BIOLOGICAL AND NUTRITIONAL VALUE OF THE GENUS *Medicago* L. IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Abstract

We investigated the biological peculiarities, productivity, biochemical composition and nutritional value of the natural fodder of species of the genus *Medicago* L., *M. falcata* L., *M. varia* Mart., *M. tianschanica* Vass., *M. agropyretorum* Vass., *M. cancellata* M.B. and *M. glutinosa* M.B., *Medicago sativa* L. was used as control. It was found out that, at the first mowing, the species *Medicago tianschanica*, *Medicago varia* and *Medicago agropyretorum* have a productivity of 2.00-2.14 kg/m^2 exceeding by 22-27% the control, with a nutritional value of the natural fodder - 0.20-0.23 nutritive unit/kg and a content of digestible protein – 175.6- 211.6 g/ nutritive unit.

Key words: biological peculiarities, fodder leguminous plants, nutritional value, productivity, species of genus *Medicago* L.

It is well known that, in the modern agriculture, the sustainable farming is important because it ensures a balance between plant growing and animal husbandry. The development of the zootechnical sector requires provision and diversification of fodder production so that it will be balanced in terms of quantity and quality throughout the year, according to the physiological requirements of animals and the stability of animal production that will meet the market requirements. The area of the agricultural lands cultivated with fodder crops has been considerably reduced in the last 20 years, the grasslands and the hayfields in Moldova are in a deplorable state, their productivity is very low and the share of fodder leguminous plants is decreasing year by year. The fodder leguminous plants contribute to biological nitrogen accumulation in the soil, to the improvement of soil's physical and chemical characteristics, to the formation of soil's structure and its recovery, play an important role in increasing the quality of feed because they contain significant amounts of protein, vitamins and minerals, increasing the nutritional value of fodder and animal production (Lüscher A. et al. 2013). Of the approximately 19 thousand leguminous species of the world flora, very few are cultivated (Larin I. et al. 1951; Lewis G. et. al. 2005). Alfalfa is considered one of the primary herbs used as fodder and the main source of production of vegetable protein. The genus *Medicago* L. of the family *Fabaceae* Lindl. subfamily *Papilionoideae* L. ex DC., tribe *Trifolieae* (Bronn) Endl., comprises three subgenera and 87 species (Small E., 2011). In our country, six species are known (Negru A., 2007), of wich alfalfa, *Medicago sativa* L. is often grown as fodder crop (Lupasco M., 2004). Alfalfa species show a high ecological plasticity through their resistance to heat, drought, salts and low temperatures, efficient use of water resources, their capacity to regenerate quickly after mowing and the fact that they can be cultivated in different geographical areas (arid steppes and forest steppes, in meadows, on various types of soils, but, with neutral or low alkaline reaction). In the world, alfalfa is cultivated on an area exceeding 35 million hectares. The forage value, very high digestibility and high content of estrogenic substances make alfalfa to influence positively the productivity and the reproductive cycle of animals and that's why it is considered "the queen of the forages" (GholamiA. et al., 2014; Lupaşcu M., 2004, Varga P. et al. 1973).

After over six decades of scientific research on plant resource mobilization, the Collection of nontraditional fodder plants of the Botanical Garden (Institute) of the ASM, which includes over 300 species and cultivars, including 70 fodder leguminous plants, has been founded. The genus *Medicago* L. is represented by 20 species from different floristic regions of Central and South Europe, Caucasus, Central Asia. The seed material was collected as a result of expeditions and international exchange of seeds (Teleuță A.,

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1989, 2010; Teleuță A., Sergentu E.,.1993; Teleuță A., □î□ei V., 2012).

In order to improve the situation regarding fodder productivity and quality, the areas where fodder crops grow need to be expanded and the range of fodder leguminous plants needs to be widened mobilizing native species and species from other floristic regions whose biological peculiarities, productivity, biochemical composition and nutritional value must be studied. These issues have determined the choice of the object of the study.

MATERIAL AND METHOD

The species of the genus *Medicago* L., *M. falcata L.*(native flora), *M. varia* Mart. (Central European flora), *M. tianschanica* Vass. and *M. agropyretorum* Vass. (Caucassus flora), *M. cancellata* M.B. and *M. glutinosa* M.B. (Middle Asian flora) were the object of study. *Medicago sativa* L. (alfalfa), served as control variant. See the figures *1-7*. The experiments were performed on non-irrigated experimental land in the Botanical Garden (Institute) of the Academy of Sciences of Moldova, on usual chernozem, they started in spring, when the soil had reached the physical maturity. The seeds were planted at a depth of 1.5-2.0 cm with soil compaction before and after sowing. The evidence area of the plot was of 10 m^2. The number of repetitions - 4. The scientific researches on growth and development, productivity and nutritional value of the plants were carried out according to the methodical indications (Ermakov A. et al. 1987; Novosiolov Iu., 1987; Ivanov A., 1985)

RESULTS AND DISCUSSIONS

As a result of phenological observations (*table 1*), it was found that the studied species of the genus *Medicago* L. differ significantly regarding the period of seed germination and seedling emergence at the soil surface. At the species *M. tianschanica,* the seedlings emerge at the surface after 7 days, that is 4 days earlier than the control *M. sativa* and *M. varia* and at the species *M. falcata* and *M. agropyretorum* this period starts 5 days later in comparison with the control. The species *M. cancellata* and *M. glutinosa* are characterized by the latest period of seedlings' emergence (28-30 days), but they require a shorter period until the formation of flower buds. The species *M. varia* and *M. falcata* need a longer period until bud formation than the control. We could mention that the flowering period and ripening of seeds of the studied species start later in comparison with *M. sativa*. A very long period of formation of flower buds, flowering and ripening of seeds is characteristic of the plants of *M. agropyretorium*. The species *M. tianschanica* and *M. cancellata* need 121-128 days and *M.glutinosa* and *M. falcata* – 140-144 days until the complete ripening of seeds.

The studied species have a different rate of growth. Thus, in the flowering period, the plants of *M. varia* are 108.2 cm tall, that is by 11.6 cm taller than the control, the species *M. tianschanica*, *M. agropyretorum, M. falcata* and *M. cancellata* reach 80.6 – 83.4 cm tall, and the shortest are the plants of *M. glutinosa*. It is known that the rate of growth and development influence the formation of natural fodder and the accumulation of dry mass. A high productivity of fresh mass at the first mowing is found at the species *M. tianschanica* – about 2.14 kg/m^2, that is 27% higher compared with the control, and the species *M. varia* and *M. agropyretorum* - 2.00-2.02 kg/m^2. *M. glutinosa* plants have a very low productivity of fresh mass because they are small.

The dry matter content in the harvested fodder of the species *M. tianschanica* reaches 31% and exceeds essentially the control, the species *M. falcata* and *M. cancellata* are characterized by a low content of up to 27%. The biochemical composition of the dry matter from the fodder influences the digestibility and nutritional value, the health and productivity of animals. Protein substances are essential as a limiting factor for the manifestation of the productive potential. The content of raw protein in the studied species (*table 2*) is of 15.37% in *M. cancellata*, it reaches 19.41% in *M. varia*, compared with 16.50% in *M. sativa*. The fats in fodder are the main source of energy for the animals because they are necessary for the organism in order to ensure the normal development of vital processes and transportation of soluble vitamins in fatty acids and it also contributes to the accumulation of fat in the milk. The studied species of the genus *Medicago* L. are distinguished by a high content of fat 2.18- 3.01% compared with 1.59% in the control *M. sativa* and *M. varia.* The species *M. agropyretorum* and *M. cancellata* are the richest in fats.

It is known that the cellulose content in feed, its insufficiency, but in most cases its excess, adversely affects the metabolic processes of organisms. The dry matter has a high content of cellulose 30.01- 38.43%. The species *M. agropyretorum, M. varia, M. glutinosa* and *M. cancellata* yield to the control at this index. The nitrogen free extractive substances consist of soluble mono and polysaccharides (sugar, starch etc.) and provide animals with energy necessary for vital processes, contributing to the formation and storage of fat. The species *M. cancellata* is notable for its high content of nitrogen free extractive substances (NFE), *M. falcata* and *M. tianschanica* have the

lowest content of nitrogen free extractive substances, the other species are at the same level as the control.

Table 1

Biological peculiarities and productivity of plants of the genus *Medicago* L.

Indices	*M. sativa*	*M. falcata*	*M. varia*	*M. tianschanica*	*M. agropyretorum*	*M. cancellata*	*M. glutinosa*
Sowing on emergence of seedlings, days	11	16	11	7	16	30	28
Emergence of seedlings –flower buds, days	57	63	61	55	56	43	51
Emergence of seedlings - flowering, days	68	83	69	72	90	72	73
Emergence of seedlings - ripening of seeds, days	112	144	111	121	155	128	140
Plant height at flowering, cm	96.6	81.7	108.2	83.4	82.5	80.6	43.9
Yield of fresh mass, 1 mowing, kg/m^2	1.68	1.36	2.02	2,14	2.00	1.21	0.64
Yield of dry mass, kg/m^2	0.50	0.36	0.61	0.66	0.58	0.33	0.19

Table 2

Biochemical composition and nutritional value of natural forage of plants of the genus *Medicago* L.

Indices	*M. sativa*	*M. falcata*	*M. varia*	*M. tianschanica*	*M. agropyretorum*	*M. cancellata*	*M. glutinosa*
Biochemical composition of dry matter:							
-raw protein, %	16.50	18.35	19.41	18.19	18.43	15.37	16.80
-raw fats, %	1.59	2.18	1.59	2.29	3.01	3.00	2.70
-raw cellulose, %	35.48	38.43	31.58	37.91	30.01	33.60	33.30
-nitrogen free extractive substances,%	37.95	32.74	37.05	33.50	39.74	40.83	38.10
-minerals,%1 kg natural fodder contains:	8.48	8.27	10.37	8.11	8.91	7.20	9.10
-nutritive units	0.20	0.17	0.25	0.20	0.23	0.21	0.23
-metabolizable energy, MJ/kg	2.63	2.33	2.86	2.73	2.64	2.45	2.66
-dry matter, g	295.10	265.40	302.00	310.00	291.90	269.90	300.00
-raw protein, g	48.70	48.70	62.10	56.40	53.80	41.50	50.40
-raw fats, g	4.70	5.80	4.80	7.10	8.80	8.10	8.10
-raw cellulose, g	104.70	102.00	95.40	117.50	87.60	90.70	99.90
- nitrogen free extractive substances, g	112.00	86.50	111.90	103.90	116.00	110.20	114.30
-minerals, g	25.00	22.00	27.80	25.10	25.70	19.40	27.30
-calcium, g	5.00	5.15	4.95	5.73	10.30	5.94	7.78
-phosphorus ,g	1.30	1.20	1.69	1.48	1.44	1.39	1.96
-iron, mg	77.80	57.30	130.60	58.00	54.64	71.90	210.00
-carotene, mg	4.66	7.50	3.21	8.50	9.20	7.80	10.70
Digestible protein, *g/* nutritive unit	182.6	242.7	196.2	211.6	175.6	148.2	164.5

Figure 1 ***Medicago falcata* L. Photo A.Teleuta**

Figure 2 ***Medicago varia* Mart. Photo A.Teleuta**

Figure 3 ***Medicago agropyretorum*** **Vass.**
Photo A.Teleuta

Figure 5 ***Medicago cancellata*** **M.B.**
Photo A.Teleuta

Figure 4 ***Medicago tianshanica*** **Vass.**
Photo A. Teleuta

Figure 6 **M*edicago glutinosa*** **M.B.**
Photo A.Teleuta

Thus, 100 kg of natural fodder contains 17 – 25 nutritive units supplied with metabolizable energy of 233 - 286 MJ. We found that the species *M. varia* and *M. tianschanica* have a high nutritional value of the fodder and *M. falcata* – a low one, due to the low content of dry matter. The nutritive unit is well provided with digestible protein 196.2-242.7g at the species *M. falcata*, *M. tianschanica* and *M. varia.* The minerals in the natural fodder of the studied species of the genus *Medicago* L. constitute 19.40 – 27.80 g/kg, the species *M. varia* and *M. glutinosa* surpass the control at this index, having also a high content of phosphorus of 1.69-1.96 g/kg and iron – 130.60- 210.00 mg/kg.

Biologically active substances (vitamins, hormones) are in very small quantities and play a crucial role in obtaining the desired animal products. Carotene is a precursor of vitamin A. The studied species have a high content of carotene, especially *M. glutinosa, M. agropyretorum* and *M. tianschanica,* 8.50-10.70 mg/kg.

CONCLUSIONS

The species *Medicago tianschanica*, *Medicago varia* and *Medicago agropyretorum* have a productivity of 2.00-2.14 kg/m^2 at the first mowing, surpassing by 22 – 27% the control, the nutritional value of their natural fodder constitutes 0.20 - 0.23 nutritive unit/kg and the content of

digestible protein – 175.6- 211.6 g/ nutritive unit. These species can serve as starting material for improving and implementing new leguminous species for fodder production.

Figure 7 ***Medicago sativa*** **L. Photo V.Titei**

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