

## DIVERSITY AND DISTRIBUTION OF SOME ECONOMICALLY IMPORTANT LEAF BEETLES (COLEOPTERA: CHRYSOMELIDAE) IN BIBHUTIBHUSHAN, BETHUADAHARI AND KULIK WILDLIFE SANCTUARIES OF WEST BENGAL, INDIA

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### ABSTRACT

This study investigates the biodiversity of economically important leaf beetles (Coleoptera: Chrysomelidae) within Bibhutibhushan, Bethuadahari, and Kulik Wildlife Sanctuaries in West Bengal, India. Specimens collected from these sanctuaries were examined, resulting in the identification of 21 species across 14 genera and 6 subfamilies. The study revealed the dominance of Galerucinae (11 species), followed by Cassidinae (4 species), Cryptocephalinae (2 species), Hispinae (2 species), Eumolpinae (1 species), and Criocerinae (1 species). Many of these identified Chrysomelid species are known pests of commercially valuable agricultural and forestry crops, highlighting their economic significance. This inventory provides baseline data for assessing the ecological roles of these beetles and developing integrated pest management strategies within the protected areas and surrounding agricultural landscapes of West Bengal.

**Keywords:** Chrysomelidae, Leaf Beetles, Biodiversity, Economic Importance, Wildlife Sanctuaries.

### INTRODUCTION

The Chrysomelidae family, commonly known as leaf beetles, represents a remarkably diverse and ecologically significant group within the Chrysomeloidea superfamily. Primarily herbivorous, these beetles feed on a wide array of plant matter, including leaves, flowers, and roots. Their striking diversity in morphology, coloration, and global distribution underscores their ecological and economic importance. With over 32,500 species worldwide, classified into 2,114 genera (Bouchard *et al.*, 2017), Chrysomelidae are predominantly found in tropical regions, though they are also well-represented in temperate zones. They inhabit diverse habitats, showcasing a fascinating array of adaptations that facilitate survival in varied ecological niches. Often exhibiting vibrant metallic colors and intricate patterns, leaf beetles employ camouflage for defense and mate attraction. Their robust bodies and brightly colored elytra are distinctive characteristics.

The feeding habits of Chrysomelidae are equally diverse, with many species specializing on particular plant hosts. Some leaf beetles are recognized as significant agricultural

pests, capable of causing substantial damage to crops, while others play critical roles as pollinators or herbivores in natural ecosystems. The family is further divided into numerous subfamilies, each with unique characteristics. For example, the Alticinae, or flea beetles, are known for their jumping ability, facilitated by powerful hind legs (Maulik, 1926). The Galerucinae subfamily includes many economically significant pests, such as the pumpkin beetle, *Aulacophora foveicollis*, and the Colorado potato beetle, *Leptinotarsa decemlineata* (Sarker *et al.*, 2016). Other notable subfamilies include the Chrysomelinae, Eumolpinae, and Clytrinae, each possessing distinct morphological features and ecological roles.

Monographic studies on the Chrysomelidae fauna of India were conducted by Jacoby (1908) and Maulik (1919, 1926, 1936). Basu (1996) significantly contributed by documenting 320 Chrysomelidae species in West Bengal. More recent research, such as Patra and Bera's (2007) discovery of the polyphagous beetle, *Schenklingia bhaumiki*, feeding on ten fern species in the Lower Gangetic Plains, and Kharel *et al.*'s (2020) survey recording three leaf beetle species in Kalyani, West Bengal, have

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further expanded our understanding. While protected areas in West Bengal have received comparatively less attention, studies by Mitra *et al.* (2015) and Basu *et al.* (2017) have documented 16 species in Bethuadahari Wildlife Sanctuary, and Saha and Raychaudhari (1997) and Raychaudhari and Saha (2017) have explored leaf beetle diversity in the Buxa Tiger Reserve.

Documenting the leaf beetle fauna within wildlife sanctuaries is crucial for establishing baseline biodiversity data, monitoring ecological changes, and informing conservation strategies. These protected areas can serve as reservoirs for both beneficial and pest species, influencing the surrounding agricultural landscapes. In this study, we aimed to identify and catalog the leaf beetle species present in Bethuadahari, Bibhutibhushan, and Kulik Wildlife Sanctuaries in West Bengal. This research documents 21 species of leaf beetles, representing 14 genera and 6 subfamilies, from these sanctuaries. These species have significant economic implications, potentially impacting regional agricultural productivity through crop damage, particularly affecting crops such as rice, vegetables and fruit trees, and influencing natural ecosystem dynamics. This inventory provides essential data for developing integrated pest management strategies and furthering our understanding of the ecological roles of Chrysomelidae within West Bengal's protected areas.

## MATERIAL AND METHODS

### Study Areas

**i. Bethuadahari Wildlife Sanctuary**, a relatively small, tropical moist deciduous forest, is located in the Nadia district of West Bengal, India. Geographically positioned at 23.5975516°N 88.3920227°E, it covers approximately 66.77 hectares. Established in 1998, the sanctuary serves to protect the region's biodiversity.

**ii. Bibhutibhushan Wildlife Sanctuary** is a protected area situated in the North 24 Parganas district of West Bengal, India. This sanctuary is located on the banks of the Ichamati River, covering an area of approximately 0.68 square kilometers. Its geographical coordinates are 23°11'10"N 88°45'44"E.

**iii. Kulik Wildlife Sanctuary** is located in Raiganj, West Bengal, India, at 25°38'13"N 88°07'16"E. The sanctuary's specific geographical characteristics, including its proximity to the Mahananda River and its location within a tropical climate, contribute to its diverse ecosystem, supporting a wide variety of flora and fauna.

### Specimen collection and Identification

Specimens for this study were collected from three wildlife sanctuaries in West Bengal, India: Bibhutibhushan, Bethuadahari, and Kulik, during surveys conducted in 2021. Collection methods primarily involved sweep netting and hand picking. Locality details were meticulously recorded for each specimen. Subsequently, specimens were dry-pinned and identified using taxonomic literature from the Fauna of British India (including Ceylon and Burma) (Jacoby, 1908; Maulik, 1919, 1926, 1936) and by

comparison with reference collections housed at the Zoological Survey of India (ZSI), Kolkata. The identified specimens were then deposited in the National Zoological Collections of the Zoological Survey of India, Kolkata.

## RESULTS AND DISCUSSION

A total of 123 leaf beetle specimens were collected from Bibhutibhushan, Bethuadahari, and Kulik Wildlife Sanctuaries in West Bengal during surveys conducted in 2021. Identification of these specimens revealed 21 species, representing 14 genera and 6 subfamilies within the Chrysomelidae family: Cryptocephalinae, Criocerinae, Cassidinae, Hispinae, Galerucinae, and Eumolpinae (Table 1). The distribution of species across subfamilies was as follows: Galerucinae (11 species), Cassidinae (4 species), Cryptocephalinae (2 species), Hispinae (2 species), Eumolpinae (1 species), and Criocerinae (1 species).

*Aspidimorpha miliaris* (Fabricius, 1775) and *Monolepta signata* (Olivier, 1808) were recorded from all three wildlife sanctuaries. Conversely, *Cryptocephalus analis* Olivier, 1808, *Hoplasoma unicolor* (Illiger, 1800), *Monolepta limbata* (Olivier, 1808), *Oides flava* (Olivier, 1807), and *Oncocephala tuberculata* (Olivier, 1792) were exclusively recorded from Kulik Wildlife Sanctuary. *Lilioceris cheni* Gressit & Kimoto, 1961, *Aspidimorpha sanctaecrucis* (Fabricius, 1792), *Aulacophora indica* (Gmelin, 1790), *Phygasia unicolor* (Olivier, 1808), and *Sphenoraia bicolor* (Hope, 1831) were exclusively recorded from Bethuadahari Wildlife Sanctuary. *Platycorynus peregrinus* (Herbst, 1783) was exclusively recorded from Bibhutibhushan Wildlife Sanctuary. In this study, the collected 123 leaf beetle specimens, representing 21 species across 14 genera and 6 subfamilies, exhibited the following subfamily distribution: Galerucinae (52.38%), Cassidinae (19.04%), Cryptocephalinae (9.52%), Criocerinae (4.76%), and Eumolpinae (4.76%).

Bethuadahari Wildlife Sanctuary demonstrated the highest species richness, 14 species from 10 genera and 43 individuals. Kulik Wildlife Sanctuary recorded 11 species from 8 genera and 46 individuals. Bibhutibhushan Wildlife Sanctuary exhibited the lowest species richness and abundance, with 7 species from 6 genera and 34 individuals. The percent composition of the Chrysomelidae subfamilies recorded is presented in Figure 1. Table 3 presents the diversity indices calculated for leaf beetles in Kulik, Bethuadahari, and Bibhutibhushan Wildlife Sanctuaries, with the following observations:

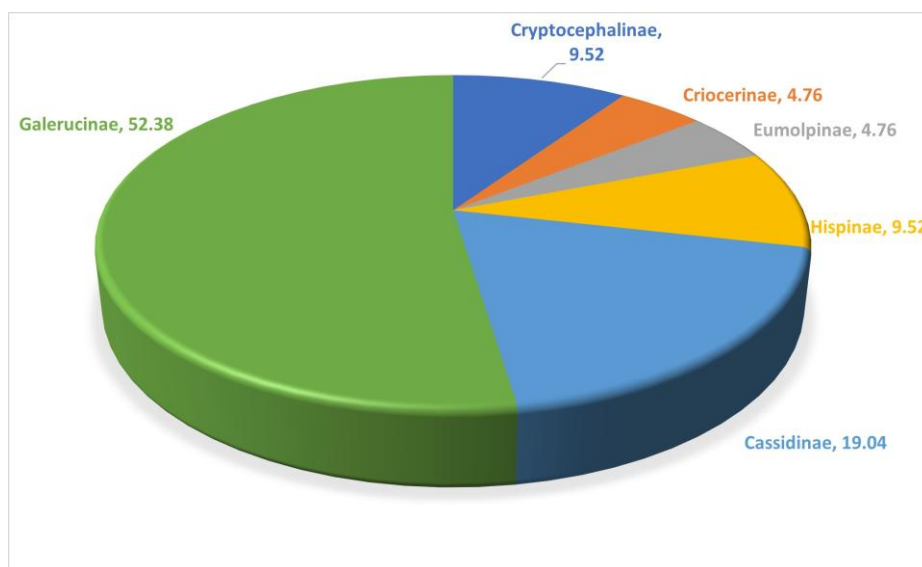
Bethuadahari Wildlife Sanctuary: Exhibited the highest species diversity with 14 species and 43 individuals. Simpson's Diversity Index: 0.318, indicating moderate species diversity. Shannon-Wiener Diversity Index: 0.779, indicating a less even species distribution compared to Kulik.

Recorded 14 species and 43 individuals. Simpson's Diversity Index: 0.318, suggesting moderate species diversity. Shannon-Wiener Diversity Index.

Bibhutibhushan Wildlife Sanctuary: Displayed the lowest species diversity with 7 species and 34 individuals.

Simpson's Diversity Index: 0.104, suggesting low species diversity. Shannon-Wiener Diversity Index: 0.644, demonstrating the least even distribution of species among the three sanctuaries. Based on these indices, Bethuadahari

Wildlife Sanctuary exhibited the highest biodiversity of leaf beetles, followed by Kulik. Bibhutibhushan Wildlife Sanctuary demonstrated the lowest diversity.



**Figure 1.** Species Distribution of Leaf Beetles by Subfamily in Kulik Wildlife Sanctuary (KWLS), Bethuadahari Wildlife Sanctuary (BDWLS), and Bibhutibhushan Wildlife Sanctuary (BBWLS).

**Table 1.** Checklist of Economically Important Leaf Beetles (Coleoptera: Chrysomelidae) from Kulik Wildlife Sanctuary (KWLS), Bibhutibhushan Wildlife Sanctuary (BBWLS), and Bethuadahari Wildlife Sanctuary (BDWLS), West Bengal (21 species, 14 genera, 6 subfamilies).

| Sl. No.                                           | Species Name                                     | Kulik          | Specimens Studied<br>Bethuadahari | Bibhutibhushan  |
|---------------------------------------------------|--------------------------------------------------|----------------|-----------------------------------|-----------------|
| <b>Subfamily Criocerinae Latereille, 1804</b>     |                                                  |                |                                   |                 |
| 1                                                 | <i>Lilioceris cheni</i> Gressit & Kimoto, 1961   | -              | 2 (07.xii.2021)                   | -               |
| <b>Subfamily Cryptocephalinae Gyllenhal, 1813</b> |                                                  |                |                                   |                 |
| 2                                                 | <i>Cryptocephalus analis</i> Olivier, 1808       | 2 (25.ix.2021) | -                                 | -               |
| 3                                                 | <i>Cryptocephalus sehestedti</i> Fabricius, 1798 | -              | 3 (05.xii.2021)                   | 2 (14.xii.2021) |
| <b>Subfamily Eumolpinae Hope, 1840</b>            |                                                  |                |                                   |                 |
| 4                                                 | <i>Platycorynus peregrinus</i> (Herbst, 1783)    | -              | -                                 | 3 (14.xii.2021) |
| <b>Subfamily Galerucinae Latreille, 1802</b>      |                                                  |                |                                   |                 |
| 5                                                 | <i>Aulacophora foveicollis</i> (Lucas, 1849)     | 9 (25.ix.2021) | 3 (07.xii.2021)                   | -               |
| 6                                                 | <i>Aulacophora indica</i> (Gmelin, 1790)         | -              | 1 (07.xii.2021)                   | -               |
| 7                                                 | <i>Hoplasoma unicolor</i> (Illiger, 1800)        | 7 (25.ix.2023) | -                                 | -               |
| 8                                                 | <i>Monolepta bifasciata</i> (Hornstedt, 1788)    | 1 (25.ix.2021) | 1 (04.xii.2021)                   | -               |
| 9                                                 | <i>Monolepta limbata</i> (Olivier, 1808)         | 2 (24.ix.2021) | -                                 | -               |
| 10                                                | <i>Monolepta signata</i> (Olivier, 1808)         | 9 (24.ix.2021) | 11 (06.xii.2021)                  | 7 (13.xii.2021) |
| 11                                                | <i>Oides flava</i> (Olivier, 1807)               | 3 (25.ix.2021) | -                                 | -               |
| 12                                                | <i>Oides maculata</i> (Olivier, 1807)            | -              | 4 (04.xii.2021)                   | 8 (13.xii.2021) |
| 13                                                | <i>Oides palleata</i> , (Fabricius, 1781)        | 2 (24.ix.2021) | -                                 | -               |
| 14                                                | <i>Phygasia unicolor</i> (Olivier, 1808)         | -              | 1 (25.ix.2021)                    | -               |
| 15                                                | <i>Sphenoraia bicolor</i> (Hope, 1831)           | -              | 2 (26.ix.2021)                    | -               |
| <b>Subfamily Cassidinae Gyllenhal, 1813</b>       |                                                  |                |                                   |                 |
| 16                                                | <i>Oncocephala tuberculata</i> (Olivier, 1792)   | 3 (26.ix.2021) | -                                 | -               |
| 17                                                | <i>Rhadinosa reticulata</i> (Baly, 1888)         | -              | 4 (09.xii.2021)                   | 5 (13.xii.2021) |
| 18                                                | <i>Aspidomorpha dorsata</i> (Fabricius, 1787)    | -              | 1 (04.xii.2021)                   | 1 (15.xii.2021) |
| 19                                                | <i>Aspidomorpha miliaris</i> (Fabricius, 1775)   | 6 (25.ix.2023) | 5 (07.xii.2021)                   | 8 (14.xii.2021) |

|    |                                                     |                |                 |   |
|----|-----------------------------------------------------|----------------|-----------------|---|
| 20 | <i>Aspidimorpha sanctaecrucis</i> (Fabricius, 1792) | -              | 3 (06.xii.2021) | - |
| 21 | <i>Cassida circumdata</i> Herbst, 1799              | 2 (25.ix.2023) | 2 (07.xii.2021) | - |

**Table 2.** Species Richness of Leaf Beetles by Subfamily in Kulik Wildlife Sanctuary (KWLS), Bethuadahari Wildlife Sanctuary (BDWLS), and Bibhutibhushan Wildlife Sanctuary (BBWLS).

| Sl. No. | Subfamily        | Genera    | No. of Species | Species %  |
|---------|------------------|-----------|----------------|------------|
| 1       | Cryptocephalinae | 1         | 2              | 9.52       |
| 2       | Criocerinae      | 1         | 1              | 4.76       |
| 3       | Eumolpinae       | 1         | 1              | 4.76       |
| 4       | Galerucinae      | 7         | 11             | 52.38      |
| 5       | Hispinae         | 2         | 2              | 9.52       |
| 6       | Cassidinae       | 2         | 4              | 19.04      |
|         | <b>Total</b>     | <b>14</b> | <b>21</b>      | <b>100</b> |

**Table 3.** Diversity Indices for Leaf Beetles in Kulik Wildlife Sanctuary (KWLS), Bethuadahari Wildlife Sanctuary (BDWLS), and Bibhutibhushan Wildlife Sanctuary (BBWLS).

| Diversity Indices              | Kulik | Bethuadahari | Bibhutibhushan |
|--------------------------------|-------|--------------|----------------|
| Number of Species              | 11    | 14           | 7              |
| Number of Individuals          | 46    | 43           | 34             |
| Simpson's Diversity Index      | 0.408 | 0.318        | 0.104          |
| Shannon-Weiner Diversity Index | 1.033 | 0.779        | 0.644          |
| Evenness                       | 0.431 | 0.295        | 0.331          |
| Dominance                      | 0.454 | 0.036        | 0.009          |

## CONCLUSION

This study provides a comprehensive account of the diversity of economically significant leaf beetles (Chrysomelidae) across three key wildlife sanctuaries in West Bengal Bibhutibhushan, Bethuadahari, and Kulik. The identification of 21 species spanning 14 genera and 6 subfamilies, with a notable dominance of Galerucinae, underscores the rich biodiversity of Chrysomelids in these protected ecosystems. Given that many of the recorded species are recognized agricultural and forestry pests, their presence within and around these sanctuaries carries important ecological and economic implications. The findings serve as a vital reference for future ecological monitoring and pave the way for the development of informed, area-specific integrated pest management (IPM) strategies. Continued studies are essential to better understand the dynamics of these beetle populations and their interactions with native flora and cultivated crops in the region.

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## CONFLICT OF INTERESTS

The authors declare no conflict of interest

## ETHICS APPROVAL

Not applicable

## AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

## DATA AVAILABILITY

Data will be available on request

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