *Lamia scabrator* Fabricius, 1781: 224.  
*Lamia spinator* Fabricius, 1798: 145.  
*Lamia gladiator* Fabricius, 1801: 284.  
*Psaromaia renei* Pascoe, 1888: 501.  
*Aristobia murina* Nonfried, 1894: 82.  
*Celosterna spinator* Fletcher, 1914: 325.  
*Celosterna scabrator* var. *griseator* Aurivillius, 1920: 372.  
*Cerosterna scabratrix* Löbl & Smetana, 2010: 279.

**Host range:** *Acacia arabica*, *A. catechu*, *Cassia siamea*, *Casuarina equisetifolia*, *Pithecolobium dulce*, *Prosopis juliflora*, *P. spicigera*, *Tectona grandis*, *Zizyphus jujube* and *Vitis vinifera* [10, 16].

**Distribution:** India (India Orientalis; Tamil nadu: Kodaikanal Mountain, South Arcot, Tirunelveli; Karnataka: Bangalore; South India; Uttar Pradesh; Chhattisgarh).

### 11. *Stromatium barbatum* (Fabricius, 1775)

**Synonyms:** *Callidium barbatum* Fabricius, 1775: 189.  
*Cerambyx* (*Callidium*) *tranquebaricus* Gmelin, 1790: 1848.  
*Callidium funestum* Boisduval, 1835: 481.  
*Callidium variolosum* Fabricius, 1798: 149.

**Host range:** *Anacardium occidentale*, *Tectona grandis*, *Zizyphus jujube* and 350 different kinds of wood are attacked [5, 16].

**Distribution:** India (Tamil Nadu: Nagapattinam; Manipur; Arunachal Pradesh; Pondyicherry: Mahe; Karnataka: Bellary; Uttar Pradesh: Asansole, Kunbir; India Orientalis; Andaman Island).

### III. Damage on fruit trees and commercial crops in India

The behaviour and reproductive strategies of adult cerambycids are shaped by host requirements of the larval stage [22]. The larvae of most cerambycids bore into shoots, twigs, stems and roots of woody plants. A few small species develop in seeds while, others attack herbaceous plants [23]. Many plantation and fruit crops are prone to longhorn beetle which result in reduced yield or complete death in the case of severe incidence.

#### Cucurbits (*Cucurbita moschaeta*)

*Apomecyna saltator* beetle feeds and lays eggs in the stems of living pumpkin and the larva tunnels along pith and surrounding tissues. The life cycle lasts for 35 to 50 days in hot weather with 3 or 4 generations per year. Emergence from dry climbers of the overwintered generation occurs from May to September [10]. Kariyanna *et al.* [16] stated that, the *Apomecyna saltator* is causing greater damage on cucurbit crop in almost all part of the India.

#### Apple (*Malus pumila*)

*Aeolesthes holosericea* (Fabricius, 1787) is a destructive pest of apple trees in Jammu and Kashmir. The grubs of *A. holosericea* are known to damage healthy green trees, sickly standing trees and even freshly felled trees [24, 25]. The *Apriona germarii* in North-eastern India and *Aeolesthes holosericea* in Jammu and Kashmir was more threatening longhorn beetles on *Anacardium occidentale* [16].

#### Cashew (*Anacardium occidentale*)

The stem and root borer (*Neoplocaederus ferrugineus* L.) of the cashew plant is a most serious pest of cashew as its damage results in death of trees. It is an internal tissue borer and infestation was up to 40 per cent in different periods and severely attacked trees die within a period of two years causing substantial tree loss. The infestation by the pest is more severe in neglected plantations [26]. The problem of *Neoplocaederus ferrugineus* in Karnataka and Kerala and *Prionomma atratum* in South and Central India is pronouncing recent pass on cashew orchards [16]. Severely attacked trees die within a period of two years causing capital loss to the growers needing to uproot and replace the infested trees. Existing pest management strategies utilizing cultural, mechanical and chemical control methods have met with limited success mainly due to the cryptic life-cycle of the borer inside the trunk and roots [27, 28, 29, 30, 31].

#### Citrus (*Citrus* spp.)

The citrus trunk borer, *Anoplophora versteegi* Ritsema is the most destructive pest of citrus in the entire north eastern

region of India [32, 33]. Kunhikannan [34, 35] recorded *Chelidonium cinctum* (Guer.) in citrus from south India. Kariyanna *et al.* [16] reported the *Pseudonemophas versteegii* from North-eastern India and *Chelidonium cinctum* in south India on citrus plants.

#### Grape vine (*Vitis vinifera*)

The stem borer is one among the pests which assumed a serious pest status in the recent past and turned out to be one of the limiting factors in grape cultivation. The grubs of *Celosterna scabrata* Fabr. (Coleoptera: Cerambycidae) are the commonly occurring stem borer in grapes [36]. The damage by *Sthenias grisator* in Southern India and *Celosterna scabrator* in Southern India and Northern India was normally seen on grapes plants [16].

#### Coffee (*Coffea arabica*, *Coffea robust*)

The coffee white stem borer (CWSB), *Xylotrechus quadripes* (Chevrolat) (Coleoptera: Cerambycidae), is the most problematic pest of arabica coffee in some Asian countries [34, 37, 38]. The monitory importance of the CWSB is greatest in India as it is a major producer of arabica coffee in Asia [39]. Arabica and robusta coffee varieties are equally planted over a total area of about 3,50,000 hectare [40]. As per the opinion of the majority of growers, stem borer is the prime threat to arabica coffee, many times crop losses can reach up to 93.6 per cent in some plantations when timely management is not implemented [41]. Monitory losses caused by the uprooting of stem borer affected plants at the rate of one plant per ha result in a total loss of about US \$6,42,585 annually in India [42]. In India, over nine million trees are destroyed every year due to infestation by CWSB, which costing around \$40 million annually for replacement and loss in production [43]. The annual loss due to the CWSB in India is \$17.5–26 million [44]. The major host plants of *Xylotrechus javanicus* [45] are coffee, *Quercus*, *Pinus*, and *Salix* [46]. The crop loss caused by the coffee white stem borer (CWSB) due to the uprooting of infested trees in India varies from 2.3 to 12.5 per cent when integrated pest management (IPM) tactics are applied and from 17.8 to 20 per cent with heavy infestation [47]. Many studies have indicated an infestation of 6.6 per cent in lowland and 9.7 per cent in hilly areas [48].

The proportion of borer incidence is related to the age of the plants, with a maximum infestation of 8.3 per cent observed in old plants and only 0.7 per cent in very young plants in India [48]. In Vietnam, mean yearly crop losses caused by the CWSB are about 7.0 per cent [49].

The *Xylotrechus quadripes* in Karnataka and Tamil Nadu, *Sthenias grisator* in Southern India, *Batocera rufomaculata* in North-eastern India and Southern India, *Apriona germarii* in North-eastern India and *Epepeotes uncinatus* in North-eastern India and Southern India are attacks on coffee plants [16]. It shows that the coffee plant is prone to more than one type of longhorn beetle species.

#### Mango (*Mangifera indica*)

Rahaman [50] and Ayyar [51] reported *Batocera rufomaculata* DeG., *B. royeli* Hope and *B. titana* Thoms. on mango crop in India. Kariyanna *et al.* [16] reported *Glenea multiguttata* in Nilgiri Hills, *Olenecamptus bilobus* in North-eastern India and Southern India, *Batocera rufomaculata* in North-eastern India and Southern India, *Batocera numitor* in Southern India, *Acanthophorus serraticornis* in South and Central India, *Neoplocaederus obesus* in North-eastern India, *Aeolesthes holosericea* in Karnataka and Maharashtra are causing severe

incidence on mango crop and the place act as hotspot for them.

#### Mulberry (*Morus* spp.)

*Apriona germari* Hope (Coleoptera: Cerambycidae), a mulberry longicorn beetle commonly found in China, Japan, Korea, Vietnam, Burma and India, is a polyphagous pest infesting healthy hosts including *Orus* spp., *Salix* spp. and *Populus* spp. [10, 52, 53]. Khan *et al.* [54] concluded that, *A. germari* is a major pest of mulberry plants in Northern India. Kariyanna *et al.* [16] reported that, major incidence of *Olenecamptus bilobus* in North-eastern India and Southern India, *Sthenias grisator* in Southern India, *Batocera rufomaculata* in North-eastern India and Southern India, *Apriona germarii* in North-eastern India, *Epepeotes uncinatus* in North-eastern India and Southern India, *Xylotrechus smei* in North-eastern India and Deccan India, *Acanthophorus serraticornis* in South and Central India, *Aeolesthes holosericea* in Karnataka and Maharashtra was seen.

*Jatropha* (*Jatropha curcas* L.) and Guava (*Psidium guajava*) The longicorn beetle, *Acanthophorus rugiceps* Gahan (Coleoptera: Cerambycidae), was found causing severe root damage in physic nut (*Jatropha curcas* L.) plantations in Hyderabad, India [55]. Kariyanna *et al.* [16] reported the *Aeolesthes holosericea* in Karnataka, Maharashtra and Arunachal Pradesh on *Psidium guajava* (Guava) plants.

#### Conclusion

Long horn beetles have adapted to feed on the wide range of food plants. In the absence of primary food plants, beetles switch over to new food plants. Longhorn beetle diversity and distribution are affected by cultural and other management practices followed in agriculture, horticulture and forest ecosystems. There is always a highly positive relationship between the estimated species richness of longhorn beetles and the number of tree species. Many immature stages of most Longhorn species are isolated in wood and are readily transported through International commerce, and exotic and potentially invasive pest species are commonly intercepted in international quarantine.

India is one of the major mega biodiversity nations, have forest cover of 78.92 million hectare which is 24.01 per cent of the geographical area of the country, known to harbour rich and diverse biotic resources. Nowadays forest canopy is replaced by plantation and fruit crops and also because of deforestation many numbers of Longhorns are shifting towards horticultural crops. So, the concern should be given towards the detailed study of major horticulturally important longhorn beetles and their biology, ecology, population dynamics and finally develop effective management tools to combat them.

#### Acknowledgement

The authors acknowledge the financial and infrastructure facilities provided by the Director, ICAR-NBAIR, Bengaluru.

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