A Checklist of the Bettles (Coleoptera) of Jakhama, Nagaland

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Abstract

The present work is a checklist of the biodiversity of beetles (Coleoptera) at Jakhama, Nagaland. Surveys were carried in the areas covering the crop, weeds and forest areas at Jakhama, during 2021-2023. A total of 70 species, belonging to 17 families viz- Coccinellidae, Scarabaeidae, Oedermeridae, Cerambycidae, Lucanidae, Meloidae, Tenebrionidae, Hydrophilidae, Silphidae, Chrysomelidae, Cantharidae, Lampyridae, Passaloidae, Dynastidae, Buprestidae, Trictenotomidae and Elateridae were collected and identified. From the collection it is found out that maximum no. of species (19) belonged to family Scarabaeidae which constituted 27.14% of the total, followed by family Cerambycidae (15species) representing 21.43% and family Lucanidae with 8 species representing 11.43% and rest belonged to other families. The maximum number of 46 species was identified as phytophagous representing 65.71% followed by a total number of 12 species representing decomposers (17.14%). Predators comprised of 10 species making up 14.29%. And scavengers comprised of 2 species making up 2.85%.

Keywords Biodiversity, Indian Himalayan region, species, urbanization, conservation, habitat loss, extinction, phytophagous, predators, scavengers.

Introduction

It is estimated that there are some 750,000 species of insects [1]. There are five orders which are known for their species richness. These five orders known are Coleoptera, Lepidoptera, Diptera, Hymenoptera and Hemiptera. According to recent data, Coleoptera comprises between 300,000-450,000 species [2], Lepidoptera comprises above 350,000 species, Diptera comprises above 350,000 species, Hymenoptera comprises above 350,000 species, and Hemiptera comprises above 350,000 species. It is surprising that for over 270 years, the insect taxonomist across the world could represent the number lesser than the actual richness of the insects. It is impossible in our time scale to inventorize all species even from a small area. The pattern of species-richness across the groups is uneven, so is their distribution geographically. Even though there is lack of proof by the inventories, yet the species richness in the tropical areas appears to be much higher compared to the temperate areas.

About 2000 species are currently considered edible for both humans and animals [1]. Some edible insects such as wasps, winged termites, grasshoppers, beetles, maggots, crickets, butterflies, caterpillars, palm tree larvae, locusts are reported as a good source of fats, proteins, vitamins and minerals, especially iron and zinc [3, 4, 5, 6]. It is expected that by the year 2050, the global population will reach or exceed

9 billion which will lead to the increase in demand for food, feed and fibres by 70% [7]. Thus, insects could contribute to the environment positively and also to the human health mainly for reasons associated with high protein content, minerals and vitamins and lower impact on the resources and environment by minimal emission of greenhouse gases, occupying lesser space and water and also converting ingested food into biomass efficiently as compared to their other vertebrate counterparts [8].

Jakhama is located 18 km towards South of Kohima. Kohima is the Capital of Nagaland state of North-Eastern Region (NER) of India. Jakhama is the indigenous Southern Angami Naga Village. This region is located at an elevation of 1606 meters (5269 feet) above sea level and lies between 25.58213ºN latitude and 94.12563ºE longitude [9]. The soil of the North Eastern region is acidic in nature and rich in organic matter [10]. The region falls under Indian Himalayan region and is a biodiversity hot spot. No consolidated data are available on the work done on the diversity of the coleopterans in this region apart from the works of Bhutani and Jotwani (1984) [11] and David (2001) [12] who cited some of the coleopterans in India. Zeenet et al., (2011) [10] have provided a checklist of coleopterans associated with the ecosystems of NER.

On this threatened planet, low priority is given for the concepts on conservation of habitats on insects. According to the study done in tropical American rainforests, the undescribed novelty insect species seems to be from the beetles, which gives an estimate for the high species richness. Yeates et al., (2003) [13] in his study has estimated that there are 23,000 species of bettle in Australia. Studies done on beetle communities on Oceanic Islands [14], and large administrative unit [15, 16, 17] gave a finer scales on important biodiversity data. Whether we estimate 30-80 million species in our globe, at least half of species diversity comprises of insects. Hence, an attempt has been made in this region to provide an annotated checklist of the coleopterans.

Methodology

Study area: Periodic surveys were carried out in the different areas covering the crops, weeds, road side walks and all approachable forest areas of the locality in Jakhama of Kohima district over a span of two years i.e., 2021-2023. Occasional encountered specimens were also taken and considered for the study.

Climatic conditions: It has a temperate highland tropical climate with dry winter climate. Average annual temperature is 21.12ºC (70.02ºF) which makes it 4.85% lower than the India's average. Jakhama region has a high rainfall of about 461.18 millimetres (18.16 inches) and has around 251.29 days (68.85 % of the time) annually. Average humidity is 80.89%. Altitude of the area is 1606m (5,269 ft) above sea level [9].

The insects were collected through visual encounter surveys methodology and by methods such as light traps, net-sweeping, hand picking and pitfall trap. The visual encounter survey methodology is the only feasible and appropriate method of surveys in hilly regions [18]. Specimens were collected and preserved for identification. Preservation of specimens was as per standard entomological techniques. Identification was done till species level based on morphological features using standard reference books [19, 20, 21, 22].

Results and Discussions

Beetles are considered the largest group of organisms on earth with about 30,000 species recorded in Australia and many yet to be discovered. Worldwide it is estimated to be 3,50,000 beetle species. Beetle can vary difference in size from tiny, just a fraction of a millimetre to huge, 160 millimetre long [23].

The identification of the coleopteran species for the study is carried out and comprises of numerous families. Altogether a total of 70 species, belonging to 17 families were enumerated, *viz* Scarabaeidae (19), Cerambycidae (15), Lucanidae (8), Coccinellidae (7 species), Oedermeridae (3), Meloidae (3), Tenebrionidae (3), Hydrophilidae (2), Silphidae (2), Chrysomelidae (1), Cantharidae (1), Lampyridae (1), Passaloidae (1), Dynastidae (1), Buprestidae (1), Trictenotomidae (1) and Elateridae (1). "Table 1" represents the list of identified species according to their families. Family Scarabaeidae constituted 27.14% followed by family Cerambycidae representing 21.43%. It is then followed by family Lucanidae representing 11.43% and rest belonged to other families.

The study on the habitat as well as the utility of the identified species is also carried out given in "Table 2". The total of 46 different species is identified as phytophagous representing 65.71% followed by 12 species representing decomposers (17.14%). It is then followed by a total number of 10 species identified as predators representing 14.29%, and 2 species representing scavengers (2.85%).

The total different species representing phytophagous insects are known for its cybernetic system in the ecosystem. In the ecosystem it occupies a small biomass, amplifies rapidly. They are sensitive to airborne and waterborne environmental cues with a close system regulating itself using a feedback loop on primary production as well as other processes [24]. The predators representing 10 different species are important in keeping the phytophagous population in check. Scavengers and decomposers like the dung beetle (*Scarabeaus sacer*) feed on decaying matter and serve as a decomposer. They play an important role in recycling nutrients in the ecosystems by releasing nutrients, such as carbon and nitrogen, back into the environment.

Habitat loss and urbanization has an impact at the extinction of organism in localized and regional level [25, 26]. These habitat losses have automatically led to the global decline in insect biodiversity [27, 28, 29, 30]. Insects such as fireflies are attracted by light which is commonly known as flight-to-light behaviour and they are much impacted by pollution of light [31, 32, 33]. Female of fireflies are especially adversely impacted by artificial lights, with females under artificial lights being nonresponsive to nearby males [34]. It is a key global challenge for the conservation of insects in urban environments [35]. There is continuous expansion of urban areas globally [36] raising the concerns of its rapid impacts on the biodiversity and urban ecology during these past decades [37] affecting into natural environments even into protected areas [38, 39].

Table 1 List of coleopteran species identified and presented according to families.

Sl. No	Common Name	Family	Genus	Species
1.	European Chafer	Scarabaeidae	*Amphimallon*	*Majale*
2.	Four-Toothed Dung Beetle	Scarabaeidae	*Pseudocanthon*	*Peplexus*
3.	Christmas Beetle	Scarabaeidae	*Anoplognathus*	*Pallidicollis*
4.	Green Chafer	Scarabaeidae	*Anomala*	*Albopilosa*
5.	Cupreous Chafer	Scarabaeidae	*Anomala*	*Cuprea*
6.	Chafer Beetle	Scarabaeidae	*Cheirotonus*	*Macleayi*
7.	Horned Dung Beetle	Scarabaeidae	*Copris*	*Lunaris*
8.	Green June Beetle	Scarabaeidae	*Cotinis*	*Nitida*
9.	Southern Masked Chafer	Scarabaeidae	*Cyclocephala*	*Lurida*
10.	Elephant Dung Beetle	Scarabaeidae	*Heliocopris*	*Bucephalus*
11.	African Black Beetle	Scarabaeidae	*Heteronychus*	*Arator*

12.	Scarab Beetle	Scarabaeidae	*Heterorrhina*	*Elegans*
13.	Sugarcane Beetle	Scarabaeidae	*Holotrichia*	*Consanguinea*
14.	Grapevine Beetle	Scarabaeidae	*Pelidnota*	*Punctata*
15.	May Beetle	Scarabaeidae	*Phyllophaga*	*Nebulosa*
16.	Rhinoceros Beetle	Scarabaeidae	*Xylotrupes*	*Gideon*
17.	Dung Beetle	Scarabaeidae	*Scarabeaus*	*Sacer*
18.	Coconut Rhinoceros Beetle	Scarabaeidae	*Oryctes*	*Rhinoceros*
19.	Flower Chafer	Scarabaeidae	*Mimela*	*Splendens*
20.	Longhorn Beetle	Cerambycidae	*Aristobia*	*Approximator*
21.	Rubber Root Borer	Cerambycidae	*Batocera*	*Rubus*
22.	Mango Stem Borer	Cerambycidae	*Batocera*	*Rufomaculata*
23.	Round Neck Longhorn Beetle	Cerambycidae	*Chlorophorus*	*Varius*
24.	Palo Verde Beetle	Cerambycidae	*Derobrachus*	*Geminates*
25.	Ivory Marked Beetle	Cerambycidae	*Eburia*	*Quadrigeminata*
26.	Baded Hickory Borer	Cerambycidae	*Knulliana*	*Cincta*
27.	Timberman Beetle	Cerambycidae	*Monochamus*	*Galloprovincialis*
28.	White Spotted Swayer	Cerambycidae	*Monochamus*	*Scutellus*
29.	Pine Swayer	Cerambycidae	*Monochamus*	*Sutor*
30.	Ribbed Pine Borer	Cerambycidae	*Rhagium*	*Inquisitor*
31.	Mango Branch Borer	Cerambycidae	*Rhytidodera*	*Simulans*
32.	Black Longhorn Beetle	Cerambycidae	*Spondylis*	*Buprestoides*
33.	Longhorn Beetle	Cerambycidae	*Thysia wallichii*	*Tonkinensis*
34.	Monkeypod Roundhead Longhorn Beetle	Cerambycidae	*Xystrocera*	*Globosa*
35.	Little Stag Beetle	Lucanidae	*Dorcus*	*Rectus*
36.	Giant Stag Beetle	Lucanidae	*Dorcus*	*Titanus*
37.	Stag Beetle	Lucanidae	*Lucanus*	*Cervus*
38.	Elephant Stag Beetle	Lucanidae	*Lucanus*	*Elaphus*
39.	Miyami Stag Beetle	Lucanidae	*Lucanus*	*Maculifermoratus*
40.	Golden Stag Beetle	Lucanidae	*Odontolabis*	*Cuvera*
41.	Saw-Tooth Stag Beetle	Lucanidae	*Prosopocoilus*	*Inclinatus*
42.	Giraffe Stag Beetle	Lucanidae	*Prosopociolus*	*Giraffe*
43.	Two-Spotted Ladybug	Coccinellidae	*Adalia*	*Bipunctata*
44.	Nine Spotted Ladybug	Coccinellidae	*Coccinella*	*Novemnotata*
45.	Seven Spotted Beetle	Coccinellidae	*Coccinella*	*Septempunctata*
46.	Transverse Ladybeetle	Coccinellidae	*Coccinella*	*Transversalis*
47.	Variable Ladybird	Coccinellidae	*Coelophora*	*Inaequalis*
48.	Asian Lady Beetle	Coccinellidae	*Harmonia*	*Axyridis*
49.	Lady Bug	Coccinellidae	*Oenopia*	*Conglobata*
50.	Redneck False Blister	Oedermeridae	*Asclera*	*Ruficollis*

	Beetle			
51.	Red-Black False Blister Beetle	Oedermeridae	*Ananca*	*Bicolour*
52.	False Blister Beetle	Oedermeridae	*Asclera*	*Puncticollis*
53.	Blister Beetle	Meloidae	*Lytta*	*Aenea*
54.	Stripped Blister Beetle	Meloidae	*Epicauta*	*Hirticornis*
55.	Blister Beetle	Meloidae	*Hycleus*	*Phaleratus*
56.	Hairy Darkling Beetle	Tenebrionidae	*Lagria*	*Villosa*
57.	Darkling Beetle	Tenebrionidae	*Tenebrio*	*Molitor*
58.	Dark Mealworm Beetle	Tenebrionidae	*Tenebrio*	*Obscures*
59.	Dark Diving Beetle	Hydrophilidae	*Hydrophilus*	*Cashmirensis*
60.	Giant Black Water Beetle	Hydrophilidae	*Hydrophilus*	*Triangularis*
61.	Carrion Beetle	Silphidae	*Necrophila*	*Americana*
62.	Burying Beetle	Silphidae	*Nicrophorus*	*Defodiens*
63.	Red Pumpkin Beetle	Chrysomelidae	*Aulacophora*	*Foveicollis*
64.	Soldier Beetle	Cantharidae	*Cantharis*	*Livida*
65.	Portugese Firefly	Lampyridae	*Luciola*	*Lusitanica*
66.	Patent Leather Beetle	Passaloidae	*Odontataenius*	*Disjunctus*
67.	Rhinoceros Beetle	Dynastidae	*Pentodon*	*Idiota*
68.	Jewel Beetle	Buprestidae	*Sternocera*	*Chrysis*
69.	Not named at present	Trictenotomidae	*Trictenotoma*	*Grayi*
70.	Click Beetle	Elateridae	*Agriotes*	*Sputator*

Table 2 The habitat and utility of the beetles collected.

Sl. no.	Scientific name	Food habits	Economic importance
1.	*Agriotes sputator*	Phytophagus	Plant pest
2.	*Amphimallon majale*	Phytophagus	Plant pest
3.	*Cheirotonus macleayi*	Phytophagus	Plant pest
4.	*Chlorophorus varius*	Phytophagus	Plant pest
5.	*Anomala albopilosa*	Phytophagus	Plant pest
6.	*Anomala cuprea*	Phytophagus	Plant pest
7.	*Aristobia approximator*	Phytophagus	Plant pest
8.	*Asclera puncticollis*	Phytophagus	Plant pest
9.	*Asclera ruficollis*	Phytophagus	Plant pest
10.	*Aulacophora foveicollis*	Phytophagus	Plant pest
11.	*Batocera rubus*	Phytophagus	Plant pest
12.	*Batocera rufomaculata*	Phytophagus	Plant pest
13.	*Cotinis nitida*	Phytophagus	Plant pest
14.	*Cyclocephala lurida*	Phytophagus	Plant pest (grubs)
15.	*Derobrachus geminates*	Phytophagus	Plant pest
16.	*Eburia quadrigeminata*	Phytophagus	Plant pest
17.	*Epicauta hirticornis*	Phytophagus	Plant pest

18.	*Heteronychus arator*	Phytophagus	Plant pest
19.	*Heterorrhina elegans*	Phytophagus	Plant pest
20.	*Holotrichia consanguinea*	Phytophagus	Plant pest
21.	*Hycleus phaleratus*	Phytophagus	Plant pest
22.	*Knulliana cincta*	Phytophagus	Plant pest
23.	*Lagria villosa*	Phytophagus	Plant pest
24.	*Lucanus cervus*	Phytophagus	Plant pest
25.	*Lucanus elaphus*	Phytophagus	Not present in enough number to be considered as pest
26.	*Mimela splendens*	Phytophagus	Plant pest
27.	*Monochamus galloprovincialis*	Phytophagus	Plant pest
28.	*Monochamus scutellus*	Phytophagus	Plant pest
29.	*Monochamus sutor*	Phytophagus	Plant pest
30.	*Oryctes rhinoceros*	Phytophagus	Plant pest
31.	*Pentodon idiota*	Phytophagus	Plant pest
32.	*Pelidnota punctata*	Phytophagus	Plant pest
33.	*Phyllophaga nebulosa*	Phytophagus	Plant pest
34.	*Prosopocoilus inclinatus*	Phytophagus	Plant pest
35.	*Prosopociolus giraffe*	Phytophagus	Plant pest
36.	*Pseudocanthon peplexus*	Phytophagus	Plant pest
37.	*Rhagium inquisitor*	Phytophagus	Plant pest
38.	*Rhytidodera simulans*	Phytophagus	Plant pest
39.	*Spondylis buprestoides*	Phytophagus	Plant pest
40.	*Sternocera chrysis*	Phytophagus	Plant pest
41.	*Trictenotoma grayi*	Phytophagus	Plant pest
42.	*Tenebrio molitor*	Phytophagus	Plant pest
43.	*Tenebrio obscures*	Phytophagus	Plant pest
44.	*Thysia wallichii tonkinensis*	Phytophagus	Plant pest
45.	*Xystrocera globosa*	Phytophagus	Plant pest
46.	*Xylotrupes Gideon*	Phytophagus	Plant pest
47.	*Scarabeaus sacer*	Decomposer	Ecosystem restorer
48.	*Lucanus maculifermoratus*	Decomposer	Ecosystem restorer
49.	*Hydrophilus triangularis*	Decomposer	Ecosystem restorer
50.	*Necrophila Americana*	Decomposer	Ecosystem restorer
51.	*Nicrophorus defodiens*	Decomposer	Ecosystem restorer
52.	*Odontataenius disjunctus*	Decomposer	Ecosystem restorer
53.	*Odontolabis cuvera*	Decomposer	Ecosystem restorer
54.	*Copris lunaris*	Decomposer	Ecosystem restorer
55.	*Dorcus rectus*	Decomposer	Ecosystem restorer
56.	*Dorcus titanus*	Decomposer	Ecosystem restorer
57.	*Heliocopris bucephalus*	Decomposer	Ecosystem restorer

58.	*Hydrophilus cashmirensis*	Decomposer	Ecosystem restorer
59.	*Oenopia conglobata*	Predator	Pest control
60.	*Adalia bipunctata*	Predator	Pest control
61.	*Harmonia axyridis*	Predator	Pest control
62.	*Luciola lusitanica*	Predator	Pest control
63.	*Lytta aenea*	Predator	Pest control
64.	*Coccinella novemnotata*	Predator	Pest control
65.	*Coccinella septempunctata*	Predator	Pest control
66.	*Coccinella transversalis*	Predator	Pest control
67.	*Coelophora inaequalis*	Predator	Pest control
68.	*Cantharis livida*	Predator	Pest control
69.	*Ananca bicolour*	Scavenger	Ecosystem restorer
70.	*Anoplognathus pallidicollis*	Scavenger	Ecosystem restorer

Conclusion

The checklist of the biodiversity of beetles (Coleoptera) at Jakhama shows species-richness representing a good total of 70 species of coleopterans. The study on the habitat and their utility gave a different specialised feeding mechanism found in insect groups such as phytophagous feeding including sap feeding, detritus feeding on rotting or decaying matter, woods etc., and predators controlling the population of a particular organism. Thus their role in ecosystem dynamics cannot be underestimated. Some beneficial insects contribute as human food as well as through other food sources. While other insects' gives an impact in agriculture and horticulture field, and thereby affect our economy apart from our health. Habitat loss and urbanisation has an impact at the extinction of organism. Works associated with human aesthetics have been carried out on the butterflies and large showy beetles, but much more needs to be done.

Conflict of interest

Authors have no conflict of interest.

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