

## BREEDING SYSTEMATIZATION OF INDIGENOUS BREED MEDJIMURJE HORSE

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### Summary

Medjimurje horse is critically endangered breed ( $N_e = 14.17$ ) and is one of three Croatian indigenous horse breeds. The aim of this research is to systematize the Medjimurje horse breeding, defining stallion and mare lines, and analyzing the prevalence of other breeds in Medjimurje breeding horses. The result of systematization is defining 7 stallion lines and 37 mare lines which are the basis for breeding in the future. By analyzing the pedigree, we established higher rate of other breeds in Medjimurje breeding horses, and the fact that the breeding hasn't been done pure blooded, which is necessary given that it is the indigenous breed since the year 1999, after founding the breeds registry. A large proportion of other horse breeds in the Medjimurje horse registry leads to the conclusion that it is not an indigenous horse breed, but the type of cold-blooded horse, so the status of current population "authenticity" is doubtful.

**Keywords:** Medjimurje horse, breeding systematization, stallion lines, mare lines

### Introduction

Medjimurje horse was created under the influence of soil, climate, social conditions, tradition and culture of livestock keeping in Medjimurje region (Kursar and Horvat, 1994). The name is derived from the latin name "*Insula Muro Dravana*" which describes Medjimurje as an island between the rivers Mura and Drava. Although developed in Medjimurje, breed has spread to a wider area, so there is a number of similar names, depending on the language: "*Muraközi ló*" in Hungary, "*Murinsulaner*" in Austria "*Muransulan*" in Poland and "*Murano*" in Germany (Vincek and Ernoić, 2001). There are different breeds and types of horses suitable for different purposes, and for hauling heavy loads strong and durable horses are needed (Stipić, 1978). Precisely for those needs in 1870 a lighter type of Medjimurje horse was grown in Medjimurje and they were created by breeding the Arab and angloarabian mares with Noriker stallions, and also a heavier type which was built on crossing the lighter Medjimurje horse type with Belgian stallions and other cold-blooded breeds (Steinhausz, 1944). Beside Medjimurje horse, Croatia has heritage of two other horse breeds like Croatian Cold-blooded and Posavina horse, which were also systematized before by the same methodology (Cacic et al., 2006; Cacic, 2010, 2011). Medjimurje horse breeding registry (stud book) was founded in 1999, and in the year 2003 the breed was officially included on the "*List of indigenous and protected breeds in Croatia (NN 73/03)*". An important factor in breeding and conservation of indigenous breeds of farm animals is credible management of herd books. Credible parent records offer a chance for planned breeding, preservation of genetic variability in the population and avoiding harmful effects of inbreeding (Gama and Smith, 1993). Selection response in closed breeding population results in

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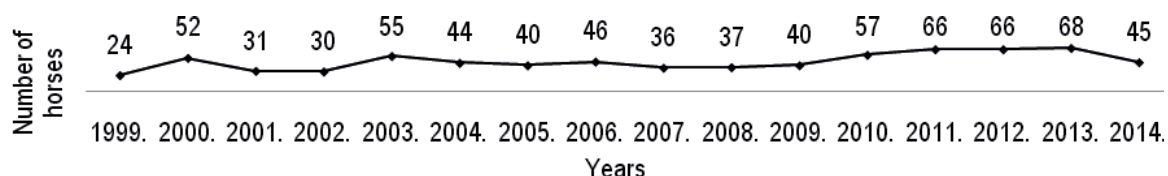
increased inbreeding coefficient and reduction of genetic variability, and it can cause inbreeding depression of fitness, so this fact should be taken into account when designing breeding programs. The aim of the research is to create breeding systematization of indigenous Medjimurje horse breed defining stallion and mare lines as the base of planned horse keeping and breeding (planned mating), and analyzing the prevalence of other breeds in Medjimurje breeding horses. Presented results of breeding systematization (pedigree data systematization) in this study are related to the pedigree data of the entire breeds registry and not only to the current (alive) population of Medjimurje horses. Series of studies will be conducted on the indigenous breed of Medjimurje horse and this is the first one, all to preserve genetic variability and to avoid the occurrence of inbreeding depression, in order to create the conditions for designing long-term, high-quality breeding program, and obtaining valuable information for further work on the conservation of this critically endangered breed.

### **Material and Methods**

In this research we used the data of all the throats updated in the Medjimurje horse registry located in the Croatian Agricultural Agency (HPA) in the period from the year 1999 to 2015. Defining stallions and mare lines is done using each male or female without full parental origin as the founder of the stallion or mare line. Horses of other similar breeds which are accepted in Medjimurje horse breeding also represent founders of stallion and mare lines. In making the genealogy Tesio Power, Ver. 5.0 (2002) software package was used.

### **Results and Discussion**

According to the HPA datas, in 2015 in Croatia, population of Medjimurje horse numbered 45 throats, of which 7 were stallions, 27 were mares and there were 4 males and 7 females of offspring. Horse number data and effective population size ( $N_e = 14.17$ ) show the status of Medjimurje horses as critically endangered breed.



Graph 1. Number of Medjimurje horses from 1999 to 2014 (HPA, 2015)

Graf 1. Broj Međimurskih konja od 1999. do 2014. (HPA, 2015)

Since the registry is established in 1999, 172 heads of Medjimurje horses was updated up until 2015 of which 72 were males and 100 were females. From total number of 172, we found 128 horses (66 males and 63 females) whose parents were in the registry, 30 throat were with unknown origin (founders) and were originally entered into the registry during its establishment, while the remaining 14 horses of other breeds was accepted into Medjimurje horse breeding as originators (not founders) of individual lines. Labeling stallion lines has been done with the letter 'L' and a number of line is added after the identification number and the name of

the throat (eg. 6 Sokol L1). Mare line labeling was also done with registration number and the name of the mare with the addition of letters 'Mk' and the number of line (eg. 32 Vranka Mk1). Line founders had the letter 'R' added before the tag 'L' or 'Mk' (eg. 2 Lari R-L1 and 9 Brena R-Mk11). The result of stallion systematization is defining 7 stallion lines (table 1). The founders of only two lines (L1 and L2) are indigenous stallions of Medjimurje horse breed. Lines L3, L4 and L5 have origin in the French breeds of Ardennes and Percheron, whose descendants were introduced as originators into the Medjimurje horse breeding through the breeds of Hungarian and Croatian Cold-blooded. Line L6 has its origin in the breed of Croatian Cold-blooded and line L7 is connected to Belgium Draft horse, whose distant male descendant was introduced into the Medjimurje horse breeding as Polish Cold-blooded representative and he became the originator of the line. After systematization we defined 37 female lines in total (table 2), of which 30 lines has the indigenous origin, and 7 mares originated from Croatian Cold-blooded but they were introduced into the Medjimurje horse breeding as line representatives.

Table 1. The sire line of the indigenous Medjimurje horse breed

Tablica 1. Linije pastuha izvorne pasmine Međimurski konj

Sire line	The founder of sire line, year of birth	Breed	Country of origin	The originator of sire line in the Medjimurje horse breed		
				Sire name, year of birth	Breed	Country of origin
L1	2 Lari R-L1, 1995	Mk	Croatia	2 Lari L1, 1995	Mk	Croatia
L2	Vranac R-L2, 1990	Mk	Croatia	Vranac L2, 1990	Mk	Croatia
L3	110 Dragon de Barbencou, 1965	Ard	France	4111 Šargo L3, 1998	CC	Croatia
L4	Espoir de l' Ecole, ~ 1940	Ard	France	4452 Fazekasboda-277 Szivárvány L4, 2002	HC	Hungary
L5	Négateur, ~ 1950	Per	France	5075 Hobol-97 Csongor L5, 2006	HC	Hungary
L6	4870 Riđan R-L37, 1998	CC	Croatia	4870 Riđan L6 (R-L37), 1998	CC	Croatia
L7	Bruine Hengst Van Typens, 1822	BD	Belgium	397 Hegemon L7, 2002	PC	Poland

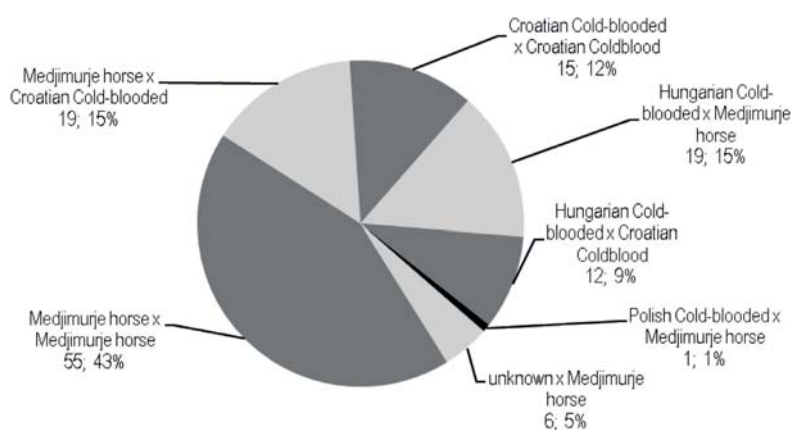
mk – Medjimurje horse; Ard – Ardennes; Per – Percheron; CC – Croatian Cold-blooded; BD – Belgian Draft; HC – Hungarian Cold-blooded; PC – Polish Cold-blooded

Analysis of the pedigree from the standpoint of other breeds in the Medjimurje horse breeding, points to a large share of accepting other breeds (graph 2). From a total of 128 heads born to date since registry foundation, less than a half (43%) of the horses are the result of breeding stallions and mares, representatives of Medjimurje horse breed. As a result of crossing the Medjimurje horse with similar cold-blooded breeds (Croatian, Hungarian and Polish Cold-blooded) 31% of foals was born, while 12% of foals was accepted into the register as the result of purebred mating of Croatian Cold-blooded stallions and mares.

Table 2. The dam line of the indigenous Medjimurje horse breed  
 Tablica 2. Rodovi kobila izvorne pasmine Međimurski konj

Dam line	The founder of dam line, year of birth	Breed	Dam line	The founder of dam line, year of birth	Breed	Dam line	The founder of dam line, year of birth	Breed
Mk1	30 Ruža R-Mk1,1987.	Mk	Mk14	3488 Olga R-H207, 1992	CC	Mk27	42 Beba Kotoribska R-Mk27,1996	Mk
Mk2	18 Cujza R-Mk2,1985	Mk	Mk15	29 Rička R-Mk15,1994	Mk	Mk28	16 Vranka R-Mk28,1990	Mk
Mk3	6 Rička R-Mk3,1989	Mk	Mk16	4919 Lasta R-H1306,1997	CC	Mk29	20 Branka R-Mk29,1990	Mk
Mk4	4 Zora R-Mk4,1988	Mk	Mk17	Vranka R-H103,1995	CC	Mk30	21 Rička R-Mk30,1990	Mk
Mk5	8 Vranka R-Mk5,1988	Mk	Mk18	35 Dinka R-Mk18,1992	Mk	Mk31	24 Zora R-Mk31,1993	Mk
Mk6	11 Rička R-Mk6,1992	Mk	Mk19	4830 Rička R-H1289,1996	CC	Mk32	28 Riba R-Mk32,1996	Mk
Mk7	23 Lasta R-Mk7,1995	Mk	Mk20	5015 Sofija R-Mk20,1997	CC	Mk33	36 Mirza R-Mk33,1993	Mk
Mk8	34 Riđa R-Mk8,1996	Mk	Mk21	3 Mica R-Mk21,1985	Mk	Mk34	37 Rička R-Mk34,1990	Mk
Mk9	34 Suzy R-Mk9,1997	Mk	Mk22	15 Rička R-Mk22,1988	Mk	Mk35	39 Olga R-Mk35,1992	Mk
Mk10	3491 Zeka R-H1160,1993	CC	Mk23	17 Vranka R-Mk23,1992	Mk	Mk36	38 Ciga R-Mk36,1993	Mk
Mk11	9 Brena-R- Mk11,1992	Mk	Mk24	14 Zvezda R-Mk24,1995	Mk	Mk37	4303 Maja R-H281,1997	CC
Mk12	22 Zora R-Mk12,1985	Mk	Mk25	1 Vranka R-Mk25,1993	Mk			
Mk13	41 Zora R-Mk13,1990	Mk	Mk26	7 Rička R-Mk26,1993	Mk			

mk – Medjimurje horse; CC – Croatian Cold-blooded



Graph 2. Breed registry structure (parental pairs)  
 Graf 2. Struktura registra pasmine (roditeljski parovi)

As a result of crossing other breeds (Hungarian and Croatian Cold-blooded) with Medimurje horses, 9% of foals is updated in the registry, while 5% of foals was born from Medjimurje mares and unknown father. In the early years of the Medjimurje registry acceptance of a large proportion of Croatian indigenous horse breeds, like Croatian Cold-blooded and Posavina horse, can be seen in the breeding, and in the last five years the introduction of foreign cold-blooded breeds and the mares of Croatian Cold-blooded.

### **Conclusion**

Number of horses from critically endangered ( $N_e = 14.17$ ) indigenous breed of Medjimurje horse, since the registry foundation in 1999 to date, does not inspire hope in population increasing any time soon. By making this breeding systematization on pedigree data and by defining 7 stallion lines and 37 mare lines, we created base for further planning and management of breeding (planned mating) to prevent the reduction of genetic variability, credible analysis of demographic parameters, estimation of genetic variability, implementation of molecular research, deposition of biological material in Gene bank of domestic animals of Croatia with a significant cost reduction and a credible control of farming from the standpoint of culling animals from breeding. A great representation of other breeds in Medjimurje breeding horses is concerning after being detected in the analysis of pedigree. Analysis indicates acceptance of a large number of other horse breeds into the Medjimurje horse breeding, especially in the last five years. We conclude that the breeding since the registry foundation in 1999 hasn't been done in pure blood, which is necessary to maintain an indigenous horse breed. The introduction of new breeds into the breeding is necessary due to the size of the population, but it should be planned and professionally supervised. A large proportion of other horse breeds in the Medjimurje horse registry leads to the conclusion that it is not an indigenous horse breed, but the type of cold-blooded horse, so the status of current population "authenticity" is doubtful.

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## **SISTEMATIZACIJA UZGOJA IZVORNE PASMINE MEĐIMURSKI KONJ**

### **Sažetak**

Međimurski konj je kritično ugrožena pasmina ( $N_e = 14,17$ ) i jedna je od tri hrvatske izvorne pasmine konja. Cilj istraživanja je sistematizirati uzgoj međimurskog konja definiranjem linija pastuha i kobila, te analizirati zastupljenost drugih pasmina u uzgoju međimurskog konja. Rezultat sistematizacije je definiranje 7 linija pastuha i 37 rodova kobila koji su temelj daljnjeg planskog vođenja uzgoja. Analizom rodovnika utvrđena je velika zastupljenost drugih pasmina u uzgoju međimurskog konja, te nevođenje uzgoja u čistoj krvi od utemeljenja pasminskog registra 1999. godine do danas, što je nužno obzirom da se radi o izvornoj pasmini. Veliki udio grla drugih pasmina u registru navodi na zaključak da se ne radi o izvornoj pasmini, nego o uzgojnom tipu hladnokrvnog konja, te da je upitan status „izvornosti“ aktualne populacije.

**Ključne riječi:** međimurski konj, sistematizacija uzgoja, linije pastuha, rodovi kobila

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