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A new cave population of *Discoptila beroni* POPOV, 1975 (Insecta: Ensifera: Gryllidae) from southern Turkey, with some remarks on the genus

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Abstract

In the Yalan Dünya cave near Gazipasa (Villayet Antalya) in southern Turkey the gryllid species *Discoptila beroni* POPOV, 1975 was found in a great population. It is the third locality of the species, which is only known from two other caves in the region. The adult female is described in detail, drawn and measured from the four specimens sampled. The individuals of the new population are in most of their body measurements distinctly larger than the ones described hitherto, and differ also in a few other characteristics. It is concluded that long isolated populations of this cave-inhabiting cricket can develop differently in their morphometry. Finally, the hitherto described 12 species of the genus *Discoptila* are mapped for the first time and listed in tables with distribution and morphometrical data.

Key words: Turkey, Gryllidae, *Discoptila*, distribution, morphometry, variation

Zusammenfassung

In der Höhle von Yalan Dünya bei Gazipasa (Villayet Antalya) an der türkischen Südküste wurde die Grillenart *Discoptila beroni* POPOV, 1975 in einer großen Population gefunden. Es ist der dritte Fundort dieser Art, die bislang nur aus zwei anderen Höhlen des Gebietes bekannt war. Das adulte Weibchen wird anhand von vier gesammelten Individuen ausführlich beschrieben, gezeichnet und morphometrisch erfasst. Die Tiere der neuen Population sind in den meisten Körperparametern durchweg größer als die bisher beschriebenen und unterscheiden sich auch geringfügig in einigen anderen Merkmalen. Es wird der Schluss gezogen, dass die seit langem isolierten Populationen dieser höhlenbewohnenden Art sich vor allem in morphometrischen Merkmalen abweichend voneinander entwickeln können. Abschließend werden die bisher beschriebenen 12 *Discoptila*-Arten erstmals tabellarisch hinsichtlich ihrer Verbreitung (mit Karte) und Morphometrie zusammengefasst.

Introduction

Since the first description of a *Discoptila* species by I. BOLÍVAR (1885, as *Gryllomorphus Fragosoi*) altogether twelve more or less certain species from southern Europe and Morocco have been described, mainly differing from *Gryllomorpha* by the male genitalia and the presence of small wing rudiments in both sexes (summarized by HARZ 1969a, GOROKHOV 1984, WILLEMSE 1984, 1985a, b, POPOV 1984, SCHMIDT 1991,

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Tab. 1: Morphometrical variability in adult females of *Discoptila beroni* POPOV, 1975 from three caves of Southern Turkey. Bold: distinctly longer measures in our material.

character (in mm)	WEIDNER (1964) Damlatas	POPOV (1975) Maara cave Damlatas	Us (1975) Maara cave	Yalan Dünya cave
Body	12.2 - 13.7	10.8 - 14.2	15.0	15.0-17.0
Antennae		up to 52.5		>37.0
Pronotum		2.0 - 2.4	2.5	2.4 - 2.5
Elytra		0.1 - 0.3	0.3	0.5 - 0.6
Postfemora		8.7 - 10.0	9.5	10.5 - 11.1
Cerci		9.2 - 10.6		9.3 - 10.0
Ovipositor	6.5 - 7.5	5.3 - 6.9	6.0	7.3 - 7.9
1st femora			5.0	5.7
2nd femora			5.0	5.7
1st tibiae			5.0	5.4
2nd tibiae			5.0	5.9
Posttibiae			9.3	10.3

BACCETTI 1992). Despite this, till now no revision of the genus has been published, and the little material available is widely scattered throughout European collections. A clarifying review of the genus comparing the different species descriptions is given by POPOV (1984). Recently, with *D. clauseri* SCHMIDT, 1991 the last new species, and with *D. lindbergi nana* BACCETTI, 1992 the first subspecies have been described.

Hitherto two species from Turkish territory have been mentioned, with *D. beroni* only on the central southern coast. Here the individuals were found in only two caves: one in Alanya and another between Anamur and Silifke (Tab. 2, Fig. 5). But these gryllids were believed to belong to four species: *D. fragosoi* WEIDNER, 1964, *D. brevis* HARZ, 1969, *D. uvarovi* Us, 1975, and *D. beroni* POPOV, 1975. It was POPOV (1975, 1984) who stated that all the individuals belong to the same species, which should be named *D. beroni*, while *D. uvarovi* was placed in synonymy (POPOV 1984). According to the descriptions of Us (1975) and POPOV (1975) our recently found individuals also belong to this species, sampled at a locality between Alanya and Anamur (Fig. 5). Of *D. beroni*, mainly the adult male was described in detail by POPOV (1975) and Us (1975), whereas the adult female is less known.

It is obvious that there must be a considerable variability between and within the populations. Following this, all the existing descriptions of these gryllid species are summarized, the females of *D. beroni* are described in detail and compared with descriptions from other populations. The results are compared with data of all species of the genus *Discoptila*, available in the literature.

Material and Methods

The gryllids were sampled (by CR) on 31.12.2001 in the Yalan Dünya cave about 5 kms SE of Gazipasa in the direction of Anamur, Vilayet Antalya (36°16'N, 32°21'E - Fig. 5). Altogether 4 adult females and 1 older male larva could be caught and conserved in 70 % ethyl alcohol. The female characteristics were described and compared with characte-

Tab. 2: The hitherto described species of the genus *Discoptila* PANTEL, 1890 in alphabetical order and their sampling data; f - females, m - males, j - juveniles. Localities mainly named according to the authors.

Species name	Author, year	Country	Locality	Date	Individuals
<i>beroni</i>	POPOV, 1975	S-Turkey	Maara cave, Karatepe	15.12.72	8m, 6f, 5j
			Damlatas cave, Alanya	16.12.72	2m, 2f, 1j
<i>beroni</i>	Us, 1975	S-Turkey	Maara cave, Karatepe	no date	1m, 1f, 6j
[syn. <i>uvarovi</i>]			Damlatas cave, Alanya	25.6.63	6j
<i>beroni</i>	WEIDNER, 1964	S-Turkey	Damlatas cave, Alanya	3.8.63	3m, 11f, 4j
[nec <i>fragosoi</i>]					
<i>beroni</i>		S-Turkey	Yalan Dünya cave	31.12.2001	4f, 1j
<i>bureschi</i>	MAŘAN, 1958a	E-Bulgaria	Aladja monastery, Varna	19.6.56	2m
	HARZ, 1969b	SE-Bulgaria	Ropotano valley	7.7.66	1f
<i>clauseri</i>	SCHMIDT, 1991	Italy	Castagnoli near Corniolo	18.9.75	1f
<i>eitschbergeri</i>	HARZ, 1976	Spain	Teruel / Sierra Alta	30.7.72	1m
<i>fragosoi</i>	I. BOLIVAR, 1885	Spain	Dos Hermanas near Sevilla	no date	1m
	I. BOLIVAR, 1887	Greece	Attika	no date	
	I. BOLIVAR, 1914	Morocco	cited by KIRBY, 1906	no date	
	RETOWSKI, 1889	S-Ukraine	Crimea: Theodosia (= Feodossija)	before 1888	no rare
	MIRAM, 1927	S-Ukraine	Crimea: 8 localities	1899-1914	1m, 4f, 2j
	BOLDYREW, 1928	S-Ukraine	Crimea: Simferopol	M4/1928	8m, 18f
	ÖNDER & al., 1999	W-Turkey	Istanbul	14.3.48; 1968	2 ind.
<i>fragosoi</i>	BEY-BIENKO, 1964	S-Ukraine	Crimea: Sevastopol	no date	f
[syn. <i>brevis</i>]					
<i>fragosoi</i>	GÜMÜŞSUYU, 1980	SW-Turkey	between Mugla and Köycegiz	18.5.80	1m
[syn. <i>brevis</i>]					
<i>kinzelbachi</i>	HARZ, 1971	Greece	Karpathos Mts., cricket cave	31.3.63	2m, 1j
<i>krueperi</i>	PANTEL, 1890	Greece	Parnass Mts.		1m
<i>lindbergi</i>	CHOPARD, 1957	S-Greece	E-Crete: 9 grottoes		
	POPOV, 1984	S-Greece	E-Crete: five caves	13./14.1.68, 27./29.9.74	3f, 8j
	BACCETTI, 1992	S-Greece	Crete: Kamaraki, Marmorospilia	31.3.89 31.3.89	1f 1m, 1f
			Iraklion, Kamilari Antron		
<i>lindbergi nana</i>	BACCETTI, 1992	SE-Greece	Kos: Paleo Pyli, grotto n.1	24.3.89	1m
<i>newmanae</i>	HARZ, 1969a	Greece	Epirus Mts.: Paraskevi	no date	
<i>newmanae</i>	EBNER, 1954	Greece	Epirus Mts.: Paraskevi	14.-16.6.33	2m, 3f
[nec <i>krueperi</i>]					
<i>sbordonii</i>	BACCETTI, 1979	Italy	Tramutola grotto, Lucania,	24.9.78	3m, 2f
<i>willemsei</i>	KARAMAN, 1975	Montenegro	Moratscha gorge	4.6.74	2m, 3f, 8j
<i>zernyi</i>	WERNER, 1934	Morocco	High Atlas, Tachdirt, 2.500 m	2.-10.7.33	1m, 7f

ristics given by WEIDNER (1964), POPOV (1975) and Us (1975). Important parts of the body were measured with a stereomicroscope (SM XX - 7.8× and 20×) using an ocular micrometer. The drawings were also made from alcohol material. The conserved material is deposited in the Orthoptera collection of the Natural History Museum Vienna, Austria.

Habitat

The cave is situated N of road 400 on the southern slopes (Taşeli Yaylasi) of the Taurus Mountains some kms from the coast, and about 50 m higher than the coastal plain. In recent years it was often visited, and therefore electrical light has been installed. The caves length is about 70 - 80 m ending in a large chamber, which is rather dry and without any stalactites. In this absolutely dark chamber the gryllids were found from the bottom up to 2 m height, mostly near crevices, where they rapidly disappeared after disturbance. Certainly more than 100 individuals were present.

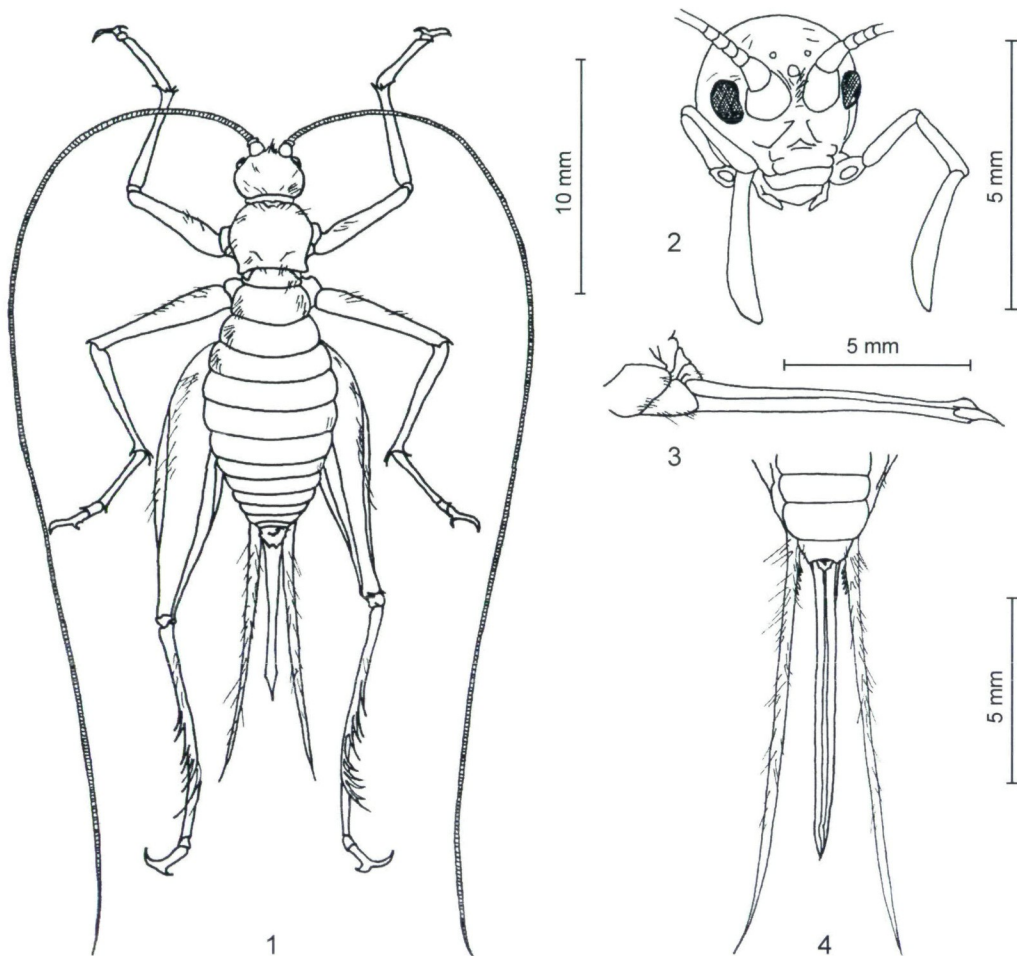
Description (adult female)

According to observations on living specimens, the body of the adult female is of a pale yellowish brown, with somewhat lighter femora and darker tibiae, tarsi, and the ovipositor. The pronotum shows a light mid-stripe dorsally. The whole body is covered with short and closely spaced bristles. The front of the head is triangular rounded with the vertex slightly projecting between the antennal bases, with half the width of the scapus and with 10 - 14 longer and dark bristles (Fig. 2). The clypeofrontal ridge is slightly curved and on both sides strongly chitinized in dark brown. The head is narrower than the pronotum and has fewer bristles (mostly on the rear margin) than the remaining body. The eyes are bean-like to slightly triangular, and the ocelli form an equilateral triangle, with the lateral ones closely above the scapus and the central ocellus on the upper frons (Fig. 2). The antennae are filiform, gradually narrowing to the tip, and reach double body length (Fig. 1). The scapus is dorsoventrally flattened and all antenna segments are densely set with fine hairs.

The pronotum is a little wider than long and laterally longer than high, broadest before the middle and with rounded margins, except the straight posterior one. The central ridge is very weak and marked as a light line, extending over the rear two thirds of the pronotum. The front and rear margin bear dense bristles of different lengths, with few longer ones also laterally and dorsally on the pronotum. The whole pronotum is framed with a marginal fine and dark brown line. The very small and nearly circular elytra sit on small stalks and are largely covered by the pronotum, but still clearly seen from above (Fig. 1).

The 10th tergum is triangular rounded and distally densely covered with light bristles. It is 2/3 as long as wide, centrally slightly deepened and basally at the edges raised tooth-like. The subgenital plate is trapezium-like rounded and distinctly concave (Fig. 4).

The cerci are distinctly longer than the ovipositor, and in one female even of different size, with the right one only as long as the ovipositor. The ovipositor is straight and ends



Figs. 1 - 4: Morphological characteristics of female *Discoptila beroni* POPOV, 1975: (1) habitus; (2) head (with the long maxillary palps); (3) ovipositor; (4) subgenital plate, ovipositor, and cerci (ventral view).

in a bill-like tip (seen laterally and ventrally - Figs 3, 4). Very long hairs protrude from the cerci, and basally on the inner side there are numerous ampullae-formed bristles over about one sixths of the cerci length (Fig. 4), perhaps sensory hairs according to BACCETTI (1979) and SCHMIDT (1991).

The forecoxae are longer than the mid and hind ones, irregularly deepened and lobed. The femora are laterally flattened and show a deep longitudinal furrow on their ventral sides over the whole length. The fore- and midfemora are of about half the length of the postfemora (Tab. 1), which are developed for short jumps (length-breadth-ratio 2.8 : 1). All three pairs of tibiae ventrally show two apical spines each, the midtibiae having an additional one on the outer side. The posttibiae are densely covered with fine hairs. In the basal half on the upper side there are four pairs of spines with the first and the fourth

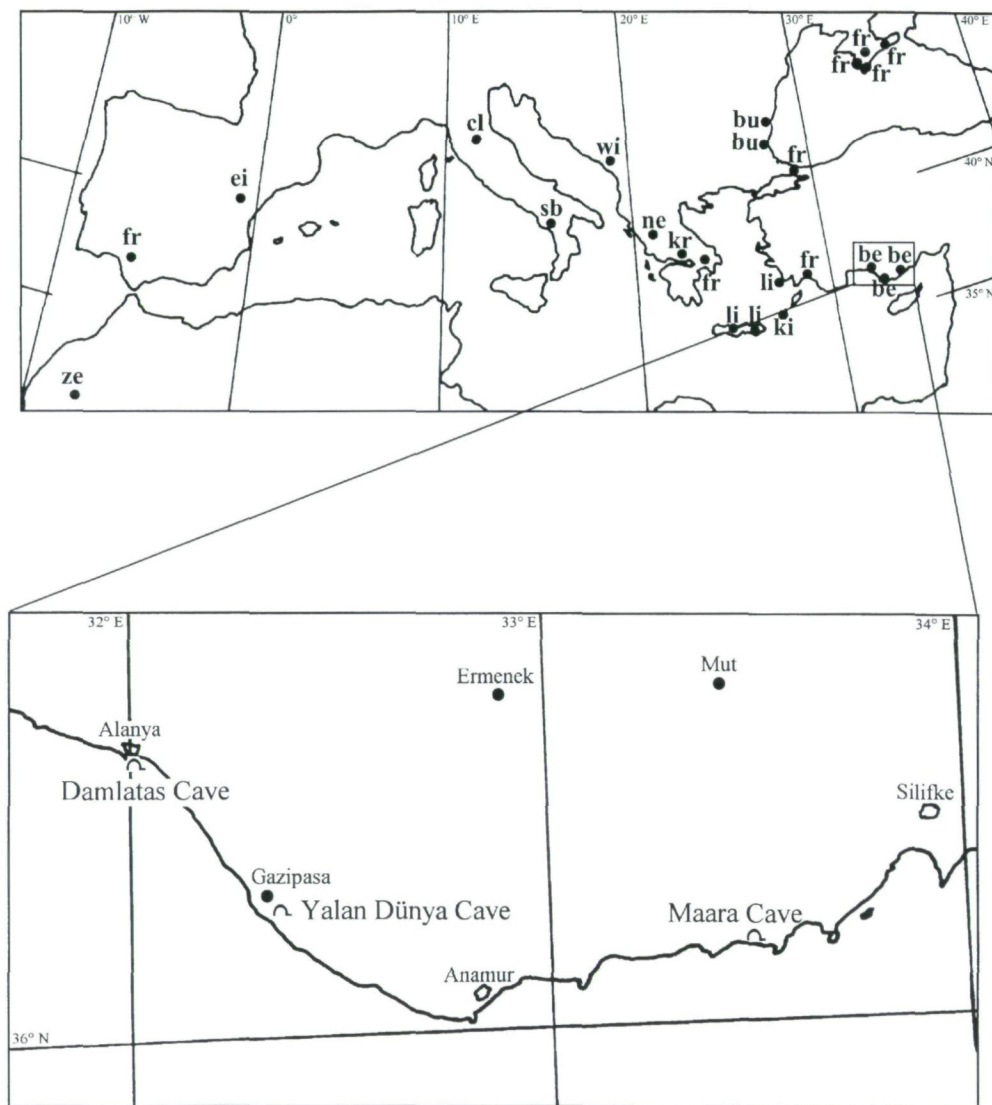


Fig. 5: Above: Mediterranean distribution of the *Discoptila* species, hitherto described: be - *D. beroni*, bu - *D. bureschi*, cl - *D. clauseri*, ei - *D. eitschbergeri*, fr - *D. fragosoi*, ki - *D. kinzelbachi*, kr - *D. krueperi*, li - *D. lindbergi*, ne - *D. newmanae*, sb - *D. sbordonii*, wi - *D. willemsei*, ze - *D. zernyi*. Below: Distribution of *D. beroni* in three caves of Southern Turkey.

being shortest. Immediately in front of the tip there is another single and very short spine. Near the base of the metatarsus there are two strong longer inner spines and one shorter outer apical spine, with the inner ones reaching the middle of the metatarsus, which itself has a length of one third of the posttibia.

Most of the characteristics described correspond with the (comparatively short) descriptions of females in POPOV (1975) and US (1975). Despite this, there are also a few

marked differences which are interpreted in the context of a species variability due to adaptations to different habitats. First, the females of the Yalan Dünya cave are distinctly larger than females from the other two caves, especially in length of body, elytra, postfemora and ovipositor, but also in all the other leg parameters (Tab. 1). Referring to other characteristics, in our material the fastigium bears 10 - 14 long black bristles, whereas Us (1975) mentions only 4 bristles. The elytra are more or less circular, and not lengthy-oval, and about twice as long as stated by Us (1975) and POPOV (1975). Finally, the ovipositor reaches $\frac{3}{4}$ of the length of the hind femur, and not $\frac{2}{3}$ according to POPOV (1975).

Distribution of the genus *Discoptila*

The twelve described species of *Discoptila* are known from about 35 localities in eight countries (including islands) around the Mediterranean Sea and the Black Sea. In this region by far the most populations are concentrated in the Eastern Mediterranean (WILLEMSE 1984, 1985a, b, HELLER & al. 1998), with most of the habitats near the coast. By way of contrast, the few populations in Italy, Spain, and Morocco were found away from the sea coast (Tab. 2, Fig. 5). Whereas most of the individuals live in caves and grottoes, some species were also found in more or less open country under stones (*D. bureschi*, *D. clauseri*, *D. krueperi*) and in houses, especially in cellars (*D. zernyi*, Crimean *D. fragosoi*).

In southern Turkey the species *D. beroni* obviously occurs only in caves of marine origin near the coast (Fig. 5). Here the grottoes inhabited are at distances of about 45 kms (Damlatas - Yalan Dünya) and 110 kms (Yalan Dünya - Maara). They may have been isolated since the last glacial period in Europe at most.

Discussion

It is noteworthy to emphasize that of all *Discoptila* species hitherto described only about 100 adults and 50 larvae have been sampled (Tab. 2), despite the authors having sometimes observed many individuals. Altogether eight of the twelve *Discoptila* species are only known from their type material, which in three cases is based on adult males and in one case on adult females only. Unfortunately, our knowledge about the variability within and between populations is rather fragmentary. Also details of the biology (mainly copulation) are only known from Crimean populations, considered to belong to *D. fragosoi* (BOLDYREV 1928, GOROKHOV 1984).

The body measurements within the genus *Discoptila* vary considerably (Tab. 3), such as in females in the length of body (9 - 17.4 mm), elytra (0.1 - 1.5 mm), postfemora (7 - 12 mm), and ovipositor (1.5 - 9.6 mm). The new population of the Yalan Dünya cave lies in three of these characteristics at the upper end, only the elytra are of medium size. But when comparing the species variability of *D. beroni* (Tab. 1) with that of the whole genus (Tab. 3) it is striking that in *D. beroni* nearly the whole genus variation in the length of body occurs, while elytra and ovipositor still vary over 30 % of the genus measurements. Despite this, no new subspecies is introduced, and the differences are interpreted as intraspecific variation, perhaps also due to different food availability.

Tab. 3: Morphometrical parameters (length in mm) of the described *Discoptila* species. f - female, m - male.

Species	Sex	Body	Pronotum	Elytra	Postfemora	Ovipositor	Author
<i>beroni</i>	f	15- 17	2.4 - 2.5	0.5 - 0.6	10.5 - 11.1	7.3 - 7.9	KÖHLER & al.
	f	10.8 - 14.2	2.0 - 2.4	0.1 - 0.3	8.7 - 10.0	5.3 - 6.9	POPOV, 1975
	m	11.6 - 13.1	1.7-2.0	1.8-2.2	8.3-9.3		POPOV, 1975
[syn. <i>uvarovi</i>]	f	15	2.5	0.3	9.5	6	US, 1975
	m	14.5	2.3	1.7	9		US, 1975
[nec <i>fragosoi</i>]	f	12.2 - 13.7				6.5-7.5	WEIDNER, 1964
	m	10.5 - 12.2					WEIDNER, 1964
<i>buerschii</i>	m	13	1.9	1.6			POPOV, 1984
	m	14 - 14.5		1.6 - 1.7	10		MAŘAN, 1958
	f	12.5	2.7		8.5	7.5	HARZ, 1969b
<i>clauseri</i>	f	12	2.3	0.5	10.3	6.3	SCHMIDT, 1991
<i>eitschbergeri</i>	m	10	2	1.1	5.4		HARZ, 1976
<i>fragosoi</i>	f	11.5 - 13.5	2.3 - 2.5	- 1.0	7.5 - 9.2	7 - 8	HARZ, 1969a
	f	12.5	2.1		8	7.2	MIRAM, 1927
	m	11	2	1	8		I. BOLIVAR, 1887
	m/f	12.7 - 14		1.5			BOLDYREV, 1928
<i>fragosoi</i>	f	9	2.1	0.4	7.6	3.5	HARZ, 1969a
[syn. <i>brevis</i>]							
	m	10	2	1.5	8		HARZ, 1969a
	f	9				3.5	BEY-BIENKO, 1964
	m	11	2.2	1.3	7.8		GÜMÜŞSUYU, 1980
<i>kinzelbachi</i>	m	11 - 12	2	1.4 - 1.6	8 - 8.3		HARZ, 1971
<i>krueperi</i>	m	13	2	0.7	8		PANTEL, 1890
<i>lindbergi</i>	f	12.5	2.5	0 ?	8.5	6.7	HARZ, 1969a
	m	11	2.1	1.5	8		HARZ, 1969a
<i>lindbergi nana</i>	m	8	1.3	1.3	6		BACCETTI, 1992
<i>newmanae</i>	f	13 - 15	2.7 - 3	0.3 - 0.4	9 - 10	7 - 7.3	HARZ, 1969a
	m	12.5 - 13	2.5 - 2.7	1 - 1.2	8.5 - 9.2		HARZ, 1969a
<i>newmanae</i>	f	13 - 15	2.7	0.4	9 - 10	7 - 7.3	EBNER, 1954
[nec <i>krueperi</i>]							
	m	12.5	2.5	1.0	8.5 - 9		EBNER, 1954
<i>sbordonii</i>	f	9	2	0.5	7	1.5	BACCETTI, 1979
	m	9	2	0.5	7		BACCETTI, 1979
<i>willemsei</i>	f	16.8 - 17.4	3.1 - 3.4	- 0.3	11.6 - 12.0	9.3 - 9.6	KARAMAN, 1975
	m	- 15	3.0 - 3.3	1.3 - 1.5	10.2 - 11.1		KARAMAN, 1975
<i>zernyi</i>	f	13.7				8	WERNER, 1934
	m	15.8					WERNER, 1934

Furthermore, the differences in the characteristics complexes between the species are small and most significant in the male phallic complex, whereas most of the other characteristics used for differentiation are rather weak. The only comprehensive paper about the genus *Discoptila* with the demonstration of more or less taxonomically stable as well as rather variable characteristics is from POPOV (1984). Notwithstanding that, almost

every author presented a determination key to the genus. But considering aspects of variability we cannot be sure about the value and distribution of some species, especially the older descriptions of *D. fragosoi* from Spain and the Crimean peninsula, recently acknowledged again as the same species (GOROKHOV 1984, see also Tab. 2). Only in the case of *D. lindbergi* occurring on Crete and Kos, from the Aegean island Kos a new subspecies *D. lindbergi nana* has been described (BACCETTI 1992), and this is the only subspecies within the genus. Perhaps there are still further subspecies especially in cave inhabiting *Discoptila*, as known from the genus *Troglophilus* (MAŘAN 1958).

Additional remarks

As reviewer of this manuscript, the well-known gryllid specialist Dr. Andrej Gorochov (St. Petersburg) questioned the possibility of determining the material as *D. beroni* because only adult females were available but no adult males (with their genitalia as decisive key characteristics). Indeed, the determination and taxonomy of *Discoptila* remains a difficult problem because no revision of the genus yet exists. Furthermore, the Italian species *D. clauseri* has been described from only one female (SCHMIDT 1991). Therefore our decisions are based on the following points.

First, for separating the similar genera of *Discoptila* and *Gryllomorpha*, several keys with male and female characteristics have been published (HARZ 1969a, BACCETTI 1979, GOROCHOV 1984, WILLEMSE 1985b). According to these, our females (with small elytra and straight ovipositors) belong to the genus *Discoptila*. Second, several keys exist for *Discoptila*, based on male and female (HARZ 1969a, WILLEMSE 1985b) or only on male (BACCETTI 1979) or only on female characteristics (SCHMIDT 1991). These keys are, however, useless for identifying female *D. beroni* because they were either written before POPOV (1975) described the species (HARZ 1969a), covered only Greece but not Turkey (WILLEMSE 1985b), give only male characters (BACCETTI 1979) or simply fail to mention the species (SCHMIDT 1991). Third, falling back on the original descriptions of *D. beroni* (POPOV 1975, US 1975), we find that all important morphological female characteristics correspond to those described. Additionally, all the material from the same geographical region (Maara and Damlata caves), formerly described as three species, despite their morphometrical differences, belongs to the same species *D. beroni* (POPOV 1975). The population, here described for the first time, derives from a cave that lies geographically between the two other *beroni*-caves mentioned.

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