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DISTRIBUTION AND HABITATS OF DORMICE IN CROATIA

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ABSTRACT – New findings have been used to construct distribution maps for *Dryotnys nitedula*, *Eliomys quercinus*, *Muscardinus avellanarius* and *Myoxus glis* in Croatia. The northern part, on the edge of the Pannonian Plain, is populated by *M. avellanarius* and *M. glis*, while *E. quercinus* has only been recorded sporadically before 1970. **All** four species live in the western, montane part, but they are probably syntopic only in the altitudinal belt between the euro-siberian and mediterranean regions (forests of *Seslerio-Fagetum* type). *Dryomys nitedula* and *E. quercinus* have never recorded sintopically. The *Eliomys quercinus dalmaticus* is, except for *M. glis*, the only dormice living in Dalmatia. The data suggest the disappearance of *E. quercinus* from the continental parts of Croatia. *Muscardinus avellanarius* has been recorded in mediterranean habitats of Istria only along streams and in swamps. *Myoxus glis* is most common in beech forests of the montane belt in the Dinaric karst, where it is a traditional target for hunters. The scarcity of recent records in the Pannonian forests is explained by the disappearance of old trees with holes.

Key words: Myoxidae, Distribution, Habitat requirements, Croatia.

RIASSUNTO – *Distribuzione e habitat dei Mioxidi in Croazia* – Sulla base di nuovi ritrovamenti, vengono completate le carte di distribuzione in Croazia di *Dryomys nitedula, Eliomys quercinus, Muscardinus avellanarius* e *Myoxus glis*. La regione settentrionale, al margine della pianura Pannonica, e popolata da *M.avellanarius* e *M. glis*, mentre la presenza di *E. quercinus* e stata registrata sporadicamente prima del 1970. Nella regione montana occidentale sono presenti le quattro specie, ma probabilmente sono sintopiche soltanto nella fascia altitudinale compresa tra la regione euro-sibirica e quella mediterranea (foreste di tipo *Seslerio-Fagetum*). *Dryomys nitedzila* e *Eliomys quercinus* non sono mai stati trovati sintopici. *Eliomys quercinus*, oltre a *M. glis*, è l'unica specie di mioxide vivente in Dalmazia. I dati suggeriscono la scomparsa di *E. quercinus* dalle regioni continentali della Croazia. *Muscardinus avellanarius* e stato ritrovato in ambienti mediterranei dell'Istria soltanto lungo corsi d'acqua ed acquitrini. *Myoxzis glis* e la specie piu comune nelle faggete della fascia montana del carso Dinarico, dove rappresenta il bersaglio tradizionale dei cacciatori. Lo scarso numero di ritrovamenti recenti nelle foreste pannoniche viene spiegato con la scomparsa di vecchi alberi con cavita.

Parole chiave: Myoxidae, Distribuzione, Requisiti dell'habitat, Croazia.

INTRODUCTION

Cubich (1875), Kolombatovic (1882), and Mojsisovics (1882), were the first to report *Myoxus glis*, *Muscardinus avellanarius* and *Eliomys quercinus* for Croatia and since Wettstein's **(1928)** report of *Dryomys nitedula*, all four dormice are

known to occur there. The most complete information on the distribution of these species was given by Petrov (1992). In addition to those references collected by Petrov, the following authors have contributed to knowledge of dormice distribution in Croatia: Matisz (1896), Hranilovic & Hirc (1905), Franic (1910), Turkalj (1906, 1939, 1940, 1948), Cop (1921), Paka (1942), Dubac (1956), Lipej (1988), De Luca et al. (1990), and Vujošević et al. (1993). Our collection of has data increased knowledge of their distribution and indicated their habitat preferences.

MATERIAL AND METHODS

From 1974 to 1993, comprehensive data about dormice has been collected during field research and has been combined with unpublished data from the Croatian Natural History Museum (CNHM) collection. The distribution of records is presented in the 10x10 km squares of the UTM grid but due of lack of space, the detailed information about localities will be published elsewhere (Tvrtkovic et al. in preparation). We are now able to summarize all the existing data about their occurrence in different types of forest. Forest types are according to Horvat et al. (1974).

RESULTS

FOREST DORMOUSE, *Dryomys nitedula* (Pallas, 1779)

New data: Lazac (VL63), Mrkopalj (VL81), Bijele stijene (VL90), Vucjak (VK96), Modrica dolac (VK96), Mirevo (VK95), Papratnjak (WK13), Buljma (WK31), Malovan (WK41).

D. nitedula occupies the smallest area in Croatia and is the species about which least is known. It has been recorded only in the area of Risnjak, Velika Kapela and the Velebit Mountains (Figure 1). The data for Veternica cave, the Medvednica Mt. (Petrov, 1992) is not considered here. After communication with Dr. Mikuska, who was responsible for this record, we agreed that the information is doubful. It dates back to 1964, when Mikuska was a student, and a voucher specimen was lost.

D. nitedula has been found on the southern slopes of the coastal mountains only at the higher altitudes (920 to 1,650 meters above sea level). In contrast, on the continental side, the lowest record is from only 550 m. So far established habitats for this species are forests and rocky ground exclusively in the montane and subalpine belts. More precisely, deciduous and mixed forests of *Abieti-Fagetum* and *Fagetum subalpinum* types, and coniferous forests of *Piceetum montanum et subalpinum*, *Calamagrosti-Piceetum* and *Pinetum mughi types*. The data coincide with those of Kryštufek (1985). Nevertheless, it is worth noting the considerable number of specimens collected at (Velebit Mt. at 920 m) in *Seslerio-Fagetum* forest type, together with *Myoxus glis*. *Eliomys quercinus* was also recorded in the same type of forest, but at different localities.

GARDEN DORMOUSE, *Eliomys quercinus* (Linnaeus, 1758)

Unpublished data (before 1970):Varazdin (XM02), Tuskanac (Zagreb, WL77),

Zdencina (WL55), Matic poljana (Velika Kapela, Mt. VL91), Labudovac (WK46), Novi Vinodolski (VK89), Metkovic (YH16).

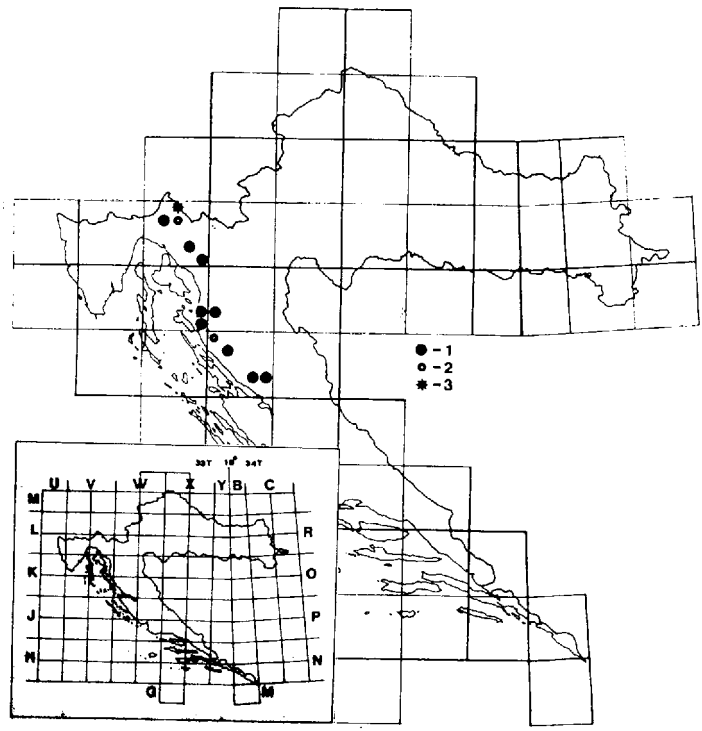

Fig. 1 – Distribution of *Dryomys nitedula* in Croatia. 1 - new data (after 1970); 2 - old data (before 1969); 3 - data before 1910 or unconfirmed data.

New data: Brgud (Ucka Mt.VL30), Donja Klada (VK96), Gornja Klada (VK03), Trubaja (WK12), Tulove grede (WK50), Prezid (WK60), Obli kuk (WJ69), Jasenice (WJ69), Miocici-Razanac (WK20), Posedarje (WJ39), Tucepi (Biokovo Mt., XH69), Metajna (Pag Isl., WK02).

The majority of new records for *E. quercinus dulmuticus* (Dulid & Felten, 1962) are inside the known area (Storch, 1978; Petrov, 1992). Petrov omitted the Korcula island (Dulid, 1971), where the species was collected near Pupnat (XH65). Two findings eastward of the Neretva river (Prenj Mt. in Bosnia and Herzegovina and Metkovic) indicate that the southeastern boundary of its distribution is not restricted by such barriers as the river.

The vertical distribution of this species was investigated in detail in the northern and central Velebit Mt. At Donja Klada (VK96), *E. quercinus dulmuticus* was found between 100 and 980 m above sea level, and at Karlobag (WK03) from 150 to 900 m. **All** the sites were in a karst area of the *Querco-Carpinetum orientalis*, *Seslerio-Ostryetum*, and *Seslerio-Fagetum* forest types. Southward, this species searches for shelter in rocky areas, pine forest and underbrush in the

Quercetus ilicis forest type belt, and in relic montane forest of *Pinus nigra*. There, it has a wider vertical range, having been recorded at 1,400 m (Dinara Mt, Biokovo Mt). The majority of specimens were captured from June to early October. There are single records for December, January, March, and one record of a female with embryos on April 23rd, indicating a longer activity period when climatic conditions through the winter are suitable.

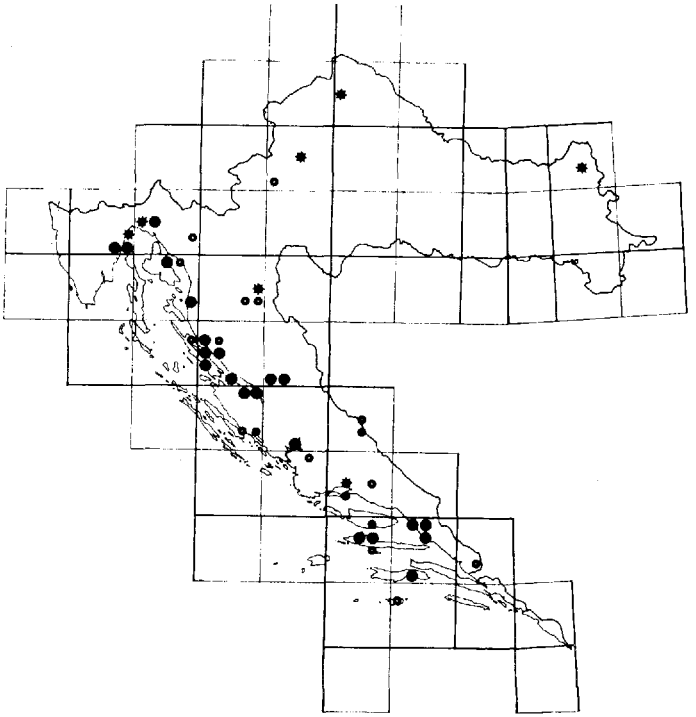

Fig. 2 – Distribution of *Eliomys quercinus* in Croatia. See Fig. 1 for explanation of symbols

We are sceptical about old data from north of the Sava River (Bilje /CR26/ by Mojsiosovics, 1882, and Varazdin /XM02/ - field note by Jurinac from 1882) (Figure 2). because the voucher specimen was lost. Documented findings in the collection of CNHM from the southern slopes of Medvednica Mt. (Tuskanac, WL77) from 1886 and 1909, and observations of this species by V. Pfeiffer in Zdencina (WL55) on the southern slopes of Samoborsko **Mt.** froin 1965, confirm the assumption that *E. quercinus* had a wider distribution in the recent past. Individual records from Velika Kapela Mt. (Matic Poljana, VL91), Mala Kapela Mt (Vrhovine, Dulić, 1971), and "Plitvice Lakes" National Park (Labudovac, WK46 - CNHM documentation; ? lower Plitvice lake, WK47 - Franic, 1910) are valuable. These records were in, or near to, thermophilous *Ostryo-Fagetum* type forests. In the Vrhovine area, *E. quercinus* was found in a relic pine forest of the *Heleboro-Pinetum* type. This type of forest was once widespread in central Europe, particularly during the boreal (Horvat et al., 1974), i.e. when *E. quercinus*

started its expansion into Central Europe from Würmian refuges (Horáček, 1974). New records from the southwestern edge of the Pannonian Plain are unlikely because of the general recent tendency of *E. quercinus* to disappear from Central Europe (Dudich, 1993; Anděra, 1995). With the lack of such records, the taxonomic position of these populations (ssp. *dalmaticus* or ssp. *quercinus)* remains unknown.

HAZEL DORMOUSE, *Muscardinus avellanarius* (L., 1758)

Unpublished data (before 1970): Vukovar (CR42), Kutina (XL33), Bukovac & Ksaver (Zagreb, WL77), Bigina poljana & Cuica krcevina (WK47), Susak (VL51).

New data: Jovanovica (Papuk Mt., XL95), Cernicka Sagovina (XL82), Koprivnica (XM41), Ivanec (WMXI), Pregrada (WM51), Medvednica Mt. (WL77), Gornje Pokuplje (WL34), Japetic (WL46), Mali Lomnik (WL47), Grdanjci (WL47), Prekobunje (WL95), Vratovo (WL95), Crna Mlaka (WL55), Gornja Planina (WL88), Mirica stropina (WK46), Licko Lesce (WK35), Brusane (WK22), Razvala (WK19), Zive vodice (VK96), Babica sica (VK96), Zalovci (VK96), Lazac (VL93).

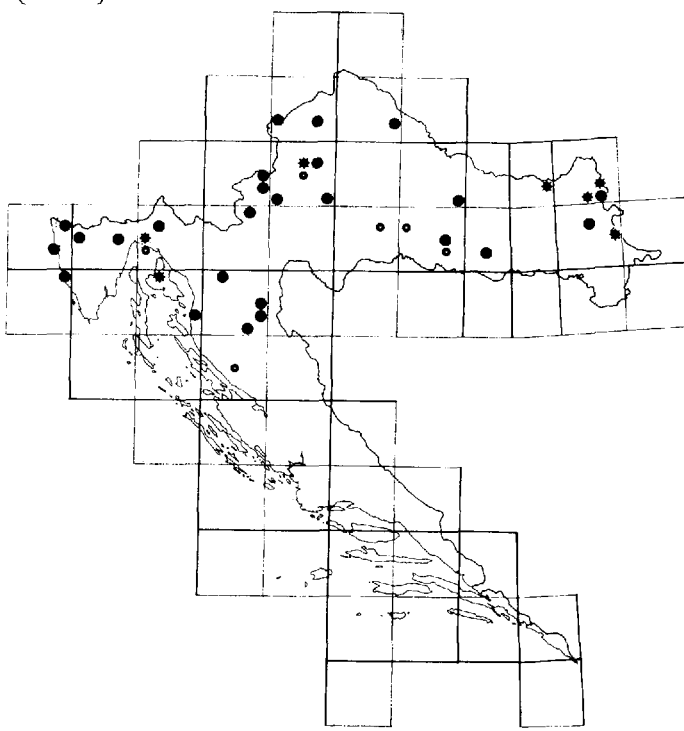

Fig. 3 – Distribution of *Muscardinus avellanarius* in Croatia. See Fig. 1 for explanation of symbols.

Petrov (1992) cited 15 localities for *M. avellanarius* in Croatia, and an additional 29 are reported here (Figure *3)*. The records from the Slovenian part of Istria, just on the border with Croatia (Secovljanske soline, VL83, leg. D. Sere & J. Gregori, 1987), convinced us that the numerous records in Istria, determined from

owl pellets (Lanisce and Momjan, Lipej, 1988; estuary of the Mirna River, Livade and Rovinj, leg. Kovacic) are not accidental, and that *M. avellanarius* is distributed along streams and in swamps through the coastal area of Northern Adriatica at least. Information given by Krpan (1962; Zagora, N-Split) cited by Petrov (1992: UTM HJ15) is quite problematic. Krpan was not mammalogist, and in his paper he relied mostly on data from Kolombatovic. He did not mention *E. quercinus*, but he cited indefinite information about *M. avellanarius* as a widely distributed species, which is in contradiction to our experience from Dalmatia. In continental parts of Croatia, *M. avellanarius* is distributed in degraded forests and their edges along all the vegetational belts, from alluvial forests in the floodplains to subalpine *Pinetum mughi* forests (Zavizan, 1,700 m). The records were from March - late November, and data related to montane areas were from May - September. In Istria, on November 29th, a female was recorded with 5 juveniles, suggesting the possibility of more litters per year.

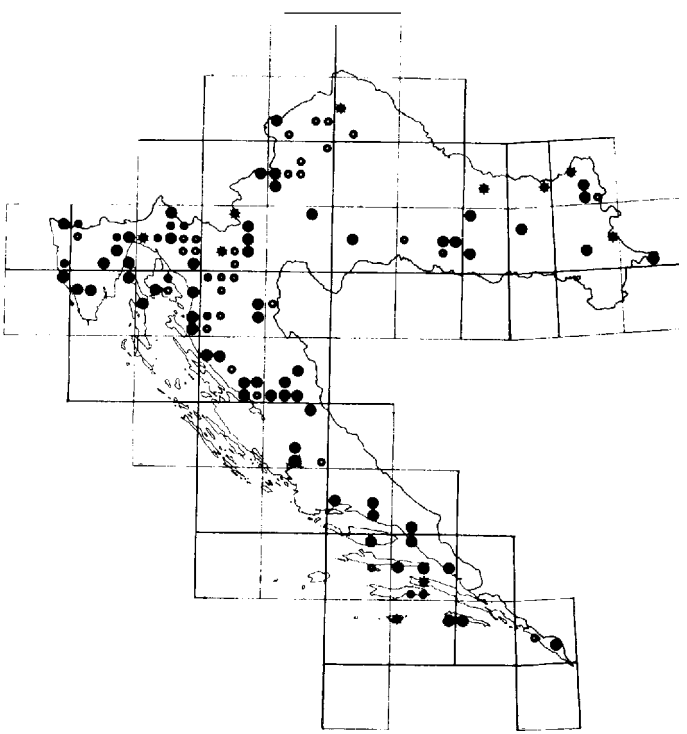

Fig. 4 – Distribution of *Myoxus glis* in Croatia **See** Fig 1 for explanation of symbols

FAT DORMOUSE, *Myoxus glis* (Linnaeus, 1766)

Unpublished data (before 1970): Senj (VK98), Knezovi, Drnis (WJ95), Rogozno (VI73), Krizevci (XM10), Samobor (WL57), St Ivan Zelina (WL99).

New data: Snijeznica Mt. (BN81), Vosac & Kotisina (Biokovo Mt., XH69), Dugopolje (Mosor Mt., XJ32), Malacka (Opor Mt., XJ02), Mazin (WK72),

Corkova uvala (WK47), Cerovac (WK70), Deringaj (WK61), Zrmanja (WJ89), Prezid (WK60), Mila Voda (WK50), Bunovac (WK41), Medacka vrata (WK31), Velika Paklenica (WK30), Papratnjak (WKI3), Ledenik (WK03), Gornja Klada (WK96), Oltari (VK96), Mirevo (VK95), Potpican (VL20), Kastav (VL32), Moscenicka Draga (VL40), Bale (VK08), Sajini (VKI89, Filipana (VK18), Kamenjak (VL62), Vilje (VL72), Cabar (VL74), Bijele stijene (VL90), Ravna Gora - Skrad (VL92), Pregrada (WM10), Radinje (XL92), Sagovina (XL82), Papuk **Mt.** (YL04), Nasice (BR72), Vinkovci (CR21), Ilok - Sarengrad (CR70), Gabrovica (WL57), Bratelji (WL47), Plesivica (WL56), Hunjka (WL78), Prkovec (WL84), Banija (XL12), Perjasica (WL31), Jarce Polje (WL33), Zvecaj (WL32).

We recorded *M. glis* in 48 new localities. It is widely distributed including all the larger islands (Cres, Krk, Brac, Hvar, Korcula, Mljet, Lastovo before 1882 - Figure 4). On the mainland it reaches the subalpine belt (Zavizan, 1,670 m) and until now has not been recorded in the alluvial forests in the floodplains of the Sava and the Drava Rivers. Krasovec (1939) stated that dormice had almost vanished from Slavonia as a consequence of logging of old oaks, that took place at the end of the 19th and beginning of the 20th century. This was confirmed by Paka (1942) for the Ivancica Mt. in northern Croatia, where this species was quite common before 1920. Jurkovic (1985) also argued that fat dormouse is threatened in noncarstics area by logging activities because it can hibernate only in tree holes.

In the mediterranean part of Croatia, the most frequent habitats for this species are forests of *Quercus ilicis* and *Quercetum pubescentis* types, in areas with distinct karst micro-relief or with rock wals, as well as forest of *Pinus halepensis* (Mljet, Porec) and forests of ***P. nigra*** (Hvar, Brac). The most numerous findings in the continental part of Croatia are in areas with pure and mixed beech forests on karst.

Tab. 1 – The dormice (Myoxidae) distribution in Croatia through different vertical belts and forest types. EQ - *Eliomys quercinus*; MG - *Myoxus glis;* **MA** - *Muscardinus avellanarius;* DN - *Dryomys nitedula.* Vertical belts and forest types after Horvat et al. (1974).

VERTICAL BELT	TYPE OF FOREST	EQ	MG	MA	DN
planar	*Quercetum roboris*			*	
collin - submontan (continental)	*Querco-Carpinetum*		*	*	
	Fagetum montanum		*	*	
	Ostryo-Fagetum	*	*	*	
montan (continental)	*Hellebero-Pinetum* (relic)	*			
	Abieti-Fagetum		*	*	*
	Calamagrosti-Piceetum				*
	Piceetum montanum			*	*
subalpin	*Piceetum subalpinus*			*	*
	Pinetum mughi			*	*
	Fagetum subalpinum		*	*	*
montan dinaric coastal slope	*Seslerio-Fagetum*	*	*	*	*
submontan-collin (mediterranean)	*Quercetum pubescentis*	*	*		
	Quercetum ilicis	*	*		

Unfortunately, the material collected is mostly of adult specimens, without data on juveniles or adult's reproductive condition. Valuable data about the time when specimens were collected, in the active period or during hibernation, are missing. So far, we cannot draw any conclusions about possible differences in the period of activity and species biology between populations distributed in continental and mediterranea areas.

The tradition of dormice hunting is particularly strong in the areas of Gorski kotar (Risnjak Mt., Velika Kapela Mt), and has been recently recorded in Istria, Zumberk Mt., Ivancica Mt., on Hvar island (Dol, Gdinj) and on Brac island too.

The distribution of all four dormice species, through different vertical belts and forest types, is summarized in Table 1. *Myoxus glis* is distributed widely in Croatia, except in foodplain forests and in pure forests of *Picea excelsa* or similar habitats. Three other dormice species are tied to particular areas of Croatia. *Muscardinus avellanarius* is absent from the mediterranean region, with the exception for extra-zonal habitats in Istria. Populations of *Dryomys nitedula* and *Eliomys quercinus dalmaticus* are allopatric. *D. nitedula* is missing from mediterranean habitats near the Adriatic coast and from collin or planar continental habitats. *Eliomys quercinus* is absent through the subalpine belt of the Dinaric Mts. It is also absent from the continental part of Croatia, except in oases of therniophilous forests and relic pine forests.

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