

## First record of the ant *Formica bruni* (Hymenoptera: Formicidae) in the Czech Republic

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**Abstract.** Nest aggregation of the ant *Formica* (*Coptoformica*) *bruni* Kutter, 1967 was found in the edge of the kaolin quarry near Nepomyšl, NW Bohemia, Czech Republic. The colony contains 60 nests spread over an area of ca. 675 m<sup>2</sup>. The site (altitude ca. 420 m a. s. l.) is covered by sparse ruderal vegetation (e.g. *Calamagrostis epigejos* and *Lupinus polyphyllus*). However, majority of nests was found in places with unconnected lower vegetation consisting mainly of clumps of fescue (*Festuca* sp.). The origin of this, in Central Europe very rarely collected ant species, is discussed and the idea is suggested that it is a relict, which survived in the region from the end of late Glacial. The record of *F. bruni* is the first one in the Czech Republic. Therefore, the number of the outdoor ant species of the country increases to 113.

**Key words.** Distribution, ecology, endangered species, ants, *Formica* (*Coptoformica*) *bruni*

### INTRODUCTION

The Palaearctic subgenus *Coptoformica* Müller, 1923 of the genus *Formica* Linnaeus, 1758 currently contains 14 species of ants (Seifert & Schultz 2021). Of them three species, *Formica exsecta* Nylander, 1846, *F. foreli* Bondroit, 1918, and *F. pressilabris* Nylander, 1846 were found in the Czech Republic (Bezděčka & Bezděčková 2008, Bezděčková & Bezděčka 2011, Werner et al. 2018).

Another species that has been expected to be present in the Czech Republic but not found so far is *Formica bruni* Kutter, 1967. It is a western Palaearctic species; its distribution range stretches from northern Spain to southeastern Kazakhstan. However, its distribution is poorly known throughout its range, and the abundance is underestimated due to its former frequent confusions with *F. foreli*, *F. pressilabris*, and *F. fennica* Seifert, 2000, until Seifert (2000) has clarified the species delimitations. Above all, the records from the areas lying eastwards of Central Europe are extremely scarce (Schultz & Seifert 2007). The northernmost localities of this ant are known from southern Sweden, the southernmost records come from northern Spain and Greece (Borowiec 2014). In Central Europe, *F. bruni* ranks among the rarest *Formica* species, as only seven isolated sites are known from whole Germany and Austria (Seifert 2018). In other countries neighbouring the Czech Republic, i.e. Slovakia, Hungary, and Poland it was not recorded so far (Werner & Wiezik 2007, Czechowski et al. 2012, Borowiec 2014, Csösz et al. 2021).

The ant species of the subgenus *Formica* (*Coptoformica*) prefer open, extensively managed grassland habitats. That is why they belong to the most endangered ant species in Central Europe, partly due to human land use and partly due to the overgrowing of open grassland by bushes. All

the *Coptoformica* ants possess unique behavioural characters – they cut grass into small pieces, which serve as a material for construction of nest mound with very smooth surface. Such mounds often form aggregations containing tens to thousands of mounds. However, a considerable decreasing in numbers of such aggregations is observed in the period since the second half of the 20<sup>th</sup> century till now, at least in the Czech Republic (Bezděčková & Bezděčka 2011).

## RESULTS AND DISCUSSION

During field research of ants in the Doupovské hory Mts. on 2 August 2024, we visited a kaolin quarry near Nepomyšl, Louny District, NW Bohemia, Czech Republic (50.2193561°N, 13.3282150°E, altitude 420 m a. s. l.). We found there a group of nest mounds typical for the ants of the subgenus *Coptoformica* (Fig. 1A). From one of these mounds, we collected 11 workers (9 dry, 2 in alcohol). On 26 August 2024, we visited the locality again and collected other 23 workers from another nest (11 dry, 12 in alcohol). The species identification was made by Petr Werner according to the characters summarised by Seifert & Schultz (2000) and Seifert (2018). Additionally, the newly collected ants were compared with voucher specimens of *F. foreli* and *F. pressilabris* from the Czech Republic and Slovakia, and of *F. bruni* from Germany and North Macedonia (all in the PW collection). The identification revealed the presence of *F. bruni*. Subsequently, an alcohol sample of five workers were sent to B. Seifert (Senckenberg Museum für Naturkunde Görlitz, Germany) who confirmed this identification. Voucher specimens of this record are deposited in the Karlovy Vary Museum and Museum Vysočiny [Highland Museum] (Karlovy Vary and Jihlava, both Czech Republic), Senckenberg Museum für Naturkunde Görlitz, and in the Petr Werner and Vladimír Vohralík private collections.

The wider area of the occurrence of *F. bruni* in the Czech Republic is located on the border between the Doupovské hory Mts. and the Žatecká pánev Basin. It is an agricultural landscape composed of a mosaic of fields, meadows, pastures, and deciduous and mixed forests. Based on the data from the period 1901–2000, the climate of this area is characterised as moderately warm and dry (Mackovčín et al. 2011). The summer is medium long with 20–40 summer days, average day temperature of 13–15 °C, and dry, with precipitations lesser than 200 mm. The winter is characterised as medium long with 50–60 frost days, moderately cold with the average temperature between -2 and -3 °C, and the precipitations lesser than 200 mm, and short period of snow cover of 50–60 days. The transition periods are medium long with 140–160 frost days, the spring is cold with average temperature of 5–7 °C and moderately warm autumn, with average temperatures of 6–8 °C. The total annual rainfall ranges from 500 to 600 mm (Mackovčín et al. 2011), which is a below-average value concerning the climate of the Czech Republic.

The Nepomyšl kaolin quarry was opened in 2004; the kaolin mined there was created by kaolinisation of sedimentary rocks. The bentonite, in the overburden of the kaolin, is not mined. In the current time as well as during the previous ten years, the kaolin mining took place here only occasionally and in a small scale. No foreign material was ever brought and deposited in the quarry area (J. Hujsl pers. comm. 2024).

The finding site of the *F. bruni* nests is located in the north-eastern edge of the kaolin quarry area at an altitude of approximately 420 m a. s. l. An original soil cover in this part of the quarry is mostly missing and the surface consists of a bentonite layer. The locality is covered by sparse ruderal vegetation (Fig. 2) in which the wood small-reed (*Calamagrostis epigejos*) and the many-leaved lupine (*Lupinus polyphyllus*) are gradually expanding, while along the road that borders the discovery site, the bushes of roses (*Rosa* sp.) and hawthorns (*Crataegus* sp.) are frequent. However, majority of nests was found in places with unconnected lower vegetation consisting mainly of clumps of the fescue *Festuca* sp. (Fig. 1B).



Fig. 1. A – group of nest mounds of *Formica bruni* Kutter, 1967 in the Nepomyšl kaolin quarry, northwestern Bohemia, Czech Republic. B – a nest of *Formica bruni* in a clump of the fescue grass (*Festuca* sp.). Photo by J. Matějů, on 2 August 2024 (B) and 26 August 2024 (A).

During the second visit to the site on 26 August 2024, at least 60 nests of *F. bruni* were found (this number is only approximate, as in some cases it was not clear whether it was one single nest or more nests joined together) in a total area of ca. 675 m<sup>2</sup> (Fig. 3). The nest positions were determined using a GPS receiver and individual nests were photographed with a scale. According to the size (taken as the maximum diameter), the nests were divided into ten size categories (Fig. 4). The nest size exhibits balanced distribution, most numerous nests are those with the diameter ranging between 15 and 20 cm. The presence of 10 nests (16.6%) of the smallest size (below 10 cm) suggests a viable nest aggregation with a good proportion of young nests. Three outliers (diameter larger than 40 cm) were in the northern edge of the aggregation, south of the line of roses and hawthorns. According to the colour and starting decomposition of the grass pieces on their margins, they belonged probably to the oldest, i.e. founder nests. Size composition and dynamics of the nests can be a useful tool in evaluating of the nest aggregation prosperity in the future.

The occurrence of *F. bruni* in northwestern Bohemia is not easy to explain. This species prefers the oligotrophic and xerothermic grasslands of the planar to submontane zone (Seifert 2018). In general, all the *Coptoformica* species need to receive a lot of heat from the sun because they are unable to generate metabolic heat, in contrast to the members of the nominotypical subgenus of *Formica*. Therefore, *F. bruni* cannot survive in habitats of the close shady forests (Seifert 2018). This may explain the recent sporadic occurrence of this ant in the Central European lowlands.



Fig. 2. General view of the locality with the nest of *Formica bruni* Kutter, 1967 in the Nepomyšl kaolin quarry. Photo by J. Matějů, 26 August 2024.



Fig. 3. Distribution of the nests of *Formica bruni* Kutter, 1967 in the north-eastern edge of the Nepomyšl kaolin quarry.

According to Chytrý (2012), for most of the territory of Bohemian lowlands, a spreading of woodland was typical at the expense of late-glacial open steppe at beginning of the Holocene (ca. 11,500 years BP). This process culminated in the period of the Atlantic (ca. 8,000–4,500 years BP), when the dense canopy of broad-leaved trees considerably decreased the light falling to the soil surface. However, even in this period, some areas remained where the steppe vegetation was continuously present throughout the Holocene. Such areas still occur, e.g. in northwestern Bohemia, east of the Doupovské hory Mts., a region in the rain shadow of the Krušné hory Mts. (Chytrý 2012). Later, at the onset of the Neolithic period (at ca. 5000 years BP) the pine-birch forest-steppe continuously developed into secondary grasslands due to anthropogenic deforestation and grazing by domestic livestock (Pokorný et al. 2015).

Therefore, *F. bruni* could survive in the above specified area of northwestern Bohemia from the end of the Late Glacial until present and its presence should be considered a relic. This hypothesis could be supported also by a continuous occurrence of the open-landscape species of snails (Gastropoda) in the neighbouring Ohře River valley throughout the whole Holocene (Juričková et al. 2013). Another candidate for the late glacial relic occurrence in the mentioned area is a steppe-habitat bound small mammal, the Ural field mouse (*Apodemus uralensis cimrmani* Vohralík, 2002), whose small relic range (ca. 25×20 km) is situated in a close neighbourhood of the locality of *F. bruni* and isolated by distance of ca. 230 km from its continuous distribution in the Pannonian Basin (Vohralík 2002). Even among ants, it is possible to find a similar example of this fauna. It is *Camponotus piceus* (Leach, 1825), a xerothermophilic species living mostly in open dry grasslands. The northern border of its range is situated in the northern Pannonia, however, it was surprisingly found also in the xerothermic area of the Žatec Natural Monument, ca. 20 km north-east of the *F. bruni* locality (Vysoký 2012). In addition, several specifically steppe plant species such as the speargrass (*Stipa pennata*) and horsetail (*Pulsatilla pratensis bohémica*) are common in a number of the nearby locations, the closest being, for example, the Mlýnský vrch Hill – just 1.5 km north-east of the *F. bruni* site (Broum & Koutecký sine dato).

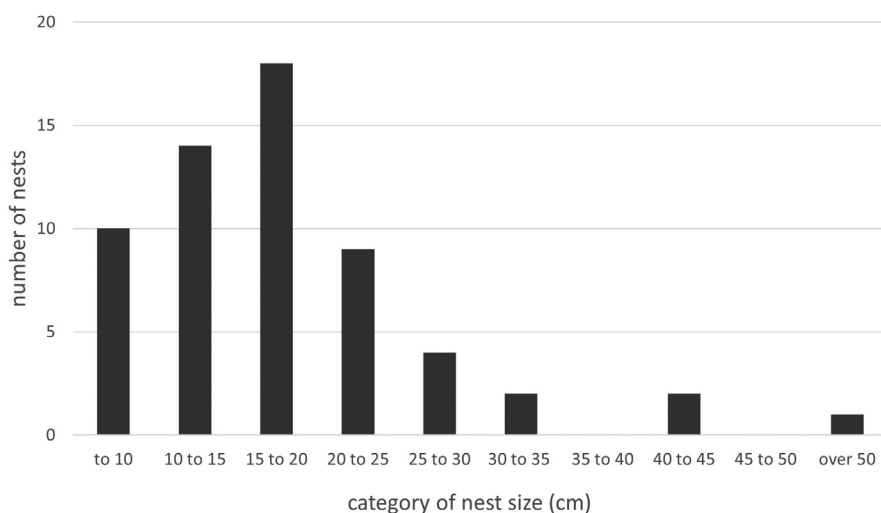


Fig. 4. Size composition of the nests of *Formica bruni* Kutter, 1967 in the Nepomyšl kaolin quarry.

It should be remarked that the occurrence of *Coptoformica* in northwestern Bohemia was mentioned already by Záleský (1939) who reported a finding of *Formica execta pressilabris* in the locality named as “Karlovy Vary v údolí Ohře (Kohn)” [= Karlovy Vary, in the Ohře River valley (Kohn)], without any other details. Franz Gerhard Kohn (1881–1939) was a naturalist working in the Karlovy Vary region and his isolated mention was later never confirmed. In addition, in the ant collection by M. Záleský, housed in the National Museum, Prague, the sample from the Kohn’s locality is missing. Since in the times of Záleský publication, *Formica pressilabris* was often confused with *F. foreli*, and *F. bruni* as a species was recognised and described much later (1967), the species identity of the Kohn’s record remains enigmatic, although much less after the new finding of *F. bruni* in the Nepomyšl kaolin quarry.

The record of *F. bruni* is the first one in the Czech Republic. Therefore, the number of the outdoor ant species documented to occur in the Czech Republic increases from 112 (Werner et al. 2018, Bezděčka et al. 2023) to 113. Due to the general decline of the abundance of the *Coptoformica* ants in Central Europe (cf. Bezděčková & Bezděčka 2011), it would be most desirable to ensure the protection of this nest aggregation and to carry out regular monitoring of its condition in future.

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