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DRESSING PERCENTAGE OF FOUR CROATIAN COMMON CARP (*CYPRINUS CARPIO* L.) POPULATIONS

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Summary

The morphometric traits were determined on the sample of 459 marketable size common carp from the four Croatian fish farms. There traits were analyzed by the classical methods in order to determine the influence of population, scaliness, age and sex on the dressing percentage. The obtained results show the existence of different phenotypes of common carps at Croatian farms, primarily, morphometric differences. However, the sygnificant diferences of dressing percentage among the populations were not registered ($p>0.05$).

The significant difference between the dressing percentages of scaled and mirror carps was not detected ($p>0.05$), what leads to the conclusion that the scaliness does not influence dressing percentage significantly. The age and sex also, dit not show significant influence on dressing percentage. As the carps were sampled in winter the differences in dressing percentage caused by the different maturation of males and females were excluded.

Key words: common carp, dressing percentage, Croatia, morphological features

INTRODUCTION

Common carp is the most cultured species of Croatian fresh–waters, that for years has been contributing between 80% nad 90% to the total fish production (Turk, 1997). Marked demand had been gradually turning towards the

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processed fish, fillets in particular (Hough, 1993; Vallod, 1995). Hence, after being processed, the demand for commercially less valuable cyprinids — bighead, has increased considerably in the USA (Thomas and Engle, 1993). The processing enables the selling of fish not only to traditional fish–stores, but to mass general stores as well. By taking thick and uneatable skin away, and by cutting off the intermuscular bones, the common carp fillet becomes a highly valuable meal that can also be further processed (Lin et al., 1989; Treer et al., 1995).

The carp has changed its morphological features tremendously in the culturing process. For example, the body formation, scaliness, size of the mouth and length of the gut differ significantly from that of the wild form (Balon, 1995). Likewise, mirror carps prevail over the scales ones in the ponds. As less scales means less waste, the mirror carp is simply expected to have higher dressing percentage (Treer et al., 1996).

Although it is generally known that the dressing percentage represents the mass of cleaned fish in proportion to live fish, there are different detailed descriptions of that fact. The waste may contain all or some parts of: head, scales, skin, gut, gonads and some fins (Tumbas, 1976; Lovell, 1981; Dunham et al., 1983). It is assumed (Gross, 1997) that the differences in dressing percentage among different lines and their hybrids of common carp can be attributed to the difference in their body forms (head lenght, body depth, width and volume). Similar results were obtained by Dunham et al. (1983) for channel catfish, where head width and body depth and width had significant influence on the dressing percentage ($p<0.05$). All the relations on catfish body were negatively correlated to the dressing percentage (El–Ibiary et al., 1976; El–Ibiary and Joyce, 1978; Reagan, 1979). It means that each elongated fish is bound to have better dressing percentage than the rounded one. Common carp culture on the contrary, traditionally favours the selection of high depth–length relationship (Ankorion et al., 1992).

As the sex also influences the differences in dressing percentage, the use of genetic engineering (e. g. gynogenesis) might be welcomed in common carp culture (e. g. Nagy and Csanyi, 1984; Hollebecq, et al., 1986; Sumantadinata, et al., 1990; Nagy, et al., 1991). Therefore, the aim of this paper was to study the dressing percentage influenced by the population, sex, age and scaliness.

MATERIALS AND METHODS

The market–size fish were supplied by four warm water fish farms situated in the eastern (Grudnjak–G and Našička Breznica–NB), central (Končanica–K) and western (Draganići–D) part of the Pannon region of Croatia known for carp culture. Carps were harvested at all farms during February 1993. The

Table 1. The values of investigated parameters at Končanica farm (SD=standard deviation; CV=cofficient variation)
Tablica 1. Vrijednosti istraživanih obilježja šarana iz Končanice (SD=standardna devijacija; CV=koeficijent varjacija

Parameter Obilježje	Končanica											
	Mirror Maloljuskavi						Scaled Ljuskavi					
	Males Mužjaci			Females Ženke			Males Mužjaci			Females Ženke		
	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV
Total mass Masa ukupno	1832,86	332,89	18,16	1730,03	355,43	20,55	1794,37	394,66	21,99	1866,67	351,26	18,22
Carcass mass with scales Masa trupa s ljuskom	1239,40	208,81	16,85	1152,21	220,99	19,18	1244,22	272,45	21,90	1088,94	223,68	20,54
Dressing percentage (with scales) Randman s ljuskom	0,68	0,03	4,25	0,67	0,04	6,35	0,69	0,02	3,18	0,59	0,08	14,07
Carcass mass without scales Masa trupa bez ljuske	1213,17	201,02	16,57	1128,13	216,33	19,18	1150,27	262,36	22,18	993,83	214,37	21,57
Dressing percentage (without scales) Randman bez ljuske	0,66	0,03	4,35	0,66	0,04	6,29	064	0,02	3,26	0,54	0,08	14,86

Table 2. The values of investigated parameters at Našička Breznica farm (SD=standard deviation; CV=cofficient variation)

Tablica 2. Vrijednosti istraživanih obilježja šarana iz Našičke Breznice (SD=standardna devijacija; CV=koeficijent varjacija

Parameter Obilježje	Našička Breznica											
	Mirror Maloljuskavi						Scaled Ljuskavi					
	Males Mužjaci			Females Ženke			Males Mužjaci			Females Ženke		
	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV
Total mass	1843,57	619,92	33,63	1648,75	521,14	31,61	2041,81	691,13	33,85	1877,77	507,81	27,04
Masa ukupno												
Carcass mass with scales	1210,28	364,39	30,39	1121,91	343,79	30,64	1344,15	447,61	33,30	1254,12	298,69	23,82
Masa trupa s ljuskom												
Dressing percentage (with scales)	0,67	0,05	7,04	0,69	0,06	8,80	0,66	0,03	4,92	0,68	0,06	8,30
Randman s ljuskom												
Carcass mass without scales	–	–	–	–	–	–	–	–	–	–	–	–
Masa trupa bez ljuske												
Dressing percentage (without scales)	–	–	–	–	–	–	–	–	–	–	–	–
Randman bez ljuske												

Table 3. The values of investigated parameters at Draganići farm (SD=standard deviation; CV=cofficient variation)
Tablica 3. Vrijednosti istraživanih obilježja šarana iz Draganića (SD=standardna devijacija; CV=koeficijent varjacija

Parameter Obilježje	Draganići					
	Mirror Malo Luskavi					
	Males Mužjaci			Females Ženke		
	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV
Total mass Masa ukupno	1182,19	275,38	23,29	1272,95	352,75	27,71
Carcass mass with scales Masa trupa s ljuskom	770,34	173,69	22,55	861,26	243,81	28,31
Dressing percentage (with scales) Randman s ljuskom	0,65	0,03	4,54	0,69	0,05	7,70
Carcass mass without scales Masa trupa bez ljuske	760,54	152,82	19,86	878,69	220,03	25,04
Dressing percentage (without scales) Randman bez ljuske	0,63	0,04	5,93	0,66	0,07	10,27

random sample was taken from each farm. From Končanica and Draganići farms 120 fish (from 997g to 2924g and from 710g to 1968g) were analyzed, from Našička Breznica 117 (from 918g to 3928g) and from Grudnjak 102. The fish were deep–frozen and kept at –28 °C. The day before the analysis, fish were exposed to the raised temperature of 4 to 6 °C, then washed under the running water and dried gently.

After the weighing of the total mass, the head with gills, gut and gonads were removed and weighed again. The scales from all fish from Končanica farm and partly from Draganići farm (33 males and 22 females) were also removed and carcass without them weighed again.

Table 4. The values of investigated parameters at Grudnjak farm (SD=standard deviation; CV=cofficient variation)
Tablica 4. Vrijednosti istraživanih obilježja šarana iz Grudnjaka (SD=standardna devijacija; CV=koeficijent varjacija

Parameter Obilježje	Grudnjak											
	Mirror Maloljuskavi						Scaled Ljuskavi					
	Males Mužjaci			Females Ženke			Males Mužjaci			Females Ženke		
	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV
Total mass Masa ukupno	1525,05	455,83	29,89	1442,47	542,28	37,59	1329,57	350,39	26,35	1518,60	394,02	25,95
Carcass mass with scales Masa trupa s ljuskom	998,81	278,69	27,90	954,68	326,36	34,19	889,12	217,27	24,44	1053,70	262,78	24,94
Dressing percentage (with scales) Randman s ljuskom	0,66	0,03	4,39	0,67	0,05	7,32	0,67	0,02	3,58	0,70	0,02	2,92
Carcass mass without scales Masa trupa bez ljuske	–	–	–	–	–	–	–	–	–	–	–	—
Dressing percentage (without scales) Randman bez ljuske	–	–	–	–	–	–	–	–	–	–	–	–

Table 5. *Significant differences (p<0. 05) of investigated parameters between the populations (<=lower than; >=higher than)*

Tablica 5. *Opravdane razlike (p<0, 05) istraživanih parametara između populacija (<=manje od; >=više od)*

Parameter Obilježje	Mirror Maloljuskavi		Scaled Ljuskavi		Total Ukupno	
	Males Mužjaci	Females Ženke	Males Mužjaci	Females Ženke	Males Mužjaci	Females Ženke
Carcass mass with scales Masa trupa s ljuskom	D<G D<K D<NB G<K G<NB	D<K D<NB G<K	G<K G<NB	Ø	D<G D<K D<NB G<K G<NB	D<K D<NB G<K G<NB
Dressing percentage (with scales) Randman s ljuskom	D<K G<K	Ø	KNB	G>K K<NB	D<K G<K K<NB	Ø
Carcass mass without scales Masa trupa bez ljuske	D<K	D<K	–	–	D<K	D<K
Dressing percentage (without scales) Randman bez ljuske	D<K	Ø	–	–	D<K	Ø

Computer programme for analysis of variance was used to define the differences in dressing percentage between scaliness and different sex (Statistica for Windows, 1993).

RESULTS AND DISCUSSION

The smallest dressing percentage with scals (male 0,65 and formale 0,68) and without scales (male 0,63 and female 0,66) was registered in the carp from Draganići fish farm (Table 3). Being cultured for only two years, these carps were expected to be the smallest. This corresponds with the fact that younger fish have higher proportion of head mass in the total mass (Geri et al., 1995). Also, the muscules of younger fish contain less fat (Lovell, 1988; Tidwell and Robinette, 1990). Fauconneau et al., (1991) determined positive correlation between the fish mass and fat content in the body and muscles of the cyprinids.

The mirror males from Draganići ($\bar{x}$ 1832,86g), Našička Breznica ($\bar{x}$ 1843,57), Grudnjak (x1528,05g) and scales males from Našička Breznica ($\bar{x}$ 2041,81g) males were lighter than females and their measured parameters were more homogeneously distributed. Higher female mass is usual in these age groups of carp (Zaitsev et al., 1969). The highest dressing percentage was obtained in scaled carps from Našička Breznica, where there were higher values for the males (Table 2). Dependent of fish age and species, the dressing percentage values of the males can either be significantly higher (Gjerde and Gjedrem, 1984), almost the same (Gjerde, 1989) or no different (Schmidt, 1985) than females.

After comparing only the fish cultured for three years, the lowest dressing percentage 0,66 was registered (particularly in the scaled males), at Grudnjak fish farm, (Table 4). Considering the heterogeneity of this parameter in relation to sex and scaliness, the dressing percentage was the most heterogeneous in mirror males from Našička Breznica farm 7,04 and the most homogenous in mirror males from 4,25 Končanica farm.

The dressing percentage was also counted without the scales out of the entire sample from Končanica and part of the sample from Draganići. This parameter was again smaller in two–year–old fish (0,63; 0,66). In Končanica, this type of dressing percentage was smaller in scaled (males 0,64; females 0,54) than in mirror carps (males 0,66; females 0,66) (Tables 1 and 3). At the same farms, the differences between the sexes were not significant ($p>0.05$). These differences between the lines could be attributed to the body form differences of for example head lenght, body depth and length etc., (Gross, 1997).

As the dressing percentage is a compound parameter, its hereditability is very low and it should not be included in the selection programmes (Gjerde and Gjedrem, 1984; Gjerde, 1989). More important are phenotypic and genetic correlation between the dressing percentage and the body traits (Simm, 1983; Gjerde and Schaeffer, 1989). The phenotypic correlation in our investigation shows that elongated fish could be associated with higher values of dressing percentage (Safner, 1998). It means that intensive work done on decreasing lenght–depth relation (Ankorion et al., 1992) did not affect positively the efforts in getting better carp fillets.

Despite numerous morphological differences between investigated carp populations, the significant differences in dressing percentage in most cases were not found ($p>0.05$), (Table 5). However, there was significant difference ($p<0.05$) within the populations in total mass and usable part of the body between the scaled and mirror carps. This difference did not result in the significance of dressing percentage. Very high correlation significance ($p<0.01$) between dressing percentages when the scales were or were not taken off, indicate that it is possible to use one of these parameters to asses the other.

The overall results of this investigation indicate that the culture of monosex carps is not going to improve the dressing percentage results in production.

Sažetak

RANDMAN ČETIRIJU POPULACIJA HRVATSKIH ŠARANA (*CYPRINUS CARPIO* L.)

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Cyprinidae (šaranke) ukupno čine najveću skupinu uzgajanih riba u svijetu, s udjelom u svjetskoj proizvodnji od oko 74%. U Hrvatskoj je šaran glavna slatkovodna vrsta i već godinama čini 80% do 90% ukupne proizvodnje. Argumentiranim otklanjanjem predrasuda o šaranu kao ribi bijede i teških životnih situacija (II. svj. rat), ribi glomaznih dimenzija nepogodnih za pripremu, punoj kostiju i s okusom na ustajalu vodu (Vallod, 1995) naglašava se i razvoj kontroliranih linija sa standardnim morfološkim obilježjima. Uzgoj tako formatiranih riba povećava učinkovitost riboprerađivačke opreme uz jednostavnije oblikovanje postrojenja za filetiranje. U takvoj ponudi odnos iskoristivog dijela ribe i njezine ukupne mase, tj. randman, postaje sve bitnija odrednica njegova daljnjeg komercijalnog iskorištavanja. Zato je cilj ovoga rada procjena randmana konzumnih šarana u Hrvatskoj. Odabrana je riba s ribnjačarstava u Draganićima (D), Končanici (K), Našičkoj Breznici (NB) i Orahovici (G–Grudnjak). I dok se u Draganićima konzumni šaran proizvodi u dvogodišnjem pogonu, na ostalim trima ribnjačarstvima primjenjuje se tehnologija trogodišnjeg uzgoja. Tako odabranim uzorkom željelo se utvrditi rezultiraju li međusobna dislociranost ribnjačastava s različitim ekološkim uvjetima, različitom primijenenom tehnologijom i dužinom trajanja uzgoja, te različitim izvorima nasadnog i matičnog materijala, i razlikama u randmanu konzumne ribe. Randman je određen kao iznos obilježja ukupna masa i obilježja masa trupa bez glave sa škrgama, utrobe i gonada. S dijela uzorka odstranjene su i ljuske pa je određen i randman bez ljusaka kao odnos ukupne mase i mase trupa bez glave sa škrgama, utrobe, gonada i ljusaka. Obilježje je procijenjeno na osnovi populacijske pripadnosti, dobi konzumne ribe (dvogodišnja i trogodišnja), ljuskavosti (ljuskavi, maloljuskavi) i spola.

Rezultati analize pokazuju da unatoč razlikama u prosječnoj masi tijela, prosječnoj masi trupa bez glave sa škrgama, bez utrobe i gonada, te prosječnoj masi trupa bez glave sa škrgama, utrobe, gonada i ljusaka između populacija analiziranih šarana s različitih ribnjačarstava među njima nije utvrđena opravdana razlika u randmanu ($p>0,05$). Između spomenutih populacija konzumnih šarana također nije utvrđena opravdana razlika u randmanu glede različite ljuskavosti, različite dobi i različitoga spola.

Ključne riječi: šaran, randman, Hrvatska, morfološke karakteristike

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