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RESEARCH ARTICLE

JUNIPERUS COMMUNIS FORMATIONS ON HEATHS OR CALCAREOUS GRASSLAND - A NEW HABITAT IN THE DANUBIAN PLAIN (BULGARIA).

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Abstract

The natural habitat 5130 *Juniperus communis* formations on heaths or calcareous grassland was established for the first time in the Danube Plain (Northern Bulgaria). The habitat was found near the northern borders of the Shumen Plateau (The eastern part of the Danubian Plain in Republic of Bulgaria). So far such habitats have been discovered in the southern, western and central parts of Bulgaria. The presence of the habitat on the Shumen Plateau can be seen as an isolated example in comparison to its typical distribution in other areas. The new habitat is characterized by a rich composition of species typical for similar habitats. The locality differs from previously described localities of the habitat by its lower altitude, northwest-facing, small slope and low density of the phytocoenose of *J. communis*. The habitat was located within the Shumen Plateau Protected Area (BG0000382) and the Shumen Plateau Natural Park. The conservation status of the habitat in the protected area was assessed.

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Introduction:-

Natural habitat 5130 *Juniperus communis* formations on heaths or calcareous grassland is announced by Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive. In Bulgaria the conservation status of the habitat is potentially threatened (NT – A1, 2 B1 C1 D2 E2 F1 G1 H1 I L2). It is included in Appendix I of the Biodiversity Act of the Republic of Bulgaria and in the Red Data Book of the Republic of Bulgaria (Vitkova & Tashev, 2015).

This habitat type comprises the phytocoenoses of Common juniper (*Juniperus communis* L.) that occur throughout Bulgaria from the oak belt up to the mountain belt, and in some places reach the timberline (Central Rhodopi Mts). The species occurs in the subalpine belt as well, where it forms communities with *Vaccinium myrtillus* L., and sometimes with *V. vitis-idaea* L. The habitat usually develops on limestone terrains where soils are shallow and skeletal with frequent rock outcrops, and less moderately moist. It develops on eroded Cambisols and more rarely on Rendzic. This habitat covers mainly southern slopes, but sometimes occurs on western or eastern slopes as well. In most cases the slopes are steep, sometimes reaching 40° (Apostolova & Meshinev, 2012a; Vitkova & Tashev, 2015).

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The phytocoenoses of *J. communis* have a two-layer structure, composed of a shrubs and woods layer and herbaceous layer. The horizontal structure is irregular. The projective cover varies considerably, from 30% up to 80% (Apostolova&Meshinev, 2012a; Vitkova & Tashev,2015). Common juniper forms open communities in combination with xerophilous grass components characterized by a rich species composition. Common associated species are: *Bothriochloa ischaemum*(L.) Keng, *Chrysopogon gryllus*(L.) Trin., *Bromus inermis*Leys., *Festuca valesiaca*Schleich. exGaudin, *Carlina vulgaris*L., *Euphorbia cyparissias*L., *Rosa spp.*, *Salvia nemorosa*L., *Eryngium campestre*L.etc. To identify the habitat, suffices to confirm the dominant presence of *J.communis*. The identification of other typically associated with it species is not necessary. The boundaries of the habitat are determined by the boundaries of distribution of the dominant species (Apostolova&Meshinev, 2012a).

The habitat is in a relatively stable succession phase. Although of secondary origin, it remains stable over time. *J. communis*may increase its total projective cover, but this does not change the type of habitat. The onslaught of deciduous tree species is unlikely because of shallow and dry soils. A part of the habitat is used for grazing under restriction (Apostolova&Meshinev, 2012a).

A threat to the habitat present the following: 1. Afforestation of land with artificial forest plantations – a moderate degree of threat; 2. Intensive grazing – a slight degree of threat; 3. Fires – a moderate degree of threat (Apostolova&Meshinev, 2012a). To these, we can add the following impacts: logging, collection of galbules for medicinal purposes, extention of the arable land, erosion, and soil-slides. The anthropogenic impact on the habitat used to be considerable in the past. A tendency for the restoration and the increase of the areas covered by Common juniper has been observed recently as a result of the abandonment of arable land (Vitkova & Tashev,2015).

The area of the habitat at national level is 5054.73 ha (Apostolova&Meshinev, 2012c). To protect the natural habitat, part of this area (993.94 ha) (Information system for Natura 2000 in Bulgaria)is included within the protected areas of the National Ecological Network of the Republic of Bulgaria, which is part of the European ecological network of protected areas NATURA 2000. The habitat spreads over 14 protected areas designated under the Habitats Directive: Vitosha (BG0000113), Sinitekamani (BG0000164), Lozenska Mt (BG0000165), DolniKoriten (BG0000295), Strandzha (BG0001007), Osogovska Mt (BG0001011), Oranovskiprolom – Leshko (BG0001022), SredenPirin – Alibotush (BG0001028), Rhodopi – Zapadni (BG0001030), Rhodopi – Sredni (BG0001031), Rhodopes – Iztochni (BG0001032), ZapadnaStaraplanina and Predbalkan (BG0001040), Yadenitsa (BG0001386), Srednagora (BG0001389) (Information system for Natura 2000 in Bulgaria). According to the latest data, such habitats are not anymore found in the other 4 protected areas where they were initially mapped: Krushe (BG0000626), Zemen (BG0001012), Popintsi (BG0001039) and Centralen Balkan-buffer (BG0001493).

Materials and Methods:-

This survey was conducted on the route method in July 2016. The marking of the range of the habitat was made using GPS receiver Garmin Oregon 450. WGS 84 UTM 35N coordinate system was used.

In determining the species was used the Handbook for Plants in Bulgaria (Delipavlov& al., 2011). The names of the species are according to the Conspectus of the Bulgarian Vascular Flora (Asyov& al., 2012). The abbreviations of the authors' names of the plants are according to the International Plant Names Index (IPNI 2015+). The families of flowering plants are according to the Angiosperm Phylogeny Group IV (2016).

The life forms are according to the Raunkiaer's system (Raunkiaer, 1934). For their determination were used the Flora of the People's Republic of Bulgaria (Yordanov, 1963–1979;Velchev, 1982–1989) and the Flora of the Republic of Bulgaria (Kozuharov, 1995;Peev,2013). The projective cover of the species in the habitat is according to Braun-Blanquet (Westhoff & Maarel, 1973). The assessment of the conservation status of the habitat in the protected area is according to the adopted methodology (Apostolova&Meshinev, 2012b).

Results and Discussion:-

According to the current known data on the spread of the natural habitat (Apostolova&Meshinev, 2012a; Vitkova & Tashev,2015, Information system for Natura 2000 in Bulgaria), it occurs in southern, western and central parts of the Republic of Bulgaria (Fig. 1). The altitudinal range of the habitat is from 500 to 1900 m asl (Vitkova & Tashev,2015). So far, there is no information about the discovery of the habitat in the Danube Plain (Northern part of the Republic of Bulgaria).

As a result of fieldwork was found the habitat near the northern borders of the Shumen Plateau (quadrant MH99 in the eastern part of the Danubian Plain on the territory of the Republic of Bulgaria). As can be seen from Fig. 1, this part of the Danube Plain is hilly and characterized by plateaus. It can be assumed that what caused the habitat's spread here is the proximity to the hilly and low mountainous area known as Forebalkan that spreads south in the mountain range of the Balkan Mt. The distance between the new locality and Forebalkan is only 20 km by air in the south. The author thinks that this proximity provides only an explanation for the favorable conditions for the habitat, but does not sufficiently explain its origin. The author research in adjacent parts of the Forebalkan and the Balkan Mt did not yield other similar habitats. The nearest locality of another such habitat is near the town of Sliven about 75 km by air route in the southwest. The studies that the author have conducted in recent years in the neighbouring raised parts of the Danubian Plain, show a lack of such habitats in those locations. The presence of the habitat on the Shumen Plateau can be seen as an isolated example, because it is far away from typical for such habitats' areas. The habitat does not occur in lowland areas north of the Danube River in Romania, where there are no populations of *J. communis* (NATURA 2000 Standard Data Form for the Shumen Plateau Protected Area).

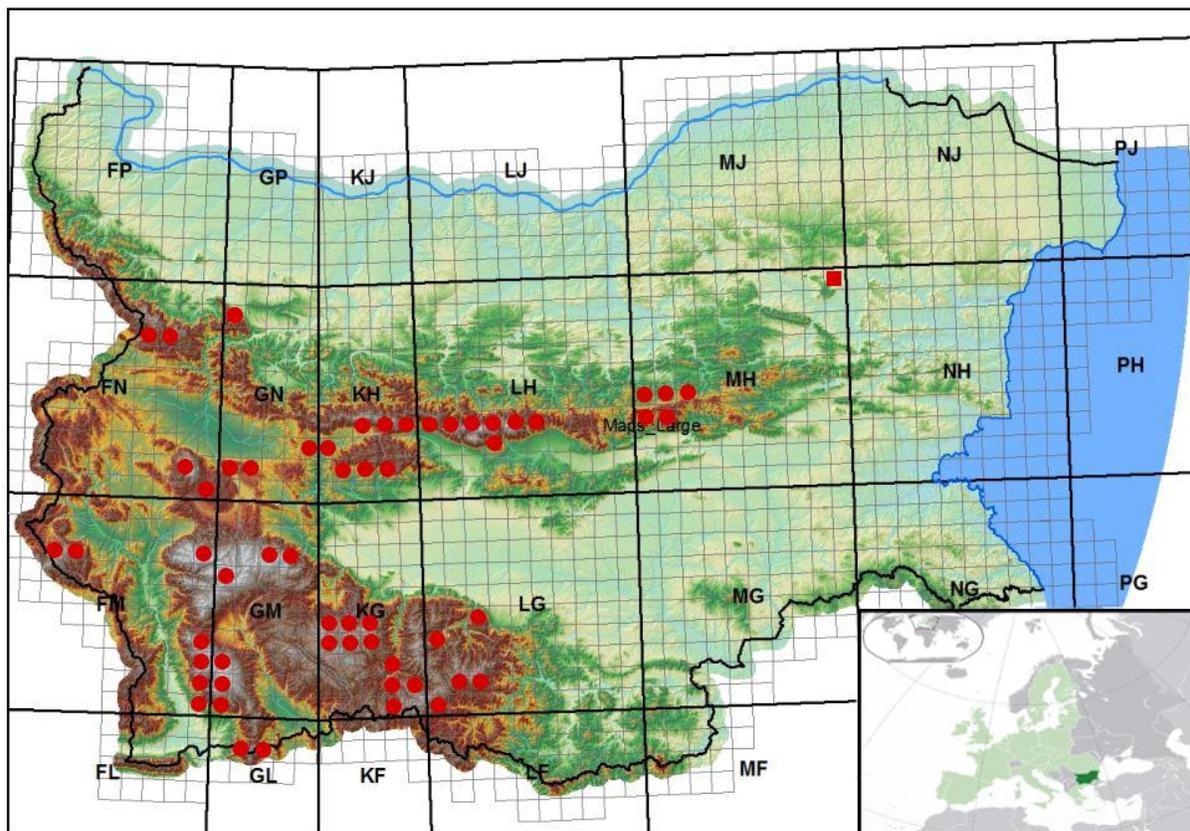


Figure 1:- Map of the distribution of the habitat in Bulgaria (modified after Vitkova&Tashev 2015). Legend: circle – known localities, box – new locality in quadrant MH99

The habitat that was established is located within the Shumen Plateau Protected Area (BG0000382) and Shumen Plateau Natural Park. So far, it has not been described in either the Standard Form of the protected area (NATURA 2000 Standard Data Form for the Shumen Plateau Protected Area), or in the Management Plan for the natural park (2011).

The habitat (Fig. 2) was located in three polygons (with area of 1.46 ha, 0.12 ha and 0.03 ha). The total area of the polygons is 1.61 ha. The coordinates of the endpoints of the range of the habitat are: 1. 43.298252° N, 26.886357° E; 2. 43.298091° N, 26.887069° E; 3. 43.300380° N, 26.892313° E; 4. 43.299201° N, 26.886225° E. The altitude varies from 319 to 345 m asl.

The exposure is northwest. The slope varies from 5° to 10° in individual polygons. The soil is shallow and it is a complex of lithocarbonaterendzinas and lithosols with calcareous rocks (Management plan for the Shumen Plateau Natural Park, 2011). The main rock is sandstone. The cover of the vegetation is 90% in the largest polygon.

The habitat borders on forest plantations of *Pinus nigra* J.F. Arnold. The floristic composition of the habitat occurs in the largest polygon (see Table in Appendix). In this habitat, were identified 78 species belonging to 70 genera and 28 families. Of these, 17 species are phanerophytes (Ph), 4 species are chamaephytes (Ch), 54 species are hemicryptophytes (H), 2 species are cryptophytes (Cr) and 1 species is a therophyte (Th). The majority of the species – 47 species (60.3%) have a projective cover less than 5% and the number of individuals over 50.



Figure 2:-A view at the habitat (Photograph by Dimcho Zahariev)

The assessment that was made on the habitat's conservation status in the Shumen Plateau Protected Area (BG0000382) follows the Methodology by Apostolova & Meshinev (2012b) and reveals the following: According to Criterion 1 (The habitat's area within the protected area), the habitat is in favourable condition. This assessment is due to lack of information about reducing the area of the habitat. Since the habitat is established for the first time in the protected area, the present location was compared to the reference value from 2007 when the Shumen Plateau was declared Protected Area. At that point, the habitat had not been registered and the reference value was assumed to be zero.

According to Criterion 2 (The habitat's structure and functions), the habitat is in unfavourable-bad condition. This assessment is based on a total of 7 parameters. If one of them demonstrates an unfavourable condition, the evaluation for all criteria is considered to be equal. Of the estimated parameters, six are in favourable condition and one is in unfavourable-bad condition. The results by individual parameters are as follows:

1. Fragmentation within the habitat: The habitat's condition is favourable because there are no impacts which cause fragmentation.
2. Domination of *J. communis*: This parameter is in unfavourable-bad condition. The reason is that less than 25% of the habitat is covered by the population of *J. communis*.
3. Summary projective coverage of the phytocenoses: The condition of the habitat is favourable because the cumulative projective coverage of phytocenoses exceeds the required minimum of 60%.
4. Typical plant species: The condition of the habitat is favourable. To identify the habitat, the dominant presence of *J. communis* suffices. Furthermore, was described a sufficient number of typical plants for the habitat: *Bothriochloaischaemum*(L.) Keng, *Carlina vulgaris* L., *Crataegusmonogyna*Jacq., *Eryngiumcampestre* L., *Juniperuscommunis*L., *Plantago media* L., *Rosaspp*.
5. Ruderalisation and secondary increase on tree and shrub species within the habitat in result of converting to mesophilic conditions or transferring of biogenes from neighbouring arable lands: The condition of the habitat is favourable because the ruderal species do not form separate cenoses and bushes and trees do not increase.
6. Presence of invasive species: The condition of the habitat is favourable due to lack of invasive species.
7. Resumption of *J. communis*: The condition of the habitat is favourable, because the population of *J. communis* is resumed. Proof of this is the presence of individuals of different ages. There are dozens of young individuals.

According to Criterion 3 (Future Prospects – threats and influences), the habitat is in unfavourable-bad condition. The formation of this assessment took into account three criteria:

1. Intensity of grazing: The condition is unfavourable-bad due to complete absence of grazing.
2. Use of fertilizers and pesticides and presence of contaminants (importers of biogenes): The habitat is in unfavourable-bad condition due to availability of arable land within a radius of less than 100 m away from the habitat. The arable areas are associated with the use of fertilizers and pesticides and the transfer of weed species. In this research were found the presence of a small number of weed species (*Euphorbia agraria*M.Bieb., *Rubuscaesius* L., *Sambucusebulus*L.) with a total projective cover less than 5%.
3. Fires: The condition of the habitat is favourable because in its territory and in the vicinity have not been registered any fires.

The overall assessment of the natural habitat's state according to the three criteria is unfavourable-bad condition. The reason for this is the assessment according to 3 parameters as described in the second and third criteria above.

The unique location of the habitat requires taking measures to improve its conservation status. These measures are the following:

1. Increasing the density of the population of *J. communis*. The natural increase in the number, which was found in this study, can be supported by seed propagation. The seed material must come from the local population in order to protect its gene pool.
2. Motivating local shepherds to hold moderate intensity grazing within the habitat. According to the methodology the number of animals should be 0.3-1.5 animals of 1 ha. Grazing should be held in no less than 90% of the area of habitat.
3. Growing that does not require the use of fertilizers and pesticides in the arable land within a radius of 100 meters of the habitat can grow crops. At worst, they may be replaced with meadows.

Conclusion:-

The natural habitat 5130 *Juniperuscommunis* formations on heaths or calcareous grasslands is a new habitat in the Danubian Plain (Northern Bulgaria). It is characterized by a rich species composition that is typical for such habitats. The locality differs from the previously described localities of the habitat in the following: lower altitude, northwest-facing, small slope and low density of the phytocoenose of *J. communis*. The author propose to adjust the altitude range of the habitat's distribution as the lower limit needs to be changed from the current 500 m asl to the more accurate 320 m asl. In order to improve the conservation status of the habitat, the authors suggest taking adequate measures.

Appendix:-

Table 1:-Floristic composition of the habitat

Legend: 2a – projective cover from 5 to 12.5%, 2m – projective cover less than 5% and number over 50 individuals, 1 – projective cover less than 5% and number among 6 and 50 individuals, + – projective cover less than 5% and number among 2 and 5 individuals, r – projective cover less than 5% and only one individual.

No	Plant name	Family	Life form	Projective cover
1	<i>Juniperus communis</i> L.	Cupressaceae	Ph	2a
2	<i>Botriochloa ischaemum</i> (L.) Keng	Poaceae	H	2a
3	<i>Brachypodium pinnatum</i> (L.) P. Beauv.	Poaceae	H	2a
4	<i>Pinus nigra</i> J.F. Arnold	Pinaceae	Ph	2a
5	<i>Poa trivialis</i> L.	Poaceae	H	2a
6	<i>Ulmus minor</i> Mill.	Ulmaceae	Ph	2a
7	<i>Achillea millefolium</i> L.	Asteraceae	H	2m
8	<i>Agrimonia eupatoria</i> L.	Rosaceae	H	2m
9	<i>Anacamptis pyramidalis</i> (L.) Rich.	Orchidaceae	Cr	2m
10	<i>Anthyllus vulneraria</i> L.	Fabaceae	H	2m
11	<i>Arrhenatherum elatius</i> (L.) P. Beauv. ex J. Presl & C. Presl	Poaceae	H	2m
12	<i>Asperula cynanchica</i> L.	Rubiaceae	H	2m
13	<i>Astragalus onobrychis</i> L.	Fabaceae	H	2m
14	<i>Brachypodium sylvaticum</i> P. Beauv.	Poaceae	H	2m
15	<i>Briza media</i> L.	Poaceae	H	2m
16	<i>Campanula rapunculoides</i> L.	Campanulaceae	H	2m
17	<i>Carex flacca</i> Schreb.	Cyperaceae	H	2m
18	<i>Carlina acanthifolia</i> All.	Asteraceae	H	2m
19	<i>Carlina vulgaris</i> L.	Asteraceae	H	2m
20	<i>Centaurea rhenaena</i> Boreau	Asteraceae	H	2m
21	<i>Centaurea scabiosa</i> L.	Asteraceae	H	2m
22	<i>Clinopodium vulgare</i> L.	Lamiaceae	H	2m
23	<i>Cornus sanguinea</i> L.	Cornaceae	Ph	2m
24	<i>Coronilla varia</i> L.	Fabaceae	H	2m
25	<i>Crataegus monogyna</i> Jacq.	Rosaceae	Ph	2m
26	<i>Cuscuta epithymum</i> L.	Convolvulaceae	Th	2m
27	<i>Dactylis glomerata</i> L.	Poaceae	H	2m
28	<i>Dorycnium herbaceum</i> Vill.	Fabaceae	Ch	2m
29	<i>Eryngium campestre</i> L.	Apiaceae	H	2m
30	<i>Euphorbia agraria</i> M. Bieb.	Euphorbiaceae	H	2m
31	<i>Euphorbia amygdaloides</i> L.	Euphorbiaceae	H	2m
32	<i>Filipendula vulgaris</i> Moench	Rosaceae	H	2m
33	<i>Fragaria vesca</i> L.	Rosaceae	H	2m
34	<i>Galium album</i> Mill.	Rubiaceae	H	2m
35	<i>Hypericum perforatum</i> L.	Hypericaceae	H	2m
36	<i>Knautia macedonica</i> Griseb.	Caprifoliaceae	H	2m
37	<i>Koeleria simonkaii</i> Adamovič	Poaceae	H	2m
38	<i>Lembotropis nigricans</i> (L.) Griseb.	Fabaceae	Ph	2m
39	<i>Leontodon crispus</i> Vill.	Asteraceae	H	2m
40	<i>Leucanthemum vulgare</i> Lam.	Asteraceae	H	2m
41	<i>Linum tenuifolium</i> L.	Linaceae	H	2m
42	<i>Medicago falcata</i> L.	Fabaceae	H	2m
43	<i>Ononis spinosa</i> L.	Fabaceae	Ch	2m
44	<i>Origanum vulgare</i> L.	Lamiaceae	Ch	2m
45	<i>Plantago media</i> L.	Plantaginaceae	H	2m
46	<i>Polygala major</i> Jacq.	Polygalaceae	H	2m
47	<i>Prunus spinosa</i> L.	Rosaceae	Ph	2m
48	<i>Pyrus pyraeaster</i> (L.) Burgsd.	Rosaceae	Ph	2m
49	<i>Sanguisorba minor</i> Scop.	Rosaceae	H	2m
50	<i>Scabiosa ochroleuca</i> L.	Caprifoliaceae	H	2m
51	<i>Silene vulgaris</i> (Moench) Garcke	Caryophyllaceae	H	2m
52	<i>Teucrium chamaedrys</i> L.	Lamiaceae	Ph	2m

53	<i>Thymus callieri</i> Halácsy ex Litv.	Lamiaceae	Ch	2m
54	<i>Ajugalaxmanii</i> (L.) Benth.	Lamiaceae	H	1
55	<i>Allium rotundum</i> L.	Amaryllidaceae	Cr	1
56	<i>Campanula sibirica</i> L.	Campanulaceae	H	1
57	<i>Cichoriumintybus</i> L.	Asteraceae	H	1
58	<i>Clematis vitalba</i> L.	Ranunculaceae	Ph	1
59	<i>Cornus mas</i> L.	Cornaceae	Ph	1
60	<i>Cotatinctoria</i> (L.) J.Gay.	Asteraceae	H	1
61	<i>Daucuscarota</i> L.	Apiaceae	H	1
62	<i>Dianthus giganteus</i> D'Urv.	Caryophyllaceae	H	1
63	<i>Digitalis lanata</i> Ehrh.	Scrophulariaceae	H	1
64	<i>Hieraciumcymosum</i> L.	Asteraceae	H	1
65	<i>Knautiadrymeia</i> Heuff.	Caprifoliaceae	H	1
66	<i>Ligustrumvulgare</i> L.	Oleaceae	Ph	1
67	<i>Potentillapedata</i> Willd.	Rosaceae	H	1
68	<i>Ranunculusvelutinus</i> Ten.	Ranunculaceae	H	1
69	<i>Rosa canina</i> L.	Rosaceae	Ph	1
70	<i>Rubuscaesius</i> L.	Rosaceae	Ph	1
71	<i>Sambucusebulus</i> L.	Caprifoliaceae	H	1
72	<i>Tragopogondubius</i> Scop.	Asteraceae	H	1
73	<i>Vincetoxicumhirundinaria</i> Medik.	Apocynaceae	H	1
74	<i>Juglansregia</i> L.	Juglandaceae	Ph	+
75	<i>Thalictrum minus</i> L.	Ranunculaceae	H	+
76	<i>Viburnum lantana</i> L.	Caprifoliaceae	Ph	+
77	<i>Picrishieracioides</i> L.	Asteraceae	H	r
78	<i>Pinussylvestris</i> L.	Pinaceae	Ph	r

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