

Ants (Hymenoptera: Formicidae) in the nature reserves of the Kaczawskie Mountains and Foothills

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Abstract: The myrmecological inventory of ten nature reserves (Buczyna Storczykowa na Białych Skałach, Buki Sudeckie, Góra Miłek, Mszana i Obłoga, Nad Groblą, Ostrzyca Proboszczowicka, Wąwóz Lipa, Wąwóz Myśluborski koło Jawora, Wąwóz Siedmicki, and Wilcza Góra) located in the Kaczawskie Mountains and Foothills revealed 31 ant species. Four species have been recorded in the Western Sudetes for the first time: *Formicoxenus nitidulus* (Nylander, 1846), *Lasius emarginatus* (Olivier, 1792), *Ponera coartata* (Latreille, 1802), and *Temnothorax parvulus* (Schenck, 1852).

Key words: biodiversity, faunistics, Western Sudetes, insects

INTRODUCTION

Faunistic research on the distribution of ant species in Poland has intensified in recent years. Successive reports on new species for Poland (Salata & Borowiec 2011, 2013; Michlewicz 2022; Pawluk *et al.* 2022a, 2022b; Trigos-Peral & Czechowski 2025) and updates on the species richness of particular zoogeographical regions (Salata *et al.* 2015, 2016, 2018; Żurawlew & Salata 2021; Zięcina & Salata 2022; Stępień & Borowiec 2023; Kaczmarowski & Salata 2025; Lewek *et al.* 2025; Mika *et al.* 2025) indicate a continuing need for such research. Despite intensive research, Polish myrmeco-fauna remains poorly understood, and some regions with unique national characteristics have never been sufficiently studied.

Kaczawskie Mountains and Foothills, situated in the Lower Silesian Voivodeship within the Western Sudetes faunal region, are among the least studied regions. They are classified as low mountains, with the highest peaks reaching around 730 metres above sea level. The topography of this area is highly varied, featuring gentle hills, river valleys, and sharply sloping hillsides. This area is considered one of the most habitat-diverse regions in the Sudetes, with 25 natural habitats identified (Świerkosz *et al.* 2012). Despite its uniqueness, the Kaczawskie Mountains and Foothills region has never been thoroughly studied from a myrmecological perspective. In the literature, the only site reported from this area is Wojcieszów, which was studied in the 1950s and 1960s (Banert & Pisarski 1972).

In this publication, we present a list of ants collected in nature reserves within the Kaczawskie Mountains and Foothills, which are recognised as the best-preserved and most valuable areas for natural heritage. We also report four species new to the Western Sudetes region.

MATERIALS AND METHODS

The study was conducted between June and September 2024 and 2025. The main method, applied at all sites, was direct sampling (hand collecting). Specimens of ants were collected on the ground, in leaf litter, under stones, in deadwood, on tree trunks and twigs. All specimens were collected by Dominik Zięcina and Sebastian Salata and preserved in 70% contaminated ethanol. The material was identified on the basis of the available literature (Czechowski *et al.* 2012). Species characteristics and distribution are also based on Czechowski *et al.* (2012). The descriptions of the nature reserves are based on data provided by Dajdok *et al.* (2017). The lists of collection sites (nature reserves) and of collected species are arranged alphabetically. The specimens are held in the collections of the Department of Biodiversity and Evolutionary Taxonomy at the University of Wrocław. The research carried out within the reserve was conducted pursuant to a permit issued by the Regional Directorate for Environmental Protection in Wrocław, reference number WPN.6205.18.2025.DJB.

Characteristics of the sampled sites – nature reserves:

(the localities of the investigated nature reserves are shown in Fig. 1)

1. Buczyna Storczykowa na Białych Skałach [UTM WS64]

The reserve was established in 2001 and covers an area of 8.76 hectares. It is a forest reserve comprising rich Sudeten beech forests and thermophilous beech forests with numerous orchid species, situated at an altitude of approximately 455 to 550 metres above sea level.

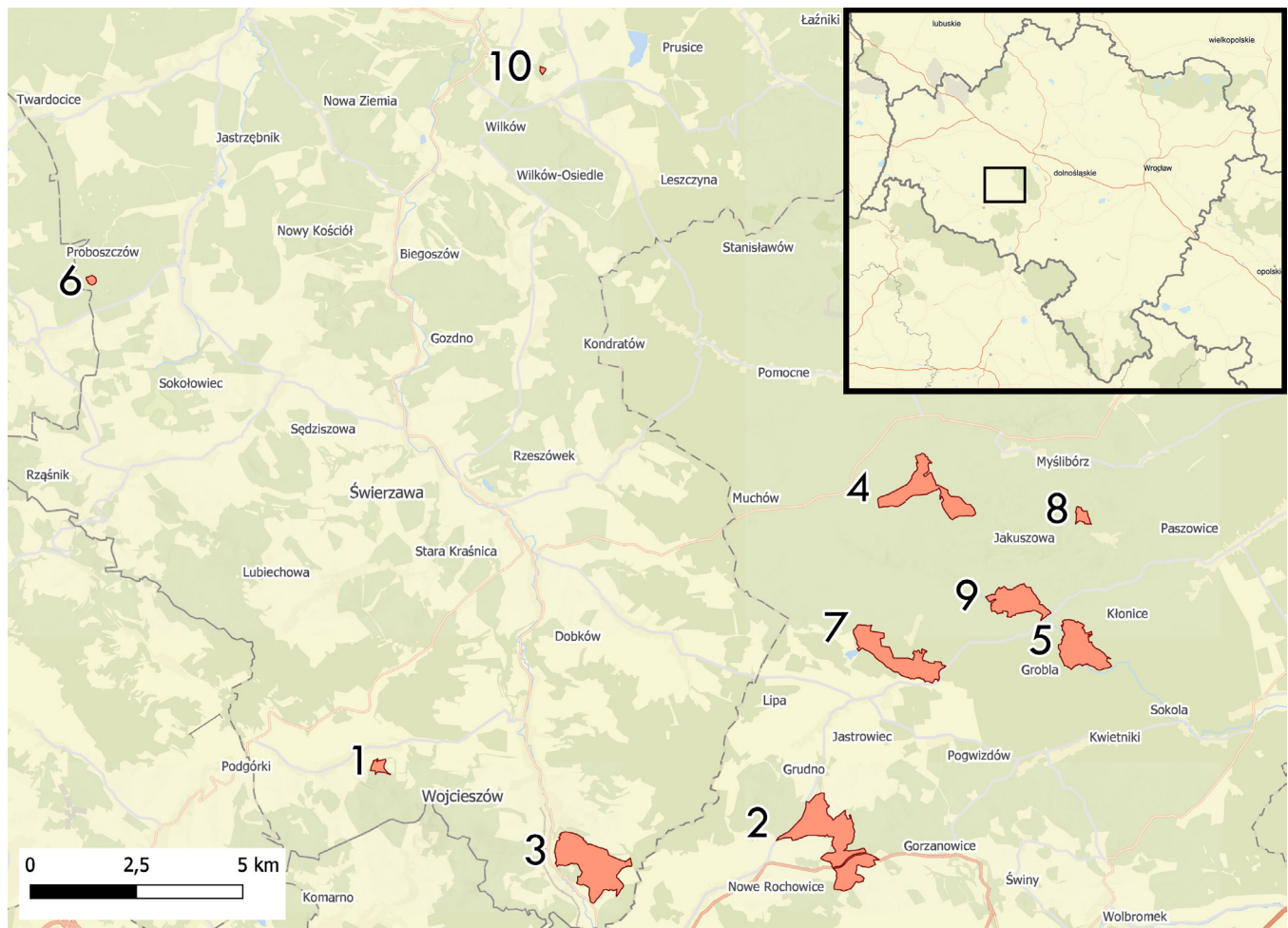


Figure 1. Map presents localities of investigated nature reserves (numbers indicate investigated nature reserves - see M&M section)

2. Buki Sudeckie [UTM WS74]

The reserve covers 174.42 hectares and was established in 1994. It encompasses the slopes and summits of Czerwone Wzgórze and Rakarnia, at altitudes ranging from approximately 430 to 548 metres above sea level. Among the most valuable communities in the reserve are eutrophic beech forests, which form one of the largest complexes of this vegetation type in the Western Sudetes. In small areas, in stream valleys and around springs, there are ash riparian forests of *Fraxinus excelsior* Linnaeus, 1753.

3. Góra Miłek [UTM WS64]

The reserve was established in 1994 and covers an area of 141.35 hectares. It protects a section of the lower montane forest typical of the Sudetes, situated on limestone rock, featuring natural plant communities and a rich invertebrate fauna. The reserve covers the slopes and peaks of Mount Miłek, ranging from approximately 360 to 573 metres above sea level. Our research was extended to include a disused quarry next to the mountain.

4. Mszana i Obłoga [UTM WS75]

The reserve covers 99.92 hectares and was established relatively recently, in 2015. It includes the slopes and summits of the Mszana and Obłoga hills, at altitudes ranging from approximately 380 to 475 metres above

sea level. The natural vegetation here consists of multi-species deciduous forests, with 70% of the reserve's area covered by maple-lime forests.

5. Nad Groblą [UTM WS74]

The reserve was established in 2001 and covers an area of 88.41 hectares. Its purpose is to protect one of Poland's largest concentrations of tree-like forms of *Sorbus torminalis* (Linnaeus, 1763) in their natural habitats. A variety of forest types are found here, including oak forests, oak-hornbeam forests and maple-lime forests.

6. Ostrzyca Proboszczowicka [UTM WS55]

The Ostrzyca Proboszczowicka Nature Reserve covers 3.81 hectares and was established in 1962. It is an isolated hill, and the reserve extends across an altitude range of approximately 430 to 501 metres above sea level. The natural vegetation here consists of multi-species deciduous forests, oak-hornbeam forests and, in the higher areas, maple-lime forests.

7. Wąwóz Lipa [UTM WS74]

The Wąwóz Lipa Nature Reserve covers an area of 101 hectares and was established in 1996. The reserve comprises various forest types at altitudes ranging from 330 to 390 metres above sea level. The varied topography results in a wide variety of vegetation (Fig. 2).

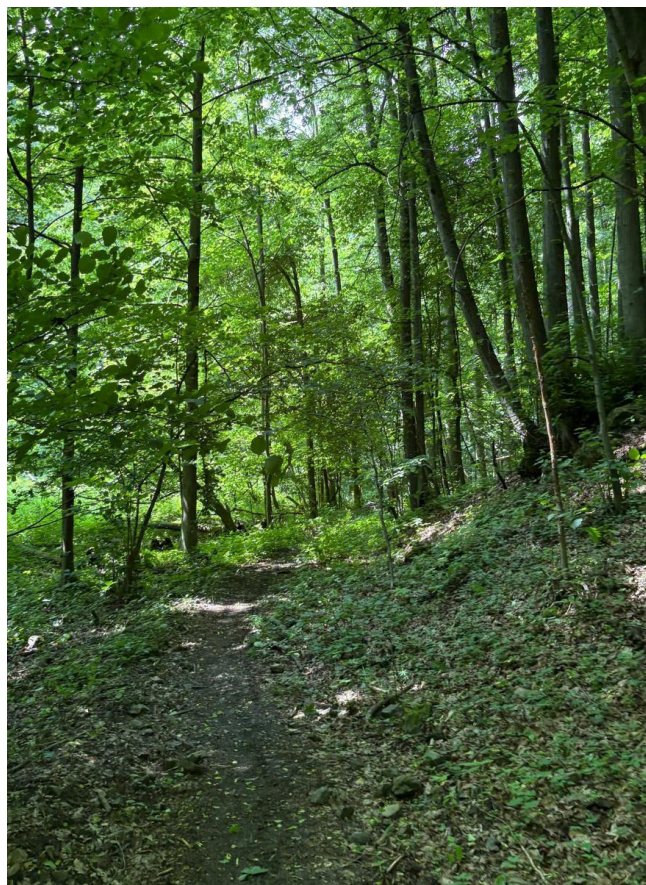


Figure 2. Example of a sampling site: forest in the valley of the Rogozina Stream within the Wąwóz Lipa Nature Reserve (locality 7).

8. Wąwóz Myśliborski koło Jawora [UTM WS75]

The reserve was established in 1962 and covers an area of 9.72 hectares. The aim of the conservation effort is to preserve the only population of *Asplenium scolopendrium* Linnaeus, 1753 in Lower Silesia. The reserve covers the valley of the Jawornik Stream at an altitude of 260 to 350 metres above sea level. Rich, multi-species forests grow here.

9. Wąwóz Siedmicki [UTM WS74, WS75]

The reserve, established in 2001, covers an area of 68.761 hectares. Within the reserve's boundaries, there are various plant communities, including oak forests, alluvial forests and meadows (Fig. 3).

10. Wilcza Góra [UTM WS66]

The nature reserve covers 1.6267 hectares and was established in 1959. It includes a part of Wilkołak Hill at an altitude of between 310 and 350 metres above sea level. It is mainly a geological reserve, which means there is little space for flora and fauna, and it is mostly inhabited by pioneer species.

RESULTS

List of collected species

(species new to the fauna of Western Sudetes marked with an asterisk *)

Camponotus fallax (Nylander, 1856)

Locality: 7.

It inhabits light, dry forests, mainly deciduous; it is also found in mixed forests, old parks and gardens. It nests in the hollow parts of living trees or in wooden structures. Considered rare.

Camponotus herculeanus (Linnaeus, 1758)

Locality: 5, 7.

A boreal mountain species found mainly in shady coniferous forests, but also in sunnier areas. It nests in rotting wood. In Poland, it is found mainly in mountainous regions and in the north-east.

Camponotus ligniperda (Latreille, 1802)

Locality: 3, 4, 5, 6, 9, 10.

A forest species found mainly in mixed and deciduous forests. It nests mainly in rotting wood and in dead parts of living trees. Known throughout almost the whole of Poland.

Dolichoderus quadripunctatus (Linnaeus, 1771)

Locality: 3, 5, 7, 10.

A dendrophilous species found mainly in deciduous forests. It is found in warm, sunny places. Once considered rare in Poland, it has been observed with increasing frequency in recent years.

Formica cunicularia Latreille, 1798

Locality: 10.

This species prefers dry, warm, open habitats; it is found on sandy dunes, limestone and gypsum mountain slopes, as well as in meadows, pastures, forest clearings, forest edges and sparse woodland. In Poland, this species is found almost throughout the country.

Formica fusca Linnaeus, 1758

Locality: 3, 4, 5, 7, 9, 10.

A species found in various forest and woodland habitats, ranging from wet to dry. In Poland, it is considered one of the most common species.

Formica polycтена Foerster, 1850

Locality: 3, 5, 9.

A species found mainly in coniferous and mixed forests, although it also occurs in deciduous forests. It usually nests in sunny spots, such as forest edges and along forest paths. Common throughout Poland, in the mountains, it occurs up to the lower limit of the subalpine zone.

Formica rufa Linnaeus, 1761

Locality: 1, 3, 5, 7, 10.

This species is mainly associated with coniferous and mixed forests, although it also occurs in deciduous forests and on peat bogs. It is often found in sunny areas, such as forest clearings and forest edges. In Poland, it is common throughout the country; in the mountains, it occurs up to the lower limit of the subalpine zone.

***Formica rufibarbis* Fabricius, 1793**

Locality: 3.

A species inhabiting dry, sunny, open habitats. It is found throughout Poland, except in the Tatra Mountains.

***Formica sanguinea* Latreille, 1798**

Locality: 3, 4, 6, 7, 10.

A species found in dry habitats, preferring sunny spots, forest clearings or areas of deforestation. A social parasite that practices slavery on species of the subgenus *Serviformica*.

Formicoxenus nitidulus* (Nylander, 1846)

Locality: 3, 5.

A social parasite living in the nests of ants of the genus *Formica*, mainly of the subgenus *Formica* s. str. The species is most likely found throughout Poland, but is only sporadically recorded due to its behaviour. New to the Western Sudetes.

***Lasius brunneus* (Latreille, 1798)**

Locality: 2, 3, 4, 5, 7, 8, 9.

A species of deciduous forest, also found in mixed forests. It nests under the bark and in the wood of both dead and living trees.

Lasius emarginatus* (Olivier, 1792)

Locality: 3, 6, 10.

A species that prefers warm, dry habitats, inhabiting grasslands and deciduous forests, typically found in sunny, rocky areas with sparse vegetation. In Poland, it occurs in xerothermic habitats but also found in city parks. New to the Western Sudetes.

***Lasius flavus* (Fabricius, 1782)**

Locality: 3, 10.

A species that prefers open, sunny areas, though it also inhabits forest areas. One of the most common species in Poland.

***Lasius niger* (Linnaeus, 1758)**

Locality: 3, 5, 9, 10.

A species found in moderately warm and dry environments, mainly open habitats, though it is also found in light forests. It is also found in various anthropogenic habitats.

***Lasius platythorax* Seifert, 1991**

Locality: 1, 3, 4, 5, 7, 8, 9.

A forest species, it inhabits various forest habitats as well as damp open areas. Unlike *L. niger*, it avoids human-made habitats.



Figure 3. Example of a sampling site: thermophilous oak forest in the Wąwóz Siedmicki Nature Reserve (locality 9).

***Leptothorax acervorum* (Fabricius, 1793)**

Locality: 1, 3, 4.

A forest species most commonly found in dry, open coniferous forests with sparse undergrowth. It is also found in open habitats, ranging from damp peat bogs to dry grasslands.

***Leptothorax gredleri* Mayr, 1855**

Locality: 4.

A species found mainly in moist and shady deciduous and mixed forests.

***Leptothorax muscorum* (Nylander, 1846)**

Locality: 8.

It inhabits sunny, dry coniferous forests and is also found in open areas, preferring dry, warm habitats.

***Myrmecina graminicola* (Latreille, 1802)**

Locality: 3, 5, 6, 10.

It mainly prefers warm deciduous forests, although it can also be found in open habitats such as stony meadows.

***Myrmica rubra* Linnaeus, 1758**

Locality: 2, 3, 5, 10.

This species has been recorded in a wide variety of habitats, ranging from moderately to heavily moist. It is frequently found in anthropogenic environments, such as gardens. It is one of the most common species in Poland.

***Myrmica ruginodis* Nylander, 1846**

Locality: 1, 2, 3, 4, 6, 7, 8, 9, 10.

It is found in moist forests, avoiding dry, sunny areas and anthropogenic sites. It is one of the most common species in Poland.

***Myrmica scabrinodis* Nylander, 1846**

Locality: 3, 4, 5, 6, 7, 9, 10.

A species found in open habitats such as meadows and pastures, as well as in forests, but only in sunny spots. It is also found in marshes. Common in Poland.

***Myrmica schencki* Viereck, 1903**

Locality: 5, 6.

A species that inhabits open, sunny areas in forests. It is one of the most thermophilic species in this genus.

Ponera coartata* (Latreille, 1802)

Locality: 3, 9.

A species found in warm, dry open habitats as well as in light forests. New to the Western Sudetes.

***Stenamma debile* (Foerster, 1850)**

Locality: 5.

A species inhabiting shady forests, mainly deciduous ones with a lot of leaf litter. This ant is found almost throughout the country, but is rarely recorded due to its cryptic behaviour.

***Temnothorax crassispinus* (Karavaiev, 1926)**

Locality: 1, 3, 4, 5, 6, 7, 8, 9, 10.

It inhabits various types of forest, ranging from coniferous to mixed and deciduous. It is the most common species of *Temnothorax* in Poland.

***Temnothorax nigriceps* (Mayr, 1855)**

Locality: 3.

A xerothermophilic species inhabiting dry, sunny rocky habitats with sparse vegetation. Relatively rare in Poland.

Temnothorax parvulus* (Schenck, 1852)

Locality: 5.

A species found in dry, sunny deciduous forests. Considered rare in Poland. New to the Western Sudetes.

***Temnothorax unifasciatus* (Latreille, 1798)**

Locality: 6, 10.

It inhabits xerothermic habitats, particularly sunny deciduous forests, though it is also found in various dry open habitats.

***Tetramorium caespitum* (Linnaeus, 1758)**

Locality: 3, 4, 6, 10.

A species found in dry, sunny habitats with sparse vegetation. These may be open habitats or forests, but it avoids areas with high humidity.

DISCUSSION

The studies conducted confirm the presence of 31 ant species in the reserves of the Kaczawskie Mountains and Foothills. This represents 31,6% of all native species known in Poland. Of the species listed in this study, two are protected in Poland (*F. polycetena* and *F. rufa*). Three of the species are mentioned in the IUCN Red List: *Formicoxenus nitidulus* (category VU), *Formica polycetena* (category NT), and *F. rufa* (category NT) (IUCN 2026). In addition, four new species (i.e., *Formicoxenus nitidulus*, *Lasius emarginatus*, *Ponera coartata*, and *Temnothorax parvulus*) have been recorded for the Western Sudetes, bringing the total number of known ant species in this zoogeographical region to 51. Except for the social parasite, all newly recorded species are associated with warm, dry habitats. This indicates that the Kaczawy Mountains, with their rich mosaic of habitats, can host taxa with highly specific habitat preferences that are not found at any other site in the Western Sudetes.

Species richness varies significantly among the investigated nature reserves (Table 1). The lowest number of species (3) was recorded in the Buki Sudeckie Nature Reserve. It might be due to a habitat type (beech forest), which usually does not support high species diversity. The highest number of species (22) was recorded from the Góra Miłek Nature Reserve. The reserve is vast (141.35 hectares) and situated on limestone rock hosting rich and diverse plant communities. These factors, along

Table 1. Ant species richness in the investigated nature reserves (numbers indicate investigated nature reserves - see M&M section).

location number Species	1	2	3	4	5	6	7	8	9	10
<i>Camponotus fallax</i>							x			
<i>C. herculeanus</i>					x		x			
<i>C. ligniperda</i>			x	x	x	x			x	x
<i>Dolichoderus quadripunctatus</i>			x		x		x			x
<i>Formica cunicularia</i>										x
<i>F. fusca</i>			x	x	x		x		x	x
<i>F. polyctena</i>			x		x				x	
<i>F. rufa</i>	x		x		x		x			x
<i>F. rufibarbis</i>			x							
<i>F. sanguinea</i>			x	x		x	x			x
<i>Formicoxenus nitidulus</i>			x		x					
<i>Lasius brunneus</i>		x	x	x	x		x	x	x	
<i>L. emarginatus</i>			x			x				x
<i>L. flavus</i>			x							x
<i>L. niger</i>			x		x				x	x
<i>L. platythorax</i>	x		x	x	x		x	x	x	
<i>Leptothorax acervorum</i>	x		x	x						
<i>L. gredleri</i>				x						
<i>L. muscorum</i>								x		
<i>Myrmecina graminicola</i>			x		x	x				x
<i>Myrmica rubra</i>		x	x		x					x
<i>M. ruginodis</i>	x	x	x	x		x	x	x	x	x
<i>M. scabrinodis</i>			x	x	x	x	x		x	x
<i>M. schencki</i>					x	x				
<i>Ponera coarctata</i>			x						x	
<i>Stenamma debile</i>					x					
<i>Temnothorax crassispinus</i>	x		x	x	x	x	x	x	x	x
<i>T. nigriceps</i>			x							
<i>T. parvulus</i>					x					
<i>T. unifasciatus</i>						x				x
<i>Tetramorium caespitum</i>			x	x		x				x
Total number of species	5	3	22	11	17	6	11	5	10	16

with the inclusion in this study of an abandoned quarry adjacent to the reserve's border, undoubtedly contributed to the high species count in this locality.

As many as eight out of 31 recorded species are known from a single reserve. Some of them are rather common species, i.e., *Formica cunicularia* and *F. rufibarbis*, that can be considered rare in the investigated

reserves only due to the lack of suitable habitats. *Camponotus fallax*, *Leptothorax gredleri*, and *Temnothorax parvulus* are rare taxa typical for dry and deciduous forests. Similarly, *Temnothorax nigriceps* is strongly associated with xerothermal grasslands (Czechowski *et al.* 2012). Their presence in the Kaczawy Mountains proves that this region provides habitats unique in the Western

Sudetes. The single record of *Stenamma debile* and *Lepthorax muscorum* might be due to their cryptic lifestyles, which make it very difficult to detect in the field. In recent times, the myrmecofauna of only two regions in the Western Sudetes was studied: Stołowe Mountains National Park (Salata 2014), and the Sudety Wałbrzyskie Landscape Park (Męczywór & Salata 2026). As many as 32 ant species were recorded from the Stołowe Mountains National Park, of which 19 were also recorded in this study. The differences mainly concern typically mountainous species found in the Stołowe Mountains National Park and thermophilic species recorded only in the Kaczawskie Mountains and Foothills. The faunistic overlap between the Sudety Wałbrzyskie Landscape Park and the Kaczawskie Mountains and Foothills is even more significant. Out of 21 species known from the landscape park, only three alpine taxa (*Formica lemni* Bondroit, 1917, *Manica rubida* (Latreille, 1802), and *Tetramorium impurum* (Foerster, 1850)), were not noted from Kaczawy.

The identification of 31 species from ten, mostly forested, reserves reveals how little we know about Poland's myrmecofauna. We expect that extending the research across the entire Kaczawskie Mountains and Foothills will increase the number of species associated with dry, warm habitats, such as grasslands and closed quarries.

ACKNOWLEDGEMENTS

In preparing this faunistic account, we are deeply aware that this work rests on foundations laid by Professor Wojciech Czechowski. His lifelong dedication to the study of ant fauna in Poland and Central Europe has fundamentally shaped our understanding of species diversity, distribution, and ecological relationships in the region.

We would like to express our sincere gratitude for his pioneering contributions, which not only established the core framework of modern Central European myrmecology but also continue to guide and inspire current faunistic and ecological research.

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STRESZCZENIE**Mrówki (Hymenoptera: Formicidae) rezerwatów przyrody Gór i Pogórza Kaczawskiego**

Przeprowadzona inwentaryzacja myrmekologiczna na terenie dziesięciu rezerwatów przyrody (Buczyna Storczykowa na Białych Skałach, Buki Sudeckie, Góra Miłek, Mszana i Obłoga, Nad Groblą, Ostrzyca Proboszczowicka, Wąwóz Lipa, Wąwóz Myśliborski koło Jawora, Wąwóz Siedmicki i Wilcza Góra) znajdujących się na obszarze Gór i Pogórza Kaczawskiego wykazała występowanie 31 gatunków mrówek. Stwierdzono także 4 gatunki mrówek nowe dla Sudetów Zachodnich: *Formicoxenus nitidulus* (Nylander, 1846), *Lasius emarginatus* (Olivier, 1792), *Ponera coartata* (Latreille, 1802) i *Temnothorax parvulus* (Schenck, 1852).
