

Distribution of *Osmoderma* Lepeletier & Serville, 1828 in North Macedonia

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Abstract



This is the first comprehensive study on the presence and distribution of *Osmoderma* spp. in North Macedonia. The material includes 23 specimens of *Osmoderma* spp. collected from 12 localities in the period of 1926-2020, as part of the analyses of museum collections and field trips in different parts of the country.

The majority of specimens were recorded from the already existing protected areas (Mavrovo, Šar Planina and Galičica National Parks, Osogovo Protected Landscape).

The adult beetles were mainly found in hollows of old oak, beech and alder trees, during summer period June-August, at altitudes between 225 and 1580 m.

Key words: new records, saproxylic beetle, Republic of North Macedonia

Introduction

Osmoderma eremita s.l. (fam. Scarabaeidae, subf. Cetoniinae) is a rare species with broad range in Europe. It is treated as a complex of five species: *O. eremita* (Scopoli, 1763), *O. barnabita* (Motschulsky, 1845), *O. lassallei* Baraud & Tauzin, 1991, *O. italicum* Sparacio, 2000 and *O. cristinae* Sparacio 1994, separated as a result of sympatric and parapatric speciation (Audisio et al. 2007). Two of these species are distributed on the Balkan Peninsula. *Osmoderma barnabita* is distributed in Eastern and Central European countries, including North Macedonia and adjacent countries of Albania, Serbia, Montenegro and Bulgaria, while *Osmoderma lassallei* occurs in mainland Greece and European Turkey, far away from the territory of North Macedonia

(Audisio et al. 2007; Nieto et al. 2010). Therefore it can be assumed that the only *O. barnabita* is present in North Macedonia. However, no genetic research has been done on samples from North Macedonia, hence further genetic analyses are needed to clarify the taxonomic status.

Osmoderma species, also known as hermit beetles, are obligate saproxylic species with short living imago stage, emerging in July or at the beginning of August. The duration of imago stage is 10 -20 days for males and approximately 90 days for females (Maurizi et al. 2017). The distribution of the species ranges from foothills up to almost 1600 m a.s.l. They prefer the ecotones of well-preserved forests with old hollow deciduous trees mostly oak, but also of beech, hornbeam, willow, poplar, plane, elm, walnut trees, etc. Very few studies confirm their presence in coniferous trees (see Maurizi et al. 2017). The dispersal abilities of *Osmoderma* spp.

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are very limited and well described (Ranius & Hedin, 2001; Macagno et al. 2012).

Hollow trees rich in dead wood provide long-lasting resources (Ranius & Nilsson 1997), shelter for larval stages, food, suitable moisture, constant temperature, and pH condition (Müller et al. 2014). Because it takes time (minimum dozen of years) for the tree to grow and to form holes, there is a danger of premature cutting of these trees. Hence, because of the low distribution ability (only few hundred of meters) and specific microhabitat needs, the survival of these species is threatened.

Osmoderma eremita s.l. is listed in Annex II and IV of the EU Habitats Directive (Council Directive 92/43/EEC 1992) with a status of priority species (*). It is also listed in Annex II of the Bern Convention as a strictly protected species. Red List of saproxylic beetles of Europe lists *Osmoderma eremita* (s.l.) with status *Near Threatened* (NT). The Mediterranean Red List of saproxylic beetles considers the species as *Not Evaluated* (NE) due to the lack of knowledge regarding the presence, distribution and population status of *Osmoderma* in the Mediterranean region. However, IUCN Red List of Threatened Species (2021-3) treats the five species separately: *O. eremita* and *O. barnabita* as NT while *O. cristinae*, *O. italica* and *O. lassallei* as Endangered (EN).

In recent years, the interest of the distribution of saproxylic insects in North Macedonia has increased due to the process of establishment of Natura 2000 network. *Osmoderma eremita* s.l. is considered as a priority species in identification of Natura 2000 sites and management of forests, but also a flagship-species for the protection of the local saproxylic communities (Ranius 2002). Nevertheless, the distribution of *Osmoderma* in North Macedonia was poorly known. The first record (sub *O. eremita*) for Tetovo dates from 1941 (Mikšić 1955; Ranius et al. 2005). Two more records were published recently from the foothills of Belasica mountain (Kovács & Mesaroš 2021). This paper presents data about the distribution and ecological characteristics of *Osmoderma* spp. in North Macedonia.

Materials and methods

This study includes 23 specimens of *Osmoderma* spp. collected from 12 localities collected in the period between 1926 and 2020, as part of the review of museum collections and field trips in different parts of the country.

The collections of the Natural History Museum of the Republic of North Macedonia (MMNH) and National Museum Dr. Nikola Nežlobinski in Struga (NMNSS) were reviewed. In total, four specimens are deposited in these two collections. The information on the labels of these specimens contains only collection dates and imprecise information on localities.

The material during the field research was collected manually with active searching in hollows of old grown trees. Intercept traps were used only on Dešat mountain. This material is deposited in the personal collections of Gabor Mesaroš (c. GB), Slavcho Hristovski (cSH), and the National Collection of Invertebrates (NCI) at the Institute of Biology, Faculty of Natural Sciences and Mathematics in Skopje (specimens from Osogovo and Dešat).

The presentation of the geographic distribution follows the regional division of North Macedonia (Melovski et al. 2013). The analysis of the overlap of the records with system of protected areas was performed on the basis of Melovski et al. (2011).

Results and discussion

In total, 16 new records of *Osmoderma* spp. (23 specimens) are presented in the following text from different localities in the country.

Locality: **ŠAR PLANINA Mt.**, Ljuboten

Habitat: unknown

Date: 24.07.2013

Collecting method: manually

Material: 1 ♂ specimen

Leg.: Emilija Stojkoska (MMNH)

Notes: The site is within borders of Šar Planina National Park. The published record for Tetovo (Mikšić 1955) may refer to the area of Šar Planina Mt. The record from Ljuboten confirms the presence of the species in Šar Planina National Park.

Locality: **BISTRA Mt.**, village Lazaropole, Jugosurovina resort (41.534510, 20.698714), 1330 m

Habitat: beech forest

Date: 15.07.2003

Collecting method: manually

Specimens: 1 ♀

Leg.: Slavcho Hristovski (cSH)

Notes: The female specimen was found inside the building of Jugosurovina resort. The surrounding is a well-developed beech forest. The site is within the Mavrovo National Park.

Locality: **BISTRA Mt.**, village Lazaropole, Glavino Selo (41.546320, 20.691865), 1330 m

Habitat: beech forest

Date: 18.07.2003

Collecting method: manually

Specimens: 1 ♂

Leg.: Slavcho Hristovski (cSH)

Notes: The male specimen was found in a cluster of large fallen trees in a ravine below the cave Kalina Dupka. The surrounding is a well-developed beech forest with individual large trees of *Juglans regia*. The site is within the Mavrovo National Park.

Locality: **RADIKA GORGE**, Boškov Most (41.5293443, 20.624674), 640 m

Habitat: Alder forest, on Alder tree (*Alnus glutinosa*)

Date: 06.07.2020, 28.07.2020, 14.08.2020

Collecting method: intercept traps

Specimens: 3 specimens

Leg.: Sanida Ramadanoska (NCI)

Notes: *Osmoderma* was collected by intercept traps placed on an old hollowed alder trees near the river Radika. The site is about 200 m from the border of the Mavrovo National Park.

Locality: **DEŠAT Mt.**, Mogorečki Livadi (41.54839, 20.61872), 642 m

Habitat: alder forest, on Alder tree (*Alnus glutinosa*)

Date: 29.07.2020

Collecting method: intercept traps

Specimens: 1 specimen

Leg.: Sanida Ramadanoska (NCI)

Notes: *Osmoderma* was collected by intercept trap placed on an old hollowed alder tree near the river Mala Reka, the largest tributary of Radika. The site is about 1.5 km from the border of the Mavrovo National Park.

Locality: **STRUGA**

Habitat: unknown

Date: 01.06.1926

Collecting method: manually

Specimens: 2 ♀

Leg.: Nikola Nezlobinsky (NMNSS), sub. *Osmoderma* sp.

Notes: The information on the label is imprecise. The specimens were probably collected from the town of Struga and its surroundings or foothills of Jablanica Mt.

Locality: **GALIČICA Mt.**, Baba pass, parking place by St. George Chapel (40.953994, 20.812633), 1580 m

Habitat: hollow tree of *Fagus sylvatica* near parking place by the St. George Chapel

Date: 18.08.2018

Collecting method: manually

Specimens: 1 specimen

Leg.: Gabor Mesaroš (cGB)

Notes: The site is within the Galičica National Park. The immediate surroundings of the site are mountain pastures on limestone which is not a typical habitat for the species. We assume it flew from some of the forests in the area. The closest beech forest is about 250 m away. The site is right above the well-known refugium site of Zli Dol – a ravine with some relict or endemic species (e.g. *Aesculus hippocastanum*, *Acer obtusatum*).

Locality: **GALIČICA Mt.**, Elshani, Kalenderica (41,028499 20,808933), 760m

Habitat: In old walnut tree (*Juglans regia*)

Date: 25.05.2007

Collecting method: manually

Specimens: 6 specimens

Leg.: Ljubomir Stefanov (cSH)

Notes: Imagoes were reared from pupae (6 pupae from previous year). The site is within the Galičica National Park.

Locality: **MARIOVO**, village Melnica, St. Ilija Monastery (41.163717, 21.780978), 750 m

Habitat: old oak tree (*Quercus* sp.) in the yard of St. Ilija Monastery

Date: 28.07.2008

Collecting method: observation

Specimens: 1 ♂

Leg.: Slavcho Hristovski (the specimen was observed and photographed, but not collected).

Notes: The single male specimen was found on a very old oak tree in the yard of the St. Ilija Monastery. The surrounding of the site is characterized by degraded



Figure 1. *Osmoderma*, Mariovo, v. Melnica, St. Ilija Monastery, 12.07.2012 (photo: Lj. Stefanov)

oak forests and hill pastures. The site is situated within the proposal for establishment of protected area Mariovo.

Locality: **MARIOVO**, village Melnica, St. Ilija Monastery (41,163761, 21,780896), 745 m
Habitat: Apple orchard
Date: 12.07.2012
Collecting method: observation
Specimens: 1 ♀ (Fig. 1)
Leg.: Ljubomir Stefanov (the specimen was not collected)

Notes: The site is situated within the proposal for establishment of protected area Mariovo. This locality is about 50 m away from the previous record.

Locality: **OSOGOVO Mt.**, Gradče (41.964074, 22.407167), 480 m
Habitat: on an old oak tree (*Quercus* sp.)
Date: 03.07.2016
Collecting method: observation
Specimens: 1 specimen
Leg.: Despina Kitanova (the specimen was not collected)

Notes: The site is within the Osogovo Protected Landscape.

Locality: **OSOGOVO Mt.**, Emirička Reka, (42.076325, 22.280949), 845 m
Habitat: old beech forest
Date: 22.08.2017
Collecting method: manually
Specimens: 1 specimen
Leg.: Aleksandra Cvetkovska-Gjorgjievska (cNCI)
Notes: The site is within the Osogovo Protected Landscape

Locality: **KUČUKOL**, Lower Bregalnica, village Bekirlija (41,680282 21,940658), 225 m
Habitat: small gardens with fruit trees in the village
Date: 12.07.2016
Collecting method: observation
Specimens: 2 specimens
Leg.: Ljubomir Stefanov (the specimen was not collected)

Notes: The site is situated within the proposal for establishment of Monument of Nature Lower Bregalnica.

Locality: **BELASICA Mt.**
Habitat: unknown
Date: 09.07.1990
Collecting method: manually
Specimens: 1 ♂ specimen
Leg.: Vladimir Krpač (MMNH)
Notes: The site is situated within the proposal for establishment of Protected Landscape Belasica (Durgutović et al. 2011).

There are 19 records of *Osmoderma* spp. in North Macedonia (16 new records and 3 from the literature). In total, 26 specimens of *Osmoderma* spp. were observed or collected in the country (23 in this study and 3 from the literature). Six records (7 specimens) are from the east parts of North Macedonia (to the east of river Vardar) and 13 records (19 specimens) from the west of the country (Fig. 2).

The imagoes of the beetles in North Macedonia were mainly found in hollows of old oak (*Quercus* sp.), Walnut (*Juglans regia*), European beech (*Fagus sylvatica*) and alder (*Alnus glutinosa*) trees. Kovács & Mesaroš

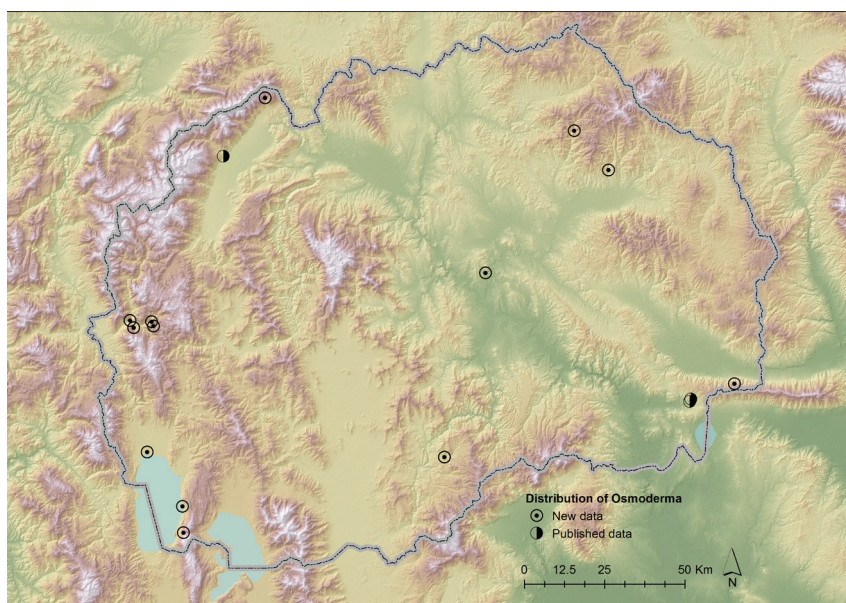


Figure 2. Distribution of *Osmoderma* spp. in the Republic of North Macedonia

(2021) reported the species from old hollow trees of Oriental plain (*Platanus orientalis*).

It seems that all of the imagoes were observed during summer period July-August with only one record in June. The reared specimens from Galičica, Elshani appeared in May.

Osmoderma has also broad preference in terms of its vertical distribution. It was recorded in the altitudinal range between 225 and 1580 m. However, the majority of the records (9) are from the altitudes between 600 and 900 m.

The majority of specimens were recorded from the already existing protected areas (Šar Planina, Mavrovo and Galičica National Parks, Osogovo Protected Landscape) or such proposed for protection (Mariovo, Lower Bregalnica and Belasica).

These records not only enhance the conservation value of protected areas, but also present useful tool in the processes of identification of areas with high species richness and in the design of conservation strategies for the species.

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Literature

Alexander, K., Buche, B., Dodelin, B. & Schlaghamersky, J. (2010). *Osmoderma barnabita*. The IUCN Red List of Threatened Species 2010: e.T157901A5169119. <https://dx.doi.org/10.2305/IUCN.UK.2010-1.RLTS.T157901A5169119.en>. (Accessed on 17.01.2022.)

Audisio, P., Brustel, H., Carpaneto, G.M., Coletti, G., Mancini, E., Piattella, E., Trizzino, M., Dutto, M., Antonini, G. and De Biase, A. (2007). Updating the taxonomy and distribution of the European *Osmoderma*, and strategies for their conservation

(Coleoptera, Scarabaeidae, Cetoniinae). *Fragmenta entomologica*, Roma, **39** (2): 273-290.

- Дургутовик, А., Хармел, М., Храбар, М., Јанеж, Ј., Кошир, П., Мицевски, Б., Пилтавер, А., Вучиниќ, Ж., Борота, Д. (2011). *Валоризација на природниште вредносии на Планинаша Беласица*. ОИКОС, Словенија, Љубљана, 130 стр.
- Kovács, T. & Mesaroš, G. (2021). Beetles from West-Balkan, with new country records (Coleoptera). *Folia historico-naturalia Musei Matraensis* **44**: 137-140.
- Macagno, L.M.A., Gobbi, M., Franceschini, A. and Lencioni, V. (2012). New record of *Osmoderma eremita* (Scopoli, 1763) (Coleoptera: Cetoniidae) in chesnut trees in Trentino (Eastern Italian Alps). *Studi Trent. Sci., Nat.*, **92**: 37-41.
- Maurizi, E., Campanaro, A., Chiari, S., Maura, M., Mosconi, F., Sabatelli, S., Zauli, A., Audisio, P., Carpaneto, G.M. (2017). Guidelines for the monitoring of *Osmoderma eremita* and closely related species. *Nature Conservation* **20**: 79-128.
- Melovski, L., Hristovski, S., Brajanoska, R., Veleviski, M., Sarov, A., Avukatov, V. (2011). Development of the representative protected areas system in the republic of Macedonia based on GIS Methodology. *Zaštita prirode u XXI vijeku. Zbornik plenarnih referata (knjiga br. 1)*. Žabljak, Crna Gora, 95-109.
- Melovski, L., Markovski, B., Hristovski, S., Jovanovska, D., Anastasovski, V., Klincharov, S., Veleviski, M., Velkovski, N., Trendafilov, A., Matevski, V., Kostadinovski, M., 2013. Regional division of the Republic of Macedonia for the needs of biological databases. *Macedonian Journal of Ecology and Environment*, **15**(2), pp.81-111.
- Mikšić, R. (1955). Fauna insectorum Balcanica – Scarabaeidae. *Godišnjak Biološkog Instituta Univerziteta u Sarajevu*, **6** (1-2) (1953): 49-281.
- Müller, J., Jarzabek-Müller, A., Bussler, H., Gossner, M.M. (2014). Hollow beech trees identified as keystone structures for saproxylic beetles by analyses of functional and phylogenetic diversity. *Animal Conservation* **17**: 154-162.
- Nieto, A., Dodelin, B., Petrakis, P., Büche, B. 2010. *Osmoderma lassallei*. The IUCN Red List of Threatened Species 2010: e.T157575A5098836. <https://dx.doi.org/10.2305/IUCN.UK.2010-1.RLTS.T157575A5098836.en>. Accessed on 17.01.2022.
- Ranius, T. (2002). *Osmoderma eremita* as an indicator of species richness of beetles in tree hollows. *Biodiversity and Conservation* **11**: 931-941.
- Ranius, T. & Hedin, J. (2001). The dispersal rate of a beetle, *Osmoderma eremita*, living in tree hollows. *Oecologia* **126**, 171-180.
- Ranius, T., Aguado, L. O., Antonsson, K., Audisio, P., Ballerio, A., Carpaneto, G. M., Chobot, K., Gjurašin, B., Hanssen, O., Huijbregts, H., Lakatos, F., Martin, O., Neculiseanu, Z., Nikitsky, N. B., Paill,

W., Pirnat, A., Rizun, V., Ruicănescu, A., Stegner, J., Süda, I., Szwajko, P., Tamutis, V., Telnov, D., Tsinkevich, V., Versteirt, V., Vignon, V., Vögeli, M., Zach, P., 2005. *Osmoderma eremita* (Coleoptera, Scarabaeidae, Cetoniinae) in Europe. *Animal Biodiversity and Conservation*, **28.1**: 1-44

Ranius, T., Nilsson, S.G. (1997). Habitat of *Osmoderma eremita* Scop. (Coleoptera: Scarabaeidae), a beetle living in hollow trees. *Journal of Insect Conservation* **1**: 193-204.