Russian Journal of Earth Sciences, Vol. 22, ES01SI06
https://doi.org/10.2205/2022ES01SI06

Russian Journal of Earth Sciences

Special Issue: "Fundamental and Applied Aspects of Geology, Geophysics and Geoecology"

A new association of *Trachomitetum sarmatiensea* of *Phragmiti-Magnocaricetea* Klika in Klika et Novak 1941 class on the territory of Krasnodar Krai

Yu. A. Postarnak*,[1] and S. A. Litvinskaya†[1]

[1] *Kuban State University, Institute of Geography, Geology, Tourism and Service, Krasnodar, Krasnodar Krai, Russian Federation*

Received 1 July 2021; accepted 10 August 2022; published 20 October 2022.

Based on the data of the geobotanical survey of near-water herbaceous and shrub vegetation of the main water bodies of the Krasnodar Krai (floodplain and delta of the Kuban River, the Black Sea, and the Azov Sea), a new association of ***Trachomitetum sarmatiensea*** ass. nova hoc loco and two subassociations of ***Trachomitetum sarmatiensea calystegetosum sepium*** subass. nova, ***Trachomitetum sarmatiense cynanchumetosum acutum*** subass. nova as part of the **Phragmiti-Magnocancetea** class were identified. The article presents tables of relevés of phytocenoses, phytocenotic characteristics of the communities of the new association, quantitative indicators of the abundance and density of the species *Trachomitum sarmatiense* that are rare for the Western Caucasus and the Black Sea coast.

Keywords: *syntaxonomy, coastal vegetation, rare plant species, Phragmiti-Magnocaricetea, Phragmitetalia communis, Phragmition communis, Trachomitum sarmatiense* Woodson

Citation: Postarnak, Yu. A., and S. A. Litvinskaya (2022), A new association of Trachomitetum sarmatiensea of Phragmiti-Magnocaricetea Klika in Klika et Novak 1941 class on the territory of Krasnodar Krai, *Russian Journal of Earth Sciences*, Vol. 22, ES01SI06, doi: 10.2205/2022ES01SI06.

Introduction

One of the basic modern scientific tasks of Russia is the development of effective measures for the conservation and rational use of plant resources. In this regard, it is necessary to create a classification of vegetation until 2030 [*Ermakov et al.*, 2020], one of the elements of which is the systematization and inventory of the diversity of plant communities in Russia at different hierarchical levels.

The **Phragmiti-Magnocancetea** class unites groupings of moderately saline habitats with a high degree of their moisture content. Communities of the **Phragmitetum sommipis** association are the most common in the near-water areas of the Kuban River floodplain, coastal clay slopes and pebbles of the Azov-Black Sea coast. *Phragmites australis* (Cav.) Trin. ex Steud. has a wide ecological amplitude, growing on the territory of a watered floodplain delta, on a poorly watered sand-shell littoral, dominating both desalinated and moderately saline biotopes. Communities of this class are the most important component of the ecosystems of the floodplain coastal territories of the Azov-Black Sea coast of Russia and the coastal zones of the Kuban River, which are of great fishery and recreational importance. *Trachomitum sarmatiense* Woodson is a rare Caucasian-Pontian species with a disjunctive type of habitat. It is included in the Red Book of the Krasnodar Krai with the status of 2 IS "Endangered", category Endangered EN Aac; B2ab (ii,iii, iv) [*Litvinskaya*, 2017] included in the European Red List [*Commission Regulation (EU)*, 2022]

In the national syntaxonomy, coastal-aquatic communities in the rank of associations of the ***Phragmiti-Magnocancetea*** class were identified and characterized for the Southern nonchernozem zone [*Bulokhov*, 1990; *Semenishchenkov*, 2006], the mouth region of the Dnieper [*Semenishchenkov*, 2006; *Dubyna and Dzyuba*, 2009], the lower part of the Volga River delta [*Rukhlenko and Golub*, 2013]. For the Krasnodar Krai, a number of syntaxons of this class were indicated for the coastal zone of the Azov Sea [*Postarnak and Litvinskaya*, 2015; *Grechushkina et al.*, 2011]. Plant communities with the participation of *Trachomitum sarmatiense* in the system of ecological and floristic classification

*Corresponding author: ecopost@mail.ru
†litvinsky@yandex.ru

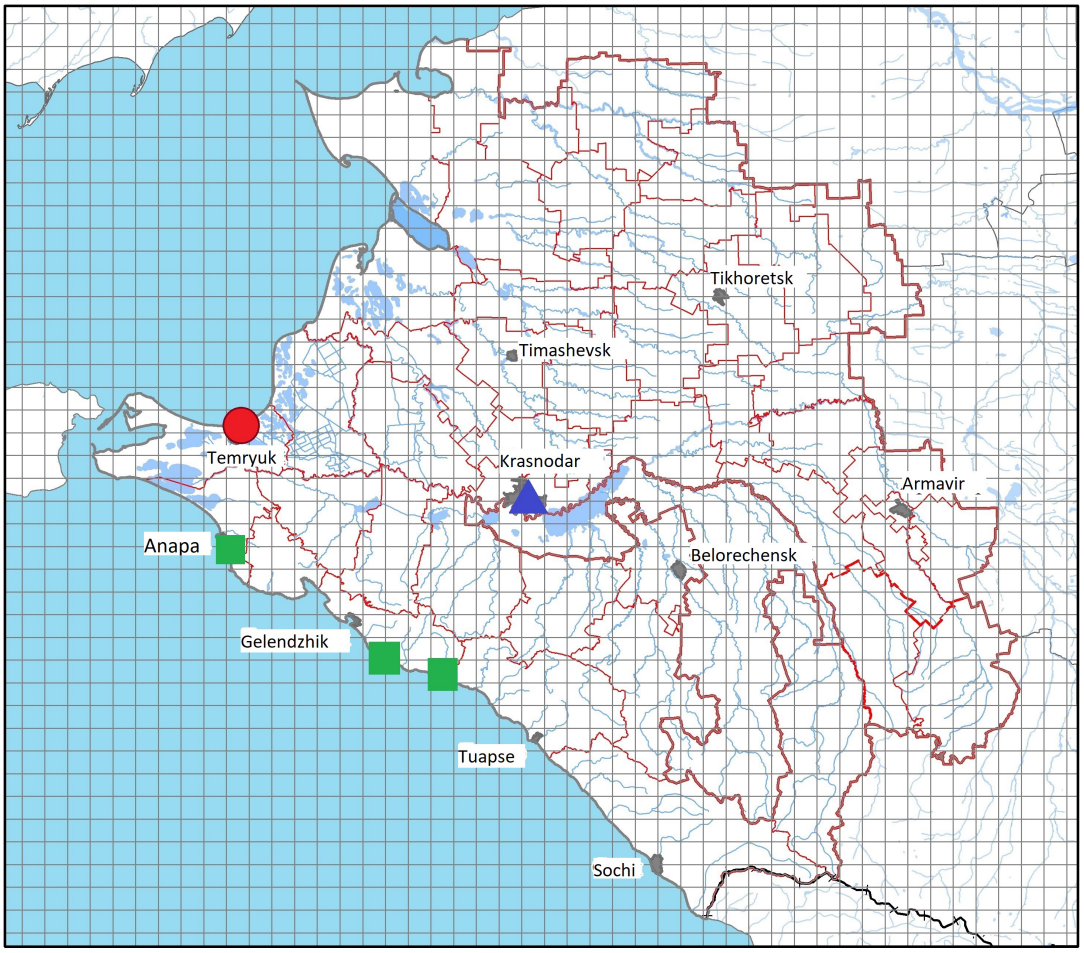

Figure 1: Research area: green square – communities ass. ***Trachomitetum sarmatiense ass. nova***; red circle – subass., blue triangle – subass. communities. ***Trachomitetum sarmatiense calystegetosum sepium subass. nova.***

were allocated for the lower part of the Volga River delta [*Rukhlenko and Golub*, 2013] in the rank of the association ***Trachomito-Calamagrostidetum epigei Rukhlenko, Golub 2013***. They are defined as part of the order **Althaeetalia officinalis** of the **Molinio-Arrhenatheretea R. Tx.**, class, which unites meadows of steppe and semi-desert zones of southeastern Europe on slightly saline and moderately saline soils of river valleys flooded for a long time, diagnostic species of which are *Althaea officinalis*, *Carex melanostachya*, *Hierochloë repens*. The study of the floral composition of the studied communities showed their specificity and difference from those previously described in other regions, on the basis of which we consider them as part of the class of reed communities **Phragmiti-Magnocancetea.**

Object of study and methods

The studies were carried out in coastal and floodplain grass-shrub communities of the Azov-Black Sea littoral of the Krasnodar Krai and the coastal zone of the Kuban River during the growing season 2017–2022. The characterized phytocenoses are described on the Verbyanaya Kosa of the Azov coast of Russia (Temryuk, Slavyansky district), in the littoral of the Black Sea coast (the vicinity of the village Bzhid in Tuapse district) and in the coastal strip of the Krasnodar Forest Park on the right bank of the Kuban River (south-eastern part of the city of Krasnodar) (Figure 1). 28 relevés were performed. 16 relevés were selected after culling to characterize the studied phytocenoses. The sampling areas are 100 m^2.

The Brown-Blank scale was used to assess the abundance of species [*Grechushkina et al.*, 2011] for describing the floral composition: r – single individuals of the species, mostly only 1 specimen; + – individuals of the species are sparse or cover only a small part of the area; 1 – individuals are numerous, but cover up to 5% or rather sparse, but with a larger amount of coverage; 2 – projective coverage of 5–25% or individuals are very numerous, but coverage is lower; 3 – projective coverage of 26–50%; 4 – projective coverage of 51–

Figure 2: Community acc. ***Trachomitetum sarmatiense ass. nova***, in the littoral coastal zone of the Black Sea in the vicinity of the Bzhid (photo by Yu. A. Postarnak, 15.07.2022).

75%; 5 –projective coverage of more than 75%. The names of the species were clarified according to the summary of S. K. Cherepanov [*Cherepanov*, 1995]. The relevés were processed using the Brown-Blank method [*Westhoff and van der Maarel*, 1973] the MEGATAB [*Hennekens and Schaminée*, 2001] and TWINSPAN software [*Hill*, 1979]. The names of syntaxons are given in accordance with the Code of Phytosociological Nomenclature [*Theurillat et al.*, 2021].

Results and discussion

The information about the belonging of taxa to the diagnostic species of the ***Phragmiti-Magnocancetea*** class is taken from the article of L. Mucina [*Mucina et al.*, 2016]. A comparison of the lower syntaxons established for the Krasnodar Krai uniting communities dominated by *Trachomitum sarmatiense*, with the literature data showed that new associations and subassociations have been studied. Table 1 presents data on the floral composition and abundance of plants of the isolated phytocenons. Their characteristics are given below.

Ass. ***Trachomitetum sarmatiense ass. nova (subass. T.s.typicum)*** hoc loco (Table 1, RN. 10–14, Figure 2) Diagnostic types: *Trachomitum sarmatiense*, *Phragmites australis.*

Nomenclature type (holotypus hoc loco) – RN. 12 (Yu P), Table 1: *Trachomitum sarmatiense* – 3, *Phragmites australis* – +. Krasnodar Krai, the village Bzhid, Tuapse district. 15.07.2022.

Monodominant communities are associated with *Trachomitum sarmatiense* Woodson (with an abundance of 15–95%, on average 55%), whose constant companion is *Phragmites australis* (with an abundance of 3–5%). The floral richness of the communities is low, i.e. 1–2 species and the total projective coverage is 20–55%. The maximum height of aboveground shoots varies from 40 to 70 cm and the average height is 50 cm. The association communities grow sporadically in the littoral narrow part of the pebble beach of the Black Sea coastal zone. The largest associations in terms of occupied area are spread from Inal Bay to Blue Bay (the Bzhid village). They grow in the littoral zone from the recreation center "Inal" to the checkpoint of Tkachev JSC "Agrocomplex". The association communities are confined to a thin strip of pebble beach of 5–10 m wide and are registered for 1088 m. The population of the dogbane is estimated as full-fledged, represented by multiple-aged groups. The density of the species is 15–28 individuals per 1 m^2. The number of rare species is estimated at 380 individuals. The plant communities of this association are registered in the vicinity of Krinitsy, .

Subass. ***Trachomitetum sarmatiensea cynanchumetosum acutum subass. nova*** (Table 1 RN. 6–9, Figure 3, Figure 4). Diagnostic types of subassociations: *Cynanchum acutum*, *Xanthium strumarium.*

Nomenclature type (holotypus hoc loco) – RN. 7 (SL), Table. 1: *Trachomitum sarmatiense* – 3, *Cynanchum acutum* – 1, *Achillea millefolium* – +, *Phragmites australis* – 2, *Xanthium strumarium* – 1, *Calystegia sepium* – 1, *Plantago maxima* – +, *Galium aparine* – 1, *Verbascum blattaria* – +, *Hordeum leporinum* – 1, *Papaver rhoeas* – +. Krasnodar Krai, Slavyansky district, 15 km northeast from Temryuk, Verbyanaya Kosa. 16.06.2017.

The communities of this subassociation have a more diverse species composition and a more powerful projective cover. The projective coverage

Table 1: Phytocenotic characteristics of the ass. ***Trachomitetum sarmatiense ass. nova.***

Relevés Number (RN)		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Author's relevés		Yu P	Yu P	Yu P	Yu P	Yu P	SL	SL	Yu P	Yu P	Yu P	Yu P	Yu P	Yu P	Yu P
Projective covering of the shrub layer (%)		70	80	80	80	30	10	60	15	30	30	20	30	20	20
Projective covering of the shrub layer (%)		80	60	60	60	70	80	80	50	20	10	10	5	0	3
Number of species in the relevés		11	11	7	12	12	15	11	7	10	3	2	2	1	2
Diagnostic types *subass.* ***Trachomitetum sarmatiensea calystegetosum sepium subass. nova***															
Calystegia sepium (L.) R. Br.	hl	1	+	+	+	.	.	1	.	.	.	.	.	.	.
Amorpha fruticosa	s2	+	+	.	+	+	.	.	.	+	.	.	.	.	.
Rubus caesius	s2	2	2	2	2	1	.	.	.	.	.	.	.	.	.
Diagnostic types *subass.* ***Trachomitetum sarmatiensea cynanchumetosum acutum subass. nova***															
Cynanchum acutum L.	hl	.	.	.	.	.	+	1	1	+	.	.	.	.	.
Xanthium strumarium	hl	.	.	.	.	.	.	1	1	+	.	.	.	.	.
Diagnostic types *ass.* ***Trachomitetum sarmatiense ass. nova (subass.T.s.typicum)***															
Trachomitum sarmatiense	s2	3	3	3	2	1	2	3	2	2	2	2	3	2	3
Diagnostic types Ord. ***Phragmitetalia communis*** Koch 1926 (Cl. Phragmiti-Magnocaricetea Klika in Klika et Novak 1941)															
Phragmites australis	hl	2	2	2	3	3	2	2	2	.	+	+	+	.	+
Other															
Periploca graeca	s2	.	+	.	.	+	.	.	.	.	+	.	.	.	.
Calamagrostis pseudophragmites	hl	.	.	.	1	.	1	.	.	.	.	.	.	.	.
Glycyrrhiza echinata	s2	1	.	.	+	1	.	.	.	.	.	.	.	.	.
Urtica dioica	hl	.	1	1	+	2	.	.	.	.	.	.	.	.	.
Humulus lupulus		1	1	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia virgata	hl	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium incanum	hl	.	+	.	+	+	.	.	.	.	.	.	.	.	.
Sambucus ebulus	hl	1	.	.	2	.	.	.	.	.	.	.	.	.	.
Phalacroloma septentrionale	hl	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Sorghum halepense	hl	.	.	+	.	1	.	.	.	.	.	.	.	.	.
Hordeum leporinum	hl	.	.	.	.	.	.	1	1	1	.	.	.	.	.
Artemisia austriaca	hl	.	.	.	.	.	+	.	.	1	.	.	.	.	.
Bromus japonicus	hl	.	.	.	.	.	+	.	.	2	.	.	.	.	.
Crambe maritima	hl	.	.	.	.	.	+	.	.	+	.	.	.	.	.

In addition, with a consistency of less than 20% were found: *Aristolochia clematitis* (1); *Elytrigia repens* (1); *Acer saccharinum* (2); *Juglans regia* (2); *Rorippa austriaca* (3); *Senecio grandidentatus* (4); *Acer negundo* (5); *Robinia pseudoacacia* (5); *Swida australis* (5); *Artemisia annua* (6); *Echium biebersteinii* (6); *Lepidium latifolium* (6); *Leymus arenarius* (6); *Medicago romanica* (6); *Melandrium album* (6); *Rumex crispus* (6); *Seseli tortuosum* (6); *Achillea millefolium* (7); *Galium aparine* (7); *Papaver rhoeas* (7); *Plantago maxima* (7); *Verbascum blattaria* (7); *Lactuca tatarica* (8); *Artemisia arenaria* (9); *Cakile euxina* (9); *Medicago romanica* (9); *Senecio vernalis* (9);

Note to Table 1.

I. Locations and dates of relevés: 1 (01.07.2022), 2–5 (07.07.2022) – Krasnodar (44.993884, 39.081001); 6–7 (16.07.2016), 8–9 (23.05.2019) – Verbyanaya Kosa, 10 km south of Temryuk (45.362859, 37.493250); 10–14 (17.07.2022) – littoral of the Black Sea coast between Inal Bay and Blue Bay, 3 km south of the village Bzhid (44.320113, 38.643861);

II. Authors' relevés: SL – S. A. Litvinskaya, Yu P – Yu. A. Postarnak

Figure 3: Community subass. ***Trachomitetum sarmatiensea calystegetosum sepium subass. nova***, Verbyanaya Kosa, 16.06.2017 (photo by S. Litvinskaya).

Figure 4: Community subass ***Trachomitetum sarmatiensea calystegetosum sepium subass. nova***, Verbyanaya Kosa, 23.05.2019 (photo by Yu. Postarnak).

Figure 5: Community subass. ***Trachomitetum sarmatiense calystegetosum sepium*** subass. nova, in the coastal zone of the Kuban River in Krasnodar (photo by Yu. A. Postarnak, 1.07.2022).

does not exceed 50% in the subassociation **subass.T.s. typicum**, while in this subassociation it reaches 80%. Subassociation communities grow in the floodplain of the Kuban River in the littoral coastal zone of the Azov Sea on a saline sand-shell substrate. They are distributed in the middle part of the Verbyanaya Kosa, near the drilling site of the "Novaya" Oil Company Priazovneft. The area of the population locus is 144 m^2. *Trachomitum sarmatiense* grows in dense patches together with *Phragmites australis*. Vitality is complete. The number and density are high. The density of shoots is 25 sp./1 m^2, 46 sp./4 m^2. Flowering is abundant. Individuals go through all stages of vegetation. The communities were subject to significant anthropogenic transformation due to the infrastructure development of the oil-producing enterprise. In 2006, a 12 km dam road was built from the recreation center "Temryuchanka" up to the mouth of the Kulikovskoye Estuary, which practically divided the population into two loci. Partially, *Trachomitum sarmatiense* inhabited the new rocky ecotope of the dam. The population was completely destroyed during the construction works in 2022. Currently, the Verbyanaya Kosa is developing as a natural and man-made system [*Krylenko and Krylenko*, 2020]. As a result, transformed communities emerged in place of the primary littoral psammophytic settled and reed communities [*Litvinskaya and Postarnak*, 2009]. This is manifested in a significant change in the ecological-cenotic structure towards a significant participation of synanthropic elements. There are species of *Hordeum leporinum* and *Bromus japonicas* with high constancy.

Subass. ***Trachomitetum sarmatiensea calystegetosum sepium subass. nova***. (Table 1, RN. 1–5, Figure 5). Diagnostic types of subassociations: *Calystegia sepium*, *Rubus caesius*.

Nomenclature type (holotypus hoc loco) – RN. 1 (SL), Table 1: *Trachomitum sarmatiense* – 3, *Phragmites australis* – 2, *Rubus caesius* – 2, *Calystegia sepium* – 1, *Sambucus ebulus* – 1, *Amorpha fruticose* – +, *Glycyrrhiza echinata* – 1, *Humulus lupulus* – 1, *Aristolochia clematitis* – 1, *Elytrigia repens* – 2, *Euphorbia virgata* – +. Krasnodar Krai, south-eastern part of Krasnodar 01.07.2022.

Subassociation communities are dominated by *Trachomitum sarmatiense* Woodson (with an abundance of 55–85%, on average 65%). The invariable companions of the communities are *Phragmites australis* (with an abundance of 15–50%), dwarf elder (5–15%) and licorice (with an abundance of 10–20%). The maximum height of aboveground shoots varies from 150 to 210 cm and the average height is 80 cm. The herbage of the community is dense with uniform laying; the total projective coverage is 90–100%. The vertical structure is simple, single-layered. Here only shrub layer (*Trachomitum sarmatiense*, *Amorpha fruticosa*, *Glycyrrhiza echinata*) and upper grass layer (*Phragmites australis*, *Urtica dioica*, *Elytrigia repens*) are clearly represented. Non-layered shrubs (*Periploca graeca*) and herbaceous (*Calystegia sepium*, *Humulus lupulus*) lianas are abundant. They are scattered on the territory of the UPT "Krasnodar Forest Park", the monument of natural science of regional significance (Krasnodar) occupying a narrow 40-meter riverine part of the Kuban river on stream-laid sod layered primitive soils. The synanthropic elements (*Urtica dioica*, *Cirsium incanum*) and invasive North American species (*Amorpha fruticosa*, *Acer saccharinum*, *Acer negundo*, *Robinia pseudoacacia*, *Erigeron annuus*, *Solidago sanadensis*) are abundant in the communities of the association.

Currently, they are a common component of urban flora changing significantly the appearance of floodplain ecosystems and form fundamen-

tally new communities. However, they do not have a negative impact on the *Trachomitum sarmatiense* cenopopulation. On the contrary, the high vital condition of clasping-leaved dogbane is noted. Middle-aged individuals of *Trachomitum sarmatiense* are characterized by high indicators of biomass, shoot height and abundance. Thus, the density indicators of dogbane shoots vary from 280 to 489 sp./16 m^2, of which 11–23% are generative. The number of the *Trachomitum sarmatiense* coenopopulation is estimated at 8949 individuals.

1 Conclusion

Thus, the position of the characterized communities dominated by *Trachomitum sarmatiense* Woodson and *Phragmites australis* in the system of higher syntaxons is presented as follows:

Class ***Phragmiti-Magnocaricetea*** Klika in Klika et Novak 1941
Order ***Phragmitetalia communis*** Koch 1926
All. ***Phragmition communis*** Koch 1926
Ass. ***Trachomitetum sarmatiense*** ass. nova (subacc. T.s.typicum)
subass. ***Trachomitetum sarmatiense calystegetosum sepium*** subass. nova
subass. ***Trachomitetum sarmatiensea cynanchumetosum acutum*** subass. nova.

The primary communities should be considered monodominant communities of *Trachomitum sarmatiense* with insignificant participation of reeds. Floral saturation of the association occurs due to the introduction of synanthropic species during the transformation of vegetation cover. The formation of communities with the active participation of the weed element does not depress the edificator.

Acknowledgement. The work was supported by the RFBR grant 19-45-230019 "Phytocenotic structure and floristic diversity of the degrading littoral florocenocomplex of the Azov-Black Sea coastal zone".

References

Bulokhov, A. D., Syntaxonomy of herbaceous vegetation of the southern Non-Chernozem region. 1. Class Phragmiti-Magnocaricetea Klika in Klika et Novak 1941, *Ed. Journal. Biol. Sciences.*, (4429-B90), 42, 1990.

Cherepanov, S. K., Vascular plants of Russia and adjacent states, *St. Petersburg*, p. 992, 1995.

Commission Regulation (EU), 2021/57 REACH Lead in gunshot in or around wetlands – National legislations – Bulgaria, https://ec.europa.eu/docsroom/documents/45858, 2022.

Dubyna, D. V., and T. P. Dzyuba, Syntaxonomic diversity of vegetation of the mouth area of the Dnieper. III. Class Phragmito-Magnocaricetea Klika in Klika et Novak 1941. Order Magnocaricetalia Pignatti 1953 and Nasturtio-Glycerietalia Pignatti 1953, *Rastitelnost Rossii*, (14), 15–36, 2009.

Ermakov, N. B., V. Plugatar Yu., P. V. Krestov, and N. V. Matveeva, Information about the project "Creation of vegetation classification of Russia", *Vegetation of Eastern Europe and Northern Asia. Materials of the II International Scientific Conference (Bryansk, October 12–14, 2020)*, p. 20, bryansk: RISO BSU, 2020.

Grechushkina, N. A., A. N. Sorokin, and V. B. Golub, Plant communities dominated by Phragmites australis and Bolboschoenus glaucus on the territory of the Russian coast of the Azov Sea, *Bulletin Of "Samarskaya Luka"*, *20*(2), 105–115, 2011.

Hennekens, S. M., and J. H. Schaminée, TURBOVEG, a comprehensive data base management system for vegetation data, *Journal of Vegetation Science*, *12*(4), 589–591, doi:10.2307/3237010, 2001.

Hill, M., *TWINSPAN—A Fortran Program for Arranging Multivariate Data in an Ordered Two-way Table by Classification of The Individuals and Attributes*, 15 pp., 1979.

Krylenko, V. V., and M. V. Krylenko, Monitoring of the Verbyanaya Kosa coast by satellite data, *Bulletin Of Mguki*, *25*(3), 169–180, 2020.

Litvinskaya, S. A., Clasping-leaved dogbane, in *Red Book of Krasnodar Krai. Plants and fungi*, edited by S. A. Litvinskaya, 3rd ed., pp. 325–326, Adm. – Krasnodar krai, Krasnodar, 2017.

Litvinskaya, S. A., and Y. A. Postarnak, Transformation of the plant component of the littoral landscapes of the Verbyanaya Kosa, *Environmental protection in the oil and gas complex*, (11), 49–54, (In Russian), 2009.

Mucina, L., H. Bültmann, K. Dierßen, J.-P. Theurillat, T. Raus, A. Čarni, K. Šumberová, W. Willner, J. Dengler, R. G. García, M. Chytrý, M. Hájek, R. Di Pietro, D. Iakushenko, J. Pallas, F. J. Daniëls, E. Bergmeier, A. Santos Guerra, N. Ermakov, M. Valachovič, J. H. Schaminée, T. Lysenko, Y. P. Didukh, S. Pignatti, J. S. Rodwell, J. Capelo, H. E. Weber, A. Solomeshch, P. Dimopoulos, C. Aguiar, S. M. Hennekens, and L. Tichý, Vegetation of europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities, *Applied Vegetation Science*, *19*(S1), 3–264, doi:https://doi.org/10.1111/avsc.12257, 2016.

Postarnak, Y. A., and S. A. Litvinskaya, Water and coastal-aquatic vegetation of the Primorskayay Kosa of the Eastern Azov Sea (Verbyanaya Kosa), *Modern science: actual problems and ways to solve them*, *3*(16), 85–90, 2015.

Rukhlenko, I. A., and V. B. Golub, Supplement to the syntaxonomy of plant communities of the Volga River delta, *Bulletin of the V.N. Tatishchev Volga State University*, *1*(4), 34–43, 2013.

Semenishchenkov, Y. A., Syntaxonomy of natural grass vegetation of Sudost-Desnyansky interfluve (Bryansk region). Class Phragmiti-Magnocaricetea, *Uspekhi sovremennogo estestvoznaniya*, *7*(9), 103–105, acessed: 20.07.2022, 2006.

Theurillat, J.-P., W. Willner, F. Fernández-González, H. Bültmann, A. Čarni, D. Gigante, L. Mucina, and H. Weber, International Code of Phytosociological Nomenclature, *Applied Vegetation Science*, *24*(1), e12491, doi:https://doi.org/10.1111/avsc.12491, 2021.

Westhoff, V., and E. van der Maarel, The braun-blanquet approach, in *Ordination and Classification of Communities*, pp. 617–726, Springer Netherlands, doi:10.1007/978-94-010-2701-4_20, 1973.