



DOI 10.23859/estr-220523

EDN DORMVM

UDC 581.142.32(282.2)

*Short communication*

## **Morphostructural malformations of graceful cattail *Typha laxmannii* Lepech. (Typhaceae) in the Don River delta**

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**Abstract.** The article describes first findings of three multi-tiered anomalous pistillate morpho-structures (proliferation, “branching”, and fasciation) of *Typha laxmannii* inhabiting the coasts of the Donskoy Island, the Don River delta. It is suggested that these malformations are associated with an increasing technogenic load on the region as well as the transformation of the landscape in the historical and geological past, which led to the isolation of archaic and migratory *Typha* species in the delta branches.

**Key words:** proliferation, branching, fasciation, multi-tiered anomalous structures, Rostov Oblast, Donskoy Island

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**Funding:** The work was carried out within the framework of the State Tasks nos. AAAA-A18-118012690095-4 and 2022-02-17.

**To cite this article:** Krasnova, A.N., Polshina, T.N., 2023. Morphostructural malformations of graceful cattail *Typha laxmannii* Lepech. (Typhaceae) in the Don River delta. *Ecosystem Transformation* **6** (3), 3–9. <https://doi.org/10.23859/estr-220523>

Received: 23.05.2022

Accepted: 16.07.2022

Published online: 16.08.2023

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УДК 581.142.32(282.2)

### **Краткое сообщение**

## **Морфоструктурные аномалии рогоза Лаксмана *Turpha laxmannii* Lepech. (Tyrphaceae) в дельте р. Дон**

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**Аннотация.** Описаны первые находки многоярусных пестичных морфоструктур трех типов аномалий (пролификация, «ветвистость» и фасциация) *Turpha laxmannii* в прибрежьях о-ва Донского в дельте р. Дон. Высказано предположение, что причинами возникновения подобных структур служат возрастающая техногенная нагрузка на регион, а также трансформация ландшафта в историко-геологическом прошлом, которая привела к изоляции архаичных и мигрирующих видов рода *Turpha* в рукавах дельты.

**Ключевые слова:** пролификация, ветвистость, фасциация, многоярусные аномальные структуры, Ростовская область, остров Донской

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**Финансирование:** Работа выполнена в рамках госзадания, темы № АААА-А18-118012690095-4 и № 2022-02-17.

**Для цитирования:** Краснова, А.Н., Польшина, Т.Н., 2023. Морфоструктурные аномалии рогоза Лаксмана *Turpha laxmannii* Lepech. (Tyrphaceae) в дельте р. Дон. *Трансформация экосистем* **6** (3), 3–9. <https://doi.org/10.23859/estr-220523>

Поступила в редакцию: 23.05.2022

Принята к печати: 16.07.2022

Опубликована онлайн: 16.08.2023

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## Introduction

The Don River is one of the largest rivers in European Russia. The river delta of total area of 55 thousand hectares locates in the lower reaches, downstream of the city of Rostov-on-Don. It is a swampy lowland, crossed by riverbed dams and ramparts of ancient and modern eriks (shallow channels) and numerous branches, or “girlas”, which number reaches forty. Interzonal hydromorphic soils predominate in the delta: the most common are meadow, meadow-bog, marsh, and alluvial-meadow soils. Coastal-aquatic vegetation on numerous reservoirs, streams and ponds (about 150 in total) is represented by single-species communities of pondweeds: *Potametum compressi* Tomaszcz, *Potametum crispis* Soo, *Potametum graminei* Lang, *Potametum lucentis* Huek, *Potametum natantis* Oberdorfer, and *Potametum pectinati* Carstensen ex Hilbig. In the girlas, there are communities with the participation of *Ceratophylletum demersi* (Soó) Eggier, *Myriophylletum spicati* Soo, and *Sparganietum erecti* Roll. Wetlands are widely represented in the river delta; they are of the grass type with a predominance of dense thickets of reeds *Phragmites australis* (Cav.) Trin. ex Steud and cattails *Typha latifolia* L., *T. angustifolia* L., and *T. laxmannii* Lepech. (Demina, 1996). Wetlands of the lower reaches of the Don River and its delta have been recommended for the list of wetlands protected by the Ramsar Convention (Demina, 1996).

The modern Don River delta is a natural-technogenic landscape (Dzerzhinskaya, 2005). As a result of changes in the primary landscape of the river delta in the Cenozoic, the frequency of occurrence of various neoplasms (anomalies) increased among archaic species and newcomers inhabiting its branches (Balashov and Parakhonskaya, 1977; Dzerzhinskaya, 2005; Kuzmichev, 1992; Takhtadjan, 2007; Timofeev-Resovsky, et al., 1977; Zavadsky, 1968). *Typha laxmannii* is one of these species; it actively populated the coasts of the southern steppe reservoirs and streams of Eurasia as a result of the Oligocene drying of the Tethys seas (Kuzmichev, 1992). However, the unfavorable historical and geological conditions in late Pleistocene and early Holocene (Badyukova, 2011) led to isolation of the *T. laxmannii* populations in the Don River delta.

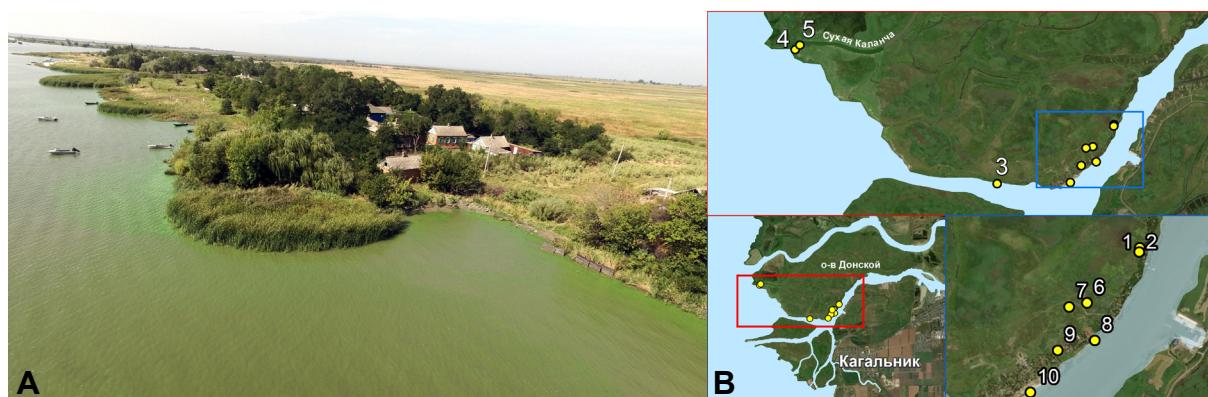
The study aims to describe anomalous pistillate morphostructures of *Typha laxmannii* from the Don River delta.

## Materials and methods

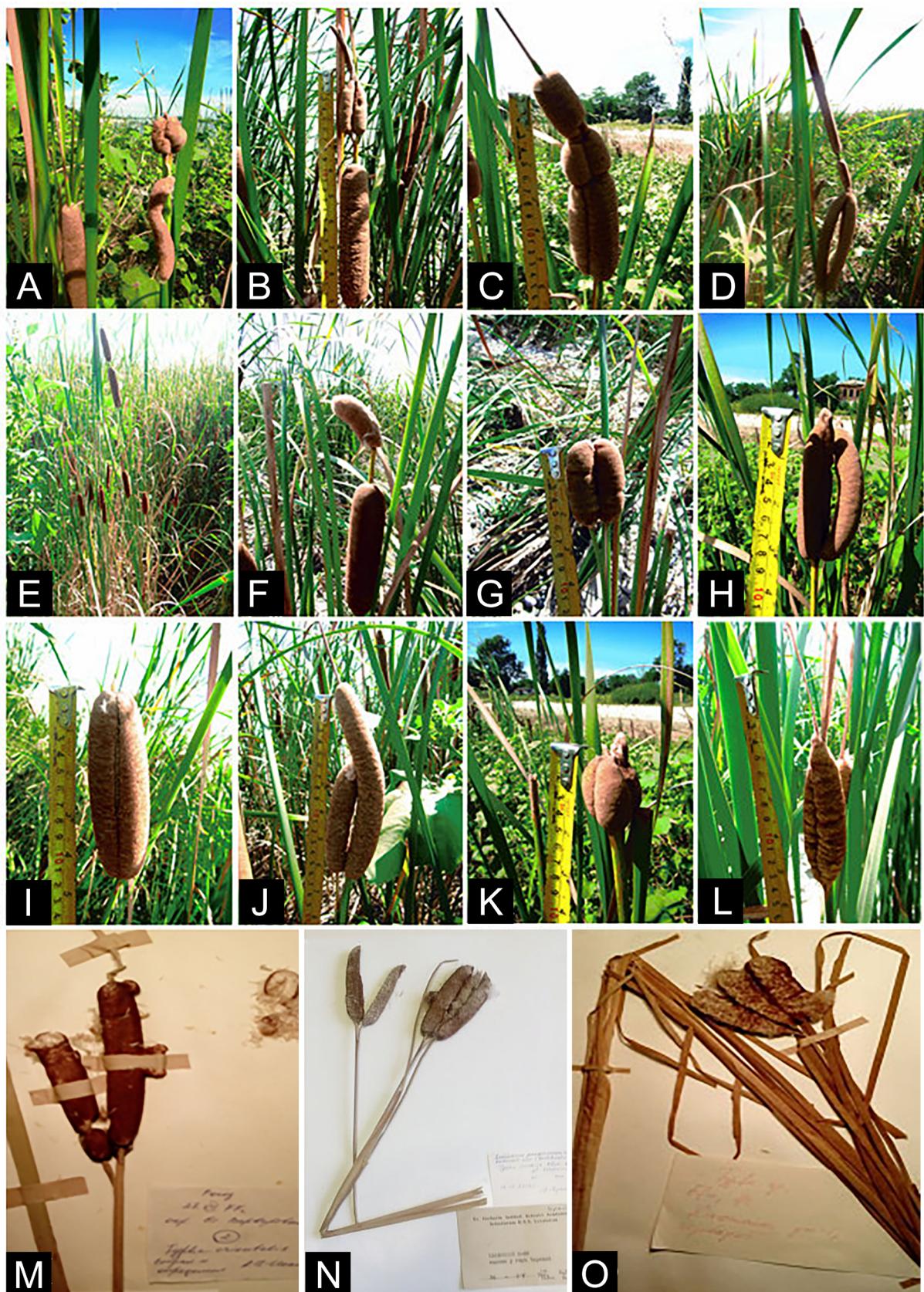
Herbarium collections obtained by T.N. Polshina at the coasts of Donskoy Island (Don River delta, Rostov Oblast, Russia) served as the material. The material was collected in August 2020 according to the Shennikov's method (Shennikov, 1950). In total, ten sites were identified and analyzed in the study area (Fig. 1). Photos of anomalous plants were taken with a Canon Power Shot D30 camera.

## Results and discussion

When examining populations of *T. laxmannii* of the Donskoy Island at the sites nos. 8–10, previously unknown multi-tiered pistillate anomalous morphostructures of several types were registered: prolifera-



**Fig. 1.** Map of the study area: **A** – general view of the study area; **B** – localities of thickets of anomalous plants *Typha laxmannii*.



**Fig. 2.** Single and multi-tiered anomalous pistillate morphostructures of *T. laxmannii*: A–F – single and multi-tiered morphostructures in proliferation and fasciation types; G–O – single morphostructures in the branching type.

tion (doubling of organs), “branching” (splitting of the axis of the inflorescence), and fasciation (fusion of the stem and inflorescence) (Fedorov, 1958).

Previously, we considered single (simple) morphostructures of proliferation and branching anomalies (Krasnova, 2016; Krasnova and Polshina, 2020). Multi-tiered (complex) pistillate morphostructures were found for the first time in the Don River delta (Fig. 2A–L). It should be noted that “double” and “triple” pistillate morphostructures were previously noted in the herbarium collections: LE (Komarov Botanical Institute, Russian Academy of Sciences, St. Petersburg, Russia) (Fig. 2M) and KW (Kholodny Institute of Botany, National Academy of Sciences, Kiev, Ukraine) (Fig. 2N, O).

Both an increase of technogenic load (Kaidanova, 2012; Koronkevich et al., 2020) and a transformation of the river delta landscape due to regressions and transgressions of the Manych Bay (Badyukova, 2011) may serve as possible explanations for the emergence of multi-tiered pistillate morphostructures in *T. laxmannii* in the Don River delta. In addition, the described anomalous pistillate multi-tiered morphostructures in *T. laxmannii* is closely related to the processes taking place in the isolated sub-populations of this species, where the processes of hybridization and divergence may occur simultaneously (Timofeev-Resovsky et al., 1977; Zavadsky, 1968). The mechanisms emerging the appearance of such morphostructures are closely related to the increase in the technogenic factor that reduces the species abundance (Sozdateli..., 2012).

## Conclusions

Multi-tiered anomalous pistillate morphostructures have been found in the populations of *T. laxmannii* at the coasts of the Donskoy Island (Don River delta) in addition to the known types of malformations (proliferation, fasciation, and “branching”). We propose that the long-term technogenic pollution of the Don River delta may be presumably the cause of this phenomenon. First of all, these malformations testify to active morphogenesis processes (Fedorov, 1951, 1958) in *T. laxmannii* populations.

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