Proceedings of 28th Annual Meeting of DAGENE

Danubian Animal Genetic Resources

Volume 2 (2017)

DAGENE
International Association for the Conservation
of Animal Breeds in the Danube Region
1078 Budapest, István street 2.
Hungary

Proceedings of 28th Annual Meeting of DAGENE

Danubian Animal Genetic Resources

Volume 2 (2017)

DAGENE
International Association for the Conservation
of Animal Breeds in the Danube Region
1078 Budapest, István street 2.
Hungary

Danubian Animal Genetic Resources

Volume 2 (2017)

"*Tradition and innovation in preservation of autochthonous breeds*"

Proceedings of 28th Annual Meeting of DAGENE

in Pazin, Croatia

from 26th to 29th of April 2017

DAGENE

International Association for the Conservation

of Animal Breeds in the Danube Region

1078 Budapest, István street 2.

Hungary

Danubian Animal Genetic Resources

Volume 2 (2017)

Editorial office: DAGENE - International Association for the Conservation of Animal Breeds in the Danube Region, 1078 Budapest, István u. 2. office@dagene.eu - www.dagene.eu

Publisher: DAGENE - International Association for the Conservation of Animal Breeds in the Danube Region, 1078 Budapest, István u. 2. office@dagene.eu - www.dagene.eu
Person responsible for publishing: Pál HAJAS president of DAGENE

Printed by A/3 Printing and Publishing Ltd., Péter MOHAI

HU ISSN: 2498-5910

This journal, founded 2016 is the official leaflet of the Annual Scientific Conference of DAGENE, as well as the publication medium for the yearly activity of DAGENE members.

Our journal is freely distributed in hard copy among the members of DAGENE and cooperating associations, however it is available from website www.dagene.eu.

Supporting and advertising are possible at the office.

CONTENT
PROGRAM OF ANNUAL MEETING

The date of 28th Annual Meeting of DAGENE is from **26th to 29th of April 2019** (four days).

Place of Conference at the location of Hotel & Restaurant "Na Brijegu" and Gasto center "Gortanov Brijeg". Here you will find the proper address with GPS coordinates: **Rogovići 82/c Lovrin, 52000, Pazin**, Croatia, degrees of latitude: 45.2269463 and longitude: 13.9129226.

The program contains is the following:

Wednesday **26 April 2017**
- 17:00 Arrival, Welcome drink
- 18:00 DAGENE Board meeting

Thursday **27 April 2017**

12:40	KOVÁCS, Endre – ZENKE, Petra – MITRO, Susanne – TEMPFLI, Károly – BECSKEI, Zsolt – SÁFÁR, László – BALI PAPP, Ágnes – GÁSPÁRDY, András: **Die Ergebnisse der molekulargenetischen Untersuchungen der Traberkrankheit bei ungarischen Cikta Schafen** (vollständiger Beitrag)	91
12:50	BECSKEI, Zsolt – SAVIĆ, Mila – DIMITRIJEVIĆ, Vladimir – DIMITRIJEVIĆ, Blagoje – NENADOVIĆ, Katarina – COJKIĆ, Aleksandar – VUČKOVIĆ, Sava – RELIĆ, Renata – XEXAKI, Anna – ÖZVEGY, József – KÖNYVES, Tibor – GÁSPÁRDY, András: **Influence of the traditional habitat on added value and product quality of Sjenica Zackel Sheep** (full paper)	98
13:00	KLAFFENBÖCK, Michael – BERGER, Beate – MÉSZÁROS, Gábor – SÖLKNER, Johann: **Selecting candidates for SNP-Chip genotyping from endangered Austrian goat breeds using pedigree analysis** (full paper)	103
13:10	PELLES, Zsófia – ZENKE, Petra – MARÓTI-AGÓTS, Ákos – GÁSPÁRDY, András – ZÖLDÁG, László: **Detection of the hidden merle colour in Mudi breed with genetic test** (full paper)	106
13:20	KULÍKOVÁ, Barbora – BALÁŽI, Andrej – KUŽELOVÁ, Lenka – CHRENEK, Peter: **Cryopreservation of Nitra and Zobor rabbit semen as animal genetic resources in Slovakia** (full paper)	111
13:30	ŽAN LOTRIČ, Metka – OSOJNIK, Gasan – RANT, Petra – BOJKOVSKI, Danijela – SIMČIČ, Mojca: ***In situ* conservation of endangered breeds on ark-farms and ark-centres in Slovenia** (full paper)	117
13:40	GÁSPÁRDY, András – SEREGI, János: **Description of a planned subject „Basic aspects of farm animal handling" – based on experiences with native breeds** (full paper)	122

13:50 - 14:45 ***LUNCH*** *(Gasto center "Gortanov Brijeg")*

14:45 - 19:00 **TECHNICAL TOUR**
(visit of more farms with autochthonous breeds)

19:00 ***DINNER*** *(in hotel, in price of accommodation)*

Friday **28 April 2017**

09:00 - 12:30	**Visit of Agency for Rural Development of Istria** (http://www.azrri.hr/)	
09:00 - 09:15	ŠUBARA, Gordan: **The role of local government in the preservation of Istrian autochthonous breeds** (abstract)	126
09:15 - 09:30	ŠURAN, Edmondo: **Gastronomic valorisation of Istrian cattle meat**	127
09:30 - 10:30	Visit of farm of Istrian Cattle - Agency for Rural Development of Istria	
10:30 - 11:30	Visit of small meat processing unit in Pazin - Agency for Rural Development of Istria	
11:30 - 12:30	Visit of educational gastronomic center in Pazin - Agency for Rural Development of Istria	
12:30 - 13:00	**PRESS CONFERENCE** (Gasto center "Gortanov Brijeg")	
13:00 - 15:00	***LUNCH*** *(Gasto center "Gortanov Brijeg")*	
15:00 - 16:00	**GENERAL ASSEMBLY** **Round table** (possibility of further collaboration) & Conclusion of 28th Annual DAGENE Meeting, information on 2018 joint event with SAVE	
16:00 - 19:00	***Visit of Pazin city*** *(sightseeing)*	
19:00	***DINNER*** *(in hotel, in price of accommodation)*	

Saturday **29 April 2017**
Farewell & departure

In trauriger Erinnerung an unseren unvergesslichen
Herrn Professor Dr. Fritz Dietrich Altmann (1935-2016)

Fritz Dietrich Altmann ist am 29. 6. 1935 im Kreis Pirna/Elbe geboren. Im Jahre 1960 promovierte er zum Doktor der Veterinärmedizin und im Jahre 1961 erhielt er die Approbation als Tierarzt. Seine Tochter Angelika Hinke studierte in Leipzig Veterinärmedizin und ist als Tierärztin tätig.

1962 wurde er Direktor und Zootierarzt des Zooparks Erfurt in Thüringen, im dem er bis 1989 in besagter Position tätig war. Altmann hielt an der Universität Leipzig Vorlesungen für das Fachgebiet Tierzucht und Tierhaltung in den Tropen und Subtropen und wurde Honorardozent.
Altmann erlangte seine Weiterbildung zum Fachtierarzt für kleine Haus- und Pelztiere im Jahre 1979 mit der Note sehr gut. Kurze Zeit später wurde ihm der Titel Veterinärrat verliehen.

Seine Berufung zum Honorarprofessor für „Tierzucht und Tierhaltung in den Tropen und Subtropen“ an der Universität Leipzig geschah im Jahr 1987 und dort war er den ordentlichen Professoren gleichgestellt. 1990 erhielt er an der Veterinärmedizinischen Universität Wien die Professur für „Tierzucht und Tierhaltung sowie Erkrankungen von Haus- und Nutztierrassen in den Tropen und Subtropen“ als auch für die „Zucht, Haltung, Ernährung und Erkrankungen von Kaninchen und Heimnagetieren“.

1991 wurde ihm vom Wiener Volksbildungswerk die Konrad-Lorenz-Medaille verliehen und er erhielt vom österreichischen Bundesministerium für Umwelt, Jugend und Familie den Auftrag im Gebiet „Vom Aussterben bedrohte Haustierrassen Österreichs und Wege zu ihrer Erhaltung“ zu forschen.
Im selben Jahr wurde er in der „Allianz zur Erhaltung aussterbender Haustierrassen der Donauländer – DAGENE“ Leiter der Fachbereiche Ziegen, Esel, Wasserbüffel, Hunde, Geflügel, Tauben und Kaninchen.

Als Mitbegründer und Präsident des „Vereines zur Erhaltung der Weißen Barockesel“ schrieb er das berühmte Buch „Die Rettung der weißen Esel“. Gleichzeitig veröffentlichte er zahlreiche Bücher und weit über hundert wissenschaftliche und populärwissenschaftliche Publikationen.
Hinsichtlich darauf, dass wir während der Zusammenstellung des 25-Jahre Jubiläums Buches (DAGENE) mit ihm auf Grund seines verschlechterten Gesundheitszustandes nicht mehr in Kontakt treten konnten, übersandten wir dem „Verein zur Erhaltung des Weißen Barockesels“ zwei Exemplare unseres DAGENE-Jubiläumsbuches.

Herr Professor Dr. Fritz Dietrich Altmann ist am 10. Juni 2016 seinem Herzleiden erlegen. Der Verlust unseres langjährigen DAGENE Mitgliedes stürzt uns in tiefe Trauer. Er wird uns stets in herzlicher und bester Erinnerung bleiben.

In memoriam our Judith,
M.Sc., DVM, mpx. Ph.D. Iudith Ipate-Veress (1968-2017)

Iudith (Judith) Veress was born in Topliţa, Harghita county Romania on 13 May 1968. Iudith changed her name when she married Nicolae (Nick) Ipate at the end of 2002. From this year she used to carry her married name, Iudith Ipate also in the professional life. In 2005 their beautiful daughter Ingrid Ana-Maria was born, who we hope will follow her footsteps. Besides her mother tongue which was the Romanian she used excellently the Hungarian, German, French and English languages.
At the University of Agronomic Sciences and Veterinary Medicine – Bucharest she graduated as M.Sc. of animal science engineer (1995), then three years later as Doctor of Veterinary Medicine (1998). In 2004 she provided her dissertation thesis and obtained the degree Ph.D. in Biotechnology of Reproduction.

All her life was dedicated to the science and research in the field of biotechnology applied in conservation of animal genetic resources. Her skills were to work in group and organize scientific symposiums.
Between 1998 and 2005 she coordinated a research team for animal biotechnology at the Institute for Bovine Research and Development, Baloteşti. From 2005 until 2007 she directed the Biotechnology Reproduction Laboratory as the head of this Lab at this Institute. From 2007 until 2009 she was the scientific director of the Centre of Study and Research for Agro Forestry Biodiversity "David Davidescu", Bucharest, one of the research location of the Romanian Academy of Science. Lately, she, as senior researcher, coordinated and organized the strategic research team of this academic institute in multidisciplinary fields of bioeconomy, eco-economy and conservation of animal genetic resources in co-operation with a wide variety of partners at national, bilateral and international level. All her work was materialized in more than 200 scientific papers, books, presented and published at home and abroad as well.
Her thirst for knowledge continued in studying economy and bioeconomy which culminated in second Ph.D. thesis economy 2016.
She was member of the following associations: DAGENE (from 2007), IABS (International Animal Biologic Science), EurSafe (International Society for Agricultural and Food Ethics), FOODLAWMENT (European Food Chain Parliament), FEEDSEG and Association of Romanian Embryotransfer (ARET), expert of High Level Panel of FAO. She was also a member of the Moldavian Academy of Science.

She took great effort to realize the 21st DAGENE Annual Meeting „Biodiversity is live – Agrobiodiversity is our life" in Brazi, county Haţeg, Romania, 15-17 April 2010.

She, who worked with enthusiasm for a multicolored life, is no longer living among us. She went to her long home on 10th of February. Her funeral took place in Topliţa on 14th of February. Her memory, cheerfulness, love of work will be preserved with affectionate regret by us.

The Editors would like to thank to Eng. Amalia Străteanu, colleague of Iudith, events coordinator of the above DAGENE Annual Meeting for her help in bibliographical data collection.

Status of farm animal genetic resources in Croatia – a review

IVANKOVIĆ, Ante[1] – RAMLJAK, Jelena[1]

[1]Department of Animal Science and Technology, University of Zagreb, Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia (aivankovic@agr.hr)

Abstract

Erosion of animal genetic resources has been present on the regional, national and global level. Main reasons for disappearance one part of autochthonous breeds are: globalisation, industrialisation of agriculture, import of allochthone breeds, inadequate selection, depopulation and urbanisation of rural areas. Animal genetic resources are Croatian heritage with value visible on economic, social, natural and cultural level. Preservation of native breeds is implemented in national programs. The aim of this review paper is analysis of status and trends of farm animal genetic resources in Croatia.

1. Cattle breeds

Three cattle breeds were recognised as national genetic heritage. Programs for preservation of Istrian Cattle and Slavonian Syrmian Podolian Cattle were started during the 90's of the 20th century, while a Busha cattle is included in protection programme from 2003.

Busha is autochthonous late maturing breed of cattle with smaller body frame (withers height 100 to 115 cm). Cows have live weigh up to 250 kg, and bulls up to 300 kg. Calves are small with birth weight around 15 kg. Female animals remain in the breeding period for 10 to 12 years and live up to 20 years. Busha is unicoloured, white, brown, yellow, red or black coat colour with an eely stripe on the back in contrast with the main colour. Horns and hooves are dark coloured. Bone structure of the head is gentle, forehead regularly broad, horns short, more or less curved, in basis horizontally directed. Back are narrow, short and straight, croup pointed and struck down. Milk production ranges from 1.500-2.800 kg.

Istrian Cattle are late mature, long livin breed of moderate body frame size. Bulls reach 155 to 170 in withers height. Milk production of Istrian cattle is small (800 – 1.500 kg). Animals are unicoloured light grey to white coat colour with transitions in darker grey shades. Bulls are commonly darker then cows and heifers. One of the specificities is the darker pigment of the neck, shoulder blade, lower ribs area and belly, dorsal ridge, distal parts of the legs, around the eyes, borders and inside of earlobes and lower inner part of the tail. Tongue is grey, while palate is almost black. Horns are proportionally long with a span of 70 cm and more, and shaped like a lyre. Calves are mostly red upon birth, but coat color can vary from white to grey. Istrian Cattle reach their maturity in 6-7 years of age which causes long breeding capacity.

Slavonian Syrmian Podolian Cattle is a late maturing breed of moderate frame (withers height 125 to 130 cm). Coat colour of cattle is grey-white to dark grey, often with dark pigmentation of the dewlap, head and neck. In bulls pigmentation is more pronounced, and the dark circles around the eyes are larger. Snout, eye mucosa and hooves are dark pigmented

(black). Horns are distinctively long, often placed diagonally with tips pointing to the side, and with a large span between them. Milk production is around 1.000 kg during lactation.

2. Breeds of horses

In Croatia, systematically **breeding of Lipizzan** horses starts in 1806, by the arrival of horses from Lipica stable, which were running away from Napoleon and took shelter in Đakovačka stable. Lipizzan in Slavonia became part of the tradition. This "baroque" horse became known by its noble and firm body structure, resistance, modesty in keeping and feeding, good learning capabilities and will to work. The neck is medium long, muscular, nicely bent and highly positioned. Chest is of moderate depth and width. Shoulder blade is long, slightly bent down and well muscled. Connection is moderately long well connected with muscles. Croup is strong, firm, moderately round and steep. Legs are correctly position, joints are expressed and dry. Movements are rich, elegant and balanced.

Croatian Coldblood Horse is heavy, wide and robust horse. Head is of medium sized, wide forehead, straight to slightly convex nose profile, eyes and nostrils are expressed. Neck is long, muscular and moderately high positioned. Chest is wide and deep. Shoulder blades are long, moderately diagonally positioned, covered by muscles and firmly connected with the body. Back is medium long and strong. Croup is good structured, wide, with visible spliting of expressed muscles. Legs are strong with well expressed joints. Pastern is moderately covered with hair Most often is bay coat colour, rarely black, chesnut, dun or other..

Croatian Posavina Horse is a mid weight horse of solid constitution and compact body. Head is dry, small with wide forehead, straight profile, small ears, large and expressed eyes and nostrils. Neck is moderately long, well covered with muscles, and firmly connected to the body. Chest is wide and deep. Shoulder blades are moderately long, diagonally positioned, well covered with muscles and firmly connected to the body. Back is medium long and strong. Croup is wide, split, and well covered with muscles. Legs are dry and strong, joints expressed, and fetlock short. Posture of legs is correct, hoof are wide and adequately built. Bay coat colour of the horse is the most frequent, and black, chesnut, dun or Isabella appear rarely..

Murinsulaner Horse belongs to the group of heavy, coldblood, working horses. Head is relatively small with small ears. Neck is short and muscular, withers expressed, back wide and short, and croup broad and split. Chest is strong, deep and wide with rounded ribs. Legs are correctly built, firm with wide hoofs. Body is wide, deep and compact. Most frequent coat colour is bay horse, rarely black, chesnut and other.

3. Breeds of Donkeys

Littoral Dinaric Donkey was created on today's breeding area of Croatian coast, developing characteristics of adaptability and exquisite working capabilities, with maintenance of a smaller body frame, adopted to dry karst environment. Coat colour is mostly ashy grey, and to lesser extent dark brown. Head, tail and legs in the lower part are for one shade darker than the body. Dark stripe along the shoulder blades and back (cross) is clearly expressed. Mane is strong, hairy, with dark top rim, and rarely completely black. Head is of medium size, flat to mildly concave nose profile, short ears with darker outer rim and white hair in the ear and around the eyes. Neck is of medium length and muscularity. Wither is long but weakly expressed, back is straight to mildly concave. Croup is steep, weakly muscular with protruding sacral part. Chest is shallow and narrow. Legs are firm with medium strong bones.

Istrian Donkey was created in the area of central, southern and west Istria. Istrian donkey has a firm composure and large square frame. Coat colour mainly is black, rarely dark brown. Cross and zebras in legs are not visible. Crest is black and expressive and hairy. Head is big, straight to mildly concave nose profile with long ears which have white hair on the inside.

Neck is wide, muscular and well positioned. Wither is long and expressive, back line mainly slightly concave. Chest is of medium depth, but narrow. Legs are firm with strong bones.
North Adriatic Donkey has been created in the area of Northern Adriatic, primarily in the area of Kvarner. Given the size of the body frame it is positioned somewhere between Littoral Dinaric and Istrian donkey. Coat colour varies from dark brown to black, and only to a smaller extent dark grey. Cross and zebras are not clearly visible. Head is large with straight nose profile, with long ears and white hair on the inside and dark rim. Neck is moderately wide, muscular and well positioned. Wither are long and less expressive, back line straight to mildly convex. Croup is mildly steep, of medium muscularity with expressive sacral part. Chests are medium deep, but narrow. Legs are firm with moderately strong bones.

4. Breeds of sheep

Nine autochthonous sheep breeds in Croatia are protected. Larger number sheep of breeds (Pag Island sheep, Dalmatian pramenka, Licka pramenka, Istrian sheep, Cres Island sheep, Krk Island sheep, Rab Island sheep, Tzsigai sheep) are in economic use (milk, cheese, meat), and their production characteristics are improved with selection trough breeding.
Pag Island Sheep belongs to the group of merinised prameka of Pag Island. This sheep is somewhat smaller than the other Island sheep breeds. Body mass of adult sheep is 30-40 kg and rams 40-55 kg. The body of Pag Island sheep is built proportionally with medium emphasis of depths and width. Back line is straight. Legs are firm and strong, with perfectly coordinated movements and regularly not covered with wool in the lower part. Neck is of medium length and muscularity. Head is of medium size, noble look and properly dimensioned. Sheep are usually hornless, while rams mostly have firm and well developed horns. Head are mainly white coloured. Body is covered with closed to semi-closed fleece of mixed wool. Fertility of Pag Island sheep is approx. 120%, and lactation lasts approx. 180 days during which the Pag Island sheep produces 80 to 150 kg of milk. Basic goal of Pag Island sheep breeders is milk production which is purchased by larger cheese factories on Pag Island or it is being processed into the well known hard cheese of Pag Island.
Krk Island Sheep has proportional and firm body structure. Sheep are mostly white, rarely black, grey or brown. Head is small with straight profile and hornless. Ram has a convex nose bone profile and mostly is with horns. Fleece is semi closed to closed. Head and legs are mostly white with the fact that on the legs, head, and earlobes black, brown or grey spots can appear. Adult sheep weigh 33-38 kg, and rams 50-55 kg. Fertility ranges up to 110% and body mass in lamb aged 3-4 months amounts 25-30 kg. Krk Island sheep is a breed of combined production characteristics.
Licka Pramenka Sheep is firmly built and of strong constitution. Sheep are of average weight 45-55 kg and rams 65-75 kg. Usually her body is longer than higher. Body is covered with an open fleece of mixed wool, consisting of pointy strains. Typical colour is white, with bigger and smaller black spots. Milk production during lactation is 120-150 kg. Lambs in age of 3-4 months reach weight of 25-30 kg. Main production goal is meat.
Ruda Sheep is medium developed and proportionally built. It is in most cases white. Average body mass is around 45 kg and rams 55-60 kg. Priority in breeding, compared to other sheep breeds, Dubrovnik ruda gained due to its fine wool and a slightly higher milk production (120-160 kg in lactation). Fertility of sheep is 120-150% and the lambs in age of 35-45 days reach a body mass of 12-15 kg, and in age of 3-4 moths 25-30 kg.
Rab Island Sheep is petite, but of proportional and firm body structure. Head is small with straight nose profile and hornless. The neck is of medium length and muscular. Legs are firm and strong. The fleece is semi-closed. Sheep are mostly white. Head and legs are mostly white with the fact that on the legs, head, and earlobes black, brown or grey spots can appear. Adult sheep weigh 35-40 kg and rams 55-60 kg, which shows that through feeding and selection,

good production results can be achieved. Today the Rab Island sheep is mostly bred exclusively for meat production (lamb). Fertility ranges up to 110 % and body mass in lamb aged 3-4 months amounts 25-30 kg.

Dalmatian Pramenka has of strong body constitution and is proportionally built. Neck is of medium length. Ridge is well exposed, and back line is straight. Legs are firm and strong. Head is of medium size; sheep have a straight profile line, and in rams slightly curved. Rams have strong horns and sheep are mostly hornless. Wool is of open type with pointy strains. Body mass of sheep ranges from 30 to 40 kg and rams 45-55 kg. It is a late maturing breed. Colour of wool is white, although significant percentage of head can have black colour, and in a smaller percentage with brown and grey colour. Adult sheep weigh 35-40 kg and rams 55-60 kg.

Istrian Sheep belongs to the group of the largest autochtonous breeds. It is proportionally built, of strong constitution and longer body. Body in its white basis is spotted, and the belly and legs are regularly completely black. In the past the pigmentation was so expressed that it looked as the basic colour was black. The sheep are of average body weight of 70 kg, and rams weigh up to 100 kg. Fertility of Istrian sheep is 130-150%, and the body mass of lambs aged 45-60 days is 15-18 kg. This breed belongs to the group of sheep of combined production characteristics (meat-milk). The largest number of breeders of the Istrian sheep produces a full-fat hard sheep cheese very high valued on the market.

Cres Island Sheep is small and durable, and to a large extent resistant and adaptable. The body is medium height and length, quite proportionally built with somewhat thinner, but extremely firm legs adapted to the hard rocky terrain of the Cres Island. Fertility of the Cres Island sheep is 120-150%. Body mass of lambs is 30-45 days and it amounts 12-15 kg. Milk production is 60-100 L counting the amount sucked by the lamb. Cres Island sheep belongs to the group of breeds with combined production characteristics, although Cres Island sheep was never known for cheese production, but for lamb meat production.

Tsigai Sheep is a large breed, of firm body structure and strong constitution. The body is of medium length, but relatively narrow and of rectangular shape. Adult sheep weight 50-65 kg, and rams 70-100 kg. Sheep are hornless, but rams can have horns. Head, ears and legs are black. Lambs have mouse grey colour at birth. This colour is lost in time, so that by four months of age lambs get white colour of the wool. Tsigai is a breed with combined production characteristics (meat, milk and wool). Although Tsigai in lactation can give up to 120 kg of milk, today it is exclusively bred for meat production. Fertility ranges from 140-180% and body mass of lamb in age of 3-4 months amounts to 30-35 kg.

5. Breeds of goats

Croatian White Goat has smaller constitution. Goats weigh between 35 to 45 kg, and male goats from 50 to 60 kg. Head is small and dry, mostly with horns and white beard. Neck is long and of medium muscularity. Hair is thicker, harsher and longer, especially on thighs. Croatian white goat is a breed of combined production characteristics, so the main products are meat and milk. Average milk production is 250-300 kg of milk in lactation from 250 to 280 days. Average fertility is 160 to 180%. Kid weighs 13.5 kg in two months of age.

Croatian Spotted Goat is characterised by its resistance and adaptability to harsh karst terrain. It is proportionally built, of a firm frame and longer body. Head is medium long and of a straight profile. Does and bucks can be yellow and with horns. Horns are dark, rough and two-edged. Neck is long, flat and medium muscular. Chest is narrow and shallow, back line long and straight, croup steep, legs long and firm. Body of the goats is covered by long, thick and shiny hair of different colour. Breeding of domestic spotted goat is organised mainly in highly extensive conditions. Fertility of goats in average amounts 100% and in better herds

20-30% twinning can occur. Average milk production is approx. 100-250 kg in lactation. Main production goal is meat.

Istrian Goat has a large frame, strong constitution, somewhat stronger bones, basic white coat with possible greyish nuances with possible pigmentation of muzzle top, inner side of ears and udder. Estimated body weight of adult, physically developed goats is from 65 to 80 kg, and buck from 90 to 120 kg. Udder is well developed. According to established general exterior impression and udder development and with conversation with breeders, it can be concluded that this is milk type of goat with daily production from 2 to 6 kg of milk. Additionally, this is very fertile goat type giving birth from two to three kids in litter, depending on herd conditions (nutrition), and breeders prefer the most siblings (twins).

6. Breeds of pigs

Black Slavonian Pig belongs to the medium size breed. Body is really short with deep and wide chest. Head is medium long, dry with convex nose profile, ears are medium long and half lop. Neck is medium long, wide enough and of good muscules. Croup is medium wide and slightly struck, hams of medium musculature. Legs are relatively short and thin. Skin is ash coloured covered with medium long and thin straight bristle. Snout and hooves are black. Sows have 10 to 12 tits and farrow 7 to 8 piglets, by birth uni-coloured greyish and almost hairless. Upon weaning piglets weighs 8 to 12 kg. During fattening they achieve daily gain of 500 to 550 g. Muscle ratio in carcases on slaughter line ranges from 32.6% to 42.6%. Meat is of good quality and colour. Percentage of intermuscular fat is high and ranging from 6 to 8%.

Turopolje Pig belongs to medium size breeds. Head is medium long with bowed profile, snout is strong, medium long and ears are medium long and half floppy. Neck is short and not very muscular, back is straight, weakly muscular and croup folded and also weakly muscular. Belly line is straight, and thighs poorly muscled. Body covered with thick curly bristle of white yellow colour with dark spots size of a palm, skin nonpigmented, snout pink. Sows have 10 to 12 tits and farrow 7 to 8 piglets. After weaning two months old piglets weight 10 to 15 kg. In intensive fattening system from 20 to 100 kg achieve daily growth of 550 g. Meat is juicy and pink, therefore highly valued.

7. Breeds of poultry

Croatian Hen is bred in three basic types which differ in colour of feathers: black, red and spotty or gold. Body mass of cocks ranges from 3.5 and 4.0 kg and hen between 2.5 and 3.0 kg. With sufficient green food the meat is of good quality and egg production is desirable. It stands out for its resistance to diseases and cares for chickens, good fertility and meat quality. With good care and feed ti can lay more than 200 eggs annually. This is one of the rare breeds of hen which kept the instinct to sit on eggs.

Zagorje Turkey is bred in four types primarily differentiate by colour. Most frequent is the bronze, and the rarest is the black colour, while light and grey type appears more openly. Males in age of 28 weeks reach an average live weight of 6.5 kg and female turkeys on average 4.0 kg. Female turkeys lay on average 16 eggs during the season and hatch is around 80%.

References

CROATIAN AGRICULTURAL AGENCY (2005.2016): Annual reports. Zagreb (http://www.hpa.hr/publikacije/)

GROUP OF AUTHORS (2011): National programme for the protection of autochthonous - native and protected breeds of domestic animals in the Republic of Croatia. (http://www.mps.hr/default.aspx?id=7088)

CAPUT, P. – IVANKOVIĆ, A. – MIOČ, B. (2010): Conservation of biological heritage in livestock. Croatian Dairy Association, Zagreb.

Table 1. Overview of native and protected breeds, population size, and categorisation in relation to endangerment level and trend estimate

Species	Breeds	Number of animals valid for breeding				Effective size of population (Ne)		Categorisation of breed endangerment status	Estimate of the population trend
		Total	Under control						
			Male	female	Offspring	Ne	Ne^S		
Cattle	Busha	1 314	55	703	556	204.0	142.8	Potentially endangered	Positive
	Istrian cattle	1 346	53	781	512	198.5	139.0	Highly endangered	Positive
	Slavonian Syrmian Podolian cattle	325	12	183	130	45.0	31.5	Critically endangered	Positive
Horse	Lipizzan	1 995	513	941	541	1 328.0	929.6	Not endangered	Positive
	Croatian Coldblood horse	6 877	686	3 749	2 432	2 319.6	1 623.7	Not endangered	Positive
	Croatian Posavina horse	4 691	331	2 692	1 665	1 179.0	825.3	Not endangered	Positive
	Murinsulaner horse	49	5	29	15	17.1	11.9	Critically endangered	Positive
Donkey	Istrian donkey	369	59	200	110	182.2	127.6	Highly endangered	Positive *
	Littoral Dinaric donkey	1 320	267	746	307	786.5	550.6	Potentially endangered	Positive *
	North Adriatic donkey	70	8	41	21	26.8	18.7	Critically endangered	Stable *
Sheep	Pag Island sheep	30 000*	173	4 388	595	-	-	Not endangered	Stable
	Krk Island sheep	18 000*	8	347	51	-	-	Not endangered	Stable
	Licka sheep	30 000*	277	7 833	1 354	-	-	Not endangered	Stable
	Ruda sheep	727	36	591	100	135.7	95.0	Highly endangered	Positive
	Rab Island sheep	6 500*	29	672	107	-	-	Not endangered	Stable
	Dalmatian pramenka	280 000*	344	9 632	1 252	-	-	Not endangered	Stable
	Istrian sheep	1 943	70	1 357	516	266.3	186.4	Potentially endangered	Stable
	Cres Island sheep	15 000*	40	869	118	-	-	Not endangered	Stable
	Tzigai sheep	3 000*	30	986	314	-	-	Not endangered	Stable
Goat	Croatian white goat	5 000*	6	83	15	-	-	Potentially endangered*	Stable *
	Croatian spotted goat	25 000*	51	825	141	-	-	Not endangered*	Stable *
	Istrian goat	24	1	15	8	-	-		
Pig	Black Slavonian pig	1 496	191	1 305		666.5	466.5	Potentially endangered	Positive
	Turopolje pig	162	30	132		97.8	68.4	Highly endangered	Stable
Poultry	Hen Hrvatica	5 414	526	4888	-	1 899.6	1 329.7	Not endangered	Positive
	Zagorje turkey	1 809	-	1809	-	-	-	Potentially endangered	Positive

*Estimation; sources: Annual report, Croatian Agriculture Agency, 2016

Table 2. Number of breeding adult animals of native and protected breeds in the Republic of Croatia in the period 2004-2015

Breed / year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	**2015**
Istrian cattle	300	368	361	437	481	531	623	663	729	761	780	**834**
Slavonian Syrmian Podolian cattle	37	68	77	102	116	134	157	154	177	184	193	**195**
Busha	55	116	111	141	188	221	265	341	420	507	591	**758**
Lipizzan	398	449	454	477	573	582	639	865	1,275	1,468	1,307	**1,454**
Croatian Coldblood horse	1,406	1,573	2,220	2,552	2,981	3,035	3,114	3,476	3,794	4,213	4,402	**4,435**
Croatian Posavina horse	1,505	1,616	1,618	1,732	1,954	2,267	2,196	2,492	2,582	2,895	3,042	**3,023**
Murinsulaner horse	29	25	25	21	28	28	26	41	48	51	34	**34**
Istrian donkey												**259**
Littoral Dinaric donkey	804	970	1,074	965	1,385	1,712	1,825	2,099	3,331	2,522	1,642	**1,013**
North Adriatic donkey												**49**
Pag Island sheep	1,248	1,509	2,032	2,072	2,010	3,670	3,464	4,361	4,106	4,338	4,122	**4,561**
Krk Island sheep	-	-	-	68	140	62	78	118	108	353	364	**355**
Licka sheep	4,011	3,754	4,116	4,224	4,493	5,421	6,019	6,712	7,333	7,553	7,601	**8,110**
Ruda sheep	197	231	270	305	380	450	530	602	595	665	646	**627**
Rab Island sheep	-	603	667	631	1,090	1,031	638	461	455	707	720	**701**
Dalmatian Pramenka	1,766	118	2,389	3,227	7,324	8,589	8,419	8,477	10,394	8,842	10,111	**9,976**
Istarian sheep	1,965	1,982	1,976	1,885	1,831	1,829	1,734	1,865	2,019	2,332	2,253	**1,427**
Cres Island sheep	327	469	626	729	777	829	802	769	786	874	936	**909**
Tsigai sheep	557	2,206	1,880	2,216	1,993	1,460	1,066	1,161	1,048	1,388	1,214	**1,016**
Croatian white goat	-	-	-	-	68	64	60	62	76	76	85	**89**
Croatian spotted goat	251	305	217	80	455	616	439	424	680	488	608	**876**
Istrian goat								-	70	21	48	**16**
Black Slavonian pig	619	685	650	669	747	716	971	1,005	1,075	959	1,227	**1,496**
Turopolje pig	125	143	150	193	145	156	157	159	155	153	148	**162**
Hen Hrvatica	-	-	22	122	396	429	591	1,052	1,419	2,394	3,902	**5,414**
Zagorje turkey	1,933	1,940	1,816	2,151	2,681	2,501	2,615	2,860	3,258	2,958	2,742	**1,809**

Sources: Annuals report, Croatian Agriculture Agency, 2005-2016

Genetic resources in buffalo species (Bubalus bubalis) in the world

BORGHESE, Antonio[1]

[1]General Secretary International Buffalo Federation, Coordinator FAO-ESCORENA Buffalo Network, Former Director of Animal Production Research Institute, Monterotondo, Roma, Italy, antonio.borghese@email.it – antonioborghese@live.it

Abstract

A revue on genetic variability in buffalo species (Bubalus bubalis) is offered, with the presentation of the more known breeds in buffalo subspecies Swamp and River. The Swamp breeds are diffused in South Asian countries and are used for draught, particularly in rice fields, producing few quantity of milk, meat, bone, horns and dungs. On the contrary River breeds are selected for the production of relevant quantity of milk and meat and are diffused in all the continents for food purposes, as many products are coming from cheese industry and are very appreciated by market and consumers.

Introduction

The buffalo species (Bubalus bubalis) is a very common species, particularly widespread in tropical and subtropical countries with hot and humid climates, as in South East of Asia, but we can find now buffaloes quite in all the countries in the world, for the great capacity of adaptation of the species, from the very cold countries as Canada, Germany and U.K., to Mediterranean countries as Italy and equatorial ones, as Colombia and Brazil.
We have in the world a total population of about 200 million of buffaloes (BORGHESE et al., 2016), the 83.5% of the total is in three countries (India, Pakistan, and China). In Africa we find domestic buffalo only in Egypt, with more than 4 million head (2.0%); there is also the wild buffalo but it is another species (Syncerus caffer). In Europe the most number and practically the alone product economy is in Italy with about 400,000 head (0.2%) and a very strong market of mozzarella and other quality cheeses, fresh and processed meat, semen of high genetic level. In America there are about 4.5 million head and buffalo is mostly represented in Brazil with more than 3,5 million head (1.7%), but its number and food production is increasing too in Venezuela, Colombia, Argentina, Cuba (BORGHESE, 2011a).
The genetic variability in buffalo species is very high with a lot of breeds in different countries of the world. The buffalo is a priority animal in the world as a draught animal, particularly used in rice fields in South Asian countries and it is a source of protein food for human survival and sustainability. Asian buffalo or water buffalo is classified under the genus Bubalus, species bubalis. The Bubalus bubalis belongs to the class Mammalia, subclass Ungulata, order Cetoartiodactyla, suborder Ruminantia, family Bovidae, subfamily Bovinae, tribe Bovini, which includes the following three groups: Bovina (cattle) with 60 chromosomes, Bubalina and Syncerina, between which no interbreeding appears possible.

Syncerina includes only the species Syncerus caffer (the African buffalo) with four subspecies. Syncerus caffer caffer, with 52 chromosomes, lives in savannah of eastern and southern Africa, (COCKRILL, 1974). Many experiences showed the possibility of domestication of the wild African buffalo as it is shown in figure 1, where some animals are used as trailers.
Bubalina (the Asian buffalo) includes three species.
Bubalus depressicornis or Anoa which lives only in Indonesia, with 46 chromosomes, very small animal (100 cm high) with thin and straight horns 25 cm long, conserved in the zoo and never used for draught or for products as it was a wild buffalo living singly or in pairs in mountains or in lowland forests (fig. 2 and 3). Bubalus mindorensis which was found only in the Mindoro island in the Philippines and therefore is called also Tamarao or Mindoro buffalo. Bubalus arnee is original in the north of India as wild animal, living in the marshes and in the jungles (COCKRILL, 1974); the population is much reduced.
Bubalus bubalis is deriving from the domestication of the Bubalus arnee, the Indian wild buffalo.
Bubalus bubalis (BORGHESE, 2005), named also water buffalo or Asian buffalo or domestic buffalo, includes two subspecies known as the River and Swamp types, the morphology and purposes of which are different as are the genetics. The River buffalo has 50 chromosomes of which five pairs are submetacentric, while 20 are acrocentric: the Swamp buffalo has 48 chromosomes, of which 5 pairs are submetacentric and 19 pairs are acrocentric. The two subspecies are inter-fertile and produce progeny with 49 chromosomes. Morphology of the two types differs considerably. Swamp buffaloes, called too Krbao or Carabao, are less heavy, the adult male weight ranging between 325 and 450 kg, while the River type weighs between 450 and 1 000 kg. While the Swamp buffalo is reared mainly for draught purposes, although it also produces a valuable milk yield of up to 600 kg milk per year, the importance of the River buffalo depends on the high quality and quantity of the milk that it produces. River buffaloes, called too domestic buffalo, are generally large in size, with curled horns and are mainly found in India, Pakistan and in some countries of western Asia. They prefer to enter clear water, and are primarily used for milk production, but are also used for meat production and for draught purposes. Swamp buffaloes are stocky animals with marshy land habitats. They are primarily used for draught power in paddy fields and haulage but are also used for meat and milk production. Swamp buffaloes are mostly found in south East Asian countries. A few animals can also be found in the north eastern states of India. Each subspecies includes many breeds that are described successively. The buffalo population trend is increasing in the world and in the different continents as people discovered the possibility to obtain, not only draught, but also more milk, very useful for food purposes.

Swamp buffalo breeds

The breeds of Swamp subspecies are many and many and are not clearly defined, as there are somatic and physiological differences according the different climate and lands of Asian continent, due to also the total isolation, as is shown in different islands of Indonesia, where Swamp buffaloes of Sulawesi, living in the jungle, are totally different if compared with Sumatra Swamp breed, living in the lagoons: Sulawesi breed is clearly a meat animal, strong and muscular with a big heat, very appreciated in banquets for marriages and for funerals, particularly if it is spotted animal, that are more paid and therefore this character is selected . Sumatra breeds are lighter animals, with thin head, more used for milk purposes, as milk is a basic resource for the villages in march areas, where the people is living in pale dwelling, milk is dried at the fire and conserved as food supplies. Both the breed are used too for draught in the fields and as trailers.

According to statistical data (FAO, 2008), the total number of buffalo in China is 23.27 million, the third largest population in the world, representing the 28.17% of the total bovine population in China. Chinese buffalo is Swamp type, as a total of 18 local breeds, which are represented by 415 000 head living in the mountains in Sichuan: Fuzhong breed (57 000 head) living in Guanxi province, Enshi breed (77 000 head) living in Hubei, Dongliu breed (27 000 head), living in the Anhui province, Binhu breed (461 000 head), living in the Hunan province, Shanghai breed (36 000 head) living around the city of Shangai. Swamp breeds are mainly used for draught since their milk production is very low (500-700 kg milk yield for lactation) as they are very resistant working in the marshlands, particularly in rice fields. China imported Murrah buffalo from India in the late 1950s and Nili-Ravi from Pakistan in the late 1970s. Milk performance has been markedly improved in crossbreds through the crossbreeding system applied in upgrading the two breeds such as crossbred Murrah F1, F2 and crossbred Nili-Ravi F1, F2 with average milk yield per lactation respectively: 1240, 1423, 2041, 2325 (YANG et al., 2003). Murrah buffaloes are also used to provide milk and milk processed food to poor people in the villages.
Recently crossbreeding was applied using Mediterranean/Italian semen with better results.
In the Philippines there are 3.34 million buffaloes (FAO, 2010), 99 percent belong to small farmers that have limited resources, low income and little access to other economic opportunities.
The buffalo, known as Carabao, is swamp type. Its history is basically of small-hold land-based agriculture, since for centuries, the Carabao has played a major role in draft animal-dependent farming, mainly in the production of major agricultural crops, such as rice, corn, sugar. The Carabao Development Programme is a massive programme started in 1993 to improve the native Swamp buffalo locally known as the Carabao to develop their meat, milk and draught potential. An elite herd of Riverine buffalo has now been established at the Philippine Carabao Center, Science City of Muňoz by importing about 3 000 Murrah buffaloes with pedigree performance records from Bulgaria. Each female crossbred when raised for milk can produce about 1 350 kg of milk per lactation (CRUZ, 2003). The crossbreeding of Bulgarian Murrah (producing 1 800 kg per lactation) with a Swamp population (producing 400 kg per lactation, obtained F1 with 1 100 kg and F2 with 1 350 kg mean production respectively. In the Philippines (CRUZ, 2010) the program has established a distinct gene pool for the Philippines Swamp Carabao, apart from the gene pool of riverine buffaloes. Likewise, the government has supported the Tamaraw Conservation Program aimed at protecting the Tamaraw (Tamaraw mindorensis), a species from being extinct (CRUZ, 2010).

River buffalo breeds

1. Mediterranean or European

The Mediterranean buffalo originates from the Indian buffalo. It was introduced into Europe with the advent of Islam and the Arab occupation in the 8th century in Sicily and in the south of Italy, while in the east Europe, buffalo was introduced later with crusaders in the 12th century and after with Turkish invasion during the Ottoman empire (15th century; BORGHESE, 2011b). Anyway the Italian breed is totally different from the Balkan breeds: as the first one is now classified as Mediterranean/Italian breed as it was selected for 60 years for milk purposes and it is clearly a dairy breed. The Balkan breeds as Carpathian or Macedonia are draught animals, used for carriage, smaller in size and with low milk production.
The Mediterranean population in Europe is about 459 000 head, but Mediterranean is present in many countries of South America as particularly Brazil, Argentina, Venezuela and Colombia, where it was introduced to increase the milk and meat capacity. In these countries

and in many Asian countries (Turkey, Iran, China, Bangladesh, Indonesia), Mediterranean/Italian semen was largely used to create F1 crossbreds with higher milk potential. Therefore we can find many million head coming from crossbreeding with Mediterranean in the world, from America to Asia.
Description: black, black and brown, dark grey coat. The horns are flat at the bottom, backwards and slightly outwards pointed, and backwards straightened; the top is pointed inwards. They have a compact conformation with a deep and wide chest as well as a developed pectoral. The back is short. The rump is short. The udder is medium size with squarely placed quarters and halves; the teats are cylindrical. Where machine milking is popular (only in Italy) udders are more regular and better shaped. Size, weight and productivity vary a lot according to the environment and management (MOIOLI and BORGHESE, 2005). Average herd size is below five breedable buffaloes in most countries, except in Italy where it is around 160 (BORGHESE, 2011a). The body weight of the adult female is 450-650 kg, while the male weight can arrive more than 1000 kg, particularly in Mediterranean/Italian, heavier than other European buffaloes.
Distribution: Italy: 400 000 (Mediterranean Italian breed); Romania: 25 000; Germany: 2 111; United Kingdome: 2 500; Greece: 3 137 (BORGHESE, 2013); a few hundred in Serbia, Albania, Macedonia, The Netherlands, Switzerland and 2000 in Hungary, many thousands in Brazil.
Average daily milk yield reveals a huge variability, mainly depending on the feeding system. It can range from 3 to 4 kg milk/day for poorly fed animals to 15 kg/day in intensive management systems. In Bulgaria, Romania, Macedonia, Greece and Albania, extensive management systems are employed, while Italy applies only intensive system.
Products: Mozzarella, treccia, scamorza and other cheeses, ricotta (Italy), Vladaesa cheese, Braila cheese (Romania); White brine cheese (Bulgaria, Romania); yoghurt, meat and meat industry products: bresaola, salami, sausages, cacciatorini (little salami), etc.

2. Murrah

Murrah is the most important and well-known buffalo breed in the world, selected in the North West of India for milk purposes and typical for curled horns. Description: black in colour. Massive and stocky animals, heavy bones, horns are short and tightly curled. Placid. Height at withers of adult male is 142 cm, body weight is 750 kg. Height at withers of adult female is 133 cm, body weight is 650 kg. Distribution: From its origins in the centre of Haryana, it has spread to the Punjab, Ravi and Sutley valleys, north Sind and Uttar Pradesh. It has been exported to Brazil, Bulgaria and many countries of eastern Asia (MOIOLI and BORGHESE, 2005).
Products: milk, ghee, cream, meat. SETHI (2003) reported the performance characteristics at the Buffalo Research Institute, Hisar, Hariana, India.

3. Jafarabadi

The Jafarabadi breed is original from Gujarat, India. Description: black coloured coat. Massive and long-barrelled conformation. Horns are long, heavy and broad and sometimes they cover the eyes.
Height at withers of adult male is 142 cm, body weight varies from 600 to 1 500 kg. Height at withers of adult female is 140 cm, body weight is about 550 kg, and some individual may weigh as much as 700-800 kg.
Jafarabadi is a good milk producer but it is also a big animal, with good conformation and high muscularity. Therefore this breed was chosen by many American countries and selected as meat purpose breed. Now it is possible to find Jafarabadi pure or derivate in Brazil, in

Colombia and in other South America countries, where this breed shown a great adaptability to marsh lands, to different crops and pastures and a high meat production.

4. Buffalypso

Buffalypso is the typical buffalo of Trinidad and Tobago. He is derived by Jafarabadi breed as 30 Jafarabadi were imported in Trinidad in 1905. Steve Bennet in 1948 crossed Badhawari bulls on Jafarabadi to create Buffalypso breed (Buffalo x Calypso, the Caribe popular music), with the purpose to obtain a meat breed, useful too as a draught animal to work in sugarcane plantations in hot and humid climates of Caribe. Buffalypso was crossed subsequently with Murrah, Surti, Nili, Nagpuri breeds too. Now it is used also for milk production.

There are 5 000 Buffalypso head in Trinidad Tobago, 67 000 in Cuba, many thousand in other countries, particularly of Centre and South America: Venezuela, Costa Rica, Guatemala, Honduras, Nicaragua, Brazil, Panama, Mexico, Columbia, U.S.A., Taiwan.

From 1996 the milk production from Buffalypso started too in Cuba (figure 25), because of the high need of milk as human food, with an average 873 kg milk for lactation of 244 days (MITAT, 2011).

Products: yogurt, dahi, soft cheese, ghee (clarified butter), mozzarella cheese, queso blanco, queso de mano, cream, paneer, shahi paneer, paneer tikka (Indian cottage cheese with vegetarian dishes), barfi, rasgulla, rasmalai (Indian sweets; RASTOGI and RASTOGI, 2004).

5. Nili-Ravi

Nili Ravi is the most important livestock in Pakistan. It is also present in India and in the Punjab. This breed is similar to the Murrah in almost all characteristics except for the white markings on extremities and walled eyes; horns are less curled than in the Murrah; the udder is well shaped and extends well forward up to the naval flaps. Height at withers of adult male is 135 cm, body weight is 700 kg, height at withers of adult female is 125 cm, and body weight is 600 kg. The skin colour is generally black but there are albino animals, brown, spotted and with clear eyes. The major proportion is in Punjab (65%) with more than 10 million head.

The genetic improvement is promoted by the Semen Production Unit in Qadirabad, where progeny test and semen collection are carried out, for artificial insemination in the country, while the Buffalo Research Institute in Pattoki promotes applied researches in many fields, particularly on milk production, as Nili-Ravi is the best dairy buffalo breed in Asia, selected for this purpose. The milk yield is however depending from the buffalo farming system, with 1130 kg per lactation in rural farms, 2880 kg per lactation in peri-urban and commercial farms until 3050 kg in rural marked oriented farms (YOUNAS et al., 2009).

The milk is used for direct consumption after the skimming to produce butter, ghee and cream, used too in sweet industry.

6. Anatolian

The Anatolian buffalo has been raised in Turkey for centuries. Description: black in colour, long hair. Height at withers of adult male is 138 cm, body weight is 200-500 kg. Height at withers of adult female is 138 cm, body weight is 200-500 kg.

Distribution: concentrated in the Black Sea region, North of Middle Anatolia, Thrace, Hatay, Mus, Kars, Dyarbakir, Afyon, and Sivas. Population size: 85 000 (BORGHESE, 2011a).

7. Azeri or Caucasian

This breed originates from the Indo valley (Indian buffalo). There is some evidence that buffalo were raised in Lorestan (Iran) in the 9th Century B.C. since six engraved buffalo heads have been found on a bronze stick from this period. Population size: 600 000.

Description: black in colour, short horns growing backwards. Height at withers of adult male is 137 cm, body weight is 400-600 kg. Height at withers of adult female is 133 cm, body weight is 400-600 kg.

Distribution: In Iran, they are found in West Azerbaijan, East Azerbaijan and the Caspian Sea. In Azerbaijan, everywhere. In Georgia and Armenia, they were widespread until 1940, but then declined.

8. Kuhzestani or Iraqi buffalo

Population size: 200 000. Description: Horns are short and grow upward forming a ring at the end. In size, it is very likely the biggest buffalo breed in the world. Height at withers of adult male is 148 cm, body weight is 800 kg. Height at withers of adult female is 141cm, body weight is 600 kg.

Distribution: In Iran, they are located in Kuhzestan and Lorestan. In Iraq, mainly in the South, in the peri-urban areas of Baghdad and Mosul.

Products: milk, yoghurt, fresh cream, fresh cheese, butter, ice-cream, rice pudding, churned yogurt, dried whey, ghee (BORGHESE, 2011a).

Conclusions

The genetic variability in buffalo is very high. We presented 16 breeds, 8 from Swamp buffalo and 8 from the most known River buffalo, but there are many and many: in India there are at minimum more 12 local River breeds as Bhadawari, Jerangi, Manda, Meshana, Nagpuri, Sambalpuri, Surti, Tarai, Toda, Pandharpuri, Kalahandi, South Kanara (BORGHESE, 2013). In Pakistan is very common the River breed Kundi, in Nepal we find two River breeds, Lime and Parkote, in Bangladesh the Bangladeshi breed, in Egypt we find the Egyptian, very similar to Mediterranean type, in Europe the Mediterranean type is distinguished in Mediterranean/Hungarian, Mediterranean/Serbian and Carpathian breed in Romania; in Bulgaria we find the Bulgarian Murrah coming from the crossing between Indian and local breeds (BORGHESE, 2013) with a total of 37 breeds until now, but is not the total situation. The first book in English with the presentation of genetic variability of buffalo was edited by Dr. W. Cockrill Ross with FAO on 1974 (COCKRILL, 1974), followed by Prof. Antonio Borghese edited with FAO too on 2005 (BORGHESE, 2005) and by the last one by Borghese on 2013 (BORGHESE, 2013). There is also a complete book in Spanish published by Marco Zava on 2011 (ZAVA, 2011). Anyway I think that a great job has to be made in classification of buffalo breeds, that cover quite the all surface of planet, with great capacity of adaptation to hot and cold climates, living in the lagoons, in intensive systems and on poor pastures, swimming in the rivers or working in rice fields, anyway showing in each condition a great resistance to pathologies and producing animal power in draft, the precious milk, appreciated by poor people living in the villages and by modern cheese industries, good quality meat, bone, horns, skin for leather, manure for fuel or fertilizer.

References

BORGHESE, A. (2005): Buffalo Production and Research. FAO Ed. REU Technical Series, 67, 1-315.

BORGHESE, A. (2011a): 9th Encontro brasileiro de bubalinocultores. Santarem, Parà, Brasil, 11-14 Sept.

BORGHESE, A. (2011b): Il bufalo in Romania. La Bufala Mediterranea Italiana, 6 (3), 4-5.

BORGHESE, A. (2013): Buffalo Livestock and Products. Antonio Borghese and C.R.A. Ed.: 1-511.

BORGHESE, A. – BOSELLI, C. – TERZANO, G.M. (2016): Planetary Impact of Dairy Buffalo. Proceedings of 11th World Buffalo Congress, Cartagena, Colombia, 23-25 November.

COCKRILL, W.R. (1974): The husbandry and health of the domestic buffalo. FAO, Rome 1-991.

CRUZ, L.C. (2003): Philippine Carabao Center. Tenth Anniversary, 27 Mar.

CRUZ, L.C. (2010): Recent developments in the buffalo industry of Asia. Proc. 9th World Buffalo Congress, Buenos Aires, 25-28 April. In "Revista Veterinaria" 21 (1), 7-19.

FAO (2008): FAOSTAT (http://faostat.fao.org/default.aspx)

FAO (2010): FAOSTAT (http://faostat.fao.org/default.aspx

MITAT, A. (2011): VI Simposio de Bufalos de las Americas. Havana, Cuba, 22-26 Nov.

MOIOLI, B. – BORGHESE, A. (2005): Buffalo breeds and Management systems. In Buffalo Production and Research, Ed. Antonio Borghese, FAO Reu Technical Series 67, 51-76.

RASTOGI, L. – RASTOGI, R.K. (2004): Buffalypso. Livestock & Livestock Products Board, Trinidad & Tobago.

SETHI, R.K. (2003): Buffalo Breeds in India. Proceed. 4th Asian Buffalo Congress, New Delhi, India, 25-28 Feb.

YANG, B. – LI, Z. – LIANG, X. – ZOU, C. (2003): The advance of genetic improvement and the development of the dairy industry in the Chinese Water buffalo. Proc. of the Fourth Asian Buffalo Congress, New Delhi, India, 25 to 28 Feb., 27-30.

YOUNAS, M. – YAQOOB, M. – AHMAD, T. – BABAR, M.E. – ALI, A. – SHAHZAD, F. (2009): Study on breeding practices of water buffalo kept under various production systems in Punjab, Pakistan. Proceed. 6th Asian Buffalo Congress, Lahore, Pakistan, Oct. 27-30. Pakistan J. Zoology, Suppl. 9, 91-102.

ZAVA, M. (2011): El buffalo domestic. Orientacion Grafica Editora: 1-899.

Some information of the Hungarian Gidran Horse population based on pedigree data

POSTA, János[1] – HARDON, Daniella[1] – MIHÓK, Sándor[1]

[1]Department of Animal Husbandry, University of Debrecen, H-4032 Debrecen, Böszörményi str.138, Hungary

Abstract

An effective gene conservation programme requires the knowledge of genetic diversity of the population. The genetic structure of Gidran breed was studied from pedigree records. Herdbook data available up to 2014 of registered Gidran horses were analysed. The pairwise genetic distance between lines was the largest for line "B" and "C" whereas it was the shortest between line "A" and "B", respectively. The traditional, Mezőhegyes originated mare families were closer to each other than any other possible pairwise distance among the mare families. St. Simon xx had the most selected offspring in the Gidran pedigree whereas Gidran XI had the most selected progenies among the purebred Gidran stallions. The broodmare Gidran VI-2 (Spiné) had the most selected foals in the population (6 mares).

Introduction

An effective gene conservation programme requires the knowledge of genetic diversity of the population. All Gidran horses are originated from the stallion Gidran Senior and descendants of his son Gidran II after the mare 74 Tifle (MIHÓK and ERNST, 2015). The Gidran breed is a result of a classical line breeding and was formed in Mezőhegyes Stud. It is often originated from the establishment date (1785) of the stud farm, though the Austrian Ministry of Defence declared this heavy riding horse as a separate breed in 1885. About 200 mares played their roles on the formation of the breed but only 16 of them became family founder. Three genealogical lines have been formed during the years (MIHÓK, 2006, 2012).

The demand to get to know the genetic variability of livestock animals has been continuously increasing (WOOLLIAMS et al., 2002). Analysis of pedigree data gave information about the ancestors and relatives of the animals and there are various measurement variables to describe the population genetic structure and variability (MAIGNEL et al., 1996).

The analysis of pedigree data is most popular and used in horse breeding. Inbreeding, pedigree completeness and generation intervals are estimated for Arabian (CERVANTES et al., 2008; GLAZEWSKA and JEZIERSKI, 2004) as well as for English Thoroughbred (BOKOR et al., 2013; MOUREAUX et al., 1996) horses. Among the Hungarian traditional breeds, the Shagya-Arabian stock of Bábolna (GERSTNER, 2014) and Hucul horses were also evaluated (MIHÓK et al., 2016).

The aim of the research study was to analyse the pedigree information of the registered Hungarian Gidran population.

Material and methods

The basis of the current study was the Hungarian active breeding population of Gidran Horse between 2012 and 2014. The active population was chosen as reference when needed. The base pedigree information was given by the Kisberi and Gidran Horse Breeding Association. The pedigree information of Shagya-Arabian and English Thoroughbred horses were completed using www.shagya-database.ch and www.pedigreequery.com, respectively. There were the pedigree data of 8581 animal in the developed database.
The population was described with number of progenies (for sires and mares) and number of selected progenies, and distance among sire lines and mare families. The genetic distance among sire lines and mare families were characterized using Nei-genetic distance which was calculated using the formula: $D^{ij} = D_{ij} - \left[\left(D_{ii} + D_{jj}\right)/2\right] = \left[\left(f_{ii} + f_{jj}\right)/2\right] - f_{ij}$ where f_{ij} is the pairwise coancestry coefficient between the i and j subpopulations (sire lines and mare families, respectively.
All the above described parameters were computed using ENDOG (GUTIÉRREZ and GOYACHE, 2005) and POPREP (GROENEVELD et al., 2009) softwares.

Results and discussion

The distribution of the reference population by sire lines is illustrated in Figure 1. From gene preservation point of view, it would be desirable to maintain each line with equal proportion within the population as much as possible. There were the less animals in line ”C” and line “A” was the most numerous. The high proportion of “out of sire lines” category shows the importance of (English) Thoroughbred stallions in the breeding but it could be also a warning for the Breeder Association to avoid the low proportion of purebred stallions.
The pairwise genetic distances among sire lines could be followed in figure 2. The largest genetic distance can be seen between line “B” and “C”. The “A” and “B” lines were the closer to each other.
The distribution of the reference population by mare families is shown in Table 1. Maintaining of each mare families is important from gene preservation point of view with possibly equal distribution over the breed. Only passing of the responsibility the fine-sounding argument that only families unable to survive are disappearing and the family size is directly proportional to its importance. It might give information about the best adaptation to the given environmental conditions and not in relation with the genetic value of the family. In our study, the most populous families were “Mezőhegyesi 2-es” and “Mezőhegyesi 7-es”. This fact offers and gives the possibility of strict selection within these mare families. Large proportion of the mare families has only a few representative broodmares within the active breeding population.
The pairwise genetic distances among mare families is illustrated in figure 3. Except the “Borodi 14-es” mare family, the young “Borodi/Népies” mare families were well separated from the mare families originated from Mezőhegyes. In addition, the traditional mare families were closer to each other than any other possible pairwise distance among the mare families, respectively.

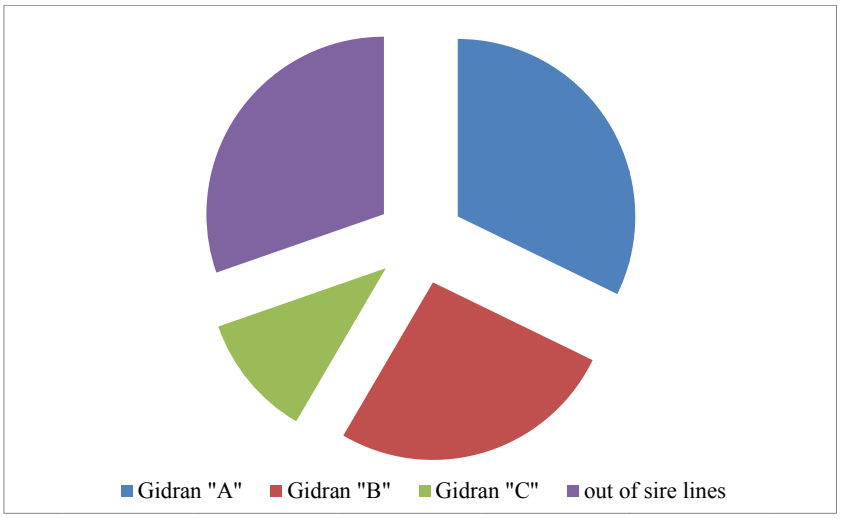


Figure 1. Distribution of animals in the reference population by sire lines

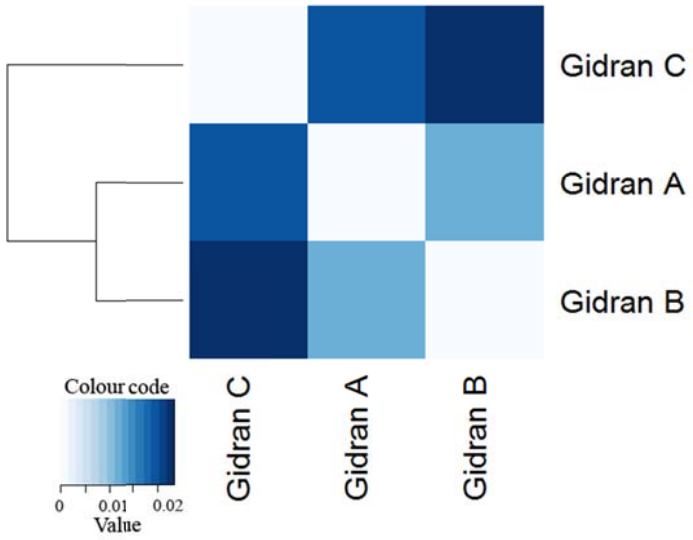


Figure 2. Pairwise Nei-based genetic distances among sire lines

To maintain the genetic variability of the breed from generation to generation, the number of selected progeny could be important information. Figure 4 shows 30 breeding stallions having the most selected progeny in the analysed database. There were near 50 offspring within the pedigree of Gidran horses (and they English Thoroughbred ancestors) St. Simon xx. This could show the effect of a widely used historical breeding stallion from more than a century time period. The Gidran XI stallion had the most selected progenies among the purebred Gidran stallions. There were 15 English Thoroughbred stallion having at least 15 offspring within the pedigree of the Hungarian Gidran horses. As the performance of the Thoroughbred horses is well known, these stallions popularity was not excessive, though some purebred stallions having really excellent progeny could not get the right place forming the genetic background of the Gidran breed.

Figure 5 illustrates 30 broodmares having the most selected offspring for breeding in the analysed pedigree. Broodmare with the most selected progeny was Gidran VI-2 (Spiné) belongs to the Mezőhegyesi 2-es mare family. The aim of the relatively high number of offspring (6 mares) in the breeding might be to maximize the genetic merit of the mare across the population. It would be especially beneficial when these mares appear more than one herd.

Also a good question could be the future act of this young broodmares within the genetic variability of the breed.

Table 1. Distribution of animals in the reference population by mare families

Mare family	Number of born foals	Mare family	Number of born foals
Mezőhegyes 1st	5	Borodi 1st	13
Mezőhegyes 2nd	34	Borodi 2nd	7
Mezőhegyes 3rd	27	Borodi 3rd	11
Mezőhegyes 4th	26	Borodi 4th	2
Mezőhegyes 5th	2	Borodi 5th	4
Mezőhegyes 6th	6	Borodi 6th	4
Mezőhegyes 7th	33	Borodi 7th	1
Mezőhegyes 8th	9	Borodi 8th	3
Mezőhegyes 9th	1	Népies 9th	4
Mezőhegyes 11st	14	Borodi 14th	9
Mezőhegyes 12nd	2	Népies 15th	3
Mezőhegyes 13rd	6	Borodi 16th	3
Mezőhegyes 14th	2	Borodi 17th	1
Mezőhegyes 15th	2	Borodi 18th	3
Mezőhegyes 17th	6	Borodi 19th	2
Mezőhegyes 18th	3	Népies 22nd	1
Mezőhegyes 19th	12	Népies 23rd	2
Mezőhegyes 21st	4		

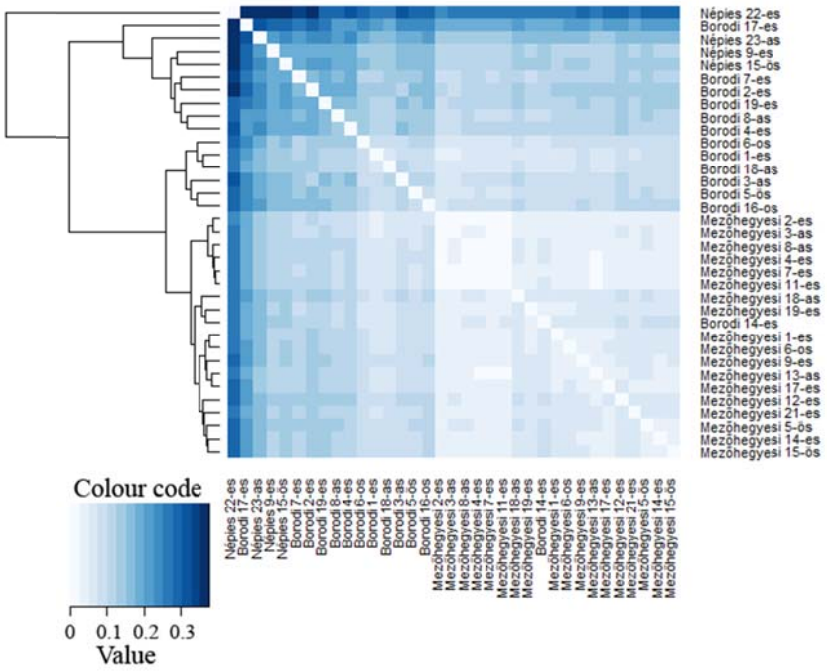


Figure 3. Pairwise Nei-based genetic distances among mare families

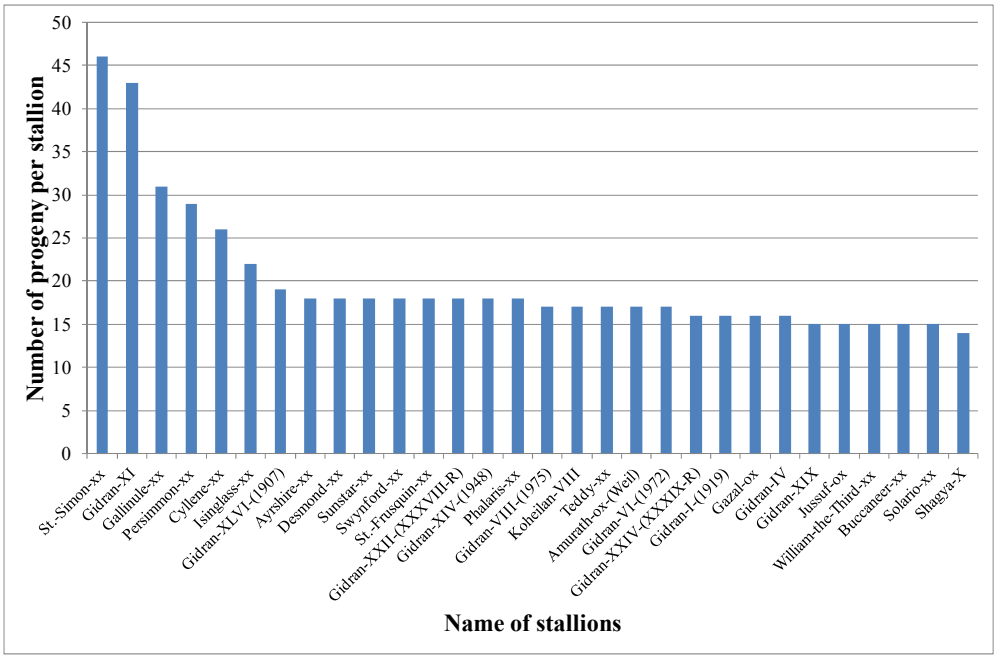


Figure 4. Stallions having the most selected progeny

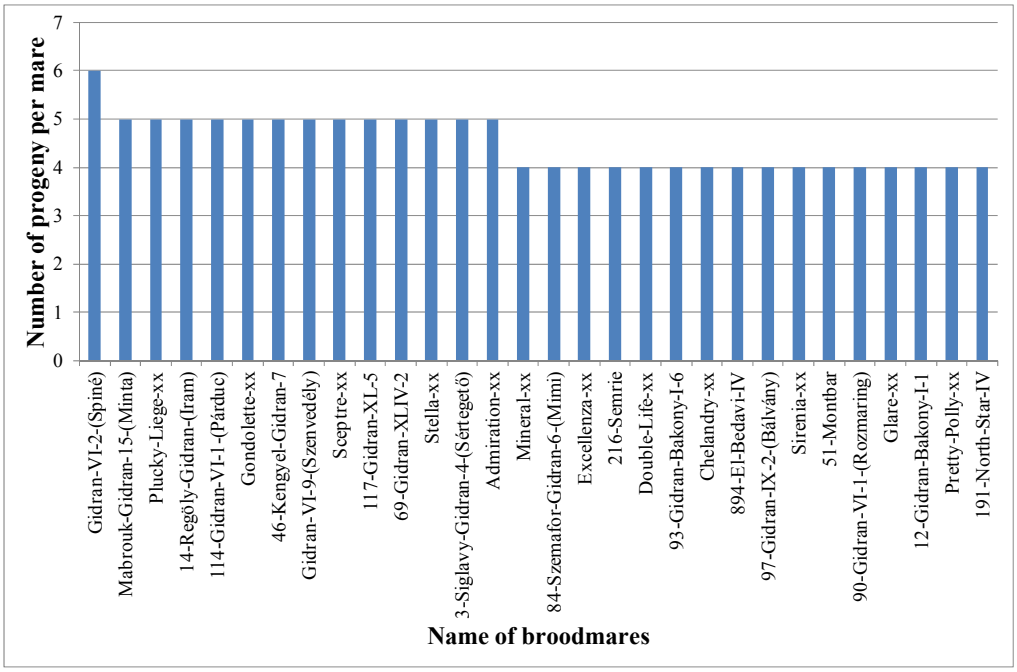


Figure 5. Broodmares having the most selected progeny

It would be favourable from the genetic conversation point of view to select at least one female offspring per broodmares. This could keep the genetic variability almost unchanged but it rarely occurs in practical breeding and even more rarely successful. The selected progeny per mares is an important indicator, but it doesn't always provide sufficient information. The English Thoroughbred mare, Plucky Liege xx is among the important ancestors having 5 progenies within the pedigree of Gidran horses but had not a large effect on the genetic variety of the breed across her foals.

Conclusions and recommendations

Our results gave a warning for breeders to keep sire lines equally distributed over the population and avoid the low proportion of Gidran stallions. The pairwise genetic distance among Mezőhegyes originated mare families were much lower than for other mare families. The English Thoroughbred stallion St. Simon had the most selected progenies within the Gidran pedigree whereas Gidran XI had the most selected progenies among the purebred Gidran stallions. The broodmare Gidran VI-2 (Spiné) had the most selected foals in the population (6 mares).

References

BOKOR, Á. – JÓNÁS, D. – DUCRO, B. – NAGY, I. – BOKOR, J. – SZABARI, M. (2013): Pedigree analysis of the Hungarian Thoroughbred population. Livestock Science. 151. 1–10.

CERVANTES, I. – MOLINA, A. – GOYACHE, F. – GUTIÉRREZ, J. P. – VALERA, M. (2008): Population history and genetic variability in the Spanish Arab Horse assessed via pedigree analysis. Livestock Science. 113. 24–33.

GERSTNER, B. (2014): Pedigree analysis of the Bábolnian Shagya-Arabian stock. MSc. Thesis. University of Debrecen, Department of Animal Husbandry

GLAZEWSKA, I. – JEZIERSKI, T. (2004): Pedigree analysis of Polish Arabian horses based on founder contributions. Livestock Production Science. 90. 293–298.

GROENEVELD, E. – WESTHUIZEN, B.V.D. – MAIWASHE, A. – VOORDEWIND, F. – FERRAZ, J.B.S. (2009): POPREP: a generic report for population management. Genetics and Molecular Research. 8 (3): 1158-1178.

GUTIÉRREZ, J.P. – GOYACHE, F. (2005): A note on ENDOG: a computer program for analysing pedigree information. Journal of Animal Breeding and Genetics. 122. 172-176.

MAIGNEL, L. – BOICHARD, D. – VERRIER, E. (1996): Genetic variability of French dairy breeds estimated from pedigree information. Interbull Bulletin. 14. 49–54.

MIHÓK, S. (2006): Monography of the Gidran Horse. Publication of Kisberi and Gidran Horse Breeding Association, Debrecen. 43pp.

MIHÓK, S. (2012): Gidrán Méneskönyv II. Publication of Kisberi and Gidran Horse Breeding Association, Budapest, 450pp.

MIHÓK, S. – ERNST, J. (2105): The Gidran. Mezőgazda Publishing, Budapest, 303pp.

MIHÓK, S. – SOMOGYVÁRI, E. – POSTA, J. (2016): Some population genetic parameters of the present Hungarian Hucul Horse population. Acta Agraria Debreceniensis 2016/69. 15-22.

MOUREAUX, S. – VERRIER, É. – RICARD, A. – MÉRIAUX, J.C. (1996): Genetic variability within French race and riding horse breeds from genealogical data and blood marker polymorphisms. Genetics Selection Evolution. 28. 83–102.

WOOLLIAMS, J.A. – PONG-WONG, R. – VILLANEUVEA, B. (2002): Strategic optimisation of short and long term gain and inbreeding in MAS and non-MAS schemes. In: Proceedings of 7th World Congress on Genetics Applied to Livestock Production, Montpellier, INRA, Castanet-Tolosan, France, CD-Rom, comm. No. 23_02.

Breeding and usage of Gidran Horse in Croatia

RAMLJAK, Jelena[1] – IVANKOVIĆ, Ante[1] – TROGRLIĆ, Josip[2]

[1]University of Zagreb Faculty of Agriculture, 10000 Zagreb, Svetosimunska cesta 25, Croatia
[2]Croatian Breeders Association of Gidran horse breed, Franje Vidovića bb, 43240 Čazma

Abstract

In Croatia breeding of Gidran horses has tradition longer than a hundred years. At first Gidran served as a war horse, and selection make elegant, noble, well-riding and agile hussar horse. Reaffirmation of the breed began in the 21th century. Currently in Croatia 66 individuals of all categories are registered. By phenotype characteristics Gidran population from Croatia is very similar to the population from Hungary. Today Gidran is mostly used as a sport horse and in recreation, and is an integral part of cultural events and manifestations in Croatia.

Introduction

Horse breeding in Croatia has a long tradition. One part of the breeds originate from local populations of domestic animals from this region, and some of them have arrived from neighbouring countries during migration or during the war, after which they are accepted as part of the tradition. In the Croatia there are three autochthonous horse breeds: Croatian Posavian horse, Croatian Coldblood, Murinsulaner and Lipizzan as traditional transboundary breed. According to FAO (2015) report, Europe and the Caucasus has the highest number of regional transboundary horse breeds (36) whose importance is evident in usage and conservation of animal genetic resources. One of such transboundary horse breed, which exists on Croatian territory more than one hundred years is Gidran horse.
History of Gidran's goes way back in 1816 when 7-year old Gidran Senior Arab stallion across Trieste was moved to a military stud Bábolna in Hungary in 1818. He was founder of three genealogic lines; line A (GIDRAN XXXI born in 1863), line B (GIDRAN XXXIII born in 1868) and line C (GIDRAN XXI born in 1863) whose offspring were stallions of Hungarian, Romanian, Bulgarian, Czech and Slovakian and Austrian state herds. Consolidation of Gidran breed starts in 1855 when Lt. Lobkowitz formed stud farm number IV mainly consisted from horses of Gidran origin and typical chestnut coat colour (JÓNÁS et al., 2006). Same year Austrian Ministry of Defence was compelled to declare Gidrans as a separate breed. Afterwards planed breeding of purposeful line and family formed an elegant, well rideable, although hardy build riding horse. During 20th century Gidrans population has experienced several bottlenecks which resulted in decreasing the size of the population and also loss of valuable genetic characteristics. Luckily, in 1974 protection of Gidrans as traditional indigenous Hungarian breed starts and resulted with increased population size and regeneration of original gene pool. This excellent breed show to be very good athlete achieving outstanding sports results in different equestrian disciplines like show jumping, eventing, dressage, and hunting.
As multipurpose military horse Gidran was spread and used in the area of today's Hungary, Romania, Bulgarian and Croatia during the second half of the nineteenth and early twentieth

centuries. Nowadays, if we look Gidrans as transboundary breed, his size is relatively modest. Hungary counts the highest number of animals (~ 320 animals), than Croatia (~ 66 heads), Romania (~ 50 heads), and Bulgaria (~ 30 heads). Eventhough, according to FAO criteria for endangerment level, this population could be considered as highly endangered (FAO, 2015).
The aim of this study was to estimate breeding trend of Gidran horse in Croatia and way of his utilisation nowadays. Comparing body measurements of two Gidran's populations, one from Croatia and one from Hungary, we want to determine similarity, i.e. differences level towards the exterior.

Material and methods

Data about population size of Gidran horse in Croatia through years are collected from Annual report of Croatian Agriculture Agency (CAA, 2003-2016). Body measurements were taken during summer 2016 in Bjelovar-Bilogorska County. The exact method and procedures of measuring are described in the paper IVANKOVIĆ et al. (2016). From Croatian Breeders Association of Gidran horse we get information about historically written material and photographs.

Results and discussion

History of breeding Gidran horse in Croatia

Breeding of Gidran horses breed in nowadays Croatian teritory lasts longer than one and a half centuries, but continuity of breeding has been disrupted at the end of the First and Second World War. In the area of Bilogora there are still residues of former military-cavalry quarters in Zrinski Topolovac and Letičani near Bjelovar indicating the development and importance of cavalry fort in the times. There are lots of eveidence about historical remans of Gidran horses in Croatia. One example (Figure 1) is painted stylized horses figures of chesnut coat color (which is characteristic of the Gidrans) on the outer side of the wall of an old barn in Zrinski Topolovac (from 1704 to 1756 there were placed military command of the Habsburg Monarchy).

Figure 1. Stable with drown chesnut horse on the wall in Zrinski Topolovac

In northern parts of the country Gidran were used as warhorses in the cavalry by so called Hussar troops established in Bjelovar as far back as 1756 (Figure 2a). The old records do suggest that the breeding of Gidrans on the Croatian territory was already present in 1885 (NN, 1885) what confirm Figure 2b describing buying two stallions Gidran I and Gidran II for 700 and 400 forints from Mezőhegyes Stud farm. Gidran was reliable, excellent, durable horse who shows good skills in the military as well as in the field breeding.

2b

Napokon zanimat će strukovnjake da saznadu, uz koli su povoljne ciene ljetos nabavljeni opasači za našu zemaljsku pastuharnu iz ugarskih državnih ergeljah. U Kisberu kupljeno je: Ostreger engl. ¾ krvi za 1500 fr. i Njemački Michl engl. ½ krvi za 1200 for., u Babolni: Gazlan, punokrvnjak arabski za 1200 for., Ecet, polukrvnjak arabski za 800 for., zatim ¾ krvni Arabi Amurat Bairaktar, Jussuf iz Šagye i Jussuf iz Amurate svaki za 1000 for., a napokon u Mezohegyešu: Gidran I. arabske pasmine za 700 for., Gidran II. također arabske pasmine za 400 for., Prid of England, Norman za 1000 fr., Vihar, engl.-arabske pasmine 800 for., Šagya, arabske pasmine za 400 fr., te Medješ ½ krvi englezke pasmine za 400 forintah.

—g—

Figure 2a. 10th Hussar Home Guard in the corps before World War I; 2b. Allegation of purchase stallion Gidran I and Gidran II for 700 and 400 forints in Hungary

Current status of breeding Gidran horse in Croatia

According to data from CAA (2016) breeding of Gidran horses in Croatia are spread over 10 Counties (Figure 3).

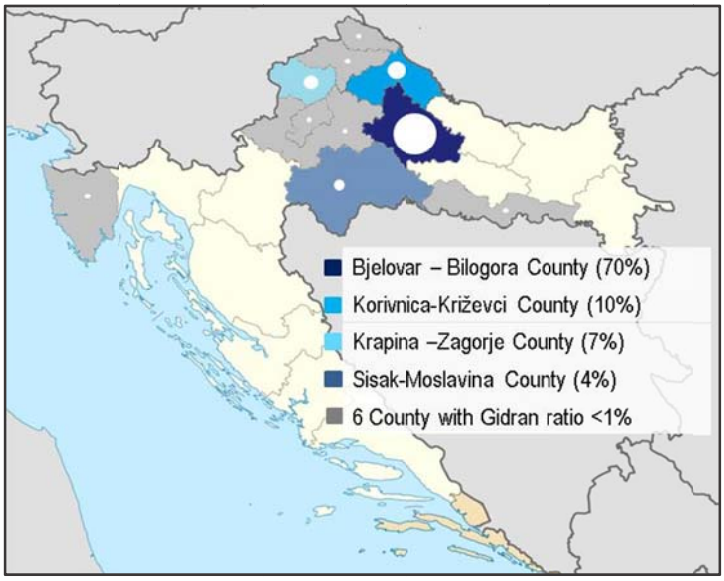


Figure 3. Breeding areas of Gidran horses in Croatia. The four Counties with the largest number of horses are blue shaded, and other six counties with only one animal in grey (Slavonski Brod, Zagreb, Istria, Medjimurje, Varazdin, Zagreb County). Diameter of the white circle is proportional to the share of Gidran horses in each County.

Census size of Gidran population in Croatia is 70, of which 48 heads (70%) are bred in the area of Bjelovar County. In other Counties breeding of Gidran is represented in smaller percentages, i.e. from 1% to 10%. Only Gidran horses registered in the Central Equine Registry in Croatia which is led by CAA make breeding stock. They are represented with all age and sex categories of which 13 are stallions and 37 are mares (CAA, 2016). Figure 4 presents the number of Gidran horses in period from 2003 to 2016. In the mentioned period, it is evident increase in the number of animals from year to year with minor fluctuations during 2014.

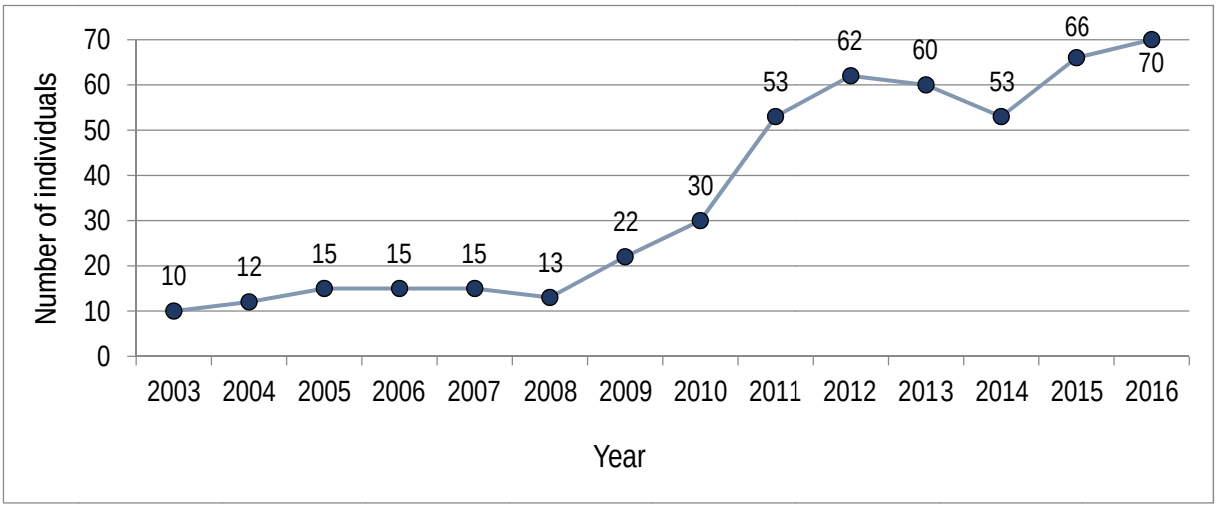


Figure 4. Overview of Gidran population size in Croatia in the period from 2003-2016 (CAA, 2004-2016)

In the Central Equine Registry in Croatia from a total of 70 individuals of Gidran, 40 individuals (57%) have Croatian unique equine life number (*UELN*) while Hungarian *UELN* number have 30 individuals (43%). These data point out good practice of conducting breeding program using Croatian lines as a parent for new generations. That is the reason why more than 40% of the current Gidran population in Croatia are young, aged between one to eight years (Figure 5). Older population of Gidran, aged 8-12 years makes only 23% of the total population. To this increase in population size and offspring's from 2008 onwards contribute establishment of historic troops "Bjelovar Border Troops - Hussars 1756" at the beginning of 2008, which use mainly Gidran horses for their units.

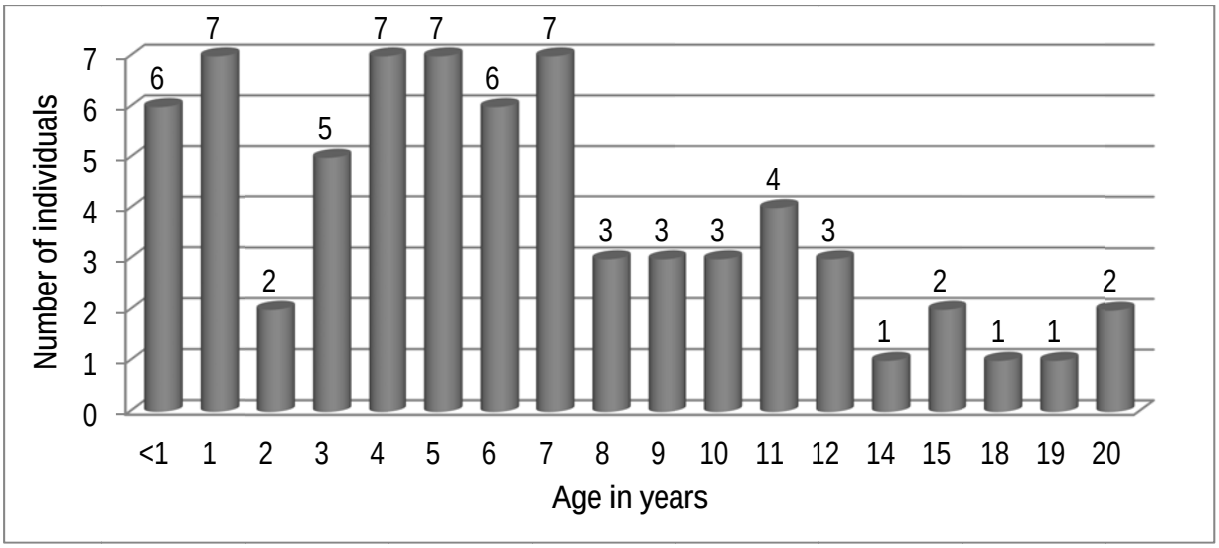


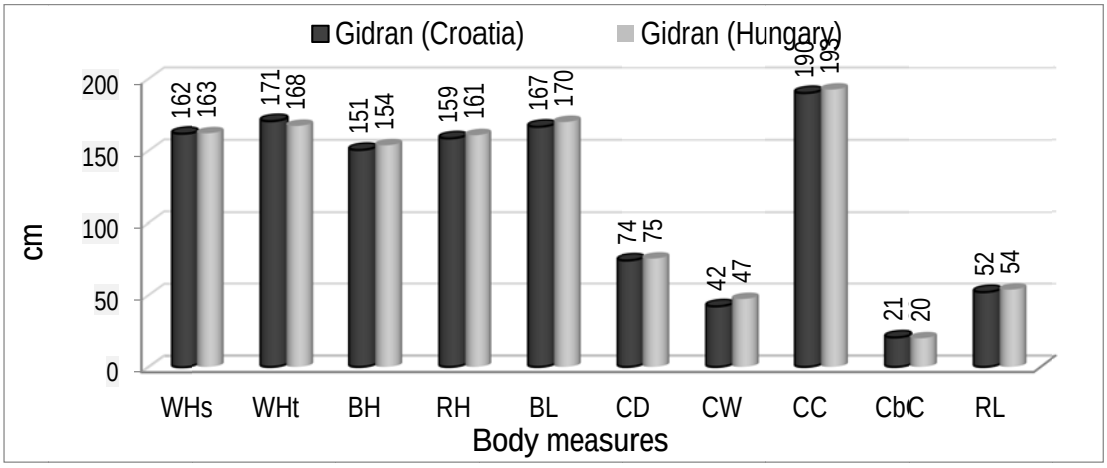
Figure 5. Age structure of Gidran horses in Croatia from 1996-2016

Breeding and selection with the aim to improve some characteristics of Gidran population in Croatia imply the best parent's selection of future offspring. For this purpose, mating of breeding stallions and breeding mares is conducted with great care to get the best foals of good genetic potential and good exterior. Mating procedure is planned with the aim to minimize occurrence of hereditary blemish (flaws), unacceptable exterior features and/or inbreeding as states in Breeding program for Gidrans (Croatian Association of Gidran horse breeders, 2011; 2014). Till now, 28 28 stallions were used as fathers in the current Gidran population in Croatia. All stallions are of Hungarian origin, except Security Tag (USA)

stallion that is of American origin. The highest number of 13 offspring gave Stallion 5050 Gidran Gavaller (7 males and 6 females), while the stallion 4889 Selection (Gidran XXVII.tm) gave 8 offspring with equal ratio of male and females. Other stallions gave from one to five foals. In genealogy of Gidran horses in Croatia there were 48 mares as mothers of current population. Majority of them have Hungarian background, only two mares, 4 Gidran-2 (Alma) and 10 Gidran-3 (Fiona) are with Croatian background. Six-year-old mare 4 Gidran-2 (Alma) gave two foals, while five-year-old 10 Gidran-3 (Fiona) gave one foal. Using smaller number of selected stallions, breeding focus is placed on selection and faster achievement of the breeding goal, but at the same time, use a larger number of mares maintains a substantial genetic basis. Approach like this enables consolidation within Gidran population, and while preservation genetic diversity within the breed.

The characteristics of the population phenotype Gidran horses

In the genesis of Gidran horses we can find breeds like Thoroughbreds and Nonius, which left important imprints in Gidran horses. IIVANKOVIĆ et al. (2016) study body measurements and indices of Gidran population from Croatia and due to better insight compared the same qualities with Gidran from Hungary (Figure 6).



WH (s) – withers high (stick); WH (t) – withers high (tape); BH – height of back; RH – height of rump; BL – length of body, CD – depth of chest; CW – width of chest; CC – cannon bone circumference; RL – length of rump

Figure 6. Body measurements comparison of Gidran mares from Croatia with Gidran mares from Hungary (BENE et al., 2014; IVANKOVIĆ et al., 2016)

Generally, population of Gidran from Croatia has higher withers height (170.9 cm) and canon circumference (20.5 cm) in relation to the Gidran population from Hungary (167.6 cm, 19.9 cm). Population of Gidran mares from Hungary has had higher values for other eight body measurements, although not significant. The highest observed difference of 5.3 cm between these two populations was related to width chest (41.9 cm for Gidran in Croatia, 47.2 cm for Gidran in Hungary; IVANKOVIĆ et al., 2016). IVANKOVIĆ et al. (2016) state that similarity considering body measures are expected since Croatian breeding of Gidran horses is established on Hungarian genetic pool. During 2008 Croatian Association of Gidran horse breeders import 20 breeding heads (IVANKOVIĆ et al., 2016) and revitalization of breeds gets solid ground.

Breeding status of Gidran horse in Croatia

Breeding of Gidran horse in Croatia again started in nineties of XX century when breeding individuals are registered into National Registry Book at CAA. In 2009 and 2010 City of Bjelovar supports the purchase of 20 high-quality Gidran horses for the purposes of the newly established historical cavalry "Bjelovar Border Troops - Hussars 1756" what was main sweep to the breeding. Later, by adopting Breeding program for Gidran horses in Republic of Croatia (2011) and establishing "Croatian Association of Gidran horse breeders" more productive and directed breeding activities started. This Association in its work is closely linked with breeders and breeding association of Gidran horses from Hungary, and adapted its own version of breeding program to the breeding program from Hungary. The Hungarian Association of Gidran horse breeder expressed full compliance of these two breeding programs what is field for future collaboration. The main National Herd Book is held in Hungary and Croatian represent filial National Herd Book for Gidran horses.

Gidran horses are marked according to Regulations on the identification and registration of equine in Croatia and the corresponding regulations of the Breeding program. Mandatory marking include implantation of transponders, diagram description of exterior and hot brand marking. Croatian brand for Gidran horses is consisted of connected letters 'G' and 'H'. The offspring from the mare which came from the original Gidran families from Mezőhegyes Stud farm (Hungary) under "GH" letters have brand of stylized six-pointed star "*" (Figure 7).

Figure 7. Breed stamp of Gidran horse in Croatia

Way of utilization of Gidran horse in Croatia

Gidran horse from its beginning is design as a multipurpose, with slightly emphasis on military. He encompasses speed, strength, endurance and good interior characteristics what is visible in remarkable results in equestrian competition disciplines, especially in the military and jumping disciplines. Nowadays, Gidran horse in Croatia is mainly use as excellent sport horse and according to the phenotype measures and physical predisposition he fined his usage in: military, show jumping, endurance, dressage competition and driving. In Croatian Gidran play an important role in traditional performances and events, folklore manifestations, etc. One of such manifestation is Terezijana where "Bjelovar Border Troops - Hussars 1756" participate regularly (Figure 8).

Figure 8. Participation of "Bjelovar Border Troops - Hussars 1756"
on Gidran horses at the Terezijana cultural manifestation in June 2016 in Bjelovar

Cultural events also accompanying events from further or closer past in Croatia; good example is participation of Croatian historic Hussar Troops on the First Equestrian parade in May 2016 (Figure 9).

Figure 9 Preparation of "Bjelovar Border Troops – Hussars 1756"
for the preparation First Equestrian parade in May 2016 in Zagreb

Based on the experience from neighbouring countries, it is visible that Gidran horses can be used in many other activities. These are activities of social significance like: use horses by urban police troops, use by border police, in the operation of rescue services, in hippotherapy, etc. At the current time there are an increasing number of recreational riders who want to enjoy horseback riding, learn about the natural and cultural features of the region, so utilization of horses in recreational riding and tourism is very promising. Population of Gidran horses also represent important genetic values. Since total (including neighbouring countries) population of Gidran horses counts about 450 individuals and is in the group of highly endangered breed. According to EU classification (EC 817/2004) this population has rights for financial support for equine breeds whose number of reproductive available female individuals are below 5.000. This emphasizes the need to preserve Gidran population at the national and international level as transboundary breed.

References

CROATIAN AGRICULTURE AGENCY (CAA, 2003-2016): Annual report - horse breeding. Križevci.

BENE, S. – KECSKÉS, B.S. – POLGÁR, J.P. (2014): Comparison of live weight and body measurements of adult brood mares from different genotypes in Hungary. Journal of Central European Agriculture 15 (2): 1-11.

FAO (2015): The second report on the state of the world's animal genetic resources for food and agriculture. Rome. Italy.

HRVATSKA UDRUGA UZGAJIVAČA GIDRAN PASMINE KONJA (2011, 2014): Uzgojni program Gidran pasmine konja u Republici Hrvatskoj. Bjelovar.

IVANKOVIĆ, A. – RAMLJAK, J. – TROGRLIĆ, J. (2016): Exterior features of Gidran horse in Croatia. Stočarstvo (In press).

JÓNÁS, S. – HAJBA, N. – MIHÓK, S. – VÖRÖS, J. (2006): Monograph of the Gidran horse. Debrecen: Center-Print Press.

NARODNE NOVINE (NN; 1885): Prilog 258. Nacionalna knjižnica Grada Zagreba.

Changes in genetic diversity in the Hucul breeding stock in Hungary

SOMOGYVÁRI, Enikő[1] – POSTA, János[1] – MIHÓK, Sándor[1]

[1]University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Animal Science, Biotechnology and Nature Conservation, Department of Animal Breeding, Hungary, 4032, Debrecen, Böszörményi street 138.

Abstract

The aim of the study was the examination of changes in genetic diversity between the stocks included in the Hucul Stud Books published in 2002 and 2011. Average inbreeding coefficient was 6.21 % and 6.36 % in the stocks of 2002 and 2011, respectively. The average relatedness were 11.17 % and 12.58 % for the years 2002 and 2011. The mean complete generation equivalent was 7.13 in the 2002 stock and 8.27 in the 2011 population. The mean of the maximum number of generations was 17.21 generations (2002 stock) and 18.54 generations (2011 stock). The mean of the number of full generations traced in the case of the individuals published in the 2002 stud book was 4.36, while it was 5.21 in the case of the 2011 stock. The mean generation intervals were 9.98 years and 10.63 years for the 2002 and 2011 stocks, respectively. In the stocks included in the 2002 and 2011 stud books the effective number of ancestors (fa) was 15 (in both populations); the effective number of founders (fe) was 26 and 23, and the ratio of the two (fa/fe) was 0.6521 and 0.576. The ancestors with the highest genetic impact are listed in a table.

Introduction

The purpose of our examination was to evaluate the genetic structure of the Hungarian Hucul population based on pedigree data, by applying population genetic methods. The regular examination of the genetic structure of the Hucul breed – which is indigenous in Hungary and can be categorised as endangered at the same time – reveals the changes that have occurred in the population. This has a great role from the point of view of breeding: it shows which direction breeding develops, where changes should be made and probably also reveals that the import and further breeding of individuals from which mare families and stallion studs help improving the diversity of the population.

Material and methods

In the study we analysed the Hucul breed, considered an indigenous Hungarian horse breed, based on the populations in the Hucul Stud Books published in 2002 and 2011. Our aim was to follow up on the changes in genetic diversity that took place over a decade's time. There were 85 individuals in the stud book published in 2002, while the stud book published in 2011 presented the characteristics of 274 Hucul horses kept under stud book control. Using the Endog programme developed by GUTIÉRREZ and GOYACHE (2005) inbreeding

coefficient, average relatedness, pedigree completeness, generation interval, effective number of ancestors, effective number of founders, the ratio of the two and the ancestors responsible for variability were calculated. The individual indicators can be characterised in brief as follows:

Inbreeding coefficient indirectly shows the diversity of the stock. The precision of the inbreeding coefficient depends on the length and, indirectly, also on the completeness of the pedigree (BOICHARD et al., 1997). In the case of populations with a decreased number of individuals of indigenous breeds with a closed stud book, where the import of foreign genes is now allowed, it is a huge task to even keep its level. In most cases, efforts to maintain the species focus on holding back the rise of the inbreeding coefficient. Endog calculates it using WRIGHT's (1922) formula ($F_X = \Sigma(1/2)^{n+n'+1} \times (1+F_A)$, where the indicator obtained is the inbreeding coefficient of the individual 'X'.

Endog calculates ***average relatedness*** with an algorithm made by COLLEAU (2002). It shows the likelihood of an allele randomly chosen from the pedigree characterising the whole population belonging to an individual. It is closely related to the inbreeding coefficient.

Pedigree completeness can be characterised by the values of the number of full generations traced, the maximum number of generations and the equivalent complete generations. Indigenous breeds are usually characterised by a long pedigree, especially if the origin records have not been lost for any reason. The *number of full generations traced* is defined as the furthest generation in which all the ancestors are known. Ancestors with no known parent were considered as founders (generation 0). The *maximum number of generations* is the number of generations separating the individual from its furthest ancestor. Equivalent complete generations is an adjusted indicator characterising the pedigree completeness. *The equivalent complete generations* is computed as the sum over all known ancestors of the terms computed as the sum of $(1/2)^n$ where n is the number of generations separating the individual to each known ancestor (MAIGNEL et al., 1996).

Generation interval shows the average age of parents at the time of their offspring's birth (JAMES, 1977). According to GÁSPÁRDY et al. (2003) generation interval is the time that passes between the birth of a parent and the birth of their breeding offspring, i.e. the average age of the parents – weighted with the number of their further reproducing (effective) offspring – at the birth of their offspring. The value can be calculated along four different lineages (father–son, father–daughter, mother–son, mother–daughter) on the basis of the recoded individuals' and their parents' birth dates. In the maintenance of indigenous stocks, controlling the fall of diversity and keeping the rise of the inbreeding coefficient at the possibly lowest level are among the objectives, considering which longer generation intervals are always more favourable. In the maintenance of breeds, fast generation changes are not an objective.

All individuals of the population can be traced back to the ***founders,*** which, however, contribute to the formation of the population's genetic stock to various extents. This latter is what is adjusted by the ***effective number of founders*** (fe) in a way as if the founders had contributed to genetic diversity to the same extent. The ***effective number of ancestors*** (fa) is lower (or the same as) the effective number of founders. ***Ancestors*** are selected on the basis of their genetic contribution to the population, since certain individuals are not necessarily founders, so in view of relatedness genetic contributions may be overlapping (and their totality may be more than 100%). In the case of ancestors we consider their marginal

contribution (using the non-overlapping part of genetic contributions). The ***ratio of effective number of ancestors and effective number of founders*** (fa/fe) implies the bottleneck effect suffered. If fe is higher than fa, the population suffered a bottleneck effect. Success in the maintenance of protected populations usually depends on individuals that can be traced back to the highest possible number of founders.

Results and discussion

Inbreeding coefficient

The average inbreeding coefficient of the stock listed in the 2002 stud book was 6.21%. The mean inbreeding coefficient value of the individuals presented in the 2011 stud book was 6.36%. The values imply a slight increase in the degree of inbreeding of the Hungarian population of the breed in the period examined. It is also remarkable that the values obtained are significantly higher than those published by BARTOLOMÉ et al. (2011) with reference to Spanish Sports Horses (0.66 %), although that stock obviously does not have a closed stud book. The value obtained by PJONTEK et al. (2012) with reference to the Hucul population in Slovakia, 6.26 %, is very close to the figure obtained in our study. Our values of 6.21 and 6.36 % proved, however, lower than the values published by BOKOR et al. (2013) (for Hungarian Thoroughbred): 9.58 % and ZECHNER et al. (2002) (for Lipizzan horse): 10.81 %. These stocks, too, have clearly a larger population size.

Average relatedness

As regards average relatedness in the two compared stocks, the significantly larger stock presented in the stud book published later is characterised by a higher degree of average relatedness: 12.58% compared to 11.17%. The change (rise) in average relatedness indicates (since average relatedness is higher than half of the inbreeding coefficient) that the mating of related individuals could not be avoided in the stock. Some of the growth in the stock size originated in the further breeding of the stock under stud book control in 2002 and, inevitably, the pairing of related individuals grew. Unsurprisingly, the average relatedness published by BARTOLOMÉ et al. (2011) with reference to Spanish Sports Horses is significantly lower (0.16%). The lower degree of average relatedness published by PJONTEK et al. (2012) for the Slovakian Hucul population (9.34%) is surprising at the same time. While he observed a similar value for the inbreeding coefficient, he obtained a lower value for average relatedness, which indicates a lower level of close breeding in the Slovakian than in the Hungarian Hucul population. The 12.25% average relatedness published by VALERA et al. (2005) for Andalusian horses is closest to the values of 11.7 % and 12.58 % we obtained.

Pedigree completeness

The equivalent complete generations was 7.13 generations on the average (the values changing between 4.89 and 8.6) in the 2002 population. With reference to the population in the 2011 stud book, the mean value was 8.27 (changing between 8.4 and 9.83, i.e. in a much narrower range). The generation indicator of 1.72 published by MEDEIROS et al. (2014) with reference to Brazilian Sports Horses is significantly lower, which implies that the breed is under formation. A value almost identical with the equivalent complete generations of the stock in the 2002 stud book (7.1 generations) was published by PJONTEK et al. (2012) with reference to the Slovakian Hucul population. Unsurprisingly, the generation value of 15.46

recorded by BOKOR et al. (2013) surpasses our indicators since the Hungarian Thoroughbred have a several hundred years' history.
In the stock of the 2002 stud book we know of ancestors up to 20 generations; in the 2011 stud book population up to 22 generations (in the 2002 stock the figure varied between 14 and 20; in the 2011 between 19 and 22). This means that there was not only a generation change but also there were individuals included in the stud book control that had a longer breeding history. The maximum number of generations of the stock was 17.21 generations (2002 stock) and 18.54 generations (2011 stock). Surprisingly TEEGEN et al. (2008) published a value of only 4.55 generations with reference to Trakehner Horses. A similar value to ours was once again published for the maximum number of generations by PJONTEK et al. (2012) for the Slovakian Hucul population (17.54 generations). This reflects the same or similar Hucul history of the two countries. BOKOR et al. (2013) calculated 29.96 generations for the Hungarian Thoroughbred.
We are familiar with the full ancestry up to 4-7 generations of 84% of the 2002 stock and 89% of the 2011 stock. The full ancestry of 5.8% of the stock can be traced back to 7 generations. The number of full generations traced of the individuals in the 2002 stud book was 4.36 on the average; of the 2011 stock, it was 5.21. A lower value was recorded by TEEGEN et al. (2008) for Trakehner Horses (1.86 generations). PJONTEK et al. (2012) published a figure a little lower than our value for the Slovakian Hucul population (4.29 generations). BOKOR et al. (2013) published a higher value (6.69 generations) for the Thoroughbred population in Hungary.
The pedigree completeness value obtained can be considered favourable considering the historic past of the Hucul breed. Comparing the populations in the two stud books (2002 and 2011), a clear rise can be observed in all the three pedigree completeness values. This supports the conscious breed maintenance efforts. More complete and longer ancestries are more favourable for calculating more precise inbreeding values.

Generation interval

The generation interval values of the 2002 and 2011 stocks obtained along four different lines of descent were summarised in Table 1. In both stocks, the longest generation interval values were exhibited by stallions siring female foals, followed by stallions siring male foals. In the 2002 stock, somewhat higher generation interval values were calculated for mares producing female foals than for mares producing male foals. In the 2011 population, mares producing male foals exhibited longer generation interval values. The mean values obtained for the 2002 and 2011 stocks respectively were 9.98 and 10.63 years. There are no major changes to be observed in the generation interval values of the two stocks.

Table 1. Generation interval values of the 2002 and 2011 stocks along 4 different lines of descent

Parent-offspring lineages	Generation interval (years)	
	2002 stock	2011 stocks
Sire- son	10.22	11.73
Sire- daughter	11.72	12.29
Dam- son	8.26	10.48
Dam- daughter	8.50	8.87
Average	9.98	10.63

Effective number of founders (fe); effective number of ancestors (fa); ratio of effective number of ancestors and effective number of founders (fa/fe)

In the population in the stud book published in 2002 the effective number of founders (fe) was 26 and that of ancestors (fa) was15. As regards the 274 individuals in the stud book published almost 10 years later (2011) the effective number of founders (fe) fell to 23 (also reflected in the rise of the inbreeding coefficient), while the effective number of ancestors (fa) stayed unchanged. The ratio of the effective number of ancestors and effective number of founders (fa/fe) was 0.6521 in the case of the first and 0.5769 in that of the second population. Since the effective number of founders is higher than the effective number of ancestors it can be established that there was a bottleneck effect in the population. An indicator identical to those with reference to the Hungarian population was published by PJONTEK et al. (2012) for the Hucul population in Slovakia. Their research revealed that in the Slovakian population the effective number of founders was 26; that of ancestors was 16. These values are almost the same in the two countries, which comes as no meaningful surprise considering the common origin.

Ancestors with the highest genetic impact

Table 2 summarises the 10 individuals with the highest genetic impact from the stocks under stud book control at the two dates concerned. The ten most important individuals of the stock recorded in 2002 (7 stallions and 3 mares) are responsible for 71.14 percent of the genetic variability, while in the stock published in 2011, it was ten stallions that were responsible for 68.97 percent of the genetic variance. Table 2 presents these individuals by name. The impact of the ancestor with the greatest genetic impact, Goral III (Lu), continued to grow (from 12.7 % to 14.81 %). This stallion is followed by 3139 Polan (Pol), with a significantly shorter breeding history but present with large direct offspring as well as many grandsons and granddaughters. He had an impact of 11.7% on the genetic structure of the 2002 stock, which slightly grew in the following ten years (to 11.91%). The impact of 162 Ousor 02-7 Turek (Murány) fell, while the impact on genetic structure of Hroby VIII (Lu) increased. In the stock published in 2011 stud book, two individuals of the stud Pietrosu appeared as new and are to be considered as ancestors with high genetic impact. Thereby the influence of the individual studs fundamentally changed. In addition to the influential role of the four individuals responsible for the greatest genetic coverage, that of other ancestors changed as well. In some cases impact on the genetic structure fell, while in other cases it increased.

Table 2 Ancestors with the highest genetic impact in the 2002 and 2011 stock

Animal	Gender	Contribution (%)	
		2002 stock	2011 stock
Goral III (Lu)	stallion	12.70	14.81
3139 Polan (Pol)	stallion	11.76	11.91
162 Ousor 02-7 Turek (Murány)	stallion	11.13	7.27
Hroby VIII (Lu)	stallion	6.82	8.16
2967 Ousor VI-61 Tornádó (Lu)	stallion	5.80	-
3254 Hroby Jóság	mare	4.96	-
224 Gurgul V-11	mare	4.89	-
117 Goral X (Top) Goral VII-1 (Lu)	stallion	4.88	-
2539 Bravij (Ukr)	stallion	4.41	-
307 Gurgul V-30 Lucka (Sk)	mare	3.78	-
Ousor (Lu)	stallion	-	6.15
Pietrosu II (Lu)	stallion	-	5.93
Pietrosu VIII (Lu)	stallion	-	4.52
Hroby XXI (Lu)	stallion	-	4.30
Hroby (Bukovina)	stallion	-	3.10
Goral I (Lu)	stallion	-	2.82

Conclusion and recommendation

One can observe a rise in the three different kinds of pedigree completeness values in the 2011 stock. They became longer and more complete, whereby we were able to determine inbreeding more precisely. The effective number of founding ancestors fell from 26 to 23 with reference to the individuals recorded in the 2011 stud book, which partly explains the higher level of inbreeding. The inbreeding coefficient of 6.21% in 2002 grew to 6.36% in 2011, in parallel to which the degree of average relatedness also rose from 11.17 to 12.58 percent. The role of the four individuals responsible for the highest genetic coverage was retained, while the significance of additional stallions grew. In order to reduce the degree of inbreeding, the import of individuals with a rare pedigree is recommended for the future.

References

BARTOLOMÉ, E. – CERVANTES, I. – VALERA, M. – GUTIÉRREZ, J.P. (2011): Influence of foreign breeds on the genetic structure of the Spanish Sport Horse population. Livest. Sci., 142, 70–79.

BOICHARD, D. – MAIGNEL, L. – VERRIER É. (1997): The value of using probabilities of gene origin to measure genetic variability in a population. Genet. Sel. Evol., 29, 5–23.

BOKOR, Á. – JÓNÁS, D. – NAGY, I. – BOKOR, J. – SZABARI, M. (2013): Pedigree analysis of Hungarian Thoroughbred population. Livest. Sci., 151, 1-10.

COLLEAU, J.J. (2002): An indirect approach to the extensive calculation of relationship coefficients. Genet. Sel. Evol., 34, 409–421.

GÁSPÁRDY, A. – JÁVORKA, L. – VÖLGYI-CSÍK, J. (2003): Nemzedékköz és nemzedékváltás. Mezőhír, 3, 94–96.

GUTIÉRREZ, J.P – GOYACHE, F. (2005): A note on ENDOG: a computer program for analysing pedigree information. J. Anim. Breed. Genet., 122, 172-176.
JAMES, J.W. (1977): A note on selection differentials and generation length when generations overlap. Anim. Prod., 24, 109–112.
MAIGNEL, L. – BOICHARD, D. – VERRIER, E. (1996): Genetic variability of French dairy breeds estimated from pedigree information. Interbull. Bull., 14, 49–54.
MEDEIROS, B.R. – BERTOLI, C.D. – GARBADE, P. – MCMANUS, C.M. (2014): Brazilian Sport Horse: pedigree analysis of the Brasileiro de Hipismo breed. Ital. J. Anim. Sci., 13, 657-664.
PJONTEK, J. – KADLEČÍK, O. – KASARDA, R. – HORNÝ, M. (2012): Pedigree analysis in four Slovak endangered horse breeds. Czech J. Anim. Sci., 57, 2, 54–64.
TEEGEN, R. – EDEL, C. – THALLER, G. (2008): Population structure of the Trakehner Horse breed. Animal, 3, 1, 6-15.
VALERA, M. – MOLINA, A. – GUTIÉRREZ, J.P. – GÓMEZ, J. – GOYACHE, F. (2005): Pedigree analysis in the Andalusian horse: population structure, genetic variability and influence of the Carthusian strain. Livest. Prod. Sci., 95 57-66.
WRIGHT, S. (1922): Coefficients of inbreeding and relationhip. Am. Nat., 56: 330-333.
ZECHNER, P. – SÖLKNER, J. – BODÓ, I. – DRUM, T. – BAUMUNG, R. – ACHMANN, R. – MARTI, E. – HABE, F. – BREM, G. (2002): Analysis of diversity and population strucure in the Lipizzan horse breed based on pedigree information. Livest. Prod. Sci., 77, 137-146.

A decade of implementing the preservation program in Slovenian indigenous breed Posavje horse – an overview

LUŠTREK, Barbara[1] – POTOČNIK Klemen[1]

[1]University of Ljubljana, Biotechnical Faculty, Department of Animal Science, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract

One of the Slovenian indigenous horse breeds is Posavje horse, which has also been traditionally reared in Croatia. The purpose of this paper was to assess the progress of the Posavje horse population achieved in the recent years, from a perspective of the breed's preservation in Slovenia. The estimated population size in Slovenia for year 2016 was 1750 animals (660 breeding mares and 95 breeding stallions). Over the 11-year period, Slovenian Posavje horse population has increased and its size has been stable since 2014. Genetic trends for some conformation traits (gait correctness, 4 indexes, overall score) are shown, using standardised estimated breeding values (BV12). The data used for the evaluation of genetic changes included 1032 data records from Posavje horses born between 2000 and 2012. In general, the trends of genetic changes were not clear. Most cases of mildly positive trends referred to the breeding mares. Analysis of genetic changes showed the population is generally stable and it does not change. Horse selection in Slovenia is based on phenotype values instead of estimated breeding values, and the number of animals included in the data record is very small. Therefore, the results are expected. In the future, effort to increase the numerousness of the population and to implement breeding value based selection should be made.

Introduction

Posavje horse is defined as one of the Slovenian indigenous horse breeds. It is named after the area of origin, Posavje region, which still represents the traditional location of the majority of Slovenian population. Today, the breed is widespread all over the country. The breed originates from a population of a smaller type indigenous horses, reared in the Slovenian-Croatian Sava river basin. That population was crossed with horses of different, mostly coldblooded breeds (e.g. Belgian coldblooded type, Nonius), without any pre-planning or breeding goals set, forming the Posavje horse as it is known today. The herdbook for Posavje horse is kept in Slovenia and Croatia since 1993, as these two countries represent the breed's main rearing area (RUS, 2010; BOJKOVSKI et al., 2014).

Posavje horse breed was formed in moderate environment of tough survival conditions, which has made these animals very resistant and adaptable. Nowadays, Posavje horse is also known for its expressive sexual dimorphism, early breeding maturity and good fertility, as for its calm and pleasant temperament. From a perspective of the economic crisis and still ongoing

consequences, its good feed conversion, fast growth rate and excellent carcass traits have become quite favourable (VEJNOVIČ, 2008; RUS, 2010; BOJKOVSKI et al., 2014).
Slovenian Posavje horse is a small framed horse. It has a thin head, straight nose profile and a muscular neck with a tick, wavy mane. Its body is wide, very deep but short, with a muscular back and short, down-casted, split croup. Its legs are furry and rather thin but strong, with well-formed joints, allowing correct and efficient gaits. Most common fur colour is brown or black. Posavje horse is known as light to medium heavy, nimble and persistent horse. Farmers use it for farm labour or for cargo transport. It is used as a carriage horse, and sometimes for recreational, terrain riding (RUS, 2010; BOJKOVSKI et al., 2014). The main breeding direction of Slovenian population of the Posavje horse is the production of slaughter animals and horse sale to the meat industry (BOJKOVSKI et al., 2014).

A status of breeding organisation has belonged to the Slovenian association of breeders of the Posavje horse since 2006. It includes more than 200 members and is responsible for the breeding tasks, such as maintaining the member and animal registry, executing educational and promotional activities (exhibitions and auctions), breeding and slaughter animals' marketing, collaboration in herdbook admissions, selection and licencing of breeding stallions, stallion management, use and exchange, and organising the work ability test. It takes care for identification and registration of Posavje horses in Slovenia and generally cooperates with the Biotechnical Faculty and the Veterinary Faculty, University of Ljubljana (RUS, 2010).

Total estimated population size of Posavje horse animals in Slovenia for 2016 was 1750 horses, where 660 breeding mares (38% of total population) and 95 breeding stallions (5% of total population) have been registered to the herdbook. On average, Posavje horse breeding stallions are aged 5 – 15 years, with 1 – 140 registered progenies per stallion (Registry of equine… 2016; MESARIČ, 2016).

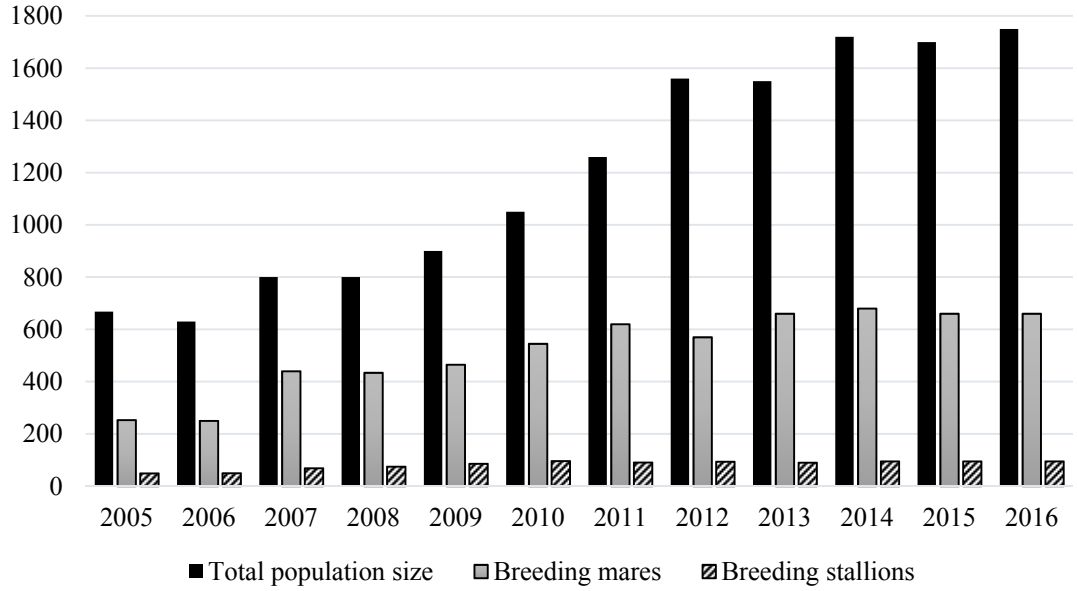


Figure 1. Change in Posavje horse population size between years 2005 and 2016

Over the studied 11-year-period the estimated number of animals in Slovenian population has been rising (Figure 1). The sudden increase seen in 2010 and later on, is mostly due to a larger extent of breeding animal registration and not actual increase in their numerousness.

Interestingly, at the beginning of the economic crisis in 2008, no significant reduction of animal number can be seen, although the reduction commonly occurred in other Slovenian horse breeds. The economic circumstances negatively affected the breeding animals' market, yet the number of Posavje breeding mares has slightly increased and has remained unchanged. The number of breeding stallions has also not changed significantly. This is, presumably, due to the meat production breeding direction. The current state of Slovenian Posavje horse population size is stable.

The present level of threat for Posavje horse in Slovenia was assessed by four criteria: regarding the criteria of "reproduction ability" (the number of purebred breeding mares and stallions in herdbook) the population is considered to be endangered. It is considered to be vulnerable following the criteria of "population trend" and "purebred mating percentage". The size of the effective population is small, which is understandable for the total population size is also small (although slowly increasing) and its numerousness in recent years has not fundamentally changed. The number of breeding stallions, which has the main role in assuring genetic variability (inbreeding prevention), is sufficient relatively to the total population size. In compliance with the criteria "inbreeding coefficient" and "geographical spread", the Slovenian Posavje horse population is considered to be critically endangered. Since the population is small, the main threat is represented by great potentiality of inbreeding. The proposition to make genealogical separation of the breeding stallion lines has emerged, and it is believed to relieve a choice of mating partners and mating plan structure. A positive assessment regarding the geographical spread of the Posavje horse is the reflection of the breed's presence in Croatia (Pravilnik o ohranjanju… 2004).

Materials and methods

Trends of genetic changes for body traits in Slovenian Posavje horse population have been estimated. Genetic changes are shown on standardised breeding value scale (BV12). For standardisation, a mean of 100 points is used, whereas 12 points represents one standard deviation. Trends are based on standardised breeding values (BV12) for 1032 horses born in 2000 – 2012. For breeding value estimation data of 885 breeding mares and 147 breeding stallions were used.

In Slovenian horse selection 22 body traits are scored or measured. Scored body traits (12) are breed type, head, neck, front part of body, middle part of body and rear part of body, front and rear legs, gait correctness and efficiency, and overall score. Measured body traits (7) consists of croup height and width, body length, wither height, chest girth, chest depth and chest width, and cannon bone girth. Also 4 indexes are determined, reflecting body proportions. For the analysis of variance, performed by statistical software package SAS/STAT, animal model was used:

$$y_{ijkl} = \mu + G_i + B_j + A_k + a_{ijkl} + e_{ijkl}$$

where y_{ijkl} represented observed trait (body trait, index or overall score (22); μ estimated overall mean; G_i fixed effect of gender (i = male, female); B_j fixed effect year of birth (j = 2000, 2001,…, 2012); A_k fixed effect of age at scoring (k = 2.5-3.5 years, 3.5-5 years); a_{ijkl} additive genetic effect and e_{ijkl} residual.

Results and discussion

Greater differences between animals within different birth year, noticed in stallions, are the expected consequence of a smaller number of scored animals (Figure 2, 3).
Minor indication of a positive genetic change can be seen for gait correctness (Figure 2) in mares. Indexes between 2 traits (chest width-wither height; chest depth-wither height; croup width - wither height; cannon bone girth-wither height) and the overall score as a sum of all scored traits (Figure 3, 4), also show a positive trend especially for mares. That means the female population of Slovenian Posavje horse reflects phenotype changes, which are in compliance with the breeding goals.

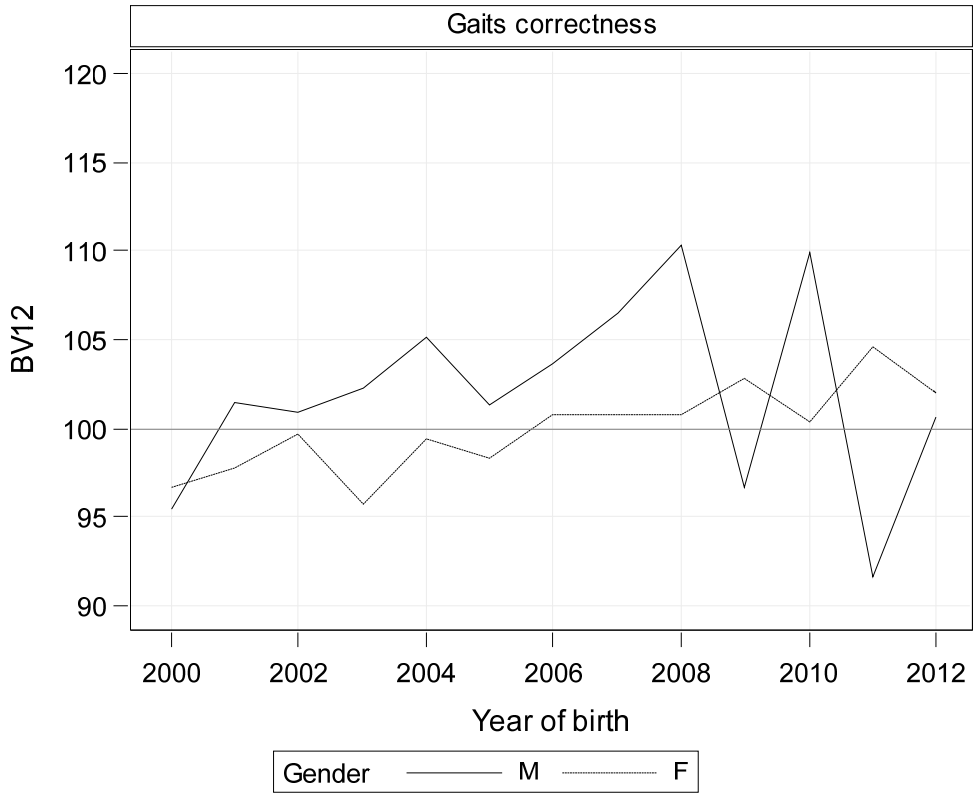
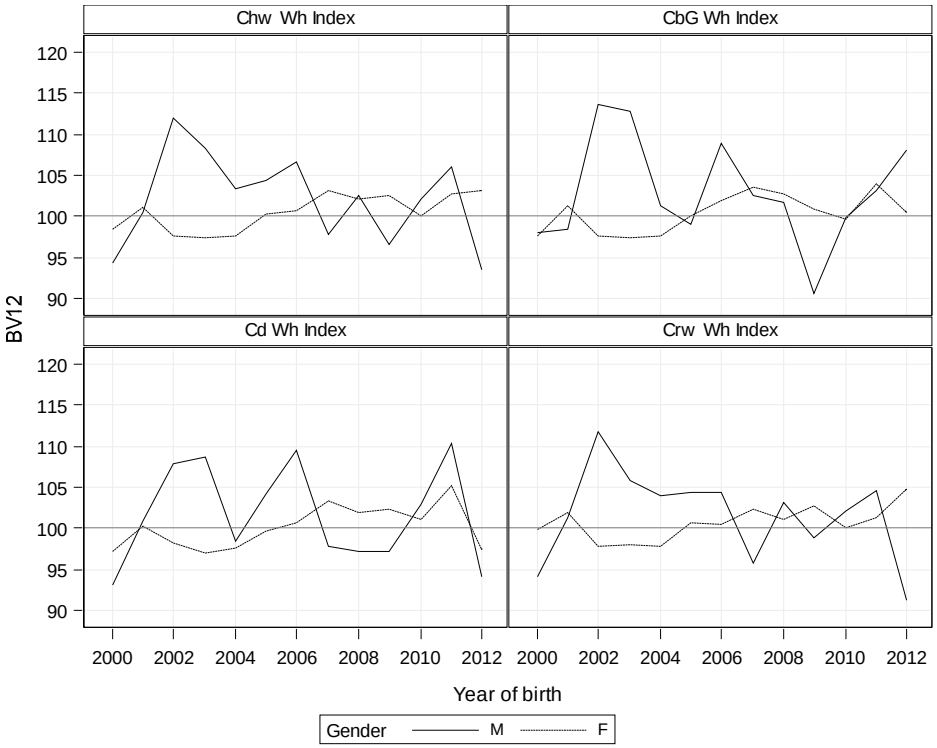


Figure 2. Estimated genetic changes for gait correctness

Body volume measurements (chest width/girth/depth; croup width) showed a very slight, positive trend for the female part of Slovenian Posavje horse population, and no distinguishable trend for the male part of the population. This could be explained by continued decrease in the number of scored stallions within the year of birth. Estimated genetic changes of scaled traits, considering head, rear legs, body and breed type showed minor positive trend for both genders. There were no noticeable population changes regarding body frame measurements (body length, croup height, wither height), front legs and gait efficiency. For the most traits the trends were not remarkable, hence they are not shown in the paper.
Among all the studied traits, estimated genetic changes showed the most positive trend for overall score (Figure 4). This is an evidence that selection of Posavje horses in general, is going in a direction towards the breeding goal.



Chw: chest width; Wh: wither height; CbG: cannon bone girth; Cd: chest depth; Crw: croup width
Figure 3. Estimated genetic changes for indexes

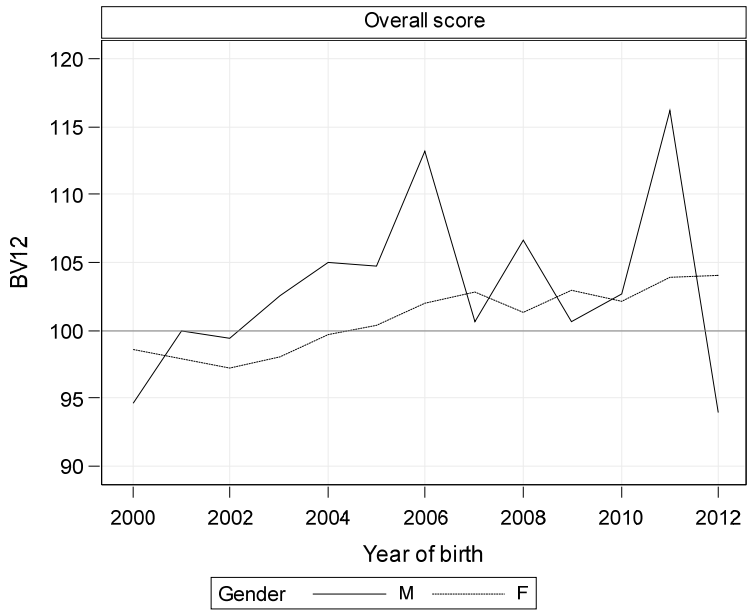


Figure 4. Estimated genetic changes for overall score

Conclusion

The population of purebred Posavje horses in Slovenia has been slowly but constantly increasing since 2006. It seems that its total size has not been affected by the conditions of economic crisis. This is probably due to the production of meat as a main breeding direction. Nevertheless, the number of breeding animals is more or less stagnant. That is a positive fact

when compared to the population state of other horse breeds in Slovenia and Europe. On the account of current weak enquiry on the market, breeding animals are hard to sell.
Overall, the estimated genetic changes in Slovenian Posavje horse population are quite small or seemingly non-existent. Since the selection of these horses is based on phenotypic values instead of estimated breeding values, trends of genetic changes such as the ones shown are expected. In Slovenian horse selection, estimated breeding values should become first and the most important criteria of consideration.
The breeding value based selection of the Posavje horse could become more interesting and effective in practice with the possibility of merging the Slovenian and Croatian Posavje horse population data.

References

BOJKOVSKI, D. – CIVIDINI, A. – ČEPON, M. – HOLCMAN, A. – KOMPAN, D. – KOVAČ, M. – KOMPREJ, A. – ŽAN LOTRIČ, M. – MALOVRH, Š. – POTOČNIK, K. – SIMČIČ, M. – TERČIČ, D. – ZAJC, P. (2014): Slovenske avtohtone in tradicionalne pasme domačih živali. Ljubljana, Ministrstvo za kmetijstvo in okolje, 8-10.

MESARIČ, M. Vloga žrebcev v reji posavskega konja. (2016): Revija o konjih, 24 (4), 42-44.

Pravilnik o ohranjanju biotske raznovrstnosti v živinoreji. (2004): Ur. l. RS, št. 90/04

Registry of equine breeds with zootechnical assessment. (2016): http://www.genska-banka.si/pasme/register-pasem-z-zootehnisko-oceno/ (20.2. 2016)

RUS, J. (2010): Rejski program za pasmo posavski konj. Ljubljana, Veterinarska fakulteta, Univerza v Ljubljani, Slovensko združenje rejcev konj pasme posavec, 39 pp.

VEJNOVIČ, J. (2008): Naši konji. Ljubljana, Kmečki glas, 203 pp.

Preliminary results on body conformation of Hungarian Fallow Donkey

LÉNÁRT, Zoltán[1] – ERNST, Mihály[2] – GÁSPÁRDY, András[1]

[1]University of Veterinary, Institute for Animal Breeding, Nutritition and Laboratory Animal Science, 1078 Budapest, István street 2, Hungary
[2]Association of Hungarian Donkey Breeders, 7477 Szenna, Rákóczi street 46, Hungary

Abstract

The Hungarian fallow donkey is autonomous type from age 2003. In this study the investigationed topic is the body conformations and bad physical formations in donkeys. The total number of donkeys included in the research was 100. The data from seven different sized stock-farm in six regions in Hungary. In addition to the measurement of different areas of the body, we have also measured particular body parameters in order to calculate their distribution/standard deviation within this heterogeneous type. The main objective of this survey was the study and detailed description of the various forms of the Hungarian donkey, although we cannot talk about exact types and type traits, only for administrative reasons.
From 100 donkeys, 57 was brown, moreover 73 donkeys had light belly in each colour. The Hungarian donkeys were in largest number of medium size, the overgrowth of the croup was common. Other body form malformations include a coarse, large head, meagre croup and malformations of the breast, rump. Toeing out and sickle-hocked was very ordinary.

Introduction

The donkey livestock production was connected mainly with sheep breeding and keeping. The reasons why shepherds used donkeys were these: perfect sociability, poor quality of the pasture and multi-applicability (ERNST, 2004). Donkeys have long historical background in Hungary, but the Hungarian Donkey became autochthonous livestock of the country officially since 2005 (Figure 1). The conscious breeding was not current in old times, so nowadays breeders must protect this untouched gene reserve. The selection should be exercised with care, because errors of body conformations are hereditary very often. The Hungarian Donkey population is about of 3000-4000. This population is heterogenic, there are less breed specific characteristics like of donkey in some country in Western Europe.
There are three categories of donkey size: small, medium and large. The value of the height at withers for the medium sized individuals is around 120 centimetres. The most common faults of the Hungarian Donkey are as follows: the disproportionate body, the coarse, large head, thin skeleton, too long back, short and meagre croup, the extremely toeing out forelimb, sickle-hocked hind limb, X-leggedness, short-bound gait.
The most common hair colours are the brown, black, grey and their shade variants. Donkeys usually have “swallow belly” in each colours. The end of the legs is often lighter than the shade of the body. However, there are also entirely black exemplars. Individuals carry often a “cross” made of the dorsal strip and the stripes running down each of their shoulders.

Our aim was to receive more data about the type and conformation of the registered Hungarian Donkey population. It is important to know the donkey's anatomy to judge its conformation. There are few differences in build of body between donkeys and horses. For example, the neck of donkey is shorter and less arched than horse's neck. Then, the withers are often not well expressed, and the shoulders are often steep in donkeys.

Material and methods

For the data recording the Association of Hungarian Donkey Breeders' gave us availability of the investigated livestock owners. The taking of body measurements and evaluation of conformation were carried out in six counties in Hungary, altogether in seven studs from July until September during 2016. The overall number of individuals was 100, the number of individuals by county was as follows: Bács-Kiskun: 28, Hajdu-Bihar: 28, Borsod-Abaúj-Zemplén: 25, Jász-Nagykun-Szolnok: 9, Heves: 5, and finally Pest: 5.
In most of the cases the age of donkeys was known from date of birth registered in their passport, but several times the microchip number was used for retrievement of birth date. The average age of investigated donkey was seven years.

The next body measurements were taken: height at withers (the highest point of the withers measured from the ground), sacral height (the highest point of the sacrum measured from the ground), greater trunk length (distance between the greater tubercle of humerus and the ischial tuberosity), and chest depth (distance between the sternum and vertebra behind withers).
To measure the donkeys measuring tape and measuring stick were used. From the investigated parameters the height at withers, sacral height and chest depth were measured by measuring stick. The greater trunk length was measured by tape measure.

With the body measurements there were calculated body indices (Table 1). The larger the index value, the more pronounced is the index property at the animal.

Table 1. Applied calculations of body indices

Index of pelvic overgrowth =	(sacral height/height at withers)*100
Index of stubbiness =	(height at withers/greater trunk length)*100
Index of long-leggedness =	(height at withers/chest depth)*100

For the investigated body measurements and indices the corrected value of the mean (LSM - Least Square Means) and its error (SEM – Standard Error of Mean) was computed by a General Linear Model (GLM, Statistica ver. 13) with fixed effects of colour and gender, and age as covariate (a covariate is a variable that is possibly predictive of the outcome under study; in this study it ranges between 1.2 and 21.1 years; DELL INC., 2015).

Figure 1. Boncida, a requested type of grey-coloured Hungarian Fallow Donkey mare born in 2003 (photo LÉNÁRT, 2016)

Further on, the coefficient of determination (R^2) was computed which is a number that indicates the proportion of the variance in the dependent variable that is predictable from the independent variable(s).

In the frame of conformation judgement the constitutional faults were especially revealed. In this study we give account about the most typical defects according to their percentual occurrence. At the same time, for the Association and a subsequent processing photos of all the individuals investigated were drawn.

Results and discussion

The Table 2 presents the Least Square Means of body measurements.
LSM of height at withers was 121.0 cm, included stallions and mares. This average value implies that the Hungarian Donkeys are of medium sized on average. The impact of the colour and the age on the height at withers is significant (P=0.005 and 0.041, respectively). Regarding the colour (results not shown) there is a reduction in the height at withers by the following rank: brown, black and grey. The observed population consisted of 57, 27 and 16 individuals in brown, grey and black hair colour, respectively.
The impact of the gender on the height at withers and all the other body measurements as well was without exception non-significant.

Table 2. Least Square Means (cm) and coefficients of determination in the body measurements

	Height at withers	Sacral height	Greater trunk length	Chest depth
LSM	121.0	123.7	131.3	55.2
SEM	2.64	2.56	3.15	1.61
colour R^2,	9.98	9.30	4.54	8.08
P-value	0.005	0.007	0.106	0.016
gender R^2,	1.70	0.89	1.59	1.75
P-value	0.170	0.322	0.208	0.175
age R^2,	3.80	4.66	0.10	0.90
P-value	0.041	0.025	0.756	0.330
error R^2	84.50	85.15	93.78	89.26

As it is displayed also in the Table 2 the mean sacral height was 123.7 cm, larger than the value of height at withers.
Similarly to the above tendency (in height at withers) there is also a diminishing in the sacral height by brown-black-grey colour rank.
Further on, there is a mild reduction in sacral height by aging.
The greater trunk length was 131.3 cm, and it was influenced by none of the effects taken into consideration.
The average of the chest depth was 55.2 cm. The effect of colour on it was the single statistically proven effect: there is a reduction in chest depth by the following colour rank: brown, black and grey.
The large values of coefficients of determination (each R^2 is over 84%) informs us that there should be many other factors beside the colour, gender and age in the background.

The Table 3 exhibits the Least Square Means of body indices.
The LSM value of index of pelvic overgrowth was 102.3 %. This value inform us that the Hungarian Fallow Donkey is a breed which is slightly overgrown in the hind part.
None of the effects has significant impact on the index of overgrowth. In a previous Hungarian research ZÁBORSZKY (2005) received similarly to our values 103.4 in males and 103.9 % in females, but also he could not prove the effect of gender on this trait.

The mean value of index of stubbiness is 92.3 %. A value being below 100 % is to mean that the trunk of the body is longer than the height at withers; so the shape of the Hungarian Fallow Donkey from side view is rather elongated than rectangular.
The age affected the index of stubbiness negatively ($P<0.002$).

The average value of index of long-leggedness was 220.0 %. This can be seen as a high value, which indicates that the Hungarian Fallow Donkey is a long legged animal, it has relatively long fore limbs for its chest depth. None of the effects investigated were influencing the index of long-leggedness.
In evaluation of body indices the values of coefficients of determination were even greater than before (each R^2 is over 88%).

Table 3. Least Square Means (%) and coefficients of determination in the body indices

	Index of pelvic overgrowth	Index of stubbiness	Index of long-leggedness
LSM	102.3	92.3	220.0
SEM	0.60	1.48	3.91
R^2 colour,	1.50	1.85	3.09
P-value	0.478	0.372	0.221
R^2 gender,	2.59	<0.01	0.43
P-value	0.112	0.962	0.514
R^2 age,	0.18	9.91	0.98
P-value	0.674	0.002	0.327
error R^2	95.74	88.23	95.50

Regarding the constitutional faults the following five major defects occurred in the donkey population studied: X-leggedness (cow hocked hind limbs) in 86%, toeing out in 73%, steep croup (goose rump) in 64%, sickle hocked hind limbs in 32%, and weak breast in 22%.

Conclusions and recommendations

The reason for higher body among brown donkeys is not known. Theoretically, the colour of the animal should not determine the size. A possible explanation can be found in the origin of the donkeys. It can be supposed that the brow individuals are the descendants of a large framed Italian donkey, Martina Franca (which was used in creation of mule in Hungary in the past, KUGLER et al., 2008), while the grey individuals stem from smaller sized Balkan donkeys. However, VLAEVA et al. (2016) published data about donkey eco-types in Bulgarian which were slightly less than our ones (119.8 and 121.0, respectively). MATIUTI et al. (2011) informed us about much less values (105.0 cm) of donkey population in Banat (Romania). Sadly, the pedigree information is incomplete currently.

The statement done in the explanation of differences in height at withers by colour can also be used in the explanation of differences in other body measurements (sacral height and chest depth).
The mild reduction in height at withers and sacral height by aging is unexpected. It is probably because our database just was not enough or our sampling was not random representative. However, we keep the age interval long enough for demonstrating any expectable changes.
The effect of colour on chest depth was the single statistically proven effect; the shallowest chest was observed in the grey-coloured individuals. Here, we could explain it also by origin (genetic impact).

From the index of stubbiness it became – according to our expectations - obvious that the older is an individual, the longer is it in its body proportions.
The large values of coefficients of determination (in all the cases) inform us that there should be many other factors like nutrition, ancestors, kind of use, health status etc. which might act on the body measurements.

In case of more constitutional faults (e.g. disproportionate body, extremely toeing out forelimb, sickle-hocked hind limb) we could have proven their predominating presence in the population.

The Hungarian fallow donkey is real value from the untouched gene reserve. But breeders should be cautious when choose their donkeys for breeding.

References

ERNST, J. (2004): The donkey. In: Living Heritage, Old Historical Hungarian Livestock (Ed. Imre Bodó). Agroinform Publishing and Printing Ltd., Budapest, 30-33.

DELL INC., 2015: STATISTICA (data analysis software system), version 13. www.statsoft.com.

KUGLER, W. – GRUNENFELDER, H.-P. – BROXHAM, E. (2008): Donkey Breeds in Europe. Monitoring Institute, 32.

MATIUTI, M. – MATIUTI, C. – DRONCA, D. – NISTOR, E. – MOT, T. (2011): Research on Donkey Populations (Equus Asinus) in Banat. Animal Science and Biotechnologies, 44 (1), 286-290.

VLAEVA, R. – GEORGIEVA, S. – BARZEV, G. – IVANOVA, I. (2016): Morphological and phenotypic characteristics of donkeys in some regions of Bulgaria. Trakia Journal of Sciences, No. 1., 92-95.

ZÁBORSZKI, T. (2005): The morphological description of Hungarian donkey population (in Hungarian). Thesis. Szent István University, Faculty of Veterinary Science, Budapest, 46.pp.

The Cynegetic Biodiversity protection in Park Hunting Charlota (Timis County)

MATIUTI, Marcel[1] – MATIUTI, Carmen[2] – HUTU, Ioan[1] – GARLEA, Cristina[3]

[1]Faculty of Veterinary Medicine, 300645 Timisoara, Calea Aradului 119, Romania
[2]Technical Collge Azur Timisoara, Romania
[3]Romanian Academy Bucharest

Abstract

The Hunting Park of Charlota entails all the activities done in order to improve – quantitatively and qualitatively – the animal population, to know exactly each wild animal species in terms of behaviour, habitat, selection, complementary nurturing, preservation. The term of economy, which refers to preserving the cynegetic biodiversity and the agro-sylvan-cynegetic equilibrium in nature. The park benefits from all of the needed functional prerequisites, such as access roads, fodder store houses, extra foddering places for the animals and for salting, water sources, watch towers, buffer areas to the farming land. The number of specimens of deer has continuously increased, creating a much higher density per hectare than if released. Due to the fact that the natural food from the park does not provide the necessary quantity and quality as required by various existing species, complementary feeding rations have been developed to feed the game. The numbers of mouflon herds is declining now after a period in which it had raised because of the fact that mouflon lambs are and more vulnerable to disease and different enemies. Acts of poaching are added to natural predators and also the fact that the trophy from this species unfulfilling the necessary score is probably not so desirable for the hunters.

Introduction

The Hunting Center near Charlottenburg, the round village of Transylvania, is situated at a distance of 50 km of Timisoara (in the Banat County, Western Romania) and has as a goal the preservation of the local cynegetic biodiversity. The village was founded around 1770 by 30 families of Swabians who came to the region as part of the second wave of settlers from Baden Wurttenberg from Lorraine and South Tyrol, in Germany during the time of Empress Maria Theresa (VASILE, 2003). Historians say these families brought with them the plans to build their round village. The Hunting Park of Charlota was founded in 1904 and covers a surface of 1204 ha surrounded by a fence (IASR, 2014). It is under the administration of Forest District Timisoara. In December 2014 a scientific gathering celebrated 110 years of the park's continuous activity, gathering in which took part specialists who had contributed to the modernisation of the park.

Material and methods

The research has been conducted between 2003-2016 in the frame of research contract between university and the Forest District Timisoara. The aim of the research was to contribute to the modernisation of the Hunting Park and of the quality of the existent biological material. The evolution of the numbers of fallow deer (*Dama dama*) and mouflon (*Ovis aries musimon*) has been observed throughout the years and the appropriate technical solution for the park area seems to be „intensive breeding in harem" (CRACIUNESCU, 2014).

Results and discussion

There mainly live fallow deer (*Dama dama*) in the park, as well as mouflons (*Ovis aries musimon*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boars (*Sus scrofa ferus*). In terms of facilities, the park is close to famous Hunting Park Snjevica - Croatia, which was actually the Charlota's updating model (MATIUTI, 2003; MATIUTI, 2004). The park benefits from all of the needed functional prerequisites, such as access roads, fodder store houses, extra foddering places for the animals and for salting, water sources, watch towers, buffer areas to the farming land. In most cases, the parks are surrounded by a wire fence. The wires go horizontally and vertically, the resulting squares (popularly named "eyes") being wider in the upper part. The fences go down in the ground as deep as 40 cm and they are bent in the lower part so that animals cannot dig and escape. The fence's height is of 2.30 in order not to be jumped over by deer. Also, it has to be very well stretched (MATIUTI et al., 2011).

In the Figures 1 and 2 one can see the dynamic of the numbers of fallow deer (*Dama dama*) between 1904-2016 and of mouflon (*Ovis aries musimon*) between 2003-2016. In Figure 1 one can observe that the number of specimens of deer has continuously increased, creating a much higher density per hectare than if released. Due to the fact that the natural food from the park does not provide the necessary quantity and quality as required by various existing species, complementary feeding rations have been developed to feed the game. The numbers of mouflon herds (Figure 2) is declining now after a period in which it had raised because of the fact that mouflon lambs are and more vulnerable to disease and different enemies. Acts of poaching are added to natural predators and also the fact that the trophy from this species unfulfilling the necessary score is probably not so desirable for the hunters. Man can improve the natural conditions offered to these animals by planting different trees whose fruits and seeds offer yet another complementary source of food and by assuring water, ideally in a natural source. The ratios have been made by Crăiniceanu E. PhD and Matiuți M. PhD from Faculty of Veterinary Medicine Timisoara (MATIUTI, 2007). They have been thought out so that they can ensure the necessary quantity of protein, fats, energy, vitamins and minerals, to which antihelmintic drugs have been added, before and after the supplementary fodder for the disinfestations of the animals.

The individualization by ear tag and blood samples were collected from the fallow deer and the mouflon. Fodder was prepared in the Forestry District's fodder kitchen at Pischia and it was administered to the feeders in the park. Also water samples were subsequently analysed by physic chemically methods at the Faculty of Veterinary Medicine Timisoara, if they corresponded to water the animals. Thanks to the intervention by complementary feeding, of "weapon selection", of veterinary actions, one can observe that the quality of the fallow deer's trophy and of that of the mouflon have improved. For example, some horns of deer did not have the "fish back" anymore, which would have to decrease its value.

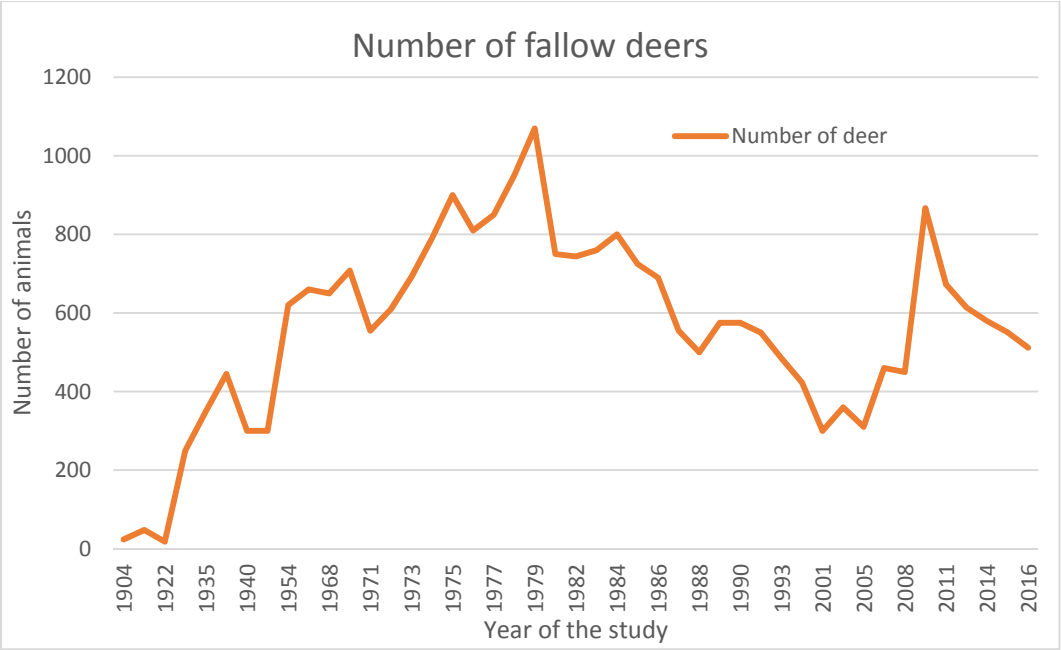


Figure 1. The evolution of the numbers of fallow deer (*Dama dama*)
Source: years 1904-2010 after Geacu S. 2012 and 2011-2016 Transilvanian Rare Breeds Association database

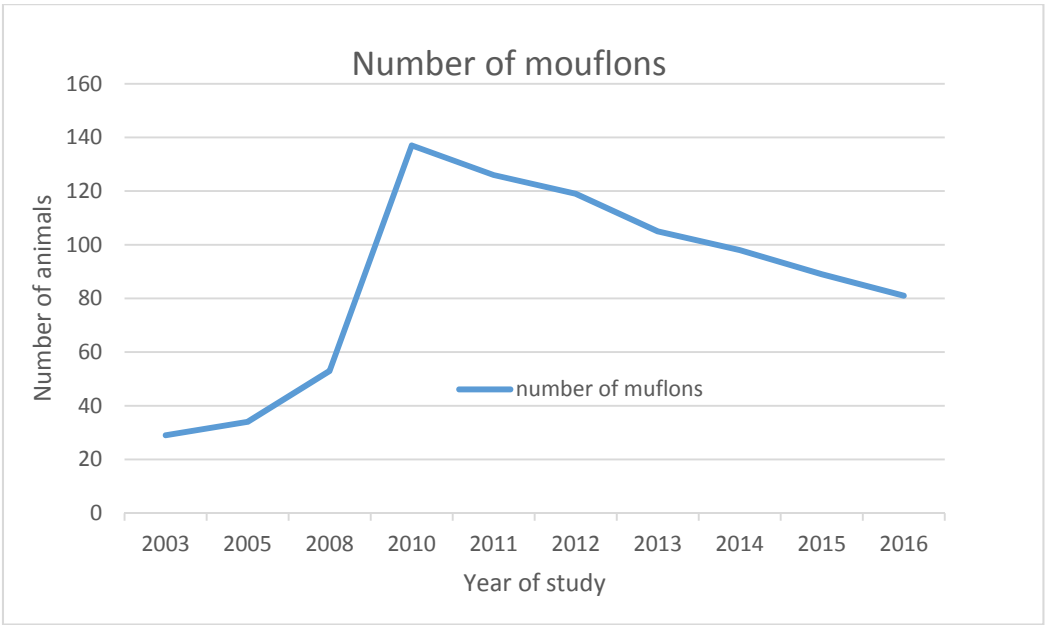


Figure 2. The evolution of the numbers of mouflon (*Ovis aries musimon*) according to Transilvanian Rare Breeds Association database

In the area around the parks there are other species such as the European pine marten (*Martes martes*), the fox (*Vulpes vulpes*), the wolf (*Canis lupus*), the wild cat (*Felis silvestris*), and the European badger (*Meles meles*).
At Charlottenburg's Museum which was arranged in the Ranger's House where numerous exhibits of game harvested in the Charlotte Park and the surrounding areas, where there is also a Center for the preservation of biodiversity.

Probably, because of climate changes a new species has emerged in the Banat and Charlota area - the golden jackal (*Canis aureus*). According to the European Directive "Habitats" the golden jackal is a species of interest for the community, whose taking in the wild and exploitation is done only by the provisions of European directives, although in the countries of S-E Europe it is considered an invasive species. The Jackal is one of the factors leading to the decrease of the mouflon lambs.

Conclusions and recommendations

The hunting parks ensure a relaxing climate for the animals there, as well as good shelter.
These parks which are true reservations of cynegetic gene banks should overlap with other protected areas such as natural reservations.
From the work of specialists administering the Charlotte Park it can be clearly proved that biodiversity hunting and sustainable exploitation of the habitat is successfully protected.
The Charlotte Hunting Park's model can be uses as a good *in situ* biodiversity practice in order to be implemented anywhere in Romania, where natural conditions meet the cynegetic requirements of the species. The Fallow deer from Charlotte contributes to the colonization in other areas of Romania or abroad: Austria, Germany, Bulgaria.

References

ALMASAN, H. (1996): Sacalul in fauna Romaniei. Rev. Vanatorul si Pescarul Roman, nr.1, 18-19.

CRACIUNESCU, A. (2014): Diversitatea faunei in ecosistemele forestiere, Editura Ceres, Bucuresti

Database of Association Transilvanian Rare Breeds

GEACU, S. (2012): Cerbul lopatar in Romania, Editura Academiei Romane, Bucuresti

Institute for Agrosylvic Research (IASR) (2014): Parcul de vanatoare Sarlota. 110 ani de activitate continua (1904-2014), Ed. Silvica

MATIUTI, M. (2003): Constituirea unui teren de vanatoare, o afacere rentabila, Rev. Agricultura Banatului, nr. 1-2, Timisoara, 17.

MATIUTI, M. (2004): Cum se organizeaza un parc de vanatoare, Rev. de Zootehnie si Medicina Veterinara, nr. 12 AGRIS, Editura Revistelor Agricole Bucuresti, 27-29

MATIUTI, M. (2007): Parcul de vanatoare, Revista Diana, nr. 1 ianuarie-martie, Editura Full Print Banat Timisoara, 4-5.

MATIUTI, M. – MATIUTI, C.L. (2011): Hunting park in the Banat of Timisoara county under cynegetic biodiversity, zoo-technical and economic aspects, The 35-th Annual Congres of the American Romanian Academy of Art and Sciences Universitatea Politehnica Timisoara iulie 26-31, Proceedings, Editura Presses Internationales Polytechnique Monreal Quebec, 96-101.

VASILE, A. (2003): Jahrhunderte vergehen. Das Heim bleibt trotzdem. Monographie des Dorfes Charlottenburg, Editura Eurostampa, Timișoara

Gegenwärtige Charakterisierung des Murnau-Werdenfelser Rindes und dessen bedrohte Lage

SCHELLINGER, Felix[1] – GÁSPÁRDY, András[1]

[1]Veterinärmedizinische Universität, Lehrstuhl für Tierzucht, Tierernährung und Labortierkunde, 1078 Budapest, István Str. 2, Ungarn

Zusammenfassung

Die Autoren veröffentlichen den Auszug einer neuen Dissertation, (SCHELLINGER, 2016) die sich mit einer vom Aussterben bedrohten, deutschen Rinderrasse beschäftigt. Die Thesis beinhaltet auch die Auswertung einer repräsentativen Umfrage, auf die aus Gründen des großen Umfangs hier leider nicht näher eigegangen werden kann.
Das Murnau-Werdenfelser Rind, auch „Oberländer“ genannt, von den Bauern als robust, genügsam und elegant beschrieben, ist eine Rasse, die in den letzten Jahrzehnten nahezu aus den Beständen verschwunden ist.

Summary
Actual characterization of the Murnau-Werdenfelser Cattle and its endangered status

The authors publish an abstract of a new dissertation, (SCHELLINGER, 2016), which deals with an endangered German cattle breed. The thesis also encloses an evaluation of a representative survey, which unfortunately cannot be mentioned here because of its large scale. The Murnau-Werdenfelser cattle, also called "Oberländer", described by the farmers as robust, modest and elegant, represents a breed that has almost disappeared from the stocks in recent decades.

Einleitung

Die Tiere sind mittelrahmig groß, schlank, behornt und mit ihren harten Klauen perfekt an die Umgebung des Voralpenlandes angepasst. Dort wurden die Tiere im Sommer auf den Bergwiesen gehalten, die mit Maschinen nur schwer zugänglich waren. Sie konnten auch schlechteres Futter verwerten. Neben den Vorteilen wie der Nutzung als Arbeitstiere und dem Erhalt der Bergwiesen, welche durch das jährliche Abgrasen von Wildwuchs und Verbuschung geschützt wurden und somit das Landschaftsbild des Voralpenraums pflegte, rückten die Nachteile der Rasse immer mehr in den Vordergrund.
Der Unterschied der Milchleistung der Murnau-Werdenfelser Rinder im Vergleich zu moderneren Milchleistungsrassen wurde immer größer, was dazu führte, dass immer mehr landwirtschaftliche Betriebe die Traditionsrasse gaben auf und damit begannen, die Rasse meist mit Braunvieh oder Fleckvieh herauszukreuzen. Auch die Nachfrage nach einer immer größeren Menge an billig produzierten Lebensmitteln drängte die Bauern zum wirtschaftlichen Umdenken. Nach und nach verschwanden Klein- und Kleinstbetriebe, welche

oft nur wenige Tiere hielten. Größere Betriebe mussten ihr Konzept ändern um weiterhin dem wirtschaftlichen Konkurrenzdruck standhalten zu können und setzten auf Rassen mit einer Prävalenz auf Milch- oder Fleischgewinnung. Das Dreinutzungsrind der Murnau-Werdenfelser, das sich durch Milch, Fleisch und Arbeit auszeichnete, wurde schnell zum Auslaufmodell. Nur noch wenige Landwirte hielten dem Druck stand und züchteten durchgehend Murnau-Werdenfelser Rinder. 1985 war der Tiefpunkt der Rasse, als nur noch zwei landwirtschaftliche Betriebe mit 39 Einzeltieren an der Milchleistungsprüfung der Murnau-Werdenfelser teilnahmen (LKV, 2015).
Einige Jahre später wurde man sich der Gefahr des Aussterbens der Rasse bewusst, doch die Anzahl der Tiere war zu gering, um ohne weiteres eine Population aufzubauen. Auch in der Bevölkerung fand ein Umdenken statt und führte zu einer vermehrten Nachfrage nach biologisch einwandfreien Produkten.
In der Fachzeitschrift der Vereine und Verbände zur Erhaltung gefährdeter Nutztierrassen „Arche Nova“ wurde das Murnau-Werdenfelser Rind zur Rasse des Jahres 2007 ernannt, die aufgrund ihrer speziellen Eigenschaften als Kulturgut erhalten werden muss (KINZELMANN und SCHEDEL, 2006). Im Rahmen eines neuen Projektes zur regionalen Förderung der Rasse sollten die Tierbestandszahlen erhöht, ein Marketingkonzept entwickelt und eine Verbindung zum Tourismus hergestellt werden (TRAUTMANN, 2016).
Die Abbildung 1 zeigt das optische Erscheinungsbild der Murnau-Werdenfelser zu sehen.

Abbildung 1: Das Murnau-Werdenfelser Rind

Phänotypische Beschreibung der Rasse Murnau-Werdenfelser

Nach Lydtin, Werner und Lehnert wird bereits Ende des 19. Jahrhunderts eine detaillierte Rassebeschreibung der Murnau-Werdenfelser vorgenommen. „Mischlinge mit vorwiegendem Braunvieh-Charakter“ sind hellgelb oder graugelb gefärbt mit einem dunklen Nasenspiegel mit senkrechtem hellem Strich halbiert, einem hell umrandeten Flotzmaul, dunkler Zunge und Gaumen sowie hellen Haarbüscheln in den großen Ohren und auf der Stirn und hell gezeichnetem Rückenstreifen. Heutzutage hat sich häufig eine rotbraune Grundfärbung durchgesetzt. Die Tiere werden durch braune Augenfarbe und schwarz umrandete Augenlider beschrieben. Die Hörner sind am Ansatz hell gefärbt und werden zur Spitze hin schwarz. Seine Fellfarbe ist am Hals, Ohren und an den Außenseiten der Gliedmaßen dunkler gefärbt als das restliche Fell. Stiere verfügen meist über eine dunklere Fellfärbung. Die Innenseiten der Gliedmaßen und der Ellenbogen sind manchmal sogar weiß, wie auch meist der Unterfuß, Sprunggelenk und Schienbein bis hin zum schwarzen Kronenrand. Schwanzquaste, After und Scheide sowie das Klauenhorn sind schwarz pigmentiert. Das Haar ist meist glatt, kurz und

glänzend und am Schopf gelockt (LYDTIN und WERNER, 1899; LEHNERT, 1882; SAMBRAUS, 2010a; STANG und WIRTH, 1928).
Die Kopfform erscheint keilförmig fein ausgeprägt und nicht besonders lang und läuft zum Maul hin spitz zu. Das Maul selbst ist breit angelegt, der Hals und Triel ist mittelmäßig stark ausgeprägt. Die Hörner sind stark und nach vorne hin nach oben gekrümmt. Das Kreuz, die Lenden, sowie die Hüften sind breit angelegt. Der vordere Teil des Rumpfes ist meist kräftiger entwickelt als das Hinterteil, sowie auch die Füße stark angelegt und im unteren Bereich fein (LEHNERT, 1896).
Das durchschnittliche Lebendgewicht einer ausgewachsenen Murnau-Werdenfelser Kuh betrug am Ende des 19. Jahrhunderts etwa 400-540 kg, eines Bullen etwa 600-750 kg und eines Ochsen ca. 500-700 kg. Die Tiere werden als schnellwüchsig und vor dem „dritten Schube“ ausgewachsen beschrieben“ (LYDTIN und WERNER, 1899).

Entstehungsgeschichte Murnau-Werdenfelser

Der Name des Murnau-Werdenfelser Viehschlags leitet sich von dem früheren Kloster Murnau und der ehemaligen Grafschaft Werdenfels ab. Der Ursprung der Rasse geht auf die Blütezeit der Klöster Ettal und Murnau zurück. Allerdings gibt es bei dem Ursprung der Rasse und bei deren Kreuzungen unterschiedliche Meinungen. So beschreibt RAMM (1901), dass der Schlag der Murnau-Werdenfelser von dem „Gelben Tiroler Vieh“ im Oberinntal aus Tierherden des Kloster Stamms abstammt und dann durch unterschiedliche Einkreuzungen mit Braunvieh, insbesondere aber auch mit „Montavoner“, „Graubündner“ und Allgäuer und Schweizer Vieh, gepaart wurden. Dafür spricht, dass die Murnau-Werdenfelser Rinder auch heute noch einen gelblichen Farbeinschlag zeigen. Auch Bluteinmischungen von „Ellinger“, „Mürztaler“ und „Murbodner“ Bullen fanden 1892 im Murnau-Werdenfelser Zuchtgebiet statt, um die gelbe Fellfarbe zu erhalten (SPANN, 1928; SÜSKIND, 1908). So schrieb Lehnert zur Eingrenzung des damaligen Zuchtgebietes: „In der äußersten Peripherie des Verbreitungsbezirks der graubraunen Gebirgsrasse finden wir das Murnau-Werdenfelser Vieh. Es ist der südwestlichste Vorgebirgsteil Oberbayerns nördlich vom Zuspitz- und dem Wettersteingebirge im Loisachtal bei Garmisch-Partenkirchen bis zum einsamen Walchensee mit seiner großartig schönen Natur, dem stillen, von hohen Bergen umschatteten Kochelsee und dem freundlichen Murnau am inselreichen Staffelsee, der uns ein Braunvieh bietet, das durch die sorgfältige Zucht einer sehr strebsamen, fleißigen, braven Bevölkerung sich fortschreitend verbessert und eine immer weitere Beachtung findet.“ Bereits damals wurden auf den großen königlichen Gütern Benediktbeuern und Schwaiganger, Seefeld sowie auch in Partenkirchen große Braunviehherden eingeführt und gezüchtet. Somit wurde das Murnau Werdenfelser Gebiet auch ein Stammzuchtbezirk für das gelbgraue Braunvieh, das sich später immer mehr durchsetzte. So schrieb LEHNERT (1896) in seinem Werk „*Rasse und Leistung unserer Rinder“: „Wir finden es bereits im Norden bis Uffing und Weilheim am Würm- und Ammersee und südwestlich vom Loisachtal bei Ettal im Graswangtal bis zum Ammerwald*“.
Es fanden auch immer wieder Kreuzungen zwischen Murnau-Werdenfelser Rindern und dem ansässigen Braunvieh statt, um eine Steigerung der Milchleistung zu erzeugen. Nach HIBLER (1909) wird der Ursprung der Murnau-Werdenfelser Rasse, dem „einfarbigen Gebirgsrind“, von Tacitus Plinius Culumella und Strabo aus der Kreuzung eines braunroten keltischen Alpenrindes mit dem weißen Steppenrind erklärt.

Tabelle 1: Milchleistungsprüfungsbetriebe des Murnau-Werdenfelser Schlages (Landeskuratorium der Erzeugerringe für tierische Veredelung in Bayern e.V. (LKV), 2015)

Jahr	Betriebe	Kühe	Jahr	Betriebe	Kühe
1933	31	279	1975	18	251
1935	209	1673	1980	2	39
1940	1968	10090	1985	3	56
1945	2374	11424	1990	18	201
1950	200	1845	1995	15	154
1955	207	2066	2000	14	184
1960	156	1739	2003	10	174
1965	128	1717	2008	9	110
1970	101	1582	2015	53	258

Zunächst im Pustertal gezüchtet wurden die Tiere über den Abt des Klosters Schlehdorf ins Werdenfelser Land gebracht. Bereits Hibler beschreibt, dass schon im 19. Jahrhundert die heimisch gewordenen Tierbestände durch das experimentierfreudige Einkreuzen von Simmentaler Fleckvieh stark zurückgedrängt oder gar gefährdet wurden. Er beschreibt auch, dass die werdenfelser Landwirte stolz auf ihren „gelben Schlag“ waren und somit die Rasse aus Traditionsgründen beibehielten. Nach SCHEDEL (1987) wurden nach der Gründung des Zuchtverbandes 1927 für das Murnau-Werdenfelser Vieh keine Einkreuzungen vorgenommen. Erstmalig 1986 wurden wieder südostfranzösische Tarentaise Bullen in sechs verschiedenen Herdbuchbetrieben eingekreuzt. Laut Sambraus lag der Höhepunkt der Zucht um 1900 im Königreich Bayern mit ca. 62.000 Murnau-Werdenfelser Rindern, was ca. 19% der ca. 3,3 Millionen Rinder in Bayern ausmachte.

Ursachen und Gründe für die negative Entwicklung der Population im 20. Jahrhundert

Die positiven Leistungen der Murnau-Werdenfelser Rasse rückten im Laufe des 20. Jahrhunderts immer mehr in den Hintergrund. Um die Jahrhundertwende beschreiben LYDTIN und WERNER (1899) die Vorzüge der Murnau-Werdenfelser Rinderrasse: *„In erster Reihe Milchergiebigkeit, sodann Mastfähigkeit und Arbeitstüchtigkeit*“.
Die Murnau-Wedenfelser Rasse entsprach den damaligen Erwartungen der Bauern. Die Tiere waren genügsam und anspruchslos und konnten im Sommer das, auf den fruchtbaren Verwitterungsböden der Kalkalpen, wachsende Gras optimal verwerten und kamen mit dem feuchten Gebirgsklima gut zurecht (KRONACHER, 1911). Auch Ihre schwarzen Klauen, welche als besonders hart und widerstandsfähig galten, waren bestens an die steilen Gebirgshänge und moosigen Wiesen, auf denen die Tiere während des Sommers gehalten wurden, optimal angepasst. Vor allem brachten die Murnau-Werdenfelser die berühmten, gängigen und schweren Zugochsen hervor, die von vielen Betrieben gut ausgebildet wurden. Eine rasche Ausbreitung von Garmisch bis Kochel, Starnberg und Landsberg wirkte sich negativ auf die Zuchtstierentwicklung aus, da meist die besten Stierkälber zur Ochsenaufzucht verwendet wurden. So kam es, dass viele Einkreuzungen aus anderen Rassen, wie „Ellinger“, „Franken“, „Allgäuer“ und „Montavoner“ Stiere zur Weiterzucht verwendet wurden. Nur die Gebiete im engsten Raum um Murnau blieben von derartigen Einkreuzungen verschont. Reinblütige Stiere wurden immer seltener und eine Umstellung auf andere Rassen wurde nötig (KINZELMANN und SCHEDEL, 2006). Durch die zunehmende Verdrängung mit leistungsfähigem und gut durchgezüchtetem Braunvieh im Westen und Fleckvieh im Osten wurde 1901 von Vertretern der Landwirtschaftlichen Bezirksvereine der“ Zuchtverband für einfarbiges Gebirgsvieh in Oberbayern“ gegründet. Ziel des Verbandes in Weilheim in

Oberbayern war es, Zucht, Leistung und Absatz des einfarbigen Gebirgsviehschlags zu fördern, worunter auch das heimisch gewordene Braunvieh zählte. Immer wieder gab es Bemühungen zur Rassenbereinigung und zur Förderung der Rasse, Viehschauen, Zuchtstiergenossenschaften, Aufnahme ins Herdbuch und Aufkauf von Zuchtstieren. 1904 konnten erstmals vier Murnau-Werdenfelser Stiere auf dem Zentrallandwirtschaftsfest in München mit dem Ehrenpreis prämiert werden. Mit dem Ausbruch des „Ersten Weltkrieges" gab es große Rückschläge, da für die Zucht essentielle Herdbuchtiere geschlachtet werden mussten, die Herdbuchführung wurde eingestellt und der Zuchtverband konnte nicht weitergeführt werden. Nach dem „Ersten Weltkrieg" kam es zu einem erneuten Aufschwung der Rasse durch Tierschauen, Milchleistungspreise und Melk- und Viehhaltungskurse. Zwischen den beiden Weltkriegen wurde die Weiterentwicklung der Rasse durch verschiedene Seuchen und Krankheiten wie Tuberkulose, Brucellose sowie Maul- und Klauenseuche gebremst. Auch die Weltwirtschaftskrise, sowie Inflation und Staatsverschuldung brachte die genossenschaftliche Stierhaltung zum Erliegen. Im Bezirk Garmisch- Partenkirchen waren die Murnau-Werdenfelser 1927 die einzig registrierte Rinderrasse. Einen eigenen Zuchtverband, nur für das Murnau-Werdenfelser Vieh, gab es erstmals 1952 (SAMBRAUS, 2010b).
Vor allem in den 60er Jahren nahm die Umstellung auf andere leistungsfähigere Rassen zu. Zwischen den Jahren 1970 und 1975 schrumpften die Herdbuchbetriebe von 60 auf 6 Betriebe. Erst als 1980 Samenproben und Embryonen (7215 Spermaportionen von 17 Bullen und 14 Embryonen) vom Zuchtverband tiefgefroren wurden und eine Mutterkuhherde der Murnau-Werdenfelser als Genreserve gehalten wurde, kam neues Interesse an der Erhaltung der Rasse auf. Auch an der Zahl der Betriebe, die an einer Milchleistungsprüfung teilnahmen, kann die negative Entwicklung nach dem „Zweiten Weltkrieg" beobachtet werden (siehe Tabelle 1; LKV, 2015).
Es ist ebenfalls festzustellen, dass die Zuchterfolge bei dem Murnau-Werdenfelser Rind, gegenüber den weitaus mehr verbreiteten Konkurrenzrassen Fleckvieh und Braunvieh mit wesentlich höheren Leistungsmerkmalen gering ausfiel und bei den Landwirten zu Motivationsproblemen führte, die Rasse zu erhalten. Umso wichtiger wurde die Entwicklung eines umfangreichen Zuchtprogrammes auf molekulargenetischer Basis, um größere Zuchtfortschritte zu erreichen. Die nebenstehende Tabelle verdeutlicht die rücklaufenden Tierzahlen.

Schlussbetrachtung

In meiner Arbeit wurde die vom Aussterben bedrohte Rasse der Murnau-Werdenfelser Rinder aus verschiedenen Perspektiven betrachtet, mit der Zielsetzung, den Erhalt der Rasse zu fördern. Insbesondere wollte ich im Kontakt mit den Züchtern und Haltern die Chancen und Möglichkeiten herausarbeiten, um den kleinen Tierbestand zu erhöhen. Auch war es mir wichtig, die Probleme und Einschätzungen der Bauern festzustellen. Denn letztendlich kann diese bedrohte Rasse nur mit engagierten Landwirten und Züchtern in der Praxis dauerhaft überleben. Von besonderer Bedeutung ist hier der wirtschaftliche Faktor, da die meisten Halter mit ihren Tieren ihren Lebensunterhalt finanzieren und somit auf eine faire Entlohnung für die qualitativ hochwertigen Produkte angewiesen sind. Bemerkenswert ist, dass die Tiere im Voralpenraum in Klein- und Kleinstbetrieben extensiv gehalten werden und ein hohes Maß an Handarbeit notwendig ist. Ich konnte feststellen, dass viele ehemals konventionelle Betriebe bereits auf eine biologische Haltung umgestellt haben und immer mehr dieser Bewegung folgen. Gleichzeitig vollzieht sich in der Bevölkerung ein Trend in Richtung gesunder Ernährung, in der die Nachfrage nach regionalen, qualitativ hochwertigen

Nahrungsmitteln steigt. Diese Entwicklung kommt dem Erhalt der „Murnauer“ zugute, da sie für ihre Fleisch- und Milchqualität längst bekannt sind. Da bei dieser Rasse zwar nur mit geringen Fleisch- und Milchleistungen zu rechnen ist, können durch ein ausgeklügeltes Vermarktungskonzept spezielle Produkte von höchster Qualität zu höheren Verkaufspreisen auf den Markt gebracht werden. Aktuelle Beispiele sind die Herstellung von Käse aus reiner Murnau-Werdenfelser Milch in der Schaukäserei Ettal oder auch die organisierte Abnahme von Schlachttieren zu höheren ökonomischen Preisen durch die „Murnau-Werdenfelser Fleischhandel GmbH“ unter der Leitung von Jürgen Lochbihler. Ein nicht zu verachtender Gesichtspunkt ist die Landschaftspflege, die durch die extensive Weidehaltung der „Oberländer“ betrieben wird. So sind meines Erachtens die Murnau-Werdenfelser mit ihren besonderen Eigenschaften, die schon vor Jahrhunderten von unseren Vorfahren sehr geschätzt wurden, bestens angepasst und geeignet. Die genügsamen und robusten Tiere können einen großen Beitrag zum Natur- und Umweltschutz auf unseren mageren Berg- und Almwiesen leisten.
Ein weiterer Aspekt, der in meiner Arbeit nur am Rande erwähnt und behandelt werden kann, ist die Verringerung der Inzucht bei kleiner Population. Gerade dieses Problem wird in der Zukunft über das langfristige Fortbestehen der Rasse entscheiden. Da, wie bereits erwähnt, die gesamte Zuchtpopulation der „Murnauer“ auf nur drei Blutlinien zurückzuführen ist, ist nur noch eine geringe genetische Variabilität vorhanden, der große Aufmerksamkeit geschenkt werden muss. Die Wissenschaft und die Forschung müssen in Zusammenarbeit mit Landwirten in der nächsten Zukunft ein großes Problem der genetischen Enge lösen und Modelle entwickeln. Die Bayerische Landesanstalt für Landwirtschaft fordert eine nachhaltige Erhaltung der genetischen Ressourcen (ADR, 2010). Das Voralpenland ist als Tourismusregion weltweit bekannt. Die Urlauber genießen in meiner Heimat die wunderbare Natur und Landschaft mit Almen und Bergwiesen. Das Murnau-Werdenfelser Rind ist von optisch besonderer Schönheit und eine außerordentliche Touristenattraktion. Aus diesem Grund ist es auch von Bedeutung, dieses einzigartige Kulturgut zu schützen und zu erhalten, um auch die nachfolgenden Generationen daran teilhaben zu lassen.
Insgesamt ist zum Erhalt dieser bedrohten Nutztierrasse enge Zusammenarbeit von Züchtern, Zuchtverband, Landeskuratorium der Erzeugerringe für tierische Veredelung in Bayern und Öffentlichkeit notwendig, um das angestrebte Zuchtziel zu erreichen. Um den Bestand der Murnau-Werdenfelser Rasse zu sichern, ist ein Beitritt der Landwirte in den Zuchtverband, die Registrierung im Herdbuch und die Teilnahme an einer Milchleistungsprüfung eine wichtige Voraussetzung.

Literaturverzeichnis

ADR (2010): Arbeitsgemeinschaft Deutscher Rinderzüchter e. V., Monitoring tiergenetischer Ressourcen. Bayerische Landesanstalt für Landwirtschaft.

GRAML, R. – SCHMID, D.O. – ERHARD, L. – BUCHBERGER, J. – OHMAYER, G. – PIRCHNER, F. (1986): Verwandtschaft des Murnau-Werdenfelser Rindes zu anderen Rassen. Bayer. Landw. Jahrbuch, 63, 273-281.

HIBLER, I. (1909): Vom Werdenfelser Rind. Deutsche Landwirtschaftliche Tierzucht, S. 25.

KINZELMANN, M. – SCHEDEL, K. (2006): Rasse des Jahres 2007 - Das Murnau-Werdenfelser Rind. Amt für LWF- Weilheim, Arche Nova 4., S. 4-6.

KRONACHER, C. (1911): Die Entwicklung der bayrischen Rinderzucht. Schaper, Hannover. S. 20.

LKV (2015): Landeskuratorium der Erzeugerringe für tierische Veredelung in Bayern e.V., Milchleistungs- Betriebe des Murnau-Werdenfelder Schlages.

LEHNERT, H. (1882): Die Rinder Rassen Deutschlands, Hollands, der Schweiz und der gesuchtesten Österreichs. Druck von Max Bading, Berlin. S. 228.
LEHNERT, H. (1896): Rasse und Leistung unserer Rinder. Verlagsbuchhandlung Paul Parey. Verlag für Landwirtschaft, Gartenbau und Forstverein, Berlin. S. 229.
LYDTIN, A. – WERNER, H. (1899): Das deutsche Rind. Unger- Verlag, Berlin. S. 26., 406., 409., 411.
RAMM, E. (1901): Die Arten und Rassen des Rindes. Eugen Ulmer Verlag, Stuttgart. S. 126.
SAMBRAUS, H. (2010a): Farbatlas. Seltene Nutztiere. Eugen Ulmer KG, Stuttgart. S. 191.
SAMBRAUS, H. (2010b): Gefährdete Nutztierrassen: Ihre Zuchtgeschichte, Nutzung und Bewahrung. Eugen Ulmer Verlag, Stuttgart. S. 187., 189.
SCHEDEL, K. (1987): Das Murnau-Werdenfelser Rind in der Gegenwart. Züchtungskunde. Eugen Ulmer Verlag GmbH & Co., Stuttgart. S. 185.
SCHELLINGER, F. (2016): Das Murnau-Werdenfelser Rind, eine Rinderrasse vom Aussterben bedroht. Thesis, Veterinärmedizinische Universität, Budapest
SPANN, J. (1928): Tierheilkunde und Tierzucht. Urban & Schwarzenberg, Berlin. S. 317.
STANG, V. – WIRTH, D. (1928): Tierheilkunde und Tierzucht. Eine Enzyklopädie der praktischen Nutztierkunde. Urban & Schwarzenberg, Berlin. S. 316.
SÜSKIND, P. (1908): Der Murnau-Werdenfelser Viehschlag und seine Zukunft. Süddeutsche landwirtschaftliche Tierzucht. München, Hannover- FAZ, 06.11.2008, S. 361.
TRAUTMANN, I. (2016): Hartnäckigkeit soll sich auszahlen. Kreisbote Garmisch-Partenkirchen, 27.04.2016, S. 1, 2.

The Romanian Grey Steppe characterisation – the breed evolution in the last century from the numerical and morphological point of view

DASCĂLU, Dan-Lucian[1] – CREANGĂ, Șteofil[1,2] – BORȘ, Silviu-Ionuț[1] – DOLIȘ, Marius-Gheorghe[2] – SIMEANU, Daniel[2] – DONOSĂ, Raluca[2]

[1]Research and Development Station Bovine Dancu, 9, Iași-Ungheni Street, Iași, 72002, Romania
[2]"Ion Ionescu de la Brad" University of Agricultural Science and Medicine Veterinary, 3, Mihail Sadoveanu Alley, Iaşi, 700490, Romania

Abstract

Taking into account the fact that in Romania the Grey Steppe breed may be found less than 150 specimens and accordingly with the international standards can be considered a cattle breed with a certain risk of extinction, being included in a critical category.
From the productive point of view, the breed no longer responds to the actual needs, but due to its historical, economic and genetic role seen as a resource of valuable genes, this breed is still considered very important, fact which imposes the preservation of this biological source as a main priority due to the situation in which it can be found, an almost extinct breed.
The revaluation of breeding cattle with a high risk of extinction for the preservation of the valuable genetic fond and the assurance of the genetic diversity of the animals' populations is a current theme which preoccupies the specialists in the field.
This approach is the major priority, given the conditions in which the extinction process of certain animal populations can irremediably affect the biodiversity of the genetic resources, this being essential for the production of goods of animal origin and the preservation of the planning diversity, as a source of income for the farmers and as an important part of the natural and cultural legacy of a country.
The current state of the issue regarding the cattle preservation for the endangered breeds determines us to continue these studies and finding the most modern and efficient preservation methods of these valuable resources in the genetic fond, represented by the Grey Steppe breed.

Introduction

The aim of this paper is to achieve of an inventorying study of the total population of Grey Steppe breed for the identification of the total effective of the cattle from this breed, which remained in Romania.
Romania, enrolled in the F.A.O. program of the conservation and management of animal genetic resources aligns itself to the policies of assessment and preservation of genetic fund of endangered breeds, the case of the Grey Steppe breed.
Raised throughout the country and under the strong influence of the environment, the Romanian Grey Steppe breed acquired outstanding properties regarding rusticity, resistance to the environment conditions, health, which were printed in the hereditary basis and were

transmitted through generations until today. The performance in the milk and meat production are still modest, being strongly influenced by less favourable environmental conditions from small stakeholders where has been grown and selected. Along the time, the Romanian Grey Steppe breed has undergone to a long process of crossing absorption with improved breeds such as, Simmental, Schwyz, Pinzgauer, Friesian; thus, contributing to the formation of Romanian improved breeds Romanian Spotted, Brown of Maramures, Romanian Black Spotted and Pinzgau of Transylvania (CREANGĂ et al., 2010).
Grey Steppe breed is one of the oldest indigenous breeds, which was formed from Bos Taurus primigenius, having common origin with other European breeds (Andaluza, Romagnola, Zamoranos, Salers, Podolite, Ukrainian Grey Steppe, etc.).
The Grey Steppe breed strain which includes the Romanian Grey Steppe breed also, has its origin in the plains of Ukraine from where this breed type had spread in the Balkans and in the Mediterranean region, where were formed Podoliantype breeds.

Material and methods

The research was carried out on 122 cows which were arranged in 8 groups: 3 groups in bovine breeding units: SCDCB Dancu Iaşi (38 heads), USAMV Cluj (4 heads), Roua-GrupIalomiţa (3 heads) and 5 groups in the smallholder farms from Neamţ county (Tazlău - 6 heads, Tupilaţi - 7 heads) and Tulcea (ChiliaVeche - 39 heads, Letea - 18 heads and Pardina - 7 heads). Through biometric determinations, it was followed the cows physical growth from the units used in the study.
The statistical interpretation and processing of obtained data was carried out with the aid of the SPSS 19 program referring to the position and variation estimators (arithmetic average X, standard deviation of the average ±s, standard deviation s, variation coefficient V%) for the studied characteristics.
The establishment of the differences significance between the features values to the analysed groups was carried out with the aid of the Fischer test, through the ANOVA method.
The information was received from the Animal Improvement and Reproduction Offices.
Based on the data received from the Offices, the geographical distribution of the cattle was established, in which the population of the Grey Steppe breed was located, in what the owners and the number of the individuals from the population is concerned, in pure breed or half-breed.

Results and discussion

Until 1850, the cattle livestock in our country consisted of two indigenous breeds Romanian Grey Steppe and Mocăniţa. The Romanian Grey Steppe was more widespread in the steppe areas being extended until the second half of the nineteenth century to a very vast geographical area, occupying the entire Old Kingdom, central and western Transylvania, and also the center of the Bassarabia. The Mocanița breed was widespread in mountainous areas. After 1892 when the first law regarding the imports of improved breeds (Simmental, Schwyz, Pinzgauer), the local breeds declined in numbers. So in 1935 the Romanian Grey Steppe breed decreased to approximately 57.3% of the total cattle herd, and in 1977 to 0.6% (CREANGĂ et al., 2010).
The official statistics presented by FAO concerning the number of Romanian Grey Steppe breed indicates that in 1986 there were over 500 animals of this breed, and in 1996 only 200 animals are found (Table 1).

In the year 2012 there was carried out a study regarding the cattle population of Romanian Grey Steppe breed raised in the Moldavia counties (Botosani, Suceava, Vaslui, Bacau, Neamt, Galati, Vrancea) and 2 counties in the southeast: Tulcea and Brăila.
It was established the geographical distribution of cattle breeds from the N, NE, SE part of the country, and within it was placed the cattle Romanian Grey Steppe breed, concerning the area where they are grown, the number of individuals in the population depending the type of growth, pure breed or half-breed respectively.

Table 1. Structure of the Grey Steppe breed in Romania

Year		Population	Breeding males	Breeding female	Females registered in RG	Purebred females
1986	no.	>513	13	500	60	85
1993	no.	>362	12	350	16	65
1994	no.	>357	7	350	16	65
1996	no.	>200	-	200	25	100

Within the breed structure, Romanian Steppe Grey raised as pure breed occupies the 8th place with a population of 83 heads (0.03%), which are located in two counties, in Iasi 59 heads, (0.19%) and in Neamt 24 heads respectively (0.06%). As half- breed, it occupies the 5th place, with a population of 592 heads (0.33%), also located in Iasi and Neamt counties (CREANGĂ et al., 2012).
Currently, it is found in very low flocks, isolated specimens or undefined half-breed in households from the north-east of Moldova, in the Iasi, Neamt counties and in the Danube Delta, and pure breed, are still raised to the Research Development Station for Cattle Breeding, Dancu Iași with an average hear of 50 animals.
From morphologic point of view, the Romanian Grey Steppe breed body development is medium, the constitution type is robust-compact, sometimes with tendency to coarse/ gross one and a dynamic temperament. They are animals with a high resistance to disease and weather conditions, tuberculosis, brucellosis and enzootic cases are rare. The animals' exterior of this variety is characteristic for the primitive breeds, with many faults especially to legs and udder.
The head has horns with characteristic shape and development and with a yellowish-white colour at base and black at the top. To the bulls, the head expresses better secondary sexual characters being slightly convex in profile, with greater width between the orbits, the horns are shorter and thicker. The cows head is relatively long, narrow, straight profile, expressive, fits the craniology type of *primigenius*. The *neck* is long, thin and weak muscled to cows and to the bulls is strong, with the crest highly developed, printing the masculinity character very well.
The upper body line is sinuous, with high, long and narrow, poorly muscled withers, the back and loins are narrow and underdeveloped muscles. At the croup, the sacrum is prominent; the rump direction is oblique anterior-posterior. The croup is poorly dressed in muscles, narrow to ischia, which is an obvious fault with implications in the act of parturition.
Cows have a narrow brisket, with a weak muscle, poor arched ribs, with obliquely spine, defining a narrow thorax but not deep enough. The udder is underdeveloped, with uniform nipples, reduced glandular tissue, the udder skin is well covered with hair and the vascularity is not well seen.
The legs are strong, with strong joints, the hooves are very resistant and black in colour. Legs frequently show obvious faults.

Colour is grey with darker shades on the head, neck, limbs and flanks and on the top line and abdomen, the colour is silvery-white. Calves at birth have yellowish reddish colour uniform throughout the body, which changes after shedding, around the age of three months when it becomes grey-grey feature race.
The productive longevity is remarkable, cows being used up to 11-12 years, but there are animals that are exploited up to 16-20 years or even above this age. But these are animals with a reduced precocity even under optimum feeding and maintenance conditions.
Studies from literature regarding the body development to Romanian Grey Steppe breed currently existing in our country have their analogy in research conducted in the interbelic and postbelic period for the Moldavian variety, because after this period all the other varieties of the breed disappeared, preserving only individuals from Moldavian variety.
Values regarding the body height at the withers varies over the time between 128 and 133.39 cm. Currently in the performed study, this parameter records an average of 129.5 cm to SCDCB Dancu, 119 cm to USAMV Cluj, 123 cm Roua-Grup, 123 cm and 119.42 cm for cattle in Neamt, and 120.35 to 121.16 cm for cattle from Delta ascertaining the decrease in the value of this character to levels that fall below the recorded minimum value according to data from literature.
Statistical analysis (ANOVA) for this character shows significant differences between the values both among cattle from different breeding units and private owners (Tables 2, 3).
Oblique body length presents values between 141.99 and 157.73 cm according to the literature compared with the values obtained from the studied farms which varies between 130.85 and 157 cm; can be noticed a preservation of this character till present day, with the exception of the cattle from Pardina locality where the body dimensions are lower for this character (130.85 cm).
Between cattle breeding specialised units there is insignificant difference regarding the values for this character, unlike the groups from smallholders where there is a significant difference.
In the specialty literature, the heart girth presents the following values 167.13 (1925) and 189 cm (2009), (1920- Dumitrescu A.; 1925- Constantinescu G.K.; 1928- Ţurcanu T.; 1947- Cardaş A.; 1949- Dincă Gh. şi Ţurcanu T.; 1961,1963- Miriţă I.; 1982- Miriţă I.; 2009- Creangă Ş., Maciuc V., cited by Creangă et al., 2012), and nowadays, thevalues for this character range between 168.42 cm to Pardina and 194.3 cm to S.C.D.C.B. Dancu; the value of this character is higher in present. There are insignificant differences for this character to the studied groups.
Concerning the body weight, currently it remains to high values (from 393.42 to 500.3 kg) compared to the values cited from the literature (372 kg in 1961 and 415 kg in 1982, (1920- Dumitrescu A.; 1925- Constantinescu G.K.; 1928- Ţurcanu T.; 1947- Cardaş A.; 1949- Dincă Gh. şi Ţurcanu T.; 1961,1963- Miriţă I.; 1982- Miriţă I.; 2009- Creangă Ş., Maciuc V., cited by Creangă et al., 2012). There are no significant differences for this character to the studied group.
To the animals raised in specialised units may be noticed significant differences for all the values of the studied morphological parameters, analysed to the first lactation. In smallholder farms may be noticed significant differences for height to rump, the oblique and horizontal body length, the chest width and whistle perimeter, and very significant differences for the tail height, chest width, stern height, rump, head and chest length and widths to chest and rump measured to the hip and the hip-femoral joint (Table 2, 3).

Table 2. The statistical significance of the differences of the main morph-productive characters of Grey Steppe breed on specialized units

	Specification		Withers height	Thorax width	Thorax depth	Thorax perimeter	Oblique body length	Hip width	Coxo-phemural width	Rump length	Whistle perimeter	Body weight
	U.M.		cm	cm	cm	cm	cm	cm	cm	cm	cm	Kg
parturition	SCDCB Dancu	n	38	38	38	38	38	38	38	38	38	38
		$\bar{X}$	71.7	17.2	33.6	77.4	68.8	18.2	19.8	23.0	8.15	29.4
	USAMV Cluj	n	4	4	4	4	4	4	4	4	4	4
		$\bar{X}$	69.3	16.2	31.5	75	65	17.5	18.5	23	7.25	30.8
	ROUA-GRUP	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	71.0	17.3	35.3	78.3	69.0	18.3	21.3	23.2	8.16	29.3
	Anova	F	1.215	1.568	3.811	3.724	7.544	0.450	7.594	0.008	0.432	1.186
		p	0.306	0.220	0.030	0.032	0.001	0.640	0.001	0.992	0.652	0.315
	Significance		Ns	Ns	*	*	***	Ns	***	Ns	Ns	Ns
6 lmonth	SCDCB Dancu	n	38	38	38	38	38	38	38	38	38	38
		$\bar{X}$	96.9	25.1	40.6	135.9	109.3	24.6	26.0	30.2	10.81	221.1
	USAMV Cluj	n	4	4	4	4	4	4	4	4	4	4
		$\bar{X}$	97.0	24.2	42.0	134.8	107.7	30.2	28.5	32.5	13.25	205
	ROUA-GRUP	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	95.3	23.8	41.0	144.3	109.3	21.3	24.3	30.7	9.33	213.3
	Anova	F	0.045	0.191	0.489	0.386	0.037	2.798	1.631	0.878	2.423	0.188
		p	0.956	0.827	0.617	0.682	0.963	0.072	0.207	0.423	0.100	0.830
	Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns
12 month	SCDCB Dancu	n	38	38	38	38	38	38	38	38	38	38
		$\bar{X}$	109.0	30.9	49.5	146.0	123.4	34.3	32.6	38.6	14.39	277.9
	USAMV Cluj	n	4	4	4	4	4	4	4	4	4	4
		$\bar{X}$	106.5	33.5	49.0	147.0	117.7	36.5	33.5	38.5	15.5	296.2
	ROUA-GRUP	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	107.6	26.6	47.0	136.6	122.6	34.0	31.0	36.0	14.66	231.6
	Anova	F	0.561	2.025	0.596	1.228	1.258	0.578	42.740	1.169	0.471	1.907
		p	0.574	0.144	0.555	0.303	0.294	0.565	0.000	0.320	0.627	0.160
	Significance		Ns	Ns	Ns	Ns	Ns	Ns	***	Ns	Ns	Ns
18 month	SCDCB Dancu	n	38	38	38	38	38	38	38	38	38	38
		$\bar{X}$	116.0	36.0	57.1	164.9	132.6	41.8	41.7	46.1	15.28	360.2
	USAMV Cluj	n	4	4	4	4	4	4	4	4	4	4
		$\bar{X}$	114.5	37.0	54.7	160.0	132.0	43.2	40.3	44.8	16.75	356.5
	ROUA-GRUP	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	115.3	35.3	55.3	160.6	136.0	41.6	44.0	46.7	13.66	352.6
	Anova	F	0.340	0.153	0.553	1.080	0.379	0.186	1.600	0.424	2.705	0.111
		p	0.714	0.859	0.579	0.348	0.687	0.831	0.213	0.657	0.078	0.895
	Significance		Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns
Ist lactation	SCDCB Dancu	n	38	38	38	38	38	38	38	38	38	38
		$\bar{X}$	122.7	43.7	63.6	181.7	149.8	45.1	43.1	49.6	17.21	500.3
	USAMV Cluj	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	119.0	38.3	63.0	170.0	137.0	43.0	41.0	47.0	16.33	417.6
	ROUA-GRUP	n	3	3	3	3	3	3	3	3	3	3
		$\bar{X}$	124.3	44.0	63.0	176.3	158.3	46.0	43.3	49.3	17.66	506.6
	SC 3Brazi	n	12	12	12	12	12	12	12	12	12	12
		$\bar{X}$	121.9	41.2	69.3	190.9	140.3	47.3	44.8	48.2	18.08	548.0
	Anova	F	0.774	2.169	0.073	4.709	2.401	2.430	2.063	1.327	3.608	154.27
		p	0.514	0.102	0.974	0.005	0.078	0.075	0.116	0.275	0.019	0.000
	Significance		Ns	Ns	Ns	***	*	*	Ns	Ns	***	***

Table 3. The statistical significance of the differences of the main morphologic characters of Grey Steppe breed on individual households

Specification	Tazlău		Tupilaţi		ChiliaVeche		Letea		Pardina		ANOVA		
	n	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	F	P	Significance
Withers height	6	123	7	119.4	39	120.5	18	121.2	7	120.4	0.402	0.807	Ns
Back height	6	121.5	7	120.6	39	119.8	18	119.6	7	117.0	1.073	0.376	Ns
Rump height	6	124.7	7	124.0	39	124.0	18	123.2	7	118.0	3.555	0.011	*
Tailbase height	6	125.7	7	125.0	39	124.9	18	124.2	7	117.8	6.083	0.000	***
Thorax depth	6	69.7	7	68.9	39	65.7	18	63.6	7	57.2	4.440	0.003	***
Sternum height	6	53.3	7	50.6	39	54.8	18	57.6	7	63.1	8.924	0.000	***
Body lenght	6	148.5	7	149.7	39	146.4	18	144.8	7	130.9	3.111	0.020	*
Oblique body lenght	6	135.7	7	131.1	39	134.3	18	139.9	7	122.6	2.978	0.025	*
Total lenght	6	190.8	7	191.4	39	182.8	18	179.9	-	-	1.392	0.253	Ns
Rump lenght	6	49.0	7	47.7	39	50.1	18	48.6	7	32.6	13.363	0.000	***
Thotax lenght	6	84.2	7	83.6	39	80.4	18	78.6	7	67.1	4.734	0.002	***
Head lenght	6	47.7	7	48.0	39	46.6	18	46.2	7	41.3	5.223	0.001	***
Thorax width	6	44.7	7	44.6	39	43.5	18	40.0	-	-	2.833	0.045	*
Brisket depth	6	40.0	7	39.7	39	38.5	18	36.4	7	30.6	9.197	0.000	***
Hip width	6	47.3	7	49.1	39	47.2	18	45.8	7	36.4	9.670	0.000	***
Coxo-phemural width	6	42.7	7	42.7	39	42.1	18	42.1	7	34.4	10.5	0.00	***
Ischium width	6	17.5	7	16.6	39	16.7	18	17.5	7	16.7	0.519	0.722	Ns
Head width	6	21.5	7	21.4	39	21.0	18	20.8	7	20.3	0.639	0.636	Ns
Thoracix perimeter	6	187.8	7	184.9	39	179.4	18	175.9	7	168.4	2.366	0.061	Ns
Cannon perimeter	6	17.4	7	17.6	39	17.9	18	18.4	7	16.6	2.743	0.035	*
Body weight-kg	6	541.0	7	486.4	39	461.9	18	436.7	7	393.4	2.001	0.103	Ns

Conclusion and recommendation

For the main analysed parameters, this study determines the following: a reduction of the height to withers with values that decrease under the minimum value reported by the specialty literature; a conservation of the value for horizontal length of the body at present, and an increase of the thoracic parameter and of the body weight, as a result of improvement of breeding and feeding conditions.

References

CREANGĂ, ŞT. – MACIUC, V. (2010): Rasa Sură de Stepă din România, Editura ALFA Iaşi, pg. 1-318.

CREANGĂ, ŞT. – DASCĂLU L. et al. (2013): Demographic study on the total Sura de Stepă breed population in Romania, Cercetări Agronomice în Moldova Vol. XLVI, No. 2 (154) / 2013, pg. 85-97.

http://www.fao.org/dad-is

Potentials of Istrian Cattle in beef production

IVANKOVIĆ, Ante[1] – ŠUBARA, Gordan[2] – ŠURAN, Edmondo[2] – RAMLJAK, Jelena[1] – KONJAČIĆ, Miljenko[1]

[1]Department of Animal Science and Technology, University of Zagreb, Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia (aivankovic@agr.hr)
[2]Agency for Rural Development of Istria, Ulica prof. Tugomila Ujčića 1, 52000 Pazin, Croatia (http://www.azrri.hr/)

Abstract

Istrian cattle are one of the autochthonous cattle breeds in Croatia. On national level, more than twenty years Croatia supports the revitalization of the population through direct subsidies to the breeders of Istrian cattle. Regional government supports different programs of economic reaffirmation of Istrian cattle as long term sustainable model for preserving the breed. Actual program is the affirmation of the breed through the production, processing and marketing of Istrian beef meat. In order to better understand production opportunity, we investigate production indicators of the Istrian cattle in the beef production. Average live weight of young bulls was 604 kg, older bulls 675 kg and cows 536 kg. Young bulls achieved average daily gain of 818 g/day and older bulls 638 g/day. Cold carcass weight in group of young bulls, older bulls and cows was 340.9 kg, 364.9 and 262.2 kg. Dressing percentages of young and older bulls were higher (56.2%; 54.1%) than in the group of cows (49.50%). Based on this research we conclude that Istrian cattle have a favorable potential for beef production, especially in the technology of low to moderate intensity level.

Introduction

Food production is the strategic activities of every society. In past centuries food production was based on local (autochthonous) varieties and breeds. In the twentieth century due to intensification and specialization of food production smaller number of varieties and breeds was preferred and result was significant loss of locally adapted varieties and breeds. The genetic resources erosion follows neglecting of traditional modes of production, loss of identity of region and economic neglecting agricultural areas that are not suitable for intensive food production (succession of pastures, losing of biodiversity). FAO recognized erosion problem of plant and animal genetic resources (AnGR) as a global one. After more than three decades of collecting information on the status of AnGR in the World, FAO (2015) indicates that 9% of mammalian and 3% of poultry breeds of domesticated species are extinct. Only 20% of mammalian and 11% of poultry breeds of domesticated species are not at risk. Therefore, FAO promote protection of all plant and animal genetic resources in the World.
On the area of today's Republic of Croatia before three decades Program for protection of autochthonous breeds started. The motive for development of such protection programs was observed rapid decrease in population size of traditional (autochthonous) breeds. In Istrian peninsula at the late 80th of twentieth century start the protection program for the Istrian cattle, initially through establishment breeders association (SUIG), collecting of all available written

material (pictures, annals, etc.) and promotion of the breed. Later, in the same area program for protection of Istrian sheep, Istrian donkey and Istrian goat were developed. Breeding of autochthonous breeds is supported with state subsidies and local government through the competent services (Agency for Rural Development of Istria, Croatian Agriculture Agency). Breeding and reaffirmation programs for autochthonous breeds are integrated in strategy for development of agriculture, rural areas, traditional gastronomy, tourism and life of total society (IVANKOVIĆ and MIOČ, 2016). In the case of Istrian cattle, as well as with other autochthonous breeds from Istria area, applies logic "we use it or lose it", local community together with breeders try to find models of their better economic reaffirmation.

Meat production program is one of the realistic chances of economic affirmation of the Istrian cattle. However, so far, the number of the research related to fattening and meat quality characteristics of the Istrian cattle is modest. MIŠON and JARDAS (1950) almost 70 years ago said that Istrian cattle have a good basis for the production of meat and beef in terms of quality, and regard to fattening characteristics they catch up other breeds. Authors state that "the meat of the Istrian cattle has all characteristics of primitive breeds: muscle fibers are rough and intense red colored, tallow accumulates in the abdominal cavity, and the taste is very pleasant because it is derived from aromatic herbs." OGRIZEK (1957) states that "fattening ability of the Istrian cattle is moderate and when feeding with forage of good quality and quantity daily gains are favorable". Meat of young animals is juicy and appreciated, and in older fattened oxen hard and tough, dark red with rough muscle fibers. Istrian cattle deposit fat mainly around the abdominal organs, and muscle fibers are poor considering intramuscular fat. Dressing percentage averages around 50-52%, and in well-fattened oxen above 56%. RAKO (1958) also states "that Istrian cattle represents good material for the meat production. The meat quality is very good. Meat from this cattle has a much better price and demand for this meat on market is better than the demand for meat of Brown Alpine cattle". IVANKOVIĆ et al. (2009) conducted a preliminary study of the fattening quality of Istrian cattle and observed that fattened young bulls achieve higher carcass weight (25 months/768 kg) and a favorable dressing percentage (55.5%). Since the Istrian cattle belong to a group of archaic Podolian cattle, it will be useful to see fattening indicators from other breeds which belong to Podolian group. BÖLCSKEY et al. (2001) studying the bulls of the Hungarian Gray cattle found an average live weight of 470.6 kg and moderate dressing percentage of 55.7%. SÁNDOR (2006) states that the Hungarian Gray cattle in semi-intensive fattening system at the age of 20 months have live weight of 467 kg. BRAGHIERI et al. (2006) state that Podolian bulls kept on pasture and fed with a small amount of concentrate in the final stage of fattening at the age of 18 months achieve dressing percentage of 56.8%. In another study BRAGHIERI et al. (2008) in population of Podolian bulls kept on pasture at the age of 18 months found an average live weight of 458.10 kg, carcass weight of 252.10 kg and the relative carcass value of 55.03%. PLAVŠIĆ et al. (2008) observed in the Podolian cattle with average live weight of 471 kg and significantly lower dressing percentage (50.77%). STOJANOVIĆ (2012) at Podolian male beef cattle determine live weight of 445.91 kg and the average dressing percentage of 53.64%. MARINO et al. (2006) exploring carcass characteristics of Podolian bulls aged 16-18 months in semi-intensive organic production system have determined the average weight of the cold carcass of 181.5 kg and dressing percentage of 51.3%. Therefore, the aim of research was to determine fattening characteristics of the Istrian Cattle to assess the economic affirmation potential of the breed through the beef production.

Material and methods

The research included 119 purebred Istrian Cattle individuals. Regard to age and sex, animals are divided into three groups: young bulls (slaughter age from 20 to 24 month; 40 animals), older bulls (slaughter age from 25 to 52 months; 61 animals) and cows (slaughter age from 4.5 to 16.4 years; 18 animals). Animals were kept on small cattle farms, in traditional housing and feeding conditions. Traditional housing system means tied housing by night and pasture during the day. Feeding of animals is based on pasture and hay. In the finish of the fattening period, bulls consume small amount of concentrated feed (up to 2 kg/day). In nutrition of slaughtering animals silage and haylage were not used.
Animals were slaughtered according to the standard procedure in local slaughterhouse. They were weighted before slaughter (live weight) and after slaughter (hot and cold carcass weight). After 24^h post-mortem, the carcass EUROP conformation score and subcutaneous fat thickness were determined according to standard procedure. For estimation EUROP conformation score were used adapted model with scores from 1 to 15 (E+, E, E–, …, P+, P, P–).Subcutaneous fat thickness were determined according to adapted model with scores from 1 to 15 (1–, 1, 1+, …, 5–, 5, 5+). Carcass dissections on commercial body parts and weighing were done in meat processing house in Pazin (AZRRI, Pazin). Statistical analysis was carried out using the General Linear Model procedure of SAS V9.2 (2008, SAS Institute Inc., Cary, NC, USA). The level of significance of the treatment was set at $P<0.05$.

Results and discussion

Table 1. Carcass characteristics of slaughtered Istrian Cattle by groups (LSMEAN ± SE)

	Young bulls	Older bulls	Cows
Live animals weight (kg)	604.0 ± 64.30[a]	674.9 ± 94.43[b]	536.1 ± 49.21[c]
Warm carcass weight (kg)	345.9 ± 54.06[a]	376.6 ± 64.58[b]	268.0 ± 38.11[c]
Cold carcass weight (kg	340.0 ± 53.44[a]	364.9 ± 64.17[b]	262.2 ± 37.86[c]
Chilling loss (kg)	5.77 ± 1.18[a]	6.19 ± 1.40[b]	5.87 ± 1.41[c]
Chilling loss (%)	1.71 ± 0.34[a]	1.73 ± 0.42[a]	2.33 ± 0.79 [b]
Dressing percentage (%)	56.22 ± 1.91	54.08 ± 2.11	49.50 ± 0.64
EUROP class of carcasses	6.26 ± 2.86	5.94 ± 2.03	11.58 ± 2.97
Degree of fatness (1 – 15)	6.76 ± 2.41	6.98 ± 1.98	6.33 ± 4.29

[a,b,c] different letters in the same row indicate significant difference ($P<0.01$); LSMEAN – least square mean; SD – standard deviation

The average slaughter age for young bulls, older bulls and cows) was 23.04 months, 33.14 months and 11.25 years. Considering the growth rate young bulls were not slaughter before the age of twenty months (Istrian cattle belong late maturing cattle). Cows were slaughter after exclusion from production (mostly reproductive reasons, infertility). An average live weight was 604 kg in young bulls group, 675 kg in older bulls group and 536 kg in cows group. Compared to other cattle breeds from Podolian group (BÖLCSKEY et al., 2001; SÁNDOR, 2006; PLAVŠIĆ et al., 2008; STOJANOVIĆ, 2012) Istrian cattle achieves higher final slaughter weight. Having in mind that the average calving weight of Istrian cattle is 30 kg, male animals in group of young bulls achieved average daily gain of 818 g/day and older bulls of 638 g/day. IVANKOVIĆ et al. (2009) observe moderate average daily gain of Istrian bulls during the fattening period (1.032 kg/day) if the feeding conditions were improved (2.6

kg/day concentrate). We concluded that Istrian cattle have a moderate capacity of growth, suitable for development different models for production beef meat of good quality.

Table 2. Weight of some dissections on commercial parts of Istrian Cattle (kg; LSMEAN ± SE) and share of commercial parts regard to cold carcass weight *(%; LSMEAN ± SE; italic)*

Commercial parts of carcass (*class of meat)*	Young bulls	Older bulls	Cows
Loin with filet mignon *(Extra)*	37.52 ± 4.39 *(11.53 ± 0.80)*	41.24 ± 6.52 *(11.44 ± 1.87)*	-
Large rose *(I)*	13.03 ± 3.96 *(3.99 ± 1.08)*	14.02 ± 3.22 *(3.87 ± 0.67)*	10.11 ± 2.11 *(3.83 ± 0.70)*
Small rose *(I)*	6.50 ± 1.20 *(1.99 ± 0.21)*	7.51 ± 1.38 *(2.09 ± 0.37)*	5.96 ± 1.30 *(2.28 ± 0.62)*
Fricandeau black *(I)*	12.70 ± 2.57 *(3.89 ± 0.63)*	14.73 ± 2.57 *(4.10 ± 0.94)*	10.44 ± 5.02 *(3.81 ± 1.49)*
Fricandeau white *(I)*	4.28 ± 0.68 *(1.31 ± 0.14)*	4.90 ± 0.95 *(1.36 ± 0.30)*	3.48 ± 0.76 *(1.23 ± 0.12)*
Eye round *(I)*	10.93 ± 1.67 *(3.36 ± 0.39)*	11.97 ± 2.34 *(3.33 ± 0.68)*	8.02 ± 3.22 *(3.01 ± 1.04)*
Cover of rose *(I)*	8.36 ± 2.05 *(2.54 ± 0.43)*	9.74 ± 1.58 *(2.72 ± 0.56)*	6.64 ± 2.47 *(2.43 ± 0.93)*
Shin-Shank *(II)*	14.19 ± 1.97 *(4.38 ± 0.62)*	16.01 ± 3.02 *(4.45 ± 0.94)*	12.47 ± 2.59 *(4.65 ± 0.72)*
Cover of blade *(III)*	10.94 ± 1.99 *(3.35 ± 0.43)*	12.84 ± 3.31 *(3.54 ± 0.71)*	8.64 ± 4.64 *(3.45 ± 2.75)*
Blade *(III)*	13.23 ± 4.23 *(4.05 ± 1.20)*	15.65 ± 6.25 *(4.32 ± 1.62)*	10.37 ± 2.21 *(3.83 ± 1.72)*
Loin (*without bone*) *(III)*	32.92 ± 8.23 *(10.00 ± 1.73)*	39.54 ± 11.00 *(10.82 ± 2.46)*	21.25 ± 6.29 *(8.00 ± 1.21)*
Brisket (*without bone*) *(III)*	7.64 ± 1.60 *(2.26 ± 0.53)*	8.83 ± 2.24 *(2.44± 0.57)*	5.41 ± 1.14 *(1.93 ± 0.55)*
Ribs (*without bone*) *(III)*	20.35 ± 8.00 *(6.26 ± 2.36)*	22.61 ± 6.75 *(6.23 ± 1.73)*	16.29 ± 6.05 *(6.42 ± 2.65)*
Flank *(III)*	13.97 ± 3.04 *(4.25 ± 0.53)*	14.69 ± 2.91 *(4.09 ± 0.86)*	12.76 ± 2.85 *(4.71 ± 0.96)*
Tail *(III)*	1.33 ± 0.23 *(0.41 ± 0.06)*	1.37 ± 0.25 *(0.38 ± 0.08)*	1.32 ± 0.45 *(0.48 ± 0.13)*

The average warm carcass weight of animals in group of young bulls, older bulls and cows was 345.9 kg, 376.6 and 268.0 kg. Cold carcass weight was as follows 340.9 kg, 364.9 and 262.2 kg for young bulls, older bulls and cows. Chilling loss in group of young bulls, older bulls and cows were 1.71%, 1.73% and 2.33% (Table 1). Dressing percentages were significantly higher in the group of young than the older bulls (56.22% vs. 54.08%), while in the group of cows were the lowest (49.50%). STOJANOVIĆ (2012) in population of Podolian young bulls observe slightly lower dressing percentage (53.64%). Contrary, BRAGHIERI et al. (2006; 2008) in population of Podolian young bulls form Hungary observe similar dressing percentage (56.8%; 55.03%) to this research.

Slaughtered animals in group of older bulls compared to younger bulls have had some favorable (*but not significant*) score of EUROP carcasses class (5.94 vs. 6.26). The average score of EUROP class for cows' carcasses had significantly unfavorable value (11.58; *equal to value O according to EUROP classification*). Weight of some dissections of commercial body parts of Istrian cattle are shown in Table 2. Older bulls, in general, had higher values for all commercial body parts.

Conclusion

Istrian Cattle due to their body frame and weight of live animals, growth rate and carcasses dressing percentage has favorable potential for production of beef meat with good quality. Considering their possibility of adaptation Istrian cattle is good choice for production technology of low to moderate intensity, as well for the organic production. Istrian cattle represent a part of the Istrian tradition and contribute to maintain the overall landscape biodiversity of the Istrian peninsula. The meat of the Istrian cattle needs to be promoted and labeled as a food with high additional (nutritional, gastronomic) value.

References

BÖLCSKEY, K. – BÁRÁNY, I. – BERTA, E. – BÍRÓ, G. – BODÓ, I. – BOZÓ, S. – GYÖRKÖS, I. – LUGASI, A. – SÜTH, M. – SZÉKELY-KÖRMÖCSZY, P. – SZITA, G. – SÁRDI, J. (2001): Magyar szürke tehenek haszonállat-előállító keresztezése charolais és fehér-kék belga fajtával. Állattenyésztés és Takarmányozás 50: 43-57.

BRAGHIERI, A. – PACELLI, C. – SEVI, A. – GIROLAMI, A. – MUSCIO, A. – MARINO, R. (2006): Effect of rearing systems on growth performance and carcass composition of Podolian young bulls. Book of Abstracts of the 57th Annual Meeting of the European Association for Animal Production, Antalya

BRAGHIERI, A. – CARLUCCI, A. – GIROLAMI, A. – NAPOLITANO, F. (2008): Tenderness, pH and acceptability of meat from podolian and limousine x podolian young bulls. Journal of Food Quality 31: 490-502.

FAO (2015): The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture. Rome

IVANKOVIĆ, A. – KELAVA, N. – ŠUBARA, G. – KONJAČIĆ, M. – PREKALJ, G. – CAPUT, P. – ŠURAN, E. (2009): Productive traits and carcass quality of the Istrian cattle. Book of papers of the International Congress "On the Tracks of Podolics" (ed: GUARCINI, R.), July 10th 2009, Perugia, Italy, 281-288.

IVANKOVIĆ, A. – MIOČ, B. (2016): Studija o revitalizaciji stočarstva, uzgoja papkara I kopitara u Istarskoj županiji. Istarska županija, Pazin

MARINO, R. – ALBENZIO, M. – BRAGHIERI, A. – MUSCIO, A. – SEVI, A. (2006): Organic farming: effects of forage to concentrate ratio and ageing time on meat quality of Podolian young bulls. Livestock Science 102: 42-50.

MIŠON, J. – JARDAS, F. (1950): Istarsko govedo.

OGRIZEK, A. (1957): Prilog poznavanju istarskog primigenog goveda (I dio). Acta Biologica I: 155-186.

PLAVŠIĆ, M. – GLAMOČIĆ, D. – TRIVUNOVIĆ, S. – KUČEVIĆ, D. – STOJANOVIĆ, S. (2008): Klanične osobine podolskog govečeta i mogućnost proizvodnje organskog mesa. Biotehnologija u stočarstvu, 24: 121-128, Novi Sad

RAKO, A. (1958): Gojidbene, tovne i kvalitete domaćeg oplemenjenog kratkorožnog goveda i istarskog goveda. Stočarstvo 12: 175-179.
MIHÓK, S. (2006): Génmegörzés, „Hagyományos háziállatfajták genetikai és gazdasági értékének tudományos feltárása“. Debreceni Egyetem, Agrártudományi Centrum, Mezögazdaságtudományi Kar, Állattenyésztés-és Takarmányozástani Tanszék, Debrecen, Hungary
SAS (2008) The Statistical Analysis System, v9.2. SAS Institute Inc., Cary, NC, USA
STOJANOVIĆ, S. (2012): Kvalitet mesa i mleka podolskog govečeta. PhD thesis, Novi Sad

Production and milk composition of Istrian Sheep

DRŽAIĆ, Valentino[1] – KASAP, Ante[1] – MULC, Danijel[2] – MIOČ, Boro[1]

[1]University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10 000 Zagreb, Croatia
[2]Croatian Agricultural Agency, Poljana Križevačka 185, Križevci, Croatia

Abstract

Istrian Sheep is Croatian autochthonous sheep breed recognizable due her fleece colour and body frame that stands her out. Among nine Croatian autochthonous sheep breed Istrian sheep has the highest milk production of about 1 kg per day. Traditionally is bred in semi-intensive production system in which the main breeding goal is milk production. Most of the ewes are lambed from November till March, with highest lambing frequency in January. Average lactation length is 184 day with 52 day of suckling and 132 day of milking period. During milking period ewes produce 131.5 kg of milk, while during suckling period lambs consume 56.8 kg of milk. Average chemical composition of Istrian sheep milk contains 5.9% of protein, 7.1% fat and 4.3% of lactose.

Introduction

Sheep breeding is traditionally represented in Croatia, especially in the coastal area were sheep are bred for centuries. According to Croatian Agriculture Agency (CAA) in Croatia under selection control are 16 sheep breeds, and half of them are Croatian autochthonous breeds. Estimated sheep population size in 2015 was around 600.000 from which 385.170 individuals (64.20%) were autochthonous, while 214.830 (35.80%) were allochthonous sheep breeds (CAA, 2016). Therefore, nine autochthonous sheep breeds form the basis of sheep production in Croatia. On the other hand, under selection control in Croatia are 39.883 individuals and more than 80% make autochthonous sheep breeds (CCA, 2016). The main production goal in sheep breeding in Croatia is meat, while for the milk production 10 to 12% of sheep flocks are intended (MIOČ et al., 2007b). Except allochthonous East Friesian and Travnik sheep, only two autochthonous sheep breeds are primary bred for milk production in Croatia. One of them is Pag Island sheep, relatively small, island breed with modest milk production, and the other is Istrian sheep, large breed with average milk production above 1 kg per day.

Istrian sheep was shaped in the wider area of Istrian peninsula where almost entire population is located. It is one of the most recognizable sheep breed due her fleece colour which can be black or white with white or black, brown or grey spots of different shapes (MIOČ et al., 2007a). It is a physically developed breed with average body weight of ewes and rams of 67 kg and 77 kg. Withers height of ewes is 73.5 cm and rams 78 cm (MIOČ et al., 2007a; MIKULEC et al., 2007). According to CAA (2016) population of Istrian sheep consist of 1.943 individuals of which 1.357 are sheep, 516 are yearlings and 70 are rams. In last ten years were evident mayor fluctuations in size of Istrian sheep population (CAA, 2009; 2012; 2016). Population size from 2005 to 2011 was relatively stable (between 2.100 and 2.300

individuals), than from 2012 to 2014 population was increased (between 2.500 and 2.900 individuals), while in 2015 population size of Istrian sheep under selection was decreased below 2.000 individuals. Similar fluctuations were observed in the number of Istrian sheep breeders (CAA, 2009; 2012; 2016).
The aim of this study was to investigate milk production in autochthonous Istrian sheep and average chemical milk composition.

Material and methods

For the purposes of the present paper lactation records of Istrian sheep breed ewes were obtained from Croatian Agriculture Agency (CAA). A total of 5.423 lactation records obtained from 2.629 lactating ewes were included in the statistical analysis. Lactation length in days was defined as time from lambing to dry period and it was divided in two periods: suckling period and milking period. Suckling period was from lambing till weaning of lambs and in that period ewes were not milked, therefore all produced milk was consumed by lambs. During suckling period lambs were with ewes and consumed mother milk at free will. Milking period lasts from weaning till dry period in which ewes were milked twice per day. In both lactation periods milk production was measured according to AT method (ICAR, 1992), once a month (morning or evening milking) every 28 to 34 days. Also, with measuring daily milk production, milk samples were taken for chemical analysis. Chemical analysis of proteins, fat and lactose were made in the reference laboratory of CAA in Križevci. On the basis of the lambing date, lambing frequencies in each month were calculated. All manipulations with the original records (such as binding few months of lambing with very few records to adjacent ones, setting parities grater then six on category six +, and excluding from the data set some records below Q1-3*(Q3-Q1) or above Q3+3*(Q3-Q1)), calculations, and plotting were performed within R programming environment (R CORE TEAM, 2016).

Results and discussion

Descriptive statistics of lactation length and milk production are shown in Table 1. Average length of lactation in Istrian sheep was 184.36 days or around six months. Slightly less than two months makes suckling period, while milking period is around four months and during this time Istrian sheep produce 131.51 kg of milk. In overall lactation period (suckling + milking period) ewes produced 188.32 kg of milk. Similar results for the same breed were reported by PLIŠKO et al. (2016). Overall milk production in Istrian sheep was notably higher than in Pag sheep (PANDEK et al., 2005) which is primarily bred for milk production.

Watching the minimum and maximum length of suckling period it is evident that in some ewes this period is longer than average milking period determined in investigated population. Therefore, with extended suckling period breeders lost large amounts of milk which could be processed in high quality cheese. On the other hand in Pag Island sheep suckling period is considerably shorter and is 28 days (PANDEK et al., 2005) or 39 days (CAA, 2016). One of the reasons way breeders prolong suckling period could be faster lambs growth, given that the breeders will achieve significant income by selling milk feed lambs. Therefore, lambs are usually slaughtered with age from 60-80 days and between 20-25 kg of slaughter weight (VNUČEC et al., 2014).

Table 1. Descriptive statistics of lactation length and milk production in Istrian sheep

Trait	Mean	Sd	Min	Max	CV (%)
Length of suckling period (days)	52.03	23.55	5.00	149.00	45.26
Length of milking period (days)	132.33	30.39	76.00	231.00	22.97
Lactation length (days)	184.36	36.60	82.00	307.00	19.85
Milk yield in suckling period	56.80	32.35	1.04	207.20	56.96
Milk yield in milking period	131.51	61.98	20.93	388.91	47.13
Total milk yield in lactation (kg)	188.31	78.72	31.29	528.40	41.80
Daily milk production (kg)	0.99	0.38	0.21	2.64	38.26

With average daily production of around 1 kg of milk Istrian sheep is Croatian autochthonous breed with highest milk production. Daily milk production in Pag Island sheep was 0.75 kg (PANDEK et al., 2005) or 0.72 kg (CAA, 2016).

All ewes included in this research started lambing in late autumn, through winter till very beginning of the spring, from November to March, respectively (Figure 1). In the remaining months of the year there were not recorded lambing's in Istrian sheep population. The highest frequency of lambing was in January, while the lowest frequency was in March. Given lambing distribution was the result of breeding management where the main objective is to maximize the use of pastures during lactation period, but before summer drought.

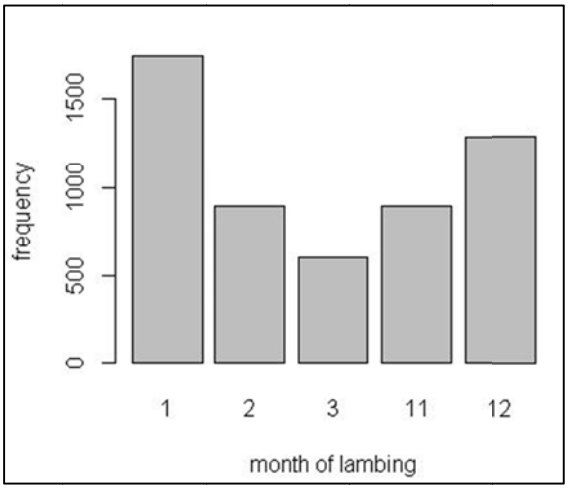


Figure 1. Lambing frequency of Istrian Sheep

Descriptive statistics of milk composition of Istrian sheep is presented in Table 2. Average content of proteins in Istrian sheep milk was 5.9% which is similar to the Pag Island sheep (CAA, 2016). Higher protein content (6.36%) in Istrian sheep milk was previously reported by PANDEK et al. (2005). Fat was the most variable milk component and varied from 2.83% to 12%, but average value was lower than previously reported for the same breed (PANDEK et al., 2005). On the other hand lactose was the most stable milk content with an average value of 4.3%.

Table 2. Descriptive statistics of Istrian Sheep milk composition

Milk component	Mean	Sd	Min	Max	CV (%)
Proteins (%)	5.93	0.45	4.36	7.83	7.59
Fat (%)	7.16	1.16	2.83	12.01	16.13
Lactose (%)	4.30	0.25	3.24	5.05	5.90

Conclusions and recommendations

Istrian Sheep as autochthonous breed of combined production traits has suitable milk production of around 190 kg in lactation of six months. Considering that all breeders use ewes for milk production it would be recommendable to reduce suckling period in order to increase amount of milk which could be potentially used for cheese production. Also, higher milk production could be achieved with better feeding and farm management given that some ewes had potential to produce more than 500 kg of milk.

References

CAA – CROATIAN AGRICULTURAL AGENCY (2016): Annual report 2015. Sheep, goats and small animals. Križevci

CAA – CROATIAN AGRICULTURAL AGENCY (2012): Annual report 2011. Sheep, goats and small animals. Križevci

CAA – CROATIAN AGRICULTURAL AGENCY (2009): Annual report 2008. Sheep, goats and small animals. Križevci

ICAR (1992): International Regulation for milk recording in sheep. Institute de l'Elevage, Paris, pp. 15.

MIKULEC, D. – PAVIĆ, V. – SUŠIĆ, V. – MIOČ, B. – MIKULEC, K. – BARAĆ, Z. – PRPIĆ, I. – VNUČEC, Z. (2007): Odlike vanjštine različitih kategorija istarskih ovaca. Stočarstvo, 61 (19, 13-22.

MIOČ, B. – DRŽAIĆ, V. – VNUČEC, I. – PRPIĆ, Z. – ANTUNOVIĆ, Z. – BARAĆ, Z. (2013): Some slaughter and meat traits of lambs and kids from an extensive production systems. Veterinarski Arhiv, 83 (3), 263-274.

MIOČ, B. – PAVIĆ, V. – PRPIĆ, Z. – VNUČEC, I. – BARAĆ, Z. – SUŠIĆ, V. (2007a): Vanjština istarske ovce. In: 42nd Croatian and 2nd international symposium on Agriculture, Opatija 13-16 February, pp 552-555.

MIOČ, B. – PAVIĆ, V. – SUŠIĆ, V. (2007): Ovčarstvo. Htvatska mljekarska udruga. Zagreb.

PANDEK, K. – MIOČ, B. – BARAĆ, Z. – PAVIĆ, V. – ANTUNAC, N. – PRPIĆ, Z. (2005): Mliječnost nekih pashmina ovaca u Hrvatskoj. Mljekarstvo, 55 (1), 5-14.

PLIŠKO, M. – PRPIĆ, Z. – MIOČ, B. – JURKOVIĆ, D. – VNUČEC, I. (2016): Some dairy traits of Istrian ewes kept in semi-intensive farming conditions. Journal of Central European Agriculture, 17 (1), 236-251.

R CORE TEAM (2016): R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

VNUČEC, I. – DRŽAIĆ, V. – MIOČ, B. – PRPIĆ, Z. – PAVIĆ, V. – ANTUNOVIĆ, Z. (2014): Carcass traits and meat colour of lambs from diverse production systems. Veterinarski Arhiv, 84 (3), 251-263.

Mother bound fattening on extensive greenland pastures with Waldschaf lambs and crossbreed lambs

PODSTATZKY, Leopold[1] – BERGER, Beate[1]

[1]HBLFA Raumberg-Gumpenstein, Institute of Organic Farming and Biodiversity of Farm Animals, 4601 Thalheim, Austrasse 10, Austria

Zusammenfassung

Muttergebundene Mast auf extensivem Grünland von reinrassiger und gekreuzten Waldschaf Lämmer. Ziel dieses Versuches war es, eine Charakterisierung des Leistungsvermögens reinrassiger Waldschafe und einer Kreuzung von Waldschaf und Ile de France bei muttergebundener reiner Weidemast auf extensivem Grünland zu bekommen. Der Versuch wurde über 2 Weideperioden geführt. 2015 weideten 20 Lämmer von Mai bis zur Schlachtung Ende August und 2016 35 Lämmer von Ende April bis zur Schlachtung Mitte September. In beiden Jahren wurden die Lämmer in der ersten Juliwoche abgesetzt. Die Kreuzungslämmer wiesen höhere tägliche Tageszunahmen und höhere Anteile an wertvollen Teilstücken auf. Die täglichen Zunahmen waren 2016 niedriger als 2015, weil mehr Tiere auf der gleichen Weidefläche weideten. Mit einer verlängerten Weidezeit konnten vor allem bei den Kreuzungslämmern annähernd marktkonforme Schlachtgewichte erreicht werden.

Abstract

In this study the performance of purebred Waldschaf lambs and crossbred lambs (Waldschaf x Ile de France) was characterized grazing together with their mothers on extensive grassland with no concentrate supplement. The trial was conducted during two grazing periods. In 2015 20 lambs were pastured from Mai until slaughter at the end of August. In 2016 35 lambs were pastured from the end of April until slaughter in the middle of September. In both years weaning occurred in the first week of July. The crossbred lambs had higher daily gain and a higher percentage of valuable cuts than the purebred lambs. As more lambs were grazed on the same area, daily gain in 2016 was lower than in 2015. Using a prolonged grazing period especially in the crossbred lambs reached slaughter weights roughly meeting the demands of commercial food retailers.

Introduction

Commercial lamb meat production requires high daily gain and good development of valuable meat cuts. Usually specialized meat breeds and intensive feeding conditions are used for lamb meat production. The commercial food retailers' demand lambs with approx. 42 kg live weight and less than 5 months of age. In organic production concentrates are expensive. Lower feeding intensity causes a longer fattening period resulting in undesirably high body fat content and negative effects on meat flavour.

The endangered breed Waldschaf (WS) is characterized by hardiness and fitness for landscaping even in bad weather conditions. It is a small framed breed. Adult ewes weigh between 45 and 65 kg and rams between 60 and 80 kg. The live weights and expression of valuable cuts desired by the food market seems to be very difficult to fulfil with that breed. Commercial crossing with improved meat breeds bred for fattening on pasture could improve the frame and muscling of the carcass. In a former trial with intensive concentrate feeding crossbreeding with Suffolk rams was not successful (PODSTATZKY et al. 2014), so the Ile the France was chosen as a breed recommended for grazing. The aim of this study was to investigate the performance of pure-bred Waldschaf lambs and crossbred lambs of Ile de France x Waldschaf (IxWS) on extensive pasture.

Material and methods

The study was conducted over two years (2015 and 2016). 2.4 ha of extensive pasture were available. The area was divided into 4 (2015) resp. 5 (2016) compartments by electric fencing. In the year 2015 20 ewes and 20 lambs and in the year 2016 23 ewes and 35 lambs were pastured, respectively. Ewes and lambs went on pasture at the end of April 2016 and at the beginning of May 2015. Weaning of the lambs occurred in the first week of August in 2015 and in the first week of July in 2016. The lambs stayed on pasture until slaughter. Shelter was provided by a pasture tent. Water and a salt lick were always available. All lambs were weighed weekly.
Statistical evaluation was performed using the statistical package IBM SPSS Statistics 22 by variance analysis. Fixed effects were breed (Waldschaf, Ile de France x Waldschaf) and year. Significance level was set at $p \leq 0.05$.

Results and discussion

In the year 2016 more sheep and more lambs were on the area, resulting in the fact that 0.6 ha of Lucerne was grazed additionally before weaning (Table 1).

	2015	2016
n WS ewes	20	23
n WS lambs	11	17
n IxWS lambs	9	18
extensive pasture, ha	2.4	2.4
lucerne, ha		0.6
Birth interval (date)	6.4.-26.4.	24.3.-9.4.
Start of pasture (date)	5.5.	27.4.
Weaning date (Ø age [days])	5.8. (113)	4.7. (97)
Slaughter date	26.8.	13.9.
Ø Weight of WS lambs at start of pasture (kg)	8.5	10.8
Ø Weight of IxWS lambs at start of pasture (kg)	9.9	10.7
Ø Weight of WS lambs at end of pasture (kg)	32.1	33.7
Ø Weight of IxWS lambs at end of pasture (kg)	37.6	39.0
Ø age of lambs at end of pasture (days / month)	134 / 4.8	167 / 5.9

Table 1. Information data

In both years crossbred lambs showed higher daily gain on pasture than pure breed lambs (Table 4). In 2016 grazing started one week earlier than 2015 with lambs one week older than the lambs in 2015. The time on pasture was longer in 2016. Weight gain in 2016 was lower than in 2015 due to heavier stocking (Table 1).

Year	Breed	Neck (kg)	Shoulder (kg)	Crest (kg)	Loin (kg)	Chop (kg)	Chest (kg)	Leg (kg)
2015	WS	1.20	2.38^{a}	0.82^{a}	1.12^{a}	1.10^{a}	2.34^{a}	4.60^{a}
	I x WS	1.42	2.90^{bc}	0.94^{ab}	1.40^{ab}	1.40^{bc}	3.00^{b}	5.64^{b}
2016	WS	1.20	2.64^{ab}	0.96^{ab}	1.14^{ab}	1.12^{ab}	2.98^{b}	5.18^{ab}
	I x WS	1.40	3.26^{c}	1.10^{b}	1.58^{b}	1.42^{c}	3.36^{b}	5.98^{b}

Table 2. Weight of individual cuts per breed and year

In all parts except the neck significant differences were seen between years and breed with higher weights of cuts of the crossbreed lambs (Table 2). Similar results were seen in life weight at slaughter, carcass weight cold and dressing percentage cold again with higher weights in crossbred lambs (Table 3).

Year	Breed	Life weight (kg)	Carcass weight, cold (kg)	Dressing percentage cold (%)
2015	WS	32.13^{a}	14.21^{a}	44.26^{a}
	I x WS	37.62^{ab}	17.33^{b}	45.82^{ab}
2016	WS	33.72^{ab}	15.88^{ab}	47.18^{b}
	I x WS	38.98^{b}	18.82^{c}	48.33^{b}

Table 3. Life weight, carcass weight and dressing percentage per breed and year

2015				2016		
		WS	IxWS		WS	IxWS
Pre weaning	week 1-14	0.20^{a}	0.26^{b}	week 1-11	0.20	0.21
Post weaning.	week 14-17	0.19	0.18	week 11-21	0.10^{a}	0.16^{b}
Pasture total	week 1-17	0.20^{a}	0.24^{b}	week 1-21	0.16^{a}	0.19^{b}

Table 4. Daily gain on pasture (kg)

The average age of the lambs at the end of the pasture was 134 and 167 days in the year 2015 and 2016, respectively. These data are similar to the results of KOCAK et al. (2016) with 162 days in organic production and 148 in intensive production systems. But slaughter weight in the trial by KOCAK et al. (2016) was at 30 kg live weight much lower. In both trials lambs were weaned with about 100 days. Over the whole pasture period crossbred lambs had higher daily gains than purebred lambs. Even the purebred WS lambs in our trial showed higher daily gains than the lambs in organic production by KOCAK et al. (2016). The fact, that in 2016 the daily gain in purebred as well as in crossbreed lambs was lower than in 2015 is

attributed to putting more ewes and lambs on pasture in the second year. HENSELER et al. (2014) also showed daily gains of about 160 grams in a trial with crossbred lambs. Similar daily weight gains of 140 grams were recorded by WILLEMS et al. (2013), but lambs were put on pasture only with 35 kg live weight. In contrast our lambs were culled at this live weight.

The Waldschaf is a small framed breed. The demand of the retailer market for carcasses of approx. 42 kg live weight at slaughter cannot be met with this breed. Crossbred lambs as used in this trial could reach this weight even under extensive pasture conditions. Grain feeding in endangered breeds, especially the Waldschaf, didn't result in better lean meat production but more body fat (PODSTATZKY et al. 2014). The dressing percentage in our trial was between 44 and 48 % and similar to the results of WELLEMS et al. (2013) with extensive breeds and good pasture quality. This is remarkable as the pasture available was not improved semi-arid grassland save the 0.6 ha Lucerne in 2016.
Usually slaughter weight for the retailer market is about 42 kg. In this trial slaughter weight of the lambs especially the purebred lambs was lower. One month more on pasture resulted in higher slaughter weights but still did not reach the slaughter weight recommended for the retailer market.

Conclusion and recommendation

Retailer market demands of lamb carcasses are difficult to meet using endangered sheep breeds. On the whole slaughter weight is approx. 42 kg live weight. The carcass should have a well-muscled back and haunches with good fat covering. The small framed breed Waldschaf showed good daily gain on extensive pasture used purebred as well as for commercial crossing with Ile de France but normally commercial slaughter weights and classifications are not reached with this breed within 5 month of fattening on pasture. Crossbred lambs nearly reached 40 kg body weight when pastured for a longer time. Excessive fat covering was not noticed.
Lamb meat produced on pasture can fulfil consumer expectations if "natural" meat production and/or organic production are an issue.
This production method is well suited for direct marketing. It could be integrated into landscaping programs and contribute to the efficient use of marginal land and an endangered breed.

References

HENSELER, S. – PREUSS, S. – BENNEWITZ, J. (2014): Fleischerzeugung mit Merinolandschaf-Gebrauchskreuzungen – 1. Mitteilung, Analyse der Schlacht- und Fleischqualität. Züchtungskunde, 86, 95-103.

KOCAK, O. – EKIZ, B. – YALCINTAN, H. – YAKAN, A. – YILMAZ, A. (2016): Carcass and meat quality of organic lambs compared with lambs reared under traditional and intensive production systems. Animal Production Science, 56, 38-47.

PODSTATZKY, L. – BERGER, B. – VELIK, M. – FREIGANG, W. (2014): Einsatz von seltenen Rassen in der Fleischproduktion – Mastleistung und Fleischqualität von Kreuzungslämmern Waldschaf x Suffolk und von reinrassigen Waldschaflämmern. Final report. https://www.raumberg-gumpenstein.at/cm4/de/forschung/publikationen/downloadsveranstaltungen/viewdownl

oad/1779-3553-wt-waldschaf/18178-einsatz-von-seltenen-rassen-in-der-fleischproduktion-mastleistung-und-fleischqualitaet-von-kreuzungslaemmern-waldschaf-x-suffolk-und-von-reinrassigen-waldschaflaemmern.html

SCHMID, W. (2003): Themenbericht extensive Weiden. www.poel.ch/pdf/**Weidebericht**_relais.pdf.

WILLEMS, H. – WERDER, C. – KREUZER, M. – LEIBER, F. (2013): Das Weidesystem beeinflusst Schlachtleistung und Fleischqualität von gesömmerten Lämmern. Agrarforschung Schweiz 4 (1), 4-9.

Die Ergebnisse der molekulargenetischen Untersuchungen der Traberkrankheit bei ungarischen Cikta Schafen

KOVÁCS, Endre[1,2] – ZENKE, Petra[2] – MITRO, Susanne[2] – TEMPFLI, Károly[1] – BECSKEI, Zsolt[3] – SÁFÁR, László[4] – BALI PAPP, Ágnes[1] – GÁSPÁRDY, András[2]

[1]Széchenyi IstvánUniversität, Landwirtschaftliche- und LebensmittelwissenschaftlicheFakultät, 9200 Mosonmagyaróvár, Vár 4, Ungarn
[2]Veterinärmedizinische Universität, Lehrstuhl für Tierzucht, Tierernährung und Labortierkunde, 1078 Budapest, István Str. 2, Ungarn
[3]Lehrstuhl für Tierzucht und Genetik, Tierärztliche Fakultät, Belgrad Universität, 11000 Belgrad, Bulevaroslobođenja 18, Serbien
[4]Verband für Ungarische Schaf- und Ziegenzüchter, 1134 Budapest, LőportárStr. 16, Ungarn

Zusammenfassung

In dieser Studie wird der gegenwärtige Zustand des ungarischen Cikta-Schafbestandes gegen Scrapie-Resistenz aufgrund ihrer genetischen Determinierung ausgewertet. Das Ziel der Studie war die Bestimmung der Prion Haplo- und Genotypen, sowie der relativen Häufigkeit der Risikogruppen. Ferner sollte die Wirksamkeit des seit zehn Jahren bestehenden Programmes der Prävention gegen Scrapie nachgewiesen werden. Die Autoren bestätigten aufgrund der größeren Anzahl der Proben die frühere Annahme, wonach die Belastbarkeit des Cikta-Schafbestandes gegen Scrapie niedrig weiterhin eingestuft werden soll. Der häufige Haplotyp ARQ und Risikogruppe 3 sind noch als Rassenspezifität anzusehen. Deren beachtliche Nutzung ist erlaubt und wird zur Erhaltung der Rassenvielfältigkeit aus anderen Hinsichten beitragen.

Summary
Results on molecular genetic investigation of scrapie in Hungarian Cikta Sheep

This study examines the current status of Hungarian Cikta Sheep based on genetic background of scrapie resistance. The aim of this study was to estimate the relative frequency of prion haplotypes, -genotypes, and risk categories as well as to demonstrate the success of scrapie eradication program achieved over the last decade.
The authors confirmed based on larger sample size the previous knowledge, that the resistance against scrapie of Cikta breed is considered as low, and the classification of this breed according to risk category has not been improved as well. However, the frequent genotype ARQ and risk category 3 can also be considered as breed specificity. The careful use of them is permitted and will contribute to the maintenance of breed diversity according to other aspects.

Einleitung

„*Die meisten der europäischen mittelalterlichen Schafe – wie die Rinder – gehörte zu einer einzigen Rasse, die primitiv war. Ihr Körperbau war klein, wie bei Rindern. Zu diesem Tierbestand gehörende Schafe mit ihren äußeren Merkmalen hatten große Ähnlichkeit, die schon aussterbenden westeuropäischen Landschafen*“ nach (BÖKÖNYI, 1958).
Das Zaupelschaf war der Abkömmling des oben erwähnten Landschafes, das in Deutschland bereits ausgestorben ist und sich zu anderen Rassen, wie dem Steinschaf, Waldschaf, Sumavska, sowie dem Cikta weiterentwickelt hat. Glücklicherweise haben wir eine ausführliche Beschreibung über diese Rasse von BOHM aus dem Jahre 1878. In seinem Lehrbuch zur Schafzucht findet sich auch über die Schafrasse Zaupel eine Beschreibung, die sehr viel Ähnlichkeit mit der heute vorkommenden Cikta-Schafrasse hat, wie es am Bild sichtbar wird (Abbildung 1). Seine Körpergröße ähnelt dem des heutigen Merinos. Die Widder besaßen ein Schultermaß von 58-60 cm und die ausgewachsenen Mutterschafe hatten eine Maß von 55-56 cm. Die metrischen Unterschiede kamen durch die verschiedenen Haltungen und Aufzuchten der Tiere zustande. Der Kopf ist verhältnismäßig klein, die Stirn erscheint flach und schmal. Bei den Widdern ist der Nasensattel gewölbt, bei den Weiblichen dagegen recht flach. Die Schnauze ist schmal und spitz. Die Augen sind klein und matt, die Ohren scharf trichterförmig zusammengerollt, schmal und spitz, haben aber keine aufrechte Richtung, sondern stehen in mehr waagerechter Lage von dem Kopf ab. Gehörnt sind in der Regel nur die Widder. Die Hörner stehen auf dem Schädel ziemlich weit voneinander. Auf nicht allzu breiter Basis wenden sich die Hörner sofort nach hinten, krümmen sich nach Art des Merino-Hornes nach unten, wieder nach vorn und endigen dann in einer stumpfen Spitze, welche sich wieder nach aufwärts richtet und in der Linie zwischen Auge und Ohr ihr Ende erreicht.

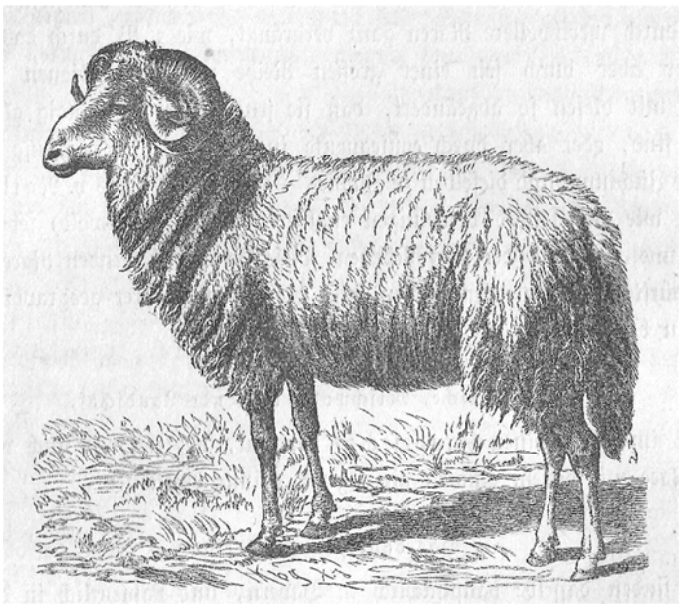


Abbildung 1: Das bayerische Zaupelschaf

Das Knochengerüst ist fein und schwach, deshalb erscheinen die Beine im Verhältnis zum Rumpf dünn und schmal. Der Schwanz reicht mit seinem letzten Wirbeln nicht ganz bis zur Ferse. Gesicht, Ohren und Beine diese noch hoch über Knie und Ferse hinauf, sind mit kurzen, straffen, glatt anliegenden Haaren bedeckt. Der ganze Rumpf, der Hals vom Scheitel herab und der Schwanz tragen eine ziemlich grobe Mischwolle. Diese besteht aus langem und

glänzendem Grannenhaar, welches reichlich mit etwas feineren Wollhaaren durchsetzt ist.
Die Farbe ist zum größten Teil ein schmutziges Weiß, mitunter aber auch Braun und Schwarz. Bei den lilienweißen Tieren findet man oft eine schwarze Schnauze und mehr oder weniger regelmäßige Ringe um die Augen. Die Tiere wurden in ihrer Heimat in der Regel zweimal jährlich geschoren. Zu vollem Jahreswuchs erreicht die Wolle eine Länge von 20-24 cm. Bei guter Wäsche kann höchstens ein Schurgewicht von 1,5 kg erreicht werden. Wegen dem geringen Fettschweiße der Haare und der guten Natur derselben ist der Ertrag jedoch sehr leicht zu erreichen.
Die Tiere sind sehr fruchtbar und gebären sehr oft Zwillinge. An ihnen wird geschätzt, dass sie bereits im Alter von einem Jahr das erste Lamm bringen. Dies scheint aber offenbar ein nicht richtiges Verfahren der Züchter zu sein, weil sie dadurch die körperliche Entwicklung der ganzen Rasse schädigen. Soll ein Schaf im Alter von 12 Monaten schon ein Lamm bringen, so muss es bereits mit 7 Monaten gedeckt werden. Zu diesem Zeitpunkt steht es noch in der ersten körperlichen Entwicklung. Wir sind der festen Überzeugung, dass die Formenverhältnisse der Rasse sich zum großen Vorteile verbessern würden, wenn man das Mutterschaf erst ordentlich auswachsen und mit vollendeten dritten Jahr das erste Lamm bringen ließe (BOHM, 1878).
Karl III., Maria Therese und Josef II. hatten ab 1720 deutsche Siedler nach Ungarn gebracht, die dann das Zaupelschaf in mehreren Etappen (u.a. die drei Schwabenzüge) in das Land eingeführt hatten. Von diesen Tieren entwickelte sich im Laufe der Zeit, etwa nach mehr als hundert Jahren, das heutige Cikta Schaf heraus. Diese Tiere besaßen eine viel bessere Wollqualität als die einheimischen Schafe. Folglich stellten die schafhaltenden Grundbesitzer allmählich ihre Zucht um. Diese Entwicklung bestätigt auch der Aufsatz von ANDRÁSFALVY (1975) über „Die Geschichte von Komitaten Tolna“. Danach heißt es: „*Die Bauern von Gemeinde Decs beklagten sich über die Grundbesitzern, weil ihre Zibben im Jahre 1749 die Trauben-Bergen verwüstet haben“.* Das Gleiche war in einem Brief der Kleinbauern von 1766 aus der Gegend von Pilis zu lesen. Die Grundbesitzer hatten keine Schafhaltung sondern eine Zibbenhaltung und das sollte ein Hinweis auf die Haltung von Cikta Schafen gewesen sein, die eine bessere Qualität der Wolle lieferten. Es konnten kein Merinos sein, weil diese erst durch Maria Therese im Jahre 1773 eingeführt wurden.
Jene gut wolligen Schafe waren die mittel-europäische Landschafe, wahrscheinlich die Cikta Zibben, die auch als Schwäbisches Schaf von Tolna und Baranya bezeichnet wurden. Diese Schafe weideten schon in den Komitaten Fejér und Zala von 100 bis 1000 Tieren pro Gruppe. Eine andere Möglichkeit der Einfuhr des Cikta Schafes nach Westungarn, geschah durch deutsche Schäfer, die damals ungarische Weiden pachteten, um ihre Tiere halten zu können. In der Umgangssprache bezeichnete man sie als Zibben-Schäfer (birkás). Das Wort „Zibben“ (birka) war schon im 16.-17. Jahrhundert im Sprachgebrauch. Zuerst wurde die böhmische/mährische Rasse danach benannt. Dies war eine der Varianten vom mitteleuropäischen Landschaf. Die Herden wurden im Norden des Landes von mährischen Schäfern übernommen. Der Gebrauch des Wortes „Zibben“ wurde langsam in ganz Ungarn üblich. Damit war die Abgrenzung vom Racka Schaf erreicht.

Die Rasse wäre längst in Vergessenheit geraten, wenn nicht unerwartet das Interesse an autochthonen Rassen der Nutztiere aufgekommen wäre. Nach den Racka und Cigaja (Zigaya) Rassen, wurden auch die Cikta Schafe mit den noch vorhandenen Individuen aus dem Lande eingesammelt und infolge der Regierungsanordnung in der Zuchtanstalt in Bezzeg-puszta im Jahre 1974 untergebracht. Seitdem die autochthonen Rassen in Ungarn staatlich unterstützt wurden, entstand im Jahre 2014 an Ort und Stelle auch ein zentraler Aufzuchtbetrieb für Cikta Zuchtwidder, durch den Ungarischen Zuchtverband für Schafe und Ziegen (MJKSZ). Neben dem züchterischen Einsatz bei autochthonen Rassen, ist auch die gesundheitliche Fürsorge

gemäß der Traberkrankheit-Vorschriften der EU (999/2001 EUV) durchzuführen. Die Traberkrankheit der Schafe (Scrapie) gehört zu den Prion-Krankheiten, wie auch die TSE (transmissible spongiform encephalopathy), BSE (bovine spongiform encephalopathy), Creutzfeldt-Jacob Krankheit und andere.
Diese Nervenkrankheit entsteht durch ein fehlerhaftes Prion-Eiweißprodukt (PRUSINER, 1982). Das normale Prionprotein PrPc wird durch das Proteinase K Enzym abgebaut, das infektiöse PrPsc kann jedoch nicht abgebaut werden. Folglich vermehrt es sich unbegrenzt und zerstört alle Zellen (FOSTER und HUNTER, 1998). Die Inkubationszeit beträgt 2 bis 5 Jahre, während das Zentral-Nerven-System stufenweise seine Funktion verliert. Es wurde bewiesen, dass unterschiedliche Genotypen mit kodierten Prion-Nukleotiden, die natürliche Resistenz der Schafe gegen die Scrapie, in verschiedenem Grade beeinflussen können (MCCUTCHEON u. Mitarb., 2005).

Nach den Landesvorschriften müssen ab 2005 von allen TSE-verdächtigen Schlachttieren und verendeten Tieren geeignete Gewebeproben von Gehirn für den Prion-Test entnommen werden (FVM, 2003). Ferner ist auch die Typisierung der Genotypen für Scrapie-Resistenz für die Selektionsprogramme durchzuführen. Die erste Typisierung der Genotypen in Ungarn wurde durch FÉSÜS und seine Mitarbeiter (2004 und 2008) im Forschungsinstitut für Tierzucht und Tierfütterung in Herceghalom vorgenommen.
Unsere Untersuchungen sollen die Haplo- und Genotypen gegen Scrapie beim Cikta-Schafbestand ermitteln und mit den Ergebnissen vor 10 Jahren vergleichen.

Material und Methoden

Die Proben haben die Mitarbeiter der MJKSZ entnommen. Für die Entnahme setzte man die Spezialzange (TypiFix TM) ein, die durch die deutsche Agrobiogen GmbH entwickelt wurde. Damit entnahm man eine Gewebeprobe von der Mitte der Ohrmuschel (Knorpelgewebe), wodurch gleichzeitig eine Markierung der Tiere erfolgte (AGROBIOGEN, 2016).
Die Typisierung der Proben wurde auch durch die oben genannte Firma durchgeführt.
In der Laboranalyse wird das fragliche Fragment des Prion-Protein-Gens mit einem Primer gekennzeichnet und dann wird die Menge dieser DNS-Sequenz in vitro durch die Polymerase-Kettenreaktion (PCR) multipliziert. Als nächstes werden die charakteristischen Abschnitte als Ergebnis von Mutationen in einem Varianten (Haplotypen) durch Pyrosequenzing bestimmt. Es kommen in dem Codon 136 Alanin (A, resistenter) oder Valin (V), in dem Codon 154 Arginin (R, resistenter) oder Histidin (H), und in dem Codon 171 Arginin (R, resistenter) oder Glutamin (Q) und Histidin (H) vor.

Die Ergebnisse der spezifischen Prion-Genotypen-Daten, die vom MJKSZ aufgezeichnet wurden, dienen als Grundlage für die Datenverarbeitung. Der Zweck der Verarbeitung war, die Scrapie-Genotypisierungen von den Tieren aus den Jahren 2013-2015, wie Jungwidder (n=336) und Mutterschafe (n=809) sowie die Feststellung der gegenwärtige Resistenz des Tierbestandes. Insgesamt wurden 1145 Tiere aus 10 Herden untersucht. Als Kontrolle diente die Arbeit von FÉSÜS u. Mitarb. (2004).
Die erforderlichen Daten wurden dazu aus der Microsoft Excel-Datenbank entnommen und mittels Dell Statistik Programm (DELL INC., 2015) statistisch ausgewertet. Es wurden in den Haplotypen und Genotypen von Prionen, sowie in den Risikogruppen der Scrapie-Anfälligkeit, die Anzahl der Tiere und die relative Häufigkeit festgestellt. Mit Hilfe der Chi^2-Probe wurden der aktuelle Zustand (2013-2015) und der frühere (2004) verglichen. Ferner wurde der aktuelle Zustand des Cikta Schafbestandes hinsichtlich des genetischen

Gleichgewichtes (Hardy-Weinberg) festgestellt. Im späteren Vergleich geben die Werte von 2013-2015 die beobachteten Häufigkeiten der Genotypen an, während die erwarteten Häufigkeiten durch die Haplotyphäufigkeiten berechnet werden.

Ergebnisse und Auswertung

Die Tabelle 1 zeigt die aktuelle Verteilung der Haplotypen (2013-2015). Danach ist der ARQ Haplotyp der häufigste (74,93%), es folgt ARR mit (14,19%) und AHQ mit (10,70%). Das Vorkommen der ARH und VRQ Haplotypen ist unbedeutend. Sowohl in der jetzigen Aufarbeitung als auch in früheren (2004) ist mit einem wesentlich niedrigeren Wert als erwünscht der Haplotyp ARR der zweite in der Reihe. Die Chi^2 Probe zeigt keinen signifikanten Unterschied (P=0,519) zwischen den aktuellen und den früheren Untersuchungsergebnissen bezüglich der Haplotypen. Es ist zu erwähnen, dass in den früheren Untersuchung von FÉSÜS u. Mitarb. (2004), die nur auf einen Bestand beschränkt waren, die ARH und VRQ Haplotypen fehlten.

Aus den Prion-Genotypen konnten nur acht identifiziert werden (siehe Tabelle 1). Die häufigsten Genotypen sind die weniger vorteilhaften ARQ-tragenden Genotypen, was aus der Haplotyphäufigkeit folgt. Es folgen die günstigeren ARR- und AHQ-tragenden Genotypen. Die empfindlichste Homozygote VRQ/VRQ kommt nicht vor.
Die Resultate bezüglich der Genotypen weichen nicht wesentlich voneinander ab (P=0,083), trotz der Tatsache, dass der ungünstige Genotyp sich um 10% erhöhte. Die Chi^2 Probe hat bewiesen, dass der jetzige Cikta-Schafbestand sich völlig im genetischen Gleichgewicht nach Hardy-Weinberg befindet (Chi^2=0,269; df=14; P=1,000).

Die Risikogruppen mit ihren Änderungen finden sich auch in der Tabelle 1. Dabei sind die wichtigsten Bemerkungen die folgenden; R4 ist nicht repräsentiert und R5 nur mit einem Tier. Wegen der großen Häufigkeit von ARQ, ist die R3 mit fast 74% vertreten. Mit nur etwa 2,5 % sind die Tiere vertreten, die für die Zucht am besten geeignet sind. Zwischen den zwei Auswertungen wurde statistisch bewiesen, dass die Cikta Rasse sich in Bezug auf die Gruppeneinteilung verändert hat (P=0,031). Durch die Erhöhung der Rate von R1, aber auch durch eine bedeutende Erhöhung der Rate von R3 ist eine zweifelhafte Verbesserung zu erkennen.

Tabelle 1: PrionHaplo- und Genotypen vom Cikta Schaf, sowie die Aufteilung der Risikogruppen der Traberkrankheit

Gruppen	2004 %	2013-15 %
Haplotypen: Chi^2=3,235; FG=4; P=0,519	(n=138)	(n=2290)
ARR	20,29 (28)	14,19 (325)
AHQ	9,42 (13)	10,70 (245)
ARH	0,00 (-)	0,13 (3)
ARQ	70,29 (97)	74,93 (1716)
VRQ	0,00 (-)	0,04 (1)
Genotypen: Chi^2=12,564; FG=7; P=0,083	(n=69)	(n=1145)
ARR/ARR	1,45 (1)	2,45 (28)
ARR/AHQ	4,35 (3)	2,79 (32)
ARR/ARH	-	-
ARR/ARQ	33,33 (23)	20,70 (237)
AHQ/AHQ	0,00 (-)	1,31 (15)
AHQ/ARH	-	-
AHQ/ARQ	14,49 (10)	15,98 (183)
ARH/ARH	-	-
ARH/ARQ	0,00 (-)	0,26 (3)
ARQ/ARQ	46,38 (32)	56,42 (646)
ARR/VRQ	-	-
AHQ/VRQ	-	-
ARH/VRQ	-	-
ARQ/VRQ	0,00 (-)	0,09 (1)
VRQ/VRQ	-	-
Risikogruppen: Chi^2=8,846; FG=3; P=0,031		
R1	1,45 (1)	2,45 (28)
R2	37,68 (26)	23,49 (269)
R3	60,87 (42)	73,97 (846)
R4	0,00 (-)	0,00 (-)
R5	0,00 (-)	0,09 (1)

Schlussfolgerungen und Empfehlungen

Die aktuelle Auswertung der größeren Anzahl von Proben bestätigt, dass frühere Wissen, wonach die Widerstandskraft gegen eine mögliche Infektion mit der Scrapie bei den Cikta-Schafbeständen als niedrig einzustufen ist. Gleichzeitig ist festzuhalten, dass sich die Risikogruppen-Einteilung der Cikta Schafe nicht verbessert hat.
Es ist weiterhin notwendig, die anfälligen Tiere aus der Zucht auszuschließen. Andererseits ist der häufigste Haplotyp ARQ und die Risikogruppe 3 als Rassenspezifität anzusehen.
Deren Nutzung ist erlaubt und wird für die Erhaltung der Rassenvielfältigkeit eingesetzt.
Unsere weitere Zielsetzung ist der Vergleich der Prion Genotypen nach Geschlecht.

Literaturverzeichnis

AGROBIOGEN (2016): Scrapie Resistenz. Agrobiogen GmbH Biotechnologie. http://www.agrobiogen.de [Accessed 25 March 16]

ANDRÁSFALVY, B. (1975): Duna mente népének ártéri gazdálkodása Tolna és Baranya megyében az ármentesítés befejezéséig. In: Tanulmányok Tolna megye történetéből VI. (Szerk.: K. Balog János). Szekszárdi Nyomda

BOHM, J. (1878): Die Schafzucht nach ihrem jetzigen rationellen Standpunkt. 2. Teil: Die Züchtung des Schafes. Verlag von Wiegandt, Hempel & Baren, Berlin

BÖKÖNYI, S. (1958): A budai Várpalota ásatásának állatcsont anyaga. In: Budapest Régiségei 18. évkönyv (Szerk.: Gerevich László), Akadémiai Kiadó, 455-486.

DELL INC. (2015): Dell Statistica (data analysis software system), version 13. http://www.software.dell.com

FÉSÜS, L. –ZSOLNAI, A. – ANTON, I. – SÁFÁR, L. (2008): Breeding for scrapie resistance in Hungarian sheep population. Acta Vet. Hung., 56 (2), 173–180.

FÉSÜS, L. – ZSOLNAI, A. – HOROGH, G. – ANTON, I. (2004): A juhok surlókórja 2. Prion genotípus gyakoriságok hazai őshonos állományainkban. Magy. Állatorv. Lap., 126 (11), 670-675.

FOSTER, J. – HUNTER, N. (1998): Transmissible spongiform encephalopathies: transmission, mechanism of disease, and persistence. Curr. Opin. Microbiol., 1:442-447.

FVM (2003): Minister für Landwirtschaft und Landentwicklung 69/2003.(Vl. 25.) und 22/20a4. (II. 27) FVM Verordnung

MCCUTCHEON, S. – HUNTER, N. – HOUSTON, F. (2005): Use of a new immunoassay to measure PrPSc levels in scrapie-infected sheep brains reveals PrP genotype-specific differences. J. Immunol. Methods, 298 (1-2): 119–128.

PRUSINER, S.B. (1982): Novel proteinaceous infectious particles cause scrapie. Science, 216 (4542), 136-144.

Influence of the traditional habitat on added value and product quality of Sjenica Zackel sheep

BECSKEI, Zsolt[1] – SAVIĆ, Mila[1] – DIMITRIJEVIĆ, Vladimir[1] – DIMITRIJEVIĆ, Blagoje[1] – NENADOVIĆ, Katarina[1] – COJKIĆ, Aleksandar[1] – VUČKOVIĆ, Sava[2] – RELIĆ, Renata[2] – XEXAKI, Anna[3] – ÖZVEGY, József[4] – KÖNYVES, Tibor[5] – GÁSPÁRDY, András[6]

[1]Faculty of Veterinary Medicine, Univerisy of Belgrade, Bulevar oslobodjenja 18, 11000 Belgrade, Serbia
[2]Faculty of Agriculture, University of Belgrade, Nemanjina 6, 118o Zemun, Serbia
[3]School of Veterinary Medicine, Aristotel University of Thessaloniki, University Campus, 54124 Thessaloniki, Greece
[4]Belgrade Zoo Garden, Mali Kalemegdan 8, 11000 Belgrade, Serbia
[5]Faculty of Biofarming Backa Topola, John Naisbitt University Belgrade, Marsala Tita 39, 243oo Backa Topola, Serbia
[6]University of Veterinary Medicine Budapest, Istvan street 2, 1078 Budapest, Hungary

Abstract

Organic production represents a process of sustainable development of the rural areas in accordance with the available resources and tradition, also implies comprehensive crop and livestock production, which ensures the preservation and restoration of natural resources, strongly supports return to the traditional values and knowledges. The new Strategy for Agriculture and Rural development in Serbia from 2014-2024 defines goals and priorities for further development of agriculture. One of priority topics is the promotion of organic production. Sjenica-Pester plateau belongs to High Nature Value region of Serbia and is well known for its rich biodiversity with favorable floristical composition of pastures and meadows. Organic sheep production is a perspective opportunity for rural regional development. Sjenica sheep is one of the most popular transboundry Zackel type, traditionally reared in the highly mountain regions of Sebia, mainly in the Sjenica Pester-plateu, where it was originally developed. The finding of favorable content of CLA and n-6:n-3 ratio, contribute to the advanced phenotypic characterization of Sjenica Zackel sheep type, the determination of locally adapted breed value and in making a realistic decision for the promotion of sustainable use of Sjenica Zackel sheep type.

Introduction

Intensification of agricultural production has a wide range of advantages, but also its negative effects are recognized. The main negative effects of the intensive, conventional agriculture are soil erosion, decrease of biodiversity, animal products from animals rared in ambience where the level of chronical stress is high, presence of residues of antibiotics and pesticides (SAVIĆ et al., 2013). Oppositely from the conventional, basic principles of organic production promote well adapted auththonous breeds, favorising pastures and meadows and rational use of natural botanical resources (SAVIĆ et al., 2014c).
Organic production represents a process of sustainable development of the rural areas in accordance with the available resources and tradition, also implies comprehensive crop and

livestock production, which ensures the preservation and restoration of natural resources, strongly supports return to the traditional values and knowledges. In order to achive economical income, the rational exploitation of animal and floristic resources, promotion of traditional products and definition of their added value is important (FAO, 2015).
Serbia has a strategy for sustainable development of rural areas and it could favorize the organic production. Rural areas represent 85% of the theritory of Serbia. They firstly cover mountain regiones with low population density (below 150 inhabitants on 1 square kilometers), negative demographic trend and insufficient infrastructure. Extensive and mixed agriculture with low productivity, minimal market surplus and diversification are dominant almost in all rural areas. From the aspect of organic production, these areas are highly valuable because the majority of natural resources with rich ecosystems and biodiversity are located in the rural regions. Organizing the sheep production in accordance with organic principles can greatly contribute to rational utilisation of local, well adapted autochtonous sheep and flora and give a big support for realising the strategy of sustainable development of mentioned rural areas.
Sjenica sheep is one of the most popular Zackel type, traditionally reared in the highly mountain regions of Sebia, mainly in the Sjenica Pester-plateu, where the type was developed. Sjenica sheep is the largest type of autochthonous Zackel sheep reared in Serbia. It is well adapted in harsh climatic and environmental conditions which exist on the mountain regions of south-west Serbia, especially on the High Nature Value Sjenica-Pester plateau (BECSKEI, 2011).

Material and Methods

The present status of Sjenica Zackel sheep within its natural habitat and the strategy for its future management were analyzed according to the FAO guidelines (FAO, 2010, 2015) and the National plan for animal genetic resource conservation. Firstly, the rearing area and the traditional habitat were identified and described.
Definition of the traditional habitat of Sjenica sheep was made using geographical descriptive method. Attention was given to the floristic composition of the natural pastures, as an important elemet of this High Nature Value region. Some of the added values and product characteristics of Sjenica sheep were evaluated using the results of previous studies, published in SAVIĆ et al. (2014a).

Results and discussion

The new Strategy for Agriculture and Rural development in Serbia from 2014-2024 defines goals and priorities for further development of agriculture. One of priority topics is the promotion of organic production. Organic sheep production is a perspective opportunity for development of rural regions.
Negative influence of climate changes and occurrence of new diseases in sheep makes the conservation of locally adapted sheep breeds important (FAO, 2010; HOFFMAN, 2010). Autochthonous locally adapted domestic animals gained resistance and adaptability through the evolution of breeds in their given ecosystems (HIEMSTRA, 2010). The most important autochthonous sheep breed in Serbia is the Zackel sheep. This breed has been developed under modest biogeographic conditions and exhibits a high degree of adaptation to environmental conditions, such as climate and specific phitocenotic conditions. Zackel sheep is triple purpose (meat, lamb, wool) low production breed, with prominent phenotype

diversity (BECSKEI, 2011). It has traditionally reared with a special emphasis on some traits such as health status and robustness, wich are important for organic production too.
Sjenica sheep is the most numerous, locally adapted, autochthonous Zackel sheep type, inhabiting the mountain regions of south-western Serbia, traditionally reared in Sjenica-Pester plateau (900-1400 m altitude). Sjenica-Pester plateau belongs to High Nature Value region of Serbia and is well known for its rich biodiversity with favorable floristical composition of the pastures (47300 ha) and meadows (26200 ha). The region has a specific microclimate with harsh and long winters, often with low temperatures up to -37ºC. In addition to this, one of the important factors of climate influence on the vegetation is the amount of rainfall and its distribution throughout the year as well as relative humidity. The annual rainfall precipitation is as much as 700 mm per square meters per year (BECSKEI, 2011).
Botanical analysis of vegetation from High Nature Value pastures and meadows of Sjenica Pester-plateau shows high biodiversity. The most frequent plants are from the families of grasses 48.4% and legumes 9.6% and other herb families made up 42.0%. Yearly yield of hay on pastures is around 4 t/ha. Based on nutritional value and look, hay is in I category (Table 1.). Results of floristic analysis suggests that grasses and legumes of high and mild quality are predominantly present. A large number of grass species were detected. From the family of *Poacea: Anthoxanthum odoratum, Arrhenatherum elatius, Briza media, Danthona calycina, Bromus raceomus, Agrostis vulgaris, Dactylis glomerata, Festuca rubra, Festuca ovina, Phleum pretense*. The family of *Fabacea* were mainly presented by *Genista saggittalis, Lathyrus latifolius, Lotus corniculatus, Trifolium pretense, Vicia cracca, Trifolium alpense, Trifolium alpestre, Trifolium panonicum, Trifolium montanum* (VUČKOVIĆ et al., 2010). The chemical composition of mixed hay from Sjenica Pester-plateu is shown in Table 1.

Table 1. Chemical composition of mixed hay from Sjenica Pester-plateu
(according VUČKOVIĆ et al., 2010)

Ash g/kg DM	Protein g/kg DM	Fat g/kg DM	Celluloze g/kg DM
55.3	81.9	15.9	332.6

DM – in dry matter

The specific botanical composition and high diversity of favourable plants in grasslands of pastures and meadows in Sjenica-pester plateau provides specific, high quality lamb meat products. The results of sensory analysis of tested lamb meat samples classified Sjenica sheep as a Zackel type with very attractive sensory characteristics (BECSKEI et al., 2015). It was shown that lamb meat has very favorable fatty acid contet (Table 2). Favorable fatty acid profile of lamb meat is important for human health and especially for infant and children nutrition (RAMIREZ-REMATA et al., 2014; SCHMID et al., 2006). These facts raises the interest for sustainable sheep production of Sjenica Zackel type. The finding of favorable content of CLA and of n-6:n-3 ratio, contribute to the advanced phenotypic characterization of Sjenica Zackel sheep type, the determination of locally adapted breed value and in making a realistic decision for the promotion of sustainable use of Sjenica Zackel type (SAVIC et al 2014a, 2014b).

Table 2. Saturated, monounsaturated, polyunsaturated, CLA, omega-6 and omega-3 fatty acid content in lamb meat of three Zackel sheep types (according to SAVIC et al., 2014a)

Fatty acids	Sjenica Sheep M±SD
Σ SFA (Saturated fatty acids)	56.38±2.91
Σ MUFA (Monounsaturated fatty acids)	34.42±2.75
Σ PUFA (Polyunsaturated fatty accids)	3.74±0.57
CLA	4.49±0.59
Σ n-3	1.34±0.44
Σ n-6	2.38±0.20
n-6/n-3	1.77±0.45

M – mean , SD – standard deviation

Conclusion and recommendentation

Sjenica sheep has a great potential in sustainable, organic production in Serbia. This breed has been developed under modest biogeographical conditions and exhibits a high degree of adaptation to environmental conditions, such as climate and specific phitocenotic conditions. As the traditional habitat contains specific floristic composition, it has a big impact on the quality and uniqueness of meat and milk products of Zackel sheep. Evaluation of both chemical and sensory Sjenica lamb meat characteristics have confirmed added value to traditional products of regional origin.

According to the preliminary results of favorable fatty acid profile and sensory characteristics of lamb meat obtained in Sjenica sheep during the conversion process, it represents the opportunity for organic production in traditional habitat.

Acknowledgements

This research work was carried out with the support of Project TR 31085 of Ministry of Education, Science and Technology Development of Republic of Serbia.

References

BECSKEI, Zs. (2011): Primena in situ konzervacije animalnih genetičkih resursa u stočarstvu, specijalistički rad, Fakultet veterinarske medicine Univerziteta u Beogradu, Beograd.

BECSKEI, Zs. – SAVIĆ, M. – COJKIĆ, A. – DIMITRIJEVIĆ, B. – RAŠETA, M. – KILIBARDA, N. – MENSUR, V. (2015): Meat quality of autochtonous Sjenica Zackel sheep – Basis for sustainable production of genetic resource on the Sjenica-Pester plateau, In: Proceedings of the 26th International DAGENE Symposium, 17-19 June, Dobrna, Slovenia, pp. 65-72.

FAO (2010): Breeding strategies for sustainable management of animal genetic resources. FAO Animal Production and Health Guidelines No.3.

FAO (2015): The second report on the state of the worlds animal genetic resources for food and agriculture. Food and Agriculture Organization of the United Nations, Rome. 2015, 1-563.
HOFFMANN, I. (2010): Climate change and the characterization, breeding and conservation of animal genetic resources. Anim Genet 41, 32-46.
HIEMSTRTA, J. (2010): Towards (self) sustainability of local cattle breeds in Europe. In: Proceedings book of the 61st EAAP annual meeting, Heraclion Crete, Greece.
RAMIREZ-RETAMAL, J. – MOLARES, R. – MARTINEZ, E. – de la BARRA, R. (2014): Effect of the type of pasture on the meat characteristics of Chilote lambs. Food Nutrit Sci 5, 635-644.
SCHMIDT, A. – COLLOMB, M. – SIEBER, R. – BEE, G. (2006): Conjugated linoleic acid in meat and meat products. Meat Sci 73, 29-41.
SAVIĆ, M. – BALTIĆ, M. – BECSKEI, Zs. – DIMITRIJEVIĆ, B. – DIMITRIJEVIĆ, V. – SAVIĆ, Đ. – VEGARA, M. (2014a): Evaluation of Zackel lamb meat quality with the aim of increasing the conservation value of the breed, Acta Veterinaria 64 (4), pp 438-446
SAVIĆ, M. – BECSKEI, Zs. – DIMITRIJEVIĆ, B. – VUČKOVIĆ, S. – PRODANOVIĆ, S. – VEGARA, M. (2014b): Organic lamb meat production in Serbia based on auttochtonous Zackel breed: opportunities and challanges. In: Proceedings of the International symposium in animal science. September 2014a, Belgrade Zemun, p. 485-490.
SAVIĆ, M. – DIMITRIJEVIĆ, V. – TRAILOVIĆ, R. – VEGARA, M. – DIMITRIJEVIĆ, B. – BEČKEI, Ž. – PETRIJKIĆ, B. – COJKIĆ, A. (2014c): Selekcijski kriterijumi u organskom stočarstvu. Vet Glasnik 68(5-6), 363-369.
SAVIĆ, M. – VUČKOVIĆ, S. – JOVANOVIĆ, S. (2013): Prilog sagledavanju potencijala prirodnih resursa sjeničko-pešterske visoravni za organizovanje organske stočarske proizvodnje. Veterinarski Glasnik 67(1-2), 97-104.
VUČKOVIĆ, S. – SIMIĆ, A. – ĆUPINA, B. – KRSTIĆ, Đ. – DURONIĆ, G. (2010): Effect of mineral fertilization on yield of Agrostideum vulgaris–type meadows in mountain grasslands in Serbia. Biotechnology in Animal Husbandry 26, 389-394.

Selecting candidates for SNP-Chip genotyping from endangered Austrian goat breeds using pedigree analysis

KLAFFENBÖCK, Michael[1] – BERGER, Beate[2] – MÉSZÁROS, Gábor[1] – SÖLKNER, Johann[1]

[1]University of Natural Resources and Life Sciences, Vienna, 1180 Vienna, Gregor-Mendel-Straße 33, Austria
[2]AREC Raumberg-Gumpenstein, Institute of Organic Farming and Biodiversity of Farm Animals, 4601 Thalheim, Austrasse 10, Austria

Abstract

Different pedigree analyses were used to select most suitable animals from endangered Austrian goat breeds for genotyping from a small number of available samples. Animals were selected according to gene contribution, number of offspring, average relatedness to the population and relatedness to other selected animals. Genotype data will be used to analyse diversity parameters and compare with available data from other Alpine goat breeds.

Introduction

To enhance the management of genetic resources from endangered farm animal breeds, underlying factors like genetic diversity, inbreeding and breed distinctiveness need to be better understood. To investigate these parameters, five endangered Austrian goat breeds will be SNP-chip genotyped. The aim of this study is to find the most genetically diverse groups of 25 animals per breed to be selected for genotyping from a limited set of available samples. Various indicators based on pedigree information are combined to make this choice (SÖLKNER et al., 1997; BOICHARD et al., 1997; BINDER et al., 2016).

Material and methods

Sperm or blood samples from five endangered goat breeds are available in the national gene bank of Austria and a private bio bank. The breeds considered are: Blobe goat (BLZ), Chamois-coloured mountain goat (GG), Pinzgau goat (PZ), Styrian pied goat (SS) and Tauern pied goat (TA). Table 1 shows the number of available samples, the size of pedigree and other pedigree related data for each breed.

Table 1. Data structure

	BLZ	GG	PZ	SS	TA
Active female breeding goats (EFABIS AUSTRIA, 2016)	197	2154	405	288	1250
No. of animals in the pedigree	1015	24368	4325	1914	9000
No. of samples available	97	697	38	192	45
Max. no. of generations traced	7	21	14	11	23
Average inbreeding coefficient	0.0059	0.0152	0.0165	0.0155	0.0924
No. founders	152	2552	467	176	231
Gene contribution of most important ten ancestors	0.315	0.165	0.299	0.421	0.623

Animals with available samples were selected according to the following steps: (1) a maximum of ten animals per breed were selected from the 50 animals with the highest probability of gene contribution, (2) another maximum of ten animals were selected according to their number of offspring (minimum ten offspring) and (3) the remaining 5-25 animals were chosen according to the smallest average relatedness to the rest of the population, as well as a maximum relationship coefficient of 0.125 with other selected animals, if possible. To calculate these genetic parameters, CFC software package was used (SARKOLZAEI et al., 2006).

Results and discussion

Table 2 contains genetic parameters of the animals selected for genotyping. For some breeds (GG, TA) no samples from animals with measurable gene contribution to the breed were available. Available samples from TA seem to very highly related to the general population, which is severely inbred (F=0.0924).

Table 2. Genetic parameters of animals selected for SNP-chip genotyping from pedigree analysis. Standard deviation in parentheses

	BLZ	GG	PZ	SS	TA
Average gene contribution	0.009 (0.014)	-	0.008 (0.007)	0.010 (0.009)	-
Average offspring	6.4 (8.6)	47.2 (65.7)	18.4 (17.5)	11.5 (15.0)	17.9 (18.8)
Average relatedness	0.012 (0.016)	0.007 (0.010)	0.029 (0.020)	0.029 (0.017)	0.195 (0.035)

Conclusion and recommendation

A three step selection procedure was used to select the most suitable candidates for genotyping based on their pedigree data. However, not all criteria could be applied in all populations due to the small number of available samples. The genotype data will be used to investigate genetic diversity, levels of inbreeding and distinctiveness of the breeds, and will be put into context by comparing it to freely available genotype data from other Alpine goat breeds.

References

BINDER, S. – BERGER, B. – SÖLKNER, J. (2016): Few important ancestors contribute much of the genetic material: Pedigree analysis of three highly endangered cattle breeds in Austria. 27th Annual Meeting od DAGENE, Danubian Animal Genetic Resources Vol. 1., 56.

BOICHARD, D. – MAIGNEL, L. – VERRIER, É. (1997): The value of using probabilities of gene origin to measure genetic variability in a population. Genet Sel Evol 29: 5-23.

EFABIS Austria. http://efabis.raumberg-gumpenstein.at/ (as by 16.02.2017 15:00).

SARGOLZAEI, M. – IWAISAKI, H. – COLLEAU, J.J. (2006): CFC: a tool for monitoring genetic diversity. 8th World Congress on Genetics Applied to Livestock Production.

SÖLKNER, J. – FILIPCIC, L. – HAMPSHIRE, N. (1997): Genetic variability of populations and similarity of subpopulations in Austrian cattle breeds determined by analysis of pedigrees. Animal Science, 67: 249-256.

Detection of the hidden merle colour in Mudi breed with genetic test

PELLES, Zsófia[1] – ZENKE, Petra[1] – MARÓTI-AGÓTS, Ákos[1] – GÁSPÁRDY, András[1] – ZÖLDÁG, László[1]

[1]University of Veterinary Medicine, 1078 Budapest, István street 2.

Abstract

The term 'hidden merle' is used for dogs which are genetically merle, but their coat colour hides their merle pattern. Merle gene affects eumelanin pigment only, making genetically merle individuals impossible to recognize based on their phenotype, if their eumelanin pigment production is inhibited by other genes. In our study we used hair and/or buccal swab samples of 23 potentially hidden merle Mudi dogs, then multiplied the exon 11 of the SILV gene with polymerase chain reaction (PCR) method from the purified DNA. Agarose gel electroforesis was used to detect the PCR products (M and m alleles) and separate them by size. 10 out of the 23 tested dogs proved to be genetically merles, despite not having merle phenotype, showing that genetic testing is the only reliable method to detect hidden merleness. Identifying these individuals are important for breeding purposes to avoid homozygous merle offspring with congenital genetic defects.

Introduction

The standard of the Fédération Cynologique Internationale (FCI) for the Mudi breed describes the breed's merle colour as "black speckled, estriped, -brindle or -spotted on lighter or darker bluish-grey primary colour" (FCI/238). This description is valid only for merles with black base colour, so called 'blue merle'. However merle pattern can be found on other base colours in the breed, such as ash, brown, or ashbrown. It can also occur with fawn or white base colours, but in these cases the usual pattern cannot be seen.

The colour is caused by a single, autosomal, not completely dominant gene according to practical observations, but the exact genetic background behind was unknown for a long time (MITCHELL, 1935). After the genome-wide association analysis of nonmerle (mm), merle (Mm) and double merle (MM) Shetland Sheepdogs, it became clear that a retrotransposon insertion is responsible for the unique colouration (CLARK et al., 2006). The affected gene is located on CFA10, known as SILV, Pmel17 and also gp100, the protein which is encoded by this region has a keyrole in the eumelanin producing pigment cells. This premelanosome glycoprotein forms a matrix for the eumelanosomes being created, and is expressed not only by the pigment cells of the coat, but also including the retina and the inner ear (KOBAYASHI et al., 1994; THEOS et al., 2005).

The usual merle colour described above is found in dogs which are heterozygous for the gene. Additionally the eye colour can also be modified by the gene, often resulting split or odd-eye (heterochromia iridis). Homozygous individuals are manifesting the traditional pattern only on separated patches divided by extensive white areas, and they have almost always fully blue eyes. Furthermore in double merles congenital auditory and ophthalmologic disorders (e. g.

deafness, microphthalmia) are significantly more common compared to nonmerle individuals (GELATT and MCGILL, 1973; STRAIN, 1999). The development of these disorders can be understood regarding the genetic background of the colour (KAELIN and BARSH, 2013).
The Mudi breed was chosen for this research because of the fact that it has as many as six accepted colours by the current FCI standard (FCI/238), including white, fawn and blue merle, and there is no breeding restriction for breeding these different colours with each other – except merle to merle breeding – thus increasing the chance for the hidden merle trait. The breed is rarely the subject of scientific research, that's why first of all our aim was to study its merle colour, and compare it with the merle colour observed in other dog breeds. According to experience the split or wall eye of phenotypically nonmerle white or fawn dogs can be a visible attribute of hidden merleness, so we treated the eye colour of the dogs participating in the research with particular attention. Eye colour however is not always affected by the merle gene, so the genetic test is the only reliable way of identifying hidden merle individuals, our aim was to test a fast, reliable and cost-efficient genetic method in the breed, which can be widely used afterwards.

Material and methods

In total 25 Mudi dogs were involved in this study – one with blue merle phenotype as a positive control, one with black phenotype as a negative control, and 23 potential hidden merle dogs. A dog is considered potential hidden merle if it is white or fawn coloured and has at least one merle parent. All of the dogs participating were registered by the FCI thus making their origins trackable. Buccal swab and/or hair samples were collected from a total of 7 European countries. The DNA was extracted from the provided samples and then the exon 11 of the SILV gene was multiplied with PCR method (CLARK et al., 2006). The PCR products (M and m alleles) were separated by size and were detected with the use of agarose gel electrophoresis (Figure 1).

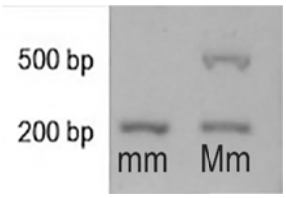


Figure 1. Detection of merle alleles on agarose gel

Results and discussion

Out of the 23 tested unknown genotype dogs ten happened to carry the dominant merle allele. 17 of the tested dogs had brown eyes, and six of them had partially blue eyes – for them we expected heterozygous genotype previous to the actual testing. Our previous expectations got confirmed by the genetic test for the six split eyed individuals, all of them proved to be hidden merles. There were also four hidden merle dogs having brown eyes, not showing any sign of merleness phenotypically, in their cases the only indicator of their true genotype was genetic testing. None of the tested dogs' result was homozygous merle, meaning that the white or fawn colour was not the result of extreme colour dilution caused by two dominant merle alleles.

Conclusion and recommendation

The 11 dominant merle allele carrier Mudis show that the merle colour being present in the breed has the same genetic background as the merle colour of other breeds. Though, merle colouration can still manifest in various ways. In some cases the intact base colour and the diluted colour is clearly distinguishable, in some others there is minimal difference between the two shades. What's more, these two states can transform from one to the other in one particular individual as time goes by – the merle colour tends to get darker as the dog is aging. To understand the exact mechanism of this alteration further investigation is required.
The traditional way of detecting hidden merle dogs can be test mating. If a potential hidden merle dog is mated to a certainly nonmerle dog the progeny may reveal the real colour of these white or fawn phenotype dogs. It's important to emphasize that if the dog carries the dominant merle allele there is fifty per cent chance that it passes it on to its descendant, additionally if the descendant turns out to be white or fawn coloured, its merleness gets hidden again. Test mating is not only complicated, slow and costly, but it's also unreliable.
Another way of recognizing these merle carriers can be monitoring their eye colour. In the Mudi breed blue, or partially blue eyes seems to appear only in albinos or merles. Experience shows that if a potential hidden merle dog has blue in its eye, it does mean that the individual is genetically merle. The results of our genetic testing also confirmed this theory – though a study on bigger sample pool would be welcome. However eye colour is not influenced by the merle gene in all of the hidden merle individuals, so this way cannot be considered unquestionable.
The most recommended way of identifying hidden merles according to our present knowledge is genetic testing. It is reliable when it's done right, besides it is faster and more cost-efficient compared to test mating. If the test is done during the puppyhood it can even be faster than checking the individual's eye colour since puppies are born with eyes closed, furthermore in the first few weeks all puppies have blue eyes.
In Hungary the most recent regulation for Mudi breeding contains a part which highlights the relevancy of genetic testing for the merle gene, but the rules are a bit controversial (NFCSO, 2016). On one hand they are too strict and are not taking into consideration that a dog can only be hidden merle if at least one of its parents carried the dominant merle allele, otherwise there is no chance for it. On the other hand it is not strict enough, as it does not regulate potential hidden merle to potential hidden merle breeding. A clear and rational regulation would be vital for this breed, as it has a small population, and is already quite inbred (ZENKE et al., 2007). Breeding restrictions for no reasonable reasons are just narrowing unnecessarily the possibilities for breeders, causing further genetic degradation in the breed.
If we parse the current FCI standard for the breed we can notice that it's not in harmony with the genetics of colours. For instance, the standard mentions the blue merle colour only of all the merle variations, despite the merle gene is inherited independently from the genes which define the dog's base colour. The American Kennel Club (AKC) has a standard description that fits better for the breed regarding the description of colours. There merleness is handled separately as a marking, thus it can be connected to any of the base colours. The names of the colours differ a bit, but interestingly there the ashbrown (AKC: greybrown) is listed among the standard colours. The FCI standard does not mention it, though it does occur with the simultaneous presence of the accepted ash and brown colours on one individual. Furthermore the FCI standard does not allow split or wall eyes for white or fawn dogs. Before the discovery of the hidden merle colour, white and fawn dogs with blue eyes were most probably selected out for pigmentation faults. Understanding the genetics behind this trait shows that these dogs doesn't have negative effect for the pigmentation of their offspring in breeding, and

they should not be selected out. Revision of the standard along these listed points regarding the effects of the different genes could result a description that is more accurate for the breed.
Among Mudi breeders the facts of hidden merleness are getting more and more well-known lately, but this phenomenon is not specific for the breed. That is why we think that the most important role of our study is to draw attention to and spread knowledge about this interesting trait of dogs. The original meaning of hidden merle is applied only for white or recessive red dogs, because these coat colours hide the merle pattern completely. However among the agouti colours there are also some which are dominated by the pheomelanin pigment, giving a possible alternative meaning for the term hidden merle.
It's necessary to emphasize that hidden merleness is a trait and not a defect. That means that these dogs are not more and not less exposed for genetic disorders than dogs with traditional merle phenotype. Knowing the dog's real colour is important for breeding purposes to avoid high risk mating and puppies with decreased viability.
Further investigation of the colours being present in the breed is promoted, as it is a field now with insufficient knowledge. The ash colour – which is thought to be the analogue of the blue colour of other breeds – for example gives a possibility, as among ash coloured Mudis one can find individuals with more or less hairless body (ears mostly). In Mudis this occurence seems to be connected with ash colour however a very similar disorder called color-dilution alopecia in other breeds was observed on else coloured individuals as well (KIM et al., 2005). There is also a new theory assuming that a mutation of the merle gene may also cause ash phenotype in the breed – we shall see.

References

AMERICAN KENNEL CLUB: Mudi description. URL: http://www.akc.org/dog-breeds/mudi/

CLARK, L.A. – WAHL, J.M. – REES, C.A. – MURPHY, K.E. (2006): Retrotransposon insertion in SILV is responsible for merle patterning of the domestic dog. Proc. Natl. Acad. Sci. USA 103. 5. 1376–81.

FÉDÉRATION CYNOLOGIQUE INTERNATIONALE (2004): FCI-Standard N° 238. URL: http://www.fci.be/Nomenclature/Standards/238g01-en.pdf

GELATT, K.N. – MCGILL L.D. (1973): Clinical characteristics of microphthalmia with colobomas of the Australian Shepherd Dog. J. Am. Vet. Med. Assoc. 162. 393-396.

KAELIN, C.B. – BARSH G.S. (2013): Genetics of pigmentation in dogs and cats. Annu. Rev. Anim. Biosci. 1. 16.1–16.32

KOBAYASHI, T. – URABE, K. – ORLOW, S.J. – HIGASHI, K. – IMOKAWA, G. – KWON, B.S. – POTTERF, B. – HEARING, V.J. (1994): The Pmel 17/Silver Locus Protein – Characteriation and investigation of its melanogenic function. J. Biol. Chem. 269. 29198–29205.

MITCHELL, A.L. (1935): Dominant Dilution And Other Color Factors In Collie Dogs. J. Hered. 26. 425–430.

NATIONAL FOOD CHAIN SAFETY OFFICE (2016): Mudi tenyésztési szabályzat NÉBIH Meoesz v6. URL: http://portal.nebih.gov.hu/documents/10182/398672/Mudi+teny%C3%A9szt%C3%A9si+szab%C3%A1lyzat+N%C3%89BIH+Meoesz+v6.doc/970eb56f-0d55-45cc-9e3a-fab3adf671d1

THEOS, A.C. – TRUSCHEL, S.T. – RAPOSO, G. – MARKS M.S. (2005): The Silver locus product Pmel17/gp100/Silv/ME20: Controversial in name and in function. Pigment Cell Res. 18. 322–336.

STRAIN, G.M. (1999): Congenital deafness and its recognition. Vet. Clin. North. Am. Small. Anim. Pract. 29. 895-907.
ZENKE, P. – MARÓTI-AGÓTS, Á. – PÁDÁR, ZS. – GÁSPÁRDY, A. – KOMLÓSI, I. – ZÖLDÁG L. (2007): Molecular genetic data to evaluate inbreeding in dog populations. Magy. Állatorv. Lapja. 129. 484-489.

Cryopreservation of Nitra and Zobor rabbit semen as animal genetic resources in Slovakia

KULÍKOVÁ, Barbora[1] – BALÁŽI, Andrej[1] – KUŽELOVÁ, Lenka[2] – CHRENEK, Peter[1,3]

[1]Research Institute for Animal Production Nitra, National Agricultural and Food Centre, 951 41, Lužianky, Hlohovecká 2, Slovak Republic
[2]Research Centre AgroBioTech, Slovak University of Agriculture, 949 76, Nitra, Tr. A. Hlinku, 2, Slovak Republic
[3]Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, 949 76, Nitra, Tr. A. Hlinku, 2, Slovak Republic

Abstract

Due to low numbers of individuals from Nitra and Zobor rabbit, which belong to Slovak national breeds, the need for long-term preservation of genetic breeding material arises. Therefore, effect of cryopreservation on sperm from individual males was examined in this study in order to store good-quality insemination doses of these two breeds as a backup collection at the Gene Bank of Animal Resources. Eight Nitra and Zobor rabbits were used to assess quality of their fresh and frozen-thawed semen samples in terms of motility and plasma membrane damage using computer assisted sperm analyser and fluorescence microscopy, respectively. Our work highlights the importance of regular fresh and frozen-thawed semen quality control. Good-quality insemination doses selection resulted in similar conception rate between fresh and frozen-thawed semen, and therefore ensures long-term storage of the two national rabbit breeds semen as a reserve of genetic variability of domestic rabbit.

Introduction

Rabbit breeds vary extensively in weight, body conformation, fur type, coat color, ear length, and this visible morphological variation dramatically exceeds the phenotypic diversity of their wild counterparts (CARNEIRO et al., 2011). National breeds belong to the cultural heritage of the country in which they were bred. Slovak breeders gave rise to ten national rabbit breeds. Nitra and Zobor rabbit are among them and belong to meat breeds with medium live weight (SUPUKA et al., 2012).

Due to the specificity of rabbit sperm membrane, fast cooling rates from room temperature to 5 °C are likely possible in this species. This fact might indicate that cold shock is not a major problem for rabbit sperm and that protocols for sperm cryopreservation in this species could be shortened (MOCE et al., 2003; MOCE and VICENTE, 2009). Nevertheless, differences between rabbit breeds in the resistance of sperm to cryopreservation process were reported (CASTELLINI et al., 1992; MOCE et al., 2003). These differences among breeds and lines studied could be explained by genetic, age and environmental factors and also by the different evaluation criteria, sample size, and semen processing methodologies applied (SAFAA et al., 2008). VIDUES DE CASTRO et al. (2004) suggested that the seminal plasma (SP) protein profile could be used to differentiate between rabbit breeds. Moreover, these differences in SP

composition have also been found among individual males and fractions of the same ejaculate (CABALLERO et al., 2012). Therefore, we aimed to compare quality of semen between Nitra and Zobor rabbit and evaluate effect of cryopreservation protocol on semen from individual males, in order to store good-quality insemination doses of these two breeds as a backup collection at the Gene Bank of Animal Resources.

Material and methods

Eight clinically healthy males of Nitra and Zobor rabbit breed (individuals marked as N1, N2, N3, N4, Z1, Z2, Z3 and Z4) of Institute of Small Farm Animals, Research Institute for Animal Production, NPPC in Nitra were used for the study. Semen was collected with a pre-heated artificial vagina once a week in a regular manner. Semen from individual males was frozen using a rapid freezing method described in previous works (IAFFALDANO et al., 2011; KULÍKOVÁ et al., 2014).

In total, 40 ejaculates were frozen in 0.25 mL French straws. Before freezing and after thawing, sperm total motility (TM), progressive movement (PM) and other parameters of movement (Velocity Curved Line - VCL; Velocity Average Path – VAP; Velocity Straight Line – VSL; Amplitude of Lateral Head Displacement – ALH; Linearity – LIN) were assessed using Sperm Vision ^{TM} immediately after collection/thawing and following 30 and 60 min of incubation at 37°C. Plasma membrane integrity and apoptosis was evaluated using fluorescein (Alexa Fluor) labeled lectin from the peanut agglutinin (*Arachis hypogea;* PNA) and fluorescein YO-PRO-1, respectively. Stained samples were immediately checked under the Leica fluorescence microscope using 488 nm wave-length filter and 400 x magnification.

In terms of artificial insemination (AI), data from 9 and 16 AI with fresh and frozen-thawed sperm, respectively were evaluated. All the does were superovulated and inseminated either with fresh, or frozen-thawed semen simultaneously with i.m. treatment of synthetic GnRH to trigger ovulation. Kindling rates were recorded 30-32 days post AI.

One Way ANOVA (Dunn's Method) and χ^2–test for comparison of mean values (motility, membrane integrity) and percentage (fertilization ability) was used, respectively. P-values at $P<0.05$ were considered as statistically significant.

Results and discussion

Variations in the susceptibility of semen to cryogenic process between breeds have been reported for several species (AUERBACH et al., 2003 in mouse; MOCÉ et al., 2003 in rabbits; LONG, 2006 in poultry and WATERHOUSE et al., 2006 in boars). In our study, we compared the two breeds analysing its pooled values of TM and PM sperm immediately after thawing and after 30 and 60 min of incubation at 37°C. At average, initial fresh TM and PM was similar between the breeds, however longer incubation showed difference ($P\leq0.05$) in fresh TM and PM sperm between the breeds. It reflects the fact that Nitra rabbit sperm motility decreased more rapidly with increasing incubation time (Figure 1). Nonetheless, after freezing-thawing, the movement was similar and sperm from both the breeds were able to hold the movement in acceptable levels.

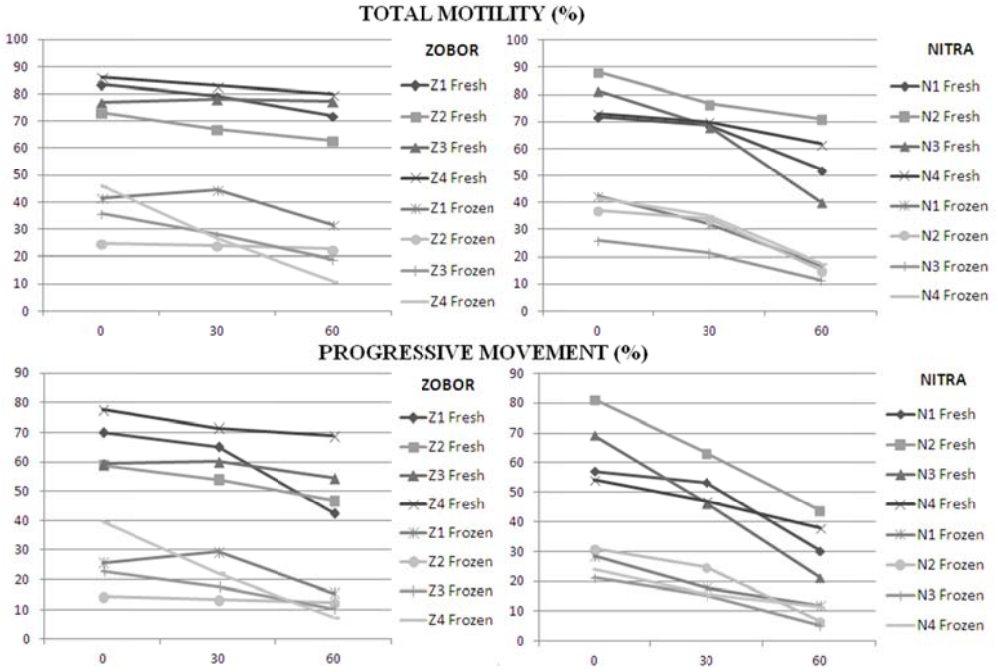


Figure 1. Fresh and frozen-thawed motility and progressive movement mean values of replicate ejaculates from each male used at three time points (0, 30 and 60 min) post incubation at 37°C

Actually, significant inter-male differences rather than difference between the two breeds were recorded after freezing-thawing. In terms of fresh semen, variability in TM and PM among the males from both the breeds increased with incubation time (CV%; TM = 8.9 vs 10.3 vs 20.9 and PM = 16.1 vs 17.3 vs 33.4, for 0, 30 and 60 min of incubation at 37°C). Nevertheless, inter-male variability was more apparent after the freezing-thawing procedure. Male-to-male differences in freezing and thawing tolerance of sperm have been reported in several species (CASTELLINI et al., 1992; THURSTON et al., 2002; WATERHOUSE et al., 2006; LAVARA et al., 2013; SELLEM et al., 2015). Our results showed increased inter-male variability caused by freezing-thawing (CV%; TM = 8.9 vs 23.3 and PM = 16.1 vs 23.3 for fresh and frozen/thawed, respectively) and the variability continued to rise with further incubation (CV%; TM = 26.4 vs 38.1 and PM = 29.8 vs. 36.2, for 30 and 60 min of incubation at 37°C, respectively). Inter-male differences ($P \leq 0.05$) were noticed also in motility parameters chosen tested (data not shown). Our results are in agreement with the study of SELLEM et al. (2015) who found increase in bovine semen variability under stressful conditions. Also, results of DEL OLMO et al. (2013) show the importance of pre-treating sperm (e.g. submitting them to incubation at 37°C) before quality assessment.

Apart from intermale variability, other sources of variability in sperm cryosurvival were observed. Actually, differences in percentage of sperm surviving the cryopreservation process within the same male (intra-male variability) was recorded in this study. Sperm numbers surviving the cryopreservation process (frozen-thawed values normalized to its pre-freeze values), calculated for each male and each semen replicate individually, showed that throughout the sessions, variable numbers of motile sperm survived freezing within a single male (Figure 2). Actually, the intramale variability expressed as CV was in the range of 6 – 15.6 % (min – max) within the individual males. Nevertheless, the lack of variation between straws showed freezing process to be highly repeatable. The reasons provided by various authors for these variations are not consistent, but it might be related to poor sustainability of the cryopreservation process (LAVARA et al., 2013). In addition, high variability in some

males might be due to their health status and inaccuracy in semen collection frequency (THURSTON et al., 2002). Our data are in good agreement with the study of LAVARA et al. (2013) on rabbits and also SELLEM et al. (2015) on bovine species, who reported marked variations across ejaculates from the same bull for several variables. Depending on the link between these variations and fertility, these authors suggest that all ejaculates used in the field for insemination may have to be routinely qualified before AI.

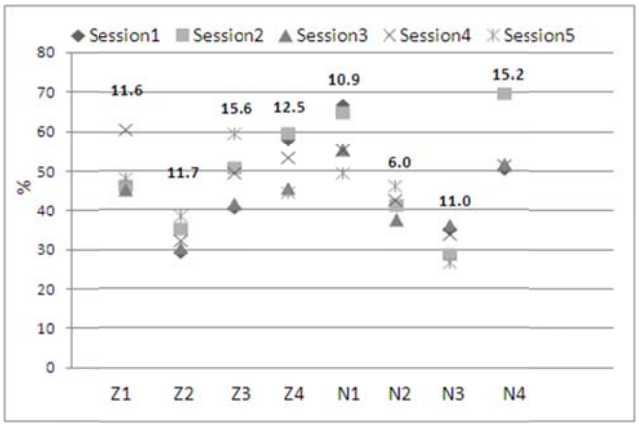


Figure 2. Total motility post/thaw normalized to its pre-freeze values for five replicate ejaculates of eight rabbit male

Similarly to the motility results, also inter-male variability in plasma membrane integrity was found (Table 1). Several authors have reported that the differences in a complex mixture of seminal plasma among males within the same species might be the reason for the male-to-male variability in semen quality (HAUGEN et al., 2007; LAVARA et al., 2013). The effects of seminal plasma on the survival of ejaculated spermatozoa after cryopreservation are largely influenced by the seminal plasma donor, and may be both beneficial and detrimental to spermatozoa (MUIÑO-BLANCO et al., 2008). The combination of an individual and a breed effect builds a strong argument for the view that variation in sperm freezability is to some extent genetically determined (THURSTON et al., 2002).

Table 1. Membrane damaged (PNA^+) and apoptotic (Yo- $Pro\text{-}1^+$) sperm per individual males

	Plasma membrane damage		Apoptosis	
	Fresh	Frozen	Fresh	Frozen
Z1	5.1 ± 1.8^{ab}	15.6 ± 5.4^{ab}	3.0 ± 1.6^{a}	20.0 ± 3.6^{c}
Z2	6.8 ± 1.4^{b}	13.7 ± 2.6^{a}	5.3 ± 2.9^{ab}	16.2 ± 2.4^{bc}
Z3	6.9 ± 2.5^{b}	17.0 ± 3.6^{ab}	2.9 ± 1.2^{a}	17.5 ± 2.9^{bc}
Z4	3.5 ± 1.4^{a}	18.3 ± 6.0^{ab}	2.2 ± 1.1^{a}	14.7 ± 3.3^{abc}
N1	7.2 ± 3.7^{b}	22.0 ± 6.1^{bc}	3.8 ± 1.4^{ab}	12.8 ± 5.6^{ab}
N2	4.2 ± 1.9^{ab}	13.8 ± 5.6^{a}	2.6 ± 0.9^{a}	9.3 ± 1.4^{a}
N3	4.9 ± 1.5^{ab}	29.8 ± 9.4^{c}	6.3 ± 1.7^{b}	19.4 ± 4.5^{c}
N4	2.7 ± 0.9^{a}	24.7 ± 5.1^{c}	2.7 ± 0.7^{a}	10.9 ± 4.0^{a}

Different superscripts per column are statistically different ($P\leq0.05$)

To test the fertilization ability of Nitra and Zobor rabbit sperm, nine fresh and sixteen frozen-thawed insemination doses were used for AI. Only the frozen-thawed samples with motility and progressive movement higher than 35% and 25 %, respectively, were used for the AI. According to kindling rate of rabbit does inseminated, no significant difference in fertilization ability of fresh (77.8 %) and frozen-thawed (68.8 %) semen was found. These data indicate that even though motility and plasma membrane integrity of fresh sperm was negatively

affected by cryopreservation process, the alternations were not enough to decrease the fertilization ability of sperm.

Conclusions and recommendations

Our study confirmed variability in different motility parameters and numbers of membrane altered sperm among individual males of rabbit. Results showed that prolonged incubation time and cryopreservation process leads to inter-male variability increase. Moreover, significant differences in freezability of semen from individual male were found. Therefore, our results highlights the importance of regular fresh and frozen-thawed semen quality control. Good-quality insemination doses selection resulted in similar kindling rate between fresh and frozen-thawed semen, and therefore ensures long-term storage of the two national rabbit breeds semena s a reserve of genetic variability of domestic rabbit.

Acknowledgement

This research was supported by grant of Slovak Research and Development Agency: (APVV-14-0043) and by VEGA (1/02611/15).

References

AUERBACH, A.B. – NORINSKY, R. – HO, W. – LOSOS, K. – GUO, Q. – CHATTERJEE, S. – JOYNER, A.L. (2003): Strain-dependent differences in the efficiency of transgenic mouse production. Transgenic Res, 12, 59–69.

CABALLERO, I. – PARRILLA, I. – ALMIÑANA, C. – DEL OLMO, D. – ROCA, J. – MARTÍNEZ, E.A. – VÁZQUEZ, J.M. (2012): Seminal Plasma Proteins as Modulators of the Sperm Functions and Their Application in Sperm Biotechnologies. Reprod Dom Anim. 47 (3), 12-21.

CARNEIRO, M. – AFONSO, A. – GERALDES, A. – GARREAU, H. – BOLET, G. – BOUCHER, S. – TIRCAZES, A. – QUENEY, G. – NACHMAN, M.W. – FERAND, N. (2011): The genetic structure of domestic rabbits. Mol Biol Evol. 28(6), 1801-1816.

CASTELLINI, C. – BATTAGLINI, M. – LATTAIOLI, P. (1992): Effects of cryoprotectants and freezing on rabbit semen quality. J Appl Rabbit Res. 15, 431-438.

DEL OLMO, E. – BISBAL, A. – MAROTO-MORALES, A. – GARCÍA-ALVAREZ, O. – RAMON, M. – JIMENEZ-RABADAN, P. – MARTÍNEZ-PASTOR, F. – SOLER, A.J. – GARDE, J.J. – FERNANDEZ-SANTES, M.R. (2013): Fertility of cryopreserved ovine semen is determined by sperm velocity. Anim Reprod Sci, 138, 102-109.

HAUGAN, T. – GRÖHN, Y. T. – KOMMISRUD, E. – ROPSTAD, E. – REKSEN, O. (2007): Effects of sperm concentration at semen collection and storage period of frozen semen on dairy cow conception. Anim Reprod Sci, 97(1), 1–11.

IAFFALDANO, N. – DI IORIO, M. – ROSATO, M.P. (2012): The cryopretectant used, its concentration, and the eqilibration time are critical for the successfull cryopreservation of rabbit sperms: Dimethylacetamid versus dimethylsulfoxide. Theriogenology. 78(6), 1381- 1389.

KULÍKOVÁ, B. – DI IORIO, M. – KUBOVIČOVÁ, E. – KUŽELOVÁ, L. – IAFFALDANO, N. – CHRENEK, P. (2014): The cryoprotective effect of Ficoll on rabbit spermatozoa quality. Zygote, 23(5), 785-794.

LAVARA, R. – DAVID, I. – MOCÉ, E. – BASELGA, M. – VICENTE, J.S. (2013): Environmental and male variation factors of freezability in rabbit semen. Theriogenology, 79, 582-589.
LONG, J.A. (2006): Avian semen cryopreservation: what are the biological challenges? Poultry Sci, 85, 232–236.
MOCÉ, E. – VICENTE, J.S. (2009): Rabbit sperm cryopreservation: a review. Anim Reprod Sci. 110, 1-24.
MOCÉ, E. – VICENTE, J.S. – LAVARA, R. (2003): Effect of freezing–thawing protocols on the performance of semen from three rabbit lines after artificial insemination. Theriogenology, 60, 115-123.
MUIÑO-BLANCO, T. – PÉREZ-PÉ, R. – CEBRIÁN-PÉREZ, J.A. (2008): Seminal plasma proteins and sperm resistance to stress. Reprod Dom Anim. 43(4), 18-31.
SAFFA, H.M. – VICENTE, J.S. – LAVARA, R. – VIUDES DE CASTRO, M.P. (2008): Semen evaluation of two selected lines of rabbit bucks. World Rabbit Sci. 16, 141-148.
SELLEM, E. – BROEKHUIJSE, M.L.W.J. – CHEVRIER, L. – CAMUGLI, S. – SCHMITT, E. – SCHIBER, L. – KOENEN, E.P.C. (2015): Use of combinations of in vitro quality assessments to predict fertility of bovine semen. Theriogenology, 84, 1447-1454.
SUPUKA, P. – SUPUKOVÁ, A. – ZIGO, F. – PAVĽAK, A. – MAŽENSKÝ, D. (2012): Slovenské národné plemená králikov. Králik ako produkčné a modelové zviera: XXV. vedecká konferencia „Aktuálne smery v chove brojlerových králikov“, 2012, 157-159.
THURSTON, L.M. – WATSON, P.F. – HOLT, W.V. (2002): Semen cryopreservation: a genetic explanation for species and individual variation? Cryoletters, 23, 255-262.
VIUDES DE CASTRO, M.P. – MARCO-JIMÉNEZ, F. – VICENTE, J.S. – NAVARRO, E. – LAVARA, R. – MOCÉ, E. (2004): Sperm kinetic parameters and differences in seminal plasma composition among two rabbit lines. Reprod Domest Anim. 39, abstract P13.
WATERHOUSE, K.E. – HOFMO, P.O. – TVERDAL, A. – MILLER, R.R. (2006): Within and between breed differences in freezing tolerance and plasma membrane fatty acid composition of boar sperm. Reproduction. 131, 887-894.

In situ conservation of endangered breeds on ark-farms and ark-centres in Slovenia

ŽAN LOTRIČ, Metka[1] – OSOJNIK, Gasan[1] – RANT, Petra[1] – BOJKOVSKI, Danijela[1] – SIMČIČ, Mojca[1]

[1]University of Ljubljana, Biotechnical Faculty, Department of Animal Science, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract

Much of the global decrease in animal genetic diversity is caused not only by extinction of animal species, but also by animal breeds. Namely, the number of the world`s livestock breeds that have become extinct in last two centuries is greater than 1100 and even in the current millennium, the proportion of the breeds at risk of extinction continues to increase. Similarly, the situation in this field in Slovenia is also grave. From a total of 12 Slovenian indigenous livestock breeds, 7 breeds are critically endangered, three are endangered, one is vulnerable, and one remains to be classified. We believe, that in order to enable sustainable conservation of endangered breeds, the means of connection with their sustainable use should be enforced. In this aspect, the newly established network of Slovenian Ark-farms and Ark-centres offers several synergistic aspects in conservation of endangered breeds. In the present paper, the rationale, concept, rules and key challenges of the Ark-farm and Ark-centre network in Slovenia are presented.

Introduction

Indigenous breeds represent unique animal genetic resources, which are frequently bearing collections of various rare characteristics, such as adaptive and breed-resistant traits. Over the last years, rearing of endangered indigenous breeds in Slovenia has become more important also due to the popularisation of agro tourism, as well as direct sales of agricultural products, which allow for sustenance of extensive farming systems. The number Slovenian endangered breeds has been on the rise since the beginning of the 21st century and up to now, as in the end of 2016 the stock of most indigenous breeds was the largest. Mainly, these breeds are geographically limited on the small territory or certain region in Slovenia. Taking into account this criterion and their reproduction capacity, population trend and pure-breeding proportion, the breeds are assigned different extinction risk statuses (Table 1).

Table 1. Estimated number of Slovenian indigenous purebred animals and risk status (2010 and 2016)

Species	Indigenous breed	Risk status	Number	
			2010	2016
Horse	Lipizzan horse	critical	1,062	1,267
	Posavje horse	critical	1,050	1,750
	Slovenian draft horse	critical	3,300	2,950
Cattle	Cika cattle	endangered	2,341	4,289
Pig	Krškopolje pig	endangered	987	1,950
Sheep	Jezersko-Solčava sheep	vulnerable	17,200	17,200
	Bovec sheep	critical	3,500	3,500
	Istrian Pramenka	critical	1,150	1,050
	Bela Krajina Pramenka	critical	880	1,050
Goat	Drežnica goat	critical	600	670
Hen	Styrian hen	endangered	1,500	1,450
Bee	Carniolan honey bee (no. of bee colonies)	not yet defined	129,970	150,000

The work in the field of biodiversity of Slovenian indigenous livestock breeds is performed under the Slovenian Public service of gene bank tasks in animal husbandry (Public service), established at the Biotechnical Faculty, University of Ljubljana. Conservation of Slovenian indigenous livestock breeds with Ark Farm and Ark Rescue Net system is one of more important efforts of *in situ* conservation that has been established in the last few years by the Public service. The Ark network was initially established as the incentive of ELBARN project funded by the European Commission (Council Regulation (EC) No 870/2004). Public service took an active part in harmonizing the principles of Slovenian Ark network to similar forms of conservation in the EU, preparation of relevant rules, talks with interested stakeholders, as well as personal interviews with involved farmers and pilot inspection visits to farms.

The term "Ark" is an international recognized word related to conservation, and in the specific context of agriculture, to rearing of indigenous (endangered) breeds. The rules and conditions for enrolment are consistent in countries all over Europe. The term "Ark" (figuratively means boat or chest) therefore indicates that farms who are rearing indigenous (endangered) breeds in the local environment and prevent their extinction are like rescue boats, enabling survival of a collection (chest) of valuable genetic resources and their persistent adaptation to the constant changes in their living environment.

The aim of the Public service in the frame of Ark network is focused on promotion, education and conservation of indigenous livestock breeds *in situ*. The Ark network aim is the conservation of rare and endangered species/breeds of livestock animals. In 2016 a new status, "Ark Centre" (i.e. in Slovenian, "Ark-središče") has been defined, apart from the existing "Ark-Farm" (i.e. "Ark-kmetija").

Ark Farm: Conservation of Slovenian indigenous breeds through livestock production is the primary activity of these farms. Ark Centre: These farms rear Slovenian indigenous breeds, primarily for the purpose of education and public awareness ("safari" park for indigenous breeds). Pure-breed are included in the corresponding breeding programmes, or alternatively, are obtained from breeding-program herds that are stationed in the area, where the individual breed originates from.

Ark status is intended for farms rearing at least three different indigenous breeds. At least one indigenous breed from each group of species should be reared on the Ark Farm or on the Ark Centre (Table 2).

Table 2. Groups of breeds by species

	Group A			Group B		Group C	
	SPECIES			SPECIES		SPECIES	
	Horse	Cattle	Pig	Sheep	Goat	Hen	Bee
Breed	Slovenian draft horse	Cika cattle	Krškopolje pig	Jezersko-Solčava sheep	Drežnica goat	Styrian hen	Carniolan honey bee (*Apis mellifera Carnica, Pollmann, 1879*)
	Posavje horse			Bela Krajina Pramenka			
	Lipizzan horse			Bovec sheep			
				Istrian Pramenka			

Furthermore, the number of animals of Slovenian indigenous breeds reared on the Ark Farm or Ark Centre should exceeded 50 % of total animal stock on the farm.

Material and methods

To establish the network, Public service prepared the list of the potential candidates for Ark Farm or Ark Centre statuses according to the available data of breeders rearing Slovenian indigenous breeds. The list and contacts of these breeders were obtained through the local Institutes of Agriculture and Forestry in the frame of Chamber of Agriculture and Forestry of Slovenia. For the purpose of ark network start-up, a special event was organised to present breeders a practical guide of good practices for conservation and use of endangered breeds in other European countries. Furthermore, the extensive design and rules of Slovenian Ark network were presented. In the discussion that followed, breeders had a chance to inform the Public service about their points of view and their needs. Public service prepared also a public call that was available at the webpage, as well through various public institutions and media coverage. Interested breeders and other operators rearing Slovenian indigenous breeds were informed that Public Service of Gene Bank Tasks grants statuses and provides professional support for the development of specific concepts for presentation of indigenous breeds in practice. A contact point for the Slovenian Ark network was established in the frame of Public service, where a new Web page with necessary information was formed (www.ark.si, also accessible at www.genska-banka.si/ark). Currently, it contains the basic contents – presentation, public call and rules. It is planned to be develop into an extensive portal for Ark network connecting breeders by regions and presentations of individual farms (products, tourism…). In this manner, a list of 68 candidates for the Ark Farms and Ark Centres was compiled. First, breeders were contacted by telephone and 62 of them were interested to join the system. However, only a few of them met the conditions for the entry in the system. They

were asked to submit an application form, describing in essence: (i) the indigenous animal breeds and number of individuals kept, size of agricultural area intended for indigenous breeds, (ii) information on any other breeds on the farm, as well as (iii) supportive infrastructure (breeding technology, type of farming – organic/conventional, farm accessibility, visiting information, products etc.). After submission and prior field inspection, the Public service checked the pedigree of animals included in the herd book, and then the breeders that complied with the set conditions were visited by members of a special commission of the Public service.

Results and discussion

The first Ark Farms and Ark Centres were established in Slovenia at the end of 2016. In 2016, three of the registered farms did not meet the requirements. After the first round of field inspections in 2016, the commission has concluded that four farms have suited requirements for Ark Farm and seven farms suited requirements for the Ark Centre.
Public Service has been organising topical conferences for more than a decade. In 2016, a special emphasis was placed on the conservation of indigenous endangered breeds in Slovenia *in situ* and their use. Slovenian farms, which fulfilled all the requirements to obtain the status of an Ark Farm or an Ark Centre, were presented at the aforementioned conference. All these farms were solemnly awarded with certificates, giving them the right to present themselves as Ark Farms or Ark Centres. These farms are the first certified Ark Farms in Slovenia. Four Ark Farms and seven Ark Centres were conferred this status in total.
This status is designed for farms rearing at least three Slovenian indigenous breeds of livestock. Furthermore, the status indicates the recognition of authenticity of breeds and that special attention is paid to the specific role of such farms in the conservation of the biodiversity of the Slovenian livestock. Processing and marketing of livestock and products of animal origin (milk, meat, wool …), sustainable organic farming and conservation of indigenous cultivated plant varieties are also desirable in both systems.
Public Service confirms admission of farms into the Ark Farm and Ark Centre system. It certifies them and provides technical assistance and promotional support (single corporate identity, promotional material, web presentation …).It acts as a connecting link between them. Furthermore, the Public Service monitors these farms to secure the continued existence of endangered livestock breeds, as well as any subsequent developments.
As a result of previous activities and successful promotion of the Ark network, several additional entry submissions have been since received. We plan to visit them in 2017. Furthermore, on a yearly basis, about 10% of the existing status holders will receive random follow-up inspection visits.
Based on the feedback from the breeders, in the certain Slovenian regions traditional farming systems are based on rearing one indigenous breed (e.g. in Ljubljana Marsh a common traditional system is horse grazing). As these farms are currently unable to join into the Ark network, the Public service also intends to formulate a concept for wider Ark areas, where several farms could apply together to obtain a joint status.

Conclusion and recommendation

The establishment of commercial, production-trait oriented livestock breeding programs drastically decreased diversity of indigenous breeds. Appropriate measures can help maintain the number of indigenous endangered breeds that are locally adapted to the specific rearing

conditions. One of the successful measures could be the Ark system. Certified Ark Farms or Ark Centres are becoming more and more popular in Slovenia. Breeders of endangered breeds are aware that appropriate promotion of these breeds and their traditional breeding systems could have a strong influence on better recognition of endangered breeds in the general public. A value chain based on local breeds can generate new sources of income, e.g. in tourism or in artisanship. Tourism, marketing and boutique products can also add value to livestock diversity. This income benefits local people directly. Biodiversity of traditional breeds is a natural and cultural heritage of a particular country. This separates us from the large multinational companies. We should strive to conserve Slovenia's identity reflected by breeding endangered livestock breeds that have lived in this territory for many centuries. Furthermore, public awareness of the local and threatened breeds is increasing. Products of endangered indigenous breeds may, therefore, fit well into the economic niches, while still preserving tradition and cultural values. Therefore, additional support should be provided for the management of Ark Farms or Ark Centres.

References

OSOJNIK, G. – ŽAN LOTRIČ, M. – RANT, P. – BOJKOVSKI, D. – SIMČIČ, M. (2016): Ark kmetije in Ark-središča. Cikasti zvonček, 17, 10-11.

OSOJNIK, G. – ŽAN LOTRIČ, M. – BOJKOVSKI, D. – RANT, P. – SIMČIČ, M. (2017): Slovenska Ark mreža in druge dobre prakse ohranjanja avtohtonih pasem domačih živali v Evropi. Kmetovalec, 85, 3: 16-20.

RANT, P. – OSOJNIK, G. (2017): Ohranjanje slovenskih avtohtonih pasem v sistemu "Ark-farm" in "Ark-rescue net". Program ohranjanja biotske raznovrstnosti v živinoreji. Poročilo za leto 2016. Domžale, Biotehniška fakulteta, Univerza v Ljubljani, 71-94.

ŽAN LOTRIČ, M. – OSOJNIK, G. – BOJKOVSKI, D. – SIMČIČ, M. – RANT, P. (2017): Genska banka v živinoreji – prvi statusi "Ark kmetija" in "Ark center". Kmečki glas, 74, 3: 10.

Description of a planned subject "Basic aspects of farm animal handling" – based on experiences with native breeds

GÁSPÁRDY, András[1] – SEREGI, János[1]

[1]University of Veterinary Medicine, Department for Animal Breeding, Nutrition and Laboratory Animal Science, 1078 Budapest, István str. 2, Hungary

Summary

In order to make the veterinary medicine course more practical, we think the introduction of the new subject "Basic aspects of farm animal handling" is necessary. We wish to educate the students in the basics of contact with farm animals, since as veterinarians, many will find their jobs in agriculture.
Our Department (for Animal Breeding, Nutrition and Laboratory Animal Science) will undertake the launch and teaching of the new subject and the compilation of teaching materials required. Our staff will work in co-operation with animal caretakers working at the Hungarian breeds Preservation unit.
This new compulsory subject will last for one semester, the study load is 15 hours consisting exclusively of practical elements. The estimated credit score of the subject is 3.
The new subject will be introduced in three languages, Hungarian, English and German, and will further strengthen the University's international recognition.

Subject description

In order to improve the practical education of veterinary students, the introduction of a subject that has been lacking up to this point is necessary. "Basic aspects of farm animal handling" is necessary to educate the students in the basics of contact with economically important farm animals as soon as possible. The country's livestock population is once again growing, and more and more vets will find work in agriculture, and practice veterinary medicine on large scale operations.
Therefore, the new compulsory subject principally focuses on the major livestock and poultry species of economic importance: horses, cattle, sheep, swine and fowl. Our aim is that each species will be represented by at least one Hungarian native breed. Students will be working with both male and female animals, and both adults and young of each breed. Our goal is to give students a good foundation in the handling of these species and also to provide some insight into Hungarian heritage breeds.

The site of our university in Üllő-Dóra Major consists of many individual parts: The Department and Clinic of Equine Medicine, a commercial farm, the Department and Clinic of Food Animal Medicine, the large animal necropsy facility, a privately run slaughterhouse and the Preservation unit of old Hungarian agricultural breeds. This practical course will be held at the Preservation unit.

The Preservation unit of the old Hungarian animal breeds was established by the former director of the site, Professor János Seregi for the 2nd Symposium of DAGENE October 6-8, 1992 (PROGRAM OF 3RD WORKSHOP). The Preservation unit serves as a living gene bank and as an animal show park of DAGENE. Here we have kept Hungarian Grey Cattle, varieties of Mangalica pig, Carpathian water buffalo, native sheep breeds and dual-purpose poultry breeds.
The renovation of the Preservation unit started last year and the University's newly-gained independence has brought additional development opportunities to the existing livestock herd and infrastructure.
However, for the sake of the successful introduction of the new subject it is necessary to obtain certain tools and consumable items, and to maintain and replace these regularly. For example this might include: a leg and neck transponder, mastitis tests, tools for identification, weighing scales, lux meter, feedstuff and faeces sampling bags, syringes, a chip reader, lead ropes and halters, a grooming kit, etc.

Our Department for Animal Breeding, Nutrition and Laboratory Animal Science undertakes the launch and teaching of the new subject and the compilation of teaching materials required. Our staff will work with the animal caretakers serving at the Preservation unit.

The new compulsory subject would last for one semester, with a study load of 15 hours. Each student receives a three-hour long targeted training about accident and labour protection at the very beginning. The next twelve hours consist of exclusively practical elements.
Each student should master these basic techniques and should gain this experience. Without this experience future veterinary work in an agricultural environment would be very difficult for these students.
On this practical training course students will perform a series of tasks. The successful completion of the tasks is required for the fulfilment and acceptance of the subject. Estimated credit score of the subject is 3.

Series of tasks by animal species

Horse: description of keeping/housing conditions, description of feeding conditions, reading individual identification, filling out a horse passport, box keeping of mare with foal, change of bedding material, imitation of blood sample taking from jugular vein, hand touching of basic body parts, lifting up the legs ("knee-up action"), holding hooves for control, estimation of body weight and height at withers, taking three major body measurements, estimation of age, inspection of teeth, use of a halter with a lead rope to lead a horse from place to place, horse equipment (saddle and harness), recognition of cart/carriage parts, recognition of horse feed stuff components, construction of a daily ration for a horse, recognition of conformation faults, blemishes and soundness.

Cattle: practice of tying up a cow, practice of driving/leading of a cow from place to place, checking the air flow through nostrils, opening of the mouth for examination and checking the teeth, identifying of cow based on numbering, marking of a cow using provisional methods, udder evaluation (halves, quarters, teats), taking three major body measurements, recognition of injuries, inflammations, expressing a few drops of milk, performing a Mastitis Test, recognition of cow feed stuff's components, assistance at feeding by base fodder and concentrates, deposition of licking salt, catching and fixing of a calf/grower to practice oral medication, imitation of blood sample collection from tail vein, up and down insertion of

neck/leg transponder, preparation of milk replacer and bucket feeding, recognition of conformation faults, blemishes and soundness, estimation of age and body weight, other biological specimen (buccal cells, hair roots) collection for DNA investigation.

Sheep: practicing the catching of an individual from the flock, leading of an animal, catching and fixing of a sheep to practice oral medication and wool judgement/wool sample taking/estimation of body condition by placing your hand on the sheep's backbone and short ribs, recognition of fleece structure/wool fibres, sitting a ewe down to imitate blood sample collection from jugular vein, sitting a ewe down to control the claws/claw trimming, laying a sheep down for estimation of fleece density/shearing/treatment of shearing injuries, identifying of a ewe based on numbering, marking of a lamb/ewe using provisional methods, denomination of sheep by age and gender, estimation of age, inspection of teeth, assistance at feeding by base fodder and concentrates, recognition of creep-feeding, deposition of licking salt, refreshing drinking water, recognition of conformation faults, blemishes and soundness, measuring rectal temperature, collecting faecal sample.

Swine: catching of a piglet and measuring its body weight, practicing of keeping a piglet/weaner for treatment/vaccination/cutting of needle tooth/castration, identification of an individual based on numbering, marking of an individual using provisional methods, leading a weaner/sow from place to place, denomination of swine by age and gender, recognition of swine feed stuff components, construction of an age-appropriate daily ration for swine, control and refreshing drinking water, recognition of conformation faults, blemishes and soundness, measuring rectal temperature of piglets.

Fowl (and other domestic birds by chance): catching of a fowl, holding chicken upside down (by its legs) for body weight measuring, body weight estimation in other birds, holding a fowl for vaccination into the webbing at the top of the wing, protection against cannibalism (spectacles, dubbing, beak-, wing- and spur/toenail trimming, bald spot from treading), denomination of fowl by age and gender, estimation of sex ratio, identification with leg ring, egg collection, evaluation (size, shape, colour, weight, egg shell quality, porosity) and marking of egg, refreshing bedding and water, recognition of conformation faults, blemishes and soundness, measuring cloacal temperature, recognition of feed stuff components.

General knowledge, and site operations

Besides the animal handling, each student should give corrects answers on the following general things:
Denomination of the different parts of the Üllő site infrastructure (personal entry, truck gate, wheel wash, vehicle weighing scales, fence, paddock, shelters, stables, feed store, bunker, silo, feed mixing plant, milking parlour, waste store and hazardous waste storage area, social buildings, separated locker rooms, veterinary room, examiner, office room, others).
Estimation of 1kg of mixed fodder.
Exposition of major data of boards set at the keeping places of the animals.
Weighing 1 kg of mixed fodder and it safety packing.
Opening a grain-filled feed sack without damaging it.
Moving and opening a small square bale, opening and inspection of a round bale of silage.
Cleaning of a self-filling drinking bowl, trough and nipple drinker.
Cleaning of a feeding automat, feeding trough and hay rack.
Control of feedstuff conveyor.

Feedstuff sample collecting, standard packing and documentation (labelling).
Collecting faecal sample, and its standard packing and documentation.
Records of sample.
Denomination of buildings and function of the site, its data on animal population size and production, its products, by-products, waste and hazardous waste.
Denomination of input materials, feedstuff, water, energy, chemicals, drugs and other active components of the site.
Calculation and preparation of daily feedstuff and water requirement for a given individual by species, utilization, age etc.
Inspection of the usual documents (weighing bill, production and control log-book, feed data and product documentation, treatment diary, receipt and expenditure documents, animal identification equipment, animal tagging documents) at the site.
Measuring of light intensity at different places of stable/paddock/rooms.
Estimation of individual space requirement in stable/paddock/pasture.
Estimation of total weekly feed requirement in Preservation unit.

Miscellaneous advantages

The new subject introduced in three languages (Hungarian, English and German) will further strengthen the University's international recognition. At the same time, it is hoped that the new subject will contribute to the practical experience required for American accreditation of our University.
This activity contributes to a stronger co-operation between our department and Üllő and to the maintenance and improvement of the Preservation unit gene bank.
For the 2nd-year students of Hungarian and English courses the "Basic aspects of farm animal handling" will be held in the spring semester. Thus, they will be sufficiently prepared to go for the extramural summer practice on Animal Breeding and Nutrition.
For the German course students, the subject will be held in the autumn semester. They do not have this compulsory summer practice at present, unless they join the English course from 3rd year. The number of subjects available for German course students is getting higher. By introducing a new one, they may have an increased possibility of changing to another university in Germany.

References

PROGRAM OF 3rd WORKSHOP, Abstracts, List of Participants. 2nd International DAGENE-Symposium on Gene Conservation, Üllő – Hungary, 6-8 October 1992. Organizers: Institute for Agricultural Quality Control and University of Veterinary Science Research Institue

The role of regional government in the preservation of Istrian autochthonous breeds

ŠUBARA, Gordan[1]

[1]Agency for Rural Development of Istria, Ulica prof. Tugomila Ujčića 1, 52000 Pazin, Croatia (http://www.azrri.hr/)

Autochthonous breeds can be protected only through social consensus and a common consideration of all the benefits that autochthonous breeds of domestic animals bring to the society. If we fall into the trap of examining the presence of these animals in space only through the prism of zootechnics and genetic resources or productivity or emotion or any other singular reason, the autochthonous breeds will disappear from space altogether. In simple terms, if the survival of autochthonous breeds will be of concern only to agronomists, veterinarians, breeders or ethnologists alone, then soon we will not have a chance to see autochthonous breeds in the landscape any more.

If we want to preserve the existence of autochthonous breeds in a meaningful and sustainable way it must become the undertaking of the entire society, ergo preservation efforts must involve a multidisciplinary approach. In addition to the above-mentioned professionals, the preservation activities require the involvement of diverse stakeholders: technologists, experts in the gastronomy field, marketers, environmental protection experts, spatial planners, educators in schools and universities, journalists, politicians …

In specific cases the national administrations play a role in connecting all different stakeholders together. However, certain segments of national administration are often more administerial than functional. It is challenging enough to galvanise different ministries to propel in joint action, let alone expect them to become moderators of such programs.

From the experience of the Istrian County and its agency AZRRI, it is evident that regional government, if politically interested, can be a very efficient moderator that connects and engages all segments of society in the process of preserving autochthonous breeds, especially in the case of indigenous breeds whose name is strictly connected to a specific region. The regional government connects and performs all parts of the protection and conservation program of autochthonous breeds excluding those activities which the national government maintained herself with the goal of protecting national wealth. That means that the Region of Istria cares about a regular presence of autochthonous breeds in the media, education of professionals and the public at large, development of a positive national attitude towards indigenous breeds, responsible spatial planning which will in the long run envision the presence of autochthonous breeds in space, ensuring basic infrastructure needs, the development of new and standardization of existing products of autochthonous breeds, as well as their promotion among the public and consumers.

All these activities are necessary if we want to achieve a sustainable population of autochthonous breeds acknowledging environmental as well as economic sustainability.

Gastronomic valorisation of Istrian Cattle meat

ŠURAN, Edmondo[1]

[1]Agency for Rural Development of Istria, Ulica prof. Tugomila Ujčića 1, 52000 Pazin, Croatia (http://www.azrri.hr/)

In the permanent protection program of Istrian Cattle by economic (gastronomic) valorisation, added value of Istrian beef stems precisely from the natural feed and rich biodiversity of Istrian grassland, embedded and validated in the unique meat of the Istrian cattle. Today more than 1800 Istrian cattle head of all categories inhabit the Istrian peninsula and Kvarner islands. With a breeding program, a specific style of holding and feeding of the cattle is defined, as well as the breeding area.

The natural mode of feeding on poor pastures of Euromediterranean and Submediterranean vegetation and extensive breeding throughout the year make Istrian beef different, richer in mineral salts, susceptible to a longer higher quality fermentation, whereby the meat takes on the specific tastes and odours, while with tearing of the muscle and connective tissue bonds, the meat softens and becomes pliable for thermal treatment and easily digestible. The added value of Istrian beef is reflected in the wealth of original flavours and aromas, and the increased proportion of unsaturated fatty acids make the meat of Istrian Cattle a very valuable and healthy culinary ingredient.

The preparation of delicacies of the meat of Istrian Cattle is demanding with regards to the investments of time, knowledge and experience it entails. Therefore, only the finest chefs, who understand the value of a particular ingredient, are able to prepare speciality dishes, making use of all categories of meat of the Istrian cattle. By establishing traceability from "farm to table" the origin of the raw materials can be determined at any stage, with the use of a code number each animal possesses. This gives added value to the ingredients and guarantees the high quality of the Istrian beef.

As a logical evolution of the Istrian beef market, the need arose to develop programs of preserved meat products made with the meat of Istrian cattle. Through the technological process of maturation, the meat of Istrian Cattle acquires a specific flavour and softness, and as such is ready for processing into high-quality meat products. In the nonindustrial production, only primary production of small quantities, the speciality delicacies are made with specific taste and aroma, under the direct supervision of AZRRI's experts. All processing's are completely natural and the resulting products are made with superior quality ingredients: Istrian Cattle meat, pork meat, Istrian wines Malvazija and Teran, Istrian olive oil, Mediterranean spices, and truffles.

Valorisation and promotion of local food ingredients including meat of autochthonous breeds, in cooperation with the catering sector, and the use of the former in menus in restaurants, hotels and taverns, is a prerequisite for the organised cultivation and marketing of local produce, with a common goal of presenting Istrian quality.

Education of chefs with the purpose of recognising the value of local produce and their gastronomic potentials with all the richness of flavour and aromas they carry is the basis for the development of Istrian cuisine and consequentially the development of rural entrepreneurship, countryside revitalisation and biodiversity conservation of the Istrian peninsula.

During the last 10 years, more than 30 training sessions with Istrian cattle meat and around 10 sessions with Istrian donkey meat were organised, attended by over 400 participants. Topics ranged from traditional Istrian gastronomy to modern and creative meals which made full use of all the culinary potential of local quality products and ingredients.