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CHARACTERISTICS OF MUGWORT PASTURES OF CENTRAL KIZILKUM (REPUBLIC OF UZBEKISTAN)

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ABSTRACT
Presented hereby the results of seasonal changes of prolificacy and nutrient values of main forage type of Artemisia (wormwood or mugwort) in the pastures of Central Kizilkum. Under various soil conditions four pasture varieties involving three Artemisia species – A. diffusa Krasch. et Polyakov, A. turanica Krasch., A. juncea Kar. et Kir. have been identified. Maximum prolificacy of Artemisia has been defined in ephemereta-artemisieta-calligonumeta pasture variety in sandy soil. By texture rocky-gravelly soil impedes formation of artemisia phytomass. Biochemical composition of artemisia species are rich in crude proteins, and from spring to autumn their amount decreases. The data have been stated on increasing bearing capacity and resulting in excessive grazing of artemisia pastures.

KEYWORDS: Artemisia, pasture, seasonal prolificacy, crude protein, crude fiber, permissible capacity, actual capacity, Kukchatau, Central Kizilkum.

INTRODUCTION

One of the oldest and the most ecological methods of nature management is pasture livestock breeding, which has a crucial significance in sustainability of forage base, livestock production extension and in its cost price fall. Therefore, in order to develop karakul sheep, goat and camel, a greater attention is drawn to desert pastures of arid areas by a single expedient and economically beneficial way of rational economic reclamation of desert areas. However, in view of degradation problems, present state of pastures in arid regions is considered as unsatisfactory. Strong degradation growth and soil covered 27% pasture lands in North America, 22% in South America, 18% in Africa and 8% in Australia. This indication in Central Asian regions is 25-38% more [8, 17, 20].

In Central Asian deserts Kizilkum is one of forage bases for livestock breeding, and further for a stabilization. Furthermore, the development of this branch is found in direct dependence on the state of natural forage available in this area. Particularly, Central Kizilkum is situated in the territories of Navoi and Bukhara regions of the Republic of Uzbekistan, which has a great significance in supporting prosperity of millions of population in desert zones and in economical development of the country. Unfortunately, today vegetation mantle of pasture ecosystem in Central Kizilkum makes 35.7 % [19].

It is important to note that in 70–75 % of this region predominates types of artemisia species – *Seriphidium* (Bess.) Rouy. *subgenus*, which serve for karakul sheep and camels in stock breeding as a main pasture forage [12]. *Artemisia diffusa* Krasch. *ex* Polyakov, *A.terrae-albae, A.halophila, A.turanica* Krasch., *A.juncea* Kar. *et* Kir, *A.leucodes* K can be included to the most spread species

[13]. However, efficient data has been given on characteristics of species of pasture Artemisia in connection with their prevalence, nutritional content and edibleness rate only in marginal areas of Southwest Kizilkum [1, 3, 4].

The aim of this work is – to study present state of Artemisia pastures of Central Kizilkum by determining the changes in prolificness of pastures by seasons, identifying nutritional value of Artemisia species, and clarifying pasture capacity.

MATERIALS AND METHODS

Central Kizilkum includes several residual mountains, and considered as an independent geo-botanical area. It limits with North, Southwest and Southeast regions of Kizilkum [4]. Its territory is located at the boundaries of two administrative regions (Bukhara, Navoi) of the Republic of Uzbekistan. The investigation has been carried out in much larger and anthropogenic-dynamic territory of Central Kizilkum – specialized karakul breeding station "Kukcha". It includes residual mountains of Kukchatau, and its pasture and hay areas make over than 253 thousand hectares. In southwest part of Kukchatau there is Zafarabad village. Three types of Artemisia – *Artemisia diffusa, A.turanica* and *A.juncea.*

Pasture Artemisia diversity was considered according to predominant types. Artemisia productivity was identified by Transecta method (10×2 m) and in hay areas (1×1 m) (Methodological guide …, 1980). For bio-chemical analysis samples were taken from the ground part of one year old shoots of studied plant in 2012–2013 yy., principally in spring (April), summer (June) and autumn (October) seasons.

Bio-chemical analysis of Artemisia was carried out by methods indicated in the literature [10].

Pasture capacity is defined by livestock quantity, which is out of pasture area unit. Permissible capacity of pasture (PCP), that is, the quantity of stock, which can be supplied with forage unit of pasture, is calculated by formula PCP = P/N×D, where P-productivity per ha of pasture in raw mass (c/ha); N - daily need for feed (c) per head; D - duration of pasture period (days) [18]. Actual pasture capacity (APC) is defined with that quantity of stock, which is used for determining grazing pasture differences in real time. Capacity intensity was identified by field methods, calculating stock heads in an actual pasture diversity per ha according to each month and season, as well as, used the data of farm "Kukcha" about seasonal paddock of stock.

RESULTS AND DISCUSSIONS

In the process of geobotanical study in various soil conditions four varieties of pastures with three soil types were differentiated, *Artemisia diffusa, A.turanica* and *A.juncea* are widespread in Central Kizilkum. Pasture varieties are formed in various soils of Kukchatau: motley grass-iris-artemisieta in grey-brown loamy sands in south-eastern parts; ephemereta - artemisieta - in grey-brown stony-gravelly soil in south parts; ephemereta-ephemeroid-artemisieta - in northern and north-eastern parts with grey-brown loamy sandy soils. Not far from these pasture varieties – in south pastures of Kukchatau, Zafarabad village is located. Ephemereta-artemisieta-calligonumeta pasture variety is developed in 25 km from the village towards the west in sandy soils (Table 1).

For the determination of prolificness of each pasture variety, the epiterranean mass productivity of particular artemisia was studied thoroughly during the season of the year (see table 1). In Central Kizilkum *A.diffusa* is found in four pasture varieties as a dominant and subdominant type, where plant prolificness is differentiated among them. The highest prolificacy was noted in ephemereta-artemisieta-calligonumeta pasture variety with average yearly prolificacy of epiterranean mass of 4.45 c/ha. Less prolificacy ws observed in ephemereta-artemisieta pasture variety – 2.05 c/ha. Mean height of epiterranean part of plant in ephemereta-artemisieta pasture variety is higher than the plant in motley grass-iris-artemisia pasture, but by its mass the plant predominates over the indications of the first variety by influencing more on plant prolificness.

A.turanica type spread over motley grass-iris-artemisia, ephemereta-artemisieta and ephemereta-ephemeroid-artemisieta pasture varieties. Out of three pasture varieties the ephemereta-ephemeroid-artemisieta pasture has 3,35 c/ha mean annual epiterranean productivity. Like in the previous type, the least indication of prolificacy of *A.turanica* was observed in ephemereta-artemisieta pasture variety (2,02 c/ha).

Geobotanical study showed that in Central Kizilkum *A.juncea* type is not so widespread as *A.diffusa* and *A.turanica.* It is found only in ephemereta-artemisieta pasture variety priviliged with dried streams where mean annual plant productivity is equal to 2,58 c/ha.

Table 1
Dynamics of epiterranean phytomass accumulation

Pasture varieties	Soil types	Average height of epiterranean part, cm	Average productivity of epiterranean part as per seasons, c/ha		
			spring	summer	autumn
Artemisia diffusa					
motley grass-iris-artemisieta	grey-brown loamy sandy	30-35	2,35	3,72	3,85
ephemereta-artemisieta	grey-brown stony-gravelly	35-40	1,14	2,41	2,59
ephemereta-ephemeroid-artemisieta	grey-brown loamy sandy	40-45	2,74	3,90	3,95
ephemereta-artemisieta-calligonumeta	sandy	50-60	3,30	4,94	5,10
Artemisia turanica					
motley grass-iris-artemisieta	grey-brown loamy sandy	30-40	2,21	3,40	3,73
ephemereta-artemisieta	grey-brown stony-gravelly	30-35	1,20	2,33	2,55
ephemereta-ephemeroid-artemisieta	grey-brown loamy sandy	35-40	2,55	3,67	3,84
Artemisia juncea					
ephemereta-artemisieta	grey-brown stony-gravelly	35-40	1,14	3,20	3,41

In the references [5] indicated that chemical content of soil has an influence on leaf size and the shoot length of artemisia species, this depends on the condition of plant. Our data indicates that not only chemical, but also mechanical components of soil are regarded as limiting factor which have influence on formation of epiterranean organs and on artemesia prolificness too.

The soil of Central Kizilkum is greyish-brown with various texture. Sand clay is basically widespread, in stony-gravelly and sandy soils the prolificacy of artemisia species is considerably differentiated. Particularly, the prolificacy of *A.diffusa* type is high in sandy soils of ephemereta-artemisieta-calligonumeta pasture variety. In this pasture variety *A. diffusa* is found as subdominant type, but due to moisture retention capability and light texture of soil, biometrical parameters and vegetative mass of plants are higher than in the plants of other pasture varieties, where it has dominant state. The analysis of obtained data showed that Artemisia pastures spread in stony-gravelly ecotopes make less phytomass comparing to other soil conditions.

Contradicting to aforementioned, *A.diffusa* and *A.turanica* are found in motley grass-iris-artemisia and ephemereta-ephemeroid-artemisieta pasture varieties with similar soil character, they differ by productivity indications. For example, spring productiveness of *A.turanica* in motley grass-iris-artemisia pasture varieties consists 2,21 c/ha, while this indication in ephemereta-ephemeroid-artemisieta pasture is equal to 2,55 c/ha, and similar difference is appropriate to all seasons of the year. This kind of difference can be linked with indirect influence of those plants which are available in the formation of the present pasture variety. Mechanical mutual effect is exactly defined in environment connected with the changes of the posture in the space, specified mutual effect among plants are shown on the remission of particular types [6].

Poa bulbosa of ephemeroid – the second dominant type of ephemereta-ephemeroid-artemisieta pasture variety, root system is less developed: short thin rhizomatous sod mat penetrates to depth of 6–10 cm and does not influence mechanically on artemisia. One of the main indications of pasture livestock breeding is nutriential value of dominant plant, which forms pasture type. Less nutriential value of dominant plant adversely influence on efficacy of using pasture lands. Moreover, nutriential value level of forage plants varies depending on seasonal dynamics and has a great significance in pasture farming (Levin *et al.*, 1951). Considering this, we have studied bio-chemical parameters of nutriential value of artemisia species during the seasons of the year (Table 2).

Biochemical analysis of various plant species, which were noted in several references [2, 11] represents that nutriential value parameters of forage plants, including artemisia types, depend on geographical location of species.

Biochemical content of *A.diffusa* and *A.turanica* species has been studied thoroughly in the condition of South-west Kizilkum [1]. But the obtained biochemical data (some levels) differed from the data presented in references and literature. The results of biochemical analysis of epiterranean mass of artemisia proved that it contains high amount of crude protein, fluctuating by seasons of the year. Positive dynamics of formation of crude protein in epiterranean parts of all types of artemisia is observed in spring, in the period of mass vegetation. Therefore, the amount of crude protein of *A.diffusa* is more (mean seasonal amount is equal to 13,7 % of completely dried mass) than in *A. turanica* (12,5 %).

Contradicting to our obtained data, in literatures [1] it was stated that in South-west Kizilkum *A.turanica* contains more crude protein (19%) compared to *A.diffusa* (16%), which can be linked with soil-climatic condition of environment. *A. juncea* also does not give way to other artemisia species by its crude protein amount, especially, as per this indication it is similar to *A.diffusa* type. The amount of crude protein decreases rapidly in summer, when summer dormancy starts in these species and occurs drying and falling of leaves of artemisia – one of the reasons of diminution of their phytomass and quality in this period. Diminution tendency of crude protein continues till autumn in *A.juncea* type and therefore its amount makes 4,2 % of absolutely dried mass. In this season mean amount of this indication is equal to 9% in *A.diffusa* and *A.turanica* types, relatively the amount of crude protein is saved two times more in these species in autumn, compared to *A.juncea* species.

Table 2

Seasonal changes of biochemical indications of nutriential value of plants, %

season	phase of growth and development	moisture	crude protein	crude fat	crude cellulose	Ash	N-FES
Artemisia diffusa							
Spring	Vegetation	6,9	20,1	9,6	15,7	16,7	31,0
Summer	summer dormancy	7,8	11,6	5,6	34,7	17,0	23,3
Autumn	Fruitage	6,5	9,4	6,5	43,6	16,2	17,4
Artemisia turanica							
Spring	vegetation	5,1	16,3	6,4	14,3	16,9	41,0
Summer	summer dormancy	5,3	12,0	4,1	35,7	17,8	2,51
Autumn	fruitage	4,4	9,1	5,3	39,8	13,9	2,75
Artemisia juncea							
Spring	vegetation	4,7	19,1	12,4	31,8	12,3	19,7
Summer	summer dormancy	3,4	11,8	8,1	35,5	17,2	24,0
Autumn	fruitage	3,6	4,2	7,4	36,8	17,4	30,6

According to the data of literatures (Levin *et al.*, 1951), artemisia species are rich in crude fat by content. Mean annual amount of this indication in *A.diffusa* is equal to 7,2 %, in *A.turanica* 5,3 %, in *A.juncea* 9,3 % of dried mass. The highest content of crude fat was observed in spring accumulated more in *A.juncea* (12,4 %) than other species. Moreover, less amount of crude fat was noted in summer and autumn seasons in all artemisia species. The highest crude fat content doesn't evidence that artemisia species differ from each other by its high assimilation. According to V.P. Subbotin [14, digestion of crude fat of artemisia is low – 55,4% and it depends on mainly content of this kind of organic substances, such as, essential oil, alkaloids, pigments and oleoresin, extracted with organic solvents including to the content of crude fat of artemisia. For example, epiterranean part of *A.diffusa* contains average 3,9% of santonic lactone with bitter taste and 1,1% essential oil, *A.turanica* contains 0,35% essential oil and 13,5% oleoresin, while *A.juncea* has oleoresin up to 10,2% and 1,1% essential oil (Levin *et al.*, 1951). High content of such ballast organic substances of artemisia species causes to increase of yield mass of crude fat, which has poor energetic balance and by content it cannot satisfy the needs for useful neutral fat of agricultural animals.

Ash content of annual shoots of artemisia is high till the time of dormancy. Midannual amount of crude ash makes 16,6 % in *A. diffusa*, in *A.turanica* - 16,2 % and in *A. juncea* - 15,6 % of absolute dried mass. On the amount of crude ash our analytical data is more than the data of literatures [1], but there is similarities on its dynamics by vegetation phases. Especially, in epiterranean mass of all species of artemisia mineral elements accumulate much in early phase of their vegetation. Crude ash increases till summer dormancy in *A. diffusa* and *A.turanica*, and its amount slightly decreases in autumn - in the phase of fruitage. Similar changes are not observed in *A.juncea* species which has similar tendency of increase in the amount of crude ash by seasons.

Artemisia species are not much rich in nitrogen-free extractive substances (N-FES). Their average seasonal amount makes 23,9 % in *A.diffusa*, in *A.turanica* – 31,2% and in *A.juncea* - 24,8 % of absolute dried mass. The amount of N-FES is higher in spring - at the beginning of vegetation of artemisia compared to other seasons of the year.

Table 3
Permissible and actual capacity of various artemisia pastures by seasons

Pasture varieties	Seasons of the year					
	spring		summer		autumn	
	P	a	p	a	p	a
Artemisia diffusa						
motley grass-iris-artemisia	0,8	1,2	1,0	1,3	1,1	1,4
ephemereta-artemisieta	0,3	1,1	0,6	1,2	0,7	1,3
ephemereta-ephemeroid-artemisieta	0,8	1,2	1,0	1,3	1,0	1,4
ephemereta-artemisieta-calligonumeta	1,0	0,8	1,1	1,0	1,4	1,2
Artemisia turanica						
motley grass-iris-artemisia	0,6	1,2	0,9	1,3	1,0	1,4
ephemereta-artemisieta	0,4	1,1	0,6	1,2	0,7	1,3
ephemereta-ephemeroid-artemisieta	0,7	1,2	1,0	1,3	1,0	1,4
Artemisia juncea						
ephemereta-artemisieta	0,3	1,1	0,9	1,2	0,9	1,3

A number of scientific researches show that support of pasture capacity with regular renewal by seed and vegetation of edible plants and reproduction of necessary forage resources is available only in their use in ecologically permissable lands [15, 16]. Basic ecological rule for rational utilization of pastures is accordance of their natural capacity to permissible capacity. But results present that in Central Kizilkum actual capacity of artemisia pasture to some extent increases from permissible one (Table 3).

Indication of permissible capacity (PC) of artemisia is low in spring and constantly increases with passing on autumn in all pasture varieties. The lowest indication of PC is noted in ephemereta- artemisieta, motley grass-iris-artemisia and ephemereta-ephemeroid-artemisieta pasture varieties. PC indication is higher in ephemereta-artemisieta-calligonumeta with *Artemisia diffusa*.

CONCLUSION

Artemisia is considered a valuable forage plant of Central Kizilkum. Depending on several factors the prolificness of artemisia species of pasture varieties are differentiated. Ecotope of all artemisia species coincides with greyish-brown sand clay soil with coarse texture, but their prolificacy is higher in sandstone which is not specific for artemisia. Nutriential value of artemisia reduces from spring to autumn, and its content is rich in proteins, varying from 4 to 20% depending on type and season. In spring low content of crude cellulose (14–31%) in all artemisia species is not regarded as indication of well edibility of animals, since abundant amount of essential oil in this period affect negatively to their edibility. Increase of crude cellulose content in autumn (36-43%) in epiterrnean part of artemisia species roughens forage for animals, but it is willingly eaten by small cattle due to satisfactory content of crude protein and low amount of essential oil.

Near the localities inexpedient distant-pasture cattle breeding has been identified. Capacity of ephemereta-artemisieta pasture is 2–3 times more, which is regarded as one of reasons of less formation of phytomass of artemisia in the present pasture variety, indicating growth degree of the region under the study.

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