Original Research Article

A Report On Coleopteran Species Composition In Rono-Hills, Arunachal Pradesh With Perspective On Ecological And Economic Aspects

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Abstracts: The primary objective of the present study was to focus on the species composition of the coleopteran species in Rono-Hills, Papumpare district, Arunachal Pradesh with a perspective to know the economic and ecological value of the coleopteran insect community in the region. For this, field based survey was conducted from the month January to December during the year 2015. Insect monitoring was based on Pollard walk during morning hours starting from 7 am to 9 am. During the survey undertaken, 30 species of Coleoptera belonging to 12 families were recorded. Cerambycidae was the dominant family representing 7 species followed by family Scarabaeidae (6), Carabidae (4), Lucanidae (3), Curculionidae (2), Coccinellidae (2), Passalidae (1), Elateridae (1), Buprestidae (1), Chrysomelidae (1), Erotylidae (1) and Trictenotomidae (1). Eleven species of Coleoptera were documented in the grassland, 9 species in mixed forest, 5 species each in open land and cropland habitat. The cultivated crops conceded were the *Luffa acutangula* and *Abelmoschus esculentus.* Among the coleopteran insects collected, 6 species viz. *Popillia japonica, Lissorhoptrus oryzophilus, Xylotrupes gideon*, *Coccinella sp.*, *Triplex collaris* and *Apriona germarii* were identified as pests of crops and plantations; 1 species, *Aulacophora palliata* as crop pollinator of the crop *Luffa acutangula* along with 2 species of dung beetle viz. *Onthophagus taurus* and *Scarabaeus sp.* of ecological importance. Thus, the survey indicated the need of management practice of these insects to gain more economic benefit and ecological service in the region.

Key words: Coleoptera, Ecological service, Habitat, Pest, Pollinator

Introduction

Insects are the most diverse group of organisms in the animal kingdom. Out of these, about 3,87,100 species of Coleoptera belonging to 160 families were found to be recorded and is known to be the most speciose order till date (Chandra, 2011). The coleopterans, commonly known as beetle are characterised by hard fore wings known as elytra which meet at the mid dorsal plane without overlapping. The antennae within this group of insects are known to vary and seven different types of antennae viz. filiform (e.g. Carabidae), Lamellate (e.g. Scarabaeidae), clavate (e.g. Siphidae), monoliform (e.g. Chrysomelidae), serrate (e.g. Elateridae, Buprestidae), pectinate (e.g. Elateridae) and geniculate (e.g. Lucanidae and Curculionidae) are known from the order. Mouthparts are of chewing type. Legs are composed of coxa, trochanter, femur, tibia, tarsus and claw. However, the legs are modified to perform specific functions such as jumping, swimming, running and digging as adaptation (Gillot, 2005). Like other insects, coleopterans also exhibit ecological and economic significance. Certain coleopteran insects like Dried fruit beetle, *Carpophilus sp.* (Nitidulidae); Snout beetles, *Endaenidius sp.* (Curculionidae); Ant like flower beetle, *Formicomus braminus* La Ferte-Senectere (Anthicidae) act

as crop pollinators (Corlett, 2004) while others damage human valued plant and plant products being a pest e.g. Ambrosia beetle, *Xyleborus formicates* Eichhoff; Cucumber beetles, *Diabrotica sp.*; Crucifer flea beetle, *Phyllotreta cruciferae* (Goeze); Coconut leaf beetle, *Brontispa longissima* (Gestro); Spotted pine sawyer, *Monochamus clamator* (LeConte); Flat faced longhorn beetle, *Acanthocinus obliquus* (LeConte); Sculptured pine borer, *Chalcophora virginiensis* (Drury); Flat headed pine borer, *Phaenops gentilis* (LeConte, 1863) (Costello *et al.*, 2008; Hazarika *et al.*, 2009; Jin *et al.*, 2014; Tangtrakulwanich *et al.*, 2014; Hong *et al.*, 2016) of major or minor importance in agriculture and forestry (Syed *et al.*, 1982; Kevan *et al.*, 1986; FAO, 2009). Apart from these, certain coleopterans are beneficial to agricultural practices as they act as the natural enemies e.g. Vedalia beetle, *Rodolia cardinalis* (Mulsant); Lady bird beetle, *Cryptognatha nodiceps* Marshall; Kuwana's lady beetle, *Chilocorus kuwanae* Silvestri; Lady bird beetle, *Hyperapsis pantherina* Fursch; Singular black lady beetle, *Rhymzobius lophanithae* (Blaisdell); Lady beetle, *Chilocorus nigritus* (Fabricus,1798) and Heather lady bird, *Chilocorus bipustulatus* (Linnaeus) (Obrycki and Kring, 1998) of a number of crop pests (Horgan and Myers, 2004; Snyder *et al.*, 2004). A number of insects are also saprophagous and thus they along with the predatory beetles play a key role in trophic chain (Safranyik and Carroll, 2006; Lindgren and Raffa, 2013).

Around 17,455 species of Coleoptera has been recorded from India. However, in Arunachal Pradesh the works on Coleoptera are very scarce. Only around 135 species of Coleoptera were known to be recorded from the region (Sengupta and Sengupta, 1981; Singh *et al.*, 2010; Kumawat *et al.*, 2015). Therefore, the present study was emphasized to document the species composition of the Coleoptera in Rono-Hills, Papumpare district, Arunachal Pradesh as a preliminary work with perspective to know the economic and ecological value of the coleopteran insect community in the region.

Materials and methods

The field based survey was conducted from the month January to December, 2015 in Rono-Hills, Papumpare district, Arunachal Pradesh. Rono-Hills is located geographically at latitude 7°08′50′′ N, longitude 93°46′01′′ E and altitude 300 m above mean sea level. The area was covered with tropical semi-evergreen forest, grassland, cropland and open land. Insect monitoring was based on Pollard walks (Pollard, 1977; Pollard and Yates, 1993). For this, four individual points were selected in each habitat and four transects of 100 m length and 1 m width were planned across each of the habitats viz. grassland, mixed forest, open land and cropland. Each of the transects was walked in one direction at slow and even pace (~ 0.2 km/h) covering the length. Monitoring was done in the four habitats in consecutive days per month during morning hours starting from 7 to 9 am. Insect samples were collected using sweep net and forceps and were identified using standard keys (Crowson, 1956; Klimaszewski and Watt, 1997; Choate, 1999). Lowest average rainfall was approximately 41.80 mm in the month of January and highest was in the month of July with about 1433.20 mm. Average minimum and maximum ambient temperature were 11.6 ºC and 27.6 ºC respectively. Humidity varies with rainfall with minimum 33% and maximum 85% RH.

The grassland habitat was dominated by Dog's tooth grass, *Cynodon dactylon* (L) Pers.; Lesser spear grass, *Chrysopogon aciculatus* (Retz.) Trin; Crown grass, *Paspalum longifolium* Roxb; Family grass, *Panicum notatum* Roxb. and was scattered by plants like Phakphet, *Spilanthus paniculata* Wall. ex DC; Billygoat-weed, *Ageratum conyzoides* L.; Mile-a-minute vine, *Micania micrantha* Kunth; Gotu kola, *Centella asiatica* (L.); Sleepy plant, *Mimosa pudica* L. and Thumbai, *Leucas aspara* L. etc. The mixed forest area was chosen inside the Botanic Garden of Rajiv Gandhi University, Arunachal Pradesh. Some of the forest trees were Jackfruit, *Artocarpus heterophyllus* Lam; Guava, *Psidium guajava* L; Fig tree, *Ficus abutilifolia* (Miq.) Miq; Mango, *Mangifera indica* L; Bay leaf, *Cinnamomum tamala* (Buch.-Ham.) T. Nees & C. H. Eberm; Soalu, *Litsea sp*; Bar-thekera, *Garcinia pedunculata* Roxb. ex

Buch.-Ham; Hollong, *Dipterocarpus retusus* Blume; Dhuna, *Canarium bengalese* Roxb; Rupohi-thekera, *Garcinia lanceifloia* Roxb. The open land selected was the barren area resulted from the earth cutting activities. The *Luffa acutangula* (L.) Roxb. and *Abelmoschus esculentus* (L.) Moench. cultivated area was conceded as the cropland habitat for the present study.

Results

A total of 30 Coleoptera species belonging to 12 families were recorded during the present survey (Table 1, Fig. 1-5). Out of these, highest number of species belonged to family Cerambycidae (7). It was followed by family Scarabaeidae (6), Carabidae (4), Lucanidae (3), Curculionidae (2), Coccinellidae (2), Passalidae (1), Elateridae (1), Buprestidae (1), Chrysomelidae (1), Erotylidae (1) and Trictenotomidae (1).

In the habitats studied, 11 species inhabited in grassland, 9 in mixed forest, 5 species each in open land and cropland. Two species of Coleoptera viz. *Aulacophora palliata* and *Coccinella sp.* were recorded from the fruit of *Luffa acutangula* and 1 species Coleoptera viz. *Popillia japonica* from the flower of *Abelmoschus esculentus*. Other two species of Coleoptera viz. *Lissorhoptrus oryzophilus* and *Epilachna sp.*

Table 1. Coleopterans in Rono-Hills, Arunachal Pradesh and their habitats.

Sl. No.	Scientific Name	Vernacular name	Family	Habitat	Month of Collection
1.	*Apriona germarii* Hope, 1831	Longhorn beetle	Cerambycidae	Mixed forest	July
2.	*Aristobia reticulator* (Fabricius, 1781)	Longhorn beetle	Cerambycidae	Mixed forest	August
3.	*Xylorhiza adusta* Wiedemann, 1819	Longhorn beetle	Cerambycidae	Mixed forest	June
4.	*Derobrachus hovorei* Leconte, 1853	Palo verde beetle	Cerambycidae	Mixed forest	July
5.	*Coptops leucostictica* White, 1858	Leopard Spot Longhorn beetle	Cerambycidae	Mixed forest	June
6.	*Baralipton maculosum* Thomson, 1857	Longhorn beetle	Cerambycidae	Mixed forest	April
7.	*Epepeotes uncinatus* Gahan, 1888	Flat faced longhorn beetle	Cerambycidae	Mixed forest	April
8.	*Lissorhoptrus oryzophilus* Kuschel, 1952	Rice Water weevil	Curculionidae	Cropland, Flower of *Fagopyrum esculentum*	October
9.	*Scyphophorus acupunctatus* Gyllenhaal, 1838	Agave weevil	Curculionidae	Grassland	October
10.	*Passalus unicornis* LePeletier & Serville, 1825	Horned passalus beetle	Passalidae	Grassland	August
11.	*Lucanus cervus* Linnaeus, 1758	Stag beetle	Lucanidae	Grassland	August
12.	*Prosopocoilus blanchardi* Parry, 1873	Stag beetle	Lucanidae	Grassland	September
13.	*Prosopocoilus giraffe* Olivier, 1789	Giraffe stag beetle	Lucanidae	Grassland	August
14.	*Xylotrupes gideon* (Linnaeus, 1767)	Siamese rhinoceros beetle	Scarabeidae	Grassland	September
15.	*Cetonia aurata* Linnaeus, 1758	Rose chafer	Scarabaeidae	Grassland	August
16.	*Popillia japonica* Newman, 1841	Japanese beetle	Scarabaeidae	Cropland, Flower of *Abelmoschus esculentus*	August
17.	*Onthophagus taurus* Schreber, 1759	Dung beetle	Scarabaeidae	Open land	August
18.	*Anoplognathus pallidicollis* Blanchard, 1851	Christmas beetle	Scarabaeidae	Grassland	October
19.	*Scarabaeus sp.*	Dung beetle	Scarabaeidae	Open land	August
20.	*Agonum cupripenne* Say, 1823	Ground beetle	Carabidae	Grassland	October
21.	*Cicindela japonica* Thunberg, 1781	Japanese Tiger beetle	Carabidae	Grassland	August
22.	*Pheropsophus sp.* (i)	Ground beetle	Carabidae	Open land	February
23.	*Pheropsophus sp.* (ii)	Ground beetle	Carabidae	Open land	February
24.	*Cryptalaus berus* Rigout, 1987	Click beetle	Elateridae	Grassland	September
25.	*Megaloxantha bicolor* (Fabricius, 1775)	Jewel beetle	Buprestidae	Mixed forest	August
26.	*Aulacophora palliata* Schaller, 1783	Leaf beetle	Chrysomelidae	Cropland, Flower of *Luffa acutangula*	April
27.	*Triplax collaris* Schaller, 1783	-	Erotylidae	Mixed forest, (Oyster Mushroom)	May
28.	*Coccinella sp.*	Ladybug	Coccinellidae	Cropland (Fruit of *L.acutangula)*	August/October
29.	*Epilachna sp.*	Lady beetle	Coccinellidae	Cropland	June
30.	*Trictenotoma formosana* Kreische, 1920	-	Trictenotomidae	Open land	May

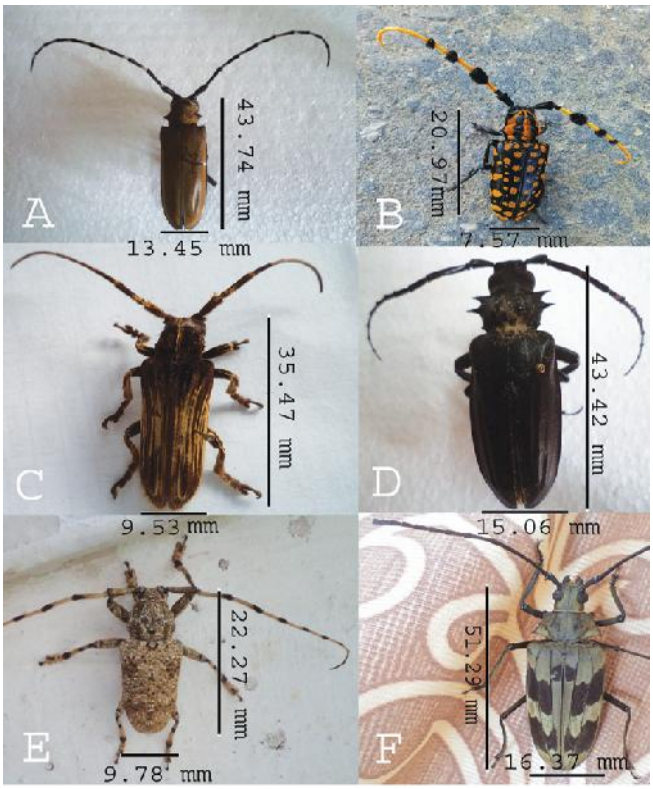

Fig. 1. A- *Apriona germarii, B- Aristobia reticulator*, C- *Xylorhiza adusta*, D- *Derobrachus hovorei*, E- *Coptops leucostictica*, F- *Baralipton maculosum*

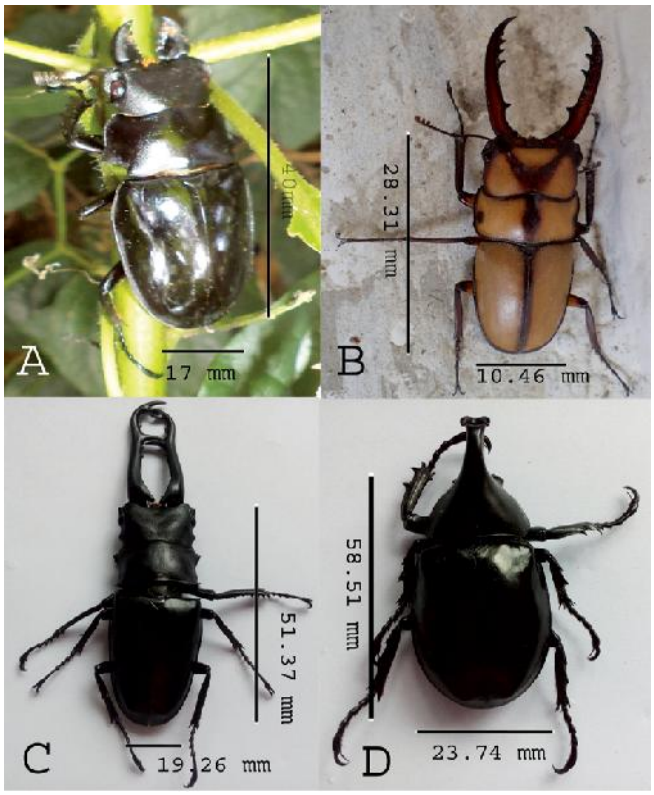

Fig. 3. A- *Lucanus cervus*, B- *Prosopocoilus blanchardi*, C- *Prosopocoilus giraffe*, D- *Xylotrupes gideon*

Fig. 2. A- *Epepeotes uncinatus,* B- *Lissorhoptrus oryzophilus*, C- *Scyphophorus acupunctatus*, D- *Passalus unicornis*

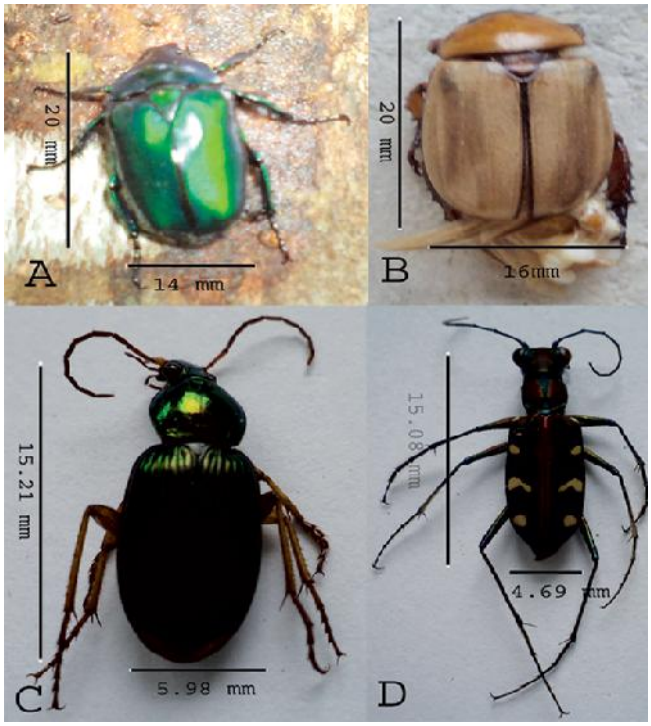

Fig. 4. A- *Cetonia aurata,* B- *Anoplognathus pallidicollis,* C- *Agonum cupripenne,* D- *Cicindela japonica*

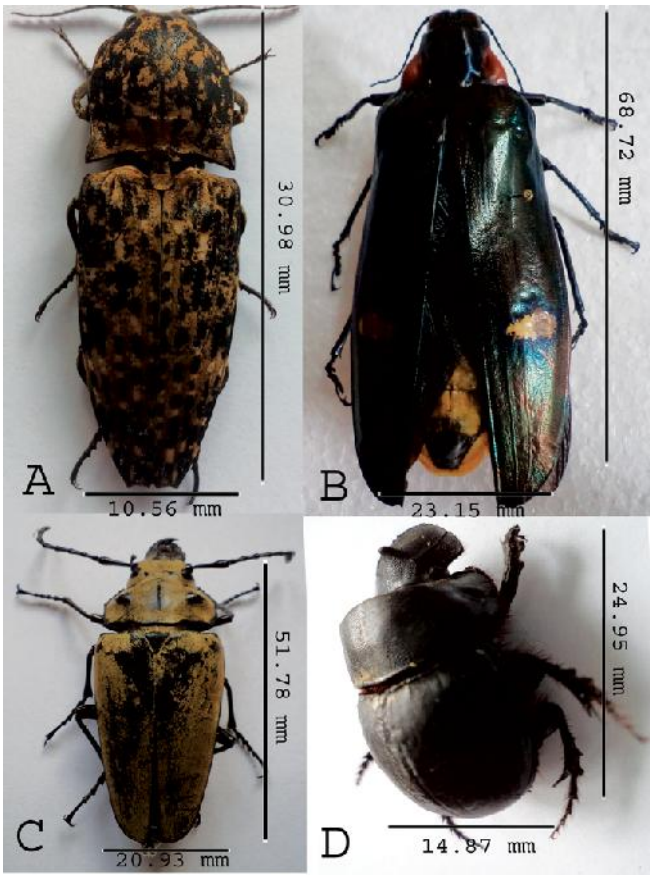

Fig. 5. A- *Cryptalaus berus,* B- *Megaloxantha bicolor,* C- *Trictenotoma formosana,* D- *Onthophagus taurus*

collected from the cropland area were not found to be associated with the crops during the survey period. *Popillia japonica*, *Coccinella sp.* and *Triplex collaris* were seen feeding the flowers of *A. esculentus,* fruits of *L. acutangula* and gills of *Pleurotus ostreatus* respectively. *Aulacophora palliata* was recorded pollinating the flowers of *L. acutangula*. Apart from these, 2 species of dung beetle viz. *Onthophagus taurus* and *Scarabaeus sp.* of ecological importance were also documented during this study.

Discussion

Although the order Coleoptera is taxonomically classified into 211 families, during the present study, only 30 Coleoptera species belonging to 12 families were recorded (Bouchard *et al.*, 2011). The comparatively less number of species recorded may be due to the coverage of smaller area, availability of suitable habitat and other resources as the distribution of insects are known to be highly influenced and determined by these factors. Apart from the natural factors, it may also be due to the method of sampling adopted which was conducted during the day time and morning hours. As many coleopterans are known to be nocturnal and inhabit in burrows under soil surface or inside trees, therefore, many of the coleopterans may not be covered while sampled during day time using transect method (Yi *et al.*, 2004). Probably, sampling simultaneously with the use of different methods will be more valid to document the coleopterans that exhibit diverse behavioural patterns from group to group.

Coleoptera possess both negative and positive aspects in terms of economics. Some species of this order are known to act as important crop pollinator whereas some others as pests and predators of the pests. The insects that cause a minimum of 5% economic loss of the crops are considered as crop pest (Paul, 2007). Out of the collected specimens, *Coccinella sp., Lissorhoptrus oryzophilus* and *Popillia japonica* are known to cause damage to a number of crops sometimes reaching the pest status (Potter *et al.*, 1966; Klein, 1981; Hummel *et al.,* 2014). *Xylotrupes gideon* is known to eat foliage of coconut palm (*Cocos nucifera* L., African oil palm (*Elaeis guineensis* Jacq.) and Cashew (*Anacardium occidentale* L.) (Hill, 1987; Howard, 2001). Many species of *Triplex* destroy Oyster mushroom *Pleurotus ostreatus* (Jacq. ex Fr.) P. Kumm and reside inside them (Gnaneswaran *et al.*, 1999). Certain species of the genus *Aulacophora* are known as pest of commercial crops, mainly in the Cucurbitaceae family (Rahman and Prodhan, 2007). In this study, *A. palliata* was recorded as anthophiles of *L. acutangula.* However, literature on *A. palliata* as pest was lacking. *P. japonica* feeds on leaves and floral parts of a number of plants. During the present study, *P. japonica* was collected from the flower of *Abelmoschus esculentus*. They temporarily reside inside the flower of *A. esculentus* causing damage to the plant. *P. japonica* adults are polyphagous in nature and feed on foliage, fruits or flowers of more than 300 species of wild and cultivated plants in 79 families including Malvaceae causing economic loss to the farmers (Fleming, 1972; Ladd, 1987). *Apriona*

germarii was not recorded to cause damage to the crops covered during the present survey. However, it is known to be a major pest of wide range of economically important plants including Mulberry (*Morus spp.*), Poplar (*Populus spp.*), Willow (*Salix spp.*), Apple (*Malus spp.*), Fig (*Ficus carica* L.), Paper mulberry (*Broussonetia papyrifera* (L.) Vent.), Jackfruit (*Artocarpus heterophyllus* Lam.) and pagoda tree (*Sophora japonica* L.) (EPPO, 2014). Both adults and larvae of *A. germarii* cause damage to the trees eating tender tree bark. Larvae usually lead to serious damage boring emerging tunnels from the site of oviposition (Shimei and Rongwu, 1992).

During the present study, *Aulacophora palliata* was recorded pollinating the flowers of *L. acutangula* in which the male and female flowers borne separately on the same plant but in different internodes (Seshadri, 1999).

Some coleopterans like carabid beetles, ladybug beetles are natural predators of a number of insect pests. On this ground, Coccinellids are used as biocontrol agents against agricultural and forest pests (Obrycki and Kring, 1998; Roy and Migeon, 2010). The adults of *Coccinella sp.* feed on important agricultural pests like aphids, mealy bugs etc. controlling the pest population below economic injury level. Similarly, *Cicindela japonica,* which is a voracious feeder also survive on small insects notorious to agricultural crops (Heinrichs and Barrion, 2004).

From the above results and discussions it was observed that though the present investigation was a preliminary survey using only transect method and confining to a small geographical area, it indicated the presence of some important agricultural and forest pests, crop pollinators and detritus feeder of ecological importance. Therefore, the study urges the management of these insects to gain more economic benefit and ecological service in the region.

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