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# SCOPOLIA

## 9

**Botanica**

Boris KRYŠTUFEK

Forest Dormouse *Dryomys nitedula*

(PALLAS, 1778)

— Rodentia, Mammalia — in Yugoslavia

**Geologica**

**&**

**Palaeontologica**

Drevesni polh *Dryomys nitedula*

(PALLAS, 1778) — Rodentia, Mammalia —

v Jugoslaviji

**Museologica**

**5 Zoologica**

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## FOREST DORMOUSE *DRYOMYS NITEDULA* (PALLAS, 1778) — RODENTIA, MAMMALIA — IN YUGOSLAVIA

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Natural History Museum of Slovenia

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UDC (UDK) 599.323.2(497.1)(045)=20 *Dryomys nitedula*

**IZVLEČEK — DREVESNI POLH *DRYOMYS NITEDULA* (PALLAS, 1778) — RODENTIA, MAMMALIA — V JUGOSLAVIJI** — Areal drevesnega polha *Dryomys nitedula* se v Jugoslaviji sklada z glavnimi gorskimi masivi (Alpe, Dinaridi, Šarsko-Pindsko in Karpatsko-Balkansko gorovje), medtem ko živi v Makedoniji tudi v nižavju. Višinski razpon nahajališč je med 60 in 2000 m nadmorske višine.

Na ozemlju Jugoslavije prepoznamo dve podvrsti: *D. n. intermedius* (Alpe, severni Dinaridi) in *D. n. ravijojla* (Makedonija). Razlikujeta se po višini lobanje z bulami. Večja je pri podvrsti *ravijojla*. Drevesni polhi iz Hercegovine, Črne gore in Kosova kažejo znake prehoda med obema podvrstama.

**ABSTRACTS** — The area of the forest dormouse *Dryomys nitedula* in Yugoslavia mostly coincides with the principal mountain massifs (the Alps, the Dinaric Alps, the Šar-Pindic and the Carpatho-Balkan mountain regions), whereas in Macedonia it lives also in the lowland. The vertical range of the localities is between 60 and 2000 m.

In the territory of Yugoslavia two subspecies were identified: *D. n. intermedius* (the Alps, the Northern Dinaric Alps) and *D. n. ravijojla* (Macedonia). They differ from each other by the braincase height per bullae which is larger in the subspecies *ravijojla*. Forest dormice from Herzegovina, Montenegro and Kosovo display signs of transition between the two subspecies.

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### Introduction

The forest dormouse *Dryomys nitedula* (hereinafter *D. n.*) is one of the less known mammals of the Yugoslav fauna. Due to its looks and unfrequent apperance it has always attracted the attention of mammalogists. Thus, one often comes across short notes concerning new localities or taxonomic problems but all of them, with no exception, are based on a small number of specimens, frequently on one single animal. In his study on the Tyrolian subspecies of the forest dormouse (*D. n. intermedius*) SCHEDL (1968) included also the north-western region of the *D. n.* area in Yugoslavia (Slovenia and Croatia), however, for our territory no new, unpublished data were at his disposal.

From the territory of Yugoslavia two new subspecies were described (*D. n. ravijojla* PASPALEV, MARTINO and PECHEV, 1952 and *D. n. diamesus* LEHMANN, 1959), but so far their taxonomic status has not been elucidated in detail. On the whole, our knowledge on the infraspecific differentiation is rather poor, for all conclusions have so far been based on few specimens only.

Some scattered data exist also with regard to the selection of the habitat and the vertical distribution of *D. n.* However, the species area of the territory of Yugoslavia as a whole remains undetermined.

### 1. Material and Methods

51 specimens of *D. n.* were examined from the entire territory of Yugoslavia. One part of the material used in this study is kept at the Natural History Museum of Slovenia (PMS). The other part was most kindly given at our disposal by Dr. B. PETROV (Belgrade), for which we sincerely thank him.

Most of the material (91,7%) was caught into snap traps. Of the animals caught the skull and usually also the skin have been preserved. On the animals just caught the following dimensions were measured:

1. Weight (in grams) — W
2. Head and body (from the snout to the anus) — HB
3. Tail length (from the anus to the tail tip) — Tl
4. Hind foot length (without claws) — Hf
5. Ear length — E

Seventeen linear measurements were taken on each of the skulls (Fig. 1) using a vernier caliper with an accuracy to the nearest 0,1 mm. Their definitions and symbols are as follows:

1. Profile length — PL
2. Condylbasal length — CbL
3. Rostrum length — RoL
4. Maxillary tooth-row length (alveolar) — MxT
5. Diastema length — DiL

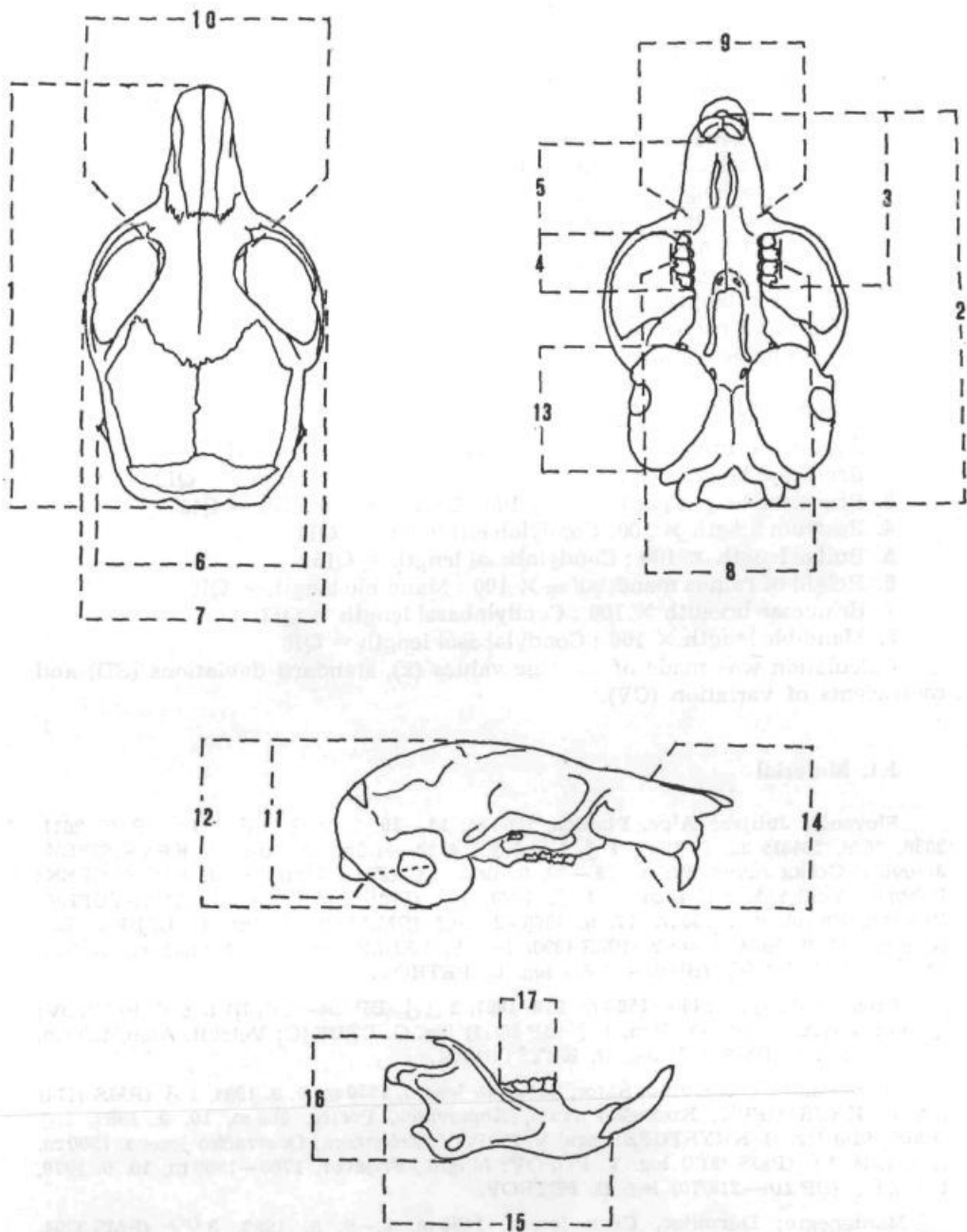


Fig. 1. Method of taking skull measurements of *Dryomys nitedula* (see the text for further explanation)

Sl. 1. Način merjenja lobanje pri drevesnem polhu. Za razlago glej tekst

6. Braincase breadth — BcB
7. Zygomatic breadth — ZyB
8. Breadth over mollars — MoB
9. Rostrum breadth — RoB
10. Interorbital constriction — IC
11. Braincase height — BH
12. Braincase height per bullae — BbH
13. Bullae length — BuL
14. Rostrum height — RoH
15. Mandible length — MdL
16. Height of ramus mandibulae — RMH
17. Mandibular tooth-row length — MdT

The following quotient indices were calculated:

1. Zygomatic breadth  $\times$  100 : Condylbasal length = QI1
2. Braincase height per bullae  $\times$  100 : Condylbasal length = QI2
3. Braincase height per bullae  $\times$  100 : Braincase breadth = QI3
4. Rostrum length  $\times$  100 : Condylbasal length = QI4
5. Bullae length  $\times$  100 : Condylbasal length = QI5
6. Height of ramus mandibulae  $\times$  100 : Mandible length = QI6
7. Braincase breadth  $\times$  100 : Condylbasal length = QI7
8. Mandible length  $\times$  100 : Condylbasal length = QI8

Calculation was made of average values ( $\bar{x}$ ), standard deviations (SD) and coefficients of variation (CV).

### 1.1. Material

Slovenia: Julijske Alpe, Planica, 1000 m, 12.—19. 8. 1982, 3 ♂♂ 1 ♀ (PMS 2611, 2636, 2639, 2643); 22. 8. 1983, 1 ♂ 1 ♀ (PMS 4423—4) leg. A. and B. KRYŠTUFEK; Jelovica, Goška ravan, 970 m, 25.—30. 8. 1983, 1 ♀ (PMS 3224) leg. I. KRYŠTUFEK; Pohorje, Velika Kopa, 1520 m, 4. 7. 1983, 1 ♀ (PMS 3480) leg. B. KRYŠTUFEK; Rakitna, Smrekovec, 750 m, 17. 9. 1968, 2 sex? (PMS 4388—9) leg. F. LEBEN; Borovnica, 23. 9. 1968, 1 sex? (PMS 4390) leg. F. LEBEN; Snežnik, Svinščaki, 1242 m, 18. 7. 1967, 1 ♂ 2 ♀♀ (BP 63—65/67) leg. B. PETROV.

Croatia: Risnjak, 1450—1500 m, 9. 8. 1967, 2 ♂♂ (BP 296—297/67) leg. B. PETROV; Velebit, Zavižan, 1500—1650 m, 1 ♂ (BP 26/71) leg. G. DŽUKIĆ; Velebit, Alan, 1300 m, 15. 8. 1976, 1 ♀ (PMS 807) leg. B. KRYŠTUFEK.

Bosnia and Herzegovina: Šator, Šatorsko jezero, 1550 m, 5. 9. 1984, 1 ♂ (PMS 4174) leg. B. KRYŠTUFEK; Kupreška vrata, Koprivnica, Poriče, 808 m, 10. 9. 1983, 1 ♂ (PMS 3616) leg. B. KRYŠTUFEK and V. POPOV; Zelengora, Orlovačko jezero, 1500 m, 9. 9. 1984, 1 ♀ (PMS 4313) leg. V. POPOV; Maglić, Prijedor, 1700—1800 m, 10. 9. 1970, 1 ♂ 2 ♀♀ (BP 216—218/70) leg. B. PETROV.

Montenegro: Durmitor, Crno jezero, 1450 m, 8.—9. 6. 1983, 3 ♀♀ (PMS 3394, 3415—6) leg. B. KRYŠTUFEK; Bjelasica, Jelovica, 1450—1500 m, 16.—17. 7. 1976, 2 ♂♂ (PMS 592—3) leg. A. and B. KRYŠTUFEK; 20. 9. 1981, 1 ♂ (BP 130/81) leg. B. PETROV; Komovi, Kom Vasojević, 1800 m, 16. 7. 1978, 1 ♀ (PMS 1012) leg. B. KRYŠTUFEK; Orjen, Crkvice, 1050 m, 1 ♀ 1 sex? (PMS 1021—2) leg. B. KRYŠTUFEK.

Serbia: Žljeb, Kula, 1750 m, 14. 6. 1970, 1 ♂ 1 ♀ (BP 68—9/77) leg. B. PETROV; Šar planina, Crni Kamen, Kačanik, 1300 m, 13. 9. 1940, 1 ♂ (BP 116/40) leg. B. PETROV; Niš, Sićevačka klisura, 300 m, 26. 9. 1969, 1 sex? (BP 369/69) leg. B. PETROV.

Macedonia: Prilep, 700—800 m, 21. 4. 1969, 6 ♂♂ (BP 58—63/69) leg. B. PETROV; Prespansko jezero, Asamati and Kurbinovo, 860—920 m, 16.—23. 7. 1977, 3 ♀♀ (PMS 700—2) leg. A. and B. KRYŠTUFEK; Kajmakčalan, Reder (5—7 km below), approx. 1000 m, 23. 9. 1972, 1 ♀ (BP 79/72) leg. B. PETROV; Gevgeli, near Vardar, 60 m, 26. 4. 1971, 2 ♂♂ (BP 33—4/71) leg. B. PETROV; Valandovo, Anska reka, 65 m, 7.—8. 4. 1968, 2 ♂♂ (BP 16/68, 33/68) leg. B. PETROV; Ovče pole, Sv. Nikole, 400 m, 17. 4. 1969, 1 ♂ (BP 13/69) leg. B. PETROV.

## 2. Distribution

The data on the distribution of *D. n.* in Yugoslavia can be found in the works of FREYER (1842), PANČIĆ (1869), MILLER (1912), PASZLAVSKY (1918), BOLKAY (1924), WETTSTEIN (1928), MARTINO (1934, 1939), ZALESKY (1938), PETROV (1939, 1969, 1979), LEHMANN (1959), HENEBERG et al. (1964), FELTEN and STORCH (1965), MIRIĆ (1966, 1981), ĐULIĆ and VIDINIĆ (1967), STORCH (1978) and KRYŠTUFEK (1979, 1982). They are supplemented by private data as given at our disposal by Dr. B. PETROV, the data from the files of the collections kept at the Natural History Museum of Slovenia and those from the Collection Martino of the Zoological Institute, USSR Academy of Sciences, Leningrad (Fig. 2).

Let us shortly comment on some older citations:

For the territory of Yugoslavia ("bei Reifnitz" = near Ribnica) H. FREYER (1842: 2) was the first to mention *D. n.* under the name of *Myoxus nitella*. DESCHMANN (1866: 214) reexamined the specimen on which FREYER's determination was based and came to the conclusion that *Myoxus dryas* (= *D. n.*) was in question. So FREYER doubtlessly had a *D. n.* in his hands and not *Eliomys quercinus* as erroneously stated in the literature.

For the forests of eastern Serbia PANČIĆ (1869: 82) cites *Myoxus nitella* and *M. dryas*, whereas *Eliomys quercinus* does not live in Serbia (PETROV 1979: 117).

MOJSISOVICS (1897: 183) and PASZLAVSKY (1918: 39) cite *D. n.* for Voivodina. Their citations are not supported by concrete data and have not been confirmed ever since. In the list of Serbian mammals PETROV (1979: 117) no longer mentions this species in connection with Voivodina. Thus we can say that no proof exists on the presence of *D. n.* in the lowland north of the Sava and the Danube.

MILLER (1912: 569) mentioned *D. n.* for Belgrade ("Serbia: Belgrade"). The material (two females) was collected by Dr. R. B. SHARPE. This citation, too, has never been confirmed in spite of an intensive research in this area (for a longer period of time also Prof. MARTINO participated in this work). It is possible that the two specimens originated from the surrounding countryside of Belgrade. Thus, for instance, *D. n.* has recently been found in Đerdap (MIRIĆ 1981: 86) i. e. about 100 km to the east of Belgrade.

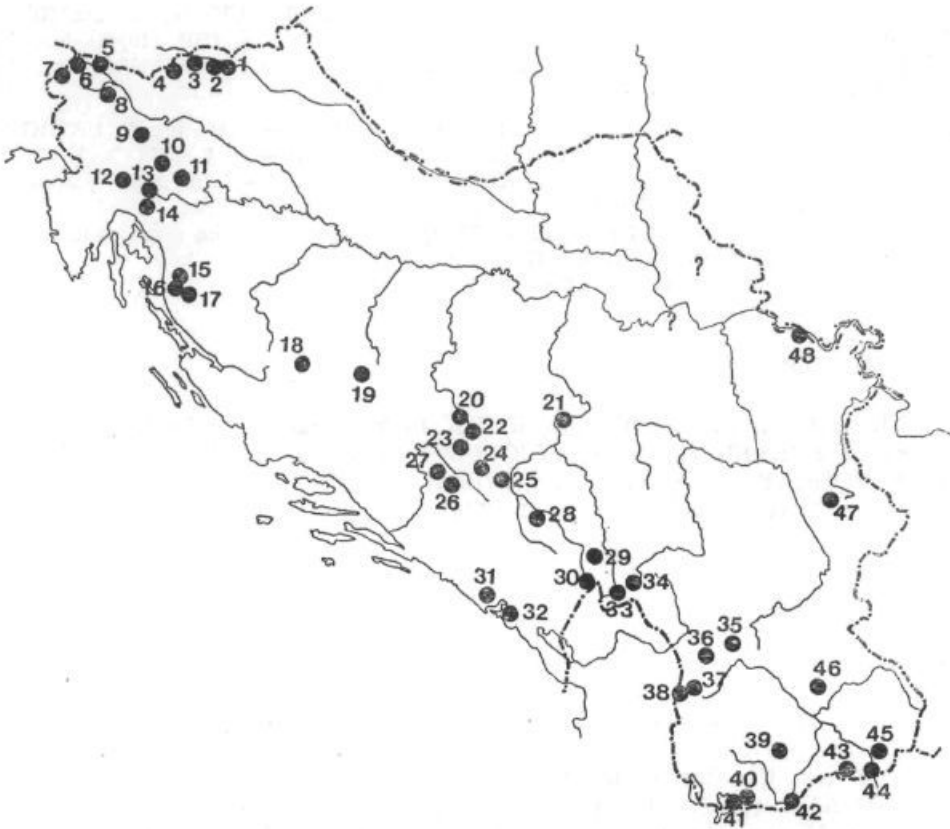


Fig 2. Distributional records of *Dryomys nitedula* in Yugoslavia  
Sl. 2. Nahajališča drevesnega polha v Jugoslaviji

1. St. Wolfgang (= Bolfenk), 700 m (ZALESKY 1938); 2. Ruše (HENEBERG et al. 1964); 3. Velika Kopa, 1520 m; 4. Mežica (M. KUNC in litt.); 5. Javornik (the files of the Natural History Museum of Slov.); 6. Rateče (ZIN-L); Planica, 1000 m; 7. Trenta (S. BRELIH in litt.); 8. Jelovica, Goška ravan, 970 m; 9. Borovnica; Rakitna, Smrekovec, 750 m; 10. Reifnitz (= Ribnica), 491 m (FREYER 1842, DESCHMANN 1883); 11. Forests of Kočevje (= Kočevski gozdi) (the files of the Natural History Museum of Slov.); 12. Snežnik, Svinščaki, 1242 m (B. PETROV in litt.); 13. Cabar (= Čabar), 550 m (ZALESKY 1938); 14. Risnjak, 1450–1550 m (B. PETROV in litt.); 15. Velebit, Zavižan, 1500–1650 m (B. PETROV in litt.); Krasno (ZIN-L); 16. Velebit, Alan, 1300 m; 17. Velebit, Štirovača, approx. 900 m (WETTSTEIN 1928); 18. Šator, Šatorsko jezero, 1550 m (ĐULIĆ et VIDINIĆ 1967); 19. Kupreška vrata, Koprivnica, Poriče, 880 m; 20. Veliki Igman, Veliko polje, 1340 m (ZIN-L); Grkalica (ZIN-L); 21. Tara Mts. (STORCH 1978); 22. Gola Jahorina, 1800 m (ZIN-L); 23. Treskavica, Kutski grad, 1450 m (ZIN-L); 24. Zelengora, Orlovačko jezero, 1500 m; 25. Maglič Prijedor, 1700–1800 m (B. PETROV in litt.); 26. Kalinovik, Vlaholje (ZIN-L); 27. Prenj, Crno polje, 1300 m (B. PETROV in litt.); 28. Durmitor, Valoviti Do, 2000 m (PETROV 1939); Crno jezero, 1450 m; Crepuljna poljana, 1700 m; 29. Bjelasica,



Jelovica, 1450—1500 m (KRYŠTUFEK 1979); 30. Komovi, Kom Vasojević, 1800 m (KRYŠTUFEK 1979); 31. Orjen, Crkvice, 1050 m (KRYŠTUFEK 1979); 32. Lovčen, Ivanova Korita (LEHMANN 1959); 33. Rugovo, Lisic (ZIN-L); 34. Žljeb, Kuša, 1750 m (B. PETROV in litt.); 35. Šar planina, Crni Kamen, Kačanik, 1300 m (PETROV 1969); 36. Prizren, Kopane vode, 1620 m (MIRIĆ 1966); 37. Bistra, Senečki Suvati, 1900 m (MARTINO 1934); 38. Korab, Čos-Alija, 1500 m (MARTINO 1939); 39. Prilep, Markova kula (ZIN-L); Prilep, 700—800 m (B. PETROV in litt.); 40. Perister, near Magarevo, 1000 m (MARTINO 1939); 41. Prespa lake (FELTEN and STORCH 1965); Asamatí, 860 m; Kurbinovo, 920 m; 42. Kajmakčalan, 5—7 km bélow Reder, approx. 1000 m (B. PETROV in litt.); 43. Kožuf, Dve Uši, 1600 m (PETROV 1969); 44. Gevgeli, near Vardar, 60 m (B. PETROV in litt.); 45. Valandovo, Anska reka, 65 m (PETROV 1969); 46. Sv. Nikole, 400 m (B. PETROV in litt.); 47. Sičevačka klisura, 300 m (B. PETROV in litt.); 48. Đerdap, Grobljanski potok near Dobra (MIRIĆ 1981)

The major part of the *D. n.* area in Yugoslavia coincides with the principal mountain massifs, namely: the Alps in the northwest, the Dinaric Alps towards the southeast, above all their karst highlands. In the southeastern Yugoslavia the area corresponds to the Šar-Pindic and the Carpatho-Balkan highlands. In Macedonia it is widespread, populating also the Macedonian lowland (Fig. 3).

*D. n.* does not live on the coast and the islands of the Adriatic. It comes closest to the coast on the Velebit and along Boka Kotorska (Orjen, Lovčen). All of these localities are on heights exceeding 1000 m, i. e. in the montane zone. It might be worth mentioning that *D. n.* has not been found on the Dalmatian highlands inhabited by *Eliomys quercinus* (Mosor, Dinara).

*D. n.* most probably does not live to the north and the east of the mountainous region and is likely to be absent also from the entire Pannonian lowland.

Climatically the *D. n.* area reveals an outstanding variability. Characteristic of certain highlands to the northwest of Yugoslavia and of Montenegro are great quantities of precipitation representing extreme values in Yugoslavia or even in Europe (the Julian Alps 3141 mm of precipitation yearly, 1921 mm thereof in the period between May and October; Risnjak 3709/2260; Northern Velebit 3013/1482; Orjen 5317/1970). Macedonian mountains are drier (Pelister 1060/526), whereas Macedonian fields are positively dry (Sv. Nikole 453/273). Likewise diverse are the average July temperatures which in the mountains vary between 10 and 15 °C (or even lower) and exceed 20 °C in the lowland of Macedonia.

### 3. Variability

#### 3.1. Age Variability

Different methods have been applied to determine age groups of *D. n.* The method based on the degree of the wear of tooth enamel permits precision up to the age of 1 year (HOMOLKA 1979, LOZAN 1961). Our material was divided into two groups:

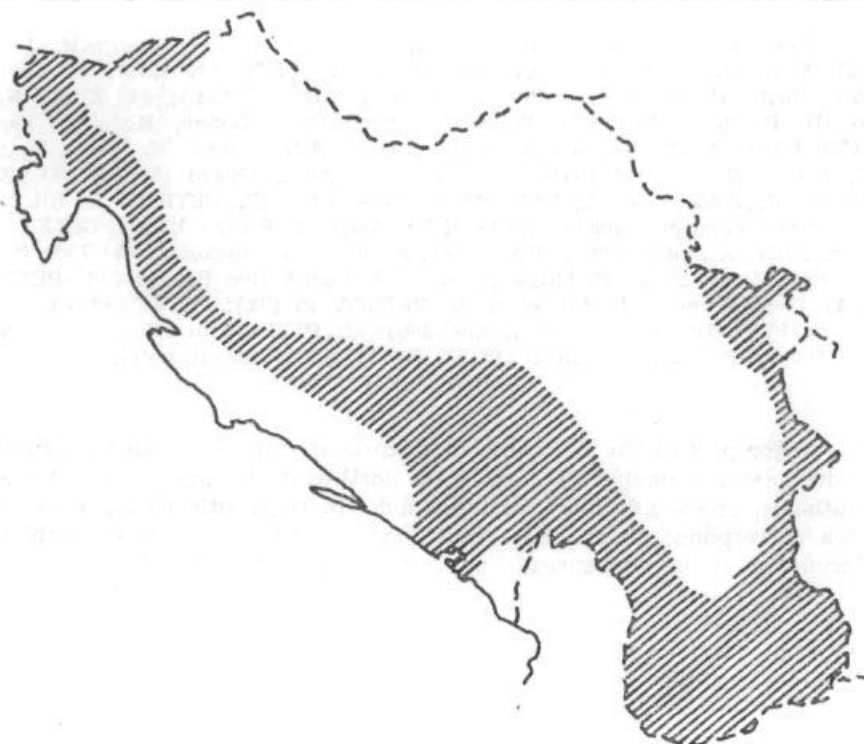


Fig. 3. Hypothetical distribution area of *Dryomys nitedula* in Yugoslavia  
Sl. 3. Hipotetična razširjenost drevesnega polha v Jugoslaviji

1<sup>st</sup> Group: Juvenile animals born within the same year. These specimens retain juvenile pelage as late as September. The tail is less bushy. The weight does not exceed 19,5 g.

In the material from Austria SPITZENBERGER (1983: 30) classified specimens from 15 to 26 g into a juvenile category.

2<sup>nd</sup> Group: Adult animals which have hibernated at least once. According to LOZAN (1961: 1741) *D. n.* does not survive a fourth hibernation, consequently, it does not live more than four years. Weight between 19 and 38 g (Tab. 1).

Month	n	1 <sup>st</sup> Group min—max	n	2 <sup>nd</sup> Group min—max
June	0		3	20 —22,5
July	2	10—11	9	21,5—29
August	4	12—19,5	5	22 —30,5
September	2	16—18,5	8	19 —38
Total	8	10—19,5	25	19 —38

Tab 1. Variations in weight of *Dryomys nitedula* from Yugoslavia with respect to age groups

Tab. 1. Variiranje teže pri *Dryomys nitedula* (iz Jugoslavije) glede na starostne skupine

	M A L E S				F E M A L E S				t
	n	$\bar{X}$	SD	CV	n	$\bar{X}$	SD	CV	
W	22/	22,89 ± 5,052		22,07	13/	25,27 ± 3,462	13,70		1,50
HB	23/	97,52 ± 4,032		4,13	13/	96,85 ± 3,826	3,95		0,51
TL	17/	83,32 ± 5,887		7,07	8/	82,00 ± 3,665	4,47		0,58
Hf	23/	20,71 ± 0,882		4,26	13/	20,51 ± 0,653	3,18		0,72
E	23/	13,71 ± 0,843		6,15	13/	14,03 ± 0,832	5,93		1,10
PL	22/	26,92 ± 0,741		2,75	13/	26,46 ± 1,024	3,87		1,53
CbL	22/	24,66 ± 0,751		3,05	13/	24,25 ± 0,782	3,23		1,55
RoL	23/	12,03 ± 0,347		2,88	13/	11,79 ± 0,547	4,64		1,83
YxT	23/	3,85 ± 0,170		4,42	13/	3,79 ± 0,171	4,51		0,95
D1L	23/	5,97 ± 0,260		4,36	13/	5,78 ± 0,255	4,41		1,76
BoB	22/	13,35 ± 0,419		3,14	13/	13,19 ± 0,299	2,27		1,24
ZyB	18/	15,28 ± 0,504		3,30	11/	15,08 ± 0,579	3,84		0,96
MoB	23/	6,23 ± 0,198		3,18	13/	6,12 ± 0,196	3,20		1,51
RoB	23/	5,07 ± 0,236		4,65	13/	4,99 ± 0,229	4,59		1,01
IC	23/	4,17 ± 0,169		4,05	12/	4,09 ± 0,151	3,69		1,34
BH	20/	9,19 ± 0,294		3,20	13/	9,00 ± 0,440	4,89		1,45
BbH	20/	11,25 ± 0,352		3,13	13/	11,12 ± 0,512	4,60		0,85
BuL	22/	7,34 ± 0,408		5,56	13/	7,21 ± 0,293	4,06		1,03
RoH	22/	4,81 ± 0,239		4,97	12/	4,83 ± 0,197	4,08		0,30
MdL	23/	13,92 ± 0,525		3,77	13/	13,85 ± 0,463	3,34		0,39
RMH	23/	6,90 ± 0,304		4,41	13/	6,73 ± 0,373	5,54		1,43
MdT	23/	3,99 ± 0,124		3,11	13/	3,97 ± 0,144	3,63		0,49
Q11	18/	62,22 ± 1,976		3,18	11/	62,41 ± 1,873	3,00		0,25
Q12	20/	45,81 ± 1,685		3,68	13/	45,89 ± 1,861	4,06		0,12
Q13	20/	84,63 ± 2,928		3,46	13/	84,36 ± 3,274	3,88		0,25
Q14	22/	48,75 ± 0,901		1,85	13/	48,59 ± 1,041	2,14		0,48
Q15	22/	29,78 ± 1,477		4,96	13/	29,57 ± 1,061	3,59		0,44
Q16	24/	49,57 ± 2,155		4,35	13/	48,58 ± 2,117	4,36		1,34
Q17	22/	54,16 ± 1,127		2,08	13/	54,11 ± 1,706	3,15		0,10
Q18	22/	56,49 ± 1,789		3,17	13/	57,15 ± 1,459	2,55		1,13

Tab. 2. Morphometrical characteristics of *Dryomys nitedula* from Yugoslavia from the sex aspectTab. 2. Morfometrične lastnosti *Dryomys nitedula* (iz Jugoslavije) glede na spol

### 3.2. Sexual Variability

Even though males attain somewhat higher values of metric indexes, the differences between the sexes are negligible and cannot be statistically corroborated (Tab. 2). Thus, we can affirm that in the case of *D. n.* secondary sexual dimorphism is not expressed.

### 3.3. Individual Variability

Of the morphometric indexes weight varies most (CV 22,07 with adult males). Body dimensions (CV between 4,13 and 7,07 for males and between 3,18 and 5,93 for females) are more variable than those of the skull (CV between 2,75 and 5,56 for males and between 2,27 and 5,54 for females). The males display a greater variability than the females.

Considerable variability is due also to the colour, which is most evident in the *D. n.* from Montenegro. By way of example: of the three specimens from the Durmitor two have a greyish and one a yellowish-grey back.

### 3.4. Geographic Variability

For the purposes of studying geographic variability the material was grouped into four populations (Fig. 4):

1. the Alps
2. the Northern Dinaric Alps



Fig. 4. Geographic positions of four populations of *Dryomys nitedula* (see the text for further explanation)

Sl. 4. Geografska lega štirih populacij drevesnega polha (za razlago glej tekst)

### 3. the Southern Dinaric Alps

#### 4. Macedonia

The population of the Alps has a relatively (QI 5) and an absolutely smaller bullae and a relatively longer rostrum (QI 4) than the population of the Northern Dinaric Alps (Tab. 3, 4). From the population of the Southern Dinaric Alps it differs by a relatively lower skull (QI 2, QI 3) and from the population of Macedonia by a lesser zygomatic breadth and a relatively (QI 2, QI 3) as well as an absolutely lower skull. The population of the Northern Dinaric Alps distinguishes itself from that of the Southern Dinaric Alps by a greater profile length, greater IoC, relatively (QI 5) and absolutely longer bullae and a relatively lower skull (QI 2). It differs from the Macedonian population by a smaller weight, a relatively (QI 2, QI 3) and an absolutely lower skull, relatively longer bullae (QI 5) and a relatively narrower skull (QI 1). The population of the Southern Dinaric Alps differs from that of Macedonia by a relatively (QI 1) and an absolutely narrower skull, a relatively (QI 2, QI 3) and absolutely lower skull and a longer mandibula.

The *D. n.* from the Alps differs from the *D. n.* from other parts of Yugoslavia by a relatively lower skull. The braincase height seems to reveal a clinal growth from the north towards the south of the state. The population of the *D. n.* from Macedonia distinguishes itself from the *D. n.* from the rest of Yugoslavia by a relatively and an absolutely higher skull. The *D. n.* from the Northern Dinaric Alps has considerably larger bullae, exceeding 8 mm (the range for the rest of Yugoslavia is between 6,6 and 7,8 mm).

In the scatter diagram (Fig. 5) in which the height of the skull per bullae is plotted against condylobasal length the population of the Alps and the Northern Dinaric Alps are well distinguishable from the Macedonian population. The population of the *D. n.* from the Southern Dinaric Alps reveals intermediate characteristics.

The coloration of the pelage displays a considerable variability. The most homogeneous are the two populations from the extreme areas of Yugoslavia. Thus, the back of the *D. n.* from the Alps is grey, with indistinct brown tones or without them. In the population of the Northern Dinaric Alps the brown tones are more obvious. Considerable homogeneity of coloration is characteristic of the population of Macedonia clearly deviating from the *D. n.* of the northwestern part of Yugoslavia by a markedly reddish-brown back. Specimens with greyish tones are extremely rare in Macedonia.

The population of the Southern Dinaric Alps is characterized by an outstanding variability of coloration. Animals with a grey or else a reddish-brown back can be found in one and the same locality (e.g. the Durmitor). On the other hand, however, the disposition of two colour types in the range of the Southern Dinaric Alps shows a disjunctive character. The *D. n.* from Maglić and Žljeb is perfectly grey. The adult female from Žljeb (BP 69/77) has a black-grey back, darker than of any other *D. n.* from the Alps that we examined. The specimens from Zelengora and Bjelasica are characterized by well pronounced brownish tones.

Tab. 3. Variations in external and skull dimensions and quotient indices of four populations of *Dryomys nitedula* from Yugoslavia  
 Tab. 3. Variabilnost v zunanjih in lobanjskih dimenzijah ter v lobanjskih indeksih pri štirih populacijah vrste *Dryomys nitedula* (iz Jugoslavije)

	ALPS				NORTHERN DINARIC ALPS				SOUTHERN DINARIC ALPS				MACEDONIA			
	n	$\bar{X}$	SD	CV	n	$\bar{X}$	SD	CV	n	$\bar{X}$	SD	CV	n	$\bar{X}$	SD	CV
W	4/	27,25	± 3,969	14,57	5/	24,00	± 2,915	12,15	11/	27,27	± 5,583	20,47	14/	29,71	± 3,832	12,90
HB	4/	99,25	± 0,957	0,96	6/	96,50	± 4,037	4,18	11/	95,91	± 3,145	3,28	14/	98,71	± 4,084	4,14
TL	4/	84,00	± 1,414	1,68	4/	84,38	± 2,213	2,62	10/	81,50	± 5,986	7,34	7/	82,71	± 7,477	9,04
Hf	4/	20,80	± 0,668	3,21	6/	20,82	± 1,216	5,84	11/	20,31	± 0,614	3,02	14/	20,83	± 0,762	3,66
E	4/	13,95	± 0,173	1,24	6/	14,40	± 1,138	7,90	11/	13,87	± 0,869	6,27	14/	13,58	± 0,718	5,29
PL	4/	26,65	± 0,666	2,50	6/	27,42	± 0,736	2,68	11/	26,39	± 0,586	2,22	13/	26,89	± 0,996	3,70
CbL	4/	24,35	± 0,480	1,97	6/	24,98	± 0,674	2,70	11/	24,32	± 0,590	2,42	13/	24,60	± 0,921	3,74
RoL	4/	11,95	± 0,191	1,60	6/	12,02	± 0,337	2,80	12/	11,89	± 0,387	3,25	14/	12,00	± 0,538	4,48
MxT	4/	3,83	± 0,096	2,51	6/	3,80	± 0,063	1,66	12/	3,90	± 0,217	5,56	14/	3,82	± 0,189	4,94
D1L	4/	5,90	± 0,183	3,10	6/	5,93	± 0,314	5,29	12/	5,77	± 0,227	3,94	14/	6,01	± 0,259	4,31
BoB	4/	13,30	± 0,356	2,68	6/	13,50	± 0,379	2,81	11/	13,21	± 0,416	3,15	13/	13,31	± 0,335	2,52
ZyB	4/	14,85	± 0,507	3,41	5/	15,32	± 0,259	1,69	9/	15,00	± 0,500	3,33	9/	15,61	± 0,426	2,73
MoB	4/	6,10	± 0,116	1,89	6/	6,27	± 0,175	2,79	12/	6,23	± 0,230	3,69	14/	6,19	± 0,186	3,00
RoB	4/	4,95	± 0,191	3,86	6/	5,12	± 0,306	5,98	12/	5,07	± 0,264	5,21	14/	5,03	± 0,190	3,78
IC	4/	4,20	± 0,141	3,36	6/	4,25	± 0,164	3,86	12/	4,12	± 0,103	2,50	13/	4,10	± 0,204	4,98
BH	4/	9,30	± 0,294	3,16	6/	9,03	± 0,234	2,59	11/	8,91	± 0,356	4,00	11/	9,32	± 0,352	3,78
BbH	4/	10,73	± 0,512	4,77	6/	11,12	± 0,204	1,84	11/	11,16	± 0,336	3,01	11/	11,54	± 0,254	2,20
BuL	4/	7,13	± 0,287	4,03	6/	7,77	± 0,489	6,30	11/	7,18	± 0,218	3,04	13/	7,24	± 0,293	4,05
RoH	4/	4,98	± 0,250	5,02	6/	4,93	± 0,137	2,78	12/	4,79	± 0,188	3,92	12/	4,76	± 0,215	4,52
MdL	4/	13,90	± 0,294	2,16	6/	13,97	± 0,671	4,80	12/	13,63	± 0,542	3,98	14/	14,11	± 0,254	1,80
RMH	4/	6,63	± 0,206	3,11	6/	6,93	± 0,356	5,13	12/	6,73	± 0,365	5,42	14/	6,95	± 0,288	4,14
MdT	4/	4,03	± 0,050	1,24	6/	4,00	± 0,110	2,74	12/	4,03	± 0,122	3,03	14/	3,94	± 0,150	3,81
QI1	4/	60,98	± 1,283	2,10	5/	61,01	± 1,566	2,57	10/	61,97	± 1,705	2,75	9/	64,04	± 1,439	2,25
QI2	4/	44,03	± 1,457	3,31	6/	44,51	± 0,957	2,15	11/	45,87	± 0,907	1,98	11/	47,27	± 1,719	3,64
QI3	4/	80,62	± 2,648	3,28	6/	82,38	± 2,069	2,51	11/	84,47	± 1,990	2,36	11/	87,35	± 1,755	1,99
QI4	4/	49,08	± 0,251	0,51	6/	48,10	± 0,598	1,24	11/	48,89	± 0,955	1,95	13/	48,68	± 1,155	2,37
QI5	4/	29,26	± 0,900	3,08	6/	31,07	± 1,365	4,39	11/	29,35	± 1,050	3,58	13/	29,47	± 1,366	4,64
QI6	4/	47,66	± 0,653	1,37	6/	49,69	± 2,576	5,18	11/	49,39	± 2,499	5,06	14/	49,25	± 2,142	4,35
QI7	4/	54,62	± 0,637	1,17	6/	54,04	± 0,549	1,02	11/	54,00	± 1,767	3,27	13/	54,14	± 1,481	2,74
QI8	4/	57,10	± 1,459	2,56	6/	55,89	± 1,832	3,28	11/	56,26	± 1,701	3,02	13/	57,52	± 1,506	2,62

	Alps	Alps	Alps	N-Dinaric	N-Dinaric	S-Dinaric
	N-Dinaric	S-Dinaric	Macedonia	S-Dinaric	Macedonia	Macedonia
W	1,42	0,01	1,13	1,22	3,02 <sup>++</sup>	1,30
HB	1,31	2,05	0,03	0,43	1,12	1,89
TI	0,29	0,81	0,33	0,92	0,42	0,37
Hf	0,03	1,34	0,07	0,15	0,03	1,84
E	0,77	0,17	1,00	1,08	1,96	0,93
PL	1,67	0,73	0,44	3,11 <sup>++</sup>	1,20	1,45
CbL	1,60	0,10	0,51	2,10	0,93	0,88
RoL	0,36	0,29	0,18	0,68	0,02	0,59
MxT	0,49	0,22	0,04	1,09	0,26	0,99
DiL	0,19	1,06	0,76	1,29	0,57	2,50
BoB	0,84	0,39	0,04	1,41	1,12	0,66 <sup>+</sup>
ZyB	1,81	1,00	2,82 <sup>+</sup>	1,32	1,39	2,77 <sup>+</sup>
MoB	1,67	1,04	0,94	0,39	0,82	0,40
RoB	0,97	0,84	0,73	0,36	0,80	0,42
IC	0,50	1,28	0,91	2,15 <sup>+</sup>	0,77	0,28
EH	1,60	1,96	0,09	0,78	1,76	2,74 <sup>+</sup>
BbH	1,72 <sup>+</sup>	0,38	4,20 <sup>++</sup>	0,25	3,43 <sup>++</sup>	3,00 <sup>++</sup>
BuL	2,34 <sup>+</sup>	0,41	0,68	6,16 <sup>++</sup>	2,96 <sup>++</sup>	0,52
RoH	0,35	1,56	1,71	1,64	1,84	0,43 <sup>+</sup>
MdL	0,19	0,93	1,35	1,15	0,72	2,94 <sup>++</sup>
RMH	1,55	0,55	2,06	1,11	0,11	1,70
MdT	0,42	0,00	1,14	0,42	0,94	1,65
QII	0,03	1,49	3,64 <sup>++</sup>	1,05	3,66 <sup>++</sup>	2,84 <sup>+</sup>
QI2	0,76	2,97 <sup>+</sup>	3,34 <sup>++</sup>	2,90 <sup>+</sup>	3,60 <sup>++</sup>	2,38 <sup>+</sup>
QI3	1,66	3,05 <sup>++</sup>	5,81 <sup>++</sup>	2,05	5,27 <sup>++</sup>	3,62 <sup>++</sup>
QI4	3,05 <sup>+</sup>	0,39	0,67	1,82	1,15	0,48
QI5	2,32 <sup>+</sup>	0,15	0,30	2,91 <sup>+</sup>	2,38 <sup>+</sup>	0,23
QI6	1,52	1,34	1,44	0,58	0,39	0,15
QI7	1,55	0,67	0,62	0,04	0,16	0,20
QI8	1,10	0,87	0,49	0,42	2,05	1,92

Tab. 4. Interpopulation t-test values of four populations of *Dryomys nitedula* from Yugoslavia. P = 0,05 (+) and P = 0,01 (++)Tab. 4. Interpopulacijske vrednosti t-testa pri štirih populacijah vrste *Dryomys nitedula* (iz Jugoslavije). P = 0,05 (+) in P = 0,01 (++)

#### 4. Subspecies of *D. n.* in Yugoslavia

The subspecific status of *D. n.* in Yugoslavia has been discussed by the following authors: MILLER (1912: 569), WETTSTEIN (1928), MARTINO (1934: 88, 1939), PETROV (1939: 78), PASPALEFF, MARTINO and PECHEFF (1953), FELTEN and STORCH (1965: 351), ĐULIĆ and VIDINIĆ (1967: 151) and SCHEDL (1968: 392).

For the territory of Yugoslavia two subspecies were described, namely:

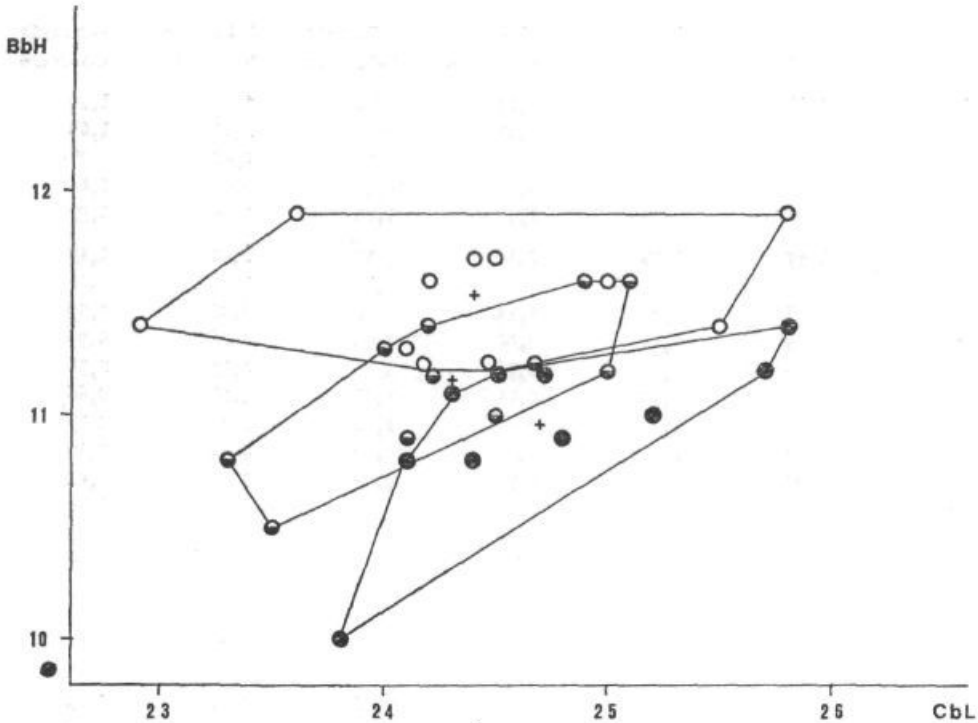


Fig. 5. Discrimination of subspecies of *Dryomys nitedula* in Yugoslavia by means of a scatter diagram where the braincase height per bullae (BbH) is plotted against the condylobasal length (CbL). Solid circles represent *D. n. intermedius*; half solid circles *D. n. intermedius*  $\lesssim$  *D. n. ravijojla* intergrades; open circles *D. n. ravijojla*; crosses, average values

Sl. 5. Razlikovanje podvrst drevesnega polha v Jugoslaviji s pomočjo korelacijskega diagrama, kjer nanašamo višino lobanje z bulami (BbH) proti kondilobazalni dolžini lobanje (CbL). Črni krogi predstavljajo *D. n. intermedius*; polčrni krogi označujejo prehodno obliko *D. n. intermedius*  $\lesssim$  *D. n. ravijojla*; beli krogi *D. n. ravijojla*; križi — srednje vrednosti

*D. n. ravijojla* PASPALÉV, MARTINO and PEČHEV, 1952 (loc. typ.: Macedonia, Bistra Mts., Senečki Suvati).

*D. n. diamesus* LEHMANN, 1959 (loc. typ.: Montenegro, Lovčen Mts., Ivanova Korita).

Most of the authors overlooked the denomination "*ravijojla*", and only CORBET (1978: 146) and STORCH (1978: 229) drew attention to this name once again.

In the last decades several subspecific classifications of *D. n.* have been proposed with respect to the Balkans. PASPALÉV et al. (1952: 202) identified four subspecies which they keyed as follows:



1. Skull massive, zygomatic breadth exceeding 15,5 mm  
(on an average) . . . . . *D. n. robustus*
- Skull delicate, zygomatic breadth not exceeding  
15,5 mm . . . . . 2
2. Back dark grey . . . . . *D. n. intermedius*
- Back yellowish . . . . . 3
3. Rostrum shorter than 8 mm . . . . . *D. n. wingei*
- Rostrum longer than 8 mm . . . . . *D. n. raviojla*

Ascribed to *D. n. raviojla* were the specimens from Macedonia, Kosovo and Bulgaria.

ĐULIĆ and MIRIĆ (1967: 28) cited 5 subspecies for Yugoslavia:

*D. n. nitedula* (PALLAS, 1779) for Croatia, Serbia, Bosnia and Herzegovina

*D. n. wingei* (NEHRING, 1902) for Macedonia

*D. n. intermedius* (NEHRING, 1902) for Slovenia, Bosnia and Herzegovina, northern Montenegro, and Croatia with a question mark

*D. n. robustus* (MILLER, 1910) for Macedonia and Serbia with a question mark

*D. n. diamesus* (LEHMANN, 1959) for Montenegro

For all of these taxa (MIRIĆ, 1970) contributed short diagnoses.

ONDRIAS (1966: 22) identified 5 subspecies for the Balkans and mapped their distribution. He cites *D. n. intermedius* for western Yugoslavia, *D. n. nitedula* for eastern Voivodina and Rumania, *D. n. robustus* for Bulgaria, *D. n. diamesus* for Montenegro, and *D. n. wingei* for Macedonia and Greece. His classification reposes on pelage coloration.

STORCH (1978: 232) proposed the following classification for the Balkans:

*D. n. intermedius* (oberseites dunkelgrau mit höchstens schwachem olivgrünem oder braunem Anflug, schmale Schädelkapsel, relativ kleiner Schädel): Alpen, Abgrenzung nach E (Ungarn) und SE (Slovenien-Bosnien) unklar.

*D. n. wingei* (bei Adulten oberseits lebhaft rostrote Tönung, relativ geringe Schädelmasse, schmale und flache Hirnkapsel): Griechenland und S-Jugoslawien (Makedonien), wahrscheinlich auch S-Albanien und SW-Bulgarien. — Synonym: *raviojla*.

*D. n. nitedula* (Oberseitenfärbung graubraun, gelbbraun oder rotbraun mit grauem bis rostrotem Überflug, Schädel relativ gross, Hirnkapsel robuster als bei den vorhergehenden): Übriges europäisches Art-Areal. Terra typica der Nominatrasse ist die Gegend von Kasan, UdSSR. — Synonyme: *robustus*, *carpathicus*, *diamesus*.

We can see that most of the authors lay great stress upon the colour of the pelage whereas we consider it an auxiliary character. In our opinion a material distinction between the population of the Alps and possibly that of the Northern Dinaric Alps (in fact the latter has larger bullae) on one hand and the population of Macedonia on the other as two different subspecies can be made by taking into account the relative height of the skull. The former would be identical with the ssp. *intermedius* (Tab. 6). In our belief the *D. n.*

Subspecies	Col. No.	Locality	Date	Sex	HB	TL	Hf	E	Legit
<i>D. n. intermedius</i>	603	Veliki Igman, Veliko polje, 1340 m	06.07.1927	♀	98	85	19	15	
"	711	Rateče	23.07.1931	♀	84	85	20	12	O. Wagner
"	1082	Veljebit, Krasno	31.07.1936	♀	89	77	19,8	13,7	E. Martino
"	1469	Gola Jahorina, 1800 m	13.09.1948	♀	90	73	17,8	12,5	"
"	1575	Kalinovik, Vlaholje	15.08.1946	♀	85	72,5	17,8	13,5	V. Martino
"	1576	Treshavica, Kutski Grad, 1450 m	05.09.1946	♀	92	77	18,2	12,2	E. Martino
"	1577	"	"	♀	86	78	19	13,2	"
"	2091	Veliki Igman, Grkhalica	07.06.1949	-			18	12,2	"
<i>D. n. wingei</i>	1434	Perister, near Magarevo, 1000 m	26.08.1928	♂	96	168	19,2	13	
<i>D. n. ravijojla</i>	795	Bistva, Trebiški buk, Semečke suvati, 1900 m	08.08.1933	♀	87	80	20	13,5	K. Martino
"	885	Prilep, Markova kula	28.07.1934	♀	108	81	19,5	13,2	
"	951	Korab, Čes-alijska, 1500 m	19.08.1935	♂	75	68	19	14,0	
"	1225	Hugovo, Lisic	07.08.1939	♂					
<i>D. n. robustus</i>	1178	Asan-Česma	15.08.1938	♀					

Tab. 5. Data on *Dryomys nitedula* from Yugoslavia as gathered from the collection of V. MARTINO (Zoological Institute, USSR Academy of Sciences, Leningrad)

Tab. 5. Podatki o vrsti *Dryomys nitedula* (iz Jugoslavije), ki so v zbirki V. MARTINO (Zoološki inštitut, Akademija znanosti ZSSR, Leningrad)

Geographic Region	Subspecies	N	min— $\bar{x}$ —max	Authors
Austria	intermedius	10	23,8—24,33—25,5	Spitzenberger 1983
Yugoslavia (Alps, North. Dinaric Alps)	intermedius	10	23,8—24,73—25,8	the present study
Yugoslavia (Macedonia)	ravijojla	13	22,9—24,60—26,4	the present study
Greece	wingei	12	23,2—23,9—24,8	Ondrias 1966
Bulgaria	wingei	110	22,0—23,95—25,5	Peshev, Mitev 1979
European Soviet Union	nitedula	114	23,0—25,12—27,0	Rossolimo 1971
Asia (Minor)	phrygius	14	22,0—23,37—24,8	Spitzenberger 1973

Tab. 6. Condylobasal length in different subspecies of *Dryomys nitedula*Tab. 6. Kondilobazalna dolžina lobanje pri različnih podvrstah *Dryomys nitedula*

from Macedonia should not be identified as *D. n. wingei* from Greece since the former is greater and has a higher skull. It is denominated *ravijojla*, Macedonia being its type locality.

The population of the Southern Dinaric Alps reveals mixed characteristics both with regard to coloration as well as in relation to BbH/CbL, therefore, it is designated as an intermediate (mixed) population (*D. n. intermedius*  $\lesssim$  *D. n. ravijojla*). If recognized as an independent subspecies, this population should be denominated »*diamesus*«. For the present, however, we consider it more adequate to treat it as a population of transitional properties.

No data are available on the morphologic characteristics of the *D. n.* from the Carpatho-Balcanic mountain region. Consequently, nothing can be said of its taxonomic status.

Summing up, the following picture is obtained:

*D. n. intermedius* (NEHRING, 1902)

Type locality: Near Lienz, Tyrol, Austria

Distribution: Alps and Northern Dinaric Alps (Snežnik, Risnjak, Velebit, western Bosnia).

Diagnosis: Skull lower (BbH 10,0—11,4 mm). Back mostly grey, brownish tones can also be expressed.

*D. n. ravijojla* PASPALOV, MARTINO and PEČHEV, 1952

Type locality: Senečki Suvati, Bistra Mts., Macedonia, Yugoslavia.

Distribution: Macedonia

Diagnosis: Skull higher (BbH 11,2—11,9). Back mostly reddish-brown, rarely with visible greyish tones.

*D. n. intermedius*  $\lesssim$  *D. n. ravijojla*

Distribution: Bosnia, Herzegovina, Montenegro and Kosovo.

Diagnosis: Mixed population. BbH 10,4—11,6 mm. From the coloration of the back the characteristics of both subspecies are evident.

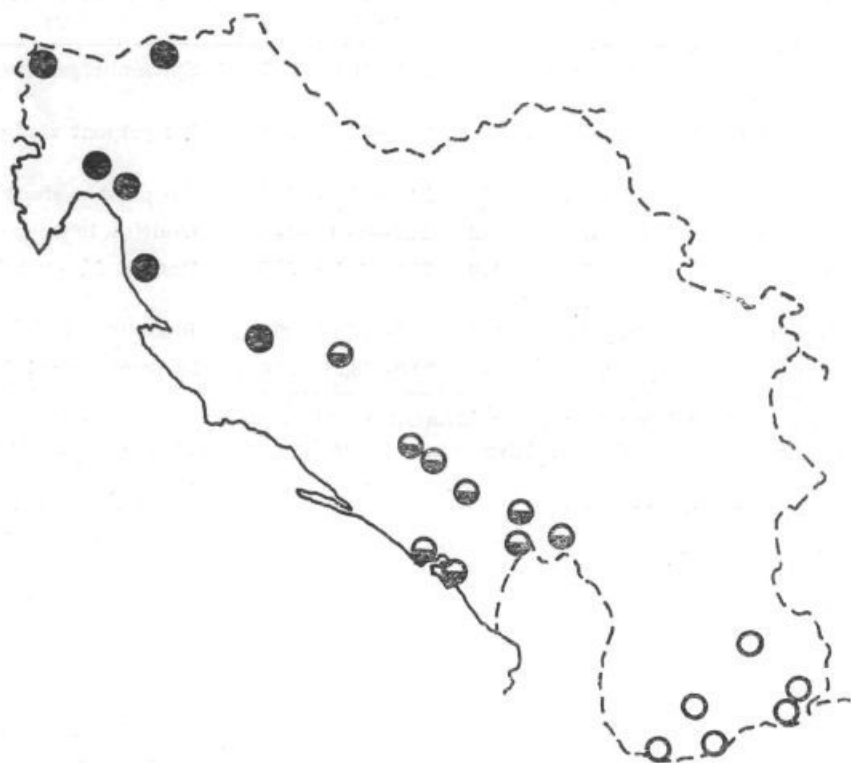


Fig. 6. Distributional records of *Dryomys nitedula* subspecies in Yugoslavia. Symbols as in fig. 5

Sl. 6. Razširjenost podvrst *Dryomys nitedula* v Jugoslaviji. Simboli so takšni, kot na sl. 5

### 5. Vertical Distribution

All known localities of *D. n.* in Yugoslavia lie within 60 and 2000 m of altitude. The lowest locality is that in the lowland of Macedonia (Valandovo and Gevgeli; PETROV 1969: 1), the highest in Montenegro (Durmitor; PETROV 1939: 78). The vertical range of *D. n.* in Slovenia is between 490 and 1780 m, in Croatia between 550 and 1650 m, in Bosnia and Herzegovina between 880 and 1800 m, in Montenegro between 1050 and 2000 m, in Serbia between approx. 60 and 1750 m, and in Macedonia between 60 and 1900 m.

67,4 % of all localities of *D. n.* lie above 1000 m. One half (53,1 %) belongs to the highland zone from 1201 to 1800 m. *D. n.* is rarest in the lowland zone (up to 600 m). In this respect the lowland of Macedonia is an exception. Most localities (65,3 %) are to be found in the montane zone (600 to 1600 m of

a

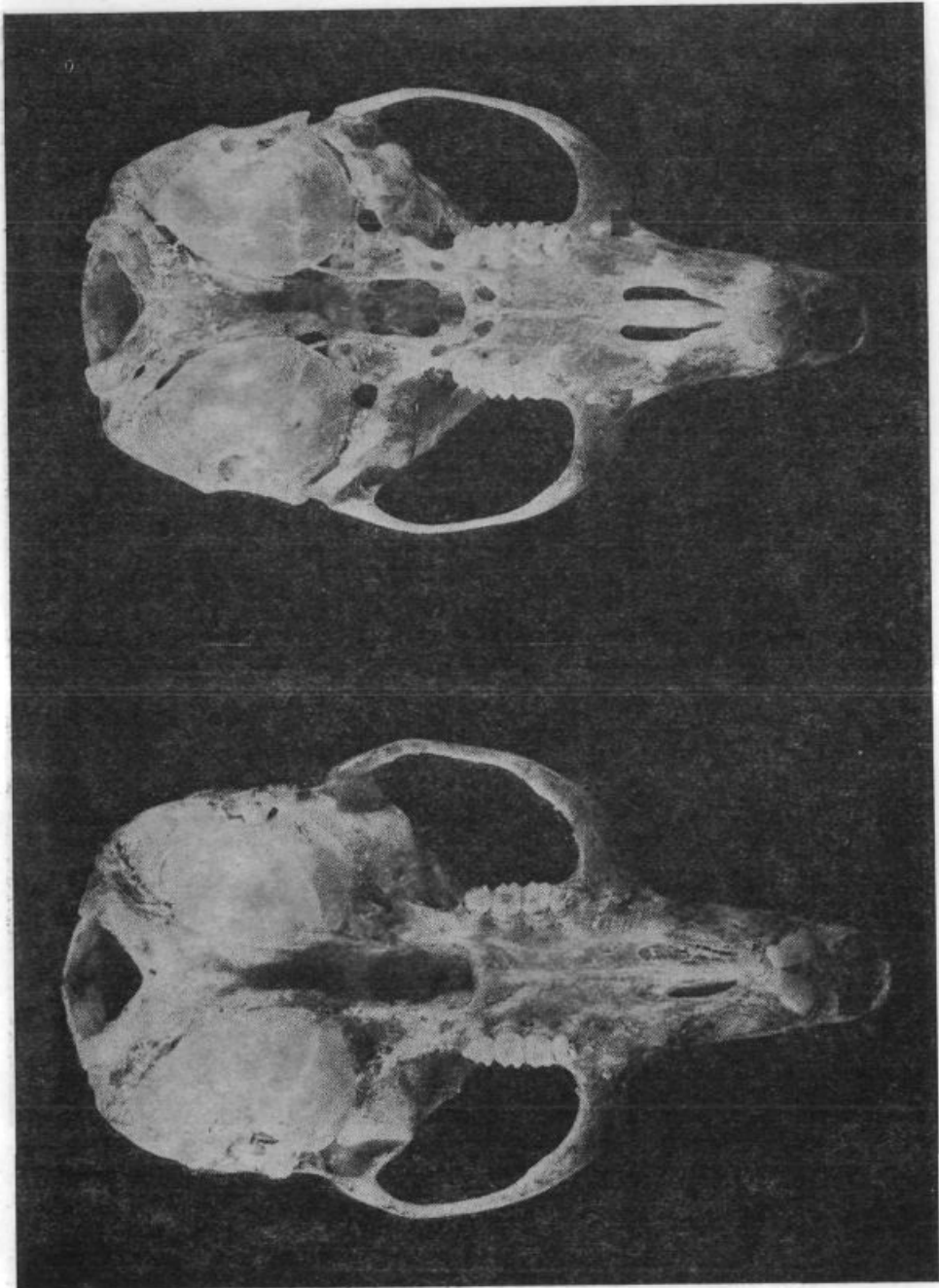


b



Fig. 7 8, 9. Skulls of *Dryomys nitedula* from Yugoslavia. a — *D. n. intermedius* (Slovenia, Julian Alps); b — *D. n. ravijojla* (Macedonia, Prespa lake). Fig. 8. — Norma dorsalis; fig. 9. — Norma ventralis; fig. 10. — Norma lateralis. (Foto M. Stangelj)

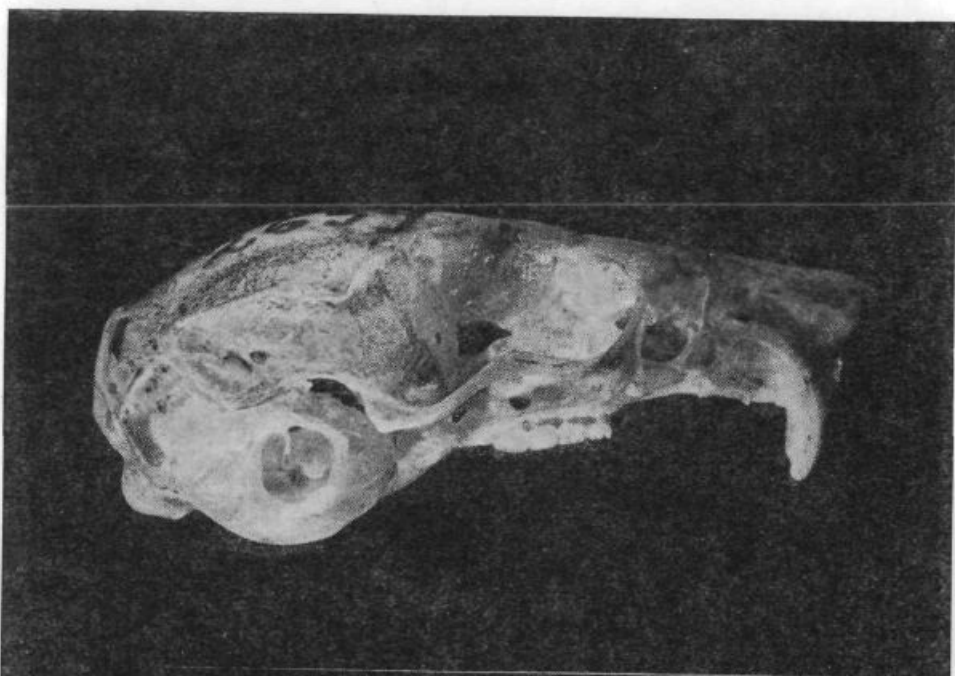
Sl. 7, 8, 9. — Lobanji *Dryomys nitedula* iz Jugoslavije. a — *D. n. intermedius* (Slovenija, Julijske Alpe); b — *D. n. ravijojla* (Makedonija, Prespansko jezero). Sl. 8. — Norma dorsalis; sl. 9. — Norma ventralis; sl. 10. — Norma lateralis. (Foto M. Stangelj)



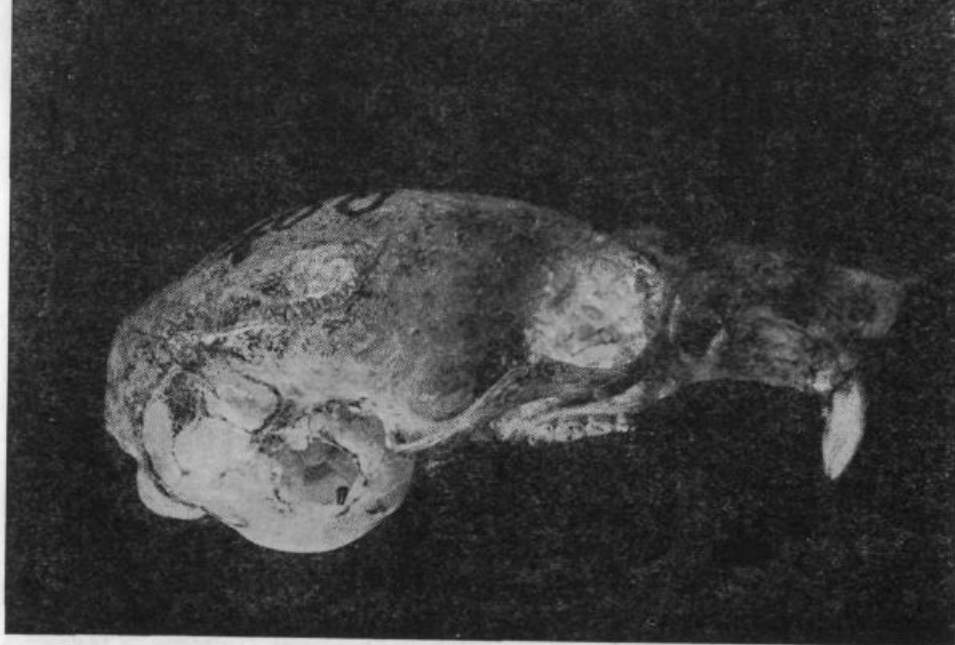
a

b

a



b



altitude). This means that *D. n.* is a species of the upper montane and the lower Alpine zone.

The narrowest vertical distribution of *D. n.* is observed in the Dinaric Alps (Velebit, Bosnia and Herzegovina, Montenegro) where it is limited to the montane and the sub-Alpine zone (verticale range from 900 to 2000 m), whereas the broadest verticale range is known in Macedonia (60 to 1900 m of altitude).

### 6. Habitat Requirements

In Yugoslavia *D. n.* inhabits the forests of the order *Fagetalia*, *Vaccinio-Piceetalia* and *Quercetalia*, as well as their degradational stadia. In beech forests (*Anemone-Fagetum*, *Abieti-Fagetum*, *Fagetum montanum*, *Fagetum subalpinum*,

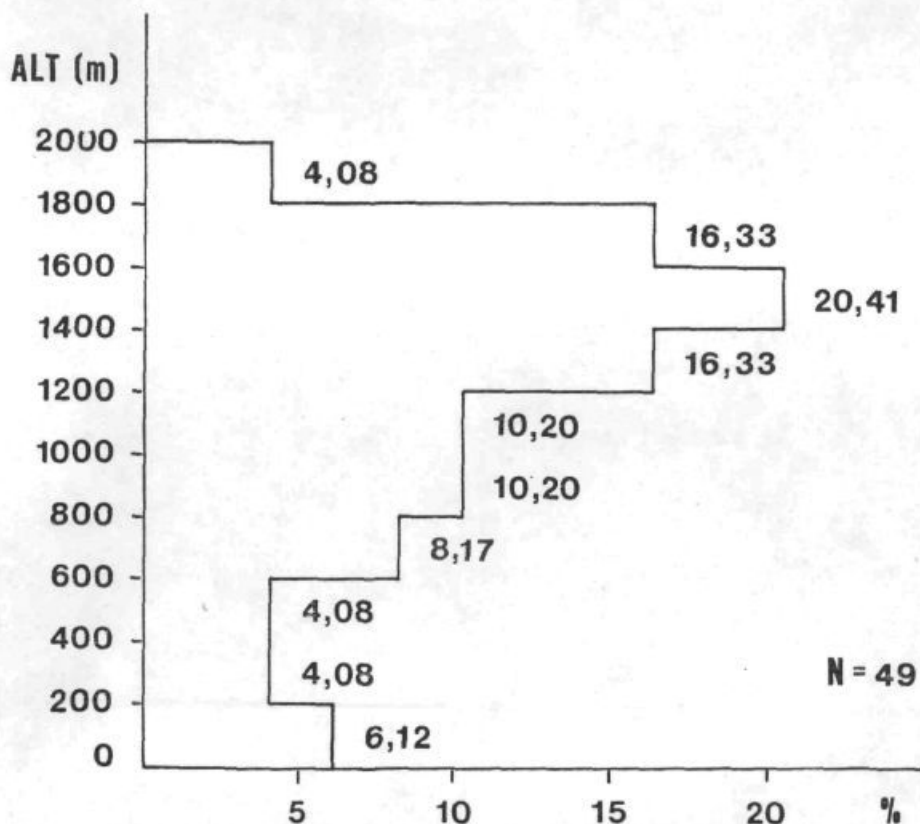


Fig. 10. Vertical distribution of *Dryomys nitedula* in Yugoslavia. Indicated is the frequency of presence within a two-hundred meter highland zone

Sl. 10. Vertikalna razširjenost *Dryomys nitedula* v Jugoslaviji. Označena je frekvenca prisotnosti znotraj dvestometerskega višinskega pasu



*Seslerio-Fagetum*) it has been found above all in the Dinaric region. It seems to prefer the rocky ground which is quite frequent in the beech forests of said region. It has also been found in rocky places once overgrown by beech forests where as a result of degradation there remain just single beech trees. It is less keen on pine and fir woods (*Luzulo silvaticae-Piceetum*, *Piceetum excelsae montanum*, *Piceetum excelsae croaticum*, *Pinetum leucodermis*, *Pinetum peucis*), preferring the dwarf pine (*Rhodotamno-Rhododendretum*, *Pinetum mugii dinaricum*) to all other environments. In Macedonia and Serbia it has been found also in oak forests (*Quercu-Carpinetum orientalis*, *Quercetum trojanae*, *Quercetum cerris moesiacum*, *Quercetum frainetto-cerris*) and the more frequently so in their degradation stadia (rocky places, live-hedges).

Most of the habitats of *D. n.* are termophilic and xerophilous. This is also true of some highlands with a high quantity of precipitation, most of them being carstic, which means that the meteoric water quickly flows off to the underground. Moist and cool habitats are an exception, at least as far as Yugoslavia is concerned (e. g. Pohorje).



Fig. 11.—19. Habitats of *Dryomys nitedula* in Yugoslavia; fig. 11. Julian Alps, Planica, 1000 m (Foto B. Kryštufek); fig. 12. Pohorje, Velika Kopa, 1520 m (Foto D. Sere); fig. 13. Snežnik, Svinščalki, 1242 m (Foto J. Gregori); fig. 14. Montenegro, Bjelasica, Jelovica, 1450 m (Foto B. Kryštufek); fig. 15. Kom Vasojević, 1800 m (Foto B. Kryštufek); fig. 16. Durmitor, Crepuljna poljana, 1700 m (Foto N. Mršić); fig. 17. Žljeb, Kula, 1750 m (Foto B. Kryštufek); fig. 18. Orjen, Crkvice, 1050 m (Foto B. Kryštufek); fig. 19. Prespa lake, Kurbinovo, 920 m (Foto B. Kryštufek).

Sl. 11.—19. Habitati drevesnega polha v Jugoslaviji



Fig. 12



Fig. 13



Fig. 14

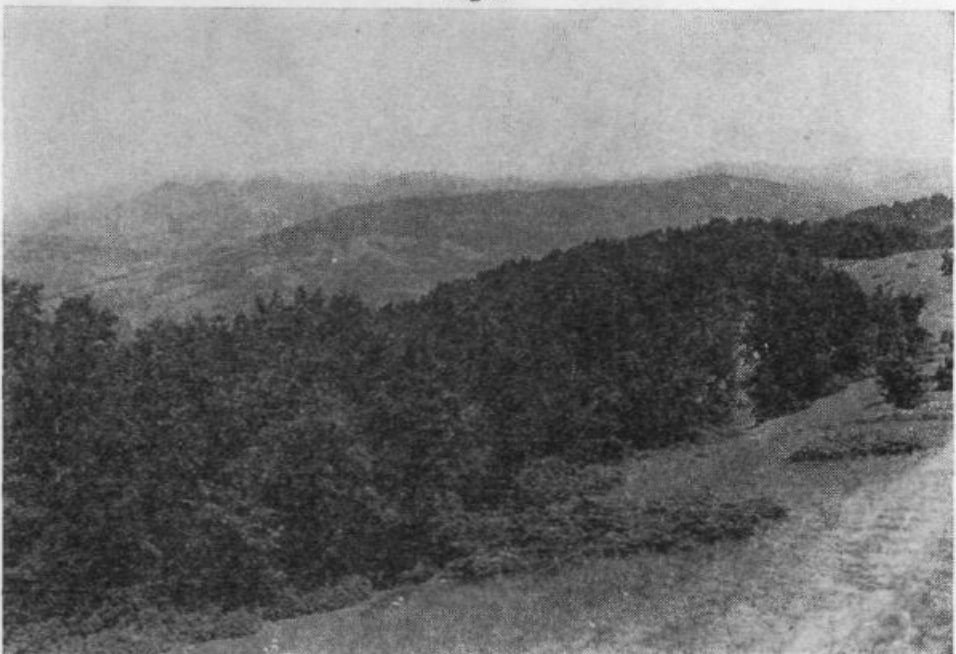


Fig. 15

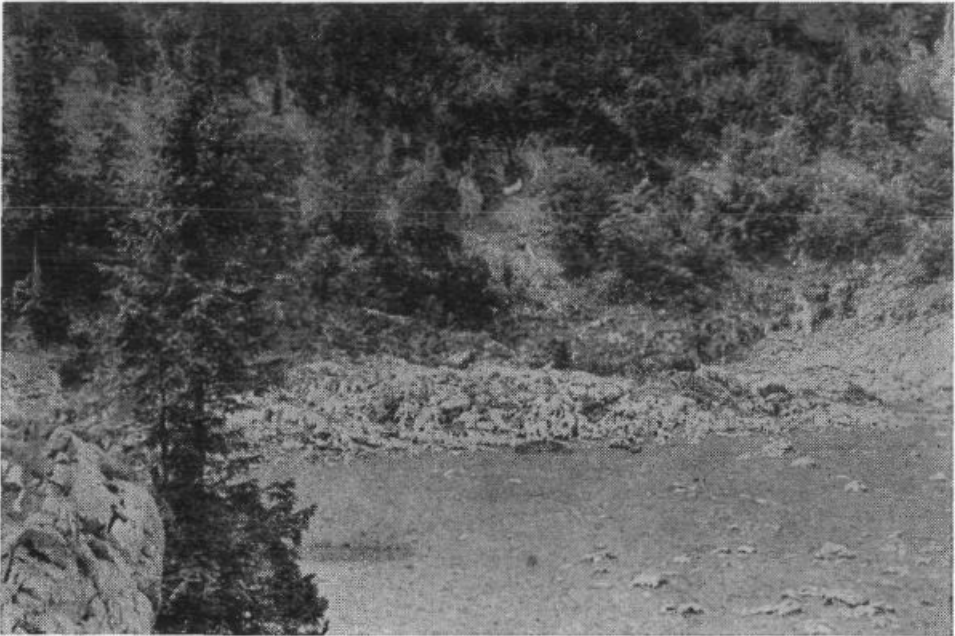


Fig. 16



Fig. 17



Fig. 18



Fig. 19



Fig. 20. *Dryomys nitedula intermedius* (carcass). Adult female caught on Pohorje, Velika Kopa (1520 m), on 4<sup>th</sup> July 1983. (Foto I. Sivec)

Sl. 20. *Dryomys nitedula intermedius* (mrtva žival). Odrasla samica, ujeta 4. julija 1983 na Veliki Kopi, Pohorje. (Foto I. Sivec)

## 7. Dominance

Among more than 10.000 specimens of small mammals caught all over Yugoslavia there are only 51 specimens of *D. n.* In Yugoslavia as a whole *D. n.* is a rare species. In single habitats where caught its dominance varies between 1,01 and 27,7% (Tab. 7), which means that it is a subprecedent and recedent, and only exceptionally a subdominant species.

Due to a high dominance of *D. n.* certain habitats deserve special attention.

### — Planica (1000 m)

In Planica small mammals were being caught during 9 nights. The density of their population has always been low, so all we caught were 39 specimens, among them 6 *D. n.* In the same habitat we found also *Sorex araneus*, *S. alpinus*, *Clethrionomys glareolus*, *Chionomys nivalis*, *Pitymys liechtensteini* and *Apodemus flavicollis*.

### — Maglić (1700—1800 m)

Into 50 traps laid for one night at *Pinetum mugii* and the neighbouring rocky areas, 11 small mammals (*Sorex araneus*, *Clethrionomys glareolus*, *Dina-*

Locality	Altitude	Habitat	N	Nd	D (%)
Julijske Alpe, Planica	1000	Rhodothamno-Rhododendretum Predominantly rocky area	39	6	15,38
Pohorje, Velika Kopa	1520	Luzulo silvaticae-Piceetum with numerous clearings	43	1	2,33
Snežnik, Svinščaki	1242	Abieti-Fagetum dinaricum	86	3	3,49
Risnjak	1450—1500	Pinetum mugii	58	2	3,45
Velebit, Zavižan	1500—1650	Fagetum subalpinum	33	1	3,03
Šator Mts.	1550	Pinetum mugii predominantly rocky area	33	1	3,03
Kupreška vrata	880	Abieti-Fagetum	90	1	1,01
Zelengora	1500	Rocky area with <i>Fagus sylvatica</i>	27	1	3,70
Maglić	1600—1800	Pinetum mugii	11	3	27,27
Durmitor	1450—1700	Piceetum excelsae croaticum with numerous clearings	53	4	7,55
Bjelasica	1350—1500	Fagetum montanum	270	3	1,11
Komovi	1800	Fagetum subalpinum and rocky area	50	1	2,00
Žljeb	1750—1800	Piceetum excelsae subalpinum	25	2	8,00
Prespan, Asamati	860—920	Quercetum frainetto — cerris	62	4	6,45
Prilep	700	Rocky area	30	6	20,00
Valendovo	65	<i>Salix</i> , <i>Populus</i>	28	2	7,14
Gevgeli	75	Rocky area overgrown with shrubbery	12	2	16,67

Tab 7. Dominance of *Dryomys nitedula* in certain Yugoslav localities  
N — total number of small mammals; Nd — number of forest dormice; D — dominance of forest dormice

Tab. 7. Dominantnost drevesnega polha na nekaterih nahajališčih v Jugoslaviji  
N — skupno število malih seselcev; Nd — število drevesnih polhov; D — dominantnost drevesnega polha

*romys bogdanovi*, *Chionomys nivalis*, *Apodemus sylvaticus* and *A. flavicollis*) were caught, among them 3 *D. n.*

— Prilep (700—800 m)

Into 100 traps set in a rocky area, 31 small mammals (*Apodemus sylvaticus* and *A. mystacinus*) were caught, 6 of them being *D. n.*

Living syntopically with *D. n.* are no less than 20 species of small mammals, namely: *Sorex araneus*, *S. alpinus*, *S. minutus*, *Neomys fodiens*, *N. anomalus*, *Crociodura leucodon*, *C. suaveolens*, *Clethrionomys glareolus*, *Dinaromys bogdanovi*, *Microtus agrestis*, *Chionomys nivalis*, *Pitymys subterraneus*, *P. liech-*

*tensteini*, *Apodemus sylvaticus*, *A. flavicollis*, *A. mystacinus*, *Mus hortulanus*, *Mus domesticus*, *Glis glis*, and *Muscardinus avellanarius*.

In no locality has *D. n.* been found together with *Eliomys quercinus*.

### 8. Period of Activity

All specimens of *D. n.* in Yugoslavia were caught in the period between 7<sup>th</sup> April and 11<sup>th</sup> October. The specimens caught in April all originate from Macedonia. In the period from October-November till the end of March (in mountainous regions probably till the end of May) *D. n.* hibernates.

Month	N. D. n.	N. r. f.	N. juv.
April	11	—	—
May	—	—	—
June	8	2	—
July	16	6	2
August	21	—	6
September	20	—	3
October	1	—	—
Total	77	8	11

Tab. 8. Demographic characteristics of *Dryomys nitedula* from Yugoslavia

N. D. n. — total number of forest dormice; N. r. f. — number of females showing signs of reproduction (pregnancy, lactation); N. juv. — number of juvenile forest dormice

Tab. 8. Demografske značilnosti drevesnega polha iz Jugoslavije

N. D. n. — skupno število drevesnih polhov; N. r. f. — število samic, ki so kazale znake brejosti, laktacije; N. juv. — število juvenilnih drevesnih polhov

### 8.1. Reproduction

Females showing signs of reproduction (lactation, pregnancy) were found in June and July. Only three of them were pregnant:

Locality	Date	Embryos	
		Number	Dimensions
Durmitor	9 <sup>th</sup> June	5	3 × 2,5 mm
Pohorje	4 <sup>th</sup> July	2	4 × 3,5 mm
Snežnik	18 <sup>th</sup> July	4	5 mm

The first young animals of the same year were caught in July (on 18<sup>th</sup> July on Snežnik and 19<sup>th</sup> July on Orjen).

The testes of sexually mature males are from 7 to 18,5 mm long and 3 to 7,7 mm broad. In young ones they amount to 5 × 3 mm.



## 9. Conclusions and Discussion

Our results have considerably changed the present knowledge on *D. n.* in Yugoslavia. STORCH (1978: 228) mapped this species for the entire territory of Yugoslavia, with the exception of Istria and western Slovenia. Now we know that *D. n.* does not live in the Pannonian lowland to the north of the Sava and the Danube, being absent also from the major part of the sub-Pannonian and hilly region to the south of the Sava. It is not an inhabitant of Istria, a large part of the Adriatic coast and the islands.

MATVEJEV (1961: 97) considers *D. n.* a species characteristic of the Mediterranean mountain rocky woods. This group of elements distinguishes itself by its tertiary age. However, KRATOCHVIL (1967) believes that *D. n.* came to Europe from the East through Asia Minor as late as in the Holocene. According to SPITZENBERGER (1983: 19) it arrived "into the Eastern Alps together with the spruce from a glacial refuge of mixed oak forest SE of the Alps in the Boreal". STORCH (1978: 232) considers *D. n.* "ein sehr junger holozäner Immigrant aus SE bzw. E."

The oldest fossil findings of *D. n.* in Europe date from the lower and the upper Pleistocene in Hungary (JANOSSY 1962, 1964, according to STORCH 1978). No data are available on fossils of *D. n.* from Yugoslavia and the Balcan Peninsula as a whole. With respect to the findings of JANOSSY it seems possible that *D. n.* inhabited the Balcan Peninsula as a glacial refuge as early as in the Pleistocene.

For the territory of Yugoslavia authors have stated a considerable number of subspecies (up to 5). We, however, distinguish only two but admit the possibility of identifying the morphologically mixed populations in the transitional area (Herzegovina, Montenegro) as a third subspecies (*D. n. diamesus*). Such an arrangement is not likely to be final. With the *intermedius* as defined the specimens of the Northern Dinaric Alps deviate from the others by their large bullae. When more material is available, the status of the population from this region (Risnjak in particular) will become much clearer. Quite heterogeneous is the population of the Southern Dinaric Alps. Here a disjunctive distribution is observed of two basic colour types, whereat their appearance cannot be explained by the ecologic conditions of the environment. If paleontologic investigations prove that to *D. n.* the Balcan Peninsula offered a glacial refuge, it might become more realistic to recognize a greater number of subspecies than recognized by ourselves. Irrespective of the above, the subspecies so far cited for the territory of Yugoslavia are contrary to facts.

### Acknowledgements

The present study could not have been realized without the generous help of Dr. BORIS M. PETROV (Belgrade) who put at my disposal his unpublished data and material, as well as data on the collection of V. MARTINO in the ZIN-L. His aid consisted also in critical advices and suggestions. I hereby warmly thank him for his help.

I am thankful also to Dr. TSOLO HR. PEŠEV (Sofia) who kindly provided me with the pertinent literature and communicated his views on the subspecific status of the forest dormouse in Bulgaria.

## SLOVENIA

No	Age	W	HB	TL	Hf	Z	LEL	ChL	RoL	HxT	DiL	BeB	ZyB	MoB	RoB	IO	BH	BbH	BuL	RoH	MLL	RMH	MAT
PMS 2611	♂ ad	30,5	99	84	21,1	14,0	27,0	24,7	12,1	3,9	6,0	13,7	15,2	6,2	5,1	4,4	9,4	11,2	7,3	5,3	13,6	6,5	4,0
PMS 2636	♂ ad	29	100	85	19,8	13,7	26,7	24,1	11,9	3,8	5,7	13,0	15,0	6,2	4,7	4,1	9,6	10,8	7,3	5,0	14,1	6,8	4,1
PMS 2639	♂ ad	28	100	85	21,2	14,0	27,2	24,8	12,1	3,9	6,1	13,5	15,1	6,0	5,1	4,2	9,3	10,9	7,2	4,9	14,2	6,8	4,0
PMS 2643	♀ juv	16,5	85	82	21,8	13,8	25,2	22,9	11,5	3,8	5,3	13,2	14,1	6,1	4,9	4,0	9,5	10,6	6,7	4,7	13,2	5,9	3,9
PMS 3480	♀ ad	21,5	98	82	21,1	14,1	25,7	23,8	11,7	3,7	5,8	13,0	14,1	6,0	4,9	4,1	8,9	10,0	6,7	4,7	13,7	6,4	4,0
PMS 4423	♀ juv	17,5	86	80	21,7	13,9	25,1	23,3	11,9	4,0	5,7	12,6	13,9	5,9	4,8	4,0	8,7	10,3	6,4	4,4	13,4	6,1	4,1
PMS 4424	♂ juv	19,5	87	75	20,5	13,5	25,7	23,3	11,5	3,8	5,4	12,9	14,0	6,1	5,2	4,0	9,3	10,5	7,0	4,7	13,3	6,3	4,0
BP 63/67	♀ ad	22	97	86	19,6	14,4	27,4	24,5	11,9	3,8	5,8	13,1	15,0	6,0	4,9	4,1	9,3	11,2	7,0	5,1	13,8	6,7	3,9
BP 64/67	♀ juv	11	70	67	19,2	12,2	22,4	20,1	9,3	3,2	4,6	12,0	12,7	6,1	4,4	4,0			6,5	4,4	11,3	5,4	3,8
BP 65/67	♂ ad	23	97	83	20,4	14,6	26,7	24,4	11,9	3,9	5,8	13,2	15,3	6,4	5,2	4,2	9,1	10,8	7,7	4,9	14,0	7,2	4,0

## CROATIA

PMS 807	♀ juv	12	77	70	19,8	12,9	24,6	21,2	10,4	3,5	4,9	12,3		6,1	4,3	4,1	8,9	10,3	6,6	4,6	12,3	5,6	4,4
BP 296/67	♂ ad	22	94	82	22,1	14,3	28,3	25,8	12,5	3,7	6,3	14,0	15,4	6,3	5,4	4,1	9,1	11,4	8,1	5,0	15,0	7,2	4,0
BP 297/67	♂ ad	24	101	87	21,6	15,3	27,8	25,7	12,2	3,8	5,9	13,7	15,2	6,4	5,5	4,5	9,2	11,2	8,4	5,0	14,4	6,8	4,0
BP 26/71	♂ ad		90		21,9	12,3	26,4	24,3	11,5	3,8	5,5	13,2		6,1	4,7	4,2	8,8	11,1	7,5	4,9	13,1	6,4	4,2

## BOSNIA and HERZEGOVINA

PMS 3616	♂ ad	19	89	80	19,9	12,8	25,3	23,1	11,2	3,6	5,4	12,6	14,2	5,8	4,9	4,1	8,8	10,4	7,0	4,3	12,8	6,4	3,9
PMS 4147	♂ ad	29	100		19,3	15,5	27,9	25,2	12,1	3,8	6,3	13,8	15,7	6,4	5,0	4,4	8,7	11,0	7,9	4,7	13,5	7,3	3,9
PMS 4313	♀ juv	18,5	89	83	20,3	14,0	24,7	22,6	11,1	3,8	5,5	13,0	14,7	6,4	4,7	4,2	8,6	10,4	6,9	4,6	12,7	6,4	4,0
BP 216/70	♂ ad	38	100	82	20,6	13,5	26,7	24,5	11,8	3,7	6,0	13,3	15,0	6,2	5,2	4,1	9,0	11,0	7,5	5,0	13,3	7,3	3,9
BP 217/70	♀ ad	30,5	93	81	19,0	12,9	25,1	23,3	11,7	3,5	5,5	12,8	14,8	5,9	4,6	4,1	8,6	10,8	7,0	4,5	12,8	6,3	3,8
BP 218/70	♀ juv	16	77	82	20,2	12,0		22,5	11,1	3,6	5,8	12,3	13,8	6,0	4,7	4,0	8,9	10,4	6,9	4,8	12,6	5,9	3,9

## SERBIA

BP 116/40	♂		82	78	20,0	12,5																	
BP 68/77	♂ ad	30	100	75	19,8	13,4	27,0	24,9	12,6	3,9	6,1	14,0	16,1	6,6	5,5	4,1	9,1	11,6	6,8	5,0	14,1	7,4	4,0
BP 69/77	♀ ad	24	99	78	20,2	14,9	27,0	25,1	12,3	4,1	5,7	13,6		5,8	5,3	4,0	9,5	11,6	7,3	4,7	14,7	7,1	4,1

## MONTENEGRO

No	Age	W	HB	TL	Hf	E	FL	CbL	RoL	HxT	DIL	BoB	ZyB	MoB	RoB	IC	SH	BH	BuL	RoH	MAL	RMH	MT
FMS 592	♂ ad	28	96	91	20,2	14,2	26,8	25,0	12,3	4,1	6,2	13,1	15,2	6,2	5,0	4,1	9,0	11,2	7,2	4,7	13,2	6,5	4,1
FMS 593	♂ ad	23	93	90	20,0	12,8	26,5	24,2	11,9	4,2	5,8	13,1	15,2	6,5	5,1	4,0	9,4	11,4	7,3	4,7	13,5	6,9	4,2
FMS 1012	♀ ad	28	95		21,1	12,7	25,7	23,5	11,2	3,8	5,5	12,6	14,9	6,1	4,7	4,0	8,4	10,5	7,0	4,8	13,2	6,4	3,9
FMS 1021	♀ juv	10	70	75	19,3	12,2		20,4	10,0		4,8	12,0		5,8	4,3	3,9			6,1		11,2	5,2	3,4
FMS 1022	- ad								11,9	4,2	5,6			6,4	5,0	4,1				4,6	13,1	6,5	4,0
FMS 3392	♀ ad	22	98	86	21,0	15,1	26,7	24,7	12,0	3,9	5,7	13,2	15,1	6,2	5,0	4,3	8,8	11,2	7,5	5,1	14,1	6,7	4,0
FMS 3415	♀ ad	20	91		20,0	14,8	26,3	24,0	11,4	3,7	5,8	13,5	14,9	6,2	4,9	4,3	8,9	11,3	7,2	4,7	13,8	6,4	4,0
FMS 3416	♀ ad	22,5	97	82	20,7	14,3	26,5	24,1	11,7	3,8	5,6	13,4	14,8	6,4	5,4	4,2	8,4	10,9	7,2	5,0	13,9	6,6	4,1
BP 130/81	♂ ad	34	93	75	20,8	14,0	26,0	24,2	11,9	3,9	5,7	12,7	14,2	6,2	5,1	4,1	8,9	11,2	7,0	4,7	13,9	6,7	4,2

## MACEDONIA

FMS 700	♀ ad	29	105		20,9	14,4	28,5	25,8	12,9	3,8	6,3	13,4	16,3	6,4	5,1	4,1	9,7	11,9	7,6	5,0	14,1	7,5	3,8
FMS 701	♀ ad	26	93		20,6	14,3	25,9	24,2	11,9	3,8	6,0	13,0		6,4	5,2		8,7	11,2	7,2		14,0	6,4	4,1
FMS 702	♀ ad	26	100		20,5	14,0	27,2	24,5	11,8	4,0	5,9	13,3	15,9	6,2	5,0	3,8	9,6	11,7	7,8	4,9	14,0	7,2	4,2
BP 16/68	♂ ad	24	99	81	21,0	12,9	26,3	23,6	11,9	3,9	6,0	13,3	15,2	6,1	5,2	4,0	9,5	11,9	7,2	4,6	14,0	7,0	3,9
BP 33/68	♂ ad	31	104		19,4	13,4	27,3	25,0	12,3	3,9	6,3	13,5	15,3	5,9	4,9	4,0	9,6	11,6	7,4	4,8	14,4	7,2	3,9
BP 13/69	♂ ad	29	95		21,1	12,9	27,0	24,7	11,9	3,9	5,9	13,8	15,6	6,3	5,2	4,5			7,4	5,1	14,2	7,0	4,0
BP 58/69	♂ ad	34	97		20,0	13,6	26,9	24,2	12,0	3,8	6,0	12,9		6,0	4,8	3,9	9,6	11,6	7,2	4,5	14,2	6,5	3,8
BP 59/69	♂ ad	37	102		21,9	14,8	27,5	25,5	12,3	3,9	6,1	13,6		6,0	4,8	4,3	9,4	11,4	7,2	4,8	14,2	7,0	3,9
BP 60/69	♂ ad	29	96	78	20,5	13,7			12,3	3,9	6,2			6,0	5,2	4,4					13,8	6,9	3,9
BP 61/69	♂ ad	35	105	97	22,6	14,1	28,3	26,4	12,6	3,8	6,3	13,9		6,4	5,4	4,2			7,2	4,9	14,8	7,0	4,0
BP 62/69	♂ ad	33	99	88	20,9	13,7	27,2	24,4	11,6	3,5	6,2	13,4	16,1	6,3	5,0	4,1	9,1	11,7	7,0	4,9	14,0	7,0	3,8
BP 33/71	♂ ad	28	98	77	21,0	12,4	26,6	24,5	12,2	4,2	5,7	12,9	15,6	6,4	4,9	4,1	9,5	11,2	6,6	4,6	14,0	7,0	4,2
BP 34/71	♂ ad	26	96	82	20,5	13,4	26,0	24,1	11,7	3,6	5,8	13,0	15,5	6,3	4,9	4,0	8,9	11,3	7,3	4,4	14,1	6,6	3,9
BP 79/72	♀ ad	29	93	76	20,7	12,5	24,8	22,9	10,6	3,5	5,4	13,0	15,0	6,0	4,8	3,9	8,9	11,4	7,0	4,6	13,8	7,0	3,7

### Povzetek

Drevesni polh *Dryomys nitedula* (odslej *D. n.*) je eden slabše poznanih sesalcev jugoslovanske favne. Zaradi svojega zanimivega videza in redkosti je vedno zanimal teriologe in zato niso redke kratke notice o njegovih nahajališčih ali taksonomskih vprašanjih. Vedno pa upoštevajo majhno število primerkov, pogosto le enega samega.

Drevesni polh v Jugoslaviji v glavnem naseljuje glavne gorske masive (Alpe, Dinaride, Šarsko-Pinske in Karpatsko-balkanske gorske pokrajine). V Makedoniji, kjer je splošno razširjen, naseljuje tudi nizko Makedonijo. Na jadranski obali in otokih *D. n.* ne živi. Omembne vredno je, da *D. n.* ni bil najden na dalmatinskih planinah, kjer živi *Eliomys quercinus* (Mosor, Dinara).

Severno in vzhodno od gorskega sveta, proti subpanonskim pokrajinam, *D. n.* verjetno ne živi več. Prav tako ga verjetno ni nikjer v panonskem nižavju.

Vsa znana nahajališča *D. n.* v Jugoslaviji leže med 60 in 2000 m nadmorske višine. Najnižja nadmorska višina nahajališča je v Makedonskem nižavju, najvišja pa v Črni Gori (Durmitor). Večina habitatov je termofilnih in kserofilnih. To velja tudi za nekatere planine, kjer je sicer veliko padavin (npr. Orjen), a ker so v glavnem kraške, padavine hitro odtečejo v podzemlje. Vlažni in hladni habitati so, vsaj v Jugoslaviji izjemni. Gledano kot celota, je *D. n.* redka vrsta. V posameznih habitatih, kjer je bil ujet, variira njegova dominantnost med 1,01 in 27,7%. Večinoma je torej subrecedentna in recedentna ter le izjemoma subdominantna vrsta.

Vsi primerki *D. n.* v Jugoslaviji so bili ujeti v času od 7. aprila do 11. oktobra. Samice, ki so kazale znake razmnoževanja, smo dobili v juniju in juliju, prve mlade živali, povržene v istem letu, pa so bile ujete v juliju.

Na ozemlju Jugoslavije razlikujemo dve geografski rasi (podvrsti) drevesnega polha. Ena je omejena na severozahodni del države, druga pa na Makedonijo. Vmesne populacije kažejo mešane (prehodne) znake, zato jih označujemo kot mešani (vmesni) takson. Če bi tudi njemu priznali status podvrste, bi ga morali poimenovati *D. n. diamesus* LEHMANN, 1959.

Subspecifična klasifikacija *D. n.* iz Jugoslavije je takšnale:

*D. n. intermedius* (NEHRING, 1902)

Nahajališče tipa: Lienz, Tirolska, Avstrija.

Razširjenost: Alpe in severni Dinaridi (Snežnik, Risnjak, Velebit, zahodna Bosna).

Diagnoza: lobanja nizka; hrbet večinoma siv.

*D. n. ravijojla* (PASPALOV, MARTINO and PECHEV, 1952)

Nahajališče tipa: Senečki Suvati, Bistra, Makedonija

Razširjenost: Makedonija

Diagnoza: lobanja višja; hrbet večinoma rdečkastorjav.

*D. n. intermedius*  $\supseteq$  *D. n. ravijojla*

Razširjenost: Bosna, Hercegovina, Črna Gora in Kosovo.

Diagnoza: mešana populacija. V obarvanosti hrbta kaže lastnosti obeh podvrst.

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