Original Article

A Contribution to Insect Studies in Ikh Nart Nature Reserve, Mongolia: Vespid Wasps (Hymenoptera, Vespidae)

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Abstract

Ikh Nart Nature Reserve remains poorly studied for invertebrates, especially for vespid wasps. A total of 14 vespid species belonging to seven genera of the subfamily Eumeninae were recorded from different habitats (rocky outcrops, springs, tall vegetation habitats, shrub-lands and short grass steppes) in the nature reserve during three-year studies (2015-2017). These species represent 27 percent of the vespid fauna of the desert-steppe zone of Mongolia. We found the highest species richness in areas where water was available (near springs and wells), and the lowest richness in habitats with tall vegetation. Among the different habitat types, vespid species composition was most similar (91% shared species) between rocky outcrops and spring habitats. Six vespid species range from Kazakhstan to Mongolian, and one species is sub-endemic to Mongolia. Availability of water sources and nesting sites were possibly the main factors influencing the distribution of vespid wasps. It is necessary to conduct comprehensive research into the insect community of Ikh Nart Nature Reserve.

Cite this paper as:

Introduction

Ikh Nart Nature Reserve protects areas in Southeastern Mongolia for their specific natural landscapes, where semi-desert and desert-steppe habitats meet. The reserve also includes suitable habitats for threatened and endangered species, such as argali sheep (*Ovis ammon*) and ibex (*Capra sibirica*).

Invertebrate studies in Ikh Nart remain in their initial stages. A few bachelor and master thesis studies (through the National University of Mongolia), and short-term projects on different groups of invertebrates have been conducted since 2007. Research to date has recorded 110 species of insects belonging to 29 families and 10 orders in Ikh Nart (Aibek, 2015; Altangerel,

2015; Reading *et al*., 2016; Jigmidmaa, 2017; Choidondov, 2017). However, no vespid wasp species were previously recorded in the published literature from the reserve.

The Vespidae (Hymenoptera) is a diverse and cosmopolitan family of wasps, including almost all the known social wasps and many solitary species. There are 100 species of vespid wasps recorded in Mongolia, which belong to 26 genera and 4 subfamilies (Buyanjargal, 2016). From these, 54 species are recorded in desert steppe region of Mongolia where the study area is located (Buyanjargal & Gantigmaa, 2016).

This study aimed to determine the species composition of vespid wasps in Ikh Nart Nature

Reserve and to describe their habitat relations.

Material and Methods

The study area (Ikh Nart Natur reserve) is located within territories of Dalanjargalan and Airag districts (soums) of Dornogovi province (aimag), covering 667 hectares. The climatic conditions of Ikh Nart are relatively mild, resulting from its low altitude (1000–1300 m) compared to higher areas of Mongolia (Reading *et al.*, 2011). Mean annual precipitation is 100–150 mm, mean annual temperature -1.9°C, and mean winter temperature is -21°C in December and summer temperature is 25°C in July. Mean annual wind speed varies between 0.7–1.3 m/sec (Reading *et al.*, 2011; Schneider, 2014). Ikh Nart lies at the junction of the steppe and desert-steppe ecosystems of Mongolia, contains numerous rocky outcrops, and is dominated by short grasses, onion grasses (*Allium* spp.), *Artemesia* spp., shrubs, and Russian elms (*Ulmus*

pumila) in the drainages (Jackson *et al.*, 2006).

Sampling sites occurred throughout the reserve, but primarily in the north (Fig. 1) and are described in Table 1.

We collected a total of 277 vespid specimens within all the different habitats in Ikh Nart during the plant growing seasons of 2015 to 2017 using sweep nets and yellow cup traps (Moericke, 1951). We either dried collected specimens or preserved them in ethanol (70%), prior to transporting them to the Laboratory of Entomology, Institute of General and Experimental Biology, Mongolian Academy of Sciences (MAS), for species identification. We used an Am binocular scope SM-3TZ-545-10M, and the identification keys by Kostylev (1940), Kurzenko (1978, 1995) and Kim & Yamane (2001, 2009) for species identification. Identified specimens are deposited in the insect collection at the Institute of General and Experimental Biology, MAS.

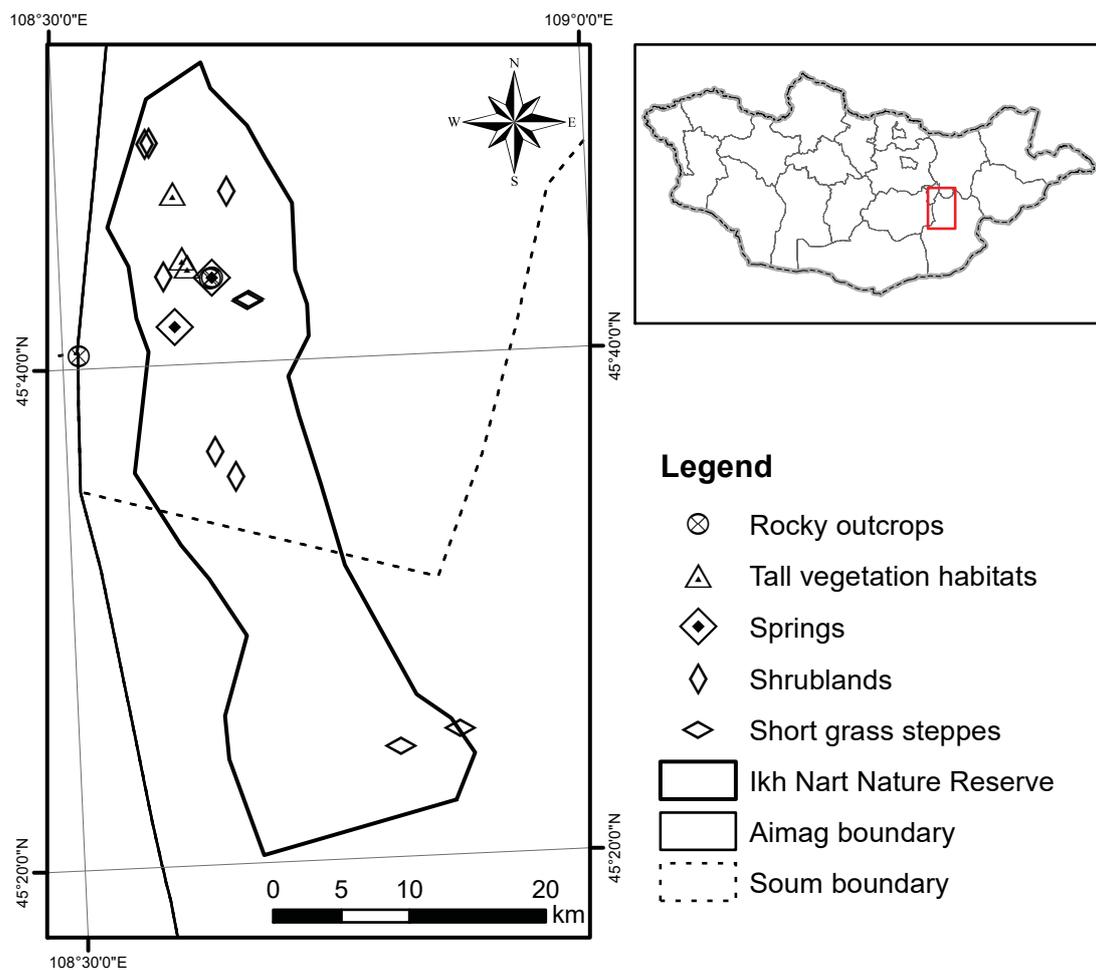Because of different sampling techniques and

Figure 1. Study area and the sampling habitats of vespid wasps.

Table 1. Habitat descriptions of study sites in Ikh Nart Nature Reserve, following Jackson *et al.,* (2006).

Habitat groups	Description
Rocky outcrops	Areas characterized by outcrops of granitic and metamorphic rocks with sparse vegetation (N45.6753 E108.5153; N45.7233 E108.6420; N45.7241 E108.6442)
Springs	This category includes wet ground surface with pebble and clay adjacent to fresh water springs and wells (N45.6920 E108.6067; N45.7236 E108.6437)
Tall vegetation habitats	Tall grasses and trees composed of mainly *Achnatherum splendens, Ulmus pumila, Salix ledeubouriana* (N45.7809 E108.6101; N45.7323 E108.6211; N45.7372 E108.6161)
Shrublands	Areas dominated by shrubs and semi-shrub vegetation (e.g., *Amygdalus pedunculata, Caragana pygmaea, Reaumuria soongorica, Salsola passerina*) (N45.7258 E108.5981; N45.6082 E108.6392; N45.7805 E108.6610; N45.6639 E108.4903; N45.8146 E108.5863)
Short grass steppes	Areas containing mostly forbs (e.g., *Allium polyrrhizum*), and short grasses (e.g., *Stipa gobica*) (N45.407252 E108.8006; N45.4173 E108.8567; N45.7074 E108.6757; N45.5910 E108.6578)

inconsistency of sampling, we only use presence/absence data. For estimation of species richness, we used an incidence-based coverage estimator (ICE),

$$S_{ice} = S_{freq} + \frac{S_{infr}}{1 - Q_1/\sum_{j=1}^{10} jQ_i} + \frac{Q_1}{1 - Q_1/\sum_{j=1}^{10} jQ_i} \gamma_{ice}^2$$

where, S_{freq} = number of frequent species (found in >10 samples), S_{infr} = number of infrequent species (found in <10 samples), Q_1 = frequency of unique species (the number of species known from only one sample), and γ_{ice}^2 = estimated coefficient of variation of the Q_1 for infrequent species (Lee & Chao, 1994).

Species composition similarity between studied habitats was calculated using classic Sørensen incidence-based similarity index,

$$S_{clas} = \frac{2A}{2A + B + C}$$

where, A = number of species found in both habitats, B = number of species only in first habitat, C = number of species only in second habitat. The Classic Sorensen similarity index and ICE estimator were calculated with EstimateSWin910. Based on the similarity index, we built a dendrogram using Statistica 5.5 for the habitats we studied. We transformed the similarity matrix into a dissimilarity matrix by subtracting similarity values from 1. We then used hierarchical method for clustering our results. From the X-axis of the dendrogram dissimilarity distance could transferred percent scale. For example, 0.1 means a 10% difference between the compared communities of the wasps. Alternatively, it also means 90% similarity between the communities.

Range analysis often reveals specific features of the fauna in a certain area. We followed longitude-latitudinal approach by Buyanjargal *et al*. (2016) for vespid species range determination. Latitudinal groups of ranges are groups of species with similar arrangements of boundaries relative to geographical zones and subzones. We allocated the longitude group of ranges based on the ratio of species to the borders of the western, central and eastern sectors of the Palaearctic.

Results

We found 14 species of vespid wasp species belonging to seven genera and one subfamily, Eumeninae (Table 2).

More common species included *Ancistrocerus scoticus, Eumenes tripunctatus, Katamenes tauricus*, *Pseudepipona przewalskyi* and *Pterocheilus sibiricus*, which found from 3-5 different habitats. Another five vespid species (*A. raddei, Euodynerus notatus, K. radoskowski, Ps. herrichi* and *Stenodynerus orenburgensis*) occurred only in certain habitats (Table 2). When considering species distributions, six species (42.3% of the vespid fauna) have Kazakhstan to Mongolian ranges (*Pt. sibiricus, Pt. quaesitus, Ps. przewalski, K. radoskowski, Eu. caspicus* and *E. mongolicus*). Only one species, *A. raddei*, is sub-endemic to Mongolia, distributed only in the arid regions of Mongolia (Fig. 2) and northeastern China. Seven species have wide ranges from Palaearctic to the Holarctic.

The highest species richness, both observed and using the ICE estimator, occurred in spring habitats. The next greatest richness occurred in

Table 2. Taxonomical composition and habitat distribution of vespid wasps of the subfamily Eumeninae in Ikh Nart Nature Reserve.

Genus	Species	Rocky outcrops	Short grass steppes	Shrublands	Springs	Tall vegetation habitats
Ancistrocerus	*A. parietum*	+			+	
	A. raddei*				+	
	A. scoticus	+	+	+	+	
Eumenes	*E. mongolicus*	+			+	
	E. tripunctatus	+	+	+	+	+
Euodynerus	*Eu. caspicus*				+	+
	Eu. notatus*	+				
Katamenes	*K. radoskowski**					+
	K. tauricus		+	+	+	+
Pseudepipona	*Ps. herrichi**				+	
	Ps. przewalskyi	+	+	+		
Pterocheilus	*Pt. quaesitus*			+	+	
	Pt. sibiricus		+	+	+	
Stenodynerus	*S. orenburgensis**	+				

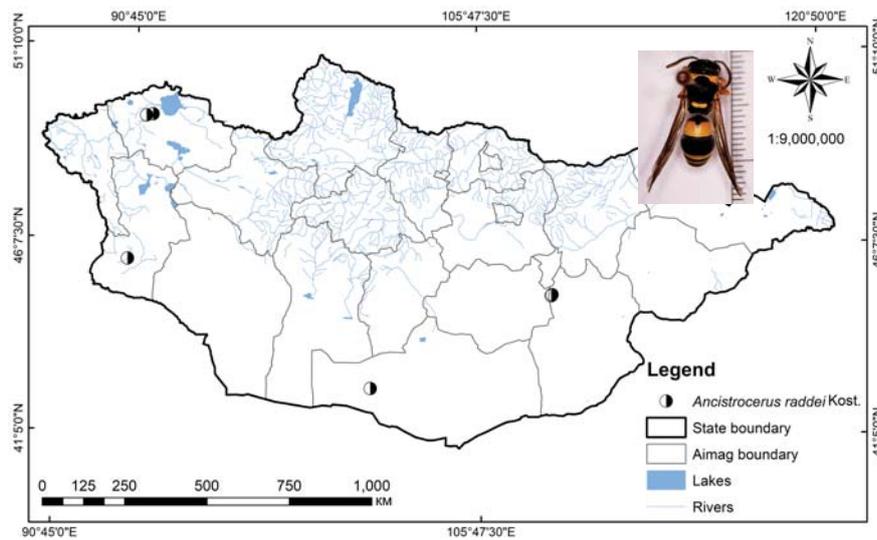Notes: + presence of a species; *species occurring in a single habitat

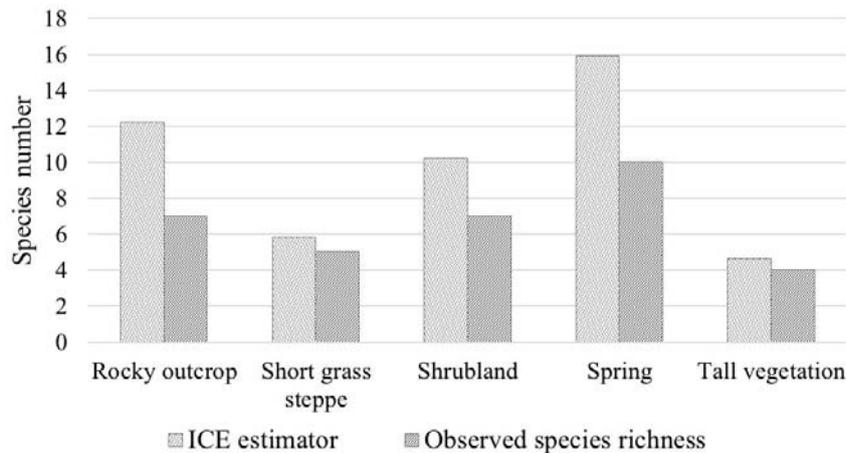Figure 2. Distribution of the sub-endemic species *Ancistrocerus raddei* in Mongolia.

Figure 3. Estimated and observed species richness of vespid waps in different habitats of Ikh Nart Nature Reserve. ICE = incidence-based coverage estimator.
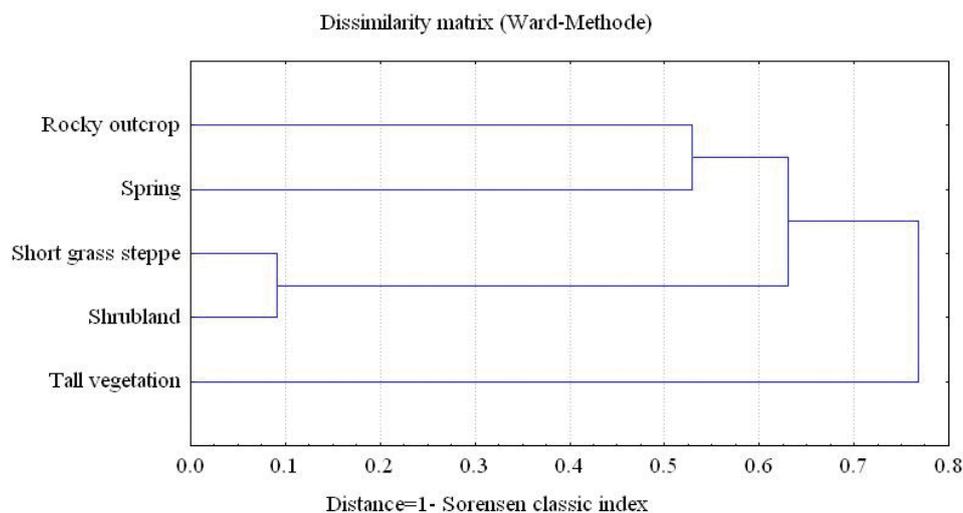
Figure 4. Species composition similarity of studied habitats in Ikh Nart Nature Reserve.

rocky outcrops followed by shrublands, while the lowest species richness occurred in tall vegetation habitats (Fig. 3).

A dissimilarity matrix divided study habitats into two groups based on species composition (Fig. 4). The first group composed of short grass steppe, shrubland habitats, rocky outcrops and spring habitats. From these, the first two habitats were the most similar in species composition (91%). Rocky outcrops with spring habitats showed about 47% of similarity and the habitats differed from the preceding two habitats by around 63%. Habitats with tall vegetation represent the second group of dendrogram, and its species number and composition differed from the other habitats by 76% (Fig. 4).

Discussion

We recorded 14 vespid species from Ikh Nart Nature Reserve, which represent 26 percent of whole species recorded in desert-steppe vegetation zone of Mongolia (Buyanjargal & Gantigmaa, 2016). However, the territory of the Ikh Nart Nature Reserve comprises only 0.14% of the total territory of Mongolia, by Yunatov's (1950) classification.

It is interesting to note that we did not find species from subfamilies other than Eumeninae, especially from the subfamily Polistinae, which includes representatives found in the desert region of Mongolia (Khanbogd soum, Umnugobi province). Possibly the Baikal-Mongolian faunal barrier precluded the presence of these species,

as this barrier strongly influences the vespid species distribution in Mongolia (Buyanjargal *et al*, 2016). Some species, such as *Ancistrocerus parietum, A. scoticus, Eumenes mongolicus, E. tripunctatus, Euodynerus notatus, Katamenes tauricus, Stenodynerus orenburgensis* and *Pseudepipona herrichii* (57% of vespids in Ikh Nart), are distributed throughout Mongolia from mountain taiga to desert zone, but others are occurred only in the arid regions in Mongolia (Buyanjargal & Gantigmaa, 2016).

Almost half of the recorded species in Ikh Nart are distributed throughout the arid regions from Kazakhstan through Mongolia.

Air temperature, precipitation, humidity and availability of nesting sites are the main factors influencing species richness of vespid wasps in humid regions of the world (Simoes *et al*, 2012; Santos *et al*, 2007; Matos *et al*. 2013). In Mongolia, availability of water sources and nesting sites are possibly the main factors influencing the habitat distribution of vespid wasps. For example, in Ikh Nart, areas surrounding springs and wells were suitable places to observe diverse vespid species and rocky outcrops often supply nesting sites for them. Thus, spring habitats represent important sources of water not only for vertebrates, but also for invertebrates like vespid wasps (Fig. 5). More comprehensive studies of insects should be conducted in Ikh Nart. Such studies would likely prove valuable for biodiversity conservation and adequate management of the protected area.

Figure 5. Vespid wasps *Eumenes tripunctatus* (A), *E. mongolicus* (B) and *Ancistrocerus scoticus* (C: all other wasps except B) at water sources (spring habitats) in Ikh Nart Nature Reserve, Mongolia in July 2017.

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