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Systematic Distribution of Checklist of First Recorded Longhorn Beetle (Insecta: Coleoptera) Fauna from Sheringal, Pakistan

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Abstract

The longhorn beetles (Arthropoada; Insecta) are one of the groups of beetles, which are pests and their antennae are very long. They have been first recorded by random collection method from the 6 quadrates of Sheringal, Pakistan during August-2015 to May-2016. The specimens collected (n_{sc}=351) were belonging to only family Cerambycidae of order Coleoptera with 3 subfamilies and 5 tribes having 6 genera and 9 species. However, subfamily Cerambycinae (covered 31.3%) has 2 tribes, Cerambycini (26.5%) with great-capricorn beetle, Cerambyx cerdo Linnaeus (16.5%) and small-oak beech-capricorn beetle, Cerambyx scopolii Füssli (9.8%); and Callichromatini (5%) with house-longhorn beetle, Hylotrupes bajulus (Linnaeus); moreover, subfamily Lamiinae (45.3%) has only 1 tribe, Batocerini (45%) with mango-stem borers, Batocera davidis Deyrolle (35%), tropical fig borers, Batocera rufomaculata (De-Geer) (3.7%) and mulberry (long horn beetle) borer, Apriona germarii (Hope) (7%); further, subfamily Prioninae (23.4%) has 2 tribes, Prionini (14%) with Prionus root borer, Prionus californicus Motschulsky (10.3%) and broad necked root borer, Prionus laticollis (Drury) (4%); and Callipogonini (9%) with pine sawyer beetle, Ergates spiculatus LeConte. They are first time reported from Sheringal. Therefore, the present research is useful for determining biodiversity of the same. Their detail study is under process.

Keywords: Cerambycidae; Coleoptera; Insecta; Longhorn Beetle; Sheringal.

Introduction

Among invertebrates, arthropods represent the greatest part of alien species, which have great importance in agriculture, horticulture and forestry, with a major economic impact. Their activity can alter ecosystems structure and functioning, therefore, eventually lead to the extinction of native species, inducing biodiversity losses. Vulnerability of ecosystems to alien species is probably one of the least studied and the most difficult questions. Their knowledge effects and potential threats is still insufficient being crucial for managing the risks related to species transfer (Munteanu et al., 2014).

The longhorn beetles (Insecta: Coleoptera) originated from Far-East, mainly China. They are attractive insects but remarkably destructive to many of the native hardwood and a very wide range of broadleaved trees worldwide. They are significantly invasive pests native to East Asia, Europe, China, Korea, Great Britain (UK) and United State of America (USA). They are listed in the Plant Health Directive (PHD) and are, therefore, regulated in the European Union (EU). They are major threat to agriculture and the wider environment, if they establish in the United Kingdom (UK). The larvae feed undetected inside trees leaving them weakened and susceptible to further pests, diseases and damages. They found to date in the UK have been associated with wooden packaging (dunnage) imported from Asia. Most citrus longhorn beetles found in the UK have been associated with Japanese maple trees, Acer spp imported from China (Online, 2016)[a].

The longhorn beetles (Cerambycidae: also known as long-horned beetles or longi-corns) are a cosmopolitan family of beetles, typically characterized by extremely long antennae, which are often as long as or longer than the beetle's body. The male has antennae are much longer than the body; however, the female has antennae about as long as the body. In various members of the family, moreover, the antennae are quite short. The family is large with over 26,000 species described, slightly more than half from the Eastern Hemisphere with several serious pests. The larvae, called round-

headed borers, bore into wood, where they can cause extensive damage to either living trees or untreated lumber, occasionally, to wood in buildings. They feed on the wood of a wide range of broadleaved trees, which causes damage and will ultimately kill affected trees. The beetle has caused extensive damage to trees, where they have been accidentally introduced in recent years, for example in several cities of the USA and Italy. In North America, those invasive alien species attack and kill a wide range of deciduous tree species, and thus pose a high-risk to the urban and natural forests of Canada. Until recently the only evidence of the beetle in Britain was within imported wood packaging intercepted by plant health inspectors. However, a breeding population was found in Kent in 2012, most likely introduced via wooden crates containing imported stone. The beetle is subject to regulation and movement controls are in place. It is important that all suspected sightings are reported (Online, 2016)[b].

They prefer maple species, Acer spp. L; including boxelder, Acer negundo L; silver leaf tree, Leucadendron argenteum (L). Their occasional to rare hosts include ashes, European mountain ash, Sorbus aucuparia L; London plane-tree, Platanus acerifolia (Aiton) Willd; mimosa spp, and Populus tremula L. Other preferred hosts are birches, Betula sp L; Ohio buckeye, Aesculus glabra Wild; elm, Ulmus sp L; horse-chestnut, Aesculus sp L and their very good hosts are willow, Salix sp L; poplar, Populus nigra L; and sycamore, Platanus orientalis L. Proper water management and poly-cultures can make trees less susceptible. A systemic insecticide Imidacloprid used on host trees in quarantined areas for removing infested trees and replanting with non-host trees, treating wooden packing materials (Ric et al., 2006).

The district Dir Upper (DU), Khyber Pakhtunkhwa (KP) (previously named as NWFP), Pakistan borders Afghanistan to the west, Chitral and Swat districts to the north and east, respectfully, and the district Dir Lower (DL) to the south. Geographically, Dir Kohistan ends on its Northern side into a vast valley of Kumrat. It is a touring paradise with lush green pastures, crystal clear water, sky-kissing mountains, thick-forest of coniferous and broad leaves trees. On the northeast, through Badgowai pass, it is linked with marvelous spots of Swat, Kohistan, Bahrain, Madayan, Kalam, Usho, Gabral and Mahodand; on the northwest via Doag Dara, it is linked with Chitral, which is known for monsoonal climate, abundance of fresh and dry fruits, Chitrali patti, specific cultural values, ancient civilization, religion of Kalash, snow covered tops and appendages of Tirich Mir (Online, 2016).

The Sheringal valley is located between the latitude 35°-90° to 35°-47° north longitudes 71°-52° to 72°-22° the east in Pakistan. Altitude is approximately 2000 m above the sea level. This is a small valley situated northern site of district Dir Upper (DU), KP, Pakistan. Bajauar Agency and Jandool is located toward the west, while it is surrounded by district Swat and Malakand Agency from the east and south, respectively. Total area covered by this hilly valley is 7992.7 hec. The northern part is generally covered with forests. The climate is extremely cold in winter and warm in summer. The minimum and maximum temperature in January has been recorded as –2.3 and 11.22 °C, respectively (Figure 1) (Perveen and Uddin, 2015).

The river Panjkora flows, meanderingly, through lush green valley inside the Sheringal. The average depth is about 6 feet, while width is 15-25 feet. It is northern in KP and north-western in Pakistan. It rises high in the Hindu Kush and flows south through DU and DL districts and joins the river Swat near Chakdara, Malakand, KP, Pakistan. The name Panjkora is because of the main 5 tributaries that fall in the river at 4 different places, viz., Gwaldi stream at Patrak, Barawal at Chukiatan, Dobando at Akhagram and Usherai Dara and Nurhund at Darora (Perveen and Rahman, 2012).

The Sheringal is home to a number of wildlife species including mammals such as the snow leopard, Panthera uncia (Schereber, 1775); common leopard, Panthera pardus (L, 1758); musk deer, Moschus anhuicnsis (L, 1758); black bear, Ursus americanus (Pallas, 1780); wolf, Canis lupus (L, 1758); yellow throated marten, Martes flaviqula (Pinel, 1792); red fox, Vulpes vulpes (L, 1758); pika, Ochotona daurica (Link, 1795); golden marmot, Marmota caudate (Geoffroy, 1844) and rhesus monkey, Macaca mulatta (Zimmermann, 1780). Himalayan monal pheasant, Lophophorus impejanus (Latham, 1790); Himalayan snow cock, Tetraoggallus himalayensis (Gray, 1848) and snow partridge, Lerwa lerwa (Hodgson, 1837) are some of the key bird species found there. At different elevation different types of vegetation occurs in Sheringal. Blue pine, Pinnus wallichiana (Jacks, 1839) is dominated species with scattered trees of the Himalayan cedar, Cedrus deodara (Don, 1831) with frequent occurrence of Himalayan popular, Populous ciliatae (Royle, 1888); walnut, Juglans regia L; chilgoza pine nut, Pinus gerardiana Wall; apricot, Prunus armeniaca L; plum, Prunus domestica L; persimmon, Diospyros kaki L; mulberry, Morus alba L; apple, Malus pumila Miller; and pear, Pyrus amygdaliformis L (Hazrat et al., 2011) (Figure 1). The objective of the present research is to report the checklist of the first recorded longhorn beetles fauna for determining biodiversity in Sheringal, DU, KP, Pakistan, to educate the people of the community about their economic importance and to create them awareness.

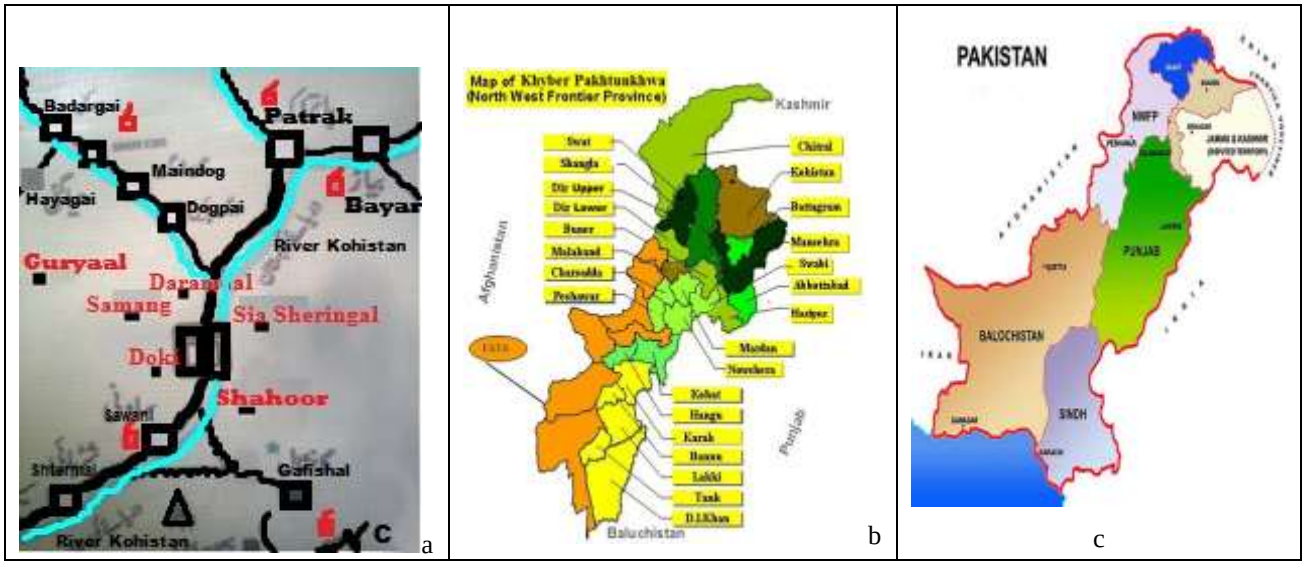

Figure 1 The first recorded longhorn beetle (Insecta: Coleoptera) fauna from the 6 quadrates i.e., the Daramdala, Doki, Guryaal, Samang, Shahoor, and Shia Sheringal of Sheringal, Dir Upper (DU), Khyber Pakhtunkhawa (KP), Pakistan; a) the 6 quadrates i.e., the Daramdala, Doki, Guryaal, Samang, Shahoor, and Shia Sheringal of Sheringal, and main roads, where the present research was conducted; b) map of KP, one of the provinces of Pakistan, where Sheringal is located; and c) map of Pakistan (Online map, 2015; Perveen and Haroon, 2016; Perveen and Khan, 2016)

Materials and Methods

Study Area

The people of Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan usually concern with agriculture. Total area covered by this hilly valley is 7992.7 acres. The population is about 20,000 and literacy rate is 51%. The present research was conducted during August 2015 to May 2016 and collection was made from the 6 quadrates of Sheringal, i.e., the Daramdala, Doki, Guryaal, Samang, Shahoor and Shia Sheringal (Figure 1; Online map, 2015; Perveen and Haroon, 2016; Perveen and Khan, 2016).

Collection and Preservation

For the present research, to prepare the checklist of the first recorded long horn beetle fauna of Sheringal was surveyed during August 2015 to May 2016. The specimens were collected by the random method (Perveen and Ahmed, 2012; Perveen and Khan, 2013; Perveen and Fazal, 2013; Perveen, Khan and Rauf, 2014; Perveen and Khan, 2015) from the 6 quadrates of the study are mentioned above. For the collection of specimens, an insect net [length: 3 m; net cloth length: 1 m; diameter (dm): 0.9144 m], transect net (length: 3 m; width: 1 m; height: 2 m) with attractants as well as they were picked manually with naked hand. They were brought to the laboratory, Department of Zoology (DOZ), SBBU. The collected live specimens were faint in cotton soaked chloroform bottles for short time. However, if chloroform was not available, they were killed carefully by pinching transversely at the thorax that all parts of the body may not be spoiled. Then they were pinned by insect pins according to their body size. They were preserved on thermopile setting board for 2 days. They were tagged for their locations and date of collection (Perveen and Rahman, 2012; Perveen and Jamal, 2012; Perveen and Haroon, 2015; Perveen and Uddin, 2015). Finally, they were mounted in the insect boxes with naphthalene balls to keep the specimens safe from the pests.

Identification

For preparation of checklist of collected longhorn beetle were identified with the help of keys (Duffy, 1952; Choate, 2003), available literature, internet, already identified specimens [National Insect Museum (NARC), Islamabad, Pakistan and Laboratory, DOZ], pictures and experts. All specimens were deposited in the Natural History Museum (NHM), DOZ, SBBU, Pakistan.

Results

The present study was conducted to report the checklist of first recorded longhorn beetle (Insecta: **C**oleoptera) fauna from the 6 quadrates of Sheringal, i.e., the Daramdala, Doki, Guryaal, Samang, Shahoor and Shia Sheringal Dir Upper (DU), Khyber Pakhtunkhwa, Pakistan. The long horn beetles specimens collected (n_{sc}=351) from SBBU during August 2015 to May 2016. The checklist, thorough systematic classification and taxonomical status of long horn beetles of Sheringal are given below in Table 1:

Table 1: Systematic Distribution Of Checklist Of First Recorded Longhorn Beetle (Insecta: Coleoptera) Fauna From Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan		
Domain: Eukaryota		
Kingdom: Animalia		
Subkingdom: Invertebrata		
Division: Metazoa		
Subdivision: Bilateria		
Clade: Protostomia		
Superphylum: Ecdysozoa		
Phylum: Arthropoda		
Subphylum: Atelocerata		
Superclass: Hexapoda		
Superclass: Insecta		
class: Neoptera		
Subclass: Pterygota		
Inferaclass: Neoptera		
Superorder: Endopterygota		
Order: Coleoptera		
Suborder: Holometabola		
Infraorder: Polyphaga		
Superfamily: Chrysomeloidea		
Family: Cerambycidae		
Subfamily: Cerambycinae		
Tribe: Cerambycini		
Superfamily: Chrysomeloidea		
Family: Cerambycidae		
Subfamily : Cerambycinae		
Tribe : Cerambycini		
Reported species 1: Great capricorn (oak cerambyx) beetle, Cerambyx cerdo Linnaeus		
Reported species 2: Small oak beech capricorn beetle, Cerambyx scopolii Füssli		
Subfamily	**:**	**Cerambycinae**
Tribe	**:**	**Callichromatini**
Reported species 3: House longhorn beetle (male), Hylotrupes bajulus (Linnaeus)		
Subfamily	**:**	**Lamiinae**
Tribe	**:**	**Batocerini**
Reported species 4: Mango stem (Chinese longhorn beetle) borers, Batocera davidis Deyrolle		

Reported species 5: Tropical fig (Chinese longhorn beetle) borers, Batocera rufomaculata (De Geer)		
Reported species 6: Mulberry (long horn beetle) borer, Apriona germarii (Hope)		
Subfamily	:	**Prioninae**
Tribe	:	**Prionini**
Reported species 7: Prionus root borer (male), Prionus californicus Motschulsky		
Reported species 8: Broadnecked root borer, Prionus laticollis (Drury)		
Subfamily	:	**Prioninae**
Tribe	:	**Callipogonini**
Reported species 9: Pine sawyer beetle, Ergates spiculatus LeConte		

The specimens collected (n_{sc}=351) were belonged to the same family Cerambycidae with 3 subfamilies and 5 tribes comprised 6 genera and 9 species. However, most of the species were collected from different biotopes, e.g., scrub, grassland, plantation, botanical and nursery gardens of Sheringal randomly (Table 2).

Table 2: First Recorded Longhorn Beetle (Insecta: Coleoptera) Fauna Were Collected From The Study Area, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan, During August, 2015 To May 2016

Subfamily n (%)	Tribe	RS*	Common names	n (%)*	Scientific names	Authority	Year	Biotope*
Cerambycinae 110 (31.5%)	Cerambycini	1	Great capricorn (oak cerambyx) beetle	58 (16.5%)	Cerambyx cerdo	Linnaeus	1785	B, S, G, P
		2	Small oak beech capricorn beetle	35 (10%)	Cerambyx scopolii	Füssli	1775	B, S, G, P
	Callichromatini	3	House Longhorn Beetle	17 (5%)	Hylotrupes bajulus	(Linnaeus)	1758	B, S, G, P
Lamiinae 159 (45.5%)	Batocerini	4	Mango stem (Chinese longhorn beetle) borers	122 (35%)	Batocera davidis	Deyrolle	1878	B, S, G, P
		5	Tropical fig (Chinese longhorn beetle) borers	13 (3.7%)	Batocera rufomaculata	(DeGeer)	1775	P
		6	Mulberry (long horn beetle) borer	24 (7%)	Apriona germarii	(Hope)	1831	B, G, P
Prioninae 82 (23%)	Prionini	7	Prionus root borer (male)	36 (10%)	Prionus californicus	Motschulsky	1845	B, S, G, P
		8	Broadnecked root borer	14 (4%)	Prionus laticollis	(Drury)	1773	G
	Callipogonini	9	Pine sawyer beetle	32 (9%)	Ergates spiculatus	LeConte	1852	B, S, P

*RS: reported species; n: number of specimens collected; %: percentage of specimens collected; Biotope: S: scrub; G: grassland; P: plantation; B: botanical and nursery gardens

The cluster analysis of long horn beetle (Class: Insecta; Order: Coleoptera; Family: Cerambycidae) specimens collected (n_{sc}=351) of SBBU collected during August, 2015 to May 2016 showed their subfamilies: Cerambycinae; Lamiinae and Prioninae. However, family Lamiinae comprised the largest number of long horn beetle, i.e., 45.3%, than Cerambycinae with 31.3%; and the smallest number Prioninae with 23.4% (Figure 2).

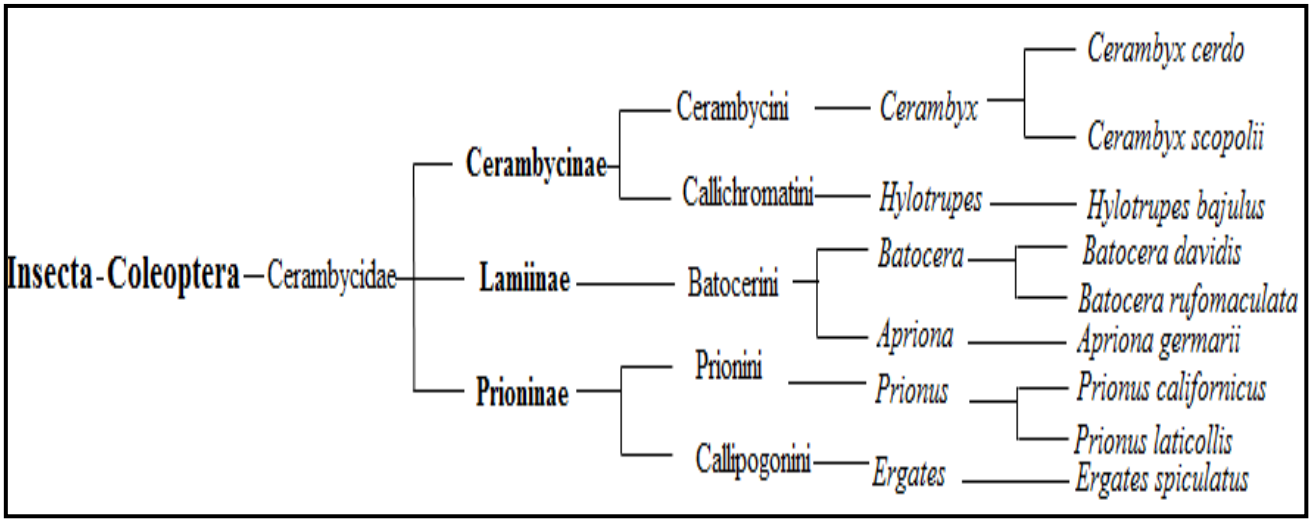

Figure 2: The cluster analysis of order Coleoptera (Phylum: Arthropoda; Class: Insecta) with family (n_f=1), subfamilies (n_{sf} =3), genus (n_G=6) and species (n_{sp}=9) collected from the study area, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan, during August 2015 to May 2016; family Cerambycidae having 3 subfamilies, i.e., Cerambycinae, Lamiinae and Prioninae; Subfamily Cerambycinae having 2 tribes, i.e., Cerambycini with 1 genera and 2 species and Callichromatini with 1 species; subfamily Lamiinae having only one tribe, i.e., Batocerini with 2 genera and 3 species; Subfamily Prioninae having 2 tribes, i.e., Prionini with 1 genera and 2 species and Callipogonini with 1 species; sample size of collected and identified specimens: n_{sc}=351

Discussion

To prepare checklist of the longhorn beetles were collected randomly during August 2015 to May 2016 from different types of vegetation, i.e., scrub, grassland, plantation, botanical and nursery gardens of SBBU, Sheringal, however, they were found particularly on the blue pine, Pinnus wallichiana (Jacks); Himalayan cedar, Cedrus deodara (Don); Himalayan popular, Populous ciliatae (Royle); walnut, Juglans regia L; chilgoza pine nut, Pinus gerardiana Wall; apricot, Prunus armeniaca L; plum, Prunus domestica L; persimmon, Diospyros kaki L; mulberry, Morus alba L; apple, Malus pumila Miller; and pear, Pyrus amygdaliformis L. They are the real pest of these plants and camouflage with their leaves. They damaged fruits and spoilage leaves as well trunk having hole of their tunnels.

They belong to insect order Coleoptera and family Cerambycidae and are also called longicorn, whose common name is derived from the extremely long antennae of the most species. However, their more than 25,000 species were occurred throughout the world but they are most numerous in the tropics. Moreover, they range in size from 2-152 mm (less than $^1/_8$ to about 6 inches). Further, these lengths may double or triple when the antennae are included (EB, 2016). At the present, they were collected from Sheringal from 6 quadrates, i.e., the Daramdala, Doki, Guryaal, Samang, Shahoor, and Shia Sheringal. They were collected easily due to their larger size but collections of some species were difficult due to camouflage to their host plants.

Using its strong jaws, the larva bores through and feeds in woody plants for one to two years or more. When ready to pupate, the larva bores a tunnel to the outside, pupates within the tree and as a new adult, uses this tunnel as its exit. Because of their wood-boring habits, long-horned beetles can be serious damaged timber and pulpwood, landscape, fruit trees, and woody ornamental plants (EB, 2016). During present research they were collected from different types of vegetation, i.e., scrub, grassland, plantation, botanical and nursery gardens of SBBU, Sheringal. Therefore, they are significant pest of the same.

The prionids (subfamily Prioninae) have leathery, brownish wing covers (elytra), and the margins of the prothorax (region behind the head) are tooth-like and expanded laterally (EB, 2016). During the present research, this subfamily covered 23% of collected species. Prionus laticollis, Prionus californicus and Ergates spiculatus were reported. Their

larvae lived in grape, apple, poplar, blueberry, and other fruit and ornamental tree roots. They burrowed in the trunk and damaged the fruits and roots of plants.

The cerambycids (subfamily: Cerambycinae) include the ribbed pine borer (Rhagium inquisitor), which has a narrow thorax with a spine on each side and three lengthwise ridges on its wing covers. It lives in pine trees during the larval stage. Another cerambycid is the locust borer, Megacyllene robiniae, which is black with yellow stripes across the body. Female locust borers lay their eggs in black locust trees. After the larvae hatch, they bore into the inner bark of the tree, creating tunnels and leaving the tree susceptible to damaging infection by a species of fungus known as Fomes rimosus and Phellinus rimosus (EB, 2016). However, at the present, this subfamily covered 31.5% of collected species. Cerambyx cerdo, Cerambyx scopolii and Hylotrupes bajulus were collected, moreover, mentioned species by EB (2016) were not found. Different of longhorn beetle fauna in 2 studies may be different of flora and environmental conditions.

The lamiids (subfamily Lamiinae) include the sawyer (Monochamus), a gray-brown beetle about 30 mm (1.2 inches) long, not including the long antennae. The larvae live in pines and firs and bore tunnels up to 10 mm (0.3 inch) in diameter. The round-headed apple tree borer, Saperda candida can be a major apple pest. The twig girdler, Oncideres cingulata deposits eggs in twigs and then girdles, or cuts, a groove around the twig. Eventually the twig dies and breaks off, and the larvae develop inside the dead twig. The Asian long-horned beetle, Anoplophora glabripennis, native to China and Korea, is a major pest of many hardwood trees, especially species of maple, boxelder, horse-chestnut, buckeye, willow, and elm. Adults are shiny black in colour with irregular white spots and are large, ranging from 1.9-3.8 cm (0.75-1.5") in body length. They have black antennae with white rings that are 3.8-10.2 cm (1.5-4") long. During the summer months, adult females chew through the bark and deposit an egg, causing a visibly dark wound in the tree that is about 1.3 cm (0.5") in diameter. After the larvae hatch, they migrate to the heart of the tree, where they feed body length.

The Asian long-horned beetle is thought to have been transported to North America in wood pallets, resulting in infestations in New York in 1996 and several years later in New Jersey, Chicago, Illinois and Toronto, Ontario (EB, 2016). During the present research, this subfamily covered 45.5% and collected species Batocera davidis, Batocera rufomaculata and Apriona germarii. Measures such as removal and destruction of trees, quarantine of infested areas, strict regulations on the transport of wood, and insecticide treatments restrict the Asian long-horned beetle to isolated areas. Their detail study and control should be needed to save the expensive trees and plant as described above.

Conclusion

The longhorn beetles specimens collected (n_{ss}=351) were belonged to only family Cerambycidae of order Coleoptera with 3 subfamilies and 5 tribes having 6 genera and 9 species. However, subfamily Lamiinae was dominant which covered 45.3% of reported longhorn beetles fauna. Moreover, tribe, Batocerini was dominant which covered 45% of the same. Further, mango stem (Chinese longhorn beetle) borers, Batocera davidis Deyrolle was dominant which covered 35% of the same.

Recommendation

It is recommended that a detail and advance study is required for further exploration of longhorn fauna found in SBBU, Sheringal with special reference to their aspect as pests and control. Seminars, symposiums, and workshops may be arranged for awareness of the community of Sheringal.

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