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# SOME SMALL MAMMALS FROM DOROSLOVO (WEST BAČKA) WITH SPECIAL REFERENCE TO GENUS APODEMUS

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Through preliminary investigations of the therriofauna in the Doroslovo area (west Bačka, Vojvodina) by trapping, 11 species of small mammals were registered. Apart from *Apodemus sylvaticus* in this region also *Apodemus microps* and *Apodemus flavicollis* were registerd.

## INTRODUCTION

The therriofauna composition in Serbia is mainly known, although P e t r o v (1977) emphasizes that the list of species is still open. Also a more detailed map of species distribution is not yet made, so that for example, the distribution *Apodemus microps* and *Apodemus flavicollis* is not sufficiently known, so this investigations were aimed to establish which of the small mammals species are present in the area of Doroslovo (west Bačka, Vojvodina) and also to determine their belonging to a certain ecosystem, their micro-habitat and mutual relations. Doroslovo was chosen due to its specific and characteristic landscape (forests, meadows, marshes, agroecosystems etc.). It is a fact that people, by forests clearing (1870—1880), soil cultivating and by melioration (the irrigation canal Dunav—Tisa—Dunav along the Mostonga river riverbed) effected chift of primary autochtone ecosystems in favour of agroecosystems. By this, the autochtone ecosystems remained only in certain oasises within the widely cultivated surface (K o v á c s, 1977a). This shift had surely influenced the fauna structure, the mutual relation among small mammals and their distribution. A complete fauna data processing in a region is a longlasting investigation task, so this work represents only a preliminary report on studies only started. Within this task, we had to determine the species of the genus *Apodemus* (subgenus *Sylvaemus),* so in this work we are describing, our experiences.

## HABITAT DESCRIPTION

The territory of Doroslovo village (45° 36' N, 19° 11' E) is situated in west Bačka and lies on the Bačka loess terrace (B u k u r o v, 1952). The highest point of this terrain is 94 *m* and the lowest 86 *m*. The whole terrain is inclined towards south-west i. e. towards the alluvial plane of Danube. The surface amounts to 4126 hectars. The village is on the left bank of the canal Dunav — Tisa — Dunav, and with gardens and orchards occupies a surface of 250 hectars (Fig. 1). Following ecosystems are of special interest: The Doroslovo forest (cca 350 hectars), a planted poplar forest, along the canal Dunav — Tisa — Dunav, marshy land (cca 200 hectars) and agroecosystems (cca 3250 hectars). Specific and especially interesting for our investigation was also the rest of the area along the former riverbed of Monstonga river (remained after the canal DTD was made), where a mosaic complex community can be found, consisting of humid and dry meadows and willow grove (cca 30 hectars).

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## MATERIAL AND METHODS

In the period from October, 1987 to April, 1988 trapping of small mammals was organized by standard procedure, using snap-traps. The traps were set on different habitats and plant communityes; in oak-horbeam forest (Doroslovo forest), planted poplar forest along the *DTD* canal, on willow groves and meadow vegetation along the riverbed of the former river Mostonga. Trapping was also organized on marshes with meadowsteppe vegetation and on uncultivated land with ruderal vegetation along the agroecosystem. The traps were on alfalfa on plowed fields and in the village (Fig. 1). Apart from data obtained through the analyse of trapped samples, with the list of small mammals species, attached are some data from literature and observations on the spot.

The trapped material was treated in the laboratory of the Institute of Biology in Novi Sad. After taking biometrical data, the animals, were dissected, the removed gonades, weighed, sculls cleaned and prepared. The scull characters were measured by means of vernier with preciseness of 0,05 *mm*. The obtained quantitative values* (for each character), were statistically processed and are shown as mean values and its standard errors (Za r, 1974). The determination of species of the genus *Apodemus* (subgenus *Sylvaemus)* was made by scutter diagram, constructed on base of *I-M*$^3$ relation with the *FI*

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*) *BL* — body length (dužina tela), *BM* — body mass (masa tela), *CBL* — condylobasal length (kondilobazalna dužina), *PGW* — postglenoidal width (postglenoidalna širina), *CH* — coronoid height (koronoidna visina), *ZGW* — zygomatic width (zigomatična širina), *DI* — diastema length (dužina diasteme), *GM* — gonade mass (masa gonada).

of scull of each individual, while the belonging of individuals from the bordering area, were determined by means of the value of length $M^{1,3}$ and feet legth (Tvrtković and Džukić 1977; Tvrtković, 1979).

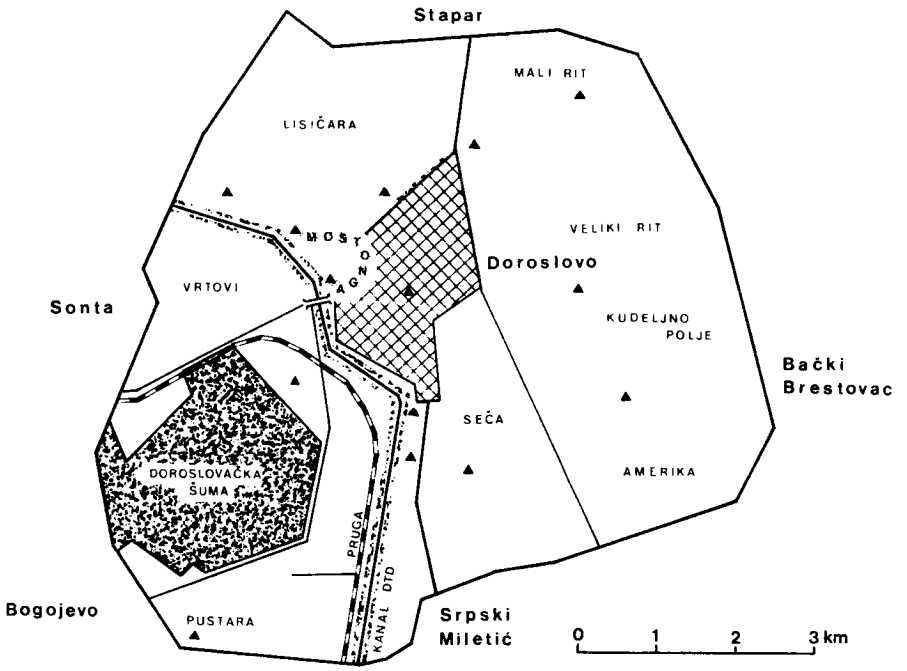


Fig. 1. — Sketch of trapping positions (triangles).
Skica mesta ulova (trouglovi).

## REZULTS

The short investigation period and meager technique, enabled the registration of only 11 species of small mammals.

*CROCIDURA SAUVEOLENS* (PALLAS, 1811)

| | *n* | *BL (mm)* | *BM (g)* | *CBL (mm)* | *PGW (mm)* | *CH (mm)* |
|---|---|---|---|---|---|---|
| ♀♀ | 7 | 66,43 ± 0,92 | 4,64 ± 0,24 | 15,99 ± 0,18 | 5,72 ± 0,09 | 4,01 ± 0,03 |
| | | | | n = 5 | n = 5 | |
| ♂♂ | 2 | 64,50 ± 2,50 | 5,75 ± 0,75 | 16,37 ± 0,62 | 5,67 ± 0,12 | 4,07 ± 0,07 |
| Σ | 9 | 66,00 ± 0,86 | 4,89 ± 0,27 | 16,10 ± 0,19 | 5,71 ± 0,07 | 4,03 ± 0,03 |
| | | | | n = 7 | n = 8 | |

All 9 individuals of this species were trapped on habitats with meadow vegetation, along the former riverbed of the river Mostonga ($n$ = 5), and along the DTD canal ($n$ = 4).

*CROCIDURA LEUCODON* (HERMANN, 1780)

| | *n* | *BL (mm)* | *BM (g)* | *CBL (mm)* | *PGW (mm)* | *CH (mm)* |
|---|---|---|---|---|---|---|
| ♀♀ | 3 | 77,33 ± 1,76 | 9,33 ± 0,88 | | 6,42 ± 0,12 n = 2 | 4,68 ± 0,03 |
| ♂♂ | 1 | 79,00 | 9,00 | 19,1 | 6,3 | 4,95 |
| Σ | 4 | 77,75 ± 1,31 | 9,25 ± 0,63 | 19,1 n = 1 | 6,38 ± 0,08 n = 3 | 4,75 ± 0,07 |

On the base of quantitative values of body charactes and the scull, as well as distinct borders in the colour of fur between the dorsal and ventral sides of the body, 4 shrews were determined as *Crocidura leucodon*. Three individuals were trapped on marshy land and 1 on alfalfa. Two females trapped in February and April, had embruyos (4 and 5).

*TALPA EUROPAEA* (LINNAEUS, 1758)

Besides registered molehills, the presence of this species was confirmed by capturing one albino individual on 10th July, 1986 by Purger J. Jene (one of the authors of this work). Osteologic material of that specimen is now conserved in the collection of prof. dr Mikeš Mihalj in the Institute of Biology in Novi Sad (M/7150).

*CRICETUS CRICETUS* (LINNAEUS, 1758)

The presence of this species was not registered in the collected samples, since the investigation period coincided with the hybernation period. However, Kovács (1977) has on the base of archive files recorded and invasion of hamster in 1910 and 1974 and our earlier visits to planted surfaces, when openings of subterranean galleries were registered, also confirm the presence of this species.

*MICROTUS ARVALIS* (PALLAS, 1779)

| | *n* | *BL (mm)* | *BM (g)* | *CBL (mm)* | *ZGW (mm)* | *DI (mm)* |
|---|---|---|---|---|---|---|
| ♀♀ | 4 | 105,00 ± 7,62 | 22,87 ± 5,82 | 24,15 ± 1,25 n = 2 | 13,03 ± 1,01 n = 3 | 6,80 ± 0,39 |
| ♂♂ | 2 | 91,00 ± 1,00 | 14,50 ± 3,00 | 22,0 n = 1 | 12,35 ± 0,09 | 6,25 ± 0,07 |
| Σ | 6 | 100,33 ± 5,66 | 20,08 ± 4,16 | 23,43 ± 1,01 n = 3 | 12,76 ± 0,58 n = 5 | 6,61 ± 0,28 |

These specimens were trapped on alfalfa ($n$ = 3) and in marches in the vicinity of cultivated surfaces ($n$ = 3). All individuals were trapped in October and November, when they did not show any signs of reproductive activity, confirmed by a low ovary mass (7,67 ± 2,55 *mg*, $n$ = 4) and testis mass (35,0 ± 0 *mg*, $n$ = 2). There were no signs of lactation at females, but they old embrional scares in the uterus (maculae cynae = 5,66 ± 0,88, $n$ = 3).

genus *Apodemus*
subgenus *Sylvaemus*
*Apodemus flavicollis* (Melchior, 1834)
*Apodemus sylvaticus* (Linnaeus, 1758)
*Apodemus microps* (Kratochvil et Rosicky, 1952)

By means of *I-M*$^3$ and *FI* values, we succeeded to separate 4 individuals, which might, based on the works of Tvrtković and Džukić, 1977 and Tvrtković, 1979 belong to the species *Apodemus microps*. In order to differ *A. sylvaticus* and *A. flavicollis*, apart from *I-M*$^3$ and *FI*, we used the help of *M*$^{1-3}$ values (Tab. 1, Fig. 2).

Four individuals of *Apodemus microps* did not have yellow collars and their body mass and length were lower than the other individuals. Their upper molars length varied between 3,6 *mm* to 3,7

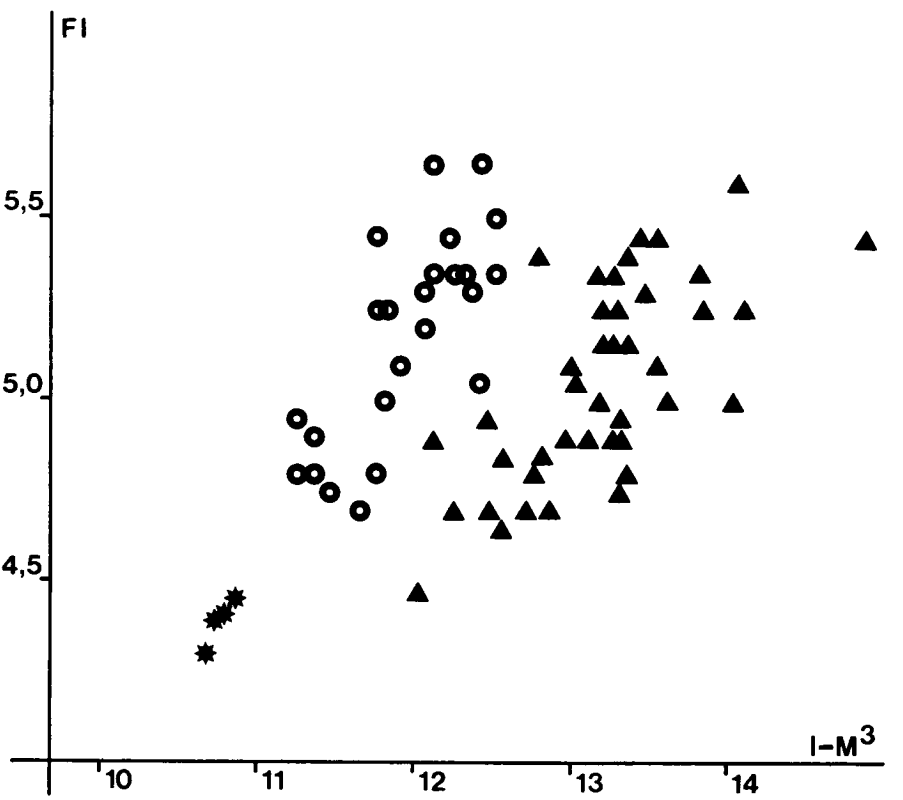


Fig. 2. — Scutter diagram *FI*/*I-M*$^3$ for *Apodemus microps* (asterisks), *Apodemus flavicollis* (triangles) and *Apodemus sylvaticus* (circles). Dimensions in *mm*.

Korelacijski dijagram *FI*/*I-M*$^3$ za *Apodemus microps* (zvezdice), *Apodemus flavicollis* (trouglovi) i *Apodemus sylvaticus* (kružići). Dimenzije u *mm*.

*mm* and their feet from 19,5 *mm* to 20,0 *mm*. The feet mean value amounted to 19,92 ± 0,14 *mm*.

Table 1. — *Biometrical data (X ± SE) on species of the genus Apodemus: n — number of specimens BL — body lenght, BM — body mass, CBL — condylobasal length, I-M³ — length of upper toothrow, FI — length of foramen incisivum, M ·3— length of upper molars*

Biometrijski podaci *(X ± SE)* vrste roda *Apodemus: n* — broj primeraka, *BL* — dužina tela, *BM* — masa tela, *CBL* — kondilobazalna dužina, *I-M³* — dužina gornjeg zubnog reda, — dužina gornjih *FI* — dužina foramena incisivuma, *M* 1.3 kutnjaka

| Species — Vrsta | Sex Pol | *n* | *BL (mm)* | *BM (g)* | *CBL (mm)* | *I-M³ (mm)* | *M (mm)* | *FI (mm)* |
|---|---|---|---|---|---|---|---|---|
| *Apodemus flavicollis* | ♂♂ | 25 | 107,08 ± 1,69 | 31,56 ± 1,24 | 27,99 ± 0,14 n = 17 | 13,35 ± 0,11 n = 24 | 4,10 ± 0,03 | 5,17 ± 0,04 n = 24 |
| | ♀♀ | 21 | 102,52 ± 1,34 | 25,92 ± 1,23 | 27,00 ± 0,17 n = 17 | 12,97 ± 0,09 n = 20 | 4,07 ± 0,02 n = 20 | 4,93 ± 0,04 |
| | Σ | 46 | 105,00 ± 1,14 | 36,61 ± 7,99 | 27,51 ± 0,14 n = 34 | 13,18 ± 0,08 n = 44 | 4,09 ± 0,02 n = 45 | 5,06 ± 0,04 n = 45 |
| *Apodemus sylvaticus* | ♂♂ | 14 | 95,50 ± 1,31 | 21,18 ± 1,04 | 25,11 ± 0,30 n = 8 | 11,91 ± 0,09 | 3,72 ± 0,03 | 5,16 ± 0,07 |
| | ♀♀ | 10 | 95,20 ± 1,51 | 22,15 ± 1,39 | 25,27 ± 0,36 n = 8 | 11,94 ± 0,15 | 3,70 ± 0,03 | 5,20 ± 0,09 |
| | Σ | 24 | 95,37 ± 0,97 | 21,58 ± 0,83 | 25,19 ± 0,23 n = 16 | 11,92 ± 0,08 | 3,71 ± 0,02 | 5,18 ± 0,06 |
| *Apodemus microps* | Σ | 4 | 81,75 ± 1,65 | 15,25 ± 0,85 | 23,20 ± 0,30 n = 2 | 10,75 ± 0,04 | 3,65 ± 0,02 | 4,38 ± 0,03 |

Half of the total number of *A. flavicollis* had yellow collars, while the rest only a yellow spot. At the majority a reddishbrown colour of fur prevailed, compared with individuals of *A. sylvaticus*, being more „grayish" with a more or less visible yellow spot. That in question were both our most frequent species of the subgenus *Sylvaemus*, is confirmed by the fact that the lengths of upper molars and feet (rear leg) were slightly overlapping and that the number of animals in the overlapping area was low.

At *A. flavicollis* the length of molars $M^{1,3}$ varies from 3,9 *mm* to 4,3 *mm*, while the feet from 22,5 *mm* to 25,0 *mm*. The feet of *A. sylvaticus* varies between 3,55 to 3,95 *mm* and the foot 20,1 *mm* to 22,5 *mm*. The foot mean value is $21{,}28 \pm 0{,}17$ *mm* ($n = 24$). Apart from differences in body and scull characters (Tab. 1.) it seems that these species are different regarding the place and way of living.

Individuals of *A. microps* were trapped on marshes having halophyte vegetation („Pustara", $n = 2$) and along the former riverbed of the river Mostonga (meadow vegetation, $n = 2$) which would be a suitable habitat according to Petrov (1975), Tvrtković and Džukić (1977) and Ham, *et al.* (1980/81).

Individuals of *A. sylvaticus* were also present on marshes ($n = 7$), along the Mostonga riverbed and the canal *DTD* (meadow vegetation $n = 9$), as wess as in agroecosystems (alfalfa, plought land, $n = 8$). No sample was trapped in the oak-hornbeam forest (Doroslovo forest). The trapping of *A. flavicollis* in the Doroslovo forest ($n = 18$) and in the planted poplar forest along the canal *DTD* ($n = 12$) would indicate and confirm that the forest ecosystem is suitable for this species. The trapping positions along the former Mostonga riverbed ($n = 9$) indicate that individuals of this species are now present also outside forest ecosystem, but exclusively on small oasises of poplar and willow trees. The trapping in bushes near roads along cultivated land (ruderal vegetation, $n = 7$) also confirms that this species is present on open surfaces. No sample was trapped on agroecosystems.

Since the investigations were organized in the winter-spring period, the condition of reproductive system of individuals was analysed, in order to establish the course and character of reproductive activity.

The individuals of *A. microps* were trapped in October and November, and due to low gonade masses (ovary mass = $3{,}05 \pm 0{,}25$ *mg*, $n = 2$, testis mass = $29{,}55 \pm 3{,}45$ *mg*, $n = 2$) it seems that they were not reproduction active at the time of trapping.

Individuals of *A. flavicollis* trapped in the period from October to January, were also not reproduction active, confirmed by the low gonade mass (ovary mass = $7{,}03 \pm 1{,}8$ *mg*, $n = 14$, testis mass = $= 37{,}06 \pm 2{,}73$ *mg*, $n = 9$). The break in reproductive activity in this period is the consequence of the presence of young individuals from later litters, whose sexual maturity is slowered and inhibited, but according to biometric data, this goes also for older individuals,

whose system is in inactive state. In January, the testis masses varied exceptionally (666,90 ± 27,00 *mg*, *n* = 10) indicating the start of recovery and preparation of the reproductive system. Recorded embryos in the uterus of one female, and high ovary masses (17,56 ± 4,33 *mg*, *n* = 3) as well as of the testis (712,25 ± 94,63 *mg*, *n* = 6) in the period February — April, confirm the above said. In the samples of *A. sylvaticus* two conditions of the system were registered, depending directly on the time of trapping. Individuals of both sexes trapped from October to January, had no reproductive ability (they were either young and sexually inhibited, or oleder and inactive individuals) confirmed by the gonade masses (ovary mass = 8,96 ± 2,89 *mg*, *n* = = 3), testis mass = 33,51 ± 4,32 *mg*, *n* = 6). The reproductive systems recovers functionally, so that reproduction starts in February, confirmed by the presence of embryos in the uterus (*n* = 2), laction signs (*n* = 2) and especially high testis masses (604,92 ± 65,96 *mg* *n* = 8). These data are suggesting that also in the population of this species, reproduction is not a continuous process throughout the year.

The determination of causes for the break in reproductive activities in the unfavourable period of the year, will be the subject of future investigations.

*APODEMUS AGRARIUS* (PALLAS, 1771)

| | *n* | *BL (mm)* | *BM (g)* | *GM (mg)* |
|---|---|---|---|---|
| ♀♀ | 11 | 98,18 ± 2,78 | 19,86 ± 1,58 | 4,64 ± 0,51 |
| ♂♂ | 22 | 100,63 ± 1,45 | 22,34 ± 0,97 | 256,16 ± 73,38 |
| Σ | 33 | 99,82 ± 1,33 | 21,51 ± 0,84 | |

Part of *A. agrarius* individuals were trapped in the oak-hornbeam forest (*n* = 8) and in the planted poplar forest (*n* = 14).

All the other individuals (*n* = 11) were trapped on uncultivated land having ruderal vegetation and a lot of waste material where no other species was trapped. The trapping positions are defining the aim of further investigations in order to determine more precisely the ecologic niches of all species of the genus *Apodemus*. The individuals of *A. agrarius* were also not reproductive in the period from October to January (testis mass = 24,03 ± 2,32 *mg*, *n* = 9) conditioning the break of reproductive activity. The testic masses (794,51 ± 31,88 *mg*, *n* = 6) in the period January-April are suggesting that the reproductive ability of individuals is reinstated and that reproduction is in course.

*RATTUS NORVEGICUS* (BERKENHOUT, 1769)

| | *n* | *BL (mm)* | *BM (g)* | *GM (mg)* |
|---|---|---|---|---|
| ♀ | 1 | 200,0 | 295,0 | 79,0 |
| ♂ | 1 | 122,0 | 31,0 | 6,4 |

Two females trapped in a village household belonged to different age and sexual categories (adult, sexually mature with embryonal scares, and juvenile, sexually unmature female).

*MUS.* SP.

| | *n* | *BL (mm)* | *BM (g)* | *GM (mg)* |
|---|---|---|---|---|
| ♀♀ | 7 | 70,86 ± 2,87 | 8,14 ± 0,73 | 3,94 ± 0,60 |
| ♂♂ | 4 | 73,50 ± 6,19 | 11,87 ± 1,78 | 122,30 ± 60,07 |
| Σ | 11 | 71,82 ± 2,74 | 9,50 ± 0,94 | |

According to the map of their distribution in Yugoslavia, for the genus *Mus* (Petrov and Ružić, 1985), the trapped individuals should belong to the species *Mus hortulanus* Nordmann, 1840. Since we did not have comparative material and the taxonomic characters are still unclear, we could not determine adequatly. Ten juvenile and sexually unmature mice were trapped in a village household, and one adult male on marshy land having ruderal vegetation.

## DISCUSION AND CONCLUSIONS

The list of small mammals in the area on Doroslovo is not complete. Future investigations on the spot and the analyse of owl pellets will surely complete the given list. By the use of scutter diagram it is possible to separate three species of the subgenus *Sylvaemus* (genus *Apodemus)* (Fig. 2).

The finding of *A. microps* should be stressed in the first place. Four individuals of this species were trapped on marshy terrain „Pustara" and on meadows along the former riverbed of Mostonga. We consider the finding of this species as important, since in literature sources about *A. microps* in Yugoslavia (Petrov, 1977) for this part of Vojvodina it is not mentioned. The finding of species *Apodemus flavicollis* in the area of Doroslovo, is in accordance with the results of Petrov (1977) who emphasizes west Vojvodina as the part of this species range. Mikuška (1981) and Vraneš (1984) have registered this species also in the neighboring region (Special zoo-reservation „Kopački rit") on flooded terrains, in poplar and willow woods. We also consider as relevant that this region once was under forest (forest on English oak and maple — *Aceri tatarici — Quercetum s. lat.)* which is recorded on the map of natural potential vegetation of Yugoslavia (1986). According to Kovács (1977a), the chronicler of Doroslovo, the village was surrounded by broadleaf forests, where dominating were English oak, European Turkey oak, hornbeem, elm and other trees, while along the river Mostonga willow groves used to be. The period of great forest clearing was from 1870 to 1880. What remained today, is only the Doroslovo forest (on the right side of DTD canal), arable land in the area called „Seča" (on the left side of DTD canal) and small willow and poplar tree woods, along the former riverbed (Fig. 1). The trapping of *Apodemus flavicollis* in the Doroslovo forest is confirming the results of many authors, that

the yellow necked field mouse is numerous in broadleaf forests. It is also evident out our results, that this species is preserved in the region of former forests, but mainly in oasises of small woods and bush (more dense vegetation). The results are suggesting that *Apodemus sylvaticus* is present also out of the closed forest. It is numerous in agroecosystems, but also on uncultivated land in communities of herbaceous plants.

The trapping spots of three species of the subgenus *Sylvaemus* are indicating that animals may be restricted to particular minor habitats scattered through larger areas. These patches on the distribution of animals are the consequence of heterogenous habitats and different life strategies. In the case of species *A. flavicollis* present on bushy-uncultivated land, the species *A. sylvaticus* are pushed into more open, less safe habitats with herbacous vegetation or into agroecosystems. On the other hand, the lack of yellow necked field mouse on marshy land, and the presence of *A. microps* on these open and less productive habitats, enables *A. sylvaticus* to occupy the zone of more dense vegetation. We are of the opinion that more precise results about mutual relations of these three species can be obtained only through planned and manysided population investigations.

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## SITNI SISARI DOROSLOVA (ZAPADNA BAČKA) SA POSEBNIM OSVRTOM NA ROD APODEMUS

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Sažetak

Ulov sitnih sisara na području Doroslova (zapadna Bačka, Vojvodina) je organizovan u cilju utvrđivanja sastava teriofaune, međusobnih odnosa vrsta sitnih sisara kao i njihovog prostornog rasporeda. Kako kompletna faunistička istraživanja predstavljaju dugoročan istraživački zadatak, ovaj rad predstavlja preliminarni izvešaj tek započetih izučavanja. Dosadašnjim istraživanjima standardnom tehnikom ulova utvrđeni su sledeći sisari: *Crocidura suaveolens, Crocidura leucodon, Cricetus cricetus, Microtus arvalis, Apodemus agrarius, Rattus norvegicus* i *Mus sp.* Od interesa je podatak da su u ovom području prisutne tri vrste podroda *Sylvaemus: Apodemus flavicollis, Apodemus sylvaticus* i *Apodemus microps*. Nalaz vrste *Apodemus microps* je nov za ovo područje Vojvodine.