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HYMENOPTERA (INSECTA) IN RURAL MONTANE HABITATS – A CASE STUDY FROM THE WESTERN RHODOPE MOUNTAINS (BULGARIA) WITH TAXONOMIC NOTES ON BETHYLIDAE

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Abstract. This study explores the Hymenoptera diversity from an uncultivated house yard in the mountain hamlet of Grashtitsa at an altitude of 1340 m in the Western Rhodope Mountains in southern Bulgaria. Additionally, data from the vicinity of the village of Patalenitsa (at the foot of the mountain) are also presented. A total of 5189 specimens from 74 species and 22 families were collected, and of them, 4695 individuals and 50 species were ants (Formicidae). In Grashtitsa hamlet, between September 2016 and April 2021, we collected 4326 ants from 36 species and 474 individuals from the other 21 Hymenoptera families, with only six pitfall traps. From the surroundings of the Patalenitsa village, between May and September 2016, we collected 369 ant individuals belonging to 26 species and 20 more individuals from 12 species of other seven hymenopteran families, with 16 pitfall traps. Some species of conservational or scientific interest were collected. Here, we give the first record of *Bethylus cephalotes* in Bulgaria and in the Balkan Peninsula, as for the first time, setae have been found on the facets of the compound eyes of this species. Interestingly, several species were established to expand their range – *Embolemus ruddii*, *Lasioglossum anellum*, *Priocnemis confusor*, *P. hankoi,* and *P. hyalinata* are here reported for the first time for the Western Rhodopes.

INTRODUCTION

Ants, bees and wasps, united under the order Hymenoptera, play crucial, though extremely varied roles in ecosystems and are often used as subjects in ecological studies in both natural and anthropogenised habitats (e.g., Coelho et al. 2009; Anderson et al. 2011; Blinova and Dobrydina 2019). There are numerous papers about the role or bioindication function of ants in various habitats, from mountain forest reserves to agrocoenoses or reclaimed heavy metals mine tailing ponds, and even overcrowded urban areas (e.g., Šerić Jelaska et al. 2010; Żmihorski 2011; Magagula and Nzima 2015; Okrutniak et al. 2018; Forero-Chavez et al. 2024). Also, a high diversity of wild bees has been detected along the last traditionally managed meadows in Eastern Europe (Demeter et al. 2024). However, studies about the hymenopterans inhabiting house yards, especially those in montane areas, are really scarce. Such habitats could be considered as semi-natural grasslands, which are believed to have only a few still remaining in Europe (Demeter et al. 2024).

Here we present novel data about the hymenopterans from a rural montane habitat, this way contributing to the knowledge about the Hymenoptera on the territory of the Western Rhodope Mountains in Bulgaria. The Hymenopteran fauna of the mountains has been summarised recently only in parts (Ljubomirov 2006), and this data excludes a lot of important and rich-in-species groups within the order, e.g., the families of Tenthredinidae, Ichneumonidae, Cynipidae, Chalcididae, Proctotrupidae, Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae, and Melittidae. Even so, having in mind this preliminary overview, it is obvious that much more is expected to be added regarding the taxonomy and ecology of the Hymenoptera from the region.

This study aims to explore the diversity patterns for the insect order Hymenoptera over a five-year period in a mountain hamlet house yard with no serious human impact and no chemical treatment of the soil and vegetation. Because pitfall traps were used for sampling during the study, the groups of Hymenoptera yielded are mostly those exhibiting epigaeic behaviour, and in the first place, these are ants (Formicidae). We have sampled communities of ground-foraging ants in the first place, and at the same time, it is expected that hypogaeic and arboreal nesting species have been undersampled.

MATERIAL AND METHODS

The main sampling site was located in an uncultivated house yard in the Grashtitsa hamlet, in the land of the village of Stoykite (41.6515°N, 24.6179°E) at about 1340 m a.s.l. in the Western Rhodope Mountains in southern Bulgaria. The sampling design and location of the study plot are given in Figure 1. The area of the yard was about 500 m^2 and was missing any agricultural treatment and processing, except for a few planted trees and not very regular (twice-a-year) mowing. Field work was carried out over a five-year period – from 2016 to 2021. The material was collected with terrestrial pitfall traps made out of cut 2 L plastic bottles buried at the level of the ground surface and filled with 8% formaldehyde. Six traps were set at about 10 m from each other in different parts of the yard, representing the main microhabitat conditions (see Figure 1). Pitfall traps are not a common method for studying Hymenoptera, but they are found to give results comparable with those from quadrat counts, which provides support for their use (Anderson 1991). Furthermore, pitfall traps are quite effective in the collection of Formicidae (Hinkley and New 1997; Miller and New 1997; Lindsey and Skinner 2001; Mohamed et al. 2001), and great numbers of ants have been collected with barrier pitfall traps as well (Boyd 1995). The traps were emptied and reset seasonally (in spring, summer, autumn, and winter) during the following sampling periods: 05.09 – 06.11.2016, 06.11.2016 – 16.04.2017, 16.04 – 09.09.2017, 09.09 – 31.12.2017, 01.01 – 06.05.2018, 06.05 – 01.07.2018, 01.07 – 06.09.2018, 06.09.2018 – 02.01.2019, 02.01 – 05.05.2019, 05.05 – 24.07.2019, 24.07 – 22.09.2019, 22.09 – 29.12.2019, 29.12.2019 – 20.04.2020, 20.04 – 15.06.2020, 15.06 – 20.09.2020, 20.09 – 27.12.2020, and 27.12.2020 – 04.05.2021.

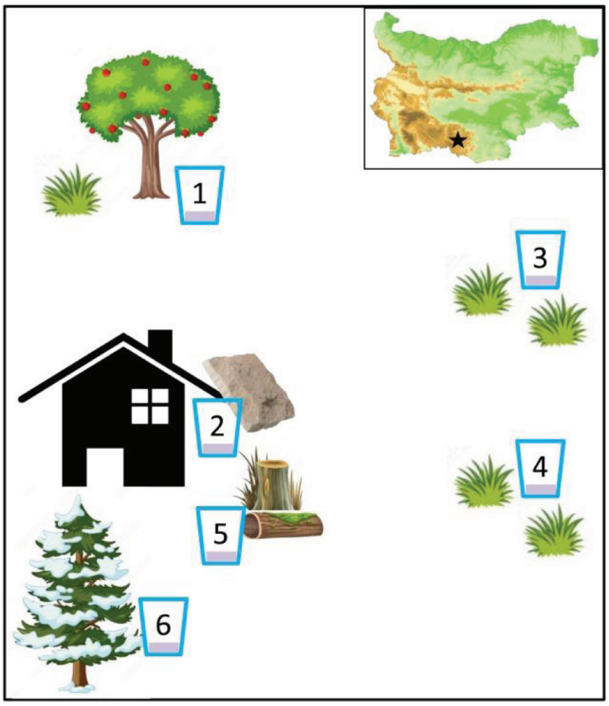

Figure 1. Sampling design and location of the study plot in the Grashtitsa hamlet. Trap 1: under a cherry plum tree (*Prunus cerasifera* Ehrh.); Trap 2: under a stone plate at the back corner of the house; Trap 3 and Trap 4: at the lawn, near the estate border; Trap 5: near a pile of trunks and wood at the front corner of the house; Trap 6: under European spruce tree (*Picea abies* (L.) H. Karst) in front of the house (source: Teofilova 2022).

Some material was collected in the vicinity of the village of Patalenitsa (coordinates of the middle of the territory: 42.1125°N, 24.1942°E), at an average altitude of 500 m. Field work was carried out in two sampling periods: 4.05 – 27.07.2016 and 27.07 – 25.09.2016, with the help of 16 pitfall traps made of 0.5 L plastic beakers.

The average genus count (species/genera ratio) was calculated to compare it with the results of the only study known to us to date containing similar data on the Hymenoptera (Šerić Jelaska et al. 2010), as well as to make a comparison with the group of the carabids studied during the same experiment (Teofilova 2022).

The collected animals are deposited in the collection of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences, Sofia, upgraded in the frames of the project DiSSCo-BG (Upgrade of the Research Infrastructure "Distributed System of Scientific Collections – Bulgaria") funded by the National Roadmap for Research Infrastructures, Ministry of Education and Science of the Republic of Bulgaria.

RESULTS AND DISCUSSION

During the study, a total of 5189 specimens from 74 species and 22 families were collected, and of them, 4695 ind. (90.5%) and 50 species (67.6%) belonging to 18 genera were ants (Formicidae). In Grashtitsa, between September 2016 and May 2021, we collected 4326 ants belonging to 36 species and 13 genera and 474 individuals from other 20 hymenopteran families. From the surroundings of the Patalenitsa village, between May and September 2016, we collected 369 ants from 26 species and 20 ind. from other seven hymenopteran families. Among the collected ants, we found a diverse ecological complex of species. A complete list of the established taxa with their full names, authors and years of description is presented in the **Appendix**.

Species of conservation or scientific interest

The red wood ant *Formica rufa* Linnaeus, 1761 (Formicidae) is protected on the entire Bulgarian territory. It is included in Annexes 2 and 3 of the Bulgarian Biodiversity Act (2002), IUCN Red List (as "Near Threatened") (IUCN 2026) and Annex 4 of CORINE (2000). It is a European forest species distributed in Bulgarian mountains, mostly between 600 and 1600 m a.s.l., and rarely found up to 2000 m or under 500 m in the plains (Atanassov and Dlusskij 1992). The major threats causing a decline of a colony are the loss, shading, drying/flooding, disturbance or destruction of the habitat, human activities, changes in climatic conditions, and natural enemies or pathogens (Dekoninck et al. 2010). We collected the species in Grashtitsa, with just single specimens over the whole study, yet in the period of 06.09.2018 – 02.01.2019 we found as many as 28 specimens.

Lasioglossum anellum (Vachal, 1905) (Halictidae) is a rare Eastern-Mediterranean sweat bee species included in the European Red List of bees as a species with insufficient scientific information, within the category "Data Deficient" (DD) (Nieto et al. 2014). We collected two specimens of this species in Grashtitsa: one male in a sample from traps at the lawn, near the estate border (Traps 3 and 4) in the period of 09.09.2017 – 02.01.2018 and one female in Trap 6 under an European spruce tree in the period of 29.12.2019 – 20.04.2020, which suggests that this species probably overwinters under the ground surface. The species has been previously collected between March and September (see Tomozii 2018).

Embolemus ruddii (Westwood, 1833) (Embolemidae) is a rarely collected species. Although it has been known for a long time, it has been recorded for the Bulgarian fauna just recently from only two locations (Ljubomirov et al. 2006; Ljubomirov 2019). We collected three females of this species in Grashtitsa: two in Trap 6 under a spruce tree (in the period of 22.09 – 29.12.2019) and one in Trap 2 under a large stone (in the period of 20.09 – 27.12.2020). The species is considered very infrequently recorded, with females being apterous and having previously been collected in or near nests of ants and moles, suggesting some degree of subterranean lifestyle (Crowley 2018). Probably, this is why this wasp seems to fall into pitfall traps, as also found by Crowley (2018). Similarly to the study in England, we found the species in the late autumn period, thus suggesting once again that it may overwinter in subterranean associations – in the soil or under bark (Crowley 2018).

Bethylus cephalotes (A. Förster, 1860) (Bethylidae) is a rare species recorded for the first time not only in the Rhodope Mountains and Bulgaria, but in the entire Balkan Peninsula. In addition, it has been recently established in the Parangalitsa Nature Reserve in Bulgaria by the second author, but this first record for the Rila Mountains was not published. Up to now, this species has been considered to have no setae on compound eyes (Trjapitzin 1978); however, very short setae do occur – see Figure 2. We collected one female of this species under a cherry plum tree (Trap 1) from Grashtitsa in the period of 16.04 – 09.09.2017.

Messor ponticus F. Steiner et al. 2018 (Formicidae) is a species of peculiar interest. In Bulgaria, for most of the 20th century, almost all of the *Messor* populations were regarded as *Messor structor* (Latreille, 1798) (Atanassov and Dlusskij 1992). The latter species is undoubtedly a complex of several ones, and this is demonstrated in the long junior synonyms or subspecies counted recently (Bolton 2017). The species *M. structor* was recently examined regarding genetic variability by using analysis of two enzymic systems, and isoenzyme polymorphism was detected for the material from the Stara Planina Mountains, Sredna Gora Mountains, Thra-

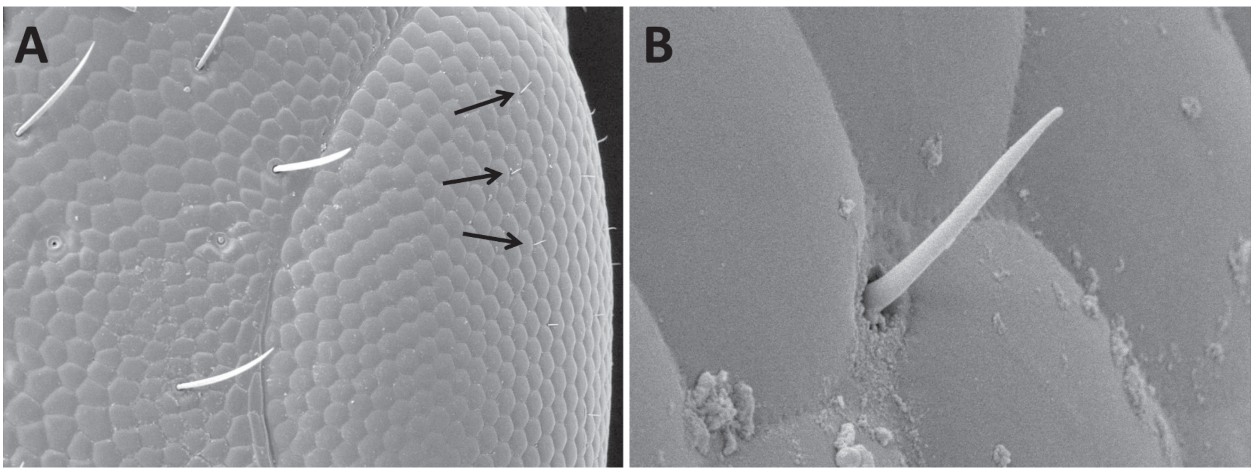

Figure 2. SEM images of the chaetotaxy of the compound eye of *Bethylus cephalotes* (specimen from France, Jura Mountains, Lac de Remoray Nature Reserve): A. The eye with very short and thin setae (on the right, pointed with arrows), magnification 909×; B. A single seta, magnification 1494×.

cian lowland, and Rhodope Mountains (Stoyanov et al. 2015). Steiner et al. (2018) solved the problem by the way of describing a new species from the area with type locality in western Bulgaria (Struma riverside southwest of Zemen town). Morphologically, the queens and workers of the new species *M. ponticus* are distinguished from its closest relatives (*Messor structor*, *M. muticus* (Nylander, 1849), *M. mcarthuri* F. Steiner et al., 2018, and *M. ibericus* Santschi, 1931) by postocular region of head mostly lacking costae and costulae (being almost smooth and shining in major workers); the coloration overall is darker; body more finely sculptured (in the first place, the head); first flagellomere shorter and the base of scape without lobe; standing setae on the side of head reduced and clypeal notch shallow; mesopleuron more regularly rugose; microsculpture of first metasomal tergum less imbricate. The recent material from Grashtitsa and Patalenitsa (Western Rhodopes), with two and 15 specimens, respectively, fully covers these features and undoubtedly corresponds to the species described by Steiner and co-authors in 2018.

Camponotus ligniperda (Latreille, 1802) is the largest ant of the Bulgarian fauna (Atanassov and Dlusskij 1992). Its habitats are associated with forests: mostly beech, but also in mixed and lower parts of coniferous forests. The microhabitat preferences of this species are related to the presence of dead wood, where it makes nests in the trunks of fallen trees at the boundary with the soil surface or deep inside the tree trunk. We collected only 11 individuals (three workers and eight females) from different traps over the years of research in Grashtitsa.

The status of *Aphaenogaster gibbosa* (Latreille, 1798) in Bulgaria is controversial. Recent studies (e.g., Salata and Borowiec 2018; Schifani et al. 2022) state that the taxa of the *gibbosa* group are "mostly West-Mediterranean" (Schifani et al. 2022: 630a) but at the same time account for at least one "species" (based on morphological characters solely), having a very wide range from Transcaucasia to Transcaspia south to Razavi Khorasan (Iran) (Salata and Borowiec 2018). We prefer to follow the treatment of the populations from Bulgaria as *A. gibbosa* following Atanassov and Dlusskij (1992), at least until the status of the taxa *A. gibbosa laevior* Forel, 1892, *A. muschtaidica* Emery, 1908, and *A. gibbosa chorassanica* Arnoldi, 1968 is solved as valid species or synonyms of *A. gibbosa* by molecular (or at least integrative) methods of species delimitation.

Embolemus ruddii, *Lasioglossum anellum*, *Priocnemis confusor* Wahis, 2006, *P. hankoi* L. Móczár, 1944, and *P. hyalinata* (Fabricius, 1793) are reported for the first time for the Western Rhodope Mountains.

Taxonomic structure and abundance

The taxonomic structure of the Hymenopteran fauna established in the pitfall traps showed the clear predominance of the ants (Formicidae), which is quite obvious due to their epigeic way of life and the method of collection used. From other families, Proctotrupidae was the most abundant (213 ind., 43% of all), and together with Diapriidae (72 ind., 15%), Ichneumonidae (61 ind., 12%) and Braconidae (53 ind., 11%) they accounted for more than 4/5 (81%) of the total "other Hymenoptera" catch. With our results we confirm that the flying Hymenoptera representatives are quite rare in pitfall collections. The abundance of the collected hymenopteran families is presented on Figure 3. The families represented with less than 10 individuals (presence 1% or less) were excluded from the graph. These were: Bembicidae (1 ind.), Bethylidae (1 ind.), Crabronidae (2 ind.), Cynipidae (1 ind.), Dryinidae (1 ind.), Embolemidae (3 ind.), Eucoilidae (1 ind.), Eupelmidae (1 ind.), Eurytomidae (1 ind.), Megaspilidae (8 ind.), Pompilidae (7 ind.), Tenthredinidae (1 ind.), and Trichogrammatidae (1 ind.).

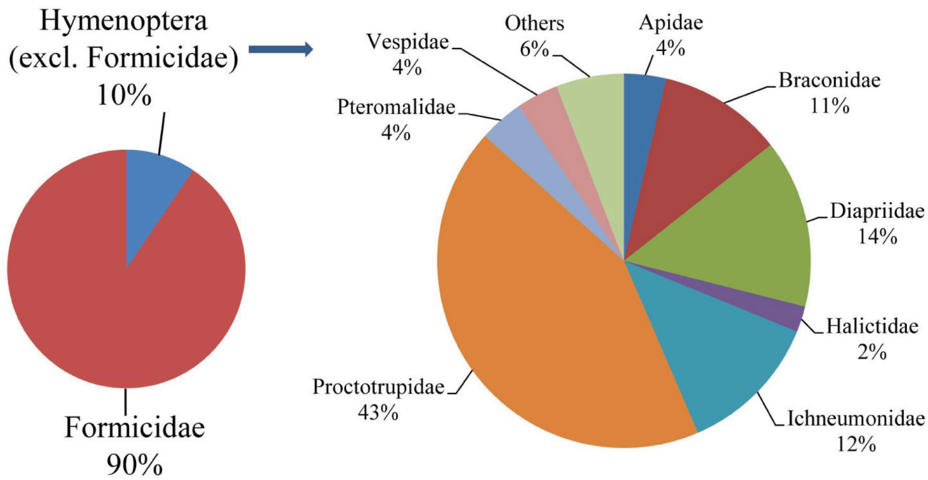

Figure 3. Abundance of Hymenoptera families collected in the pitfall traps and represented with more than 10 individuals (presence 2% or more).

We established a quite diverse taxonomic structure of the collected ant fauna, consisting of 4695 specimens, 50 species and 18 genera. This represents 29% of all species (175 in total) reported for the Bulgarian fauna and 45% of the genera (compare Borowiec 2014).

In Grashtitsa, 4326 ant specimens, 36 species and 13 genera were established, and in the Patalenitsa surroundings they were 369 specimens, 26 species and 15 genera. An interesting fact is that of all 50 ant species, the number of common species (found in both sites) was only 12 (24%), speaking of the diversity of the studied localities, inequality of the sampling, or both (see **Appendix**). Because male and female ants are winged, but workers (the most numerous part of the living forms in most of the ant species) are wingless, pitfall trapping is undoubtedly biased towards workers, as apparent in this study (only 133 of 4695 specimens collected were males and females).

The average genus count (species/genus ratio) is an acknowledged, although rarely used parameter in ecology. However, it provides information on biological diversity as an ecological concept. In our case, the species/genus ratio of the ants collected in Grashtitsa was 3.0. During the same research, we found that the species/genus ratio of the carabids was 5.8 (Teofilova 2022). We compared our results with a study from montane habitats in the Medvednica Nature Park in Croatia, also carried out with pitfall traps (Šerić Jelaska et al. 2010), and the species/genus ratios there were 1.82 for ants and 2.15 for carabids, which does not provide any consistency with our results, probably due to the sampling design. However, the ratios between the number of species of ants and carabids were 0.47 in Grashtitsa, completely comparable with the value of 0.46 in Medvednica. On the contrary, this ratio was 8.38 in urban forests within the populous city of Cali in Colombia; the species/genus ratios there were 2.87 for the ants and 1.3 for the carabids (Forero-Chavez et al. 2024). The ratio between the number of species of ants and carabids was 0.2 in a large fragmented (clear-cut) Norway spruce forest complex at 620–760 m altitude in the Czech Republic (Vele et al. 2011) and 0.3 in coenoses from two zinc-lead mine tailing ponds under different degrees of reclamation practices (Okrutniak et al. 2018).

The most species-rich ant genera (calculated both for Grashtitsa and Patalenitsa) were *Lasius* (9 species, 18% of all ant species), *Formica* (8 species, 16%), *Temnothorax* (6 species, 12%), and *Myrmica* (5 species, 10%) (Figure 4B). *Lasius* and *Formica* were also the most species-rich genera (with 20% of all ant species each) in a study from montane habitats in the Medvednica Nature Park in Croatia (Šerić Jelaska et al. 2010). From the other genera in our study, genus *Camponotus* contained four species; *Aphaenogaster*, *Crematogaster*, *Leptothorax*, *Messor,* and *Tetramorium* had two species each; genera *Cataglyphis*, *Manica*, *Myrmecina*, *Plagiolepis*, *Polyergus*, *Prenolepis*, *Solenopsis,* and *Tapinoma* were all represented by a single species.

Formica (2646 specimens, 56%) and *Lasius* (1165 specimens, 25%) were also the most numerous ant genera, followed by *Myrmica* (368 specimens, 8%) and *Tetramorium* (257 specimens, 5%) (Figure 4A). In a study of Šerić Jelaska et al. (2010), the most abundant genera were *Lasius*, with 34% of all specimens, and *Myrmica* (with 28%). Similarly, *Myrmica*, *Lasius,* and *Formica* were the most abundant group of genera (about 57% of all studied ground arthropods, also collected with pitfall traps) in a large forest complex in Western Poland (Żmihorski 2011). In our study, the genera *Tapinoma* (79 ind.), *Camponotus* (76 ind.), and *Leptothorax* (41 ind.) were less abundant but still numerous. A small number of specimens was represented by the genera

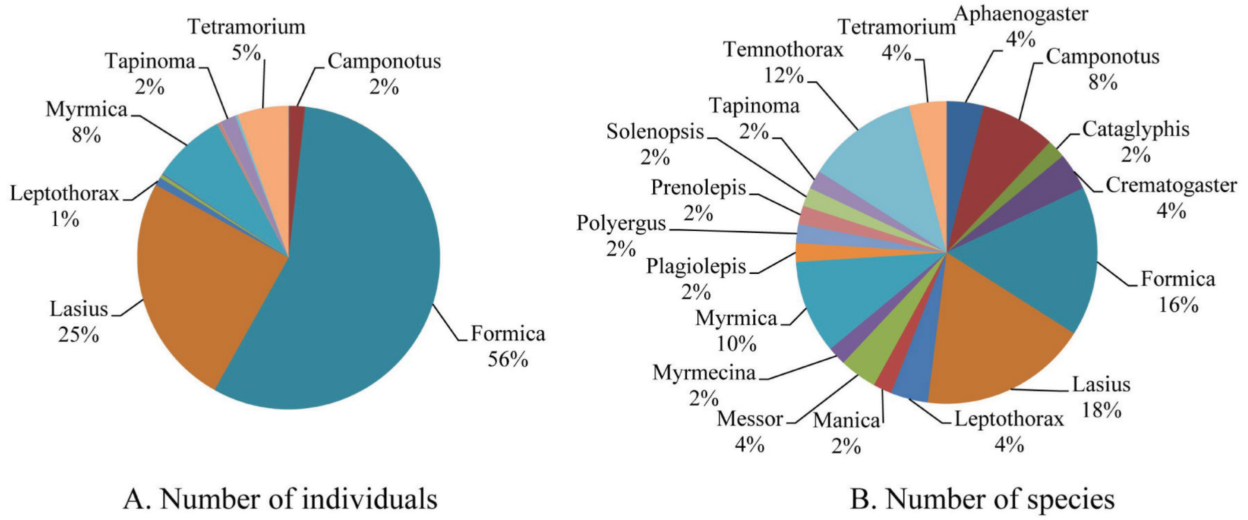

Figure 4. Formicidae genera collected in the pitfall traps (both in Grashtitsa and Patalenitsa), with the share of the specimens (A) and species (B) for each genus.

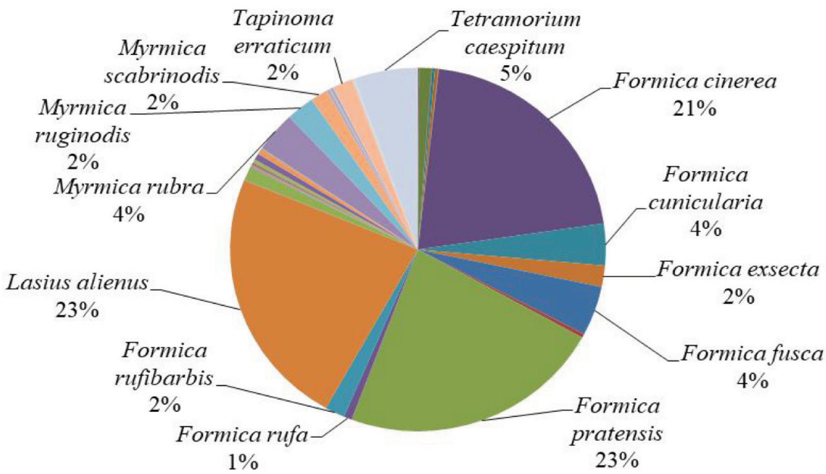

Figure 5. Abundance of ants collected in the pitfall traps. Only species with a presence above 1% are presented (except for *Formica rufa*).

as follows: *Messor* (18 ind.), *Temnothorax* (13 ind.), *Prenolepis* (11 ind.), *Aphaenogaster* and *Myrmecina* (5 ind. each), *Plagiolepis* (3 ind.), and *Crematogaster*, *Polyergus* and *Solenopsis* (2 ind. each). The genera *Cataglyphis* and *Manica* had only a single specimen.

The most numerous species were *Lasius alienus* (1083 ind., 23% of all specimens), *Formica pratensis* (1065 ind., 23%), and *Formica cinerea* (982 ind., 21%) (Figure 5). All three aforementioned species are widely distributed in Bulgaria, reaching up to 1800 m a.s.l. in the mountain areas. These ants also represented the dominant (eudominant) species in the separated ecological study in Grashtitsa, but with different shares: *F. pratensis* had 1030 ind. (23.8%), *F. cinerea* had 979 ind. (22.6%), and *L. alienus* had 974 ind. (22.5%). *Tetramorium caespitum* was a dominant species, but it only had 5.6% of the total ant numbers in Grashtitsa. The dominants' complex thus held 69% of the total ants caught. Subdominant were two species: *Formica exsecta* and *F. fusca*, and the other 30 species were recedents and subrecedents. In the study from the montane habitats in Croatia, the dominance structure was very similar, also with three eudominants representing together 67% of the total ant catch, and with three dominants holding 17% of the ant numbers (Šerić Jelaska et al. 2010). Such dominance structures are quite contrasting with the superdominance of just one species (*F. cinerea*, with 83% of all ant numbers) found in a research of reclaimed tailing ponds (Okrutniak et al. 2018). In the dominance structure of ants from urbanised forests in Cali, only one eudominant (29%) and one dominant (5.5%) emerged (Forero-Chavez et al. 2024).

The protected red wood ant *Formica rufa* was present with 33 specimens (less than 1% of the ants collected in Grashtitsa). Its abundance in the Medvednica Nature Park in Croatia was even lower (2 ind., 0.07%) (Šerić Jelaska et al. 2010).

CONCLUSIONS

It can be concluded that the present study complements research on the hymenopterans inhabiting house yards, which are poorly known habitats. With the established high taxonomic richness (74 identified species and 22 families) and species of conservational or scientific interest, it also confirms the importance of the semi-natural grasslands as valuable habitats for biodiversity.

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APPENDIX.

Species list of the Hymenoptera found during the study in the Western Rhodopes in Bulgaria, number of individuals collected in both sampling areas (♀ *w.* – worker, ♀ – female, ♂ – male).

Species	Family	Patalenitsa			Grashtitsa		
		♀ w.	♀	♂	♀ w.	♀	♂
Apis mellifera Linnaeus, 1758	Apidae	3			6		
Bombus pascuorum (Scopoli, 1763)	Apidae	1					
Bombus ruderarius (O.F. Müller, 1776)	Apidae					7	1
Argogorytes mystaceus (Linnaeus, 1761)	Bembicidae					1	
Bethylus cephalotes (A. Förster, 1860)	Bethylidae					1	
gen. sp.	Braconidae					45	8
Oxybelus quatuordecimnotatus Jurine, 1807	Crabronidae			1			
Tachysphex pompiliformis (Panzer, 1803)	Crabronidae					1	
gen. sp.	Cynipidae					1	
gen. sp.	Diapriidae		1			46	25
gen. sp.	Dryinidae					1	
Embolemus ruddii (Westwood, 1833)	Embolemidae					3	
gen. sp.	Eucoilidae					1	
gen. sp.	Eupelmidae					1	
gen. sp.	Eurytomidae					1	
Halictus cochlearitarsis (Dours, 1872)	Halictidae		1				
Halictus eurygnathus Blüthgen, 1931	Halictidae		1				
Halictus resurgens Nurse, 1903	Halictidae			1			
Lasioglossum anellum (Vachal, 1905)	Halictidae					1	1
Lasioglossum clypeare (Schenck, 1853)	Halictidae		1				
Lasioglossum punctatissimum (Schenck, 1853)	Halictidae		2				
Lasioglossum truncaticolle (F. Morawitz, 1877)	Halictidae		1				
Lasioglossum zonulum (F. Smith, 1848)	Halictidae			1			
Systropha planidens Giraud, 1861	Halictidae			1			
gen. sp.	Ichneumonidae		2			50	9
gen. sp.	Megaspilidae					8	
Auplopus albifrons (Dalman, 1823)	Pompilidae					1	
Priocnemis confusor Wahis, 2006	Pompilidae					1	
Priocnemis exaltata (Fabricius, 1775)	Pompilidae					1	
Priocnemis hankoi L. Móczár, 1944	Pompilidae		1			2	
Priocnemis hyalinata (Fabricius, 1793)	Pompilidae					1	
gen. sp.	Proctotrupidae					197	16
gen. sp.	Pteromalidae		2			17	
gen. sp.	Tenthredinidae					1	
gen. sp.	Trichogrammatidae					1	
Polistes biglumis (Linnaeus, 1758)	Vespidae				1		
Polistes nimpha (Christ, 1791)	Vespidae				1		16
Total (excl. Formicidae): 24 species, 494 ex.	21 fam.	20			474		
Ants:							
Aphaenogaster gibbosa (Latreille, 1798)	Formicidae	3					
Aphaenogaster subterranea (Latreille, 1798)	Formicidae	1		1			
Camponotus aethiops (Latreille, 1798)	Formicidae	50					
Camponotus lateralis (Olivier, 1792)	Formicidae	2					
Camponotus ligniperda (Latreille, 1802)	Formicidae				3	8	

Species	Family	Patalenitsa			Grashtitsa		
		♀ w.	♀	♂	♀ w.	♀	♂
Camponotus piceus (Leach, 1825)	Formicidae	13					
Cataglyphis aenescens (Nylander, 1849)	Formicidae	1					
Crematogaster schmidti (Mayr, 1853)	Formicidae	1					
Crematogaster sordidula (Nylander, 1849)	Formicidae	1					
Formica cinerea Mayr, 1853	Formicidae	3			972	5	2
Formica cunicularia Latreille, 1798	Formicidae	97			77		
Formica exsecta Nylander, 1846	Formicidae				89		
Formica fusca Linnaeus, 1758	Formicidae				205		1
Formica gagates Latreille, 1798	Formicidae	1			16		
Formica pratensis Retzius, 1783	Formicidae	35			1029	1	
Formica rufa Linnaeus, 1761	Formicidae				32	1	
Formica rufibarbis Fabricius, 1793	Formicidae				80		
Lasius alienus (A. Förster, 1850)	Formicidae	109			951	17	6
Lasius brunneus (Latreille, 1798)	Formicidae						1
Lasius carniolicus Mayr, 1861	Formicidae					1	
Lasius citrinus Emery, 1922	Formicidae				48	7	
Lasius emarginatus (Olivier, 1792)	Formicidae				2		
Lasius flavus (Fabricius, 1782)	Formicidae					4	
Lasius fuliginosus (Latreille, 1798)	Formicidae				1	4	3
Lasius mixtus (Nylander, 1846)	Formicidae					5	1
Lasius niger (Linnaeus, 1758)	Formicidae				5		
Leptothorax acervorum (Fabricius, 1793)	Formicidae				14		
Leptothorax muscorum (Nylander, 1846)	Formicidae				20	5	2
Manica rubida (Latreille, 1802)	Formicidae				1		
Messor ponticus F. Steiner et al., 2018	Formicidae	13	2		2		
Messor hellenius Agosti & Collingwood, 1987	Formicidae	1					
Myrmecina graminicola (Latreille, 1802)	Formicidae	1			4		
Myrmica gallienii Bondroit, 1920	Formicidae	3					
Myrmica rubra (Linnaeus, 1758)	Formicidae				156	12	1
Myrmica ruginodis Nylander, 1846	Formicidae	5			104	5	
Myrmica scabrinodis Nylander, 1846	Formicidae				52	19	
Myrmica schencki Viereck, 1903	Formicidae				6	5	
Plagiolepis pygmaea (Latreille, 1798)	Formicidae	3					
Polyergus rufescens (Latreille, 1798)	Formicidae	2					
Prenolepis nitens (Mayr, 1853)	Formicidae	1					10
Solenopsis fugax (Latreille, 1798)	Formicidae				2		
Tapinoma erraticum (Latreille, 1798)	Formicidae	2			77		
Temnothorax corticalis (Schenck, 1852)	Formicidae				3		
Temnothorax crassispinus (Karavaiev, 1926)	Formicidae	2					
Temnothorax muellerianus (Finzi, 1922)	Formicidae				3		
Temnothorax parvulus (Schenck, 1852)	Formicidae	1					
Temnothorax tuberum (Fabricius, 1775)	Formicidae	1			2		
Temnothorax unifasciatus (Latreille, 1798)	Formicidae				1		
Tetramorium caespitum (Linnaeus, 1758)	Formicidae	14			237	5	
Tetramorium hungaricum Röszler, 1935	Formicidae				1		
Total (Formicidae): 50 species, 4695 ex.		369			4326		
Total Hymenoptera: 74 species, 5189 ex.	22 fam.	389			4800		