# Observations of *Nomioides minutissimus* (Rossi, 1790) in Poland (Hymenoptera, Apiformes)

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#### Summary

Nomioides minutissimus is one of the smallest Polish bees. It has been observed in a limited number of localities in the country. Between 2010 and 2022 N. minutissimus was found in new localities and its presence in some of the known ones was confirmed.

#### Zusammenfassung

Justyna Kierat, Aleksandra Żmuda, Anna Kębłowska, Łukasz E. Mielczarek, Grzegorz Kilijański, Sylvester Kociniak, Ewelina Motyka, Andrzej Oleksa, Mikołaj Borański: Vorkommen von Nomioides minutissimum (Rossi, 1790) in Polen (Hymenoptera, Apiformes): Nomioides minutissimus ist eine der kleinsten polnischen Bienenarten. Sie ist in diesem Land sehr selten. Zwischen 2010 und 2022 wurde Nomioides minutissimus an neuen Fundorten gefunden und einige bekannte Vorkommen wurden bestätigt.

#### Introduction

Nomioides minutissimus (Rossi, 1790) is one of the smallest members of Polish bee fauna, being only 3,5–4,5 mm long (Pesenko et al. 2002). This is the only species of Nomioides found to date in Poland(Banaszak 2002, Pawlikowski 2001). Body size coupled with unique colouration make it hard to observe but unmistakable. Nomioides minutissimus is distributed throughout Europe, North Africa and south Asia (Ascher and Pickering 2020, Pauly 2017). In Europe its distribution ranges from Spain and Portugal in the west to Ukraine and Russia in the east, and further to China and Mongolia. In Poland there is one of two northernmost known locations of this species (the second one is in Izhevsk in Russia).

In Europe Nomioides minutissimus has the conservation status LC (Least Concern), meaning it is currently not endangered with extinction (Michez et al. 2013). However, in the Czech Republic it has conservation status VU (vulnerable) (Straka & Bogusch 2017), and in Germany it was considered critically endangered (Westrich et al. 2011). In Poland it is considered a rare species, listed as vulnerable (VU) on the Red List of Threatened Animals in Poland (Głowaciński 2002). To date, it was found in only three localities:

• Wrocław (Pesenko et al. 2000), Karłowice. The exact locality of observations made by Dittrich, was at the time of observations (between 1881 and 1885) a village. Presently, it is a district of the city of Wrocław. Due

to the habitat changes connected with urbanization it is uncertain and worthy of confirming in the future whether *Nomioides minutissimus* still occurs there.

- Otłoczyn near Toruń (Banaszak 1982). This was one of two northernmost localities of this species in its whole range (Pesenko et al. 2000, Pauly 2017).
- Kampinoski National Park, located near Warsaw, the capital city of Poland; three localities in the northeastern part of the National Park (Banaszak & Plewka 1981, Plewka 2003).

In this work, we provide data about presence of *No-mioides minutissimus* in previously unknown localities, and new data about occurrence in Kampinoski National Park.

#### **Methods**

Surveys were made between 2010 and 2022, in Krakow-Czestochowa Upland, Włoszczowa Basin in Małopolska Upland, the city of Bydgoszcz, the Masovian Lowland in the vicinity of Warsaw and of Puławy, and in the neighbourhood of Tarnobrzeg.

We looked for the bees in the habitats known to be preferred by this species: sandy soil with places of uncovered sand and flowering plants (Westrich 2019). We also present here the results of accidental findings of the species during other fieldwork. Phytosociological terminology is used following Matuszkiewicz (2022).

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#### Results

During the study, *Nomioides minutissimus* was found in the following localities (Fig. 1):



Fig. 1. Map of distribution of *Nomioides minutissimus* in Poland, based on UTM grid. Red dots - localities controlled by the authors, black dots - localities from the literature, not controlled during the present study. Map created with MapaUTM ver 5.4 (Grzegorz Gierlasiński, https://www.heteroptera.us.edu.pl/mapautm.html).

Kampinoski National Park [1], UTM DC89, confirming its presence in one of the known localities given by Banaszak and Plewka (1981); one ♀ feeding on Jasione montana, found by JK, 25.07.2021; on a small thermophilic grassland (Fig. 2), at the foot of a dune called Wierzejna Góra in Sieraków. Phytosociologically, the grassland represents the *Koelerio glaucae-Corynephoretea canescentis* class – sandy grasslands on inland sands, in dry and poor non-calcareous habitats. In the northern part, from the side of the dune slope, the grassland takes a form of a more pioneering community from the *Corynephorion canescentis* alliance with the dominance of *Corynephorus canescens* and *Sper*-



Fig. 2. Habitat of *Nomioides minutissimus* in Kampinoski National Park (photo: J. Kierat)

gula morisonii. In the southern part, from the side of an asphalt road, it turns into sandy grasslands, more compact and floristically richer, referring to the Vicio lathyroidis-Potentillion argenteae alliance with Pilosella officinarum, Jasione montana (Fig. 3), Scleranthus annuus, Helichrysum arenarium, Centaurea stoebe and ruderal elements such as Erigeron canadensis, Echium vulgare and Oenothera biennis.



Fig. 3. Clump of flowering *Jasione montana* in the habitat of *Nomioides minutissimus* (photo: J. Kierat)

- Kampinoski National Park [2], UTM DD70, a new locality was discovered to the northwest from already known records; one  $\bigcirc$  feeding on *Potentilla argentea* agg, found by JK and AK, 15.06.2022; in the area belonging to the Sapper Regiment of the Armed Forces of the Republic of Poland, in the landscape protection area named Grochalskie Piachy. It is a large, over 100 hectare unforested area of blown sands with various stages of succession, partly overgrown with Pinus sylvestris and pioneer deciduous trees, such as Populus tremula, dominated by grasslands, including Corynephorion canescentis alliance with Spergula morisonii, Corynephorus canescens and Cladonia ssp. lichens and ruderal communities of warm habitats belonging to the Onopordetalia acanthii order (Zaniewski 2015). Nomioides minutissimus was found in the north-central part of the area on Potentilla argentea agg. in a transitional community between thermophilous grasslands and ruderal communities, in the company of such plants as Corynephorus canescens, Spergula morisonii, Helichrysum arenarium, Sedum acre, Oenothera biennis, Erigeron annuus and Calamagrostis epigejos.
- Wólka Węglowa [3], just outside the borders of the Kampinoski National Park, UTM DC99; a new record approx. 2 km from one of the localities given by Banaszak and Plewka (1981); one ♀ feeding on *Potentilla argentea* agg. found by Kamila Chomicz, det. JK, 17.06.2022; in an intermediate community between the sandy grassland of *Vicio latyroidis-Potentillion argenteae* alliance and the ruderal community of the warm habitats belonging to the *Onopordetalia acanthii* order, grown on post-agricultural land, under the

high voltage line. In addition to Potentilla argentea agg., Oenothera biennis, Bromus sp., Plantago lanceolata, Artemisia campestris, Scleranthus annuus, Conyza canadensis and Jasione montana grow there.

**Warsaw** [4], UTM DC99, one  $\bigcirc$  feeding on *Potentilla argentea* agg. found by SK, 11.06.2022; one  $\bigcirc$  feeding on the same plant species (Fig. 4) was observed in this location by JK and Kamila Chomicz 16.06.2022; ruderal community of the warm habitats belonging to the *Onopordetalia acanthii* order with *Tanacetum vulgare*, *Oenothera* sp., *Conyza canadensis, Erigeron annuus, Centaurea stoebe, Potentilla argentea* agg., *Helichrysum arenarium, Achillea millefolium*.



Fig. 4. Nomioides minutissimus-♀ foraging on a flower of Potentilla argentea agg., 16.06.2022 (photo: J. Kierat)

Vicinity of Tarnobrzeg [5], UTM EA59; about a dozen individuals in one place, ♂ and ♀, feeding on *Echium vulgare, Erigeron annuus, Jasione montana* and *Melilotus albus*, observed by GK on several days between 14.07 and 26.07.2022; det. from fot. JK. Grassland represents the *Koelerio glaucae-Corynephoretea canescentis* class with *Pilosella officinarum, Sedum acre, Echium vulgare, Jasione montana* and *Erigeron annuus*.

Vicinity of Tarnobrzeg [6], UTM EB50; one ♀ feeding on Potentilla argentea agg., found by AŻ, 04.08.2022; on sandbanks, between soil flood barrier and the river. The area was covered by Potentilla argentea agg., Lysimachia vulgaris, Anthemis arvensis, Agrostis capillaris, Trifolium arvense, Jasione montana, Plantago lanceolata, Hypochaeris radicata. The above species form a community of the Koelerio glaucae-Corynephoretea canescentis class similar to the Vicio lathyroidis-Potentillion argenteae alliance.

Czarnca ad Włoszczowa [7], Malopolska Upland, UTM DB22, 2 ♀ leg. and det. by ŁM, 19.07.2021; on very dry sandy abandoned railway embankment covered

by Koelerio glaucae-Corynephoretea canescentis class with Pilosella officinarum, Sedum spp., Echium vulgare, Jasione montana and Convolvulus arvensis. The sides of embankments were partly covered with Pinus sylvestris, Populus tremula, Prunus cerasifera as well as invasive Prunus serotina. Numerous bees were observed visiting only the Jasione montana on the upper part of artificial hill, despite of that a potential habitat was also present at the base of embankment.

- Olkusz [8], Krakow Czestochowa Upland, UTM DA07, leg. and det. by ŁM, 25.07.2021; on dunes along the railway embankment close to Rabsztyn. It is an open area with very scarce vegetation including *Jasione montana* and *Convolvulus arvensis*, as well as *Pinus sylvestris* and *Prunus serotina*. Many bees visited the flowers of *Jasione montana* and only one was observed inside the flower of *Convolvulus arvensis*.
- **Bydgoszcz** [9], UTM CD09; approximately 10  $\bigcirc$  observed by Anna Oleksa and AO, two of them coll. by AO, 30.06.2015; 5  $\bigcirc$  on 19.06.2016 and 3  $\bigcirc$  on 26.06.2016 observed by Grzegorz Czapran and EM; the lower part of the southern exposure slope (Fordon Slope, i.e. northern edge zone of the Toruń-Eberswald glacial valley), overgrown with a mosaic of psammophilous and ruderal vegetation, as well as partly with sparse pine trees (Fig. 5). Phytosociologically, most of the grassland of the site represents the *Koelerio glaucae-Corynephoretea canescentis* class sandy grasslands on inland sands, on dry and poor non-calcareous habitats. The species was found feeding on *Jasione montana, Centaurea stoebe* and *Thymus serpyllum*.



Fig. 5. Habitat of *Nomioides minutissimus* in Bydgoszcz (photo: G. Czapran)

Puławy [10]; Mazovian Lowland, UTM EB69, one ♀ coll. by MB, 06.06.2010; the female was collected while resting on a sandy road on a mid-forest small thermophilic grassland representing the Koelerio glaucae-Corynephoretea canescentis class with Thymus serpyllum, Helichrysum arenarium, Convolvulus arvensis, Echium vulgare, Jasione montana, Erigeron annuus and Trifolium arvense. Rudki ad Przyłęk [11]; Mazovian Lowland, UTM EB58, one ♀ coll. by MB, 24.06.2019; the female was caught using a white pan trap in an agricultural landscape. Pan trap was set at the field margin between buckwheat field (*Fagopyrum esculentum*) and sandy grasslands with scarce vegetation including *Sedum acre*, *Jasione montana*, *Convolvulus arvensis*, *Thymus serpyllum* and *Rumex acetosella*.

We failed to find *Nomioides minutissimus* in the two previously known localities in Kampinoski National Park. However, one of the localities given above, namely Wólka Węglowa [3], is in the proximity of one of them.

#### Discussion

Nomioides minutissimus is a polylectic species, visiting plants belonging to a number of different families. Radchenko (1980) lists Conyza canadensis and Centaurea diffusa (both Asteraceae) as the main visited plants (observations were made in the Donetsk Province). North-African subspecies N. m. maurus has been observed to visit Senecio sp., Campanula sp., Herniaria fontanesi and Frankenia laevis (Pesenko and Pauly 2005). Interestingly, according to Pesenko et al. (2002), in the northern part of its range it prefers Thymus sp. However, during our encounters with this species, we found them on Thymus only once, in Bydgoszcz. Most of our observations were made on Potentilla argentea agg., Erigeron annuus and Jasione montana. These species were present on almost all sites, even if the bees were not observed to visit them in each site.

Some of the localities of occurrence of Nomioides minutissimus are protected within the borders of the National Park. Therefore, they are hopefully protected from urbanization or other anthropogenic forms of habitat destruction. However, because the National Park is located near Warsaw, the capital of Poland and a densely populated city, it is under pressure from tourists. Very dry grasslands on sandy soil, the preferred habitat of Nomioides minutissimus, are under threat from people walking off the designated routes and, more importantly, by the illegal use of quads and off-road bicycles. Possible threats to the continuity of occurrence of this species in these places are also ecological succession and spread of invasive alien plant species. Conyza canadensis, Erigeron annuus, Solidago gigantea and a few juvenile Robinia pseudoacacia were observed, all of which are invasive. They covered a relatively small proportion of the area, but if unmanaged they can quickly become dominant in this habitat. The change in this specific sandy habitat is also a threat to other endangered species of insects, eg. Apolysis szappanosi Papp,

2005, Glabellula arctica (Zetterstedt, 1838), Cyrtosia marginata Perris, 1839 (Mielczarek 2018). Kampinoski National Park undertakes actions of active protection of the most valuable habitats, including limiting the occurrence of invasive plant species, especially Solidago gigantea and Robinia pseudoacacia. On the other hand, Conyza canadensis and Erigeron annuus are not removed due to their wide distribution and lack of tendency to create dense patches on the grasslands. The area is also monitored to prevent walking and driving away from the permitted routes by the visitors of the National Park. Problems with both insubordinate National Park visitors and invasive species are difficult to solve and probably can never be fully eliminated, but the high protection status of this area gives hope that it will be protected sufficiently for the vulnerable habitats of Nomioides minutissimus to persist.

The site in Bydgoszcz is protected as part of the Vistula Landscape Park (Nadwiślański Park Krajobrazowy). Located on the city's edge, the area is under heavy use as a popular walking area. This results in treading, littering and (occasionally) grass fires. It seems, however, that moderate trampling is a beneficial factor, as it inhibits natural succession (overgrowing by pine forests). Development of the area with housing and transportation facilities may pose a more severe threat. There are plans to create a paved bicycle path through the site, which, together with the accompanying infrastructure, will probably contribute to reducing the area of the sandy grassland.

Nomioides minutissimus has been regarded as a very rare species in Poland. We report here new records of this species, some of which are at a large distance from those previously known. One of them (Bydgoszcz) becomes the northernmost record in the country, and therefore one of the northernmost ones in Europe. As this species was discovered in new localities no earlier than 15 years ago, we cannot exclude that it is currently extending its range, possibly because of climate change. Similar pattern can be observed in other bee species, like Xylocopa violacea (Kadej et al. 2021) and Halictus scabiosae, the latter first observed in Poland in 2020 (Wendzonka et al. 2022). Moreover, two of the new localities exist in areas used by railway which exhibit a very suitable environment for bees (Moroń et al. 2014) and may provide a migration route as well as Vistula river in case of the rest of the recent records of Nomioides. However, because of the small size of Nomioides minutissimus, it is also possible that it was overlooked during some previous studies.

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