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DISTRIBUTION OF *MUSCARDINUS AVELLANARIUS* (LINNAEUS, 1758) (MAMMALIA: RODENTIA: GLIRIDAE) IN THE SOUTH-WESTERN ROMANIA WITH NOTES ON THE BREEDING AND BIOLOGY OF THE SPECIES

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Abstract. We present for the first time a detailed map of the distribution of *Muscardinus avellanarius* (Linnaeus, 1758) in South-western Romania. Also, this is the first study on the biology and reproduction of the Common dormouse in Romania. We found that up to 37% of the adult females are reproducing twice a year and that occasionally some early born pups, given proper conditions, may reproduce in the same year they were born.

Résumé. On présente la première charte détaillée sur la répartition de *Muscardinus avellanarius* (Linnaeus, 1758) dans le sud-ouest de la Roumanie. C'est aussi une première étude sur la biologie et la reproduction du muscardin en Roumanie. On a constaté que 37% des femelles adultes se reproduisent deux fois par an et que certains jeunes exemplaires, nés au début de la saison de reproduction, peuvent se reproduire au cours de la même année si les conditions de vie leur sont favorables.

Key words: *Muscardinus avellanarius*, South-western Romania, distribution.

INTRODUCTION

The Common dormouse is a rare and therefore protected species in Romania. It is considered a vulnerable species according to the IUCN (www.iucn.org) and Murariu (in Botnariuc & Tatole, 2005). In spite of this, at the beginning of the 21st century, in Romania, the distribution, density, breeding data and other aspects of the biology of *Muscardinus avellanarius* L. are poorly known. Although in South-western Romania have been done studies on small mammals by: Popescu & Barbu, 1971, Popescu, Barbu, Hamar & Sutova, 1975, Popescu & Negrea, 1987, Duma & Stănescu, 2002-2003, Duma, 2005, in only one paper (Ene & Almășan, 1956) *Muscardinus avellanarius* L. is mentioned. Till now, this rare species had for Banat region only two distribution points: Bazoș and Timișoara (Ene & Almășan, op. cit.). Motivated by this lack of knowledge we began our studies in the summer of 2003. The purpose of our search was to identify all forests in which this species occur and to bring up to date the distribution of the Common dormouse in this part of the country. In this paper we should treat also the breeding and activity period of Common dormouse in Banat region according to the altitude.

The Banat region is located in the South-western Romania between 44°29'05'' - 46°10'17'' lat N and 20°17'17'' - 22°40'30'' long E (Google Earth). It occupies an area of over 17,300 km². The climate has strong Mediterranean influences. The average medium temperature is of 11.8°C-10.5°C in South, at low altitudes and of 3°C at the upper limit of the forest (1,800 m altitude) according to Chiriță (1981). Also, being in the West of Romania, the region gets more rainfall: from 650-700 mm per year in the lowlands up to 1300 mm in the mountain area. The winters are milder due to the mountain ridge in the East of Banat that usually stops the cold eastern winds.

MATERIAL AND METHOD

Our study began in the summer of 2003 with field searches of grassy nests, owl pellets and hazelnuts gnawed by the Common dormouse. Also forestry personnel was questioned about the *Muscardinus avellanarius* L. They have provided some information about the presence of this little rodent in many forests of the Banat region.

From the spring of 2004 we started to place wooden boxes out in the forests, orchards and hedgerows. The nestboxes were made from poplar or spruce wood. The majority of boxes had the dimensions of 20/13/15 cm. They were attached to the trees at a height of 1.5 to 2.5 m with the entrance facing the tree trunk and slightly bent rearwards by 10-20° to increase the chances that boxes attract dormice, not birds (Passeriformes).

We used 345 boxes in 2005 and 765 boxes in 2006. They were scattered through Banat region in a total of 113 sites (48 localities) from the lowlands to the upper limit of the forest at 1,770 m (in Țarcu Mountains). The sites were chosen so that they cover all the major types of forests found in South-western Romania: drain flood plain wood (term used in Ellenberg, 1988) oak forests (as. *Quercetum farnetocerris* Georgescu, 1945, Rudski, 1949; as. *Tilio tomentosae-Quercetum petraeae-cerris* Soo, 1957; as. *Quercetum petraeae-cerris* Soo, 1969; as. *Carpino-Quercetum cerris* Rațiu et al., 1966; so called „șibliac” woods: as. *Syringo-Cotinetum cogygriae* Borza, 1931; as. *Syringo-Carpinion orientalis* Jakucs et Vida, 1959; as. *Syringo-Fraxinetum orni* Georgescu, 1934) beech forests (as. *Carpino-Fagetum sylvaticae* Paucal, 1941; as. *Symphyto cordato-Fagetum* Vida, 1959; as. *Colurno-Fagetum* Borhidi, 1963, Schrött, 1972; as. *Aremonio-Fagetum* Boșcaiu, 1971; as. *Pulmonario rubro-Abieti-Fagetum* Knapp, 1942; as. *Chrysanthemo rotundifolio-Piceo-Fagetum* Soo, 1964) and spruce woods (as. *Hieracio transilvanicae-Piceetum* Pawl. et Br.-Bl., 1939 em. Borhidi, 1957; as. *Chrysanthemo rotundifoliae-Piceetum* Krajina, 1933; as. *Oxalo-Piceetum abietis* Brezina et Hadac, 1962). Also we placed some of the nestboxes in hedgerows (as. *Pruno spinosae – Crategetum* Hueck, 1931), forest clearings (as. *Sambucetum racemosi* Noirf., 1939; as. *Fragario-Rubetum* Pfeiffer, 1936) and orchards.

Because the territory was too large and the number of wooden boxes relative small we placed only 5 boxes per site in 2005. In 2006 we added new sites and we selected ten special locations in which we placed 20 nestboxes. In all sites the boxes were put at a distance of about 40 m from each other. Exception of this rule where the ten special sites where the boxes were placed at a distance of 20 m.

The boxes were checked once a month from March to November at low altitudes and from May to October in the high mountains. In the ten special designated sites we checked the boxes twice a month.

The individuals found in the boxes were weighed, sexed, verified for their general status and marked with metallic rings made of aluminium sheets of 0.3 mm thick, 2 mm wide and 8 mm long. The rings were placed above the ankle of the hind right leg. Also, we identified the age of the specimens. The individuals that had well developed sexual characters (evident nipples and perforated vagina or well developed scrotum), thick tail and weight more than 20g in summer were considered adults. Those that didn't show sexual characteristics mentioned above and had a narrower tail were considered subadults. The specimens that had less than 15g were regarded as juveniles (Sara et al., 2001).

RESULTS

The *Muscardinus avellanarius* L. is to be found especially in the hilly and mountain forests of Banat. At low altitude it is much rarer due to the deforestation, destruction and fragmentation of the suitable habitat of this species. Even so, it is still found in some larger plain woods and in the some patches of forests along the rivers.

Muscardinus avellanarius L. was found in the following localities of Banat region: Bara (TM): Bara, Lăpușnic; Băile Herculane (CS): Băile Herculane; Bogda (TM): Bogda; Boldur (TM): Sinersig; Cerna Mountains (CS): Cheile Țăsnei, Vinturătoarea Waterfall; Cerna Sat (GJ): Cerna Sat; Cheveresu Mare (TM): Cheveresu Mare; Copăcele (CS): Copăcele, Ohaba-Mâtnic, Zorile; Constantin Daicoviciu (CS): Constantin Daicoviciu, Mâtnicu Mare; Domașnea (CS): Cănicea, Domașnea; Domogled Mountain (CS); Fârdea (TM): Fârdea; Măgura (CS); Nădrag (TM): Crivina, Nădrag; Orșova (CS): Orșova; Poiana Mărului (CS): Poiana Mărului; Reșița (CS): Reșița; Sacu (CS): Tincova; Semenic Mountains (CS): Semenic peak, Trei Izvoare lake; Slatina Timiș (CS): Sadova Nouă; Teregova (CS): Teregova; Turnu Ruieni (CS): Borlova, Turnu Ruieni; Țarcu Mountains (CS): Cuntu, Mic Mountain, Bistra Mărului valley; Văliug (CS): Crivaia, Văliug; Vermeș (CS): Vermeș; Victor Vlad Delamarina (TM): Honorici, Pădureni.

Our investigations showed that *Muscardinus avellanarius* L. lives in a lot of types of forests and even in old orchards and hedgerows. He thrives however in those habitats in which he finds a great variety of plants. He avoids pure and dense stands of spruce (*Picea abies*) or even beech (*Fagus sylvatica*) and oak (*Quercus* sp.). The boxes placed in dense pure stands of forests were empty or occupied by other species of animals (Passeriformes, *Apodemus flavicollis*) in both years of study. On the other hand the nestboxes placed in proper habitats, with a lush understorey and a variety of species of plants, were occupied in some cases in proportion of up to 85%. This proves that the Common dormouse willingly occupies nestboxes whenever they are available in a suitable habitat. Our results confirm those of Almășan (1959), Morris, Bright & Woods (1990) and Juškaitis (1997 a).

The sites where *Muscardinus avellanarius* L. is present are shown on the map of the Banat region, which has been divided into squares 15 x 15 km (Fig. 1).

When two or more localities are in the same square they are shown as one sign on the map. Different signs are used for different sources of information on distribution of the Common dormouse.

The period of activity (Fig. 2) in the lowlands of South-western Romania lasts from the first days of April till the beginning of November. At higher altitudes it is much shorter. At 1,400 m in Țarcu Mountains: Cuntu, it begins in mid June and lasts till the second half of September.

The first individuals caught in the nestboxes were at the beginning of April (10 April) in lowlands and only in mid June at altitudes of over 1,000 m. About 74% of the first emerged individuals were males.

In the autumn the wooden boxes were abandoned in the second half of September in high mountains (above 1,000 m) and in late October – first days of November in lowlands. The first to go into hibernation are the adults (males and than females) while the juvenile are still active for a week or two, depending on temperature. From our in situ observations the juveniles not only have longer

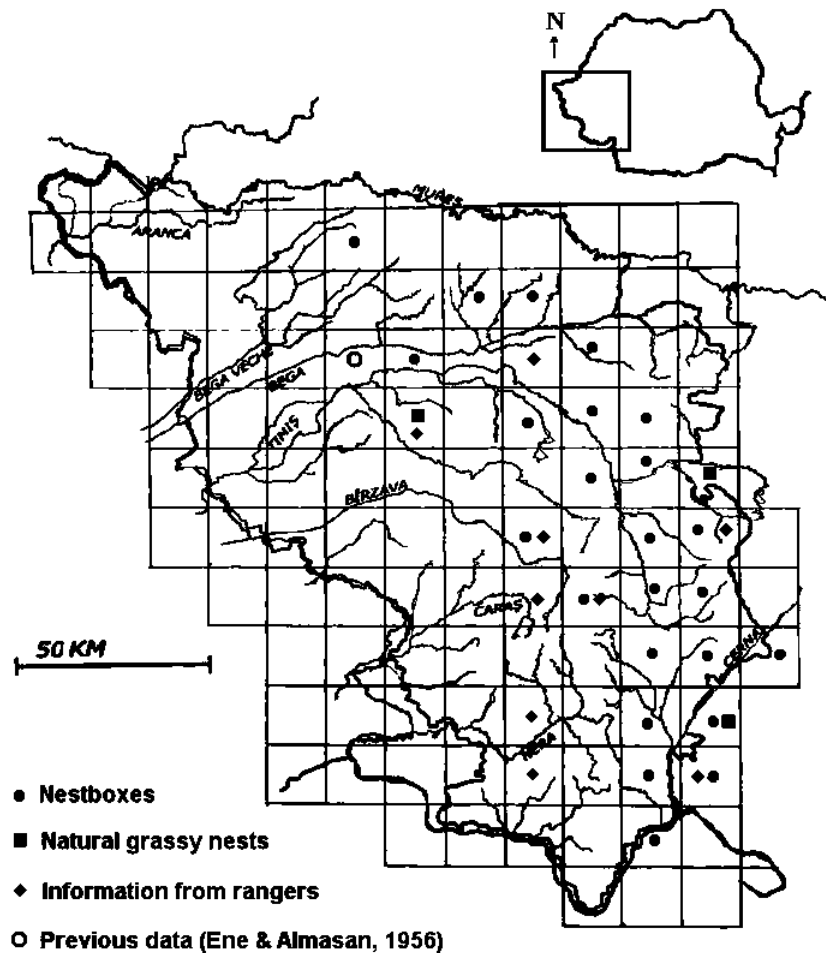


Fig. 1 – Distribution of *Muscardinus avellanarius* L. in the South-western Romania.

monthly activity in autumn but they also have longer daily activity, frequently being active even in daytime. In 2005 and 2006, due to the high autumn temperatures, juveniles were still found in nestboxes at the beginning of November. The latest individuals found in a wooden box were registered on the 12th of November 2006.

Breeding.

The majority of the females gave birth to their first litter in June or July (Figs 3, 4) depending on the altitude. The specimens found at higher altitudes gave birth in late July and first days of August. The number of pups found in one nest ranged from 1 to 9 with a medium size litter of 3.7 in 2005 and 4.1 in 2006 (Tab. 1). In the sites over 1,000 m altitude we found that females had sensibly bigger litters than those from lower altitudes. On an average, these females had 3.8 pups in 2005 and 4.3 in 2006. However, because we have data from only two years and the number of females found above 1,000 m was low, we cannot draw a conclusion, yet.

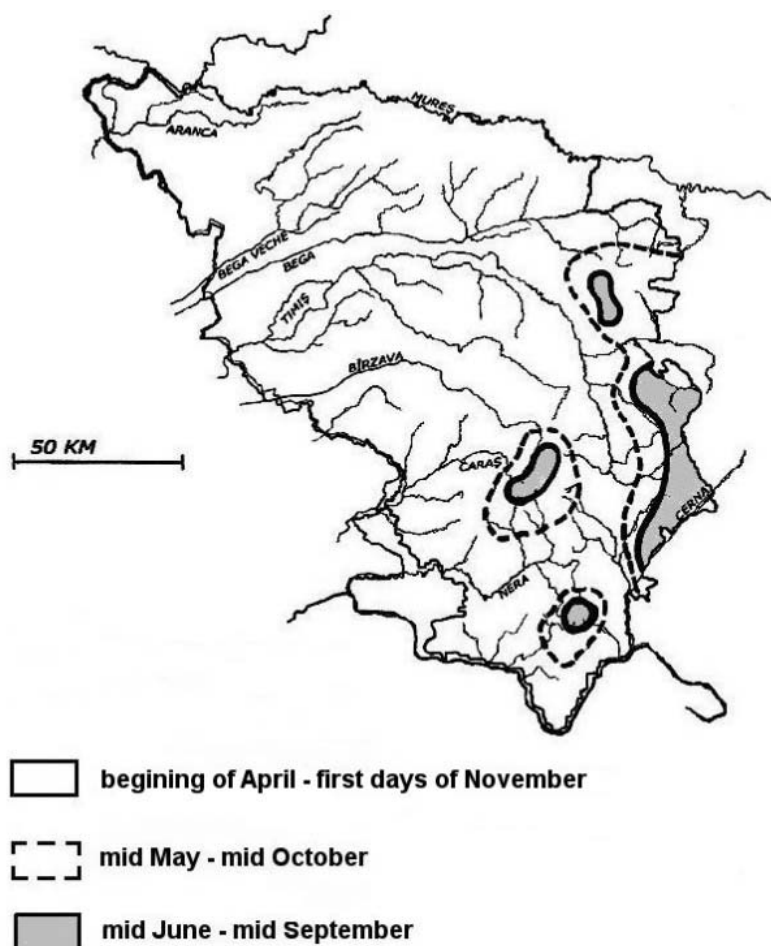


Fig. 2 – Activity period of *Muscardinus avellanarius* L. in Banat region.

Table 1

Litter size in *Muscardinus avellanarius* L.

Year	Number of pups per litter									Average pups / litter	Total number of females with pups
	1	2	3	4	5	6	7	8	9		
2005	2	9	23	16	11	7	-	1	-	3.7	57
2006	10	21	49	32	26	16	6	7	1	4.1	128

The second litter was registered in August and even in the first half of September or November in some females. In the lowlands and hilly regions of the Banat we found that the share of females with two litters was quite high: 23.7% to 37.1% (Tab. 2). The populations of *Muscardinus avellanarius* L. from the high mountains had only one litter per year.

Table 2

Number and proportions of females with second litter.

Altitude	2005		2006	
	Number of females with second litter	Average number of pups / second litter	Number of females with second litter	Average number of pups / second litter
Above 1000 m	-	-	-	-
500 – 1000 m	9 (23.7%)	3.6	24 (32.8%)	3.9
Under 500 m	3 (25%)	3.8	10 (37.1%)	3.7

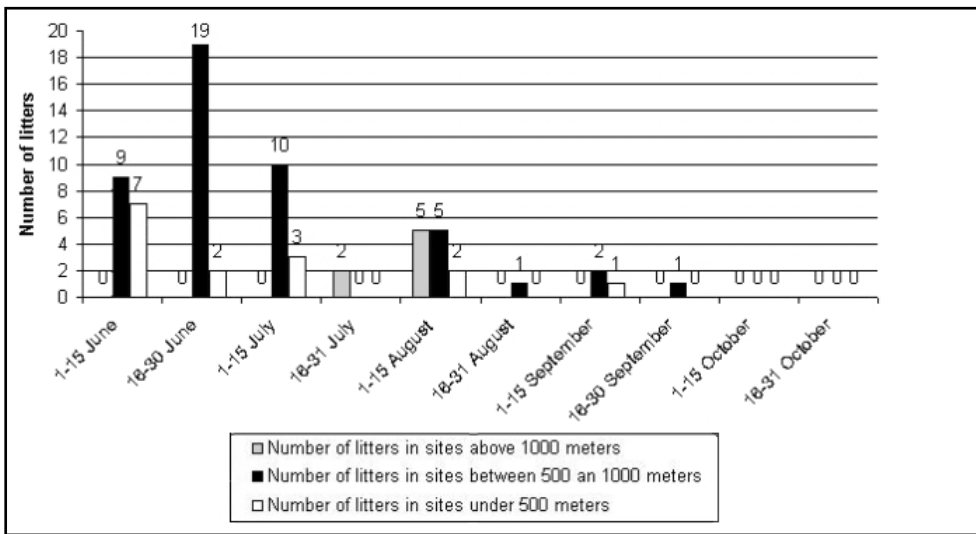


Fig. 3 – Number of litters in females of *Muscardinus avellanarius* L. found in 2005 at different altitudes.

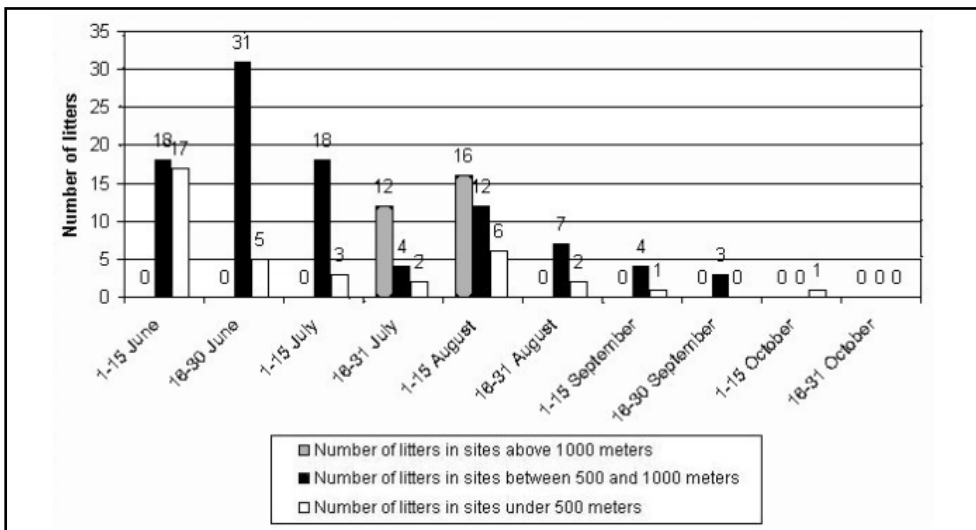


Fig. 4 – Number of litters in females of *Muscardinus avellanarius* L. found in 2006 at different altitudes.

The size of the second litters weren't significantly different from the first ones (Tab. 3). Between 2005 and 2006 we found 46 females in total (12 in 2005 and 34 in 2006) that had two litters. All of them were found at low altitudes, in optimum habitats that had plenty of food available.

Table 3

Average litter size in females with two generations of pups per year.

Year	No. of females with two litters	Average first litter size	Average second litter size
2005	12	3.7	3.5
2006	34	3.8	4.0

It is very interesting that from the total number of adult females found in nestboxes (93 in 2005 and 229 in 2006) not all of them had pups. In 2005, only 57 (61.3%) females had youngsters, and in 2006 only 128 (55.9%). This might be due to the shortage of food as in Edible dormouse (Fietz et al., 2005) and due to the density of the population (Juškaitis, 1997 a). Also we found that some young females can give birth to pups in the same year as they were born. In 2006, we found 2 (1.56%) such females but their number may have been greater. They gave birth one in August and one in September. Bought females were born in the first half of June 2006. According to Juškaitis (1997 b) this is a normal phenomenon in the *Muscardinus avellanarius* L. but it occurs just in small number of individuals (Juškaitis op. cit., Büchner et al., 2003).

DISCUSSIONS

With this paper we bring new data regarding the distribution of *Muscardinus avellanarius avellanarius* L. (Simionescu, 1977) in South-western Romania. Although the Common dormouse was found in 74 sites belonging to 32 localities we expect that the future studies will add new sites to the distribution of this species because the present study didn't manage to cover the entire surface of Banat region.

Also we infer that even if *Muscardinus avellanarius* L. is present from the lowlands to the upper limits of the forest (1,800 m) the greatest density is to be found in the deciduous forests of oak and beech, between 200 and 800 m.

The breeding period lasts from beginning of June to first half of October (in years with warm and dry autumns) thus extending for almost entire activity period. Most of the females breed between 15 June and 15 July. Only the weakest females breed later in second half of July as we observed in 2006. However at high altitudes females give birth normally between 15 July and 15 August. At low altitudes a second peak of births could be observed in August. A few females reproduced even in September or October probably due to the high temperatures in September. Also we found 2 females that gave birth in the same year they were born.

The average number of pups was 3.7 in 2005 and 4.1 in 2006. These results are similar to other data obtained in Germany (Büchner et al., 2003) and Lithuania (Juškaitis, 1997 b).

From all females we found that a share of 23.7 – 37.1% had two litters in the same year resulting that the second litter is an usual phenomenon in population of *Muscardinus avellanarius* L. in Banat region. However the share of females that rise two generations of pups per year could be higher. In other countries the shares of females with two litters are between: 18 % in Eastern Saxony (Germany) (Büchner et al., 2003), to 38 % in Lithuania (Juškaitis, 1997 b).

Also we found that in one year that not all females gave birth to youngsters but in a share of 55.9% - 61.3%. Till now we can not give an explanation to this phenomenon but Juškaitis inferred that this might be due to the density and age structure of the population.

However for a better understanding of the reproduction in *Muscardinus avellanarius* L. further studies will be needed.

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DISTRIBUȚIA SPECIEI *MUSCARDINUS AVELLANARIUS* (LINNAEUS, 1758) (MAMMALIA: RODENTIA: GLIRIDAE) ÎN SUD-VESTUL ROMÂNIEI CU NOTE ASUPRA REPRODUCERII ȘI BIOLOGIEI

REZUMAT

Studiul de față, ce vizează pârșul de alun este primul de o asemenea amploare desfășurat în România. În prezenta lucrare cităm 32 de noi localități (74 de puncte noi de distribuție) pe teritoriul cărora a fost găsită această specie rară de mamifer. De asemenea se aduc importante date referitoare la reproducerea acestei specii în România prezentându-se comparativ populațiile din zonele joase cu cele montane. Se pare că din totalul de femele adulte doar o proporție de 50 - 60 % se reproduc anual. De asemenea am constatat că un procent ridicat de femele au anual două generații de pui. Ocazional puii fătați la începutul lunii iunie se pot reproduce chiar în toamna aceluiași an.

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