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Elater ferrugineus Linnaeus, 1758 (Coleoptera: Elateridae) – a new species for the fauna of Latvia

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In the present article *Elater ferrugineus* L. is reported in the fauna of Latvia for the first time; it has been collected in the North East of Latvia in the nature reserve "Pededze Valley" in the hollow of an old oak tree using *Osmoderma* pheromone traps with pheromone *(R)-(+)-gamma-decalactone*, which in the case of *E. ferrugineus* L. often functions as a kairomone. The article presents a brief characteristic of the morphology of the specimen collected, the description of the research area where the species has been collected, as well as the description of the methodology of collecting this species.

Key words: Coleoptera, Elateridae, *Elater ferrugineus*, *Osmoderma*, fauna, Latvia, pheromone, kairomone.

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INTRODUCTION

For the first time in Latvia, using pheromone traps with the pheromone *(R)-(+)-gamma-decalactone* for catching male *Osmoderma* LePeletier & Audinet-Serville, 1825 (Coleoptera: Scarabaeidae), *Elater ferrugineus* Linnaeus, 1758 (Coleoptera: Elateridae) was collected, which is a new species of click beetles for Latvia. In the research framework the beetles were caught with the aim to collect specimens for further genetic research of *Osmoderma.*

The present article reports *E. ferrugineus* L. in the fauna of Latvia for the first time; it describes the specimen collected, the research area where the species has been collected, as well as the methodology of collecting the species. The aim of the article is to publish information on the detection of this species in Latvia and to promote its inclusion into the list of specially protected species in Latvia, as well as to initiate the study of this species' population in Latvia.

MATERIAL AND METHODS

Material

Elater ferrugineus L. was found on July 19, 2011, in the nature reserve "Pededze Valley" (Fig. 1) situated in the Stradi rural territory of the Gulbene region in the hollow of an old oak tree (Fig. 2) after checking the pheromone traps with pheromone *(R)-(+)-gamma-decalactone* set for the collection of *Osmoderma*. One male specimen was collected. The specimen is kept in the beetle collection of the Institute of Systematic

Biology, Daugavpils University (DUBC). At present, this specimen is the only certain representative of this species from Latvia. The beetle collections of *Natural* History *Museum* of *Latvia* (NHML) and Latvian University Museum of Systematic Zoology (LMSZ) have been surveyed. The abbreviations of collections used in the present article are consistent with V.R.E.M.J.-B. Bejsak-Collorado-Mansfeld (2004).

Field research methods

To carry out the field research pheromone traps (Fig. 3 - 4) with pheromone *(R)-(+)-gamma-decalactone* have been used for collecting males of *Osmoderma*. The pheromone traps were received from Finland (Turku University) for collecting *Osmoderma* males necessary for the study of this species' genetics. *Elater ferrugineus* L. got into those traps incidentally, because they reacted to the smell of the pheromone, which for this species works as a kairomone enticing beetles as indicating a possible feeding ground for their larvae. The Institute of Systematic Biology of Daugavpils University has obtained a permit issued by the Latvian Nature Protection Board that allows for the collection of invertebrates during field research.

Laboratory research methods

The research was carried out using the digital stereomicroscope *Nikon AZ100* and the *NIS-Elements 6D* software. The photographs of the imago, pheromone traps, and habitats were taken by our colleague R. Cibuļskis (Institute of Systematic Biology, Daugavpils University, Latvia) using the camera *Canon 60D*.

Description of the research territory

The nature reserve "Pededze Valley" was established in 1999; it is situated in the Gulbene and Rugāji counties, especially in the Dauksti, Rugāji and Stradi rural municipalities. Initially the area of the nature reserve comprised 4150 ha, but in 2004 its territory was enlarged by 513 ha, so it nowadays is 4663 ha in size. The nature reserve has been established with the aim to preserve the relict, biologically diverse woodland com-

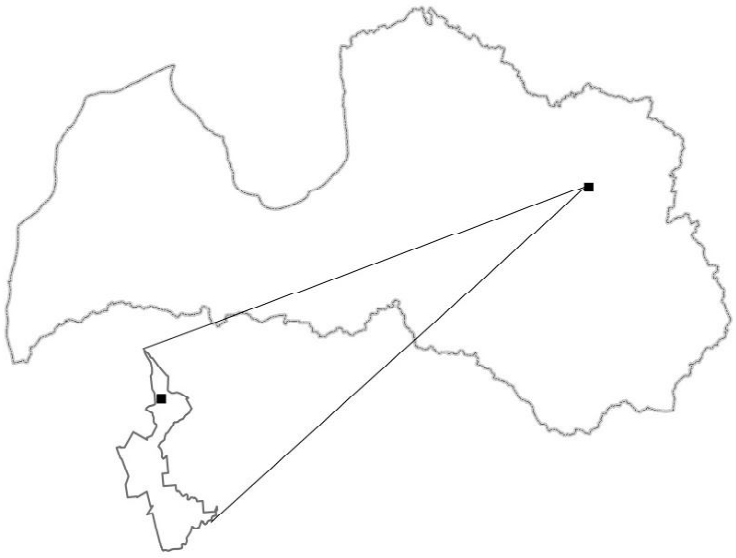

Fig. 1. Finding of *E. ferrugineus* L. in NE Latvia in nature reserve "Pededze Valley "

Fig. 2. Habitat of *E. ferrugineus* L. in nature reserve "Pededze Valley" (Photo R. Cibuļskis)

Fig. 3. – 4. Pheromone traps (Photo R. Cibuļskis)

plexes, wooded meadows, habitats of rare species, and their diversity. In 2005, the reserve was included in the network of specially protected areas – *NATURA* 2000 (area code LV0519600). It is a part of a nature reserve of international significance "Wetland of Lubāns". The main natural values of the territory are the uncontrolled floodlands of Pededze with old oak groves and Fennoscandian wooded meadows, which provide the habitat environment for a number of species of protected animals (including beetles), plants, mushrooms, and lichens.

Nine biotopes which are specially protected both on on the Latvian and European level are represented in the protected area, and, in addition, five biotopes make up complexes: natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* type vegetation; semi-natural dry grassland and scrubland facies on calcareous substrates (*Fetuco-Brometalia*); species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe); Fennoscandian wooded meadows; Western taiga; Fennoscandian deciduous swamp woods; sub-Atlantic and medio-European oak or oak-hornbeam forests of Carpinion betuli; Boog woodland; alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*); the complex consisting of Northern boreal alluvial meadows, lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*), and Fennoscandian lowland species-rich dry to mesic grassland; the complex consisting of Riparian mixed forests of *Quercus robur, Ulmus laevis*, and *Ulmus minor, Fraxinus excelsior, or Fraxinus angustifolia* along the great river (Ulmenion minoris); Fennoscandian hemiboreal natural old broad-leaved deciduous forests (*Quercus, Tilia, Acer, Fraxinus*, or *Ulmus*).

All in all, within the territory of the nature reserve 107 specially protected species have been identified to date, 24 of which are invertebrate species comprising six species which require established microreserves for their protection. In 2007, a nature protection plan for the nature reserve "Pededze Valley" was worked out (Nature Management Plan, 2007).

RESULTS AND DISCUSSION

Latvian research of the click beetle family (Coleoptera: Elateridae) began as early as in the 18th century when J.B. Fischer (1778) published the first information on the determination of *Elater pectinicornis* L. in the territory of present-day Latvia. Since then, more than 50 faunistic articles have been published that contain information on click beetles. Due to the detection of the presented species now there are 83 species

Fig.5. *Elater ferrugineus* Linnaeus, 1758 (Photo R. Cibuļskis)

of click beetles known in the fauna of Latvia (Barševskis 2005).

No published information on the detection of *E. ferrugineus* L. in Latvia has been available up to date. When surveying the beetle collections of NHML and LMSZ no specimen of this species collected in Latvia has been observed. In the NHML collection, one female of this species was found among the unprocessed materials; it was placed on an entomological pin but but without label indicating the place where the species had been collected. Most probably, the specimen had been collected outside the borders of Latvia, and therefore it was not considered representing a Latvian species.

Elater ferrugineus L. is a stenotopic species which can be found in old deciduous forests, parks, and wooded meadows. The life cycle of *E. ferrugineus* L. is 4-6 years depending on the number of food sources (Husler & Husler 1940; Gurjeva 1979; Ranius 2002; Alexander 2002; Svensson et al. 2004; Tolasch et al. 2007). In the larva stage *E. ferrugineus* L. develops in hollows of old deciduous trees (oaks, elms, willows, ashes, etc.) (Allen 1996). The beetles choose as their habitat the putrescent hollows of deciduous trees together with beetle larvae of Scarabaeidae and Lucanidae families comprising, for example, the genera *Osmoderma*, *Gnorimus*, *Dorcus*, and *Protaetia* (Schimmel & Tarnawski 2010). Their larvae prey on the larvae and eggs of Scarabaeidae and Lucanidae. *E. ferrugineus* L. imagines begin to appear in the period from the end of June to August; in most cases they are active during daylight, although by some authors they have also been reported to be active at night.

This time, collecting *E. ferrugineus* L. in Latvia was incidental. However, it may have been expected due to the match of Latvian conditions with those applying at the time the male *Osmoderma* sex pheromone was observed to function as an *E. ferrugineus* L. kairomone (Svensson et al. 2004). G.P. Svensson and M.C. Larsson (2008) state that the scarab beetle *Osmoderma eremita* Scopoli, 1763 and its larval predator, the click beetle *Elater ferrugineus* L., are threatened saproxylic beetles regarded as species-diversity indicators of the insect fauna of hollow deciduous trees. Male *O. eremita* S. produce the pheromone *(R)-(+)-ć-decalactone* to attract conspecific females, and this compound is also utilized by *E. ferrugineus* L. as a kairomone, presumably for the detection of tree hollows containing prey.

In recent years, the research on the use of *E. ferrugineus* L. chemical ecology for the protection of this species earned high topicality. The ecologies of both predator and prey species are closely related. Both are endangered and both can be used as indicators of natural forests' key habitats. They are especially important for the determination of biological diversity in old forests and wooded meadows. Both species have a covert way of life. Imagines of these species are difficult to find in the open nature without special catching methods (e.g. pheromone traps). Currently, population-ecological research is performed in both species. M.C. Larsson and G.P. Svensson (2011) point out that preserving large assemblies of suitable hollow trees is absolutely essential for buffering against stochastic population fluctuations and thus for securing long-term persistence of these two interesting beetle species.

Since monitoring of both species is important for the successful protection of respective biotopes, a lot of work has been done in recent years on the optimization of pheromones used in this monitoring (Svensson et al. 2011). Sev pheromones of *E. ferrugineus* L. are under research just as well. As indicated by T. Tolasch, M. von Fragstein and J.L.M. Steidle (2007), pheromone gland extracts of a single female *E. ferrugineus* L. have been studied using the method of gas chromatography–mass spectrometry (GC–MS). All samples studied contained the 4 esters 7-methyloctyl-5-methyl hexanoate, 7-methyloctyl octanoate, 7-methyloctyl-7-methyl octanoate, and 7-methyloctyl-(Z) 4-decenoate in a ratio of approximately 1:1:3:3.

As can be seen from the aforementioned, the ecology and biology of the click beetle *E. ferrugineus* L. is in most articles studied together with the hermit beetle (genus *Osmoderma*), although it is known that *E. ferrugineus* L. larvae also feed on larvae and eggs of other hollow-dwelling Scarabaeidae and Lucanidae (Schimmel & Tarnawski 2010). The fact that *E. ferrugineus* L. is often studied together with *Osmoderma* is however understandable, because, as many scholars have indicated, the hermit beetle *Osmoderma eremita* S. is a priority species of Appendix II of the Habitats Directive of the European Union and a flagship and umbrella species for the saproxylic fauna of hollow trees (Ranius 2002; Audisio et al. 2007; Bußler, Müller 2009). H. Bußler and J. Müller (2009) have proposed vacuum cleaning as a new method for obtaining an inventory of *O. eremita* S. and other inhabitants of hollow trees.

It is important to note that in all previous articles on the subject, *O. eremita* S. as a taxon has been used in a wider sense. Using genetic methods the composition and distribution of the different *Osmoderma* species have been specified. In Latvia, we find the species *Osmoderma barnabita* Motschulsky, 1845 rather than *O. eremita* S. (Audisio et al. 2007, 2008).

As a result of modern forestry, biotopes only marginally affected by anthropogenic changes are decreasing and in many areas certain species populations are endangered. *O, barnabita* M. can be used as an indicator species for natural forests' key habitats (Tolash et.al. 2007). In a number of countries this species is included in the lists of protected species (Shirt 1987; Buchholz, Ossowska 2004; Gärdenfors 2005; Vavrį 2005; Martin 2007; Nieto, Alexander 2010). The species is also entered into the European Red List of the saproxylic beetles (Nieto, Alexander 2010) as "nearly threatened".

Considering the protection of *E. ferrugineus* L., this species should be entered into the list of specially protected species in Latvia. It is necessary to protect the biotopes suitable for the species: old deciduous forests with hollow trees, parks, wooded meadows, hollow trees, etc. Th. Ranius, V. Johansson, and L. Fahrig (2011) indicate that the preservation of the most threatened species (*E. ferrugineus* L. and *Tenebrio opacus* Duftschmid, 1812) requires conservation efforts at larger spatial scales than required to protect *O. eremita* S., which has been frequently used as an indicator and umbrella species.

In Norway, where this species has been detected recently, it has not been entered in the National Red List as a threatened or endangered species as yet (Kålås et al. 2006), but it will be proposedly included as a critically endangered (CR) species (Sverdrup-Thygeson, Skarpaas, Ų degaard 2010).

The exterior features of the *E. ferrugineus* L. specimen caught (Fig.5) are as follows: body size 20 mm; black protonum with long posterior angles, which have sharp edges; protonum dotted evenly in disk, intervals between dots are equal to the diameter of dots; black antennae, toothed beginning with the fourth section; red-brown elytrae, lower part being a little darker; black legs. The species has a peculiar sexual dimorphism.

The genus *Elater* Linnaeus, 1758 (Coleopatera: Elateridae, Elaterini) is represented worldwide by approximately 50 species that are distributed in Palaearctic, Oriental, Australian, Nearctic, and Neotropical regions. There are 8 species distributed in the Palearctic region (Schimmel, Tarnawski 2010). In Europe, the genus *Elater* is represented by two species: *E. ferrugineus* L. and *Elater asmodaius* Wurst, 1994 (Cate 2010). *E. ferrugineus* L. is a Western Palaearctic species (Laibner 2000). The species is widely distributed in Europe, but it is rare and appears sporadically. It is known from Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Czech Republic, Denmark, France (incl. Corsica), Germany, Greece (incl. Crete), Hungary, Italy (incl. Sardinia, Sicily), Lithuania, Moldova, the Netherlands (presence uncertain), Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden. Switzerland, Ukraine, and the United Kingdom (Nieto, Alexander 2010; Mer ijevskis, Tamutis 2010). Although *E. ferrugineus* L. presence has been reported from

34 countries, the species is known in a number of them by a few detections only. In France, e.g., the species is known mainly from the northern part of the country (Brustel 2005) whilethere were only some findings in Southeast England in all of the UK (Mendel, Clarke 1996). In Spain, findings accumulated in the northern part of Navarra (Sįnchez-Ruiz *et al.* 2001). In the southern part of Norway, interestingly, 5 specimens of *E. ferrugineus* L. were collected in oak hollows on woodland, but no specimen was found in hollows of oak trees growing in parks (Sverdrup-Thygeson, Skarpaas, and Ųdegaard 2010). *E. asmodaius* W. is known from Greece (Cate 2010; Leseigneur 2007) while *E. ferrugineus* L. is represented in the Palearctic by two subspecies. The nominative subspecies *E. ferrugineus ferrugineus* L. is distributed in the majority of European countries, but in all countries it is rare. Another subspecies, *E. ferrugineus lenkoranus* Gurjeva, 1974, is distributed in Azerbaijan, Iran, and Turkmenistan (Leseigneur 2007).

In the Baltic countries, *E. ferrugineus* L. has been described by only one report from Lithuania (Kaunas) so far (Merįijevskis, Tamutis 2010).

CONCLUSIONS

The click beetle *E. ferrugineus* L. is reported for the fauna of Latvia for the first time. Due to the detection of this particular species, the number of species of the click beetle family (Coleoptera: Elateridae) in Latvia is 83. The species has been collected in the nature reserve "Pededze Valley" (NE Latvia) in an old oak tree when checking pheromone traps with the pheromone *(R)-(+)-gamma-decalactone* set for collecting *Osmoderma*. Thus, prior information concerning the fact that the male *Osmoderma* sex pheromone in the case of *E. ferrugineus* L. functions as a kairomone was affirmed in Latvia, too.

The click beetle *E. ferrugineus* L. is especially endangered and a very rare species of the stenotype in the whole area of its distribution. It is included in the lists of protected species in many countries and in the European Red List of the saproxylic beetles. It is necessary to enter this species into the list of specially protected species of Latvia as especially endangered. The only presently known finding of this species is situated in a specially protected nature territory. In places where it might be found outside of specially protected areas we should create a specially protected nature territory for its biotope. It is also necessary to launch research on its population in Latvia. It is possible to foresee that using pheromone traps this species might be collected also in other places in Latvia.

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Welcome to the EREMITA MEADOWS!

Latvia is still proud of the intact, ancient forests, natural meadows and old trees surrounded by meadows and forests, a place of shelter for countless animal and plant species. This diversity is provided by habitats, formed during decades, hundreds and thousands of years, which are unaltered or only slightly affected by human activity. It is also supported by human pursuit, knowledge and responsible action in protection of nature values.

EREMITA MEADOWS project, carried out by Institute of Systematic Biology, Daugavpils University, and financially supported by EC LIFE Nature programme, will implement measures for protection of Fennoscandian wooded meadows and two rare beetle species - Osmoderma eremita un Phryganophilus ruficollis. Nonetheless, we wish to achieve more - we want to explain to the society the importance of intact forests and old trees, growing individually, including the dry and fallen, in the meadows surrounded by forests. It is important for us to allow to see, to explore and to understand more clearly the unique treasures of Latvian nature.

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