

***Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk, ass. nova (*Prunion fruticosae* tx. 1952) in the Republic of Moldova**

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Abstract. The article describes the plant communities formed by the dominant species *Caragana frutex* (L.) K. Koch s. str. and *Teucrium chamaedrys* L. on the calcareous hills of the Republic of Moldova, grouped in a new association - *Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk in the alliance *Prunion fruticosae* Tx. 1952, order *Prunetalia spinosae* Tx. 1952, class CRATAEGO-PRUNETEA Tx. 1962. Characteristic species of the association: *Caragana frutex* s. str., *Teucrium chamaedrys*, *Marrubium peregrinum*. The associations consists of (western) Pontic-Sarmatian xeromesophilic phytocoenoses, with a general cover of 100%, poor in herbaceous plants.

Keywords: *Teucrio chamaedri-Caraganetum fruticis* ass. nova, characteristics of the phytocoenoses, ecology, distribution, Republic of Moldova.

***Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk, ass. nov. (*Prunion fruticosae* tx. 1952) – asociație nouă în Republica Moldova**

Rezumat. În lucrare sunt descrise comunitățile vegetale formate de specia dominantă *Caragana frutex* (L.) K.Koch s. str. și *Teucrium chamaedrys* L. pe colinele calcaroase din Republica Moldova, grupate într-o asociație nouă – *Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk din alianța *Prunion fruticosae* Tx. 1952, ordinul *Prunetalia spinosae* Tx. 1952, clasa CRATAEGO-PRUNETEA Tx. 1962. Specii caracteristice asociației: *Caragana frutex* s. str., *Teucrium chamaedrys*, *Marrubium peregrinum*. Asociația prezintă fitocenoze pont-sarmațiene (vest), xeromezofile, cu o acoperire generală de 100%, sărace în plante erbacee.

Cuvinte cheie: *Teucrio chamaedri-Caraganetum fruticis* ass. nov., caracteristica fitocenzelor, ecologia, răspândirea, Republica Moldova.

1. INTRODUCTION

The genus *Caragana* Lam. comprises about 80 species, which occur in the temperate region of Eurasia. In the spontaneous flora of the Republic of Moldova, the following species have been found: *C. frutex* (L.) K.Koch s. str., *C. frutex* var. *mollis* (M.Bieb.)

DC., and *C. scythica* (Kom.) Pojark. [= *C. grandiflora* auct. mold. non DC.]. Phytosociological research on the populations of these species is necessary to better solve the problems of their protection in the territory of the Republic of Moldova.

In this article, the thickets of small shrubs formed by *Caragana frutex* (L.) K.Koch s. str. on the calcareous hills in the forest steppe area of the Republic of Moldova have been described for the first time.

2. MATERIAL AND METHODS

The phytosociological research was conducted according to the methods of the Central-European school [1, 2]. The description of the association was based on 29 relevés (the relevés no. 1-22 were prepared by P. Pînzaru, the relevés no. 23-29 – by P. Pînzaru, A. Ruschuk). The area of a relevé, as a rule, was 10 x10 m, less often 3 x 5 m (rel. No. 19, 20, 28, Table 1) or 3 x 10 m (rel. no. 1, 25, 27, Table 1), 5 x 10 m (rel. no. 6, 8, 18, Table 1). The phytosociological research in the field was conducted in 1995-1997, 2009, 2014-2020. The list of the species was presented according to the monograph P. Pînzaru & T. Sîrbu [3]. The rare species, protected by the state – according to the Law LP1538/1998 (Republic of Moldova, Parliament, 1998). The soil was described according to A. Ursu [4]. The average annual air temperature and the average amount of precipitation – according to the Atlas of Climatic Resources of the Republic of Moldova [5]. The geomorphological units – according to G. Sârodoev and E. Mițu [6].

3. RESULTS AND DISCUSSION

The phytocoenoses of *Caragana frutex* (L.) K.Koch s. str., found in the upper part of the calcareous hills, at the edge or near the xerothermophilous forests, covered areas of different size, from 15-50 m² to 200-300 m², for which reason the relevés of different size, between 15 and 100 m², were prepared. These phytocoenoses have a general cover of 100 %, usually consist of a single layer, formed by *Caragana frutex*, which reveals a cover between (45) 75 and 95 %, there are few specimens of other species of shrubs. The grass layer is insignificant, but in some places, *Teucrium chamaedrys* L. has higher cover. The presence of a large number of species characteristic of steppe vegetation is due to the fact that the phytocoenoses of *Caragana frutex* s. str. are bordered by steppe ones, but the high cover of shrubs does not allow the formation of a compact layer of grasses. Thus, the number of herbaceous species and their abundance depends on the size of the areas occupied by these plant communities and the density of shrubs.

The species *Caragana frutex* (L.) K.Koch s. str., considered Pontic-Sarmatian, xerome-sophilic, is widespread in the forest steppe zone, from the southern part of Central Europe

(Babadag Plateau, Romania) to Central Asia (northeast) and Eastern Siberia (southwest); it is found both on sunny hills and in thickets of tall shrubs or glades of xerothermophilic forests. *C. frutex* var. *mollis* (M.Bieb.) DC. [= *Caragana mollis* (M.Bieb.) Besser, *C. frutex* subsp. *mollis* (M.Bieb.) Kuzm.] is indicated in Bulgaria, Romania (Dobrogea, Moldova), the Republic of Moldova, Eastern Europe (south) and the Caucasus [10, 12].

Some botanists consider the species *Caragana mollis* (M.Bieb.) Besser as a synonym of the species *Caragana frutex* (L.) K.Koch, others treat it at intraspecific level: var. *mollis* (M.Bieb.) DC or subsp. *mollis* (M.Bieb.) Kuzm. As a result of phytosociological field research, it has been found that *Caragana frutex* var. *mollis* forms isolated plant communities, near or in the absence of those formed by *Caragana frutex* s. str. The shrubs *Caragana frutex* var. *mollis*, on the calcareous slopes of the Republic of Moldova, are smaller in size, about 20-30 cm, so, they are camephytes, xerophiles; the leaves, calyx and fruit are densely pubescent, while the plants of *Caragana frutex* (L.) K.Koch are taller, about 60-90 cm, nanophanerophytes, usually glabrous, rarely with scattered hairs on the midrib of the leaves, on the edge of the teeth of the calyx or on the fruits.

The different taxonomic treatment of *Caragana frutex* and *C. mollis* species also affected the classification of the vegetation. Thus, in the vegetation of Romania (Babadag Plateau), the association *Caragana frutex* Dihoru 1970 was described based on 2 relevés, the plants corresponding to the species *C. frutex* (L.) K.Koch s. str. [8, 12]. Later, the subass. *Andropogonetum ischaemi-caraganetosum frutices* Dobrescu et Vițalariu 1973 was proposed, based in 12 relevés, with the characteristic species *Caragana frutex* var. *mollis* (abundance + dominance 2-3) and *Andropogon ischaemum* (ab. ”+” or 1-2), included in the alliance *Festucion rupicolae* Soó (1940) 1964, class *FESTUCO-BROMETEA* [10]. Lucia Mititelu (1974) described 5 relevés of *Caragana frutex* var. *mollis* from Valea Lunga (Iași County) [11]. Tudor Chifu and Irina Irimia (2014) included the relevés described by C. Dobrescu and Gh. Vițalariu (1973) and those published by L. Mititelu (1974) in the sub-association *Taraxaco serotinae-Bothriochloetum ischaemi caraganetosum frutices* (Dobrescu et Vițalariu 1973) Chifu et Irimia 2014 subass. nova, grouped in the alliance *Jurineo arachnoideae-Euphorbion stepposae* (Dobrescu 1971) Coldea et Sârbu in Coldea 2012, order *Festucetalia valesiacae* Br.-Bl. et R. Tx. ex Br.-Bl. 1949, class *FESTUCO-BROMETEA* Br.-Bl. et R. Tx. in Br.-Bl. 1949 [13]. At the same time, A. Oprea (2015) included the relevés published by Gh. Dihoru (1970, 2 rel.), C. Dobrescu & Gh. Vițalariu (1973, 12 rel.) and L. Mititelu (1974, 5 rel.) in a new association – *Bellevalio sarmaticae-Caraganetum fruticis* (Dobrescu et Vițalariu, 1973) Oprea 2015, stat. nov., alliance *Berberidion* Br.-Bl. ex Tx. 1952, order *Prunetalia*

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spinosae R. Tx. 1952, class *RHAMNO-PRUNETEA* Rivas Goday et Borja Carbonell ex Tx. 1962 [14].

The phytocoenoses dominated by *Caragana frutex* (L.) K.Koch, in Ukraine, have been grouped in two associations: *Vinco herbaceae-Caraganetum fruticis* Korotchenko et Didukh 1997 and *Amygdalo-Caraganetum* Fitsailo 2006, attributed to different classes of vegetation. The species *C. mollis* (M.Bieb.) Besser is absent among the characteristic species of coenotaxa in the Ukrainian Prodrôme, probably because it is considered synonymous with *Caragana frutex* (L.) K.Koch [15-17].

The association *Vinco herbaceae-Caraganetum fruticis* Korotchenko et Didukh 1997 has been grouped in the alliance *Stipo lessingiana-Salvion nutantis* Vynokurov 2014, order *Tanaceto achilleifolii-Stipetalia lessingiana* Lysenko et Mucina in Mucina et al. 2016, class *FESTUCO-BROMETEA* Br.-Bl. et Tx. ex Soó 1947. Characteristic species of the association: *Caragana frutex*, *Vinca herbacea*, *Adonis vernalis*, *Amygdalus nana*, *Asparagus polyphyllus*, *Carex praecox*, *Chamaecytisus austriacus*, *Elytrigia intermedia*, *Galium octonarium*, *Melica transsilvanica*, *Trifolium montanum*, *Vincetoxicum hirundinaria*. The phytocoenoses of the given association occur in the forest steppe zone, on arid hills with different exposure [15, 16].

The association *Amygdalo-Caraganetum* Fitsailo 2006 has been included in the alliance *Prunion fruticosae* Tx. 1952, order *Prunetalia spinosae* Tx. 1952, cl. *RHAMNO-PRUNETEA* Rivas Goday et Borja Carbonell ex Tx. 1962. Characteristic species of the association: *Caragana frutex*, *Amygdalus nana*, *Asparagus polyphyllus*, *Galatella biflora*, *Rhamnus cathartica* and *Thalictrum minus*. The association has been described in the steppe of the Donetsk and Lugansk regions of Ukraine [15, 17].

As a result of the new research carried out on the territory of the Republic of Moldova, we have concluded that the phytocoenoses dominated by *Caragana frutex* s. str. should be grouped in coenotaxa separated from those dominated by *C. frutex* var. *mollis*. We have included the phytocoenoses of *C. frutex* (L.) K.Koch s. str., described in the Republic of Moldova, in a new association – *Teucrio chamaedri-Caraganetum fruticis*, alliance *Prunion fruticosae* Tx. 1952.

Ass. *Teucrio chamaedri-Caraganetum fruticis*

Pînzaru et Ruschuk, ass. nova, h. l., Fig. 1

Name-giving taxa: *Caragana frutex* (L.) K.Koch s. str., *Teucrium chamaedrys* L.

Nomenclatural type h. l.: Table 1, rel. 15.

Synthetic table h. l.: Table 1, 29 relevés



Figure 1. Ass. *Teucrio chamaedri-Caraganetum fruticis* ass. nova (type) – 14.V.2017, Delacău commune, Anenii Noi district

Syn: Ass. *Caragana frutex* Dihoru 1970, in Dihoru et Doniță, Fl. și Veg. pod. Babadag: 292. – *Caraganetum fruticis* Dihoru et. al. 1971: Pînzaru et Ruschuk, 2016, Sesiunea de comunicări șt. „D. Brandza”: 25[18].

Locations: Altitude 70-250 m. Relief: Northern Moldavian Plateau, Dniester Plateau, Central Moldavian Plateau, Podolian Upland, the upper part of the hills with various exposure, but predominantly on the slopes exposed to the south or west, the inclination of the slopes between 5 and 35 (45^0), of Racovăț Valley, Căinari Valley, Răut Valley, Ichel Valley, Dniester Valley and Camenca Valley. Rocks: loam, Sarmatian limestones. Soils: rendzina or sandy clay. Climate: $T = 9^0 - 10.5^0C$, $P = 500 - 700$ mm.

Characteristic species: *Caragana frutex* s. str., *Teucrium chamaedrys*, *Marrubium peregrinum*.

Constant species (III): *Elymus repens*, *Euphorbia stepposa*, *Festuca valesiaca*, *Salvia nemorosa*, *Salvia nutans*, *Teucrium capitatum*.

Rare species: very rarely, in a single relevé, there were few specimens of *Bellevalia speciosa* (= *B. sarmatica*) [Vulnerable (VU)], included in the Red Book of R. Moldova, *Ephedra distachya* [Vulnerable (VU)], included in the Red Book of R. Moldova, *Iris pontica* [Endangered (EN)], included in the Red Book of R. Moldova; Near threatened

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(NT) species: *Asparagus verticillatus*, *Astragalus vesicarius*, *Helichrysum arenarium*, *Limonium gmelinii* [= *L. hypanicum*], *Polygala sibirica*, *Stipa lessingiana*, *S. pennata*, *S. pulcherrima*.

Phytosociological composition. In 29 relevés, 202 species of vascular plants were identified: 21 species were characteristic of the class *CRATAEGO-PRUNETEA*, 10 – cl. *TRIFOLIO-GERANIETEA*, 132 – cl. *FESTUCO-BROMETEA*, 15 – cl. *PAPAVERETEA RHOEADIS* and 24 – cl. *ARTEMISIETEA VULGARIS*. The number of species in a relevé varied from 9 to 50.

Structure: in the vertical structure of phytocoenoses, usually only the shrub layer is relevant, with a height of 60-70 cm, 80-90 cm, formed by *Caragana frutex*, abundance + dominance (3) 4-5, with an insignificant participation of tall herbaceous species: *Marubium peregrinum*, *Agropyrum cristatum*, *Elymus repens*, *Euphorbia stepposa*, *Salvia nemorosa*, *S. nutans*, *Stipa capillata* etc. The herbaceous layer is not compact, it is developed only in some phytocoenoses and consists of *Teucrium chamaedrys* accompanied by *Festuca valesiaca*, *Vinca minor*, *Artemisia austriaca*, *Potentilla arenaria* and *Fragaria vesca*.

The range of life forms contains: hemicryptophytes (H) = 52%, therophytes (Th) = 17.8%, geophytes (G) and biennial plants (TH) by = 8.7%, nanophanerophytes (Phn) = 7.4%, chamephytes (Ch) = 5.4%.

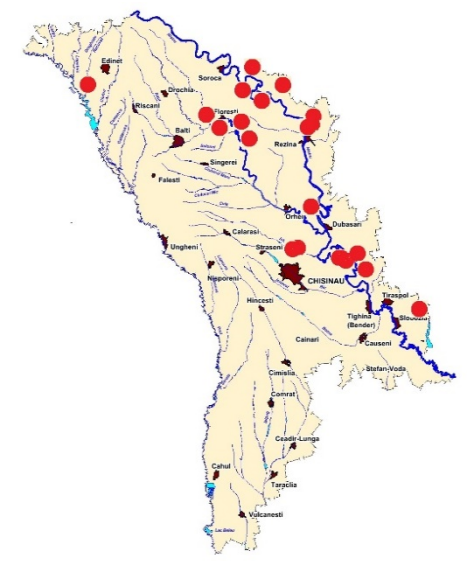


Figure 2. Locations of the ass. *Teucrio chamaedri-Caraganelum fruticis* in the Republic of Moldova.

The following geoelements predominate: Eurasian (Eua) = 43.4 %, Pontic-Mediterranean (P-M) = 12.5 %, European (Eur) = 11.4 %, Pontic (Pont) = 9.9 %, Pontic-Pannonian-Balkan (P-P-B) = 4.1 %, Pontic-Balkan (P-B) = 3.6 %, the other geoelements are few in number, about 1-5 species.

Range (Figure 2). Thickets of *Caragana frutex* s. str. on calcareous slopes were detected in the districts Edineț (Brînzei), Florești (Izvoare, Mărculești, Napadova, Zăluceni), Șoldănești (Rogojenii Vechi), Telenești (Ordășei), Chișinău municipality (Cricova, Făurești), Dubăsari (Marcăuți), Anenii Noi (Delacău, Șerpeni), Camenca (Hristovaia, Hrușca), Rîbnița (Hîrjău, Molochișul Mare, Sărăței), Grigoriopol (Butor, Grigoriopol), Slobozia (Andriașevca Nouă).

Note. A relevé from the vicinity of Demshin village, Kamianets-Podilskyi raion, Khmelnytskyi oblast, Ukraine (in "Podilski Tovtry" National Nature Park) was described by P. Pînzaru (14.VII.1997), it covered an area of 100 m² and included *Caragana frutex* s. str. and *Teucrium chamaedrys*, on the slope of Dniester valley, SE exposure, 20° inclination. General cover – 100%. Floristic composition:

Caragana frutex (abundance + dominance 4), *Teucrium chamaedrys* (1), *Asperula cynanchica* (+), *Bothriochloa ischaemum* (+), *Centaurea scabiosa* (r), *Cleistogenes bulgarica* (+), *Ephedra distachya* (+), *Erysimum canescens* (r), *Helichrysum arenarium* (r), *Hieracium virosum* (r), *Inula ensifolia* (r), *Jurinea ledebourii* (r), *Lappula marginata* (r), *Linaria genistifolia* (r), *Nonea erecta* (r), *Phlomis tuberosa* (r), *Salvia nutans* (+), *Seseli hippomarathrum* (+), *Silene otites* (r), *Stachys recta* (+), *Stipa capillata* (1), *Thalictrum minus* var. *minus* (+), *Viola hirta* (+). This relevé corresponds to the association *Teucrio chamaedri-Caraganetum fruticis* ass. nova.

Territorial protection. The phytocoenoses of the association are protected on the territory of the forest reserves: "Dubăsari" Delacău commune, Anenii Noi district, "Voinova-1" (Șerpeni commune, Anenii Noi district), "Vadul" (Hrușca commune, Camenca district), in the sector with steppe vegetation near Andriașevca Nouă village, Slobozia district, on the territory of the Geological and Paleontological Nature Monument "Brînzei Reefs" (Brînzei commune, Edineț district).

Table 1. *Ass. Teucrio chamaedri-Caraganetum fruticis* ass. nov.

Life form	Geoelements	Relevé no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	*15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	K	
		Aspect	E	E	W	E	W	NW	E	W	W	S	S	SW	W	W	E	E	S	E	S	S	S	S	S	W	N	N	W	-	NW		
		slope (°)	10	10	45	20	10	5	20	15	7	5	30	7	35	5	10	25	5	15	15	5	25	10	10	5	15	30	15	-	15		
		Shrub cover (%)	95	80	80	75	85	90	70	80	80	75	80	80	45	45	80	75	80	80	80	90	80	90	80	95	65	95	65	95	80		
		Herb cover (%)	25	45	15	50	25	20	30	20	20	20	40	20	55	60	30	25	30	35	40	20	25	15	35	10	40	45	40	30	45		
		Number of species	11	39	15	30	31	30	23	19	26	19	50	43	53	33	41	28	27	42	17	11	24	27	16	17	9	11	19	11	15		
		Caract. ass.																															
Phn	Eua	<i>Caragana frutex s. str.</i>	5	4	4	4	5	5	4	4	4	4	4	4	3	3	4	4	4	4	4	5	4	5	4	5	4	5	4	5	4	V	
Ch	Sm	<i>Teucrium chamaedrys</i>	2	2	+	2	1	-	+	1	+	1	+	+	3	2	2	1	2	2	1	1	2	1	2	-	2	2	1	2	2	V	
H	P-P-B	<i>Marrubium peregrinum</i>	1	r	+	1	+	1	1	1	+	+	+	+	+	1	1	1	+	1	1	-	+	+	-	+	+	1	+	-	-	V	
		<i>Prunion fruticosae</i>																															
		<i>Chamaecytisus</i>																															
Phn	P-P-B	<i>austriacus</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	
Phn	P-M	<i>Rosa gallica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	I	
		<i>Thalictrum minus</i>																															
H	Eua	<i>var. minus</i>	-	1	+	-	-	-	-	+	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	+	-	-	-	I	
H	Pont	<i>Vinca herbacea</i>	-	-	+	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-	-	-	1	-	-	-	1	-	-	-	I	
		<i>Berberidion</i>																															
G	P-B	<i>Asparagus verticillatus</i>	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	
Phn	Sm	<i>Cerasus mahaleb</i>	-	-	-	r	-	-	-	-	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	
Phn	P-M	<i>Cotinus coggygria</i>	-	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	I	
Phn	Eur	<i>Rosa rubiginosa</i>	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	

4. CONCLUSIONS

We consider it appropriate to accept the taxon *Caragana frutex* (L.) DC. var. *mollis* (M.Bieb.) DC. and the phytocoenoses dominated by this species to be included in coenotaxa apart from those formed by *C. frutex* (L.) K.Koch s. str.

The association *Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk ass. nova includes Western-Pontic-Sarmatian, thermophilic, xeromesophilic phytocoenoses, formed on carbonate-rich rendzina soils or on sandy clays near xerothermophilic forests in the forest steppe zone.

Overall, in the floristic composition of the studied phytocoenoses, the species characteristic of the steppe vegetation predominate (cl. FESTUCO-BROMETEA), but their presence is usually insignificant and rare (constancy I, rarely II).

The association *Teucrio chamaedri-Caraganetum fruticis* Pînzaru et Ruschuk ass. nova has been included in the alliance *Prunion fruticosae* Tx. 1952, order *Prunetalia spinosae* Tx. 1952, class CRATAEGO-PRUNETEA Tx. 1962 [19].

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