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SOME TAXONOMIC CHARACTERS AND AGE OF THE COMMON HAMSTER, CRICETUS CRICETUS L., IN THE AREA OF VOJVODINA (YUGOSLAVIA)

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Review is given for the main body characters and ten skull characters for the hamster, in order to define the age group determined on the base of eye lens mass.

INTRODUCTION

The age determination of individuals in the natural population of mammals, especially mouse-like rodents, is one of the basic but still hard to solve problems. This statement cannot be accepted having in mind the importance of age in population researches, but many attempts by many explorers have brought only partial solutions. There are solutions in the available literature enabling choices for valid and possible age indicators such as the mass and body length, eye lens mass, skul characters, the dental system abrasion, hair quality and hair coverage etc. (Adamczewska — Andrzeyewska, 1967; Nabaglo & Pachinger, 1979; Vohralik, 1975; Zejda, 1961.).

Some of the charactes vary depending on the physiological state of the specimen (gravidity effect on the mass of female) and depend on the environmental conditions (quality and quantity of food in the nest and surroundings). Out of this it could be concluded that characters within individual variatons could cause overlappings among age groups. This statement can be related to the body mass, although it is accesible in many situations. The dental system abrasion is a variable character, and its successful use is based on a great

research and the author's experience and a representative sample (Zejda, 1961). This character is used for age determination of specimen having a short life (up to one year) or to determine roughly and only orientative the age which variates widely (Vohralik, 1975).

The method and procedure of body length registration is the most frequent cause for variation of this character, but it could one of the age indicators upon the procedure standardisation. According to Nabaglo and Pachinger (1979) and Vohralik (1975) stable indicators which vary in the function of the specimen age, but not in the function of phisiological state, could be the eye lens mass and some skull characters.

In this paper we describe our attempt to define the age of individuals *Cricetus cricetus*, i. e. the age groups in the sense of some taxonomic characters. Doing so, we do not deviate from the previously stated idea about the stability of the eye lens mass, so that the intervals of this character, defining the age groups, were formed on the base of mean value and its deviation in samples of male and female specimen. The orientative age for one group was partially determined by reconstruction taking in consideration the time of capture and the growth tempo of some body characters (Vohralik, 1975). The suggested age scheme is based on these principles:

I group — specimens apprx. one month old

II group — specimens apprx. two months old

III group — specimens three to nine months old

IV group — specimens twelve to twenty four months old

V group — specimens older than twenty four months

The characters of groups were stated by Krsmanović (1984).

MATERIAL AND METHODS

The analyse of taxonomic characters was made for 217 individuals of the species *Cricetus cricetus* (106 male and 111 female). The specimen were caught by means of live trap (snare) in the period of April — October 1983 in the region of Bačko Gradište and Mošorin (Vojvodina, Yugoslavia). After capture, the individuals were laborato-

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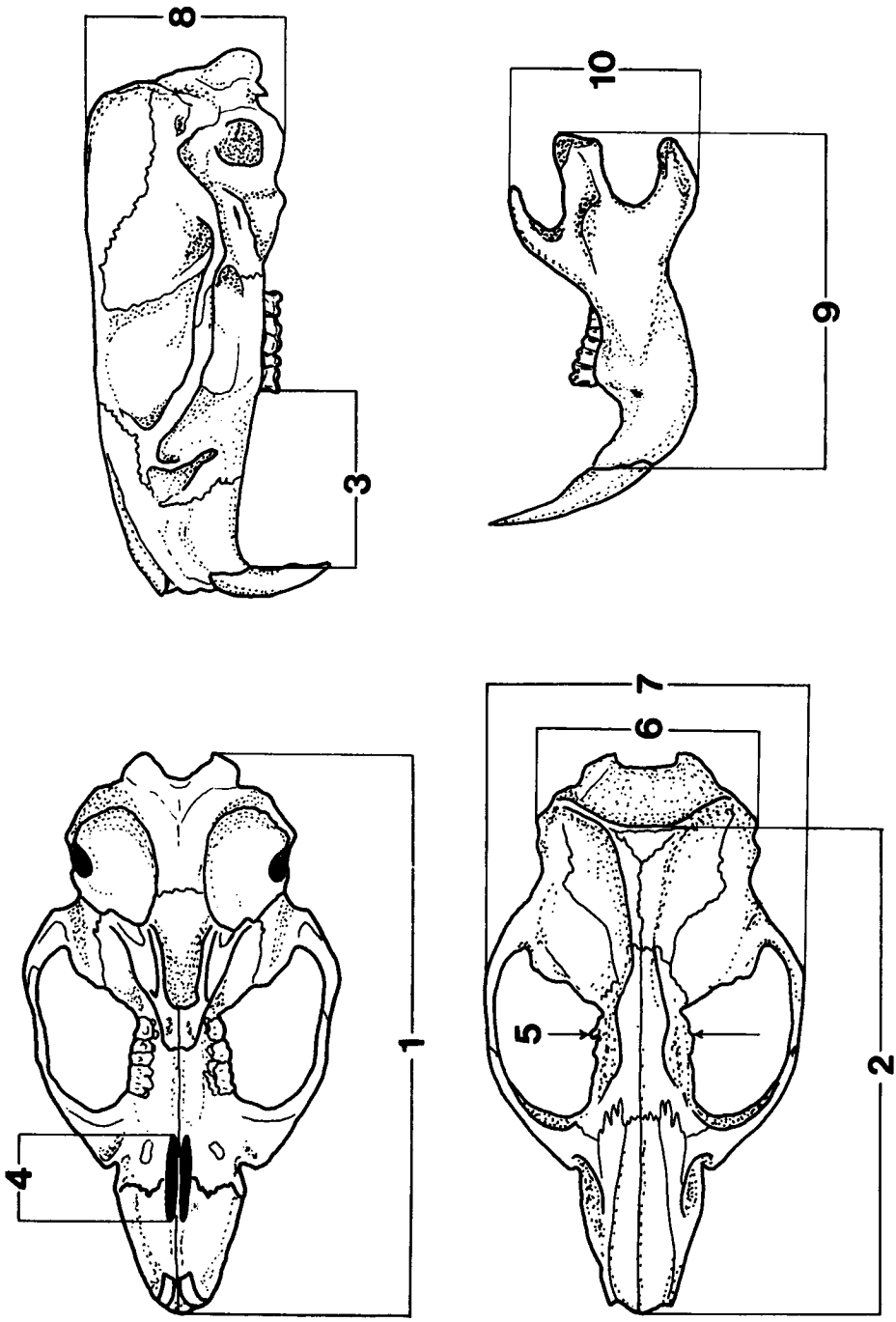
Fig. 1. — The mode of taking of skull measures: 1) Condylobasal length; 2) Total length of skull; 3) Diastema length; 4) Foramen incisivum length; 5) Interorbital width; 6) Width of brain-case; 7) Zygomatic breadth; 8) Height of brain-case; 9) Length of mandible; 10) Height of mandible

Sl. 1. — Način uzimanja morfometrijskih karaktera lobanje: 1) Kondilobazalna dužina; 2) Totalna dužina lobanje; 3) Dužina diasteme; 4) Dužina foramen incisivum; 5) Interorbitalna širina; 6) Širina lobanjske čaure; 7)Zigomatična širina; 8) Visina lobanje; 9) Dužina donje vilice; 10) Visina donje vilice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rically treated by means of standard methods, during which the length and body mass was registered. The eye lenses were prepared according to the method of Nabaglo and Pachinger (1979). The age groups were formed on base of eye lens mass (Krsmanović, 1984).

The skulls were cleaned through the activity of *Dermestes vulpinus*, Coleoptera, Insecta. The way of taking the morphometric skull characters was in accordance with Vohralik (1975) and Habijan — Mikeš, *et al.* (in press) and is shown on Figure 1.

The selection of characters was made on base of their variability, so that in this paper 10 out of 29 characters is shown (Habijan—Mikeš, *et al.)*. The measures were taken by means of nonius with an accuracy of 0,01 *mm.*, We wish to extend out thanks to TADIJAN Zvonko and JOZSA Károly biology students who participated in this part of the treatment.

The received data were statistically elaborated, and are shown as mean values and standard errors. The interval variation of character ($CL = \bar{X} \pm tSE$) was calculated for n-1 grade and $p = 0{,}001$ except for the I and V group of both sexes, where the $p = 0{,}05$.

Statistically significant differences between two groups were esteblished by Student „t" test for $p < 0{,}05$ and $p < 0{,}001$ (Zar, 1974).

RESULTS

TAXONOMIC CHARACTER ANALYSE
BODY CHARACTERS

The analyse of basic body characters (length and body mass, eye lens mass) of individuals of the species *Cricetus cricetus*, was made in accordance with the age scheme, established on base of eye lens mass.

In this way the tendency of the character growth was established from the youngest to the oldest individuals of both setes (I—V group). Considerable differences were established among age groups, but also within the same group but of different sexes. However, considerable differences in body length of males older than 12 months (IV) and males older than 24 months (V group) were not recorded. Some overlappings were registered in variation intervals of this character, but also in body mass between the mentioned groups.

Table 1. — *Results of analysis of body characters*
Tabela 1. — Rezultati analize telesnih karaktera

Age groups Starosne grupe	*n*	SEX POL	Eye lens mass Masa očnog sočiva		Body mass Masa tela		Body length Dužina tela	
			$\bar{X} \pm SE$ *(mg)*	*int.*	$\bar{X} \pm SE$ *(g)*	*int.*	$\bar{X} \pm SE$ *(mm)*	*int.*
I	5		8,80±0,37	7,83— 9,88	53,80± 3,79	43,27— 64,35	119,40±6,11	102,44—136,36
II	21		15,22±0,34	13,90—16,54	126,04± 4,65	108,14—143,94	158,28±2,27	149,56—167,02
III	46	♀♀	22,53±0,38	21,19—23,87	163,37± 4,58	147,11—179,63	180,40±1,76	174,13—186,67
IV	33		31,73±0,52	29,84—33,62	222,27± 5,85	200,94—243,59	206,48±1,64	200,49—212,47
V	6		40,73±1,40	37,15—44,33	242,00±10,38	215,33—268,69	215,00±4,31	203,92—226,10
I	3		9,60±0,75	2,35—16,85	70,66±10,59	25,09—116,23	131,33±7,31	99,88—162,78
II	28		17,28±0,61	16,03—18,53	132,28± 7,44	117,00—147,55	166,39±3,23	159,69—173,08
III	48	♂♂	26,23±0,49	24,46—27,99	244,37± 6,66	220,71—268,03	199,39±1,75	193,20—205,60
IV	24		38,49±0,56	36,38—40,59	349,79±14,43	295,40—404,15	231,79±2,71	221,58—242,00
V	3		44,70±0,37	43,12—46,29	466,67±17,63	390,81—542,53	245,00±2,88	232,61—257,39

SKULL CHARACTERS

Condylobassal length

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	31,32±0,68	29,44—33,19	32,38±0,19	31,56—33,21
II	38,32±0,28	36,96—39,08	38,80±0,48	37,02—40,58
III	41,57±0,23	40,74—42,39	44,44±0,26	43,52—45,36
IV	44,65±0,27	43,65—45,65	48,60±0,43	46,97—50,20
V	46,54±0,40	45,57—47,57	50,86±0,82	47,32—54,40

The condylobasal length of the skull is a character which grows at both setes during lifetime, proved by the span of 15 *mm* and 18 *mm* recorded between the mean values of the youngest (I) and oldest (V) group of females resp. males. The mean values of groups of this year's specimen and the span between them, are suggesting that this character grows intensively in the first year especially from the third month at both sexes. This statement probably explaines the lack of statistic differences between the I and II group relating to sex. After two months it seems that the condylobasal length at females grows slightly slower which caused the considerable differences between females older that 3, 12 and 24 months, and males of the same age on the other hand.

This character expressed through the mean value is considerably different between the age groups within the same sex, so that the condylobasal length could be considered as a good age criteria (within the age scheme according to eye lens). However this attitude couses suspicion, due to lack of considerable differences between the IV and V group of males. We tend to satte that this happened due to a small number of males (n = 3) in the V group. We suppose that the differences in this, and some other characters would be more evident in case of bigger sample, based on data by Grulich (1987) who indicates much bigger (larger) male samples. For that reason we think that the theoretical varittion intervals of condylobasal length together with the span of body characters will make easier the establishment of age of hamsters in many researches in future.

Total length of skull

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	30,26±0,53	28,78—31,73	30,67±0,64	27,90—33,44
II	35,63±0,29	34,50—36,76	36,26±0,45	34,61—37,91
III	38,25±0,25	37,35—39,15	40,53±0,21	39,79—41,27
IV	41,07±0,20	40,65—41,49	44,76±0,36	43,38—46,14
V	43,14±1,09	40,32—45,96	46,48±0,76	43,20—49,76

The obtained results show that the skull roof (uppermost part of the skull) follows the growth of condylobasal length with the same tempo. The intensive growth of all skull bones (upper part of the skull) at both sexes is slower after two months of life, proven by the differences in mean values between the I, II and II and III group. The slower growth of the skull roof after two months is characteristic for females, out of which considerable differences arised between males and females older than 3 months (III, IV, V group). Within the given age scheme on base of eye lens, mass, this character can also be an indicator for such ages. Namely, the mean values between groups of the same sex differ considerably and the variation intervals are not overlapping. Some overlapping was recorded at females of the IV, V group the mean values differ considerably ($p < 0,02$), while the lack of considerable differences and overlapping between males older than 12 (IV) and 24 (V) months is the consequence of small number of oldest males.

Diastema length

	♀♀		♂♂	
	$\bar{X} \pm SE$	int.	$\bar{X} \pm SE$	int.
I	9,55±0,32	8,67—10,43	9,65±0,34	8,19—11,11
II	11,89±0,09	11,55—12,23	12,38±0,25	11,47—13,29
III	13,11±0,12	12,69—13,53	14,15±0,09	13,80—14,50
IV	14,24±0,13	13,76—14,72	15,52±0,20	14,76—16,28
V	15,03±0,26	13,27—16,79	16,56±0,15	15,91—17,21

The diastema grows during lifetime at both sexes, especially during the first year of life. The difference in diastema length between males and females are evident after two months of life, and are maintained among oldest specimens (considerably larger mean values $p < 0,05$ at males in relation to females of the III, IV and V age group). Within the same sex, the diastema length of this year's specimens is considerably smaller in relation to overwintered specimens. This character could be an indicator of age with great accuracy within the category of this year's specimens. It can indicate whether the specimen belongs to I, II, or III group, but is not completely reliable for the IV or V group. This fact is proven by the lack of considerable differences in mean values and variation intervals overlapping between the IV and V group in both sexes.

Foramen incisivum length

	♀♀		♂♂	
	$\bar{X} \pm SE$	int.	$\bar{X} \pm SE$	int.
I	5,70±0,16	5,25— 6,14	6,09±0,18	5,30— 6,88
II	7,35±0,10	7,04— 7,68	7,23±0,10	6,86— 7,60
III	7,80±0,07	7,54— 8,06	8,13±0,06	7,92— 8,34
IV	8,25±0,08	8,08— 8,42	8,80±0,10	8,41— 9,19
V	8,47±0,11	8,18— 8,76	9,07±0,14	8,47— 9,69

The length of foramen incisivum is lager at males compared to females already after two months of life (considerably larger mean values whith the male group of III, IV and V group in relation to females of the same age).

The differences are evident between this year's and overwintered categories of individuals of the same sex, so that the length of foramen incisivum is a differential character for these two age categories. Since the mean values considerably differ between this year's group of specimen and are lacking between groups of overwintered individuals of the same sex, we consider that this character belongs to the group indicating the age of this year's specimen.

Interorbital width

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	5,33±0,21	4,74— 5,90	5,71±0,15	5.04— 6,37
II	5,81±0,06	5,57— 6,05	5,94±0,05	5,72— 6,14
III	6,00±0,05	5,83— 6,17	6,15±0,03	6,05— 6,25
IV	6,25±0,05	6,07— 6,43	6,33±0,07	6,05— 6,61
V	6,12±0,05	5,99— 6,25	6,39±0,31	5,04— 7,74

The interorbital width changes insignificantly during lifetime. The differences between groups and sexes are minimal, so that this character has no special importance in determining the age of individuals of the species *Cricetus cricetus.*

The brain case width

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	14,73±0,21	14,13—15,32	15,29±0,11	14,82—15,76
II	16,86±0,10	16,47—17,25	17,32±0,16	16,70—17,92
III	17,74±0,09	17,40—18,08	18,73±0,09	18,40—19,06
IV	18,31±0,09	17,96—18,66	19,88±0,17	19,24—20,52
V	18,60±0,18	18,13—19,06	20,17±0,32	18,78—21,56

The width the brain case is a character which can indicate that the specimen belongs to this year's or overwintered cttegory which also indicates the sex of specimen after the second month of life. It could be used as an indicator of age of this year's individuals, but not for overwintered individuals of both sexes.

Zygomatic width

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	18,57±0,40	17,43—19,71	19,34±0,32	17,95—20,73
II	21,88±0,17	21,22—22,54	22,58±0,25	21,65—23,51
III	23,97±0,14	23,47—24,47	25,84±0,16	25,27—26,41
IV	26,26±0,18	25,59—26,91	28,96±0,31	27,77—30,14
V	26,99±0,33	26,08—27,90	30,60±0,28	29,40—31,80

The changes of zygomatic with are identical with the changes in width of the brain case. We especially stress the end of growth of both characters in the female group after 12 months of age. For this reason, this character belongs to the group of characters indicating the belonging of individuals to one of the two age categories, and to one of the three groups within this year's category of specimen.

Skull height

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	12,75±0,22	12,03—13,46	13,05±0,22	12,08—14,02
II	13,97±0,08	13,65—14,29	14,31±0,10	13,93—14,69
III	14,57±0,08	14,28—14,86	15,43±0,08	15,13—15,73
IV	15,27±0,09	14,91—15,63	16,93±0,19	16,20—17,66
V	15,60±0,24	14,98—16,21	17,29±0,35	15,76—18,82

One of the visual impressions is that the skull height changes with the age. However, the obtained results are suggesting that it changes intensively during the first year of life and is considerably slower after 12 months. Further to that, the skull height could be used as a character for age definition of this year's category individuals.

Mandible length

	♀♀		♂♂	
	$\bar{X}\pm SE$	int.	$\bar{X}\pm SE$	int.
I	19,55±0,34	18,60—20,50	19,74±0,30	18,45—21,03
II	22,67±0,12	22,19—23,15	23,13±0,23	22,28—23,98
III	24,42±0,16	23,85—24,99	26,19±0,16	25,62—26,76
IV	26,47±0,14	25,94—26,99	28,97±0,32	27,77—30,17
V	27,69±0,24	27,07—28,31	29,84±0,24	28,79—30,89

The mandible growth tempo is different during lifetime. In the first year it is considerable, but intensive only up to 3 months of life, upon which the tempo is diferent at males compared to females. (the mean values for males older that 3, 12 tnd 24 months are considerably larger that for females of the same age).

However, the total growth during the first year of life is larger compared to the growth after one or more hibernation, when the differences between categories of this year's and overwintered specimen within the same sex is considerable. This character is suitable for age determination of individuals within the this year's category, and for females also within overwintered categories.

These conclusions are confirmed through considerable diferences in the mean values of characters for the mentioned groups with no overlapping of variation intervals. The possibility to separate the IV group from the V group of males is not based on considerable differences in character, but represents our intuitive supposition.

Mandible height

	♀♀		♂♂	
	$\bar{X} \pm SE$	int.	$\bar{X} \pm SE$	int.
I	9,61±0,23	8,97—10,25	10,19±0,11	9,71—10,69
II	12,03±0,14	11,52—12,55	12,20±0,19	11,47—12,93
III	13,00±0,11	12,59—13,41	14,41±0,12	13,97—14,85
IV	14,45±0,11	14,06—14,84	16,11±0,22	15,26—16,95
V	15,05±0,21	14,50—15,60	16,87±0,18	16,10—17,64

On the base of statistic data, the mandible height is a character suitable to indicate belonging of individuals to one of 5 age groups. Besides the condylobasal length, general skull length and mandible length, this character is not valid to make difference between the IV group of males, wihch is contrary to logic and quantitative values for the character, given by Grulich (1987) and Vohralik (1975).

Our supposition is that the unsufficient number of specimen did not enable to obtain statistic differences, which further researches in future should prove or reject.

DISCUSION

The abrasion of maxillary molars (M_1) is according to Vohralik (1975) an age indicator for the species *Cricetus cricetus*, and their belonging to this year's or overwintered category of individuals.

Niethammer (1982) is recomending this procedure, while Grulich (1987) is using it in analysing samples from Czechoslova-

kia. Krsmanović (1984) establishes 5 age groups on the base of eye lens mass, sufficiently good to analyse the reproductive activity of the hamster population in Vojvodina. Our further thinkings and the recommendation of Vohralik (1975) were initiating this work, in order to found out a better procedure to establish the age. However the hypothesis that some of the skull characters could be an indicator of more precise age determination was not verified. The main reason, being the case in our trial with the eye lens mass is the course of the skull growth during lifetime. Namely, the results of Vohralik (1975), and to a certain degree our results, point to the fact that all body characters including the skull characters, are growing during lifetime as per the saturation curve type, more precisely as per the type of exponential — saturational curve; they are growing, but the growth rate is reduced by age. For that reason, we are of the opinion that neither the body characters not the skull characters can determine more precisely the age of the captured individuals, that the procedure with the eye lens mass. Further to that, this work is a trial to define the age groups by means of skull character. It is still an open question whether the theoretical intervals of character variation are universal and acceptable for hamsters throughout their geographical spread, having in mind Grulich's (1987) particulars about the variation of many characters in dependence of the population number of hamsters and the place where the individuals were captured.

CONCLUSION

Based on the analyses of body characters and 10 skull characters of captured samples of the species *Cricetus cricetus* (n = 217), the following was ascertained:

— that the condylobasal length, general skull length, the length and height of mandible, could be used as indicators of age for the individuals within the given age scheme, on the base of eye lens mass. Through the given theoretical intervals of variation of these characetrs and body characters (length and body mass, eye lens mass) it is possible to determine the belonging of individuals to one of the five age groups.

— that the diastema and foramen incisivum length, skull height, zygomatic width and the width of brain case could be used to differentiate this year's from overwintered specimen.

— that within the analysed characters, the interorbital width changes insignificantly during time, so that it has no special importance in determining the age of specimen.

REFERENCES

Adamczewska-Andrzejewska, K. A. (1967): Age reference model for *Apodemus flavicollis* (Melchior, 1834). — Ekol. Pol. *A.* (41), 787—790.

Grulich, I. (1987): Variability of *Cricetus cricetus* in Europe. — Acta Sc. Nat., Brno, *21*, (7), 1—53.

Habijan-Mikeš, V., Mikeš, M., Krsmanović, Lj. (in press): Kraniometrijske karakteristike vrste *Cricetus cricetus* L., iz Vojvodine.

Krsmanović, Lj. (1984): Pokušaj određivanja starosti u populaciji hrčka, *Cricetus cricetus* L. *(Mammalia, Cricetidae)* na osnovu mase očnog sočiva. — III Kongres ekologa Jugoslavije, Sarajevo, *2*, 149—154.

Nabaglo, L., Pachinger, K. (1979): Eye lens weight as an age indicator in yellow-necked mice. — Acta Theriol. *24*, (11), 118—122.

Niethammer, J. (1982): *Cricetus cricetus* (Linnaeus, 1758). — Hamster (Fildhamster). — in Handbuch der Säugetiere Europas. Band 2 (1), 7—28, Akademische Verlagsgesellschaft, Wiesbaden.

Vohralik, V. (1975): Postnatal development of the Common Hamster *Cricetus cricetus* (L.) in captivity. — Rozpravy Československé Akademie Véd, Praha, *85*, (9), 3—50.

Zar, J. H. (1974): Biostatistical Analysis. — Prentice-Hall, Inc., London.

Zejda J. (1961): Age structure in populations of the bank vole *Clethrionomys glareolus* (Schreber, 1780), — Zool. Listy, *11*, 249—264.

NEKI TAKSONOMSKI KARAKTERI I STAROST HRČKA, CRICETUS CRICETUS L., NA PODRUČJU VOJVODINE

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Sažetak

U cilju pronalaženja boljeg postupka i pokazatelja starosti izvršena je analiza 10 karaktera lobanje 217 jedinki vrste *Cricetus cricetus L.* Zbog rasta karaktera po tipu eksponencijalno-saturacione krive, ni jedan karakter nije preciznije odredio starost nego što je to učinila masa očnog sočiva. Prema tome, u ovom radu su prikazani karakteri lobanje u okviru satrosne šeme zadate prema masi očnog sočiva. Analizom je utvrđeno da samo kondilobazalna dužina i opšta dužina lobanje, dužina i visina donje vilice mogu učestvovati u bližem definisanju svih pet starosnih grupa. Ostali karakteri (dužina diasteme i foramen incisivum-a, visina lobanje, zigomatična širina i širina moždane čaure) se mogu koristiti za razlikovanje ovogodišnjih od višegodišnjih jedinki i starosnih grupa u okviru ovogodišnje kategorije.