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The Species Diversity and Distribution of Vespidae in Southeast Region (Sangdong-eup, Gimsatgat-myeon, Jungdong-myeon) of Yeongwol-gun, Gangwon-do, Korea

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Abstract: As a result of examining Vespidae in the Southeast areas of Yeongwol-gun, Gangwon-do, total 1,598 individuals from 2 subfamilies, 5 genera and 21 species were collected. This showed very high species diversity accounting for 70% of total species of domestic Vespidae. *Vl. koreensis koreensis* was 379 (23.72%) ones, showing the highest rate, followed by *Pa. indica* (231, 14.46%), and *V. simillima simillima* (205, 12.83%). As for each genus, *V. simillima simillima* showed the highest rate, and *V. ducalis* and *V. dybowskii* showed relatively high rate as well. As for *Dolichovespula*, 2 species recorded domestically all appeared, and as for *Vespula*, 4 species were all collected except 2 species which had no distribution records recently or are potentially distributed species. There was no specific point in *Parapolybia* and *Polistes*. On one hand, as species belonging to *Dolichovespula* and *Vespula* which mainly inhabit in the northern regions appear, it is expected that their distribution will provide the basic materials useful for predicting climate change such as northing of insects in the north region according to the climate change in the future.

Keywords: Yeongwol-gun, Vespidae, distribution, emergence rate

Introduction

Yeongwol-gun is located in the southernmost of Gangwon-do, and composed of 2 eups and 7 myeons of the administrative district. It is bordered to the north by Pyeongchang-gun and Jeongseon-gun, to the east by Taebaek City, to the west by Wonju City and to the south by Yeongju City, Gyeongbuk, Jecheon City, and Danyang-gun. It is 1,127 km^2 in extent, and is about 86.3 km from east to west and 51.1 km from north to south. Also, Charyeong Mountains are stretched in the north, Sobaek Mountains in the south, from south to west, and the highest mountaintop is Duwibong (1,465.9 m) located between Jidong-ri, Jungdong-myeon and Mureung-ri, Nam-myeon, Jeongseon-gun, and the altitude of the Yeongwol-gun ranges from 180 m to 1,466 m. Average temperature for the year is about 11°C, the annual rainfall is 1,241 mm, and the region is generally a hinterland mountainous region showing typical continental climate which is extreme both in summer and winter. Like this, as Yeongwol-gun is the north central area of the South Korea where Gangwon-do starts, and also a place which shows typical mountainous topography, it has an excellent forest ecosystem. Besides, as it is expected that organism in the north region appears, there have been various kinds of biological investigations from the past. Accordingly, it can be said that the biological diversity and distribution of this region has an important meaning from the climatic and geographical aspect.

About 5,000 species of Vespidae which belongs to Insecta, Hymenoptera are recorded in the whole world, and this family is divided into 6 families including Vespinae (69 species), Eumeninae (3,579 species), Polistinae (958 species), Stenogastrinae (58 species), Euparagiinae (10 species), and Masarinae (344 species) (Carpenter, 1982). In Korea, taxonomic studies of Vespidae have been conducted intermittently by Kim *et al*. (1994, 2006), Kim and Yoon (1996), Kim (2001, 2011), Kim and Kim (2011) and other researchers, but a complete list of domestic species has not decided yet including whether some species belonging to *Dolichovespula, Vespula, Polistes* live in Korea by misidentified species and dealing with the synonym. However, recently, according to Choi *et al*. (2012, submitted), it is reported that it is valid to consider that domestic Vespidae has 2 subfamilies, 5 genera and 30 species (including 3 subspecies) provisionally except Eumeninae. Vespidae are all eusocial and subsocial insects except the solitary type, Eumeninae, and divided into 3 castes (gueen, worker or male). The queen mainly spawns in their nest, the workers conduct its role to build the nest, to forage for prey, to raise larvae and to protect their nest from invaders, and the males spend most of its time to mate with new queens in the fall

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(September). They mainly nest in very various places including in the ground, in the bushes, in a tall tree, in the branches of small shrubs, and under the rock, and they are predaceous insects, sometimes gathering in a tree's sap for taking protein (Matsuura and Yamane, 1984). Recently, due to destruction of forest habitats and increase of the green area in the city, the number of Vespidae is rapidly increasing even in the downtown areas, becoming a social problem (Choi and Moon, 2005; 2006; Choi *et al*., 2006, Choi *et al.*, 2012 a,b). Like this, as Vespidae have a high ecological status as the top-class predator among insects, their diversity can be used as a measure to show ecological health by enabling to estimate the diversity of lower-lank insects. Besides, some species distribute the north areas above the central area of the Korean Peninsula (Gangwon-do, the north part of Gyeonggi, the north part of Gyeongbuk, the north part of Chungbuk and the North Korea) or include many species which are sensitive to climate including invasion of species from subtropics due to climate change, so their distribution can be used as an important material in movement of species due to climate change in Korea in the future.

Though investigations on Vespidae have been conducted intermittently in Yeongwol area before as a part of investigations on insect fauna, it showed very insufficient results (Choi and Lim, 2010 a,b,c; Lee *et al*., 2011). Therefore, this study aims to figure out the species diversity and distributional characteristics of Vespidae in forests located around Sangdong-eup, the southern part of Yeongwol-gun.

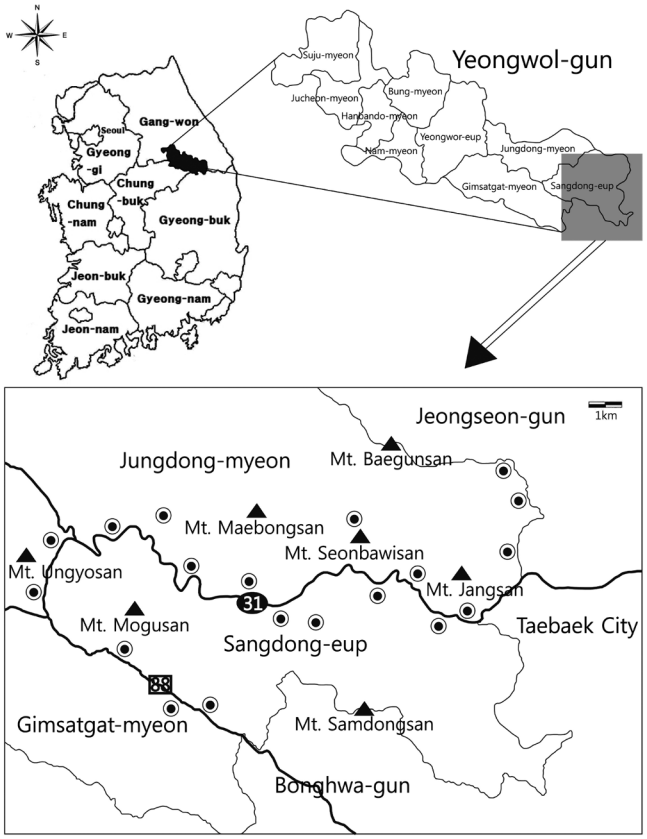

Fig. 1. Regions for collecting Vespidae in Yeongwol-gun, Gangwon-do

Materials and Method

Collecting schedule

The 1st collecting was conducted on July 23rd, 2012, the 2nd one on July 26th-27th, and the 3rd collecting on August 9th-10th.

Collecting region

Species were collected in total 19 places including villages and forest areas including Mt. Mogusan, Mt. Ungyosan, Mt. Maebongsan, Mt. Seonbawisan, and Mt. Jangsan. along the Route 31 and the Prefectural Road 88 in some areas of Gimsatgat-myeon and Jungdong-myeon centering Sangdong-eup located in the southeast of Yeongwol-gun (Fig. 1)

Collecting method

In order to collect Vespidae, we collected flying ones through brandishing and sweeping around mountaineering trails and villages first. Also, by using the fact the adults are attracted to a tree sap, we made a trap for collecting them. The trap is generally used for attracting the adults for eradicating Vespidae by beekeepers, mixing sugared water, acetic acid and alcohol at a one to one to one ratio, putting that attracting liquid into a slotted glass bottle and setting it on a tree around the place 1-2 m from the ground. The trap was installed during the 1st collecting and collected twice during the 2nd and 3rd collecting, and when we found a nest, we wore insect protection clothes for collecting it. Samples collected from the trap were cleanse, and immersed in 70% alcohol or made into an exsiccate with samples collected through brandishing and sweeping, then we recorded identification and the number of individuals. Also, considering that the number of individuals removed with the nest would increase sharply as hundreds individuals came from one nest due to the characteristics of Vespidae, a social insect, we limited 5 individuals per one nest. These specimens were all deposited in the Animal Systematics Lab., Department of Life Science, Yeungnam University.

Range of Vespidae

As for the range of Vespidae, only two subfamilies including Polistinae and Vespinae which have eusociality and subsociality except the solitary wasps, Eumeninae were analyzed according to the range by Richards (1962).

Result Analysis and identification

This study collected the specimens in total 19 points around