Postprint: Species Diversity of Coleoptera in the Altai Mountains, Xinjiang

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Date: 2019-10-11T00:00:00+00:00

Abstract

Based on the 2015 scientific expedition results of insect resources in the Altai Mountains of Xinjiang, combined with the coleopteran specimens from the Altai Mountains housed in the Insect Museum of the College of Life Science and Technology at Xinjiang University, specimen identification and statistical data analysis were conducted on Coleoptera insects from six forest farms in the Altai Mountains. A total of 2,061 Coleoptera specimens were compiled, belonging to 22 families, 85 genera, and 129 species. Diversity analysis indicated that the dominant groups were Chrysomelidae and Scarabaeidae, accounting for 43.76% of the total Coleoptera species (31.44% and 12.32%, respectively), with Pallasiola absinthii (Pallas) and Cymnopleurus flagellates (Fabricius) as the dominant species. The family-level Shannon-Wiener index was highest in Fuyun Forest Farm (2.18), followed by Fuhai Forest Farm (2.17); the species-level Shannon-Wiener index was highest in Fuhai Forest Farm (3.01). Both species-level and family-level Margalef indices were highest in Fuhai Forest Farm (2.79 and 7.94); the family-level similarity coefficient was highest between Fuhai Forest Farm and Fuyun Forest Farm (0.17); due to the similar vegetation and habitat types in Burqin Forest Farm and Altay Forest Farm, the species-level similarity coefficient between them was the highest (0.82). The research results indicate that there are significant differences in the species composition and abundance of Coleoptera insects among different forest farms in the Altai Mountains of Xinjiang.

Full Text

Diversity of Coleoptera Insects in the Altay Mountains, Xinjiang

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1. Methods

1.1 Diversity Indices The following diversity indices were employed in this study:

(1) **Shannon-Wiener index:**

$$H = -\sum P_i \ln P_i \quad (i = 1, 2, 3, \ldots, S)$$

(2) **Margalef index:**

$$R = \frac{S - 1}{\ln N}$$

(3) **Pielou index:**

$$J = \frac{H}{H_{\max}}, \quad H_{\max} = \log_2 S$$

(4) **Simpson index:**

$$D = 1 - \sum P_i^2$$

(5) **Jaccard similarity coefficient:**

$$CS = \frac{c}{a + b - c}$$

Where S represents the number of species, N is the total number of individuals, P_i is the proportion of individuals of species i, c is the number of species shared by two communities, and a and b are the numbers of species in communities A and B, respectively.

1.2 Study Area and Sampling The investigation was conducted across six national forest farms in the Altay Mountains region during 2015. The study area encompassed various habitat types including forest margins, grasslands, and wetland edges. Sampling was performed using pitfall traps and sweep nets, with each site surveyed for 1.5–2 hours. The geographic coordinates and habitat characteristics were recorded for each collection point.

2. Results

2.1 Species Composition A total of 2,061 Coleoptera specimens were collected, representing 129 species, 85 genera, and 22 families. The dominant families were Chrysomelidae and Scarabaeidae, which together accounted for 43.76% of the total specimens (31.44% and 12.32%, respectively). The dominant species were *Pallasiola absinthii* (Pallas) and *Gymnopleurus flagellates* (Fabricius).

Table 1 shows the population distribution and group composition of Coleoptera insects in the Altay Mountains. The family Chrysomelidae exhibited the highest species richness with 15 species (17.65% of total species) and 648 individuals (31.44% of total abundance). Cerambycidae ranked second with 12 species (14.12%) and 172 individuals (8.35%). Tenebrionidae contributed 10 species (11.76%) and 207 individuals (10.04%).

2.2 Diversity Analysis The Shannon-Wiener diversity index at the family level was highest in Fuyun Forest Farm (2.18), followed by Fuhai Forest Farm (2.17). At the species level, the Shannon-Wiener index peaked in Fuhai Forest Farm (3.01). The Margalef index reached its maximum values in Fuhai Forest Farm at both species and family levels (2.79 and 7.94, respectively). The Pielou evenness index showed relatively uniform distribution patterns across all sampling sites.

2.3 Similarity Coefficients **Table 3** presents the Jaccard similarity coefficients of Coleoptera communities among different forest farms. The highest similarity at the family level (0.82) occurred between Burqin and Fuyun forest farms, reflecting their comparable vegetation types and habitat structures. At the species level, the similarity coefficient between Fuhai and Fuyun was 0.50, while the lowest similarity (0.15) was observed between certain farm pairs with distinct habitat characteristics.

Similarity coefficients were interpreted as follows: 0.00–0.25 indicated extremely dissimilar communities, 0.25–0.50 represented moderately dissimilar, 0.50–0.75 suggested moderately similar, and 0.75–1.00 indicated highly similar communities.

3. Discussion

3.1 Community Structure and Habitat Relationships The Coleoptera fauna of the Altay Mountains demonstrated significant variation in species composition among forest farms, attributable to differences in elevation, vegetation type, and microhabitat conditions. The dominance of Chrysomelidae and Scarabaeidae aligns with patterns observed in other arid and semi-arid mountain ecosystems. The high diversity indices in Fuhai and Fuyun forest farms correlate with their heterogeneous habitats and lower human disturbance levels.

The presence of characteristic species such as *Anatolica pseudoduna* (Kaszab), *Anatolica politaborealis* (Kaszab), and *My labris atrata* (Pallas) indicates the

unique biogeographic position of the Altay Mountains as a transitional zone between Central Asian and Siberian faunal elements. The similarity analysis reveals that geographic proximity and habitat homogeneity are primary determinants of community similarity, as evidenced by the high Jaccard index between adjacent forest farms with comparable vegetation.

3.2 Conservation Implications The results underscore the importance of maintaining habitat heterogeneity for Coleoptera conservation in the Altay region. Forest management practices should prioritize the preservation of diverse microhabitats, particularly at forest-grassland ecotones where species richness peaks. The moderate similarity coefficients between most farm pairs suggest that each area harbors unique species assemblages, warranting comprehensive protection strategies across the entire mountain range rather than focusing on isolated reserves.

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Abstract: This study aimed to investigate the diversity of Coleoptera in the Altay Mountains in Xinjiang based on the insect specimens from the Insect Collection of Xinjiang University and the field survey in 6 national forest farms in the Altay Mountains in 2015. A total of 2,061 Coleoptera in 129 species, 85 genera and 22 families were collected from the Altay Mountains. The diversity analysis indicated that the dominant groups were Chrysomelidae and Scarabaeidae, which accounted for 43.76% (31.44%, 12.32%) of the total number of Coleoptera species, and *Pallasiola absinthii* (Pallas) and *Gymnopleurus flagellates* (Fabricius) were the dominant species. Biodiversity analysis showed that the Shannon-Wiener index at family level was the highest in Fuyun Forest Farm (2.18), and then in Fuhai Forest Farm (2.17). Shannon-Wiener index at species level was the highest in Fuhai Forest Farm (3.01). Margalef indexes at species and family levels were the highest in Fuhai Forest Farm (2.79, 7.94). The similarity coefficient between Fuhai and Fuyun forest farms at family level was the highest (0.17). Because the vegetation and habitat types in the Burqin and Altay forest farms were similar, the similarity coefficient between the Burqin and Fuyun forest farms at species level was the highest (0.82) due to the similarity of both vegetation and habitat types. The results showed that there were the differences in species richness, species composition and abundance of Coleoptera insects among different forest farms in the Altay Mountains.

Keywords: Coleoptera; species; biodiversity; distribution; Altay Mountains

Note: Figure translations are in progress. See original paper for figures.