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New records of beetle species (Coleoptera) from the Polish part of Białowieża Forest with special emphasis on the genus *Episernus* C.G. Thomson, 1863 (Ptinidae) in Central Europe

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Abstract: This paper presents data on 23 beetle species recorded for the first time from the Białowieża Forest (Polish part), and among them two species new for the fauna of Poland. All the beetles were collected using multifunnel (Lindgren) traps, placed in the the selected sites of the study area in 2018. Collected species belong to 13 families: Carabidae (1 species), Corylophidae (1), Curculionidae (1), Dermestidae (1), Elateridae (2), Eucnemidae (1), Laemophloeidae (1), Latridiidae (2), Nitidulidae (1), Ptinidae (3), Staphylinidae (7), Throscidae (1) and Trogossitidae (1). *Episernus angulicollis* C. G. Thomson, 1863 and *E. tatarinovae* Toskina et Nikitsky, 2003 (Ptinidae) are recorded for the first time from Poland, and *Microrhagus pyrenaeus* Bonvouloir, 1872 (Elateridae) and *Leptusa norvegica* Strand, 1941 (Staphylinidae), for the second time. Distribution of all the above species in Poland is briefly discussed and details on the biology of some of them are given. An identification key for the species of the genus *Episernus* C. G. Thomson, 1863 from Central Europe is presented. Species diversity of beetles in the Polish part of Białowieża Forest is estimated based on published data.

Key words: beetles, Lindgren funnel trap, faunistics, new records, distribution, Poland

Introduction

This article is a continuation of the series of new faunistic records of beetles in the Białowieża Primeval Forest. In the recent work we presented data on 69 species of Coleoptera recorded for the first time in this area, and among them one species new for the Polish fauna (Plewa *et al.* 2019). In that article we presented the most important results of a study carried out in 2017, and a brief overview of coleopterological studies in the Białowieża Forest (Plewa *et al.* 2019). Therefore, in the introduction of the present

article, we refrain from repeating similar content and focus exclusively on the information on the biodiversity of this region based on the material collected in 2018. In addition to new data records for Poland and the Polish part of Białowieża Forest, we also present a key to the identification of some Central European species of the genus *Episernus* C. G. Thomson, 1863.

Material and Methods

All the specimens were collected using Lindgren funnel traps, i.e. 12-funnel purple traps covered with PTFE to enhance trap slipperiness (see, Plewa *et al.* 2019 for trap photo). Traps were equipped with a collection chamber half-filled with ethylene glycol to preserve captured insects. A total of 328 traps were displayed from late-April to late-September of 2018 in selected sites of Białowieża Forest (Fig. 1). Traps were hung at the lower branches of trees (i.e., one trap per tree) at a height of 2–7 m (mean = 5.1 m) above ground level, and were next emptied every 1–1.5 month.

Beetle species were identified by all the authors, and determinations of some taxa were further confirmed by Radosław Plewa (RP) – Latridiidae, Szymon Konwerski (SK) – Leiodidae, Roman Królik (RK) – Ciidae, Andrzej Melke (AM) – Staphylinidae, Marek Przewoźny (MP) – Eucnemidae, Rafał Ruta (RR) – Corylophidae, Andrzej Lasoń (AL) – Nitidulidae, Henryk Szołtys (HS) – Elateridae, and Benoit Dodelin (BD) – Ptinidae.

Taxonomic nomenclature follows the Catalogue of Palaearctic Coleoptera (Löbl I. & Smetana 2003, 2004, 2007, 2011) with further amendments (Löbl I. & Löbl D. 2015; Rücker & Johnson 2007). The list of families and species is presented in alphabetical order. The locality names: Białowieża, Browsk, Hajnówka, refer to the areas administered by Białowieża Forest District, Browsk Forest District, and Hajnówka Forest District, respectively, while BNP refers to the area of Białowieża National Park. Symbols in square brackets are: (1) designations of the forest management units according to the territorial division of the Polish part of Białowieża Forest (hereafter subcompartments); (2) codes of forest habitat type (i.e. basic unit of the typological classification of forests applied in Poland) in which particular traps were installed: Bśw – fresh coniferous, BMśw – mixed fresh coniferous, BMw – mixed humid coniferous, Bw – humid coniferous, Lśw – fresh deciduous, LMśw – mixed fresh deciduous, LMw – mixed humid deciduous, Lw – humid deciduous, Ol – alder forest, OlJ – ash-alder forest; (3) name and (4) age of dominant tree species within given forest subcompartment; (5) tree species on which the trap was installed.

The location of each subcompartment within the particular UTM (Universal Transverse Mercator) square is visualized in Figure 1. Numbers of collected individuals of beetles are followed by the information about the trapping period during which they were captured.

Taxa overview

Family: Carabidae

- *Dromius laeviceps* Motschulsky, 1850

Material examined. Hajnówka: [515Cc; Lw; *Picea abies* (L.) H. Karst; 60; *Carpinus betulus* L.], 1 indiv., 8.08–19.09.2018, det. HS.

Remarks. Thus far, the species has been recorded from central and eastern parts of the country (Burakowski *et al.* 1974), and was recently discovered in the Eastern Beskid Mountains (Taszakowski *et al.* 2019) and from the border between the southern part of Podlasie and the Lublin Upland (Tylkowski 2014).

Family: Corylophidae

- *Arthrolips obscura* (Sahlberg C.R., 1833)

Material examined. BNP: [136Ca; LMśw; *Pinus sylvestris* L.; 78; *C. betulus*], 1 indiv.,

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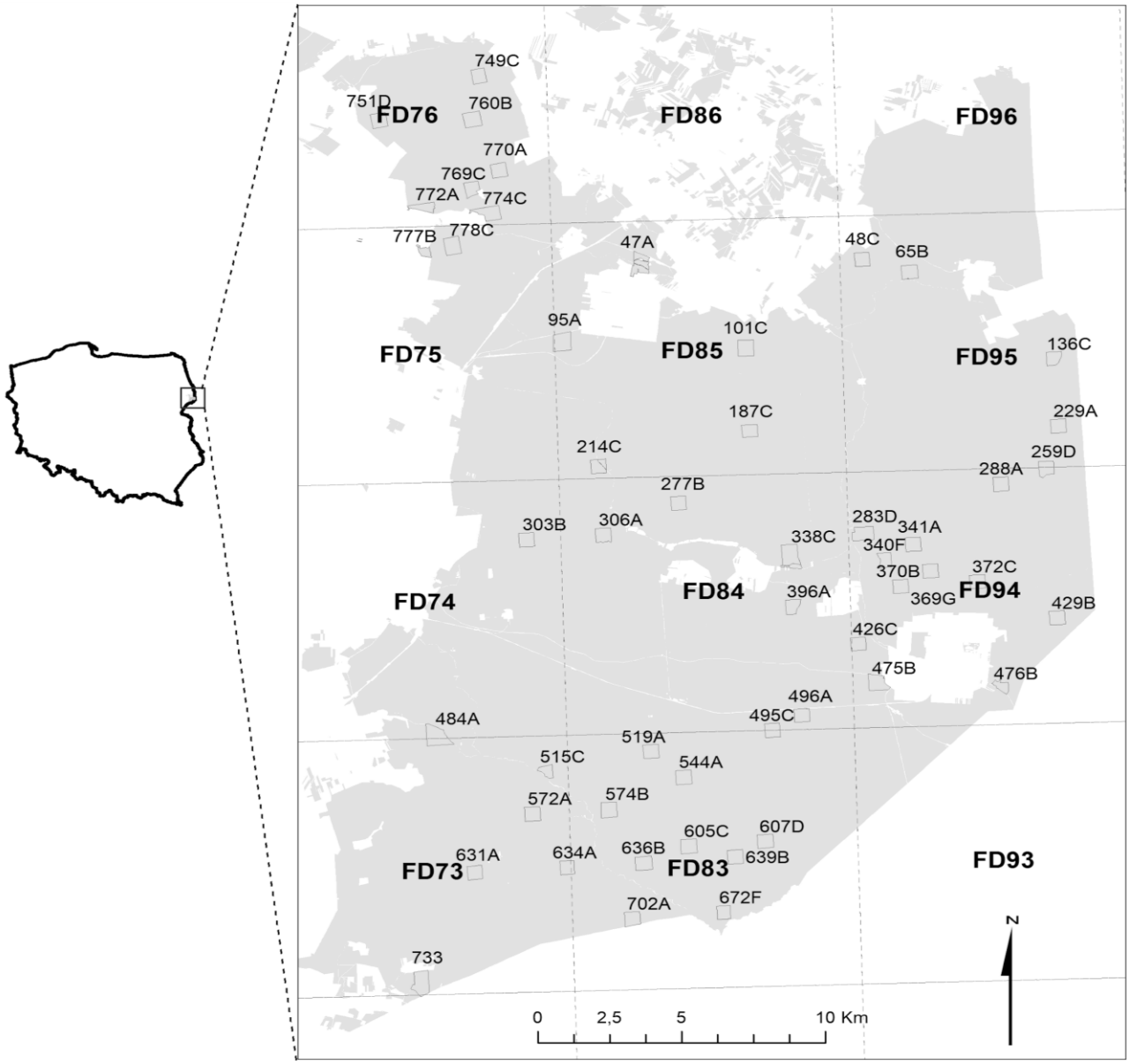

Fig. 1. Localization of study sites within Polish part of the Białowieża Forest (perpendicular lines delineate UTM squares).

17.04–28.05.2018, det. RR; Browsk: [778Cb; Lśw; *C. betulus*; 83; *C. betulus*], 1 indiv., 17.04–22.05.2018, det. RR; Hajnówka: [636Ba; Lw; *Alnus glutinosa* Gaertn.; 113; *C. betulus*], 1 indiv., 17.04–30.05.2018, det. RR.

Remarks. At the turn of 19th and 20th centuries, the species has been reported from two localities in southeastern Poland (i.e. Lower Silesia and Western Beskid Mts.) (Burakowski *et al.* 1986c). Later, the species was recorded from Roztocze (Borowiec & Iwan 1989), the Wielkopolska-Kujawy Lowland (Majewski 1994), and Lower Silesia (Trzebnickie Hills) (Ruta *et al.* 2010).

Family: Curculionidae

- *Scolytus ensifer* Eichhoff, 1881

Material examined. Browsk: [777Bb; Lw; *A. glutinosa*; 55; *C. betulus*], 1 indiv., 25.06–7.08.2018, det. RK.

Remarks. Thus far, the species has been recorded from several localities throughout the country (Mokrzycki *et al.* 2011). Larvae develop exclusively on elms *Ulmus* spp., where they inhabit thin branches (Nunberg 1954).

Family: Dermestidae

- *Attagenus pantherinus* (Ahrens, 1814)

Material examined. BNP: [283Db; Ol; *A. glutinosa*; 110; *Fraxinus excelsior* L.], 1 indiv., 17.04–29.05.2018, det. RK; Browsk: [774Cn; Lśw; *Quercus robur* L.; 83; *C. betulus*], 1 indiv., 17.04–22.05.2018, det. SK.

Remarks. In Poland, the species is relatively rarely recorded, although based on the number of records to-date it can be assumed that it occurs in most parts of the country. The distribution of *A. pantherinus* in Poland was summarized by Ruta *et al.* (2005). Larvae develop inside nests of various aculeate Hymenoptera, hence the adults are often found near them, i.e. on wooden buildings and on loess or clay walls (Burakowski *et al.* 1986a).

Family: Elateridae

- *Lacon querceus* (Herbst, 1784)

Material examined. BNP: [283Db; Ol; *A. glutinosa*; 110; *F. excelsior*], 1 indiv., 17.04–29.05.2018, det. RK.

Remarks. A rare species, reported from seven zoogeographical regions in Poland (Tarnawski 2000). Most of the localities of L. *querceus* are situated in western Poland, except for single records from the Masurian Lake District (Augustów) (Buchholz & Ossowska 1992), the Mazovian Lowland (Warsaw) (Burakowski *et al.* 1985), and the Małopolska Upland (Spała Reserve) (Byk *et al.* 2013). The species is typically associated with old, hollowed oaks. Larvae are predatory and live in decaying wood infested by brown-rot fungi, in particular by *Laetiporus sulphureus* (Bull. Et Fr.) Murr. (Burakowski *et al.* 1985).

- *Stenagostus rhombeus* (Olivier, 1790)

Material examined. Hajnówka: [702Ab; LMśw; *Betula pendula* Roth; 77; *C. betulus*], 1 indiv., 2.07–7.08.2018, det. SK.

Remarks. A rare species, known from several localities across the country, i.e. from the Baltic Coast (Wolin island), the Pomeranian Lake District, Lower and Upper Silesia, and the Wielkopolska-Kujawy Lowland (Tarnawski 2000, Smolis 2008). The species is trophically associated with deciduous trees, especially oaks, beeches, limes and elms. Larvae feed under the bark or in decaying wood, often in corridors created by larvae of the longhorn beetles – Cerambycidae (Burakowski *et al.* 1985).

Family: Eucnemidae

- *Microrhagus pyrenaeus* Bonvouloir, 1872

Material examined. Białowieża: [672Fb; Ol; *A. glutinosa*; 108; *B. pendula*], 1 indiv., 21.05–25.06.2018, det. RR & RP; [672Fb] 1 indiv., 25.06–6.08.2018, det. RP.

Remarks. The species was recently reported as new species for the Polish fauna from several localities in the Lublin Upland (Hilszczański *et al.* 2015). Thus, the present locality of *M. pyrenaeus* in the Białowieża Forest is the first record from this Region. Larvae develop in wood of deciduous trees, mainly of hornbeams, oaks, and alders, infested with white-rot fungi (Muona 1993, Brustel & Van Meer 2008).

Family: Laemophloeidae

- *Notolaemus unifasciatus* (Latreille, 1804)

Material examined. Browsk: [774Cn; Lśw; *Q. robur*; 83; *C. betulus*], 1 indiv., 25.06–6.08.2018, det. MP.

Remarks. Recent records on this species come from the 1960s from Lower Silesia (Burakowski *et al.* 1986b). Larvae develop under the bark of dead oaks and beeches, and were also found in the corridors of the scolytid beetle, *Dryocoetes villosus* (Fabricius, 1792) (Ślipiński 1982).

Family: Latridiidae

- *Corticaria umbilicata* (Beck, 1817)

Material examined. Browsk: [774Cn; Lśw; *Q. robur*; 83; *C. betulus*], 1 indiv., 25.06–6.08.2018, det. RP.

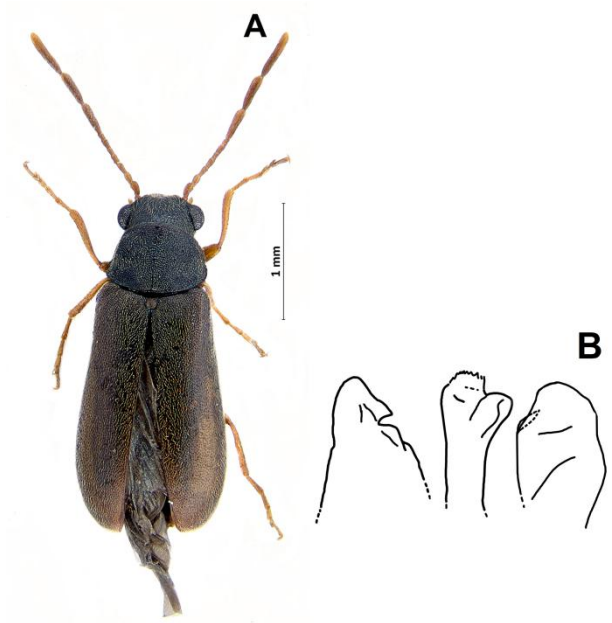

Fig. 2. *Episernus tatarinovae*: A) habitus of female; B) apex of the male aedeagus (left – right paramere; center – aedeagus apex; right – habitus of paramere) (drawings by B. Dodelin).

Remarks. To date, the species has been recorded from four regions in Poland, i.e., the Masurian Lake District, the Mazovian Lowland, the Małopolska Upland, and Roztocze (Rücker & Borowiec 1990, Majewski 1997, Plewa & Miłkowski 2018). Furthermore, the species has been found in several localities in western Poland in the late 19th and early 20th century (Burakowski *et al.* 1986c). It was also recorded several times in the Belarusian part of the Białowieża Forest (Tsinkevich 2017). This species is most often collected in sites with accumulation of dry grasses or in haystacks (Rücker 2018).

- *Melanophthalma rispini* Rücker & Johnson, 2007

Material examined. Białowieża: [338Cg; Lśw; *P. abies*; 92; *Corylus avellana* L.], 1 indiv., 27.06–7.08.2018, det. RP; Browsk: [760Bf; Lw; *Q. robur*; 103; *C. betulus*], 1 indiv., 22.05–25.06.2018, det. RP.

Remarks. Thus far, the species has been known from three regions of Poland: the Wielkopolska-Kujawy Lowland (Jałoszyński & Przewoźny 2013), the Mazovian Lowland (Plewa 2018) and the Małopolska Upland (Plewa & Miłkowski 2018). Based on present record, Białowieża Forest is the easternmost locality of *M. rispini* in Europe.

Family: Nitidulidae

- *Epuraea distincta* (Grimmer, 1841)

Material examined. Hajnówka: [306Ad; LMw; *P. abies*; 123; *A. glutinosa*], 1 indiv., 17.04–22.05.2018, det. AL.

Remarks. The species is known only from the Eastern Beskid Mts., the Masurian Lake District (Nunberg 1976), the Świętokrzyskie Mts. (Borowski 2007) and one unspecified locality (Borowski 2006). It was also recorded from the Belarusian part of the Białowieża Forest (Tsinkevich 1998).

Family: Ptinidae

- *Episernus tatarinovae* Toskina et Nikitsky, 2003 (Fig. 2)

Material examined. BNP: [229Af; Bśw; *P. sylvestris*; 26; *P. sylvestris*], 1 indiv. (male), 17.04–28.05.2018, det. BD & RP; Białowieża: [495Ca; LMśw; *Pinus sylvestris*; 92; *C. betulus*], 1 indiv. (female), 17.04–22.05.2018, det. BD & RP.

Remarks. New species for the fauna of Poland. Thus far, it was known only from the northern European part of Russia (Zahradník 2007), namely from the Pechora-Ilych Nature Reserve (Shaytanovka) in the Republic of Komi (Toskina & Nikitsky 2003). Thus, the Białowieża Forest is second known locality of *E. tatarinovae*; distant of about 2300 km from species' locus typicus.

Biology of the species is practically unknown. The adult beetles were captured using barrier traps installed on spruce and larch (Tatarinova 2002).

In Poland, two further *Episernus* species occur, i.e. *E. granulatus* J. Weise, 1887 and *E. striatellus* (Brisout de Barneville, 1863). Both species are extremely rarely recorded. *E. granulatus* was described from Poland (Eastern Sudetes, Kłodzko) but remains unrecorded since more than 100 years (Weise

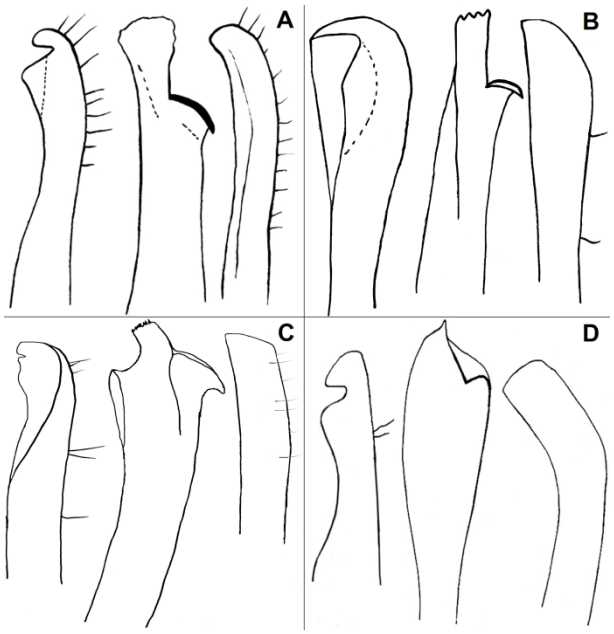

Fig. 3. Apex of male aedeagus of: A) *Episernus gentilis*, B) *E. striatellus*, C) *E. taygetanus alpestris*, D) *E. granulatus*. In each panel, figures represent: left – right paramere; center – aedeagus apex; right – habitus of paramere (drawings by B. Dodelin).

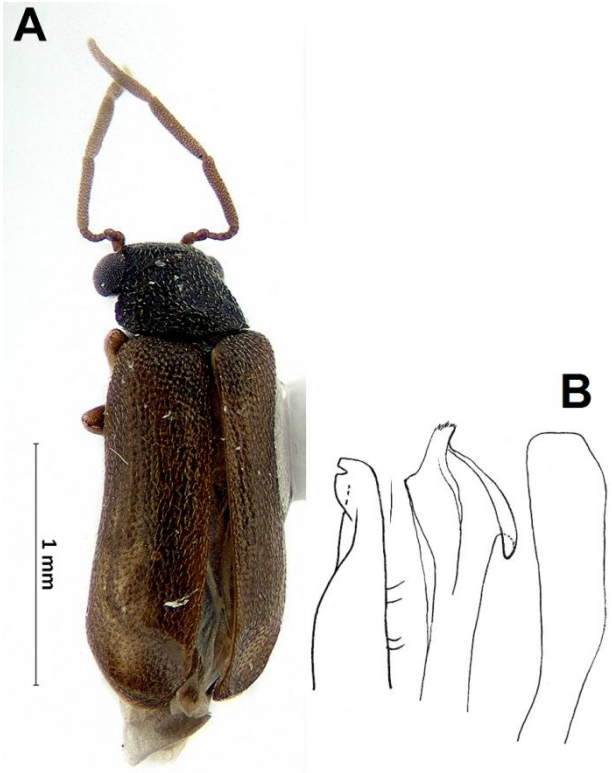

Fig. 4. *Episernus angulicollis*: A) habitus of male, B) apex of the male aedeagus (left – right paramere; center – aedeagus apex, right – habitus of paramere), drawings by B. Dodelin.

1887, Burakowski *et al.* 1986a). Thus, the species was listed in the Polish red list of endangered animals, with the category EX? (presumably extinct) (Pawłowski *et al.* 2002). In Poland, *E. striatellus* was last recorded in late 20th century from the Małopolska Upland (Borowski 1993, 2016).

Morphological description. Antennae with the 3rd and 4th segment elongated, each 2 to 2.2 times longer than wide. Segments 5 and 6, 1.2 times and 1.6 times longer than wide, respectively. Frons smooth and shiny, frons sides and vertex strongly granulated, forehead with a narrow longitudinal groove. Pronotum with rounded granules, spaced 0.5 to 1 times their diameter on the disc, surface between punctures covered with dense micro-reticulation. Elytrae covered with flat-top granules, 2 to 3 times wider than the pronotum's granules. Spaced 0.5 to 1 times their diameter, surface between punctures covered with dense micro-reticulation.

- *Episernus angulicollis* C.G. Thomson, 1863 (Fig. 4)

Material examined. Browsk: [749Cb; LMśw; *P. sylvestris*; 50; *C. betulus*], 1 indiv. (male), 17.04–22.05.2018, det. BD & RP.

Remarks. New species for the fauna of Poland. It is characterized by boreal-montane distribution and is known from most of Europe. In the northern parts of its range it was recorded from Norway, Finland, Sweden, the Northern European Russia and parts of Asia (Eastern Siberia). In southern Europe, the species is known from France, Austria, Italy and Switzerland (Zahradník 2007, Dodelin 2016).

Biology of *E. angulicollis* is partly known. Adults were collected in June and July, nevertheless present data suggest earlier phenology. Larvae develop in thin (ca. 1–2 cm) branches of Norway spruce *Picea abies* (Dodelin 2016). Furthermore, larval hosts include several other tree species, i.e. Scots pine *Pinus sylvestris*, Swiss pine *P. cembra* or mountain pine *P. mugo* (Saalas 1917, Holzer 2010).

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Identification key to Central European *Episernus* species

In the subfamily Ernobiinae subfamily, *Episernus* has the following characters: antennae consisting of ten segments (rarely nine), terminated by a three-segment club. Males can be recognized by their large, prominent eyes, as well as their antennae with the 3 last segments very long, at least twice as long as all the previous articles. Females' eyes are less protruding and the antennae have shorter clubs. European species of *Episernus* (males and females) may be distinguished by the following features:

1. Pronotum with the rear angles rounded. Lateral edge with a continuous keel widely flattened posteriorly. Pronotum marked with a smooth, longitudinal, unpressed line. Two weak depressions from either side of the disc, close to the basis — *Episernus tatarinovae* (Fig. 2)
   Distribution: Northern European part of Russia, Poland: Białowieża Forest.

1A. Pronotum with the rear angles rounded. Lateral edge without keel — 2

2B. Pronotum with distinct rear angles, placed in front of the base, in general angular and flattened but sometimes reduced to an acute point. Lateral edge with a keel reaching the middle of pronotum — 3

2. Base of elytra with no or few points aligned. Sculpture of dense and homogeneous, rounded granules, spaced apart less than their diameter, the surface between the granules smooth and shiny. Pronotum regularly convex, without noticeable relief or depression. Angularly widens at the anterior quarter. Sometimes with a median smooth line poorly indicated, pronotum brown, lighter than elytra. Head fully covered with fine granulation. Aedeagus (Fig. 3A) — *Episernus gentilis*
   Distribution: Western Europe, at low altitudes.

2A. Base of elytra with well-marked punctate striations. Sculpture of fine and superficial granules, spaced by 2 to 3 times their diameter on the elytra, 1 time their diameter on the pronotum. Pronotum: ♂ with 2 strong transverse depressions marking 3 reliefs; ♀ clearly oval with a more or less marked transversal basal groove. Pronotum and elytra concolor, light brown. Head with weak granulation, smooth and shiny in front of the forehead (♂), or entirely (♀). Aedeagus (Fig. 3B) — *Episernus striatellus*
   Distribution: Europe, at low altitudes.

3. Antennae with the 3rd segment 1.3 times longer than wide, 4th segment slightly shorter than wide. Forehead regularly granulated, without (♂) or with (♀) circular depression. Aedeagus (Fig. 3C) — *Episernus taygetanus alpestris*
   Distribution: France: Alps: Izoard, Briançonnais.

3A. Antennae with elongated 3rd and 4th segment, each 1.5 to 2 times longer than wide — 4

4. Antennae with the 5th and 6th segment 2 times longer than wide. Sculpture of elytra formed by small, well-defined cylindrical granules, spaced by distance equal to their diameter, on a smooth and shiny background. Sculpturation of the pronotum of the same structure except in the postero-lateral quarter where it is more complindiv. Aedeagus (Fig. 3D) — *Episernus granulatus*
   Distribution: Central European mountains, Eastern Alps.

4A. Antennae with the 5th and 6th segments as long as wide. Disc of elytra with few aligned points, more or less marked. Sculpture of elytra formed by pyramidal granules with contact at the base. Sculpture of the pronotum with round granules spaced by distance of 1 to 2 times of their diameter, with micro-reticulation in-between. Laterally, the granules disappear almost completely and are replaced by the micro-reticulation — *Episernus angulicollis* (Fig. 4)
   Distribution: Boreal Europe, high altitudes of the Alps and Pyrenees.

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- *Ernobius pini* (Sturm, 1837)

Material examined. Browsk: [769Cg; Lw; *P. abies*; 63; *P. abies*; 1 indiv., 22.05–25.06.2018, det. HS; Hajnówka: [631Ac; Lw; *P. abies*; 47; *P. abies*], 1 indiv., 17.04–30.05.2018, det. HS.

Remarks. Until the mid-20th century, the species has been recorded mainly from western Poland (Burakowski *et al.* 1986a). More recently, the species was recorded from single localities in the eastern part of the country (Knyszyńska Forest – Kopna Góra) by Kubisz and Szwałko (1991) and from central Poland (Rogów) by Borowski (2016). Larvae feed on pith of thin branches of Scots pine, which were previously weakened by larvae of bark beetles. Adults were observed from May to July, often near the breeding sites of larvae (Burakowski *et al.* 1986a).

Family: Staphyliniade

- *Bibloplectus tenebrosus* (Reitter, 1880)

Material examined. Białowieża: [338Cg; Lśw; *P. abies*; 92; *C. avellana*], 1 indiv., 17.04–23.05.2018; [639Bi; Lśw; *P. abies*; 36; *C. betulus*], 1 indiv., 17.04–22.05.2018; [429Bk; LMśw; *C. betulus*; 53; *C. betulus*], 1 indiv., 21.05–25.06.2018; [395Bd; Lw; *A. glutinosa*; 93; *A. glutinosa*], 1 indiv., 23.05–27.06.2018, det. AM; BNP: [341Ab; Lw; *C. betulus*; 120; *C. betulus*], 1 indiv., 17.04–25.05.2018; [259Di; OlJ; *A. glutinosa*; 133; *C. betulus*], 1 indiv., 28.05–29.06.2018, det. AM; Browsk: [769Cg; Lw; *P. abies*; 63; *P. abies*], 1 indiv., 22.05–25.06.2018; [774Cn; Lśw; *Q. robur*; 83; *C. betulus*], 2 exx., 25.06–6.08.2018, det. AM; Hajnówka: [214Cj; OlJ; *Q. robur*; 30; *A. glutinosa*], 1 indiv., 3.07–9.08.2018, det. AM.

Remarks. The species is known from three regions in Poland: the Wielkopolska-Kujawy Lowland (Burakowski *et al.* 1978, Renner & Messutat 2007), the Kraków-Wieluń Upland (Burakowski *et al.* 1978, Pawłowski *et al.* 1994) and the Mazovian Lowland (Mazur *et al.* 2010).

- *Eusphalerum tenenbaumi* (Bernhauer, 1932)

Material examined. Hajnówka: [572Af; Bw; *P. sylvestris*; 76; *C. betulus*], 1 indiv., 17.04–29.05.2018, det. AM.

Remarks. The species is known from five regions located in the southern part of Poland: Western Sudeten Mts. (Mazur 1995), Western Beskid Mts. (Kubisz & Szafraniec 2003), Bieszczady Mts. (Szujecki 1996, Pawłowski *et al.* 2000) and the Świętokrzyskie Mts. (Byk 2007, Mokrzycki 2007). Older reports (from the turn of the 19th and 20th centuries) come from the Eastern Beskid Mts., Kraków-Wieluń Upland, the Mazovian Lowland, Pieniny Mts. and Upper Silesia (Burakowski *et al.* 1979).

- *Gyrophaena lucidula* Erichson, 1837

Material examined. Białowieża: [605Cr; Ol; *A. glutinosa*; 40; *A. glutinosa*], 1 indiv., 25.06–7.08.2018, det. AM.

Remarks. The species is known from scattered localities across the country. Recent data on *G. lucidula* come from the Lublin Upland (Staniec 1994, 1998), the Pomeranian Lake District (Ruta & Melke 2002, Ruta 2009), the Małopolska Upland (Borowski 2006) the Wielkopolska-Kujawy Lowland (Renner & Messutat 2007), and Pieniny Mts. (Chachuła *et al.* 2019). The species is found inside bodies of wood-decaying fungi, especially those of *Polyporus squamosus* (Huds.) Fr. and *Pluteus cervinus* (Schaeff.) Fr., among decaying leaf-litter, and sometimes close to small water reservoirs and on the banks of rivers (Burakowski *et al.* 1981).

- *Ischnoglossa elegantula* (Mannerheim, 1830)

Material examined. Białowieża: [429Bk; LMśw; *C. betulus*; 53; *C. betulus*], 1 indiv., 21.05–25.06.2018; [496Ac; BMśw; *P. abies*; 46; *P. abies*], 1 indiv., 21.05–26.06.2018; [475Bb; LMśw; *P. abies*; 163; *C. betulus*], 1 indiv., 22.05–26.06.2018; [426Cj; Lw; *P. abies*; 173; *C. betulus*], 1 indiv., 23.05–28.06.2018,

det. AM; BNP: [372Ca; Lw; *Q. robur*; 250; *C. avellana*], 1 indiv., 17.04–23.05.2018; [340Fb; Lw; *Q. robur*; 150; *C. betulus*], 1 indiv., 17.04–29.05.2018; [372Ca] 1 indiv., 28.06–6.08.2018, det. AM; Browsk: [48Cg; Lśw; *Q. robur*; 85; *C. betulus*], 1 indiv., 17.04–23.05.2018; [47Ab; BMśw; *P. sylvestris*; 48; *C. betulus*], 1 indiv., 17.04–24.05.2018; [770Ab; Lw; *A. glutinosa*; 58; *C. betulus*], 1 indiv., 25.06–6.08.2018, det. AM; Hajnówka: [733f; Ol; *A. glutinosa*; 97; *C. betulus*], 1 indiv., 17.04–29.05.2018; [634Ac; LMśw; *Q. robur*; 53; *C. betulus*], 1 indiv., 17.04–29.05.2018; [303Ba; Lśw; *P. abies*; 93*; P. abies*, 1 indiv., 17.04–23.05.2018; [214Cj; OlJ; *A. glutinosa*; 30; *A. glutinosa*], 1 indiv., 17.04–22.05.2018, det. AM.

Remarks. The species inhabits boreal and montane regions and is known from Scandinavia, Lithuania, the European part of Russia, and the Italian Alps (Smetana 2004). It has recently been recorded from the Czech Republic (Vávra 2011) and Slovakia (Benedikt *et al.* 2015). In Poland, it is known from two localities: the Eastern Beskid Mts. (Turnica) (Buchholz & Melke 2018) and the Babia Góra National Park (Szafraniec *et al.* 2019). Knowledge about the biology and ecology of *I. elegantula* is limited, but it is perhaps similar to other species in the genus. It is presumed that the species may inhabit forests with significant amounts of dead wood of fir and spruce (Buchholz & Melke 2018). The present data from the Białowieża Forest are the third country records of this species in Poland.

- *Leptusa norvegica* Strand, 1941

Material examined. Białowieża: [277Bd; Lw; *F. excelsior*; 173; *C. betulus*], 1 indiv., 28.06–9.08.2018, det. AM; BNP: [288Aa; Lw; *P. abies*; 100; *C. betulus*], 1 indiv., 25.05–29.06.2018; [370Bb; Lw; *C. betulus*; 120; *C. avellana*], 1 indiv., 29.05–28.06.2018, det. AM; Browsk: [101Cb; LMśw; *P. sylvestris*; 42; *C. betulus*], 1 indiv., 25.05–28.06.2018; [749Cb; LMśw; *P. sylvestris*; 50; *C. betulus*], 1 indiv., 25.06–6.08.2018; [95Aa; Lśw; *P. abies*; 93; *C. betulus*], 1 indiv., 26.06–7.08.2018; [65Bf; Lśw; *C. betulus*; 163; *C. betulus*], 1 indiv., 27.06–8.08.2018; [187Cd; BMw; *P. abies*; 78; *C. betulus*], 1 indiv., 28.06–9.08.2018; [101Cb; LMśw; *P. sylvestris*; 42; *C. betulus*], 1 indiv., 6.08–17.09.2018, det. AM; Hajnówka: [303Ba; Lśw; *P. abies*; 93; *P. abies*], 1 indiv., 3.07–10.08.2018, det. AM.

Remarks. The species is known from several localities in central-west Europe (Great Britain, Germany, Denmark, the Netherlands, Slovakia), Scandinavia (Sweden, Norway and Finland), and eastern Siberia (Pace 1989, Smetana 2004, Mazur 2005). In Poland, *L. norvegica* was recorded only from one site in the Wielkopolska-Kujawy Lowland, i.e. Mosina near Poznań. The species was found under the bark of standing Scots pine with galleries of *Arhopalus rusticus* (Linnaeus, 1758) (Coleoptera: Cerambycidae) larvae (Mazur 2005). The present data from the Białowieża Forest are the second country records of this species.

- *Quedius ochripennis* (Ménétriés, 1832)

Material examined. Browsk: [751Df; OlJ; *A. glutinosa*; 103; *C. betulus*], 1 indiv., 22.05–25.06.2018, det. AM.

Remarks. In Poland, the species was reported from the Wielkopolska-Kujawy Lowland, the Lower and Upper Silesia, the Eastern and Western Sudeten Mts. and the Eastern Beskid Mts. (Burakowski *et al.* 1980, Nowosad 1990). Recent records come from the Bieszczady Mountains (Wojas 1992, Pawłowski *et al.* 2000), the Świętokrzyskie Mts. (Mokrzycki 2007) and the Małopolska Upland (Jaskuła *et al.* 2010, Byk *et al.* 2013, Mokrzycki *et al.* 2013). Previously, the species was found in decaying wood, as well as in caves, basements, barns, nests of small mammals or hornets *Vespa crabro* (Linnaeus, 1758) (Wojas 1992).

- *Thoracophorus corticinus* Motschulsky, 1837

Material examined. BNP: [369Gc; Lśw; *Tilia cordata* Mill.; 65; *C. betulus*], 1 indiv., 29.05–2.07.2018, det. AM.

Remarks. Thus far, the species has been recorded only from the Mazovian Lowland, Upper Silesia and the Western Sudeten Mts. (Burakowski *et al.* 1979). Recent records of this species come from the Wielkopolska-Kujawy Lowland (Konwerski & Staniec 2000, Jałoszyński & Konwerski 2001, Konwerski & Matusiak 2001), Mazovian Lowland (Burakowski 1997), Podlasie (Staniec 2003, 2006) and Lublin Upland (Konwerski & Staniec 2000, Staniec 2001, 2006). *Thoracophorus corticinus* is a myrmecophile species, developing inside nests of *Lasius brunneus* (Latreille, 1798) (Hymenoptera), most often inside corridors built in decaying trunks of deciduous trees (Burakowski *et al.* 1979, Jałoszyński & Konwerski 2001).

Family: Throscidae

- *Trixagus elateroides* (Heer, 1841)

Material examined. Hajnówka: [519Ag; OlJ; *A. glutinosa*; 40; *A. glutinosa*], 1 indiv., 4.07–13.08.2018, det. HS.

Remarks. The species has been very rarely recorded in Poland. Currently, the two known localities of *T. elateroides* are situated in the northwestern parts of the country, i.e., the Baltic Coast (Gruszka & Tarnawski 1995) and the Pomeranian Lake District (Bielinek forest-steppe reserve) (Buchholz 2008). Older records origin from the late 19th and early 20th century and require confirmation (Burakowski *et al.* 1985). According to Buchholz (2008), *T. elateroides* should be considered Medi-terranean species, and is probably associated with moist and warm habitats, e.g. riverside areas covered with rush plant communities.

Family: Trogossitidae

- *Nemozoma caucasicum* Ménétries, 1832

Material examined. Browsk: [760Bf; Lw; *Q. robur*; 103; *C. betulus*], 1 indiv., 17.04–22.05.2018, det. MP; [773Ad; OlJ; *A. glutinosa*; 113; *F. excelsior*], 2 indiv., 17.04–2.05.2018, det. RP.

Remarks. Relatively recently, the species was reported as new for Poland (Hilszczański 2006). Since then, it has been recorded in seven regions of Poland. A summary of faunistic data and a description of biology was recently presented by Miłkowski *et al.* (2019).

Discussion

Compared to other parts of Poland, coleopterological studies in the Białowieża Forest have a long and well-documented history (e.g., Gutowski & Jaroszewicz 2001). This allows a relatively precise estimation of the current beetle species-richness in this area. In the Catalogue of the fauna of Białowieża Primeval Forest, Gutowski and Jaroszewicz (2001) listed 2691 beetle species recorded from its Polish part. Further 50 species new for this area were recorded shortly after, during the surveys carried out by Borowski (2001), Byk (2001), Mokrzycki (2001) and Skłodowski (2001). Since then, new records of 126 species were published by various authors (Wąsowska 2001, 2005, Majewski 2003, Wanat 2003, Gutowski *et al.* 2006, Szujecki 2006, Gutowski 2010, Gutowski *et al.* 2010, Jałoszyński 2010, Mokrzycki *et al.* 2011, Plewa & Melke 2013, Hilszczański *et al.* 2014, 2015, Plewa *et al.* 2014, 2017, Greń *et al.* 2017). Based on the results of our previous research, which mentioned 69 species (Plewa *et al.* 2019), and the present study (23 species), we report a total number of 92 species. The recent paper of Gutowski *et al.* (2020) includes records on further 14 species

of beetles new for this area. Thus, the current species-richness of Coleoptera of the Polish part of Białowieża Forest is estimated at 2973 species.

Considering exclusively the families of Coleoptera studied by us, the current species richness within the Polish part of Białowieża Forest is estimated at: Carabidae (220 species, i.e. ~41,4% of the Polish fauna), Corylophidae (11, ~68,7%), Curculionidae (452, ~42,4%), Dermestidae (18, ~50%), Elateridae (73, ~54,9%), Eucnemidae (18, ~82%), Laemophloeidae (4, ~22,2%), Latridiidae (50, ~68,5%), Nitidulidae (69, ~53,5%), Ptinidae (49, ~55,7%), Staphylinidae (595, ~44,3%), Throscidae (6, ~60%), Trogossitidae (3, ~60%).

The high number of previously unrecorded beetle species in the Białowieża Forest can be explained in several ways, as highlighted in our previous work (Plewa *et al.* 2019). Firstly, this area is considered one of the best preserved forests in the European lowlands (e.g. Jaroszewicz *et al.* 2019), as reflected for example by large diversity of forest habitats, accumulation of diversified dead wood substrates, and continuity of old trees – a features which favour many species, including those highly specialized with respect to inhabited ecological niches. Secondly, it should be noted that some species which are actually present in a given area may remain undetected due to the methods used or the intensity of their application (e.g, Gu & Swihart 2004). The multi-funnel traps used in the present research are characterized by relatively high trapping efficiency (up to 100 beetle species per trap – unpublished data), which, given the number of traps used, presumably allowed for collection of species characterized by hidden lifestyle, short period of activity or occurring at very low abundances. Therefore, Lindgren funnel traps can be a valuable tool in the future studies of forest beetles.

In conclusion, our results emphasize the need to continue the investigations on the beetle fauna of the Białowieża Forest. Complex studies using various methods should be performed to fully assess the biodiversity this valuable area.

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