The article was received at editors 09.02.205

Plugatar Yu.V., Ilnitsky O.A., Korsakova S.P. Ecological phytomonitoring: historical review, current state and prospects // Bull. of the State Nikit. Botan. Gard. – 2015. – № 114. – P. 4-10

The article focuses on historical review of the new direction in Biology, phytomonitoring, its emergence and development. Applying of phytomonitoring methods gives an opportunity to get continuous and synchronic data about various processes of plant vital functions. Research of the natural and anthropogenic effects on vegetation cover is of great importance. Phytomonitoring methods permitted to determine plant-resistance and adaptation level to diverse stress factors and competitive ability being under conditions of climatic changes and environmental pollution. The research ultimate goal is to prognosticate ecological situation of the certain region and make recommendations for ecological problems solution.

Key words: *phytomonitoring, express-method, prognostication of the ecological situation.*

FLORA AND VEGETATION

UDC 581.524(477.75)

POPULATION *MEDICAGO MARINA* L. ON SPLIT OF THE DONUZLAV LAKE. PHYTOINDICATION OF ITS ECOLOGICAL AMPLITUDE.

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Introduction

Vegetation is a formative element of environment, in complex with other elements it informs about ecological landscape conditions being a part of them. Out of desert area in the coastal zones of the oceans, seas, rivers and lakes sandy landscapes are developed. Within such landscapes there are dunes, unstable accumulative and deflationary sandy relief forms, emerged out of desert area [6].

Plants of coastal dunes become indicators of accumulation and erosion [12]. Projective cover and a height of the plant stand caused sand deposition around plants, reduction of erosion [9, 11]. As well as sand delivery and favorable wind direction, vegetation is the most important factor in dune development, being an indicator of formative processes [9, 10].

One of the mediterranian species, growing on foredunes, *Medicago marina* L., on the place of ecotone of cenosis with classes *Ammophiletea Br.-Bl. et R. Tx 1943u Festucetea vaginatae* Soo 1968 em Vicherek 1972 (occasionally this species was found on the front of foredunes). This species is quite rare for the Crimea (only 2 populations are known), their size decreases due to loads on littoral ecosystem [8]. This variety was noted as a rare species and included into the Red list of rare plants in the Crimea (1999), Red Data Book of Ukraine (2009). IUCN granted this species a status – lack of data, and this fact emphasizes urgent necessity to study *Medicago marina* L. population in the Crimea more thoroughly, its ecological and coenotic characteristics.

The research objective is to conduct phytoindication of ecological amplitude of *Medicago marina* L within split of the Donuzlav lake.

Research tasks: 1) determine floristic composition of the split in the locality of *Medicago marina* L.; find out minimum, optimum and maximum points for the studied

species within ecological amplitude; 3) analysis ecological range of *Medicago marina* L. allowing for a number of quite important factors.

Objects and methods of the research

Research object is *Medicago marina* L. population, located on the split of the Donuzlav lake (Fig.1). The lake split by length 9 km and width 8,5 km limits the water level size – 48,2 km². Donuzlav bay banks are pretty high and steep, twisting by outline and resemble meandering river [5]. Phytoindication of factors gradients and assessment of optimal gradations for the studied species was based on floristic composition of vegetation in the area of split foredunes of the Donuzlav lake.

Combination of vectors modulus of gradients makes a complex multivariable species characteristics or its real ecological niche, a certain hypervolume, tracing the edge values of vectors within detached factors. It permits to determine location of species coenopopulations within vegetation cover and its geographical natural habitat, as well as to reveal ecological optimum and response to the anthropogenic influence [2].

Scales of ecological factors by Tsyganov D.N. were applied for a comparative analysis of ecology [7]: thermo-climatic scale (Tm), scale of climate continentality (Kn), ombroclimatic scale of aridity and humidity (Om), cryoclimatic scale (Cr), scale of soil moisture (Hd), scale of soil saline regime (Tr), scale of soil acidity (Rc), scale of soil nitrogen satiration (Nt), scale of soil moisture variability (fH), scale of illumination-shadiness (Lc), scale of soil aeration (Ae), scale of carbonate concentration in soils (Ca), scale of soil humus content (Gr), ranged from 0 till 100. Correction of the origin scale allowing for regional specific was carried out according to methodical instructions by Korzhenevsky V.V. [3].

Fig.1 A fragment of foredune on the Donuzlav lake split with *Medicago marina L.* population. On the left hand there is fruiting *Medicago marina L.;* on the right hand it is in phenophases of flowering.

Results and discussion

The researches made it possible to determine a complete floristic composition of species being in cenosis of *Medicago marina L.* (17 species and 9 families) on the Donuzlav lake split (table 1). It underlies the ecological range of the study case.

Locality of the studied species within the Donuzlav lake split, is under influence of the following ecological factors. Type of ombroregime is close to subarid, cryoregime of the habitat corresponds to a warm winter type. Species are found on neutral and alkaline soils (pH 6,5-9,4), according to a trophic scale soils are not enriched, by nitrogen content are poor soils. Moisture level is characterized by variable type of moistening. This locality can be considered as an open area according to a scale by illumination-shading.

Analysis of abiotical factors made it possible to find out the most tolerant zone to all ecological factors, limited by maximum and minimum factors values: the main calculated indicators are the following: minimal and maximum range lines by scale, as well as optimum of the studied species (Fig.2).

At the same time a difference between ecological optimum and ecological conditions was analyzed within the researching locality (table 2). Coefficient of favorable environment (D) was calculated for each factor due to formula: ***D=(max-min)-opt*** (with D – value difference between ecological factor in the studied locality and optimal value of this factor) [1].

Table 1

Floristic composition of *Medicago marina L.* on the Donuzlav lake split.

Species	Family
Medicago marina L.	Fabaceae
Astragalus varius ssp. eupatoricus Sytin	Fabaceae
Artemisia arenaria DC.	Asteraceae
Lactuca tatarica (L.) C.A. Mey.	Asteraceae
Scorzonera parviflora Jacq.	Asteraceae
Halocnemum strobilaceum (Pall.) M. Bieb.	Chenopodiaceae
Suaeda salsa (L.) Pall.	Chenopodiaceae
Salicornia perennans Willd.	Chenopodiaceae
Salsola soda L.	Chenopodiaceae
Halimione verrucifera (M.B.) Aellen.	Chenopodiaceae
Elaeagnus angustifolia L.	Elaeagnaceae
Cakile euxina Pobed.	Brassicaceae
Limonium caspium (Willd.) Gams.	Plumbaginaceae
Eryngium maritimum L.	Apiaceae
Juncus maritimus Lam.	Juncaceae
Elytrigia elongata (Host) Nevski	Poaceae
Agropyron pectinatum (M.B.) P.Beauv.	Poaceae

Note: taxons names are presented according to Vascular Plants of Ukraine: A Nomenclatural checklist.- Kiev, 1999.- P. 345.

Table 2

Analysis of difference between ecological optimum (studied species) and ecological conditions (studied locality)

Abiotical factor	min	opt	max	max-min	D
Lc	74	90	99	25	-65
Tm	39	60	76	37	-23
Om	44	50	69	25	-25
Cr	42	64	81	39	-25
Kn	28	56	81	53	-3

Hd	15	48	64	49	1
fH	78	88	98	20	-68
Rc	59	85	96	37	-48
Tr	27	45	63	36	-9
Ca	41	59	77	36	-23
Nt	17	33	51	34	1
Gr	39	57	76	37	-20
Ae	25	38	51	26	-12

Coefficient of environmental contentment (D) estimates degree of favorable conditions for either species and it`s a measure of population ecological discomfort as well: than more its value, than less correspondence of habitat conditions to the studied species ecology [11].

Let`s analyze response of the studied species to each of these factors.

Illumination-shadiness scale (Lc). Due to analysis of this ecological factor, species *Medicago marina L.* can be classified as euheliophyte-plant, its optimum values reaches the maximum amplitude rate 90 units, coefficient D = 65 units.

Thermoclimatic scale (*Tm*). According to total of effective temperature values, it`s possible to determine this species group as xerophytes, optimum 60 units. The difference between accuracy of this ecological factor in the given locality and optimal conditions for *Medicago marina L.* population makes 23 units.

Ombroclimatic scale of aridity and humidity (Om). The studied case is a species inhabited in conditions of arid type, optimum zone is 50 units.

Cryoclimatic scale (Cr) makes it possible to analyze growing of *Medicago marina L.* population under conditions of warm winters with optimum zone 64 units.

Scale of soil moisture (Hd). Moistening of soil in the studied locality corresponds ecological demands of the researched population, D=1 unit.

Scale of climate continentality (Kn). Coefficient D=3 units is in range of optimal conditions for the given population growing on the Donuzlav lake split.

Scale of soil saline regime (Tr). Analysis of HCO_3, CI, SO_4 ions content (soil 100g/level 50 sm) permits to reveal favorable values of the saline regime for *Medicago marina L.* within investigated locality, D=9units.

Scale of soil acidity (Rc). Amplitude pH 6,5-9,4 characterized substrate of the studied area as neutral and alkalescent. Coefficient D=48 units indicates unfavorable conditions for the studied species.

Scale of soil nitrogen satiration (Nt). Occurrence of free nitrogen in soil causes favorable conditions for *Medicago marina L.*

Scale of soil moisture variability (fH). One of unfavorable factors for *Medicago marina L.* population in the given area is a soil moisture variability. Its coefficient occurred the highest in comparison with other factors mentioned above D=68 units.

Scale of soil aeration (Ae). Coefficient D=12 units, acceptable rate for surviving of the studied case within the Donuzlav lake split.

Scale of carbonate concentration in soils (Ca). Range of soil carbonate concentration in the studied area is 41-77 units, D=23 units, that is quite congenial for the species environment.

Scale of soil humus content (Gr). Analysis of this ecological factor rate indicates humus concentration from 375 till 575 ton/ha in one-meter-depth layer, that is enough to satisfy biological needs of nutrients on the average.

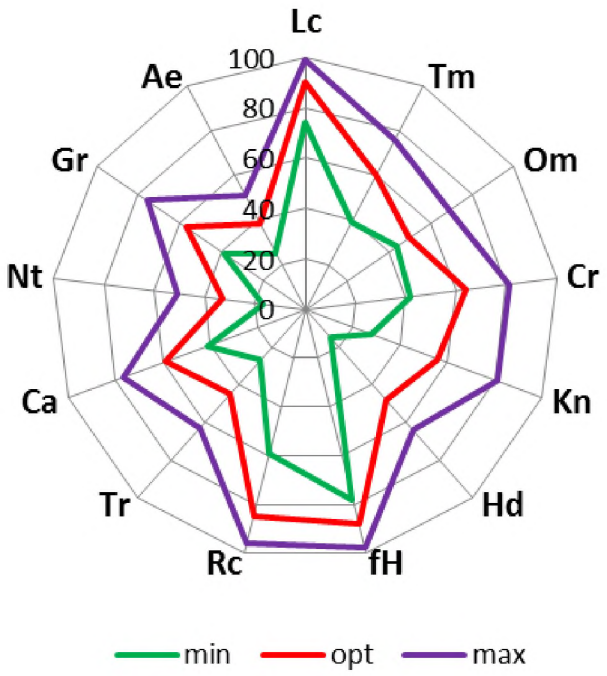

Fig.2 Amplitude ecological scale, its environmental range

Conventional signs of axes: temperature Tm, continental climate values (Kn), aridity and humidity (Om), cryoclimatic values(Cr), soil moisture (Hd), soil saline regime (Tr), soil acidity (Rc), soil nitrogen content (Nt), soil moisture variability (fH), illumination-shadiness (Lc), soil aeration (Ae), carbonate concentration in soils (Ca), soil humus content (Gr).

According to scales of abiotical factors with ranged from 0 till 100 units *Medicago marina L.* has a wide amplitude on soil moisture, continental climate and cryoclimatic values, the narrowest ecological amplitude was registered on illumination, soil aridity and humidity regimes.

Conclusions

Phytoindication of ecological scales makes it possible to characterize habitat of *Medicago marina L.* on the Donuzlav lake split in terms of ecology.

Maximum appropriate to favorable conditions factors within the given locality of studied population are free nitrogen content in the soil, moistening and aeration of soil, continentality of climate.

Due to method of ecological scales it was sorted out abiotical factors with unfavorable values in the population range: illumination, soil moisture regime, soil acidity. Probably just these very factors or combination of them make unfavorable conditions for *Medicago marina L.* population within this locality.

Gratitudes

Authors thank sincerely Svyrin S. for his assistance in a search of *Medicago marina L.* location.

The research was granted by the Russian Scientific Foundation (№ 14-50-00079)

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The article was received at editors 18.11.2014

Shkaranda Yu.S., Korzhenevsky V.V., Population Medicago Marina L. on split of Donuzlav lake. Phytoindication of its ecological amplitude// Bull. of the State Nikit. Botan. Gard. – 2015. – № 114. – P. 10-15

For the first time phytoindication of *Meicago marina L.* ecological amplitude was carried out. It was based on analysis of floristic composition within split of the Donuzlav lake. Ecological range of the studied species allowing for principal abiotical factors was determined due to scale by Tsyganov D.N., methodology by Korzhenevsky V.V. In the course of the research it was found out a location of ecological optimum for *Meicago marina L.* population in syntaxonomic region space according to the main ecological factors.

Key words: *phytoindication, ecological scales, coastal vegetation of dunes; Meicago marina L.*