

## Persistent isolated population of *Onthophagus grossepunctatus* REITTER, 1905 (Coleoptera: Scarabaeidae) near Kazimierz Dolny (Poland)

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After almost 70 years the occurrence of *Onthophagus grossepunctatus* REITTER, 1905 in Kazimierz Dolny, hitherto the only locality in Poland, has been confirmed, and additional locality discovered in Bochoznica. In numbers, with 494 exx. collected, *O. grossepunctatus* was the second most abundant species among 27 coprophagous representatives of the superfamily Scarabaeoidea in the material. The most dangerous threat to its further occurrence near Kazimierz Dolny is the abandonment of the traditional pasturage and overgrowing of xerothermic grasslands.

Keywords: Scarabaeoidea, dung beetles, ecology, new record, Lublin Upland

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### INTRODUCTION

*Onthophagus grossepunctatus* REITTER, 1905 is a xerothermophilous species, occurring from late spring through summer to (sporadically) autumn in excrements of ungulates: cows, horses, sheep and goats (Goljan 1953; Stebnicka 1976) as well as in spermophile burrows (Pittino 2001). Its distribution area in Europe extends over Iberian Pe-

ninsula (Spain, Portugal), France, Italy, Austria, Hungary, southern Czechia and Slovakia, Balkan Peninsula (Albania, Bosnia and Hercegovina, Bulgaria, Croatia, Montenegro, Greece, Macedonia, Moldavia, Romania, Serbia, Slovenia, European part of Turkey), Ukraine, central and southern areas of European part of Russia to western Kazakhstan; in Asia it inhabits only Armenia, Georgia and Turkey (Ziani & Bezděk 2016).

It was reported in Poland from Kazimierz on Vistula (now Kazimierz Dolny) (Goljan 1953) and mentioned generally from the Lublin Upland (Szymczakowski 1965) and vicinities of Puławy (Stebnicka 1976); eminent Czechian entomologist Vladimír Balthasar (Balthasar 1967; Burakowski et al. 1983) disbelieved its occurrence there, but the specimens collected by Goljan in Kazimierz Dolny, preserved in the collections of the Faculty of Forest Protection in Warsaw (coll. KOL SGGW), Faculty of Biodiversity and Evolutionary Taxonomy of the Wrocław University (coll. KBiTE UW) and of Marek Bunalski (coll. MB), should remove any reasonable doubts. Nevertheless, fully justified remain the questions as to:

- has the population of the species in Kazimierz Dolny survived until the present days?
- if so, how numerous it is after 70 years and with which other dung beetles (coprophagous Scarabaeoidea) *O. grossepunctatus* co-occurs?

## MATERIAL AND METHODS

### The study area

Kazimierz Dolny lies in southeastern Poland, in the Nałęczów Plateau at the edge of Lublin Upland (Fig. 1). Kazimierski Landscape Park in the vicinities of Kazimierz Dolny and nearby Nałęczów includes the largest in Europe network of natural loess gorges, as well as 3 reserves and 12 natural monuments (Sawicki & Mazurek-Kusiak 2009). Geological bedding is here porous but hard limestone, overlaid with thick (here and here up to 20 m.) layer of loess or alluvial sand and clayey formations. On the other hand, water erosion increased the variety of landscapes by exposing, at many places, limestone bedrock and cutting deep ravines in the loess substrate (Riedel 1954). Gorges and their forested slopes provide the environment highly diversified as regards soil and humidity. Slopes of deep, nar-

row, humid gullies are densely overgrown with hornbeam and hazel, and fertile humus soil is covered with a layer of decaying leaves. On sides of shallow, wide, and consequently dry ravines birch, hornbeam, aspen, oak, hazel, berberis and briar rose grow. Still other environmental conditions offer limestone slopes devoid of loess cover, which occur in Kazimierz Dolny near the stone-pit, but also on Góra Zamkowa and Góra Trzech Krzyży, as well as at the quarry in Bochtownica. Such limestone, strongly insolated and consequently xerotherm areas are covered mainly with grass and sparse shrubs of berberis, briar rose, blackthorn and juniper. Specific conditions dominate on small (often less than 1 are) sunny dry forest-edge meadows on elevations between neighbouring ravines, covered with grassy vegetation and blackthorn, privet and berberis on sides. Forests of the commune Kazimierz Dolny are dominated by oaks, hornbeams, lime-trees and birches; pine forests are here relatively sunny and dry, with scarce brushwood and undergrowth, where wildboars, roe-deers, stags, badgers and hares represent the fauna. Along Vistula extensive sandbanks emerge.

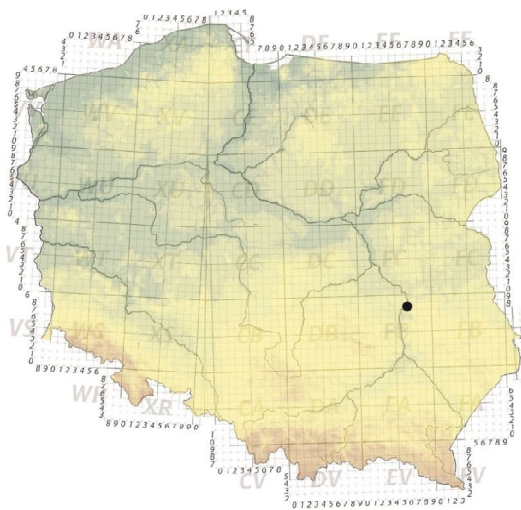


Fig. 1. Kazimierz Dolny on the map of Poland



Fig. 2. Kazimierz Dolny: a – Góra Trzech Krzyży viewed from Zamkowa street (interwar times) (photo J. Kłos), b – Góra Trzech Krzyży viewed from Zamkowa street (recent times) (photo R. Cieślak), c – Góra Trzech Krzyży viewed from Nadrzeczna street (interwar times) (photo A. Janczewska), d – Góra Trzech Krzyży viewed from Zamkowa street (recent times) (photo R. Cieślak), e – view on Góra Zamkowa (interwar times) (photo of unknown author), f – view on Góra Zamkowa (recent times) (photo R. Cieślak)

### Collecting of material

In 2019 the survey was carried on from 29 V to 30 X on 2 neighbouring localities:

- Kazimierz Dolny: Góra Trzech Krzyży (51.321732, 21.950740) (Fig. 3a),

- Kazimierz Dolny: Góra Zamkowa (52.323260, 21.949835) (Fig. 3b).

In the next (2020) year the research was continued between 8 IV and 8 VII, already on 4 (the previous 2 and 2 new:

– Kazimierz Dolny: Góry (51.324693, 21.987662) (Fig. 3c),

– Bochothnica (51.341389, 21.998796) (Fig. 3d).

All these localities lay within the single square UTM – EB68.

In Góry 1 trap was laid, on each of three other localities (Góra Trzech Krzyży, Góra Zamkowa, Bochothnica) 3 terrestrial traps baited with cattle excrements (Fig. 4); baits were replaced weekly.

## RESULTS

2405 specimens of the superfamily Scarabaeoidea have been collected – 197 in 2019 and 2028 in 2020 – belonging to the families Geotrupidae (11 exx. of 3 species) and Scarabaeidae (2394 exx. of 24 spp.). Most numerous among those 27 species were *Onthophagus ovatus* (LINNAEUS, 1767) – 615, *O. grossepunctatus* – 494 and *O. coenobita* (HERBST, 1783) – 448 (Table 1).

Altogether *O. grossepunctatus* was second most abundant among 27 coprophagous

Table 1. List of dung beetles (coprophagous Scarabaeoidea) collected in Kazimierz Dolny and Bochothnica in 2019–2020 [systematic arrangement and nomenclature after „Catalogue of Palearctic Coleoptera” (Löbl & Löbl 2016)]

Family/Subfamily/Species	Bochothnica	Kazimierz Dolny		
		Góra Trzech Krzyży	Góra Zamkowa	Góry
<b>Geotrupidae: Geotrupinae</b>				
<i>Anoplotrupes stercorosus</i> (SCRIBA, 1791)	5	2	1	
<i>Geotrupes spiniger</i> (MARSHAM, 1802)		2		
<i>G. stercorarius</i> (LINNAEUS, 1758)			1	
<b>Scarabaeidae: Aphodiinae</b>				
<i>Agrilinus ater</i> (DE GEER, 1774)	3		1	1
<i>Aphodius pedellus</i> (DE GEER, 1774)	49	64	78	11
<i>Calamosternus granarius</i> (LINNAEUS, 1767)	1			
<i>Chilothorax distinctus</i> (O.F. MÜLLER, 1776)	14	10	5	
<i>Eupleurus subterraneus</i> (LINNAEUS, 1758)	36	4	13	2
<i>Melinopterus consputus</i> (CREUTZER, 1799)	1			
<i>M. prodromus</i> (BRAHM, 1790)	171	81	33	12
<i>Oxyomus sylvestris</i> (SCOPOLI, 1763)	10	6		5
<i>Plagiogonus arenarius</i> (A.G. OLIVIER, 1789)	1	12		7
<i>Rhodaphodius foetens</i> (FABRICIUS, 1787)		10	21	
<i>Rhyssemus puncticollis</i> BROWN, 1929		1	2	
<i>Volinus sticticus</i> (PANZER, 1798)			1	
<b>Scarabaeidae: Scarabaeinae</b>				
<i>Caccobius schreberi</i> (LINNAEUS, 1767)		1		
<i>Copris lunaris</i> (LINNAEUS, 1758)		1		
<i>Euoniticellus fulvus</i> (GOEZE, 1777)		1		
<i>Onthophagus coenobita</i> (HERBST, 1783)	266	53	109	20
<i>O. fracticornis</i> (PREYSSLER, 1790)	38	15	5	13
<i>O. grossepunctatus</i> REITTER, 1905	402	58	18	16
<i>O. illyricus</i> (SCOPOLI, 1763)	2	1		
<i>O. nuchicornis</i> (LINNAEUS, 1758)	20	21	7	2
<i>O. ovatus</i> (LINNAEUS, 1767)	488	46	31	50
<i>O. semicornis</i> (PANZER, 1798)		2		
<i>O. similis</i> (SCRIBA, 1790)	35			4
<i>O. taurus</i> (SCHREBER, 1759)			3	
<b>?</b>	<b>1542</b>	<b>391</b>	<b>329</b>	<b>143</b>



Fig. 3. Collecting localities of dung beetles: a – Góra Trzech Krzyży, b – Góra Zamkowa, c – Góry, d – Bochothnica (photo R. Cieślak)

Scarabaeoidea, and on Góra Trzech Krzyży it was even more numerous than otherwise dominant, in Poland common *O. ovatus*. *O. grossepunctatus* has been collected on all studied localities:

- Kazimierz Dolny (Góra Trzech Krzyży): 29 V-4 VI 2019 (29 exx.), 25 VI-2 VII 2019 (2 exx.), 17-23 VII 2019 (1 ex.), 15-21 IV 2020 (1 ex.), 22-28 IV 2020 (14 exx.), 29 IV-5 V 2020 (1 ex.), 13-19 V 2020 (5 exx.), 20-26 V 2020 (1 ex.), 27 V-2 VI 2020 (1 ex.), 3-9 VI 2020 (2 exx.) and 10-16 VI 2020 (1 ex.);
- Kazimierz Dolny (Góra Zamkowa): 29 V-4 VI 2019 (6 exx.), 8-14 IV 2020 (2 exx.), 15-21 IV 2020 (1 ex.), 22-28 IV 2020 (2 exx.), 29 IV-5 V 2020 (1 ex.) and 13-19 V 2020 (6 exx.);
- Kazimierz Dolny (Góry): 8-14 IV 2020 (7 exx.), 29 IV-5 V 2020 (1 ex.), 20-26 V 2020 (2 exx.), 27 V-2 VI 2020 (5 exx.) and 3-9 VI 2020 (1 ex.);
- Bochothnica: 8-14 IV 2020 (135 exx.), 15-21 IV 2020 (61 exx.), 22-28 IV 2020 (162 exx.), 29 IV-5 V 2020 (1 ex.), 6-12 V 2020 (2 exx.), 13-19 V 2020 (23 exx.), 20-26 V 2020 (9 exx.), 27 V-2 VI 2020 (6 exx.), 3-9 VI 2020 (1 ex.), 10-16 VI 2020 (1 ex.) and 17-23 VI 2020 (1 ex.).

In 2019 the species was most abundantly collected at the beginning of the survey: between 29 V and 4 VI (35 exx., 92.1%); later only 3 specimens (7.9%) have been found (Fig. 5). In the second (2020) year studies were carried on from 8 IV to 8 VII, but the majority (385 exx., 84.4%) have been found in traps during the first three weeks, *i.e.* between 8 and 28 IV, later collection resulted in only 71 specimens (15.6%) (Fig. 6).

## DISCUSSION AND CONCLUSIONS

In Poland *O. grossepunctatus* has been known from only 2 neighbouring localities: Kazimierz Dolny and Bochothnica. Its occurrence in Kazimierz Dolny was discovered in mid-XX c., when A. Riedel (17 V 1948), R. Bielawski (31 V 1948) and A. Goljan (14 V 1949) found one-one



Fig. 4. Terrestrial trap baited with cattle excrements for collecting dung beetles (photo R. Cieślak)

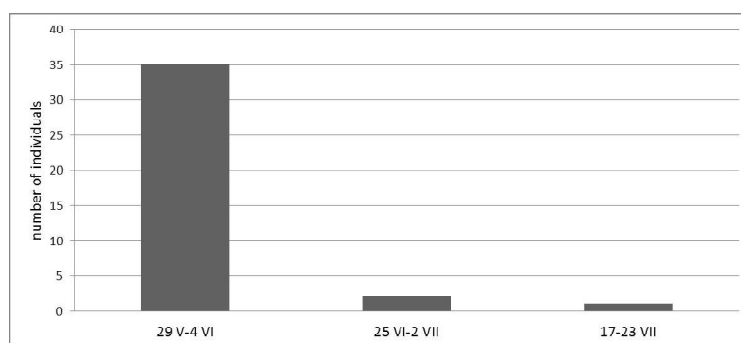


Fig. 5. Number of individuals of *Onthophagus grossepunctatus* collected in Kazimierz Dolny in 2019

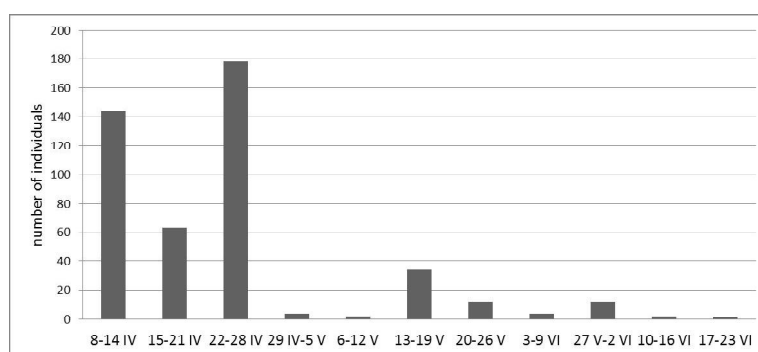


Fig. 6. Number of individuals of *Onthophagus grossepunctatus* collected in Kazimierz Dolny and Bochtotnica in 2020

male; the latter (Goljan 1953) informs also about finding of further 235 specimens between 13 V and 1 X on the same locality. Some specimens collected during this period in Kazimierz Dolny by A. Goljan are kept in KOLSGGW (2 males), KBiTE UW (1 ex.) and MB (1 male) [the photograph of the latter specimen has been published by Bunalski (1999)]. It was probably based on those reports that the species has been recorded again from the Lublin Upland (Szymczakowski 1965) and vicinities of Puławy (Stebnicka 1976; Burakowski et al. 1983). The locality in Bochońnica is presented herein for the first time.

*O. grossepunctatus* has been found on all the studied localities. Even though the exact place where it was encountered by A. Riedel, R. Bielawski and A. Goljan (Goljan 1953) was unknown, its rediscovery on Góra Trzech Krzyży, Góra Zamkowa and Bochońnica was no surprise for the authors: these stations ideally corresponded to the places inhabited by the species in southern Europe, where it abundantly occurs on southern, strongly insolated, grassy slopes of limestone hills; only the finding in currant plantation in Góry was unexpected.

Around Kazimierz humid and dry areas lie often close to each other. According to Goljan (1953) *O. grossepunctatus* prefers there open, strongly insolated, dry places, being most abundant on southern limestone slopes overgrown by steppe vegetation, whereas *O. ovatus* appears more frequently and in greater numbers on shadowy, and thence cooler and more humid stations. In autumn, with successive cooling, the situation changes: *O. ovatus* invades the open areas, while *O. grossepunctatus*, as before, occurs exclusively there. During our survey we frequently found both species in the same traps, Goljan's observations seem nevertheless apt, though the question demands a thorough study, aimed at a different goal, with prolonged observations. These two species inhabit probably somewhat different biotopes, but in cooler cloudy days of late spring and summer, as well as in autumn, seem to compete for food. In the vicinities of Kazimierz Dolny *O. grossepunctatus* was also more abun-

dant that much larger and in Poland more common species of the genus: *O. coenobita*, *O. fracticornis* and *O. nuchicornis*. Less numerous were also common species of the subfamily Aphodiinae *Aphodius pedellus*, *Melinopterus prodromus* and *Eupleurus subterraneus*. Thus, under favourable environmental and climatic conditions *O. grossepunctatus* can co-occur with common, eurytopic and frequently larger species. Szymczakowski (1965) lists it among subpontic or pontomediterranean elements reaching in Poland their northwestern limits on the Lublin Upland, but occurring further in Germany or in the greater part of southern Europe.

During our survey *O. grossepunctatus* was collected from 29 V to 23 VII 2019 and from 8 IV to 23 VI 2020; it has not been encountered later, despite continuation of the study to the end of October in 2019 and to 8 VII in 2020. In 2020 the decidedly greatest activity of imagines has been observed in April, and so from the first week; in May swarming has abruptly decreased. Thus, under the conditions reigning in the vicinities of Kazimierz Dolny, the species seems to appear not only in late spring, summer and sporadically in autumn (Goljan 1953; Stebnicka 1976) but also in early spring, when it may be even more abundant than its main competitor, *O. ovatus*, perhaps in this way avoiding, at least at the beginning of its activity, hard competition during oviposition, to assure survival for its offspring.

The answer to the question formulated in the introduction is positive: the population of *O. grossepunctatus* in Kazimierz Dolny has persisted in good condition. The species co-occurs here with at least 27 other dung beetles, including some rather uncommon in Poland: *Melinopterus consputus*, *Plagiogonus arenarius*, *Onthophagus illyricus* or *O. semicornis*.

The most serious threat to the occurrence of this species at Kazimierz Dolny is the discontinuance of traditional pasturage and in consequence overgrowing of xerothermic grasslands. The critical importance of this factor to the preservation of

*O. grossepunctatus* is evident from the fact that more than 80% of its specimens has been collected in Bochoznica, where the cattle pasturage was abandoned only in the last decade, while on Góra Trzech Krzyży and Góra Zamkowa, not pastured since 1960-s, despite 2 seasons of collecting only 15% have been found. Certainly nowadays pasturage has been partly recompensed by intermittent mowing and occurrence of wild animals, especially wildboars, less frequently roe-deers, but also dogs and humans.

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