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The Introduction of Beetles and Sur Sarovar Bird Sanctuary–A Review

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Abstract

Beetles are the flying insects, measures from less than half millimeter to more than 20 centimeter. It belongs to subclass pterygota and order coleopteran. The occurrence of coleoptera is fascinated by almost all types of environments (including terrestrial - up to mountain tops and freshwater raging waters. In numbers, around 4 out of 5 animals are nominated as a beetle which means it comprises a vast majority of species. Beetles covers almost 4o% of all insects species's while 30% of all animals. The reason behind the success of this order is due to the adaptations-overlap in habitat compatible with adult forms for the sex, mating and dispersal. Beetles probably originated in Permian period and flourished in Mesozoic era.

Keywords: beetles, , diversity, Sur Sarovar Bird Sanctuary SSBS

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Introduction

The geological history of caleoptera (Beetles and Weevils) is one of the few academic disciplines in palaeoentomology that developed in recent past. The coleopteran fossils were collected in a large extent from all epochs (or periods) (Crowason, 1974). The term coleoptera – a certain group of insect with wing shield (Gr. Koleon = sheath) was given by Aristotle in 4th century B C and he Shaded light on beetles in his book Historia Animalium volume I. Beetles are well preserved in the fossil form owing to elytra – wing case. The coleopteran (Beetles) of the lower most Jurassic period of Mesozaic era show resemblance with those from the upper most Triassic period (251 – 200 million years ago) of Mesozoic era. Some species are common in both the uppermost Triassic period and the lower most Jurassic period and collected from marine deposits in England. The insect faunal diversity is relatively slowed hear the T/J boundary and these fossils are much similar to Cupedidae genus Omma Newman, 1839. All recent Cupedids are survived on Angiosperms (or flowering plants) only (Crowason, 1981). Together with weevils, beetles were estimated collectively as much as 3,92,000 in numbers in which 3,89,487 extant species and around 2,900 species reported as fossils. This study is carried out by Zhang in 2013. Evolutionary study is revealed that the coleopteran were originated in the Jurassic period of (200 Mya) Mesozoic era and diversify into tertiary period of Cenozoic era (Grimaldi and Engel, 2005). Scientists assume that the extant species of beetles estimates about 13.5 million but heretofore only 1.75 million of species are described (Gaston and Spicer, 2004).

According to the Grove and Stork (2000), the discovery of more than 90% of all the beetles is waiting to explore. In the evolutionary history, the emergence of grass ecosystem - happened in the tertiary period of Cenozoic era - provide a chance for beetles to co-evolve with the development of coprophagy habits (Statz, 1952). The extant species of beetles are much similar to the beetles of Neocene and Pliocene in morphology but in the ecology and geography they are much different.(Elias,1994) More than 22334 species of 114 families of beetles have been recorded from India in which Polyphaga is much species rich suborder as compared with suborder Adephaga (Chandra and Raghunathan 2018)

Habitat - According to Ghosh, and Gupta (1982), India hold various kind of ecosystem which are included as – a) Terrestrial Ecosystem b) Aquatic Ecosystem which constitute forest, grassland, deserts, and mountain in Terrestrial Ecosystem where freshwater and marine ecosystem in Aquatic Ecosystem. Generally, they are phytophagous, many are aquatic and few are parasitic forms. There are few species complete their life cycle as commensals in the nests of social insects. Extreme variation is seen in the habitat of order coleopteran in which the most preferred habitat is either soil itself or matter of animal and plant decay (dung, carrion, rotting woods, fungus etc).

Key characters of Suborder Adephaga and Polyphaga

	Suborder ADEPHAGA (Mostly Predacious)	Suborder POLYPHAGA (mostly Plant feeder)
1	Presence of notopleural suture	Absent
2	Presence of hind wings with oblongum	Presence of hind wings (no oblongum is found)
3	Presence of immovable hind coxae	Presence of movable hind coxae, small trochanter aligned with coxa and femur
4	First abdominal sternum divides	No division of first abdominal sternum
5	Presence of tarsal in the form of 5-5-5 formula	No permanent formula is found of tarsal
6	5 segmented legs found in larval stage with 1 or 2 claws	Larval stage covers 4 or less than 4 segmented legs with single claw or absent

Classification of Coleoptera done by many author by periods of time, chiefly by Verhoeff in 1893; Sharp and Muir in 1912, Forbes in 1926, Stickney in 1923, Tanner in 1927, Boving and Craighead in 1931, Poel in 1932, William in 1938 and Smith in 1950 but the authentic classification by given by Crowson in 1955 on the basis of natural characters in both adult and larva stages for instances morphology, anatomy, life histories, physiology etc. In this context, Crowson categorised order coleoptera under 4 suborders, 22 super families, 157 families (3 families with uncertain systematic position).

What beetles can do?

Role in Pollination

No doubt, the order Coleoptera or Beetles are recognised as the group of insects responsible for pollination of mostly flowering plants and even, the beetles coevolved with angiosperms in the evolutionary history owing to adaptive radiation. Mostly, the polyphagous beetles visit flowers for pollination in which they feed nectar, pollen, food materials and other (Corlett, 2004). In the year of 2003, Devy and Davidar reported that beetles pollinate trees of the family Annonaceae.

Role in Integrated Pest Management (IPM)

The beetles - especially ladybird beetles in family Coccinellidae - are ecologically as well as economically very significant in Integrated Pest Management (IPM) and widely acknowledged for their role in biological control of aphids and coccids as predators (Omkar and Kumar, 2013). Role to detect illness of environment Basically, the Bio indicator species is detects the health of ecosystem and it defined as a species that reflects all the (biotic and abiotic) environmental state or in other words, it detects the illness of environment. All the environmental changes including habitat changes, community dynamic or changes in ecosystem is firstly indentified by the indicator species. (Gerhardt A., 2009). The bioindicators is based on their cost effectiveness and indicate about early changes in the environment. Carabid beetles or Ground beetles shows sensitivity against the disturbance of the environment and also shows the response of other surrounding species (Rainio and Niemela, 2003). As bio-indicators in savanna ecosystems, dung beetles have attracted a lot of research interest. To evaluate the dung beetle's indicator responses, they first employ the indicator value (IndVal) approach, and then they combine habitat fidelity and specificity assessments. Rompp B. (1990). In order to evaluate sustainable forest management in India, researchers, habitat developers, and foresters rely on bio indicators (Kotwal *et al*., 2008).

Significance in Medicinal - Blister beetles from the family Meloidae (3 species) and rove beetles from the family Staphylinidae (3 species) are the most common type of coleopteran which has medicinal significance (Mullen and Durden, 2009). The Karbi tribe of Assam (India) used the blister beetles (Epicauta hirticornis and Mylabris cichorii) as a folk medicine in the treatment of different human diseases and sometime cancer cases (Verma and Prasad, 2013).

Role As Food Resources - In 2017, Jongema described more than 2,111 edible insect species globally in which around 659 species of coleopteran are

included into the category of food resources for humankind. They are also most valuable in economic significance. These insects have a broad range of habitat, successfully obtaining any substances that have nutritional value (Coleoptera: India. 2015).The Different tribes in India are used almost 255 species as food of insects. In India, beetles are mainly consumed insects which covers almost 34% followed by Orthoptera (24%), Hemiptera (17%), Hymenoptera (10%), Odonata (8%), Lepidoptera (4%), Isoptera (2%) and Ephemeroptera (1%). Mainly Indian tribes (from different states) consume insects as food resources. (Chakravorty, 2014).

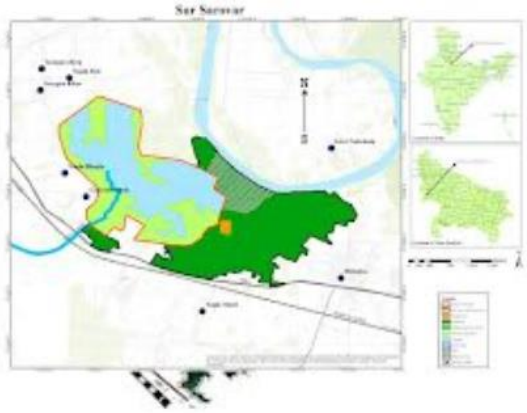
SUR SAROVAR BIRD SANCTUARY (SSBS)

Geography Location

Sur Sarovar Bird Sanctuary (SSBS) lies in the famous city of Taj (the bank of river Yamuna on other side of national higway) on the National highway 2 (Agra - Mathura – Delhi) which is regulated by the National Chambal Sanctuary Project U.P. – Agra Division. Longitudinally, this sanctuary lies between 77°-26' east to 78°-51' east and between 26°- 43' north to 27°-26' north latitudinal. The Lake inside the bird sanctuary is called Keetham Lake which is pentagonal in shape. Many islands constructed artificially on the margin of lake for shelter and breeding grounds to the migratory birds. (Uttar Pradesh Forest Department 2010). Even, the water level of Keetham Lake is stable because the raw water comes from Agra Canal originating through the Okhla barrage on River Yamuna in Delhi. On 27th March 1991, notification numbers 764/4-3-49/90 issued by the government of Uttar Pradesh under the wildlife (Protection) Act, 1972 (section 18) to announced SSBS as National **Bird Sanctuary.**

In the year of 21-08-2020, it is announced as "RAMSAR SITE" under Ramsar convention which is 8th Ramsar Site of Uttar Pradesh. Ramsar Site is the wetlands in nature of ecosystems (Uttar Pradesh Forest Department 2020). Agra is the part of the Indo - Gangetic plains. The monsoon and extra - tropical storms from the Mediterranean region that cause western disturbance. The sanctuary is spread over 713 hectares - 7.13 km2 (including Keetham Lake with 300 hectares) which is divided –

I. Core zone (central area) – it covers 3.96 km2,
II. Buffer zone – it covers 3.55 km2 and
III. Tourism zone (peripheral area) – it covers 0.48 km2



Faunal Diversity

The winter movement of birds is the main reason for its fame; over 106 species of birds, both migratory and resident, use this area for various reasons, such as resting. Keetham Lake is home to a variety of important aquatic birds, including Little Gerbs, Cormorants, Darters, Grey Heron, Purple Heron, Paddy Bird, Cattle Egrets, Large Egrets, Smaller Egrets, Little Egrets, Night Heron, Indian Reef Heron, Black necked Stork, white ibis, Spon Bill, Greying Goose, Bar headed Goose, Lesser Whistling Teal, Ruddy Shelduck, Pintail, Common Teal, Spot Billed Duck, Gadwall, Wigeon, Shovler or Comb In addition to python point and a bear rescue facility, Keetham is known for its wildlife protection efforts.

Floral Diversity

According to wwfenvis, 2015, the vegetation of this zone comprises grasses, Eucalyptus, Zizypus, Delbergia, Lantana etc. A variety of wild flora types surround SSBS. Field research revealed that Soor Sarovar Bird Sanctuary's native flora is dwindling in number while invasive species including Prosopis juliflora and Lantana camara are multiplying at an alarming rate. During summer, the entire lake region is covered in abundant growth of water hyacinth (Eichornia sp.) and Potamogeton sp., which are macrophytic plants. During the winter, Keetham Lake is home to a diverse array of birds thanks to its clean water. Soor Sarovar Bird Sanctuary is home to a variety of bird and herbivore species, and it is classified as a northern tropical dry deciduous forest by Champion and Seth.

Research Studies of Beetles in India

•Almost more than 100 years ago in 1909 the study of Indian Coleoptera was done by Lefroy and published Indian Insect life.

•Arrow began working on Lamellicorniae in 1931, which was later published as Volume I. He then published his work on Carabidae in 1929, part I, and part II, in 1935 and 1949, respectively. In 1931, Arrow produced a book on Indian coprinae as part of their Fauna of British India series. Rajasthan did not contribute even one species to this publication.

•In 1912, Fonter also published a work on Cicindellidae.

• S Biswas wrote a monograph in 1978 on Scarabaeidae from the Oriental area and the Palaearctic. The study included the Scarabaeidae fauna of many Indian states, such as Arunachal Pradesh, West Bengal, Delhi, Meghalaya, Tripura, Sikkim, Manipur, and North East India.

•In 2008, Mehta also worked on the scarabs beetles in which specially larval forms harms extensively both cultivated and forest plants while the adult forms feed on the foliage of different fruit and forest trees and become active during May - June.

•In 2012, Ali A and Rana K.S. studied in the farmer's field of cauliflower at three districts (Mathura, Agra and Firozabad) of Uttar Pradesh. They observed that farmers prepared a nursery bed of cauliflower in the first week of October and transplanted them in the field during the last week of October. On which, an aphid attack initially recorded in the month of November at every experimental site and that time aphidophagous lady beetles also appeared in the farmer's fields in the month of November to manage the aphids and their population has been increased with inhabitants of aphids. The fauna of ladybeetles associated with aphid colonies were Coccinella septempunctata, Coccinella transversalis and Menochilus sexmaculatus.

•The pioneer contributors on ground beetle fauna of SBR are Andrews (1929). A total of 15 species of 7 Genera under 6 tribes belonging to 5 Subfamilies are reported from Sundarban Biosphere Reserve (SBR), of which 7 species undser 05 Genera are recorded for the first time from this region during the survey Saha *et al*. (1995).

•Sewak examined dung beetles in 1991 in five districts of western Uttar Pradesh (India). Dung beetles from Rajasthan, Arunachal Pradesh, and Uttar Pradesh were also part of his research.

• There are 102 species of Coleoptera found in Rajasthan's Thar Desert, belonging to 13 distinct families In a study, Kazmi *et al*. 2004.

•Abhasar documented rove beetle species from Mandi (Himachal Pradesh) in 2015 and investigated rove beetles from Sandi Bird Sanctuary (Uttar Pradesh) in 2012. In the family Carabidae, there are 174 species distributed across 72 genera and 20 subfamilies documented from the Sandi Bird Sanctuary in Uttar Pradesh. On the other hand, he calculated that there are 30,000 species of superfamily Staphylinoidea (Staphylinidae) known globally, with over 3,000 species recorded from India alone.

•In their 2012 and 2013 studies, Kushwaha and Hegde examined 551 specimens that belonged to 36 genera and 95 species. There are a total of 48 new species and 12 new genera found in Uttar Pradesh; 22 of these species are new to the state.

•Predaceous Coccinellids were identified as bioindicators in a crop-ecosystem with two types of habitats (forest area and cropland area) in 2003 by M. K. Zahoor and colleagues. Coccinellid diversity, richness, and evenness are also discovered. Coccinellidae diversity was higher in forested areas than in agricultural ones, according to their findings. Coccinellids, as bioindicators, reveal more broad details about the environment they inhabit.

•During their 2000 study in Keoladeo National Park, Bharatpur, George and Ipe discovered that the 5th instar larvae of the Cassida circumdata Herbst feeding on Ipomoea reptans (Linn.) consumed the most leaf area on the eighth day. The size of the beetle larval stage increases to its maximum on days 7 and 8, according to their findings.

•To monitor biodiversity in the Shivalik landscape of the northwestern Himalaya, V. P. Uniyal of the Wildlife Institute of India conducted the first ecological study on tiger beetles in 2007.

•In 2022, Ramesh reported 56 species from the Aravalli range, Jaipur (India) under 47 genera, subfamilies, 40 tribes, 27 subfamilies, and 12 families of two suborders, Adephaga and Polyphega of the total collected,

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