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Dictyterina cholodkowskii (Cestoda: Paruterinidae): morphology, synonymy and distribution

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Key words: *Dictyterina cholodkowskii,* Cestoda, Paruterinidae, morphology, geographical distribution, taxonomy, *Lanius collurio*, Bulgaria

Abstract. *Dictyterina cholodkowskii* (Skrjabin, 1914) is recorded from *Lanius collurio* L. in Bulgaria (new geographical record). The species is redescribed and figured. A full list of synonyms is presented; it includes, among the other synonyms, *Deltokeras delachauxi* Hsü, 1935 (new synonym), *Biuterina passerina* of Oshmarin (1963) and *Paruterina parallelipipeda* of Paspalev and Paspaleva (1972). A survey of published records characterizes *D. cholodkowskii* as limited to the Palaearctic in six species of the genus *Lanius* (Aves, Passeriformes, Laniidae).

Previous descriptions (Skrjabin 1914, Spasskaja 1964, Galkin 1981) of the type-species of the genus *Dictyterina* Spassky, *D. cholodkowskii* (Skrjabin), provide incomplete information on its morphological peculiarities. The data on its rostellar hooks, mature proglottides, copulatory apparatus and uterine development are especially inadequate, and a complete redescription is needed.

During the course of the revision of the cestodes of the family Paruterinidae from Bulgaria, several specimens of *D. cholodkowskii*, previously reported as another species or undetermined, were found in the collection of Dr. A. Paspaleva. This material was used as a basis of the amended generic diagnosis for the purposes of a previous work (Georgiev and Kornyushin 1994) but a full redescription of the species and a taxonomic discussion at the species level were not provided. The aim of the present paper is to provide new information on the morphology and taxonomy of *D. cholodkowskii* and to summarize data on its geographical distribution and host range.

MATERIALS AND METHODS

This study is based on the following slides (alum carmine, whole mounts in Canada balsam) from the collection of the late Dr. A. Paspaleva (Institute of Zoology, Sofia), now deposited at the Institute of Parasitology, Bulgarian Academy of Sciences, Sofia:

No. 244, 1 slide containing 1 whole gravid specimen (fragmented), from *Lanius collurio* (adult, male), Berkovitsa, Montana District, 29 August 1964; mentioned by Paspalev and Paspaleva (1972) as *Paruterina parallelipipeda;* due to the unsuitable positioning of the fragments on the slide, they were re-mounted in four separate slides (Nos. 244a–244d);

No. 189, 1 slide containing 5 fragments (from post-mature to gravid proglottides, scolex lacking) of an undetermined cestode (1 specimen?), from *L. collurio* (adult, male), Starozagorski Bani, Stara-Zagora District, 2 May 1961;

No. 630, 1 slide containing 10 fragments (from pre-mature to gravid proglottides, scoleces lacking) of undetermined cestodes (at least 3 specimens), from *L. collurio* (juvenile, male), the village of Draganovtsi, Gabrovo District, 23 September 1967.

Metric and meristic characteristics are given as the range, mean and number of measurements or counts taken (n). The measurements are in micrometres except where otherwise stated.

The nomenclature of the birds follows Howard and Moore (1980).

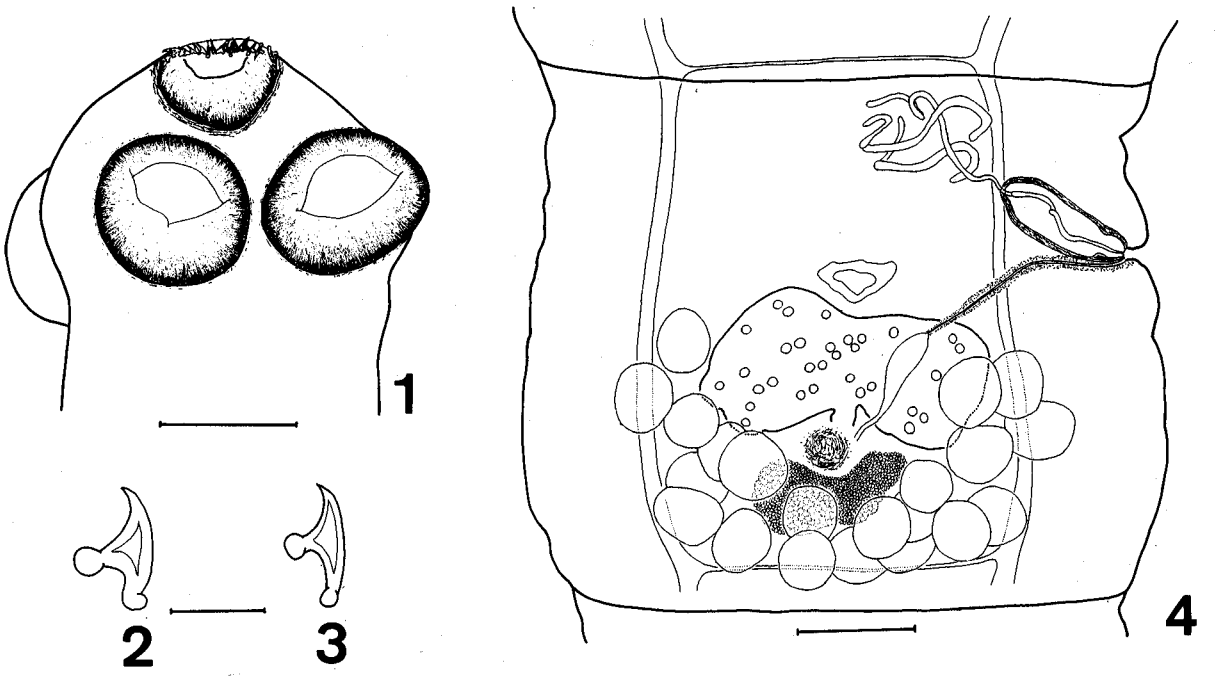
RESULTS

Dictyterina cholodkowskii (Skrjabin, 1914)

Paruterina cholodkowskii Skrjabin, 1914: 442–445, Figs. 29–34; Fuhrmann 1932: 133; Yamaguti 1959: 270; Spasskaja 1964: 44–45, Figs. 8–9.

Deltokeras cholodkowskii: Mathevossian 1965: 154; Mathevossian 1969: 125–127, Fig. 68.

Dictyterina cholodkowskii: Spassky in Spasskaja and Spassky 1971: 186, Fig. 116; Shumilo and Spassky 1976: 44; Borgarenko 1981: 143; Galkin 1981: 65, Fig. 5; Georgiev and Kornyushin 1994: 584, Figs. 27.94–27.98.



Figs. 1–4. *Dictyterina cholodkowskii* (Skrjabin). **Fig. 1.** Scolex. **Fig. 2.** Anterior rostellar hook. **Fig. 3.** Posterior rostellar hook. **Fig. 4.** Mature proglottis, dorsal view. Scale bars: 1, 4 – 100 μm; 2,3 – 10 μm.

Dictyuterina cholodkowskii: Schmidt 1986: 344–345, Fig. 362.

Deltokeras delachauxi Hsü , 1935: 543–547, Figs. 61–65 (new synonymy); Wardle and McLeod 1952: 448; Yamaguti 1959: 274, Fig. 398; Mathevossian 1969: 127, Fig. 69; Schmidt 1986: 347.

Biuterina passerina Fuhrmann, 1908 *sensu* Oshmarin 1963: 159, Fig. 65.

Paruterina parallelipipeda (Rudolphi, 1809) *sensu* Paspalev and Paspaleva 1972: 162.

Description: Strobila band-like, 91 mm (n = 1) long, consisting of 155 (n = 1) proglottides (55 pre-mature, 51 mature, 12 post-mature, 25 pre-gravid and 12 gravid). Maximum width at pre-gravid and gravid proglottides, 1.02–1.26 mm (1.12 mm; n = 3). Scolex (Fig. 1) subglobular, 219 (n = 1) long and 313 (n = 1) wide, clearly wider than neck. Rostellum muscular, sucker-like, with diameter 89 (n = 1); armed with two rows of hooks. Rostellar hooks (Figs. 2–3) small, triangular; the only available scolex has 25 hooks preserved (about half of the hooks lost); anterior hooks 13–14 (n = 2) long, with relatively shorter handle than posterior hooks; posterior hooks 12–14 (n = 2) long. Suckers rounded, highly muscular, with diameter 118–136 (128; n = 4). Neck 693 (n = 1) long and 112 (n = 1) wide in narrowest part.

Proglottides (Figs. 4, 6–8) slightly craspedote, with small velum. Mature proglottides (Figs. 4, 6) slightly wider than long; width/length ratio 1/0.88–1/0.59 (1/0.70; n = 12). Post-mature proglottides (Fig. 7) almost as long as wide; width/length ratio 1/1.31–1/0.92 (1/1.15; n = 10). Pre-gravid (Fig. 8) and gravid (Fig. 9) proglottides considerably longer than wide; width/length ratio 1/2.89–1/1.81 (1/2.24; n = 8). Genital pores irregularly alternating in short series (e.g. ... 4, 2, 1, 2, 4, 1, 2, 2, 2, 4, 1, 1, 1, 1, 2, 1, 3, 3, 2...); opening in anterior fourth or third of lateral proglottis margin (Figs. 4, 6–9). Genital atria infundibular; large, intensely stained cells seen around atria in some proglottides (Fig. 5). Ventral osmoregulatory canals 13–38 (30, n = 10)

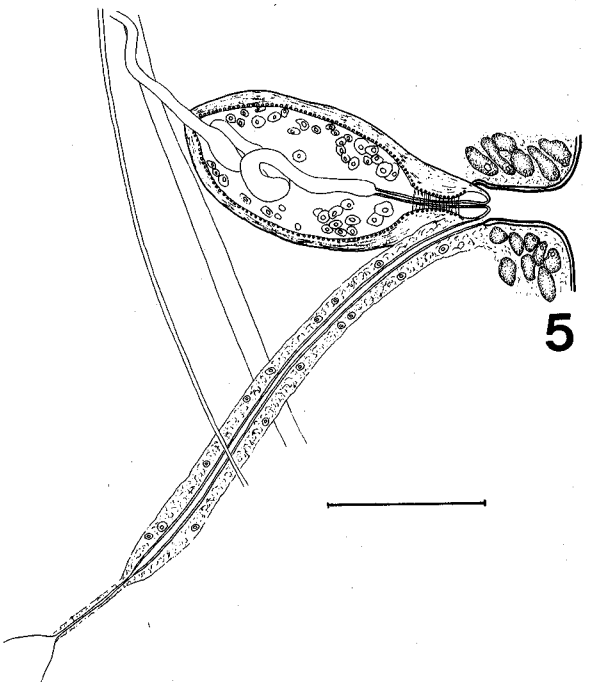


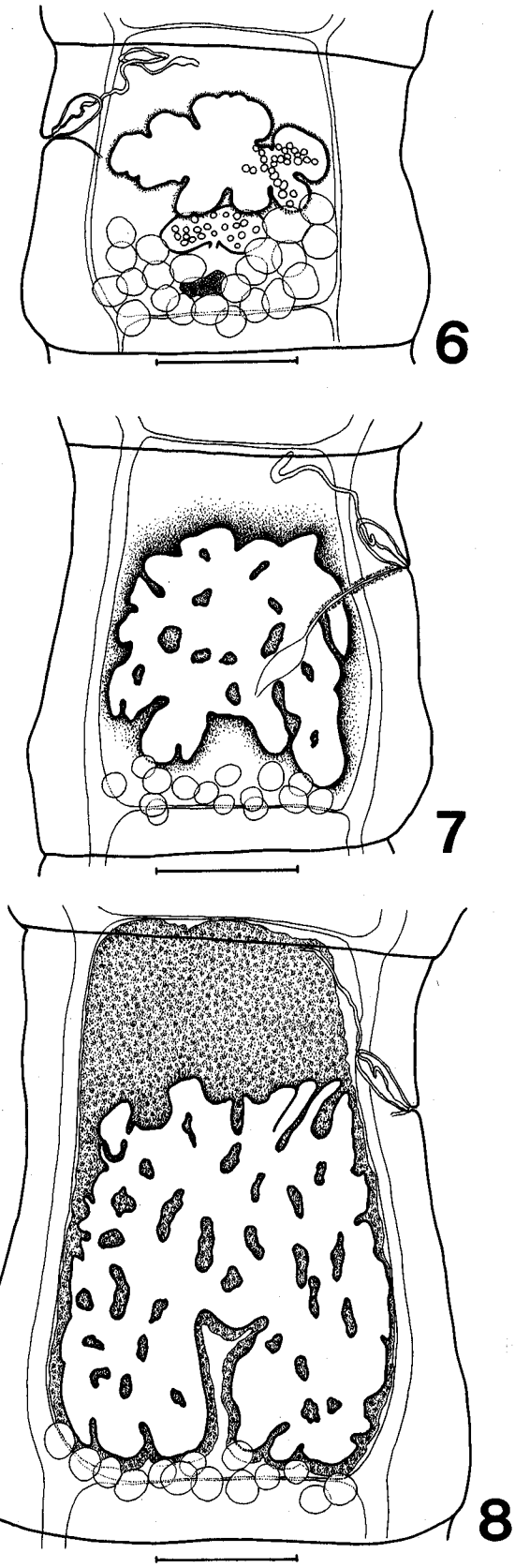
Fig. 5. Genital ducts (detail) in post-mature proglottis, dorsal view. Scale bar: 50 μm.

wide, with transverse anastomosis along posterior margin of each proglottis. Dorsal osmoregulatory canals 4–9 (6; n = 10), without transverse anastomoses. Genital ducts pass between osmoregulatory canals.

Testes 18–24 (22; n = 8) in number, situated posteriorly, laterally and dorsally to vitellarium and posteriorly and laterally to ovary; overlap lateral osmoregulatory canals (Figs. 4, 6). Cirrus-sac (Fig. 5) oblique, reaches or just crosses osmoregulatory canals; 102–138 (122; n = 15) long and 43–54 (47; n = 15) wide; elliptical or ovoid, with rounded aporal part; with thick muscular walls, often forming constriction near male pore. *Ductus cirri* merging with ejaculatory duct to form one canal with length 41–64 (56; n = 8) and width 3–4 (3.2; n = 8); armament not observed in *ductus cirri.* Internal vas deferens 6–11 (8; n = 10) in diameter, forms one or two coils in aporal part of cirrus-sac. External vas deferens 5–16 (13; n = 10) in diameter, forms numerous coils in poral part of median field near anterior proglottis margin; layer of "prostate" cells seen around it; external vas deferens and surrounding "prostate" tissue forms spongiose structure.

Vitellarium (Fig. 4) compact, median, often reniform, sometimes with irregular shape; situated near posterior proglottis margin. Ovary compact, wide, reniform or elliptical in shape. Vagina (Fig. 5) opening postero-dorsally, rarely posteriorly, to male pore and directed postero-medially as straight or slightly curved tube; vaginal lumen of copulatory part thin-walled, with diameter 3–6 (4; n = 10); surroun- ded by thick cellular sleeve with diameter 16–22 (19; n = 10). Seminal receptacle elliptical, situated dorsally to ovary, 80–134 (101; n = 8) long and 32–48 (40; n = 8) wide. Mehlis' gland globular (not always clearly seen).

Uterus appears initially (Fig. 4) as sac with irregular shape situated anteriorly to ovary. In late mature proglottides (Fig. 6) it forming anterior and posterior diverticula; posterior diverticula dorsal to ovary. In further development in post-mature proglottides (Fig. 7), uterus expanding in anterior and posterior direction; uterine diverticula becoming very long and uterus acquires reticular structure; surrounding parenchyma, including that between uterine reticulum, starting to modify forming initial stage of paruterine organ; no distinct border between tissue of paruterine organ and normal parenchyma. In pre-gravid proglottides (Fig. 8), paruterine organ occupying almost entire median field. Paruterine organ in gravid proglottides (Fig. 9) consisting of large vesicular cells with transparent content (lipid?). No fibrilar elements seen in paruterine organ at any stages of development. Eggs round or slightly oval, with diameter 36–45 (41; n = 10); outer envelope thin; embryophore thicker, staining deeply. Embryo- nic hooks of central pair 20–22 (21.4; n = 10)



Figs. 6–8. *Dictyterina cholodkowskii* (Skrjabin), proglottides demonstrating various stages of the development of the uterus and the paruterine organ. **Fig. 6.** Late mature proglottis. **Fig. 7.** Post-mature proglottis. **Fig. 8.** Pre-gravid proglottis. Scale bar: 250 μm.

long; embryonic hooks of lateral pairs 18–20 (18.8; n = 10).

Survey of the records of *D. cholodkowskii*

Records: Skrjabin (1914), Hsü (1935), Oshmarin (1963), Spasskaja (1964), Paspalev and Paspaleva (1972), Shumilo and Spassky (1976), Bondarenko (1981), Galkin (1981), present study.

Hosts: red-backed shrike *Lanius collurio* (type-host: *Otomela romanowi* = *Lanius collurio phoenicuroides*) (Skrjabin 1914, Paspalev and Paspaleva 1972, Shumilo and Spassky 1976, Borgarenko 1981, Galkin 1981, present study); brown shrike *Lanius cristatus* (Oshmarin 1963, Spasskaja 1964, Spasskaja and Spassky 1971, Borgarenko 1981); black-headed shrike *Lanius schach* (Hsü 1935, Borgarenko 1981); lesser grey shrike *Lanius minor* (Shumilo and Spassky 1976); great grey shrike *Lanius excubitor* (Borgarenko 1981); Chinese great grey shrike *Lanius sphenocercus* (Oshmarin 1963).

Distribution: Kazakhstan (type-locality) (Skrjabin 1914); Primor'e Region (Oshmarin 1963); China (Canton) (Hsü); Tuva (Spasskaja 1964, Spasskaja and Spassky 1971); Tadzhikistan (Borgarenko 1981); Moldova (Shumilo and Spassky 1976); Kaliningrad Region (Kurish Spit) (Galkin 1981); Bulgaria (Paspalev and Paspaleva 1972, present study).

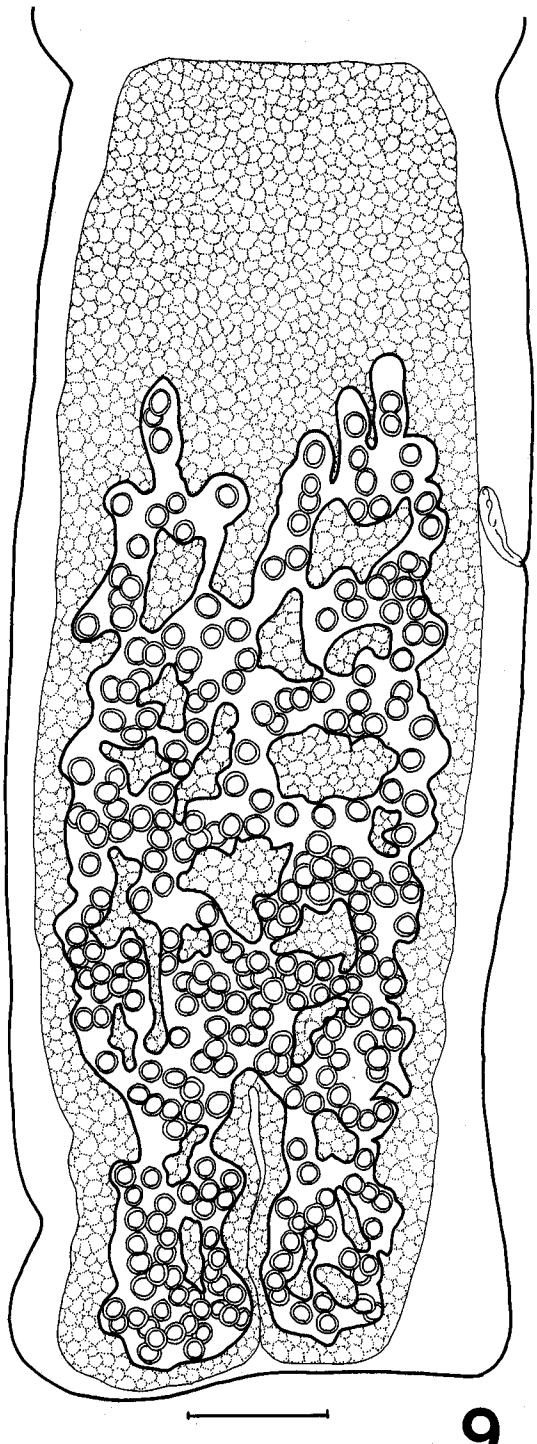


Fig. 9. Gravid proglottis. Scale bar: 250 μm.

DISCUSSION

The present description corresponds well with those of *D. cholodkowskii* (Skrjabin 1914, Spasskaja 1964, Galkin 1981). There is also good agreement of the metric and meristic characters (Table 1). The observed differences in the general length of the strobila, the diameters of the scolex and the rostellum and in the number of the testes are within the limits of the variability known for paruterinid cestode species. One of the specimens examined, identified by us as *D. cholodkowskii,* was determined earlier by Paspalev and Paspaleva (1972) as *Paruterina parallelipipeda* (Rudolphi, 1809). According to the brief description (see Mathevossian 1969) of the latter species, a parasite of the European shrikes (*Lanius* spp.), its scolex has a single crown of 19 hooks 82 μm long. The shape and size of the hooks of *P. parallelipipeda* resemble to a considerable extent those of dilepidid cestodes, e. g. species of the genus *Birovilepis* Spassky, 1975 (see Spasskaja and Spassky 1977), but differ significantly from the scolex armament of the re-examined specimen from the collection of Dr. A. Paspaleva.

Oshmarin (1963) reported tapeworms from *Lanius cristatus* and *L. sphenocercus* from the Primor'e Region (Russian Far East) as *Biuterina passerina* Fuhrmann, 1908. These specimens were not described but informative illustrations were presented. The drawings demonstrating uterine development include stages of the same pattern as described above for *D. cholodkowskii*: the developing uterus with long diverticula, the gravid uterus reticular. It is clearly different from uterine development known in *Biuterina* spp. (see Kornyushin 1989). Therefore, Oshmarin's (1963) specimens, or at least those from *L. cristatus* shown i the drawings, belong to *D. cholodkowskii.*

Table 1. Comparative metrical and meristic data for *Dictyterina cholodkowski* (Skrjabin).

Source Host Locality	Skrjabin 1914 *L. collurio* Kazakhstan	Hsü 1935[1] *L. schach* China	Spasskaja 1964 *L. cristatus* Tuva	Galkin 1981 *L. collurio* Kurish Spit	Present study *L. collurio* Bulgaria	
	Range	Range	Range	Range	Range	Mean
Strobila length /mm/ width /mm/	 50 1.5	 68 1.06	 80 1.3	 50–60 1.2	 91 1.02–1.26	 1.12
Scolex diameter	360	256	335	340	313	
Suckers diameter	170		135	120–130	118–1136	128
Rostelum diameter		90	55	95–115	89	
Rostellar hooks number length anterior posterior	 50–60 16–18[2] 16–18[2]	 14–15[2] 14–15[2]	 40 16–18[2] 16–18[2]	 60 12–14[2] 12–14[2]	 13–14 12–14	
Testes number	16–18	15–17	16–18	16–18	18–24	22
Cirrus-sac length widht	140	108–112 34–49	145 45	100–115 35–40	102–138 43–54	122 47
Egg diameter		56	50	60	36–45	41
Embryonic hooks length central pair lateral pairs			 18–20[3] 18–20[3]	 23 18–19	 20–22 18–20	 21 19

[1] Described as *Deltokeras delachauxi.*
[2] Lengths of different rostellar hooks not given separately.
[3] Lenghth of different embryonic hooks not given separately.

On the basis of the present results, we regard *Deltokeras delachauxi* Hsü, 1935 as a junior synonym of *D. cholodkowskii*. Comparison of the original detailed description of the former (Hsü 1935) and the present results shows their similarity. There is good agreement in the shape and size of rostellar hooks, in the structure of the mature proglottis and in the morphology of the uterus and the paruterine organ. The metric and meristic characters are also similar (Table 1). The synonymy of *D. delachauxi* and *D. cholodkowskii* was presumed by Spassky (1991). Kornyushin (1989) also considered that the morphology of *D. delachauxi* corresponded to the diagnosis of the genus *Dictyterina.*

A survey of the records of *D. cholodkowskii* characterizes it as a specific parasite of birds of the genus *Lanius*. Its geographical range is restricted to the Palaearctic Region. These characteristics are also valid for the genus *Dictyterina* since we regard it as a monotypic genus.

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