CONTEMPORARY AGRICULTURE / *SAVREMENA POLJOPRIVREDA* 60 (3-4) 403-412, 2011.
UDC: 63(497.1)(051)-"540.2" ISSN 0350-1205

UDC:572.023:639.112

NUTRITION SPECIFICITY OF BROWN HARE (LEPUS EUROPAEUS) AS A CAUSE OF THE DECREASED NUMBER OF POPULATION

BEUKOVIĆ MILOŠ, ĐORĐEVIĆ NENAD, POPOVIĆ ZORAN, BEUKOVIĆ DEJAN, ĐORĐEVIĆ MILUTIN1

SUMMARY: This paper reviews the specific choice of food and feed for brown hare (Lepus Europaeus) in Serbia and Europe, reducing the diversity of flora as a result of the intensification of agriculture, and the impact of these changes in population numbers. Examination of the composition of hare food is done gastric contents microscopy or fresh feces. Studies from Sweden, Austria and Hungary indicate that hare consume dozens species of plants. However, most authors agree that about 50% of meals are only 2-3 plant species. Based on the literature review can be concluded that the intensification of agriculture substantially reduced the diversity of wild plants in farming areas, most authors considered important to reduce the number of hares in Europe. In particular, it highlights the problem of food deficit in the summer, after harvest of winter crops. During that time comes to change the chemical composition of milk or falling energy value of 14.5 KJg-[1] (spring) to 11.03 KJg-[1] (autumn), which negatively affects the offspring. In contrast, the deficit in the winter diet in most areas is less pronounced, due to the wheat fields. As a solution to these problems according to the establishment of "green corridor" between the fields under the spruce monocultures, organic vegetable production, control the number of predators and possibly controlled production hare offspring in farm

Key words: *brown hare, food, feed selection, the size of the population.*

Review scientific paper / *Pregledni naučni rad*

[1]Miloš Beuković, PhD, associate professor; Dejan Beuković, MSc. research assistant; Faculty of agriculture Novi Sad. University of Novi Sad.Nenad Đorđević, PhD, professor; Zoran Popović, PhD professor, Faculty of
agriculture Zemun University of Belgrade. Milutin Đorđević, PhD, assistent professor, Faculty of Veterinary Medicine, Belgrade
Corenspondig author: Miloš Beuković, e-mail: milos.beukovic@stocarstvo.edu.rs; phone: +381 21 485 3489.

INTRODUCTION

For Serbian hunting grounds brown hare is certainly the most interesting types of small furry hunting game. To the spatial distribution and abundance of brown hare in some hunting grounds primarily affect the natural factors, such as climate (Beukovic et al. 2009a; Popovic et al., 1996a,1997), diseases and predators (Beukovićet al. 2011b; Popovic et al. 2009; Ristisc et al. 2010a); and to some extent, and anthropogenic factors: agricultural activities, transportation, hunting ...(Beukovic et al., 1997, Popovic et al.,1996b).The density of population in Serbia is a brown hare from a few individuals to several dozen individuals per 100 ha, while the highest density was recorded in Poland fifties: 240 hares per 100 ha(Popovic and Djordjevic, 2010).

This kind of hunting game features extremely high degree increments, which makes up a large mortality of young (Gajic and Popovic, 2010). Although hares can live 10-15 years, in modern conditions only 3% of hares reach the age of 4 years. Young hares (up to one year of age) account for 50-75% of fall hares population of , and the rest of are hares mostly aged 1-2 years. According to Popovic et al. (2011) in the previous decade, the greatest number of rhares in Serbia has established the 2005th (629,639 animals), followed by a decline, with the exception of Vojvodina (Beukovićet al., 2002, 2007a,2009b). Same time, there was an increase in shooting percentage, with 14.26% to 18.02%. For obvious downward trend in the number of the most important are responsible changed living conditions, increased use of herbicides, as well as various infectious diseases(Popovic, 2006, Popovic et al., 2008) and it should add the direct influence of man. The biggest influence on the strength of the game population in the hunting grounds by the users level of utilization of game populations (Beukovic et al.,2011). Percentage of population must be consistent with the size of the parent fund and must be accompanied by its oscillations. In addition, one can contribute to maintaining and increasing the number of hares other measures, such as improving nutritional potential hunting grounds, winter nutrition, import brown hares from other hunting, predator number control, closed season, the establishment of protected areas and others (Beukovic et al., 2009c).

MATERIALS AND METHODS

Basic characteristics of brown hare nutrition and feed selection

The choice of food for wildlife dependent on the specifics of the hunting area, the degree of human activity, and most of the season. Feeding wild animals in hunting areas can be fully based on natural food, or a certain percentage involve different nutrients that a man entered the grounds in order to achieve certain goals such as increasing the number of animals in a territory, a better quality of trophies, a smaller loss of game. (Beukovic et al., 2006, 2007b; Popovic, 2007, Djordjevic et al.,2008a). Interventions in the diet of wild animals can give good results only if we have good knowlage with the specific use (digestion) of food, the affinity of certain species for certain nutrients, nutrition potential of hunting grounds, the possibility of increasing production of natural food in the hunting ground, opportunities for additional nutrition of game, et all.. Therefore, in this paper provides an overview of previous research in nutrition brown hare hunting in Central Europe, which is most similar to the many features of Vojvodina as a part of Serbia with a relatively stable population of brown hare (Beukovi et al.,2009c).

Brown hare belongs to a group of small herbivores with cecum fermentation of digest, which digest plant fibers with lower efficiency compared to larger herbivores. Therefore, small herbivores in the evolutionary developed two strategies for better utilization of food: a) selection digestible nutrients and b) faster passages non digestible parts meals and selective retention of digestible. That escaped of many predators, brown hare can develop a speed of 72 kmh^{-1}, compared with rabbits with a maximum speed of 52 kmh^{-1}. This feature requires fewer digestive system and the smallest ballast in the digestive organs. This is done by selecting digestive nutrient and faster flow of fiber. This is supported by the fact that brown hare are anatomically adapted to these requirements and has a smaller percentage of the digestive organs in relation to the brown hares (Table 1).

Table 1 Organ weight (g) of selected organs including Digest as a proportion of body wt %, ± SD, (n) (Stott,2008)

	Hare (% of gross carcass weight)	Rabbit (% of gross carcass weight)
Abdominal alimentary canal	13.77 ± 2.94 (79)	18:20 ± 3.44 (37)
Stomach	2:53 ± 0.72 (68)	5:09 ± 1:38 (46)
Small intestine	2.76 ± 0.45 (24)	3.23 ± 0.49 (25)
Caecum	4.97 ± 1:49(95)	6.79 ± 1.87 (38)
Liver	2.24 ± 0.39 (13)	2.65 ± 0.61 (43)
Heart	1:06 ± 0.12 (15)	0:28 ± 0.10 (37)

Determining the composition of the diet of wild animals is a very complicated method, all methods developed so far have certain disadvantages, such as monitoring - observation nutrition in the field (De-Wichatitsky Garin et al., 2005), the method with esophagus fistula (Vetetoet al.1972), microscopy and chemical analysis of gastric contents (Kamlerand Homolka, 2005) or microscopy and chemical analysis of feces(Katona and Altbäcker ,2002).

The fastest and easiest way to assess the composition and nutritional quality of wild animals is to examine the stomach contents shooted animals (Djordjevicet al.,2008b). Specifically, these samples can be taken from each animal, except in rare cases when a hunter shot a significant seriously damages the digestive system and caused extensive bleeding. However, analysis of rumen content requires the killing or capture animals (Watanabeand Takatsuki,1993).This can be a significant problem in hunting with a smaller number of animals in protected areas and parks, and selective culling can reduce the representativeness of samples.

Assessing the quality of food based on microscopy of feces its requirements collection for the area in places where the animals move up and retained. You should use only fresh feces that are immediately analyzed or frozen until analysis of botanical (Djordjevic et al.,2007). Size (number) of the sample is crucial for the accuracy of the data (Holecheket al.,1982). The great variety in the diet of some species and low similarity between individuals of one species require larger initial sample (Katonaand Altbäcker, 2002).

In previous studies, which did Frylestam (1986) in Sweden found that hares prefer a wild plant species and their eating significantly more diverse in areas of natural grass-

lands (37 species consumed) relative to the surface under the spruce monocultures (14 species consumed). Reichlin et al. (2006), stated that although the in diet of brown hare dominated cultivated plants, the animal prefers weeds and wild grass, if available to them. However, Jennings et al. (2006) have found from research in England and Wales to hares out of pastoral areas have less mass and less fat reserves, despite a similar quality food. The authors believe that the reason for the higher energy expenditure.

Table 2 Positiveli selected plant species (Reichlinet al.,2006)

Period	Scientific name	ε	N	is
February	*Malus domestica*	0.96	1	-
	Daucus carota	0.87	3	0.08
	Beta vulgaris	0.83	22	0.08
May	*Trifolium repens*	0.87	2	0.07
	Glycine max	0.61	8	0.25
	Trifolium pratense	0.39	4	0.35
	Papaver rhoeas	0.09	9	0.32
August	*Panicum miliaceum*	1.00	1	-
	Papaver rhoeas	0.93	1	-
	Trifolium incarnatus	0.27	2	0.68
November	*Beta vulgaris*	0.98	5	0.02
	Capsella bursa-pastoris	0.85	1	-
	Triticum aestivum	0.19	20	0.21

ε mean Electivity Index, N number of Hares that the plant used, the standard error of the mean.

Reichlin et al. (2006) are research nutrition of brown hare conducted in Austria, at an altitude of 140 m. Microscopy was used for the gastric contents shooted 110 animals and seven animals were found murdered on the road. The research was carried out in February (n = 37), May (n = 28), August (n = 32) and November (n = 20) to determine the composition of the winter, spring, summer and fall feeding. The authors found that in autumn and winter in hare food dominate crops, at the first place wheat (51%), and nutrients that are provided by hunters (sugar beets, carrots ...). In contrast, the share of weeds in these months is less than 5%. Nesvadba and Zaid (1989) in studies in the Czech Republic, also found that in the winter diet of brown hare, wheat has a dominant role. The analysis of stomach contents in February found that, beside to wheat, sugar beets and alfalfa account for about 91% of the total meal. During the spring feeding in the stomach contents of brown hare dominated arable crops (83%), primarily soybeans, while in August the three most consumed wild plant species, particularly after the cereal harvest (Table 2).

Katona et al. (2010) in five areas of Hungary and the three-year research investigated the composition of the autumn diet of brown hares (n = 350) microscopy of the stomach contents. The authors found that hares consuming a total of 24 plant species. Since the dominant species of cultivated plants in the diet of hares was wheat (*Triticum aestivum*), and a small scale was used, and alfalfa (*Medicago sp.*). In contrast, research Homolka (1983) indicate much higher share of alfalfa, as high as 21%. Of other crops Katona et al. (2010) have determined the presence of 0-3% of rape, and only in one

year and two of the area, while maize and sunflower in the investigated time already harvested. Frylestam (1986) considers that rabbits avoiding rape in late autumn due to the high content of glucosinolates and Chapuis (1990) argues that rape can be responsible for the mortality of wild animals. In addition to these plant species in the samples was established a significant presence Elder berry (Sambucus spp.) In the amount of 5-41%, although in previous studies in other parts of Europe it has not been established. Consuming large quantities of these plant species may explain the high protein content (36%). Significant participation in the meal had a browsing, which the authors believe that it is encouraged with the edges of forests and agricultural fields, and not from the nearby forests. Browsing has become an important part of the hare meal especially during the winter (Katonaet al.,2004). In contrast, consumption of seeds and herbaceous plants was small. The authors found that about 50% of the meal consisted of only 1-3 plant species. This observation agrees with previous studies Homolka (1983) who argues that only a few plant species seems most of the meals of brown hares. In conclusion, the authors note a high territorial and individual variability in the diet of hares.

DISCUSSION

Based on the literature review can be concluded that the intensification of agriculture greatly reduced the diversity of weeds in crop fields, which quoted the authors consider most important to reduce the number of brown hares in Europe. There are other interpretations of this great problem for the hunting industry. Smith et al. (2005) considered that the reduction in brown hare numbers drastically changed the most responsible environmental conditions, while the variety of problems in second-rate food.

In his research Vapa et al. (2006) believe that the disease of rabbits that appeared here with similar symptoms as in other countries, accompanied by significant mortality and at the same time of year (fall winter), and which were given different names, could be considered EBH syndrome.

The same authors state that it is necessary to take comprehensive measures to fully look into epizootic situation in regard to these and other diseases during the game and enable them to scientific institutions for the diagnosis EBHS.

Critical periods in the winter diet of brown hares and other half of the summer. From the literature review, it is obvious that brown hares during the winter months a significantly (or most) part of their needs satisfy, with thanks, at first place wheat. During this period, a problem may be a reduced availability of such foods because of deep snow and low temperatures growth maintace needs of hares (Popovic and Djordjevic, 2010). Except in winter, a big problem to feed the brown hares occurs in the period after harvest, when the arable land disappears until then the dominant food (and shelter), while the natural grasslands significantly reduced production of natural food due to summer drought. This phenomenon is known as “harvest stress” and can be extremely detrimental to the population of brpwn hares that live in large farming complexes under monocultures (Djordjevicet al.,2011). Another problem is the burning of stubble (and later mazefield), where the wild are directly threatened by fire and smoke, and indirectly due to complete mineralization of organic matter and destroying the natural feed. Since hares have a high fertility and their offspring make the world in the summer and autumn, harvest leaves a heavy stress effects on their offspring. Valenčak et al. (2009) stated that the European hares has large energy needs in reproduction, the very

fast growth offspring, as well as high energy value of milk. During the first four weeks of life, feeding the young is based solely on milk and its energy value depends on fat reserves accumulated in the previous autumn and winter, or directly from food. Given that the quality and quantity of food significantly reduced at the end of summer, it could be a significant problem in the rearing of young and reflected on the number. Valencek et al. (2009) have found that milk production does not change significantly during the reproductive season, but to significantly change its energy value of 14.5 KJg-1 (spring) to 11.03 KJg-1 (autumn), and due to a decrease in the percentage of milk fat (Table 3). (Liener, 1994).

Table 3 Energy budgets of lactating female European Hares (Valenceket al.,2009)

	Spring	Summer	Autumn
MEI[1]	918.1 ± 22.7	884.8 ± 15.4	961.9 ± 25.5
Milk total energy output[2]	356.8 ± 14.7	266.0 ± 8.2	272.6 ± 13.0
Milk energy reserves from[3]	88.9	0	0
Milk energy from food[4]	267.9 ± 14.7	266.0 ± 2.8	272.6 ± 13.0
Maintenance costs[5]	650.2 ± 16.8	618.8 ± 13.2	689.2 ± 16.1

[1]Metabolizable energy intake. [2]Milk energy content x milk mass. [3]Difference between milk energy content in spring and later in the year. [4]MEI-milk energy from food.

The solution to reducing the number of brown hare may be found in farm production and release in hunting ground again, much like pheasants. (Risrtic et al. 2010b) In this respect, the greatest progress was made in France and Italy, although the quarterly settlement "half-wild" hares in hunting grounds remains a problem(Gajic and Popovic, 2010). With this procedure brown hares are kept in special cages and feed pelleted feed, which is often the chemical composition and nutritive value corresponds to the needs of rabbits. In this regard it is necessary to further examine the needs of hares in nutrients and use of concentrate mixtures that are designed according to these needs. According to one female in the season so far can be obtained in this manner from 2.2 to 2.5 young (Mertinet al.,2010). That is, compared to production of pheasants, a small number, so this production is extremely expensive and unprofitable. However, intensive work on resolving outstanding problems of this procedure may be able to become significant in the foreseeable future to maintain the number of hares.

CONCLUSION

Based on the literature review can be concluded that the drastic reduction in brown hare numbers in Europe and Serbia, the most responsible intensification of agriculture and reducing the diversity of the natural diet. For the possibility of preserving or even increasing populations hare (Lepus Europaeus) in Serbia there are several solutions, some of which are currently most relevant:

a) the preservation of "green oasis" and the establishment of "green corridors" between areas with large monocultures that will provide food and protection, especially after the harvest of winter cereals,

b) organic vegetable production that will allow the survival and diversity of wild flora and
c) control the number of predators.
d) continuous monitoring of abundance and hunting rabbits for each area in accordance with management plans and test results the percentage of young rabbits
e) One should, perhaps, add controlled production of brown hares in the hares farm, which requires intensive work on resolving the many remaining problems in this technology.

ACKNOWLEDGEMENT

The authors wish to express gratitude to the Ministry of Education and Science of the Republic of Serbia which financed this project investigations within the TR-31009th.

REFERENCES

BEUKOVIĆ M., MARINKOVIĆ B.: Effect of changes in Vojvodina agrosistemu on the number of Polish partridge (Perdixperdix) and hare (Lepuseuropaeus).Symposium: Rabbit and partridge in modern agrosistemima. Novi Sad, 1997. Proceedings, 114-126, 1997.

BEUKOVIĆ, M., GLAMOČIĆ, D, STANAĆEV, V., NOVKOV, M., ZEREMSKI, M.: Dynamics of the number and degree of use of a hare (Lepus europaeus) and the Polish partridge (Perdix perdix) in Vojvodina in the period 1990-2000. year. Genetika, 51(3-4)203-205, 2002.

BEUKOVIĆ, M. POPOVIC, Z., DJORDJEVIC, N., PLUŽAREVIĆ, K.: Situation of wildlife in national parks an other protected areas. Jahorina-Tjentište, July, 05-08., 2006. Proceedings, pp. 419-423, 2006.

BEUKOVIĆ, M. BOSNJAK, B., POPOVIC, Z. : Population dynamics rabbit in Backa and level of use. Symposium "Veterinary medicine, animal husbandry and economics in the production of safe food." Herceg Novi, 24 June - 01 July 2007. Book of Abstracts, p.112, 2007a.

BEUKOVIĆ, M. POPOVIC, Z., DJORDJEVIC, N., PLUŽAREVIĆ K, ZEREMSKI, M.: Situation and perspectives of hunting in national park Fruska Gora. International Symposium: Sustainable forestry-Problems and challenges perspectives and challenges in wood technology. Faculty of Forestry, Macedonia. Procecedings, pp. 13-16, 2007b. BEUKOVIĆ, M. POPOVIC, Z., MALETIC, V., BEUKOVIĆ, D. DJOKOVIC, D.: Impact of climatic factors on the percentage of young population in the Zajakot (Lepus europaeus Pall.) In Vojvodina. IV International Symposium of Livestock Production. Struga, Macedonia, 09-12.09.2009. Proceedings, p. 232, (2009a).

BEUKOVIĆ, M., BEUKOVIĆ, D., POPOVIC, M., PERISIC, P.. Dynamics of the number and degree of use of a rabbit population (Lepus europaeus) in the drive part of Backa. Collected scientific papers of the Institute PKB Agroekonomik, 15(3-4)173-179, 2009b.

BEUKOVIĆ M., POPOVIC Z., DJAKOVIĆ DARA, BEUKOVIĆ D.: Management of the brown hare population (Lepus europaeus P.) in Vojvodina. VI Žitnoostrovsky

odborny seminar. Dunajska Streda. Slovakia, 30.04-02.05. 2009, Proceedings of apstracts, 1(2)152, 2009c
BEUKOVIĆ, M., TEPAVAC K, BEUKOVIĆ, D., ĐORĐEVIĆ, N., POPOVIC, Z., DJORDJEVIC, M.: Management of micro-brown hare population (Lepus europaeus Paal.) Potiska hunting grounds in Backa. 22th International Symposium "Safe food production", Trebinje, Bosnia and Herzegovina, 19-25 June, 2011. Proceedings, pp.16-18, 2011.
BEUKOVIĆ, M., TEPAVAC K, BEUKOVIĆ, D., ĐORĐEVIĆ, N., POPOVIC, Z., DJORDJEVIC, M.: Biometric characteristic jackal (Canis aureus L.) in Vojvodina. 22th International Symposium "Safe food production", Trebinje, Bosnia and Herzegovina, 19-25 June, 2011. Proceedings, pp. 19-21, 2011b.
CHAPUIS, JL : Comparisn of the diets of two sympatric lagomorphs, Lepus europaeus (Pallas) and Oryctolagus cuniculus (L.) in an agroecosystem of the Ile-de-France. Zeitschrift für Säugetierkunde, 55:176-185, 1990.
WICHATITSKY DE-GARIN, M., SOUBEYRAN, Y., MAILLARD, D., DUNCAN, P.: The diets of introduced rusa deer(Cervustimorensisrussa)in a native sclerophyll forest and a native rainforest of New Caledonia. New Zealand Journal of Zoology, 32:117-126, 2005.
DJORDJEVIC, N. GRUBIC, G., POPOVIC, Z., STOJANOVIĆ, B.: Evaluation of quality of feeding of roe deer(CapreoluscapreolusL).By microscopy of the rumen contents or faeces. The International Congress: Food, Technology, Quality and Safety. Novi Sad, 13-15.11. 2007th. Proceedings, pp. 57-61, 2007.
DJORDJEVIC, N., POPOVIC, Z. GRUBIC, G., BEUKOVIĆ, M.: Ishrambeni potential hunting ground of Serbia. XVIII innovations in animal husbandry, 27-28.11.2008., Faculty of Agriculture, Zemun. Biotechnology in Animal Husbandry, 24 (special issue), 529-537, 2008a.
DJORDJEVIC, N. GRUBIC, G., POPOVIC, Z., BEUKOVIĆ, M.: Testing the quality of the natural diet of wild animals on the basis of gastric contents. Biotechnology in Animal Husbandry, 24:539-547, 2008b. DJORDJEVIC N., POPOVIC Z., BEUKOVIĆ M., BEUKOVIĆ D., DJORDJEVIC M.: Characteristic of natural nutrition brown hare (Lepus europaeus) in modern agro-biocenosa. 22th International Symposium "Safe food production", Trebinje, Bosnia and Herzegovina, 19-25 June, 2011. Proceedings, pp. 140-142, 2011
FRYLESTAM, B.: Agricultural land use effects on the winter diet of Brown Hares (Lepus europaeus Pallas) in southern Sweden. Mammal Review 16: 157-161, 1986.
GAJIC I., POPOVIC Z.: Hunting industry. University of Belgrade, Faculty of Agriculture, 2010.
HOLECHEK J. L., VAVRA M., PIEPER R. D.: Botanical composition determination of range herbivore diets: a review. J. Range Manage., 35(3)309-315, 1982.
HOMOLKA M.: The diet of Lepus europaeus in the agrocenoses. Acta Scientiarum Naturalium Academiae Scientiarum Bohemicae Brno, 17:1-41. 1983
JENNINGS N. V., SMITH R. K., HACKLÄNDER K., HARRIS S., WHITE P. C. L.: Variation in demography, condition, and dietary quality of Hares (Lepus europaeus) from high-density and low-density populations. Wildlife Biology, 12(2)179-190, 2006.
KAMLER J., HOMOLKA M.: Faecal nitrogen: a potential indicator of red and roe deer diet quality in forest habitats. Folia zoologica. 54(1-2)89-98, 2005.
KATONA K., ALTBÄCKER V.: Diet estimation by feces analysis: sampling optimiza-

tion for the European hare. Zoologica Folia, 51(1)11-15, 2002.
KATONA K, BIRO Z. S., HAHN I., KERTESZ I., ALTBÄCKER V.: Competition between European hare and European rabbit in a lowland area, Hungary: a long-term ecological study in the period of rabbit extincion. Zoologica Folia, 53(3)255-268, 2004.
KATONA K, BIRO, ZS., SZEMETHY, L., DEMEŠ T, NYESTE, M.: Spatial, temporal and individual variability in the autumn diet of European hare(Lepuseuropaeus).In Hungary. Acta Zoologica Academiae Scientiarum Hungaricae, 56(1)89-101, 2010.
MERTIN D., SLAMEČKA J., CHRASTINOVA L., JURČIK R. ONDRUŠKA L.: Optimization in feeding of brown hare (Lepus europaeus) kept on farm. Slovakian Journal of Animal Science, 4(2)78-82, 2010.
NESVADBA J., ZAID J. : Food supply for roe deer (Capreolus capreolus) and hare (Lepus europaeus) in fields in winter. Zoologica Folia, 38(4)289-298, 1989.
POPOVIC Z., GAJIC I., BOGDANOVIC V.: The influence of climatic factors on the participation of youth in the population of rabbits. 5th Congress of Ecologists of Yugoslavia, Belgrade, 22-27. September 1996. Book of Abstracts, p. 74, 1996a
POPOVIC M., BOGDANOVIC V., GAJIC I. Analysis of changes in rabbit numbers in our country. Counselling in Prokuplje and Kikinda 1995th year, the Hunting Federation of Yugoslavia. Proceedings, pp. 121-132, 1996b.
POPOVIC M., BOGDANOVIC V., GAJIC, I.: The influence of climatic factors on the participation of young in thehare,with a population(LepuseuropaeusPall.).Ecology, 32(1)139-144, 1997.
POPOVIC Z.: Management of wildlife populations uu hunting Hunting Association of Serbia. XVII innovations in animal husbandry, 16-17.11.2006., Faculty of Agriculture, Zemun. Biotechnology in Animal Husbandry, 22 (special issue), 113-128, 2006.
POPOVIC Z.: Management measures of preventing damage by game on forest and agricultural crops. International Symposium: Sustainable forestry-problems and challenges; Perspectives and Challenges in Wood Technology. 24-26-10.2007. Ohrid, Macedonia. Proceedings, pp. 224-236, 2007.
POPOVIC Z., BEUKOVIĆ M., DJORDJEVIC N.: The number and degree of use of wildlife populations in hunting Hunting Association of Serbia. XVIII innovations in animal husbandry, 27-28.11.2008., Faculty of Agriculture, Zemun. Biotechnology in Animal Husbandry, 24 (special issue)11-23, 2008.
POPOVIC Z., DJORDJEVIC N., BEUKOVIĆ M.: Nourishment of game from the Carnivora order - damages and benefits in economy hunting, forestry and agriculture. Contemporary Agriculture, 58(3-4)150-156, 2009.
POPOVIC Z., DJORDJEVIC N.: Management of wildlife populations in order to reduce damage. (Monograph). University of Belgrade, Faculty of Agriculture. 2010.
REICHLIN, T., KLANSEK, E., HACKLÄNDER, K. (2006): Diet selection by Hares (Lepus europaeus) in arable land and its implications for habitat management. Journal of Wildlife Research, 52: 109-118.
RISTIĆ Z.A., B. RISTANOVIĆ, AND M. MATEJEVIĆ.. Geographic conditions for quail presence in Vojvodina hunting grounds. Savremena poljoprivreda 59(1-2)214-222., 2010a.
RISTIĆ Z.A., B. RISTANOVIĆ, M. MATEJEVIĆ, T. ARMENSKI, AND T. JOSIN: Pheasant reproduction in open hunting grounds. Savremena poljoprivreda, 59(3-4)262-270, 2010b.
SMITH RK, JENNINGS NV, TATARUCH F., HACKLÄNDER K., STEPHEN H.:

Vegetation quality and habitat selection by Hares Lepus europaeus in a pastural landscape. Teriologica Acta, 50(3)391-404, 2005.
STOTT, P.: Comparisons of digestive function between the European hare (Lepus europaeus) and the European rabbit (Oryctolagus cuniculus): Matication, gut passage, and digestibility. Mammalian Biology, 73:276-286, 2007.
VALENČAK T. G., TATARUCH F., RUF T.: Peak energy turnover in lactating European Hares: the role of fat reserves. Journal of Experimental Biology, 212:231-237. 2009.
VAPA M., V. JOVANOVIĆ, AND D. ORLIĆ:. European brown hare syndrome in Vojvodina. Savremena poljoprivreda, 55(3-4)17-23, 2006.
VETETO, G., DAVIS, CE, HART, R., ROBINSON, R . M: An esophagen cannula for white-tailed deer. Journal of Wildlife Management. 36:906-912, 1972.
WATANABE T., TAKATSUKI S.: Comparison of nitrogen and fiber concentrations in fecal and rumen contents of sika deer. J. mamm. Soc. Japan, 18(1)43-48, 1993.

SPECIFIČNOSTI ISHRANE ZECA (LEPUS EUROPAEUS) KAO UZROK SMANJENJA BROJNOSTI POPULACIJA

BEUKOVIĆ MILOŠ, ĐORĐEVIĆ NENAD, POPOVIĆ ZORAN,
BEUKOVIĆ DEJAN, ĐORĐEVIĆ MILUTIN

Izvod

U radu je dat pregled specifičnosti ishrane i izbor hraniva za zeca (*Lepus europaeus*) u Srbiji i Evropi, smanjenje raznovrsnosti flore kao posledica intenzifikacije poljoprivrede, i uticaj navedenih promena na brojnost populacija. Ispitivanje sastava ishrane zeca vrši se mikroskopiranjem želudačnog sadržaja ili svežeg fecesa. Istraživanja iz Švedske, Austrije i Mađarske ukazuju da zec konzumira nekoliko desetina vrsta biljaka. Međutim, većina autora se slaže da oko 50% sastava obroka čine samo 2-3 biljne vrste. Na osnovu pregleda literature može se zaključiti da je intenzifikacija poljoprivrede bitno smanjila raznovrsnost divljih biljnih vrsta u ratarskim područjima, što većina autora smatra značajnijim za smanjenje brojnosti zeca u Evropi. Naročito se ističe problem letnjeg deficita u hrani, nakon ubiranja ozimih kultura. U tom periodu dolazi i do promene hemijskog sastava mleka, odnosno pada energetske vrednosti od 14,5 kJg-1 (proleće) do 11,03 kJg-1 (jesen), što se negativno odražava na podmladak. Nasuprot tome, zimski deficit u ishrani u većini područja nije toliko izražen, zahvaljujući poljima sa pšenicom. Kao rešenje ovih problema navodi se zasnivanje «zelenih koridora» između polja pod monokulturama, organska biljna proizvodnja, kontrola brojnosti predatora i eventualno, kontrolisana proizvodnja zečića u odgajivalištima.

Ključne reči: zec, ishrana, izbor hraniva, brojnost populacija.

Received / *Primljen*: 04.09.2011.
Accepted / *Prihvaćen*: 07.10.2011.