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Arcyptera microptera (Fischer de Waldheim, 1833) (Orthoptera: Acrididae) has become extinct in the Czech Republic

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Abstract: In the past, the grasshopper *Arcyptera microptera* microptera was present in the Czech Republic on the northern edge of its range. A stable population was known only in a single location (Pouzdřany Steppe-Kolby National Nature Reserve). The abundance of *A. microptera* microptera at this location declined during the 20th century, and only a few specimens from this location exist in the depositories of museums in the Czech Republic. At each of 2 other locations (Kobylí and the Kamenný vrch u Kurdějova Nature Reserve), only a single male was discovered in the past. In several extensive surveys conducted in the Czech Republic between 1990 and 2008, *A. microptera* microptera was not detected, probably because the habitat is no longer suitable for this species. At present, those parts of the Pouzdřany Steppe offering a suitable habitat for *A. microptera* microptera (vegetation coverage < 70%) are very restricted in area and are scattered. Based on these facts, it is necessary to categorize the species *A. microptera* microptera as extinct in the Czech Republic.

Key words: *Arcyptera microptera*, faunistics, distribution, extinction, Czech Republic

Arcyptera microptera (Fischer de Waldheim, 1833) is a Euro-Siberian species of grasshopper with 11 subspecies ranging from Spain to western Siberia and northern Kazakhstan (Kočárek et al., 2005). In central Europe, *A. microptera microptera* has been found in Germany, Austria, Poland, the Czech Republic, and Hungary; it was noted in only a few locations in the Czech Republic but in many locations in Hungary (Bazyluk, 1956; Kaltenbach, 1970). *A. microptera microptera* was also recorded from 2 localities in Poland (Bazyluk, 1956) but it is not mentioned in the Red Book of Poland (Głowaciński and Nowacki, 2004). In Germany, several regions of habitation were known but the species has not been observed since 1940 (Maas et al., 2002; Kohler et al., 2003; Machatzi et al., 2005). In Austria, many occurrences have been reported (Ebner, 1951) but it seems likely that the species is now extinct in that country (Berg and Zuna-Kratky, 1997; Berg et al., 2005; Nagy, 2002). In the Czech Republic, *A. microptera* has been regarded as critically endangered (Holuša and Kočárek, 2005). Although *A. microptera* was never identified in Slovakia (Kočárek et al., 1999), it is possible that it did exist there but died out without being recorded (Nagy,

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2005). In Hungary, on the other hand, *A. microptera* has been recently found in new locations, and detailed data about its requirements were obtained (Kenyeres et al., 2008).

This paper summarizes all known data about the presence of *A. microptera* in the Czech Republic. Data are presented demonstrating that this species has become extinct in the Czech Republic.

List of Records in the Czech Republic (Figure)

Pouzdřany Steppe-Kolby National Nature Reserve (faunistic field (see Prunner and Míka, 1996) 7065), 48°56′30.763″N, 16°38′35.651″E, 250–300 m.a.s.l. (Ginter, 1924, 1925, 1928, 1971; Krist, 1938; Chládek, 1988); 4 July 1952, 3 M, leg. ??; 9 July 1954, 6M/5F, leg. Čejchan, 19 August 1955, 1 M, leg. ??; 26 June 1962, 1M, leg. ??, all specimens from the collections of the National Museum in Prague, det. J.Holuša.

No specimen from this location is stored in the collections of the Moravian Museum in Brno or in the collections of the Museum of Southeastern Moravia (where the collection of O. Ginter is deposited).

Kobylí (7067), 48°56′1.168″N, 16°53′3.38″E, 200-330 m.a.s.l., 15 July 1940, 1M, leg. Hoffer., coll. Trakal (Čejchan, 1985).

Kamenný vrch u Kurdějova Nature Reserve (7066), 48°57′57.993″N, 16°45′8.484″E, 300-340 m.a.s.l., 16 July 1963, 1M, leg. Ginter, coll. Museum of South-eastern Moravia, det. J.Holuša.

A. microptera was discovered in the Pouzdřany Steppe in the 1920s (Ginter, 1924; 1925). It was abundant at this location until the 1940s, and adults were present from May to July. Its numbers quickly declined, however, and it was scarce in the 1960s there (Ginter, in litt.; 1925; 1971). Chládek (1988) also characterized its abundance in a similar manner by indicating that the species was previously abundant (presumably in the 1960s, when F. Chládek began to study orthopteroid insects intensively [see Holuša et al., 1999]) but became scarce (presumably in the 1980s) in the Pouzdřany Steppe.

No details are known about detection and abundance of *A. microptera* in the Kobylí region. The

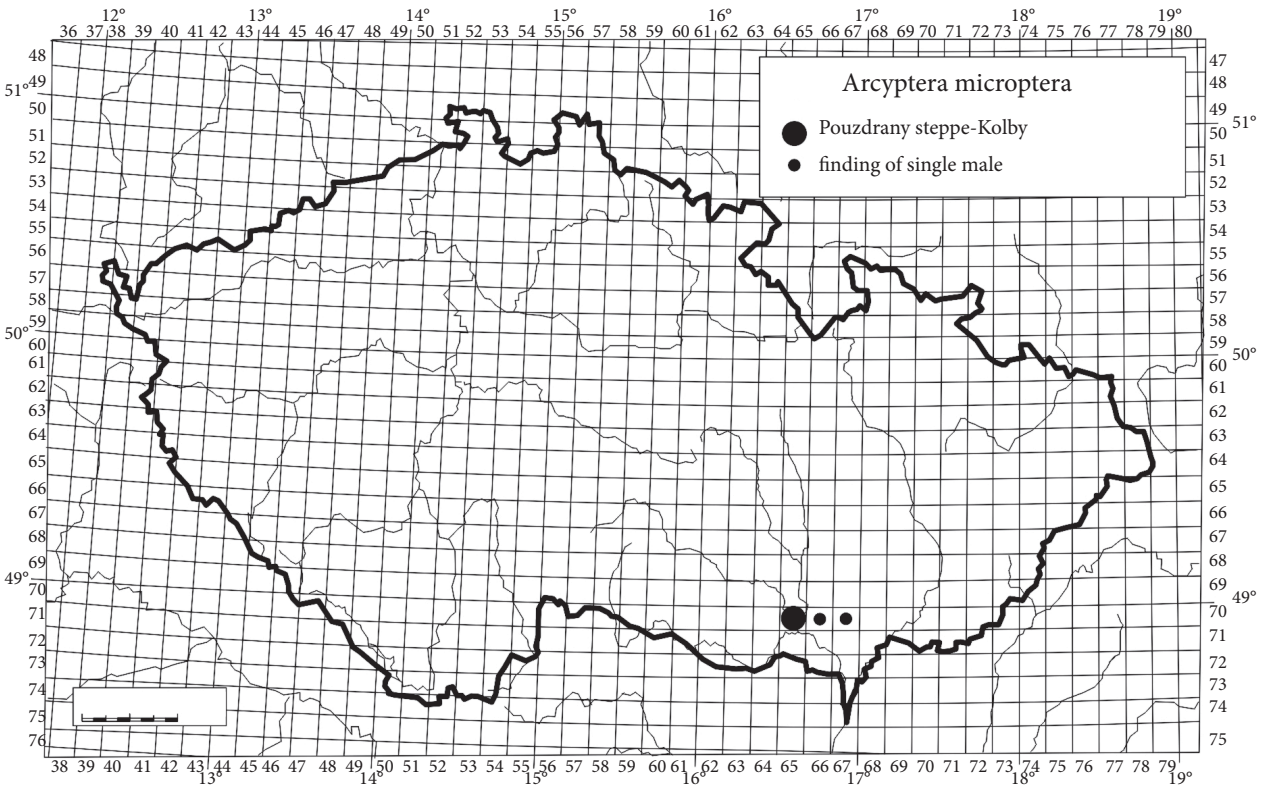

Figure. Occurrence of *Arcyptera microptera* in the Czech Republic (the large circle indicates the Pouzdřany Steppe-Kolby; the small circles indicates the 2 locations where single males were found).

reporting author doubted the verity of the findings (Čejchan 1985).

At Kamenný vrch, no stable population was discovered, not even through regular observation (Ginter, in litt.; Chládek, 2001). Ginter (in litt.) postulated that a single discovered male was blown to the location by a severe wind from the Pouzdřany Steppe (a distance of 8.4 km). This seems possible and is not in contradiction with the low mobility of *A. microptera* (Zhongcheng and Yonglin, 1998).

From 1990 to 2000, the current author did not detect this species in the Pouzdřany Steppe; extensive studies were conducted in May and June, which is the period when adults are present (Ginter, 1925; Storozhyenko, 1991; Kenyeres et al., 2008), and at locations where this species previously tended to be abundant (Chládek, pers. comm.). Recently (31 May-2 June 2009), an extensive study (3 people, song listening, sweeping, ocular observation, 17-24 °C, 1400-1600 hours) was conducted at all habitats that should accommodate this species but *A. microptera* was not detected.

In the years 2005-2008, *A. microptera* was not detected at the Pavlovské vrchy hills (limestone territory with sparsely vegetated slopes 5 km south of the Pouzdřany Steppe), even though this entire area was extensively studied from May to July. This is consistent with the hypothesis that *A. microptera* did not live in the Pavlovské vrchy hills in the past (Chládek, 1995). At Kamenný vrch u Kurdějova, *A. microptera* was not detected in July 2002, July 2005, or June 2008. Furthermore, this species has not been detected in the hilly areas on the border of the Pannonian region, in the hilly areas in the Podyjí National Park (Holuša, 2003), or in the White Carpathian hills (Holuša et al., 2008).

Altitudes of the known locations in the Czech Republic correspond to the elevations above sea level of the Hungarian locations (Kenyeres et al., 2008). The area of the entire Pouzdřany Steppe is 0.47 km^2, which equals that of the smallest Hungarian locations (Kenyeres et al., 2008). Other Czech locations are much smaller (locations in the Kobylí region are < 0.05 km^2; Kamenný vrch u Kurdějova measures 0.063 km^2).

In Hungary, this species was the most abundant in grasslands with a heterogeneous vegetation structure. That grassland type is characterized by outcrops and a balance of patches of shallow soil with sparse or no vegetation and patches of deep soil with dense vegetation. The preferred vegetation cover for *A. microptera* ranges from 40% to 80% (Kenyeres et al., 2008). *A. microptera* requires a noncompacted soil with a depth > 1 cm and with minimal vegetation cover because the females lay their eggs deeper in the soil than other locusts (Ingrish and Kohler, 1998). Conditions of Czech localities are suitable for this species in many respects but not in terms of vegetation cover because Czech locations lack large, sparsely vegetated patches. The Pouzdřany Steppe is a typical loess stipa-grass steppe that has the same character as some knolls in the surrounding area of the village Kobylí. The vegetation is dominated by associations of *Rupicolous pannonic* grasslands (Stipo-Festucetalia), semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia), and Euro-Siberian steppe woodlands with *Quercus* spp. A similar type of vegetation also predominates at Kamenný vrch u Kurdějova (http://www.nature.cz). Deep soils predominate at all locations. Thus, the vegetation coverage is 100% in most areas, i.e. there are no patches of open soil (see www.mapy.cz). The habitats at Pouzdřany Steppe, which should accommodate this species (vegetation coverage < 70%-80%), are very small (<1000 m^2) and generally have the character of narrow strips on steep slopes. This means that the area of the Pouzdřany Steppe suitable for habitation by *A. microptera* is < 0.05 km^2. In the area where this species was most abundant in the 1960s (Chládek, pers. comm.), no patches of open soil now exist. On the hills in the Kobylí region and at Kamenný vrch u Kurdějova, habitats with coverage of vegetation < 70%-80% do not occur at all.

Temporal changes in habitat suitability for the species could be the main reason for *A. microptera*'s extinction. The spreading of taller vegetation due to the absence of management (pasturing, mowing) has turned once favorable locations into unfavorable locations for *A. microptera*. This is probably the main reason for extinction of *A. microptera* in Austria (Berg, in litt.), where the last specimen was observed

in 1964 (Berg and Zuna-Kratky, 1997; Berg et al., 2005).

Global warming is an unlikely cause of *A. microptera* extinction because *A. microptera* is a xerothermic and thermophilic species (Ingrish and Kohler, 1998), and it might therefore be favored by higher temperatures. Grasshoppers and crickets sometimes react very positively and spread their range (Holuša et al., 2007; Krištín et al., 2007; Kočárek et al., 2008) as a result of increasing temperature in the Czech Republic.

It is possible but unlikely that exposure to chemical insecticides hastened *A. microptera* extinction. In the locality Pouzdřany Steppe, nearby vineyards, fields, and orchards are regularly sprayed with insecticides. In sprayed locations, however, grasshoppers on nearby grasslands are only infrequently exposed to insecticides (Kuhne et al., 2001, 2002). It seems unlikely that occasional exposure to insecticide in past years could have resulted in the complete extinction of *A. microptera* in the Pouzdřany Steppe.

In summary, only a single location in the Czech Republic was noted in the past to have a stable population of *A. microptera*, and that was the Pouzdřany Steppe. However, the numbers declined at this location during the 20th century. In spite of extensive surveys over the last 2 decades, no specimens of *A. microptera* have been detected. At present, the habitats suitable for habitation by *A. microptera* are very limited in area, i.e. most areas do not satisfy the requirements for its presence. Based on these facts, it is necessary to categorize the species *A. microptera* as regionally extinct in the Czech Republic. A reintroduction program with specimens from Hungarian localities (at least 25-50 mated females should be used, see also Wagner et al., 2005) would be successful only if the suitability of the habitat were improved; this would require an increase in patches of open soil. Such patches of open soil could be produced by the feeding of goats and sheep, whose hoofs can destroy grass bunches. Such pasture management is not likely to harm the bush cricket *Saga pedo* (Pallas, 1771) or the grasshopper *Euchorthippus pulvinatus* (Fischer-Waldheim, 1846), which are 2 rare species that were reported to co-occur with *A. microptera* in the Pouzdřany Steppe in the past (Ginter, 1928). The disturbance caused by the new management could be concentrated on the northern and eastern part of the Pouzdřany Steppe, where some patches of open soil occur.

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