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ANALYSIS OF GRASSLAND ASSOCIATIONS OF STARA PLANINA MOUNTAIN

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Invited paper

Abstract: Production of organic, biologically valuable food is a trend in the World today, and in our country it can be successfully realized in production of meat and milk from small ruminants, sheep and goats in hilly-mountainous region. Namely, grasslands in these regions are well preserved from the utilization of mineral fertilizers and chemical preparations for plant protection, therefore production of healthy food is still possible with minimum investments. The quality of plant mass is very important, i.e. presence of high quality plant species in the grassland, as well as possibility for increase of their percentage in the grassland. For this purpose, research was carried out and plant associations most present on Stara Planina Mountain on altitude of 650 to 1200 m were analyzed from the aspect of phytocenology. On these locations recordings were made and samples were taken for analysis in the period 2002-2005 and in year 2008. Total of 8 associations were analyzed, and two of them *Agrostietum vulgariae* Z. Pavl. 1955. sensu lato. and *Festucetum vallesiaca* Borisavljević 1956. occurred repeatedly on several location and different time interval of analysis. Beside mentioned two associations the following were also analyzed: *Arrhenatheretum elatioris* Br.-Bl. 1925. sensu lato, *Festuco-Chrysopogonetum grylli* Rand. 1977., *Danthonietum calyciniae* Cinc. et Kojić 1958., *Medicago falcata-Festucetum rubrae*, *Trifolium campestre-Agrostietum vulgariae* i *Festuco vallesiaca-Agrostietum vulgariae* Danon et Blaž. 1978 on 17 locations. Number of species in analyzed associations was from 34 to 77. Beside number of plant species also their share categorized in categories of high quality grasses, high quality leguminous plants and useful species from other families, as well as harmful i.e. weed species. Main quality parameters were established in samples from all associations. Objective of analyses of natural grasslands was to establish share of high quality plant species, which is reflected directly through production and quality of plant mass grazed by small ruminants, sheep and goats.

Key words: grasslands, categories of high quality plant species plant associations, Stara Planina Mountain,

Introduction

In total structure of agricultural land in Serbia, natural grasslands have the highest share. According to the latest statistical data (*Statistical Yearbook, 2007, quoted in Lazarević et al., 2009*) they are present with 28.3% (1.448.000 ha), and in Central Serbia 39.1% (1.302.000 ha). Areas increase with the altitude, so in mountainous regions they are dominant in agricultural production. Utilization of grasslands in livestock production in hilly-mountainous region is important in nutrition of large and small ruminants, sheep and goats. However, numerous natural grasslands are in most cases neglected and with very low level of utilization, due to migration of population.

One of such locations in Serbia is Stara Planina Mountain. According to its geographical, climatic, orographic characteristics typical hilly-mountainous region where main branch of economy is extensive livestock production. However, because of decrease of number of livestock, natural meadow-pasture systems are being abandoned although they are very important source of livestock feed in these areas. So, extensive livestock production in this region, and in Serbia, almost ceased to exist.

Realization of profitable fattening on pasture areas of hilly-mountainous regions in cattle, sheep and goat production, beside on increase of total production, depends also on improvement of the quality of livestock food which directly influences obtaining of high quality final products – meat and milk, of mentioned production branches (*Negovanović et al., 1983*).

Intensification of livestock production in mountain regions, i.e. organization of market production, requires knowledge of production potentials of plant associations and their dynamic changes during vegetation period. Different ecological conditions have lead to forming of great number of meadow associations which differ in regard to their productivity (*Stošić et al. 1989, Kojić et al., 1992*) and structure (*Lazarević et al., 2003*). However, the highest presence and economical importance, at least in hilly-mountainous regions, have associations *Danthonietum calycinae*, *Festucetum rubrae*, *Agrostietum vulgaris* and *Nardetum strictae*.

Distinct world trend of production of healthy and safe food imposed the need for its revitalization which includes systematic investigation of meadows and pastures as prerequisite for new systems of ecological exploitation and market orientation in livestock production. By phytocenological studies carried out by *Mišić et al., (1978)*, *Đorđević-Milošević (1995)* the most present plant associations in this region were determined, however, share of certain quality categories, primarily leguminous plants was specific for every association.

Utilization of grasslands by grazing of goats contributes to improvement and revitalization of grassland since in this way the regeneration of leguminous species is favoured. Subsequent to grazing by goats, more leguminous plants are still present on the grassland (clover) then after grazing by cows or sheep (Bown *et al.*, 1989; Penning *et al.*, 1996). In this way, the pasture can be utilized for grazing of more demanding animal species such as cattle and sheep (Del Pozo *et al.*, 1996).

Objective of investigations carried out on Stara Planina Mountain in period 2003-2005. and in year 2008. was to establish the structure of plant associations, share of species in two major families, grasses and leguminous plants. Their presence is indicator of the quality of grassland and specific soil qualities, based on which agro-technical measures can be adequately implemented, especially mineral fertilizers. Realization of this goal directly influences increase of production of milk and meat, as well as final dairy and meat products (hard cheese, smoked meat products), by applying the standards of ecological agriculture.

Structure of plant species in associations

Study of the phytocenological composition, productivity and quality of natural meadows and pastures was done on 17 locations on Stara Planina Mountain, in the vicinity of Dimitrovgrad and Pirot, by making of recordings in two or three repetitions, average recording is presented in the table (Tomić *et al.*, 2005, 2009). Share of high quality plant species was done based on data presented by Kojić *et al.*, (2001), and their sample taken from 1m², which was weighed and percentages calculated. High quality plant species were grouped in the following categories: high quality grasses, high quality leguminous plants, useful and conditionally useful plant species. Meadow associations were determined based on results obtained in previous phytocenological researches carried out on the territory of Republic of Serbia (Kojić *et al.*, 2004).

In the period 2002-2005. investigation was carried out on Stara planina Mountain with aim to determine, in the most typical region, the production and quality of bio-mass of grasslands mainly used for grazing of small ruminants almost throughout the entire vegetation season in poor households and slightly better households which use these areas for preparation of hay from the first cut, and the second cut is used for grazing.

In Table 1. the quality of bio-mass is presented determined by floristic composition in five most present plant associations, which are: *Agrostietum vulgariae*, *Festucetum vallesiaceae*, *Arrhenatheretum elatioris*, *Festuco-Chrysopogonetum grylli* and *Danthonietum calycinae*.

Botanical composition of investigated associations *Agrostietum vulgaris* and *Festucetum vallesiaceae*, showed that in the first association total of 47, and in

the second total of 77 species were determined in quality categories (Tomić et al., 2003d, Nešić et al., 2005). Association *Agrostietum vulgaris* on 4 locations, Rsovci 650 and 700 m above sea level, Vrelo 750 m and Dojkinci 900 m above sea level, had useful grasses from 47.89 – 62.81%, and useful leguminous plants from 12.40 – 30.80%. Percentage of weed species was from 14.20 – 29.94%. Same association on three locations Gulenovci on altitude from 650 to 690 m had 26.92-34.78% of useful grasses, 39.13-34.41% of useful leguminous plants and significantly more weed species, up to 46.15%.

Association *Festucetum vallesiaceae* on three locations in the vicinity of Pirot, Rsovci, Brlog and Dojkinci had useful leguminous plants from 8.85-42.40%, useful grasses from 44.00-82.31% and weed species from 6.40-10.40%. On location Mojinci in the vicinity of Dimitrovgrad, the same association was determined on four locations Mojinci on altitude 750-850 m, in which the percentage of leguminous plants was from 18.75-42.86%, of useful grasses from 9.09-22.86%, and weed species from 17.14-4.87% (Tomić et al., 2003c, 2004, 2005ab).

Table 1. Share/presence of certain quality groups in analyzed associations (%) 2002-2005 on Stara Planina mountain (Tomić et al., 2005)

| Location | Useful legumes | Useful grasses | Useful sp. other fam. | Weeds | Useful sp. total |
|--|----------------|----------------|-----------------------|-------|------------------|
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Rsovci 700 m | 12.40 | 62.81 | 6.00 | 18.79 | 81.21 |
| Vrelo 750 m | 30.80 | 48.00 | 7.00 | 14.20 | 85.80 |
| Rsovci 650 m | 14.64 | 53.60 | 7.80 | 23.96 | 76.04 |
| Dojkinci 900m | 15.60 | 47.80 | 6.66 | 29.94 | 70.06 |
| <i>Ass. Festucetum vallesiaceae</i> | | | | | |
| Rsovci 700m | 39.36 | 45.81 | 4.43 | 10.40 | 89.60 |
| Brlog 800 | 42.40 | 44.00 | 4.00 | 9.60 | 90.40 |
| Dojkinci 1200 m | 8.85 | 82.31 | 2.44 | 6.40 | 93.60 |
| <i>Ass. Arrhenatheretum elatioris</i> | | | | | |
| Gulenovci 650m | 20.83 | 25.00 | 16.67 | 37.50 | 62.50 |
| <i>Ass. Festuco-Chrysopogonetum grylli</i> | | | | | |
| Mojinci 750 m | 16.12 | 9.68 | 9.68 | 64.52 | 35.48 |
| <i>Ass. Danthonietum calycinae</i> | | | | | |
| Mojinci 820m | 14.81 | 18.52 | 11.11 | 55.56 | 44.44 |
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Gulenovci 650 m | 39.13 | 34.78 | 4.35 | 21.74 | 78.26 |
| Gulenovci 680 m | 19.23 | 30.77 | 3.85 | 46.15 | 53.85 |
| Gulenovci 690 m | 34.61 | 26.92 | - | 38.46 | 61.54 |
| <i>Ass. Festucetum vallesiaceae</i> | | | | | |
| Mojinci 750m | 18.75 | 18.75 | 15.63 | 46.87 | 53.13 |
| Mojinci 810m | 31.82 | 9.09 | 18.18 | 40.91 | 59.09 |
| Mojinci 830m | 23.67 | 13.18 | 15.78 | 47.37 | 52.63 |
| Mojinci 850m | 42.86 | 22.86 | 17.14 | 17.14 | 82.86 |

Three most present associations *Arrhenatheretum elatioris*, *Festuco-Chrysopogonetum grylli* and *Danthonietum calycinae* were described by Tomić *et al.*, (2005a). First association has the highest share of useful leguminous 20.83%, whereas the other two have in average 14%. Weed species in the first location are present in 37.50%, and in the other two 64.52% and 55.56%, respectively.

In year 2008, investigations were carried out on 8 similar locations in the vicinity of Pirot and Dimitrovgrad, total of 5 associations were analyzed and results are presented in Table 2. On location Basara, in the vicinity of Pirot, from three meadows the following associations were determined *Medicago falcate-Festucetum rubre* in which the species of *Medicago falcate* are dominant and *Festuca rubra*. In this association there was from 18.18 – 21.28% of useful leguminous plants and 16.00 – 23.40% useful grasses. Percentage of weed species was from 24.00 – 27.27%.

In the vicinity of Dimitrovgrad, from 4 locations 4 associations were determined: on location in Mojinci, association *Trifolio campestre-Agrostietum vulgaris*, on location Kamenica, association *Agrostietum vulgaris*, in Sukovo two meadows of type *Festucetum valesiaca*e and on location Senokos, association *Festuca valesiaca*e - *Agrostietum vulgaris*. According to Tomić *et al.*, (2009), ass. *Agrostietum vulgaris* on location of hunting ground Karakuša has total of 35 species, of which 8 are grasses, only 3 leguminous plants and 24 species of other families, with the highest number and covering of *Agrostis capillaris* (34.3%). Although the production is very high, quality is rather low since the protein content is low 6,53%. Same association realized production of green mass of 3.15 t ha⁻¹ and dry matter of 1.1 t ha⁻¹ (Tomić *et al.*, 2009). In research carried out by Kojić *et al.*, (1992), in the same association on Rudnjan Plateau, the highest number and covering was established for following species *Agrostis vulgaris* (5.5), *Agropyrum repens* (3.3), *Poa nemoralis* (2.2), and *Festuca rubra* (1.1). The following leguminous species with slightly higher number and covering were present *Trifolium repens* and *Trifolium campestre* (1.1). According to some authors, total number of species in ass. *Agrostietum vulgaris* on different location - Ljig, Suvobor, Gorski Kotar, Kopaonik and Golija, varied from 56 to 116 species. The highest number of grass and leguminous species was established on location Golija (13 and 10 species, respectively) (Đorđević and Mijatović, 1963). In review of meadow association Radočela (Mrfat–Vukelić *et al.*, 1988), the greatest area was taken by ass. *Agrostietum vulgaris* with 62 species.

The highest number of species was established in association *Festucetum valesiaca*e from the first meadow where 76 species were established, also the highest number of grasses 23.68% or 23 species: 6 from the group of high quality grasses, 8 of medium quality and 9 from the group of poor quality and worthless grasses. Species *Festuca valesiaca*e had the highest number and covering. Of high quality grasses the following were present: *Arrhenatherum elatius*, *Dactylis*

glomerata, *Festuca pratensis* and *Lolium perenne*. Share of useful leguminous plants was 28.30-31.58%. In investigations by Tomić et al., (2009) on location Veliki Jastrebac, joint association *Arostio-Festucetum vallesiacaewas* determined with total of 34 species, of which grasses of high and good quality participated with 20.59%: *Agrostis capillaris*, *Festuca rubra*, *Festuca vallesiacaee*, *Poa pratensis*, *Festuca pratensis* and *Cynodon dactilon*. Of leguminous species the following which are of high quality were present: *Medicago lupulina*, *Trifolium repens* and *Trifolium pratense*.

Table 2. Share/presence of certain high quality groups in analyzed associations (%) in year 2008 on Stara Planina mountain

| Location | Useful legumes | Useful grasses | Useful sp. other fam. | Weeds | Useful sp. total |
|--|----------------|----------------|-----------------------|-------|------------------|
| <i>Ass. Medicago falcata-Festucetum rubrae</i> | | | | | |
| Basara 1000 m | 20.00 | 16.00 | 44.00 | 24.00 | 76.00 |
| | 21.28 | 23.40 | 27.66 | 25.53 | 74.47 |
| | 18.18 | 22.72 | 31.81 | 27.27 | 72.73 |
| <i>Ass. Trifolio campestre - Agrostietum vulgaris</i> | | | | | |
| Mojinci 780 m | 21.05 | 21.05 | 34.21 | 23.68 | 76.32 |
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Kamenica 830 m | 18.52 | 29.63 | 33.33 | 18.52 | 81.48 |
| <i>Ass. Festucetum vallesiacaee</i> | | | | | |
| Sukovo 750 m | 22.37 | 31.58 | 23.68 | 21.05 | 78.95 |
| | 22.64 | 28.30 | 18.88 | 28.30 | 71.70 |
| <i>Ass. Festuco-vallesiacaee -Agrostietum vulgaris</i> | | | | | |
| Senokos 980 m | | 23.68 | 28.94 | 26.32 | 73.68 |

Categorization of plant species according to quality

Structure of two associations with most species on Stara Planina Mountain, *Agrostietum vilgaris* and *Festucetum vallesiacaee* is presented in following tables.

Table 3. Categorization of plant species according to quality in ass. *Agrostietum vulgaris* according to Kojić (1990); Kojić et al., (2001) (Nešić et al., 2005b)

| No. | Quality grasses | Quality legumes | Useful and cond. useful | Poor quality and worthless | Harmful and slightly poisonous |
|-------|------------------------------|-----------------------------|-----------------------------|------------------------------|--------------------------------|
| 1 | <i>Agrostis vulgaris</i> | <i>Trifolium campestre</i> | <i>Achillea millefolium</i> | <i>Cerastium pumilum</i> | <i>Rhinanthus minor</i> |
| 2 | <i>Dactylis glomerata</i> | <i>Lathyrus hirsutus</i> | <i>Crepis biennis</i> | <i>Galium verum</i> | |
| 3 | <i>Arrhenatherum elatius</i> | <i>Vicia angustifolia</i> | <i>Fragaria vesca</i> | <i>Thymus serpyllum</i> | |
| 4 | <i>Lolium perenne</i> | <i>Medicago lupulina</i> | | <i>Brunella vulgaris</i> | |
| 5 | <i>Festuca rubra</i> | <i>Trifolium incarnatum</i> | | <i>Salvia pratensis</i> | |
| 6 | <i>Festuca arundinaceae</i> | <i>Lotus corniculatus</i> | | <i>Potentilla verna</i> | |
| 7 | <i>Poa pratensis</i> | <i>Trifolium repens</i> | | <i>Hieracium baulinii</i> | |
| 8 | <i>Cynosurus cristatus</i> | <i>Lathyrus pratensis</i> | | <i>Myosotis versicolor</i> | |
| 9 | <i>Agropyron repens</i> | <i>Trifolium alpestre</i> | | <i>Cerastium anticum</i> | |
| 10 | <i>Poa bulbosa</i> | <i>Trifolium montanum</i> | | <i>Crepis vesicaria</i> | |
| 11 | <i>Trisetum flavescens</i> | <i>Anthyllis vulneraria</i> | | <i>Peucedanum austriacum</i> | |
| 12 | | <i>Vicia tetrasperma</i> | | <i>Anthoxanthum odoratum</i> | |
| 13 | | <i>Trifolium chlereucum</i> | | <i>Festuca ovina</i> | |
| 14 | | <i>Vicia grandiflora</i> | | <i>Danthonia calycina</i> | |
| 15 | | <i>Lathyrus nissolia</i> | | <i>Avena fatua</i> | |
| 16 | | | | <i>Bromus racemosus</i> | |
| 17 | | | | <i>Bromus commutatus</i> | |
| Total | 11 | 15 | 3 | 17 | 1 |
| % | 23,40 | 32,00 | 6,70 | 36,17 | 2,13 |

In this plant association in the category of useful grasses some of the following plant species were registered: *Agrostis vulgaris*, *Dactylis glomerata*, *Arrhenatherum elatius*, *Festuca rubra*, *Poa pratensis*, *Cynosurus cristatus*; in the category of useful leguminous plants: *Trifolium campestre*, which was the most present useful legume in this association, also *Trifolium incarnatum*, *Lathyrus hirsutus*, *Lotus corniculatus*, *Trifolium repens*, *Lathyrus pratensis*, *Anthyllis vulneraria*, *Trifolium montanum*; category of useful and conditionally useful species: *Achillea millefolium*, *Crepis biennis*, *Fragaria vesca*.

Table 4. Categorization of plant species according to quality in ass. *Festucetum vallesiaca* according to Kojić (1990); Kojić et al., (2001); (Nešić et al., 2005b)

| No. | Quality grasses | Quality legumes | Useful and conditionally useful | Poor quality and worthless | Harmful and slightly poisonous |
|-------|------------------------------|------------------------------|---------------------------------|------------------------------|--------------------------------|
| 1 | <i>Festuca vallesiaca</i> | <i>Trifolium campestre</i> | <i>Achillea millefolium</i> | <i>Briza media</i> | <i>Linum catharticum</i> |
| 2 | <i>Arrhenatherum elatius</i> | <i>Medicago lupulina</i> | <i>Sanguisorba minor</i> | <i>Danthonia calycina</i> | <i>Euphrasia officinalis</i> |
| 3 | <i>Agrostis capillaris</i> | <i>Lotus corniculatus</i> | <i>Plantago lanceolata</i> | <i>Festuca ovina</i> | <i>Rhinanthus rumelicus</i> |
| 4 | <i>Festuca arundinaceae</i> | <i>Vicia sativa</i> | <i>Galium verum</i> | <i>Agrimonia odorata</i> | <i>Euphrasia minima</i> |
| 5 | <i>Poa violaceae</i> | <i>Trifolium repens</i> | <i>Fragaria vesca</i> | <i>Koeleria cristata</i> | <i>Rhinanthus minor</i> |
| 6 | <i>Lolium perenne</i> | <i>Trifolium montanum</i> | <i>Convolvulus sepium</i> | <i>Aira capillaris</i> | <i>Ranunculus numerosus</i> |
| 7 | <i>Bromus erectus</i> | <i>Anthyllis vulneraria</i> | <i>Filipendula vulgaris</i> | <i>Anthoxanthum odoratum</i> | <i>Holcus lanatus</i> |
| 8 | <i>Cynosurus cristatus</i> | <i>Onobrychis viciifolia</i> | <i>Hypochoeris maculata</i> | <i>Holcus mollis</i> | <i>Hypericum perforatum</i> |
| 9 | <i>Agropyron repans</i> | <i>Vicia angustifolia</i> | <i>Crepis biennis</i> | <i>Dorychnium herbaceum</i> | |
| 10 | <i>Poa bulbosa</i> | <i>Anthyllis vallesiaca</i> | <i>Hypochoeris radicata</i> | <i>Genista sagittalis</i> | |
| 11 | <i>Trisetum flavescens</i> | <i>Trifolium alpestre</i> | <i>Scabiosa columbaria</i> | <i>Teucrium chamaedrys</i> | |
| 12 | | <i>Vicia cracca</i> | | <i>Cerastium pumilum</i> | |
| 13 | | <i>Trifolium incarnatum</i> | | <i>Poligala comosa</i> | |
| 14 | | <i>Trifolium panonicum</i> | | <i>Inula hirta</i> | |
| 15 | | <i>Vicia hirsuta</i> | | <i>Peucedanum austriacum</i> | |
| 16 | | <i>Lathyrus nissolia</i> | | <i>Stachys alpina</i> | |
| 17 | | <i>Vicia grandiflora</i> | | <i>Moenchia mantica</i> | |
| 18 | | <i>Vicia tetrasperma</i> | | <i>Thymus serpyllum</i> | |
| 19 | | <i>Trifolium resupinatum</i> | | <i>Potentilla argentea</i> | |
| 20 | | <i>Trifolium ochroleucum</i> | | <i>Crepis mollis</i> | |
| 21 | | | | <i>Carex caryophylla</i> | |
| 22 | | | | <i>Danthonia decumbens</i> | |
| 23 | | | | <i>Thlaspi alliaceum</i> | |
| 24 | | | | <i>Vicia lutea</i> | |
| 25 | | | | <i>Bromus commutatus</i> | |
| 26 | | | | <i>Lagurus ovatus</i> | |
| Total | 11 | 20 | 11 | 26 | 8 |
| % | 14,28 | 26,00 | 14,28 | 33,76 | 1,08 |

Category of weeds, or subcategories of poor quality and worthless, harmful and slightly poisonous and very poisonous species contained following plant species: *Cerastium pumilum*, *Galium verum*, *Thymus serpyllum*, *Brunella vulgaris*, *Salvia pratensis*, *Myosotis versicolor*, *Anthoxanthum odoratum*, *Danthonia calycina*, *Bromus racemosus*, *Rhinanthus minor*, (Nešić et al., 2005b).

In this plant association, following plant species were registered as useful grasses: *Festuca vallesiaca*, *Agrostis capillariss*, *Arrhenatherum elatius*, *Festuca arundinaceae*, *Poa violaceae*, *Cynosurus cristatus*; useful leguminous plants: *Trifolium campestre*, *Medicago lupulina*, *Lotus corniculatus*, *Trifolium repens*, *Vicia sativa*, *Trifolium montanum*, *Onobrychis viciifolia*, *Anthyllis vulneraria*, *Lathyrus nissolia*, *Vicia hirsute*; useful and conditionally useful species: *Achillea millefolium*, *Sanguisorba minor*, *Plantago lanceolata*, *Filipendula vulgaris*, *Crepis biennis*, *Scabiosa columbaria*. Category of weeds, or subcategories of poor quality and worthless, harmful and slightly poisonous and very poisonous species contained following plant species: *Briza media*, *Danthonia calycina*, *Festuca ovina*, *Agrimonia odorata*, *Koeleria cristata*, *Genista sagittalis*, *Cerastium pumilum*, *Poligala comosa*, *Thymus serpyllum*, *Danthonia decumbens*, *Vicia lutea*, *Linum catharticum*, *Euphrasia officinalis*, *Rhinanthus rumelicus*, *Rhinanthus minor*, *Hypericum perforatum*, (Nešić et al., 2005b).

Quality of grassland of investigated associations

In Table 5. results of the quality parameters of grasslands of investigated associations from certain locations in the period 2002-2005 are presented.

Grassland of type *Festucetum vallesiaceae* on location in the vicinity of Pirot (Brlog) according to presented results was the richest in regard to content of crude proteins, even 13.57%, whereas grassland *Agrostietum vulgaris* on location Vrelo had the lowest share of leguminous species was according to quality parameters of the poorest quality with only 4.81% of crude proteins, and contrary to others it was characterized with the highest crude cellulose content 37.17%, and on other locations content of crude proteins was slightly higher and varied from 7.65 – 12.83%, and content of crude cellulose from 26.30 – 33.66%. Association *Arrhenatheretum elatiors* had 6.28% of crude protein content, *Festuco Chrysopogonetum grylli* 6.57% and *Danthonietum calicynae* 7.60%. Grasslands from 4 locations of the association *Festucetum vallesiaceae* in regard to content of crude proteins were more uniform, 7.60 – 9.53% , whereas the content of crude cellulose was also very uniform, 27.49 – 29.55% and lower compared to ass. *Agrostietum vulgaris* (Tomić et al., 2003abc).

Table 5. Parameters of quality of grassland on Stara Planina mountain in three year research period (%) (Tomić et al., 2005)

| Locations (m a.s.l.) | DM | MM | OM | CP | CC |
|--|-------|------|-------|-------|-------|
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Rsovci, 700m. | 89.86 | 7.53 | 82.33 | 10.40 | 24.97 |
| Rsovci, 700m | 90.30 | 5.70 | 84.60 | 6.28 | 34.89 |
| Vrelo, 750m | 90.73 | 4.19 | 86.54 | 4.81 | 37.17 |
| Dojkinci, 900m | 88.67 | 7.78 | 80.89 | 12.29 | 25.10 |
| <i>Ass. Festucetum vallesiaceae</i> | | | | | |
| Rsovci, 700m. | 89.99 | 7.94 | 82.05 | 12.55 | 20.67 |
| Brlog, 800m | 90.23 | 7.63 | 82.60 | 13.57 | 24.36 |
| Dojkinci, 1200m | 85.58 | 5.09 | 80.49 | 6.53 | 29.96 |
| <i>Ass. Arrhenatheretum elatioris</i> | | | | | |
| Gulenovci 650m | 91.35 | 8.11 | 83.24 | 6.28 | 30.07 |
| <i>Ass. Festuco-Chrysopogonetum grylli</i> | | | | | |
| Mojinci 750m | 91.38 | 6.00 | 85.38 | 6.57 | 28.08 |
| <i>Ass. Danthonietum calycinae</i> | | | | | |
| Mojinci 820 | 91.11 | 7.69 | 83.42 | 7.60 | 29.55 |
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Gulenovci 650 m | 89.86 | 7.53 | 83.33 | 9.72 | 33.66 |
| Gulenovci 680 m | 90.84 | 7.10 | 83.74 | 7.65 | 28.10 |
| Gulenovci 690 m | 90.24 | 8.44 | 81.80 | 12.83 | 26.30 |
| <i>Ass. Festucetum vallesiaceae</i> | | | | | |
| Mojinci 750m | 91.03 | 7.96 | 83.07 | 8.59 | 28.28 |
| Mojinci 810m | 91.11 | 7.69 | 83.42 | 7.60 | 29.55 |
| Mojinci 830m | 91.18 | 8.00 | 83.18 | 9.53 | 27.63 |
| Mojinci 850m | 91.27 | 7.90 | 83.37 | 8.85 | 27.49 |

In Table 6. results of the quality of investigated grasslands on Stara planina Mountain in 2008 are presented.

Table 6. Parameters of quality of grasslands on Stara Planina mountain in 2008 (%).

| Location (m a.s.l.) | DM | MM | OM | CP | CC |
|---|-------|------|-------|-------|-------|
| <i>Ass. Medicago falcata Festucetum rubrae</i> | | | | | |
| Basara 1000 m | 88.42 | 6.55 | 81.87 | 12.55 | 21.56 |
| | 90.63 | 6.91 | 83.72 | 12.29 | 22.30 |
| | 89.24 | 7.42 | 81.82 | 13.00 | 21.60 |
| <i>Ass. Trifolio campestre Agrostietum</i> | | | | | |
| Mojinci 780 m | 94.21 | 7.68 | 86.53 | 10.4 | 28.50 |
| <i>Ass. Agrostietum vulgaris</i> | | | | | |
| Kamenica 830 m | 91.57 | 7.82 | 83.75 | 6.53 | 34.41 |
| <i>Ass. Festucetum vallesiaceae</i> | | | | | |
| Sukovo 750 m | 87.80 | 7.03 | 80.77 | 10.10 | 30.60 |
| | 88.31 | 6.99 | 81.32 | 10.67 | 27.17 |
| <i>Ass. Festuco-vallesiaceae Agrostietum vulgaris</i> | | | | | |
| Senokos 980 m | 89.85 | 8.01 | 81.84 | 8.24 | 32.46 |

Main quality parameters in samples from these associations, based on chemical analysis, showed that the content of crude proteins was 12,55, 12,29 and 13,00%, and content of crude fibre/cellulose 21,56, 22,30 and 21,60%. These grasslands belong to the group of high quality grasslands and they provide good forage for nutrition of goats in summer and in winter, early spring period when kidding begins.

Conclusion

In investigations of grasslands on Stara planina Mountain in the vicinity of Pirot and Dimitrovgrad on 17 locations, by floristic analysis the following associations were determined: *Agrostietum vulgarae* Z. Pavl. 1955. sensu lato. and *Festucetum vallesiacae* Borisavljević 1956., *Arrhenatheretum elatioris* Br.-Bl. 1925. sensu lato, *Festuco-Chrysopogonetum grylli* Rand. 1977., *Danthonietum calycinae* Cinc. et Kojić 1958., *Medicago falcata-Festucetum rubrae*, *Trifolium campestre-Agrostietum vulgaris* and *Festuco vallesiacae-Agrostietum vulgaris* Danon et Blaž. 1978. Number of species in associations varied from 38 to 76 with different percentages according to quality in families *Poaceae* and *Fabaceae* as well as species of other families. Diversity of associations is reflected through quality of dry matter, realized content of crude proteins was 6.53-13.0%. These grasslands provide high quality and useful pasture for nutrition of small ruminants, sheep and goats.

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Analiza nekih travnjačkih asocijacija Stare Planine

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Rezime

Proizvodnja organske, biološki vredne hrane je danas svetski trend, a koja se u našoj zemlji uspešno može ostvariti u proizvodnji mesa i mleka sitnih preživara, ovaca i koza u brdsko-planinskom području. Naime, travnjaci u ovim područjima su još uvek sačuvani od upotrebe mineralnih đubriva i hemijskih sredstava za zaštitu bilja pa je proizvodnja zdrave hrane još uvek moguća uz minimalna ulaganja. Zbog toga, izuzetno je značajan kvalitet biljne mase, odnosno

zastupljenost kvalitetnih biljnih vrsta u travnjaku, kao i mogućnosti za povećanje njihovog procentualnog učešća u travnjaku. U tom cilju obavljena su istraživanja i analizirane, s aspekta fitocenologije, najrasprostranjenije biljne zajednice na Staroj planini na nadmorskoj visini od 650-1200 m. Na ovim lokalitetima snimci su pravljani i uzimani uzorci za analizu 2002-2005 i 2008. godine. Analizirano je 8 asocijacija, s tim što su se dve asocijacije, *Agrostietum vulgarae* Z. Pavl. 1955. sensu lato. i *Festucetum vallesiaca* Borisavljević 1956. ponavljale kako na različitim lokalitetima tako i u vremenskom intervalu analiziranja. Pored ovih analizirane su i asocijacije: *Arrhenatheretum elatioris* Br.-Bl. 1925. sensu lato, *Festuco-Chrysopogonetum grylli* Rand. 1977., *Danthonietum calycinae* Cinc. et Kojić 1958., *Medicago falcata-Festucetum rubrae*, *Trifolio campestre-Agrostietum vulgaris* i *Festuco vallesiaca-Agrostietum vulgaris* Danon et Blaž. 1978. na 17 lokaliteta. Broj vrsta u analiziranim zajednicama je 34-77. Analizirano je pored brojnosti i pokrovnosti biljnih vrsta i njihovo učešće svrstanih u kategorije kvalitetnih trava, kvalitetnih leguminoza i korisnih vrsta drugih familija, kao i štetnih, odnosno korovskih vrsta. U uzorcima iz svih zajednica utvrđeni su osnovni parametri kvaliteta. Cilj ovih analiza prirodnih travnjaka je utvrđivanje učešća kvalitetnih vrsta biljaka, koje se direktno odražavaju kroz produkciju i kvalitet biljne mase koju ispasaju sitni preživari, koze i ovce.

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