

Keratin Beetle *Trox perrisii* Fairmaire, 1868 (Coleoptera: Trogidae): First Records for Greece and Poland, with a Review of its Distribution and Ecology

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Abstract: We present the first records of the keratin beetle *Trox perrisii* Fairmaire, 1868 in Greece and Poland: Kokkino Nero near Agia and Wołczyny near Włodawa, respectively. The paper summarises and analyses all the available information about the bionomy and distribution of this species. The paper gives also an identification key and a checklist of the species of the family Trogidae of Poland.

Key words: Scarabaeoidea, Trogidae, *Granulitrox*, *Niditrox*, *Trox*, new records, Greece, Poland

Introduction

The genus *Trox* Fabricius, 1775 contains 67 species (22 of the subgenus *Granulitrox* Nikolajev, 2016, ten of *Niditrox* Nikolajev, 2016 and 35 of the nominotypical subgenus *Trox* Fabricius, 1775) in all zoogeographical regions (ZÍDEK 2017); 46 of them occur in the Palaearctic, 22 have been recorded from Europe. Until recently, 119 species were considered to belong to this genus (ZÍDEK 2013). After the description of the new genus *Glyptotrox* Nikolajev, 2016, part of them were transferred there (NIKOLAJEV 2016).

The species of the genus *Trox* are reddish-brown to black, up to 15 mm. in length. Imagines are to be found at the cadavers of small or large animals, often in hollows, burrows or nests of birds and mammals; they are also attracted to light. Larvae feed on decaying organic matter of animal origin.

Trox perrisii Fairmaire, 1868 belongs to the subgenus *Niditrox*. It occurs in various countries of Europe, in North-West Africa (Algeria, Morocco) and Asia Minor (Turkey) (PITTINO & BEZDĚK 2016). Hitherto the species was found neither in Greece nor in Poland. The aim of the present contribution is to report *T. perrisii* from both countries and to summarise the scattered and scant information on its distribution and bionomy. The paper contains also

an identification key to the species and an updated checklist of the Trogidae in Poland.

Materials and Methods

In the course of many years' studies on the avifauna of the Sobibór Area (Poland), initiated by PhD Eng. Marek Keller (Department of Forest Zoology and Wildlife Management of WULS – SGGW), on inspection of nest-boxes of tawny owl *Strix aluco* Linnaeus, 1758 (Fig. 1) near Wołczyny in July 2015, an imago of *T. perrisii* was found. Another specimen of that species was collected at light by night near Kokkino Nero, vicinities of Agia (Greece), during an expedition of Polish entomologists.

The specimens were examined with a Leica M205 FA stereomicroscope; measurements were taken with an ocular grid. The photographs were taken using digital camera Leica DFC 495.

Results

Locality of *T. perrisii* in Poland: Wołczyny ad Włodawa (UTM: FC80), 170 m a.s.l., 15 VII 2015, under dead pullus of tawny owl *Strix aluco* Linnaeus,

1758, in the nest-box, in pine forest, 1 ex. (♀), leg. S. Tylkowski, det. et coll. A. Byk (Fig. 2).

Locality of *T. perrisii* in Greece: Kokkino Nero ad Agia near Larissa (UTM: FK51), 50 m a.s.l., 6-14 VI 2012, at light, in oak wood, 1 ex. (♀), leg. L. Kruszelnicki, det. et coll. A. Byk (Fig. 3).

Discussion

Distribution

Hitherto, *T. perrisii* has been reported from the following European countries: Austria (HORION 1958, PETROVITZ 1969, HOLZER 2002, SCHUH 2013), Belarus (LUNDYSHEV 2014), Bulgaria (BUNALSKI 1999, CHEHLAROV et al. 2016), Croatia (KOREN 2015, ZIANI et al. 2015), the Czech Republic (HLADIL 1973, KRÁL & VITNER 1993, RESL 1998, JUŘENA et al. 2000, KRÁL & RÉBL 2007, JUŘENA et al. 2008), France (HORION 1958, PAULIAN 1959, BARAUD 1977, NICOLAS 1999, TAMISIER 2000, MÉRIGUET et al. 2007, LABATUT 2008), Germany (STADLER 1924, HORION 1939, 1958, PAULIAN 1959, BARAUD 1977, LIEBHEIT 1979, KÖHLER & KLAUSNITZER 1998, HADULLA 2003, BUSSLER & MÜLLER 2009, RÖSSNER 2012), Hungary (ÁDÁM 1980, MERKL 1998, MERKL et al. 2004, NÁDAI & MERKL 2004), Italy (HORION 1958, BARAUD 1979, BALLERIO et al. 2014), Portugal (GROSSO-SILVA & SERRANO 2000, BRANCO 2001), Russia: European Territory (SHOKHIN 2007, SHOKHIN & PUSHKIN 2010, KOVALENKO 2012), Slovakia (TESAŘ 1957, LÖBL 1960a, b, KRÁL & VITNER 1993, JUŘENA et al. 2000, 2008), Slovenia (BRELIH et al. 2010), Spain (HAROLD 1872, FUENTE 1926, LÓPEZ-COLÓN 1986, 1988, SÁEZ BOLAÑO & BLANCO VILLERO 2006, BLANCO VILLERO et al. 2007, COELLO &

BAENA 2008), Switzerland (LINDER 1968, HORION 1971) and Ukraine (TENENBAUM 1938, VASKO 2010, KOVALENKO 2012); from North Africa: Algeria and Morocco (BARAUD 1985); and from Asia Minor:



Fig. 1. Inspection of tawny owl *Strix aluco* nest-box near Sobibór (Poland) (Photograph by S. Tylkowski)



Fig. 2. Habitat of *Trox perrisii* near Wolczyny (Photograph by L. Łoś)



Fig. 3. Habitat of *Trox perrisii* near Kokkino Nero (Photograph by L. Kruszelnicki)

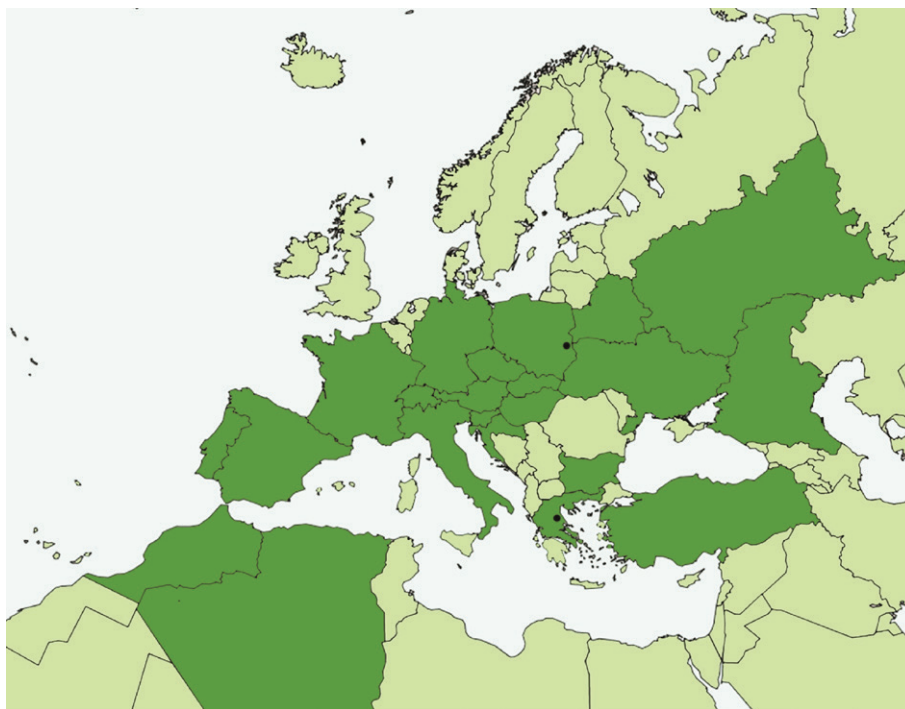


Fig. 4. Distribution of *Trox perrisii* and localities in Poland and Greece

Turkey (KEITH 2011, ATAY et al. 2012).

PITTINO & BEZDĚK (2016), in their part on the Trogidae of the „Catalogue of Palearctic Coleoptera”, mention Poland (also Belgium) among the countries, from which *T. perrisii* has been reported. The source of the information concerning Poland was probably the too general (without indication of locality or collection) 90-years-old note

on the occurrence in the Silesian Region (SCHOLZ & HINKE 1919) or the collection of a single specimen in Dźwinogród (Podole Region) (TENENBAUM 1938). Dźwinogród, or the present Dzvynigorod, is a village now situated outside of Poland, in present Ukraine. In addition, the species has not been considered in the Catalogue of Polish Fauna (BURAKOWSKI et al. 1983), Key to the identification

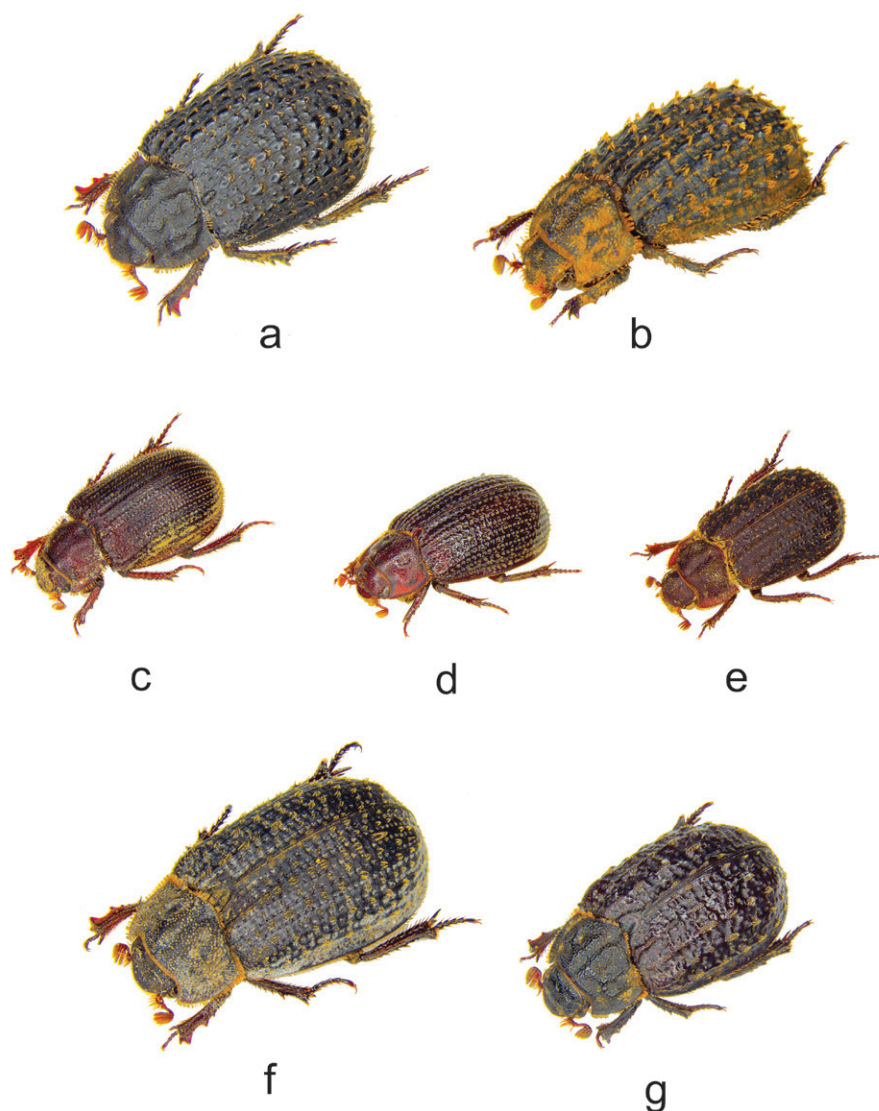


Fig. 5. Habitus of species of the genus *Trox*: a. *T. hispidus*, b. *T. niger*, c. *T. evermanni*, d. *T. perrisii*, e. *T. scaber*, f. *T. cadaverinus*, g. *T. sabulosus* (Photograph by S. Tylkowski)

of Polish beetles (STEBNICKA 1983), Checklist of Polish Animals (MROCKOWSKI & STEFAŃSKA 1991) and Fauna of Poland (BUNALSKI 2004). Only the locality presented herein solves the question about the occurrence of *T. perrisii* in Poland. JANSSENS (1960) asserts – admitting, however, the lack of any concrete record – that this beetle certainly occurs in Belgium. Up to now, *T. perrisii* has been reported from 21 countries in the world. Indeed, it might be found in the European countries from which it has never been reported, in particular in Belgium, Netherlands, Luxembourg, Albania, Bosnia and Herzegovina, Montenegro, Macedonia, Serbia and Romania. The species seems to be an European faunal element, with Maghrebian and Anatolian extensions (RÖSSNER 2012), distributed over Europe, North Africa and Asia Minor (Fig. 4). However, in all its range it is very rarely encountered, usually

with single specimens and only on few occasions more individuals have been collected: e.g. in fallen nest of white stork *Ciconia ciconia* in the Czech Republic (100 individuals, including larvae) have been found (JUŘENA et al. 2008).

Seasonal dynamics

Trox perrisii are observed in all months of the year. In Germany, *T. perrisii* is usually found between March and July, but sometimes also in October (RÖSSNER 2012), November, December and January (HORION 1958). In the Czech Republic and Slovakia imagines have been collected from February to July (mainly in April), less frequently from September to November (JUŘENA et al. 2008). On the Balkan Peninsula, it is caught in May (KOREN 2015, ZIANI et al. 2015), June (BUNALSKI 1999, BRELIH et al. 2010, CHEHLAROV et al. 2016) and July, but also in

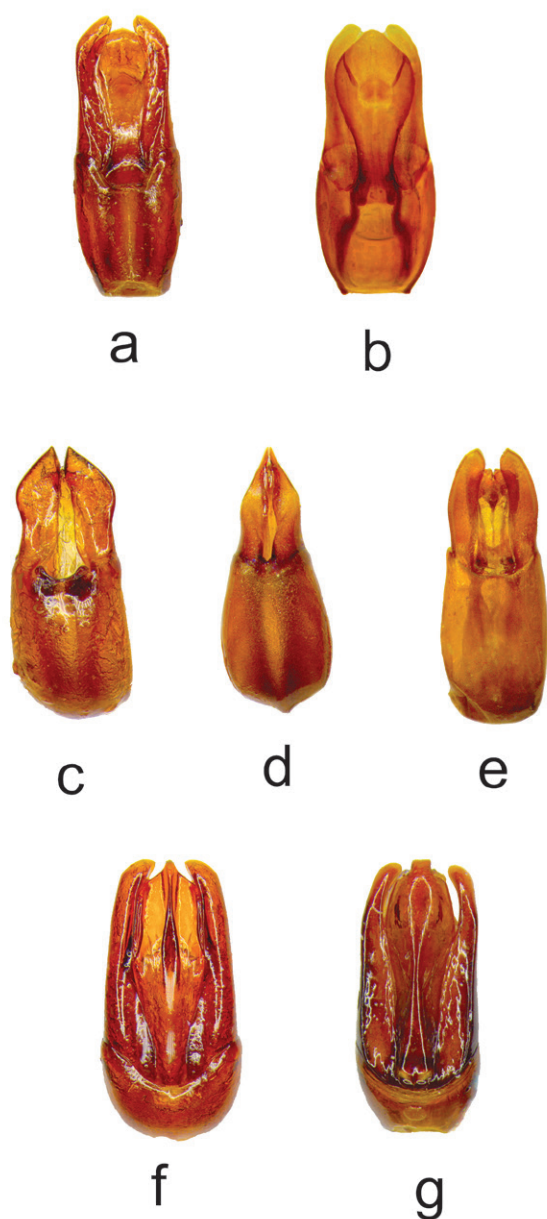


Fig. 6. Phalli of species of the genus *Trox*: a. *T. hispidus*, b. *T. niger*, c. *T. eversmanni*, d. *T. perrisii*, e. *T. scaber*, f. *T. cadaverinus*, g. *T. sabulosus* (Photograph by S. Tylkowski)

September and October (BRELIH et al. 2010). On the Pyrenean Peninsula, adults have been reported in May (SÁEZ BOLAÑO & BLANCO VILLERO 2006) and July (GROSSO-SILVA & SERRANO 2000, MARTÍN-PIERA & LÓPEZ-COLÓN 2000). In fact, imagines of *T. perrisii* are observed in any month of the year, from January to December. Studying seasonal dynamics and daily rhythm of this beetle, including maximum activity and period of swarming, is exceptionally difficult not only because of the rarity of its occurrence (few, usually accidental observations), but mainly in view of the relative inaccessibility of larval habitats and clandestine way of

imaginal life. Some potentially helpful indication of its activity cycle might be based on the dates of its appearance at light: in May (TAMISIER 2000, JUŘENA et al. 2008), June (BUNALSKI 2000, KOREN 2015, CHEHLAROV et al. 2016) and July (LÓPEZ-COLÓN 1986, GROSSO-SILVA & SERRANO 2000, KOVALENKO 2012). Thus, the period between April and July seems to be the peak of imagos' activity of this species (Table 1).

Habitats

Trox perrisii inhabits deciduous and mixed forests with old trees. On the Pyrenean Peninsula, it has been encountered in stands of *Quercus rotundifolia* Lamarck, 1785 (MARTÍN-PIERA & LÓPEZ-COLÓN 2000) and *Castanea sativa* Miller, 1768 (SÁEZ BOLAÑO & BLANCO VILLERO 2006), on the Balkan Peninsula - in oak (BUNALSKI 2000) and beech woods (KOREN 2015, CHEHLAROV et al. 2016), in Poland - in pine forest, in Germany - in field, roadside and cemetery treestands and in parks (RÖSSNER 2012). Known localities lie up to ca. 1000 m a.s.l.: in Greece it has been caught at 50 m a.s.l., in Poland at 170 m a.s.l., in Slovakia at 210 m a.s.l. (JUŘENA et al. 2008), in Eastern Germany between 100 and 350 m a.s.l. (RÖSSNER 2012), in Bulgaria at 550 m a.s.l. (CHEHLAROV et al. 2016), in Spain from 600 to 1000 m a.s.l. (MARTÍN-PIERA & LÓPEZ-COLÓN 2000), in Croatia at ca. 1000 m a.s.l. (KOREN 2015).

Our quest shows that *T. perrisii* is an inhabitant of bird nests, as well as those built in hollows or rotten fragments of trunks and boughs, as on branches of trees. Frequent hosts are owls (tawny owl *Strix aluco* – also in Poland it has been found in the nest-box occupied by this species and by the barn owl *Tyto alba*), but also woodpeckers – great spotted woodpecker *Dendrocopos major*, black woodpecker *Dryocopus martius* (RÖSSNER 2012) and European green woodpecker *Picus viridis*, and birds of prey: common buzzard *Buteo buteo*, saker falcon *Falco cherrug*, common kestrel *F. tinnunculus* and red-footed falcon *F. vespertinus*. Sometimes it may be found in the nests of white stork *Ciconia ciconia*, stock dove *Columba oenas*, common wood pigeon *C. palumbus*, western jackdaw *Corvus monedula*, Eurasian tree sparrow *Passer montanus*, common starling *Sturnus vulgaris*, common blackbird *Turdus merula* and Eurasian hoopoe *Upupa epops*, as well as in the lairs of house marten *Martes foina* (PAULIAN 1959) and woodpecker-made hollows, secondarily occupied by bats (PETROVITZ 1969) (Table 2).

Trox perrisii has been found in hollows and decaying fragments of weakened or dead oaks (*Quercus*) (HORION 1958, LINDER 1968, COELLO &

Table 1. Number of records *Trox perrisii* distributed across months (literature data)

| Month | Number of records | Summary records |
|-----------|--|-----------------|
| January | 5 (HORION 1958) | 5 |
| February | 2 (JUŘENA et al. 2008) | 2 |
| March | 1 (HORION 1958), 1 (NICOLAS 1999), 3 (JUŘENA et al. 2008), 1 (LABATUT 2008), 2 (RÖSSNER 2012) | 8 |
| April | 2 (HORION 1958), 2 (NICOLAS 1999), 3 (JUŘENA et al. 2008), 2 (RÖSSNER 2012) | 9 |
| May | 1 (TENENBAUM 1938), 1 (TAMISIER 2000), 1 (HADULLA 2003), 1 (MERKL et al. 2004), 2 (SÁEZ BOLAÑO & BLANCO VILLERO 2006), 5 (JUŘENA et al. 2008), 1 (RÖSSNER 2012), 1 (ZIANI et al. 2015) | 13 |
| June | 1 (LIEBHEIT 1979), 1 (BUNALSKI 1999), 1 (COELLO & BAENA 2008), 1 (BRELIH et al. 2010), 1 (KOVALENKO 2012), 3 (RÖSSNER 2012), 1 (KOREN 2015), 1 (CHEHLAROV et al. 2016) | 10 |
| July | 1 (HORION 1958), 2 (LÓPEZ-COLÓN 1986, 1988), 1 (NICOLAS 1999), 1 (GROSSO-SILVA & SERRANO 2000), 1 (SHOKHIN 2007), 1 (BRELIH et al. 2010), 1 (KOVALENKO 2012), 1 (RÖSSNER 2012) | 9 |
| August | 1 (TESAŘ 1957), 1 (HORION 1958) | 2 |
| September | 2 (JUŘENA et al. 2008), 1 (BRELIH et al. 2010) | 3 |
| October | 1 (LINDER 1968), 1 (BRELIH et al. 2010), 1 (RÖSSNER 2012) | 3 |
| November | 1 (HORION 1958) | 1 |
| December | 2 (HORION 1958) | 2 |

Table 2. Alphabetical list of animal species in whose nests *T. perrisii* has been found (literature data)

| Scientific name | English name | Reference |
|---|---------------------------|---|
| Accipitriformes | bird of prey | GAUDIN (1921), PAULIAN (1941, 1943), HICKS (1959) |
| <i>Ardea</i> sp. | heron | JUŘENA et al. (2008) |
| <i>Buteo buteo</i> (Linnaeus, 1758) | common buzzard | TESAŘ (1957) |
| Chiroptera | bats | PETROVITZ (1969) |
| <i>Ciconia ciconia</i> (Linnaeus, 1758) | white stork | JUŘENA et al. (2008), LABATUT (2008) |
| <i>Columba oenas</i> Linnaeus, 1758 | stock dove | GERHARD (1909), SCHOLZ & HINKE (1919), PAULIAN (1943), HICKS (1959) |
| <i>Columba palumbus</i> Linnaeus, 1758 | common wood pigeon | FALCOZ (1914), HICKS (1959) |
| Columbidae | pigeons | BICKHARDT (1907a, b, c, 1911), SCHAUFUSS (1907), FALCOZ (1914), SCHOLZ & HINKE (1919), HICKS (1959), TESAŘ (1957) |
| <i>Corvus monedula</i> Linnaeus, 1758 | western jackdaw | COELLO & BAENA (2008) |
| <i>Dendrocopos major</i> (Linnaeus, 1758) | great spotted woodpecker | GERHARD (1909), BICKHARDT (1911), HICKS (1959), PAULIAN (1959), COELLO & BAENA (2008) |
| <i>Falco</i> | falcons | MARTÍN-PIERA & LÓPEZ-COLÓN (2000) |
| <i>Falco cherrug</i> J. E. Gray, 1834 | saker falcon | MERKL et al. (2004) |
| <i>Falco tinnunculus</i> Linnaeus, 1758 | common kestrel | ÁDÁM (1980) |
| <i>Falco vespertinus</i> Linnaeus, 1766 | red-footed falcon | ÁDÁM (1980) |
| <i>Martes foina</i> (Erxleben, 1777) | house marten | PAULIAN (1959) |
| Paridae | tits | HICKS (1959) |
| <i>Passer montanus</i> (Linnaeus, 1758) | Eurasian tree sparrow | JUŘENA et al. (2008) |
| Picidae | woodpeckers | SCHOLZ & HINKE (1919), PAULIAN (1941, 1943), HICKS (1959), TESAŘ (1957) |
| <i>Picus viridis</i> Linnaeus, 1758 | European green woodpecker | FALCOZ (1914), HICKS (1959) |
| Strigidae | owls | FALCOZ (1914), GAUDIN (1921), HICKS (1959), LINDER (1968) |
| <i>Strix aluco</i> (Linnaeus, 1758) | tawny owl | RÖSSNER (2012), LUNDYSHEV (2014) |
| <i>Sturnus vulgaris</i> Linnaeus, 1758 | common starling | HICKS (1959), PETROVITZ (1969) |
| <i>Turdus merula</i> Linnaeus, 1758 | common blackbird | ŠUSTEK & KRIŠTOFÍK (2009) |
| <i>Tyto alba</i> (Scopoli, 1769) | barn owl | BUYSSON (1923), HICKS (1959) |
| <i>Upupa epops</i> Linnaeus, 1758 | Eurasian hoopoe | MARTÍN-PIERA & LÓPEZ-COLÓN (2000), COELLO & BAENA (2008) |

BAENA 2008, BUSSLER & MÜLLER 2009), poplars (*Populus*) (JUŘENA et al. 2008), beeches (*Fagus*), apple trees (*Malus*) (HORION 1958) and cherries (*Cerasus*) (HADULLA 2003). It is a saprophagous (zoosaprophagous, keratophagous) species, feeding as larvae on feathers, fur and remnants of bodies of dead birds or prey animals brought by the bird to the nest. In Germany, *T. perrisii* was found among the bones of small rodents (intermixed with black, humid, granular humus and fragments of the nest), in the nest occupied by tawny owl *Strix aluco* (WURST 2008, RÖSSNER 2012). Sometimes imagines of *T. perrisii* were found together with the cosmopolitan *T. scaber* (HADULLA 2003, JUŘENA et al. 2008).

Trox perrisii has been included in the list of relict species of ancient woodlands (MÜLLER et al. 2005).

Checklist of the Trogidae of Poland

(? – the occurrence of this species in Poland should be confirmed by a new record)

Family Trogidae W.S. Macleay, 1819

Subfamily Troginae W.S. Macleay, 1819

Genus *Trox* Fabricius, 1775

Subgenus *Granulitrox* Nikolajev, 2016

Trox hispidus (Pontoppidan, 1763)

? *Trox niger* P. Rossi, 1792

Subgenus *Niditrox* Nikolajev, 2016

Trox evermanni Krynický, 1832

Trox perrisii Fairmaire, 1868

Trox scaber (Linnaeus, 1767)

Subgenus *Trox* Fabricius, 1775

Trox cadaverinus Illiger, 1802

Trox sabulosus (Linnaeus, 1758)

Identification key to the species of the family Trogidae of Poland

1. Elytral nodosities and tubercles setose only on the posterior half (Fig. 5a–b). Tips of parameres slightly protruding beyond the tip of median lobe of aedeagus (Fig. 6a–b).....2

– Elytra not tuberculate or with tubercles setose throughout (Fig. 5c–g). Tips of parameres distinctly protruding beyond tip (Fig. 5c–e) or equal in length to the median lobe of aedeagus (Fig. 5f–g). 3

2. Tubercles on odd elytral intervals flat or slightly convex, setae on them – 2 to 9 (usually 2-6) in number – arranged in transverse or arcuate row. Tubercles on even intervals with single seta (rarely with 2 setae or glabrous) (Fig. 5a). Tip of median lobe of aedeagus broadly obtuse-angled (Fig. 6a). ..
..... *Trox hispidus*

– Odd intervals with slightly or markedly convex nodosities, setae – 3 to 18 (usually 5-9) – arranged in the shape of letter „V”. Tubercles on even

intervals small, without setae (rarely with a single one) (Fig. 5b). Tip of median lobe of aedeagus nearly right-angled (Fig. 6b). *Trox niger*

3. Setose row on 5 elytral interval consists of single setae (Fig. 5c) or of two-rowed groups (Fig. 5d–e). Parameres sharply pointed at tips and distinctly protruding beyond the apex of the median lobe of aedeagus (Fig. 6c–e). 4

– Groups of setae on 5 interval at least three-rowed (Fig. 5f) or round (Fig. 5g). Parameres not sharply pointed and not protruding beyond median lobe of aedeagus (Fig. 6f–g). 6

4. Elytral intervals with single rows of individual setae (Fig. 5c). Epistome and front lustrous. Apical portions of parameres broadly (at >45°) cuneate, sharply angular (Fig. 6c).....*Trox evermanni*

– Intervals with two-rowed agglomerations of setae (Fig. 5d–e). Front mat. Apical portions of parameres either very narrowly (at <20°) cuneate, with pointed tips (Fig. 6d) or subparallel-sided, with almost rounded tips (Fig. 6e). 5

5. Epistome lustrous. All elytral intervals equally convex. Number of setae in groups 2 to 10 (usually 4-6) (Fig. 5d). Terminal thorn of male protibial apically widened and bluntly truncated. Apical portions of parameres very narrowly (at <20°) cuneate, almost entirely concealing median lobe of aedeagus (Fig. 6d). *Trox perrisii*

– Epistome mat. Odd intervals more convex than even ones. Number of setae in groups 2 to 20 (usually 4-10) (Fig. 5e). Terminal thorn of male protibial neither widened nor bluntly truncated apically. Apical portions of parameres subparallel-sided to almost rounded tips (Fig. 6e), do not conceal median lobe of aedeagus. *Trox scaber*

6. Elytral intervals twice as wide as rows. Elytral rows with ovate, shallow punctures. Number of setae in groups from 2 to 12 (usually 4-8). Humeral denticle small (Fig. 5f). Median lobe of aedeagus sharply pointed at tip (Fig. 6f). *Trox cadaverinus*

– Elytral intervals only slightly wider than rows. Elytral rows with quadrangular, deep punctures (Fig. 5g). Setae in groups from 2 to 30 (usually 8-16). Humeral denticle large. Apex of median lobe of aedeagus broadly truncated at tip (Fig. 6g).
.....*Trox sabulosus*

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References

- ÁDÁM L. 1980. Lamellicornia aus Nesten von Vögeln und Säugetieren (Coleoptera). *Folia Entomologica Hungarica* 33 (2): 17–19.
- ATAY E., JANSSON N. & GÜRKAN T. 2012. Saproxyllic beetles on old hollow oaks (*Quercus* spp.) in a small isolated area in southern Turkey. *Zoology in the Middle East* 57 (1): 105–114.
- BALLERIO A., REY A., ULIANA M., RASTELLI M., RASTELLI S., ROMANO M. & COLACURCIO L. 2014. Coleotteri Scarabaeoidei d'Italia. Version July 2014. <http://societaentomologicaitalia.it> (Site visited on 30 October, 2017).
- BARAUD J. 1977. Coléoptères Scarabaeoidea. Faune de l'Europe occidentale: Belgique, France, Grand-Bretagne, Italie, Peninsule Iberique. Supplément a la Nouvelle Revue d'Entomologie 7 (1): 1–352.
- BARAUD J. 1979. Coléoptères Scarabaeoidea. Faune de l'Europe occidentale: Addenda et Errata. Nouvelle Revue d'Entomologie 9 (1): 23–45.
- BARAUD J. 1985. Coléoptères Scarabaeoidea. Faune du Nord de l'Afrique du Maroc au Sinaï. Paris: Éditions Lechevalier. 652 p.
- BICKHARDT H. 1907a. Käfer in Nestern. *Entomologische Blätter* 3 (6): 81–86.
- BICKHARDT H. 1907b. Käfer in Nestern. *Entomologische Blätter* 3 (7): 97–102.
- BICKHARDT H. 1907c. Über das Vorkommen von Käfern in den Nestern von Säugetieren und Vögeln. *Entomologische Zeitung* 20 (35): 254–255.
- BICKHARDT H. 1911. Verzeichnis der in den Nestern von Warmblütern gefundenen Käfer. *Archiv für Naturgeschichte* 77 (1) 11–18.
- BLANCO VILLERO J. M., SÁEZ BOLAÑO J. A., BAHILLO DE LA PUEBLA P. & LÓPEZ-COLÓN J. I. 2007. Scarabaeoidea (Coleoptera) de la Sierra de Tudía (Badajoz, Extremadura, España): II. Inventario preliminar de especies. *Boletín de la Sociedad Entomológica Aragonesa* 41: 347–357.
- BRANCO T. 2001. Coleoptera Scarabaeoidea new or otherwise noteworthy for the Portuguese Fauna, with a nomenclatural note. *Boletín de la Sociedad Entomológica Aragonesa* 29: 33–38.
- BRELIH S., KAJZER A. & PIRNAT A. 2010. Material for the Beetle Fauna (Coleoptera) of Slovenia 4th contribution: Polyphaga: Scarabaeoidea (= Lamellicornia). *Scopolia* 70: 1–386.
- BUNALSKI M. 1999. Die Blatthornkäfer Mitteleuropas. Coleoptera, Scarabaeoidea. Bestimmung – Verbreitung – Ökologie. Bratislava: František Slamka. 80 p.
- BUNALSKI M. 2000. Contributions to the knowledge Scarabaeoidea (Coleoptera) of Bulgaria. Part I. Results of the Expeditions 1996 and 1998. *Wiadomości entomologiczne* 19 (2): 85–92.
- BUNALSKI M. 2004. Scarabaeiformia. In: BOGDANOWICZ W., CHUDZICKA E., PILIPIUK I. & SKIBIŃSKA E. (Eds): *Fauna Polski – charakterystyka i wykaz gatunków*. Warszawa: Muzeum i Instytut Zoologii Polskiej Akademii Nauk, pp. 139–145.
- BURAKOWSKI B., MROCZKOWSKI M. & STEFAŃSKA J. 1983. Scarabaeoidea, Dascilloidea, Byrrhoidea i Parnoidea. *Chrzaszczki – Coleoptera. Katalog Fauny Polski. XXIII (9)*. Warszawa: Państwowe Wydawnictwo Naukowe. 294 p.
- BUSSLER H. & MÜLLER J. 2009. Vacuum cleaning for conservationists: a new method for inventory of *Osmoderma eremita* (Scop., 1763) (Coleoptera: Scarabaeidae) and other inhabitants of hollow trees in Natura 2000 areas. *Journal of Insect Conservation* 13: 355–359.
- BUYSSON H. 1923. Examen du terreau des arbres creux et appats naturels ou artificiels source inépuisable d'observations entomologiques. *Miscellanea entomologica* 27 (4–5): 25–29.
- CHEHLAROV E., GUÉORGUIEV B., HRISTOVSKI S., FANCELLO L., CVETKOVSKA-GORGIEVSKA A. & PRELIĆ D. 2016. New Country Records and Rare and Interesting Species of Coleoptera from the Balkan Peninsula. *Acta Zoologica Bulgarica* 68 (3): 331–338.
- COELLO P. & BAENA M. 2008. Nuevos datos sobre Trógidos de España (Coleoptera, Scarabaeoidea, Trogidae). *Boletín de la Sociedad Entomológica Aragonesa* 42: 193–196.
- FALCOZ L. 1914. Contribution a l'étude de la faune des microcavernes. Faune des terriers et des nids. *Annales de la Société Linnéenne de Lyon* 61: 59–245.
- FUENTE J. M. 1926. Catálogo sistemático-geográfico de los Coleópteros observados en la Península Ibérica, Pirineos propiamente dichos y Baleares. *Boletín de la Sociedad Entomológica de España* 9: 83–96.
- GAUDIN L. 1921. Captures de Coléoptères de France. *Bulletin de la Société entomologique de France* 8: 114–116.
- GERHARD K. 1909. Käfer in Nestern. *Entomologische Blätter* 5 (6): 128–132.
- GROSSO-SILVA J. M. & SERRANO A. R. M. 2000. Registros interesantes de Coleópteros (Insecta, Coleoptera) para Portugal (2ª nota). *Boletín de la Sociedad Entomológica Aragonesa* 27: 1–5.
- HADULLA K. 2003. Bemerkungen zu einigen Neu- und Wiederfunden für die Rheinprovinz (Col., Trogidae, Scarab., Curculion.). *Mitteilungen der Arbeitsgemeinschaft Rheinischer Koleopterologen (Bonn)* 13 (1–2): 40–42.
- HAROLD E. 1872. Monographie der Gattung Trox. *Coleopterologische Hefte* 9: 1–192.
- HICKS E. A. 1959. Check-list and bibliography on the occurrence of insects in birds' nests. Ames, Iowa: The Iowa State College Press. 681 p.
- HLADIL J. 1973. Příspěvek k faunistice Coleopter Moravy a Slovenska. *Zprávy Československé společnosti entomologické ČSAV* 9: 73–74.
- HOLZER E. 2002. Erstnachweise und Wiederfunde für die Käferfauna der Steiermark (VI) (Coleoptera). *Joanna Zoologie* 4: 67–78.
- HORION A. 1939. Studien zur deutschen Käferfauna III. Weitere Beispiele für das sporadische Auftreten thermophiler Käfer in Deutschland. *Entomologische Blätter* 35 (1): 3–18.
- HORION A. 1958. Faunistik der Mitteleuropäischen Käfer. Lamellicornia (Scarabaeidae – Lucanidae). IV. Überlingen-Bodensee: Kommissionsverlag Buchdruckerei Aug. Feyel. 343 p.
- HORION A. 1971. Elfter Nachtrag zum Verzeichnis der mitteleuropäischen Käfer. *Nachrichtenblatt der Bayerischen Entomologen* 6: 97–117.
- JANSSENS A. 1960. Insectes Coléoptères Lamellicornes. Faune de Belgique. Bruxelles: Institut Royal des Sciences Naturelles de Belgique. 411 p.
- JUŘENA D., BEZDĚK A. & TÝR V. 2000. Zajímavé nálezy listových brouků (Coleoptera: Scarabaeoidea) na území Čech, Moravy a Slovenska. *Klapalekiana* 36: 233–257.
- JUŘENA D., TÝR V. & BEZDĚK A. 2008. Příspěvek k faunistickému

- výzkumu listorohých brouků (Coleoptera: Scarabaeoidea) na území České republiky a Slovenska. Klapalekiana 44(Suppl.): 17–176.
- KEITH D. 2011. Sur *Trox perrisi* Fairmaire, 1868 en Turquie (Coleoptera, Scarabaeoidea, Trogidae). Entomologiste (Paris) 67 (4): 236.
- KÖHLER F. & Klausnitzer B. (Eds). 1998. Verzeichnis der Käfer Deutschlands. Entomologische Nachrichten und Berichte 4 (Suppl.): 1–185.
- KOREN T. 2015. The first record of *Trox perrisii* Fairmaire, 1868 in Croatia. Entomologia Croatica 19 (1–2): 31–35.
- KOVALENKO Y. N. 2012. New data on the distribution of *Trox perrisii* (Coleoptera, Trogidae) in Ukraine and bordering Russian territory. Vestnik Zoologii 46 (2): 184. (in Russian)
- KRÁL D. & RÉBL K. 2007. Faunistic records from the Czech Republic – 230. Coleoptera: Trogidae. Klapalekiana 43: 186.
- KRÁL D. & VITNER J. 1993. Faunistické síťové mapování listorohých brouků (Coleoptera: Scarabaeoidea) Československa – výběr výsledků získaných v letech 1989–1990. Klapalekiana 29: 25–36.
- LABATUT S. 2008. *Trox perrisi* Fairmaire. La boîte à bonnes bêtes n° 28. Bulletin de la Société linnéenne de Bordeaux 36 (2): 181.
- LIEBHEIT K. 1979. *Trox perrisi* Fairm. (Col. Scarabaeidae). Mitteilungen des Entomologischen Vereins Stuttgart 14: 85–87.
- LINDER A. 1968. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 41 (1–4): 211–232.
- LÓPEZ-COLÓN J. I. 1986. Sur quelques Scarabaeoidea (Coleoptera) de la faune espagnole. L'Entomologiste 42 (5): 289–294.
- LÓPEZ-COLÓN J. I. 1988. Nuevos datos sobre corología de Trogidae ibéricos. (Col. Scarabaeoidea). Nouvelle Revue d'Entomologie (N.S.) 5 (4): 329.
- LÖBL I. 1960a. Prispevek k poznanju koleopter Malých Karpát. Acta rerum naturalium Musei nationalis slovenici 6: 59–60.
- LÖBL I. 1960b. Zaujímavé nálezy chrobákov na Slovensku. Acta rerum naturalium Musei nationalis slovenici 6: 62–64.
- LUNDYSHEV D. S. 2014. A new record of Trogidae and Histeridae beetle species (Coleoptera) for Belorussia. Euroasian Entomological Journal 13 (6): 571. (in Russian)
- MARTÍN-PIERA F. & LÓPEZ-COLÓN J. I. 2000. Coleoptera – Scarabaeoidea. Fauna Ibérica. XIV (1). Madrid: Museo Nacional de Ciencias Naturales y Consejo Superior de Investigaciones Científicas. 526 p.
- MÉRIGUET B., JACQUET C. & ZAGATTI P. 2007. Domaine de Longchamp: Inventaire Entomologique 2006 – complété d'une liste arachnologique. Domaine de la Minière – Guyancourt: Office Pour Les Insectes Et Leur Environnement. 411 p.
- MERKL O. 1998. Vizsgálatok a Szarvasi Arborétum bogárfaunáján (Coleoptera). Crisicum 1: 168–179.
- MERKL O., BAGYURA J. & RÓZSA L. 2004. Insects inhabiting Saker (*Falco cherrug*) nests in Hungary. Ornis Hungarica 14 (1–2): 23–26.
- MROCKZOWSKI M. & STEFAŃSKA J. 1991. Coleoptera – Chrzęszcze. In: RAZOWSKI J. (Ed.): Wykaz Zwierząt Polski. XXXII (22–23). Kraków: Krakowskie Wydawnictwo Zoologiczne, pp. 7–197.
- MÜLLER J., BUSSLER H., BENSE U., BRUSTEL H., FLECHTNER G., FOWLES A., KAHLER M., MÖLLER G., MÜHLE H., SCHMIDL J. & ZABRANSKY P. 2005. Urwald relict species—Saproxylic beetles indicating structural qualities and habitat tradition. Waldoekologie online 2: 106–113.
- NÁDAI L. & MERKL O. 2004. Magyarországi irhabogárféléinek lelőhelyadatai (Coleoptera: Trogidae). Folia Historico Naturalia Musei Matraensis 28: 111–122.
- NICOLAS J.-L. 1999. Supplément à l'«Atlas des Coléoptères Scarabéides Laparosticti de France» de J.-P. Lumaret. Bulletin mensuel de la Société linnéenne de Lyon 68 (4): 87–92.
- NIKOLAJEV G. V. 2016. Taxonomic composition of the family Trogidae (Coleoptera: Scarabaeoidea) of the Russian fauna. Caucasian Entomological Bulletin 12 (1): 81–91. (in Russian)
- PAULIAN R. 1941. Coléoptères Scarabéides. Faune de France. XXXVIII. Paris: Éditions Lechevalier. 240 p.
- PAULIAN R. 1943. Les Coléoptères. Formes – Moeurs – Role. Paris: Payot. 396 p.
- PAULIAN R. 1959. Coléoptères Scarabéides. Faune de France. LXIII (2). Paris: Éditions Lechevalier. 298 p.
- PAULIAN R. & BARAUD J. 1982. Faune des Coléoptères de France. Lucanoidea et Scarabaeoidea. II. Paris: Éditions Lechevalier. 477 p.
- PETROVITZ R. 1969. Ergänzungen und Berichtigungen zu: Ad. Horion: Faunistik der mitteleuropäischen Käfer, VI/1958, Lamellicornia. Zeitschrift der Arbeitsgemeinschaft österreichischer Entomologen 21 (4): 104–105.
- PITTINO R. & BEZDĚK A. 2016. Trogidae. In: LÖBL I. & LÖBL D. (Eds): Catalogue of Palaearctic Coleoptera. Scirtoidea, Dascilloidea, Buprestoidea and Byrrhoidea. Revised and Updated Edition. IV. Leiden-Boston: Brill, pp. 53–58.
- RESL K. 1998. Faunistické zprávy z Moravy – 8. Coleoptera: Trogidae, Carabidae. Sborník Přírodovědného Klubu v Uherské Hradišti 3: 117.
- RÖSSNER E. 2012. Die Hirschkäfer und Blatthornkäfer Ostdeutschlands (Coleoptera: Scarabaeoidea). Erfurt: Verein der Freunde und Förderer des Naturkundemuseums Erfurt e.V. 508 p.
- SÁEZ BOLAÑO J. A. & BLANCO VILLERO J. M. 2006. Primera cita de *Trox (Trox) perrisii* (Fairmaire, 1868) (Coleoptera: Trogidae) para Extremadura (España). Boletín de la Sociedad Entomológica Aragonesa 39: 292.
- SCHAUFUSS C. 1907. “Rundschau”. (Besprechung der Arbeiten von Bickhardt und Joy). Entomologisches Wochenblatt 24 (10): 37.
- SCHOLZ R. & HINKE O. 1919. Käfer in Bauten und Nestern. Jahresheft des Vereins für schlesische Insektenkunde 10–12: 38–46.
- SCHUH R. 2013. Beitrag zur Kenntnis der xylobionten Käfer (Coleoptera) des Fasangartens in Wien (Österreich). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 65: 69–79.
- SHOKHIN I. V. 2007. Contribution to the fauna of lamellicorn beetles (Coleoptera, Scarabaeoidea) of Southern Russia, with some nomenclatural changes in the family Scarabaeidae. Caucasian Entomological Bulletin 3 (2): 105–185. (in Russian)
- SHOKHIN I. V. & PUSHKIN S. V. 2010. Trogidae. In: ZAMOTAJLOV A. S. & NIKITSKY N. B. (Eds): Fauna conspecta of Adygeya. Coleopterous insects (Insecta, Coleoptera) of Republic of Adygeya (annotated catalogue of species). Maykop: Adygei State University Publishers, pp. 106–107. (in Russian)
- STADLER H. 1924. Einiges über die Tierwelt Unterfrankens II. Beitrag. Archiv für Naturgeschichte 90a (1): 169–203.

- STEBNICKA Z. 1983. Jelonkowate – Lucanidae, Modzelatkowate – Trogidae. Chrząższe – Coleoptera. Klucze do oznaczania owadów Polski. XIX (26–27). Warszawa: Państwowe Wydawnictwo Naukowe. 26 p.
- ŠUSTEK Z. & KRIŠTOFÍK J. 2009. Beetles (Insecta: Coleoptera) in nests of five species of passeriform birds (*Carduelis chloris*, *Troglodytes troglodytes*, *Turdus merula*, *Turdus philomelos*, *Turdus pilaris*) in central Europe. *Oltenia Journal of Studies in Natural Sciences* 25: 97–104.
- TAMISIER J.-P. 2000. *Trox perrisi* Fairmaire. La boîte à bonnes bêtes. *Bulletin de la Société linnéenne de Bordeaux* 28 (3): 153.
- TENENBAUM S. 1938. Nowe dla Polski oraz rzadsze gatunki i odmiany chrząszczy. *Fragmenta Faunistica Musei Zoologici Polonici* 3 (19): 415–429.
- TESAŘ Z. 1957. Brouci listoroží – Lamellicornia. Scarabaeidae – Vrúbounovití. *Fauna ČSR. XI* (2). Praha: Nakladatelství Československé Akademie Věd. 326 p.
- VASKO B. 2010. Fauna and ecology of Lamellicornia beetles (Coleoptera: Scarabaeoidea) of the Right-Bank Ukraine. *The Kharkov Entomological Society Gazette* 18 (1): 4–86.
- WURST C. 2008. Stellas Pseudoskorpion *Anthrenochernes stellae* Lohmander, 1939 in Baden-Württemberg (Pseudoscorpionida: Chernetidae) – zugleich ein Beitrag zur baumhöhlenbewohnenden Käferfauna des Landes.
- ZIANI S., BEZDĚK A., BRANCO T., HILLERT O., JÁKL S., KRÁL D., MANTIČ M., RÖSSNER E. & SEHNAL R. 2015. New country records of Scarabaeoidea (Coleoptera) from the Palearctic Region. *Insecta Mundi* 0409: 1–36.
- ZÍDEK J. 2013. Checklist and bibliography of the Trogidae (Coleoptera: Scarabaeoidea). *Insecta Mundi* 0314: 1–38.
- ZÍDEK J. 2017. Updated checklist and bibliography of the Trogidae (Coleoptera: Scarabaeoidea). *Folia Heyrovskyana* 25 (1): 93–127.

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