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Research article

Genus *Xanthium* (Asteraceae) in flora of the Mordovia State Nature Reserve (Russia)

Anatoliy A. Khapugin[1, 2], Irina G. Esina[3], Sergey R. Mayorov[4]

(1) [Corresponding author] Joint Directorate of the Mordovia State Nature Reserve and National Park "Smolny", Krasnaya Street 30, 430005, Saransk, Russia, hapugin88@yandex.ru; https://orcid.org/0000-0002-6059-2779
(2) Tyumen State University, Volodarskogo Street 6, 625003, Tyumen, Russia
(3) Joint Directorate of the Mordovia State Nature Reserve and National Park "Smolny", Krasnaya Street 30, 430005, Saransk, Russia; https://orcid.org/0000-0003-0410-2779
(4) Lomonosov Moscow State University, Leninskie Gory 1, 119234, Moscow, Russia, saxifraga@mail.ru; https://orcid.org/0000-0002-5493-2386

Abstract: The history of *Xanthium* genus research in a protected area in European Russia (Mordovia State Nature Reserve) has been reviewed based on available data (herbarium collections, publications, archive of Chronicles of Nature). We found that *X. strumarium* was the only species, which has been mentioned in the Mordovia State Nature Reserve since 1939. However, the overview of available data allowed us to conclude that all *Xanthium* plants found in this protected area to date belong to *Xanthium orientale,* an invasive alien species.

Keywords: alien species, biodiversity, herbarium, misidentification, protected area

Introduction

Over the last several centuries, many species have been moved from one continent to others (Essl et al., 2020; van Kleunen et al., 2018). Besides the impact to the widely distributed man-influenced ecosystems, the majority of protected areas suffer from alien species impact through the alteration of habitats and the environment, various undesired effects on native species abundance and diversity (Pyšek et al., 2020; Foxcroft et al., 2023; Lysenkov & Galkina, 2023). Inventory of alien plant species and accurate distribution data are necessary to develop the measures for preventing and counteracting alien plant invasion on protected areas (Oswalt et al., 2021).

The genus *Xanthium* L. belongs to subtribe Ambrosiinae (Heliantheae, Asteraceae). It is represented by annual herbaceous plants, which prefer moist sandy pits, river banks, costal dunes, currently expanding to open man-made habitats, like cultivated fields, railway embankments and ruderal sites (Löve & Dansereau, 1959). In the centre of European Russia, two species of the genus are known, namely *Xanthium orientale* L. (currently often mentioned as *X. albinum* (Widder) Scholz & Sukopp) and *X. strumarium* L. (sometimes mentioned as *Xanthium sibiricum* Patrin ex Widder).

Until late XX century, the most authors did not differentiate these *Xanthium* species. Some authors consider *Xanthium orientale* and *X. strumarium* as synonyms (e.g. Stace, 2019; Magee & Ahles, 2007), while other researchers do not agree with that (e.g. Vinogradova et al., 2010; Tomasello, 2018). Some authors (e.g. Tikhomirov, 1987; Reshetnikova et al., 2010) believe that in the centre of European Russia, *X. strumarium* was replaced by *X. orientale,* a more competitive alien species. This is consistent with data of other studies indicating a decrease in number of *X. strumarium* occurrences, with increase in number of *X. orientale* occurrences, e.g. in Kyrgyzstan (Sennikov & Lazkov, 2021), Lithuania (Gudžinskas, 1997), the Czech Republic (Kaplan et al., 2021), Italy (Müller-Kiefer & Tomasello, 2022), centre of European Russia (Vinogradova et al., 2010). This

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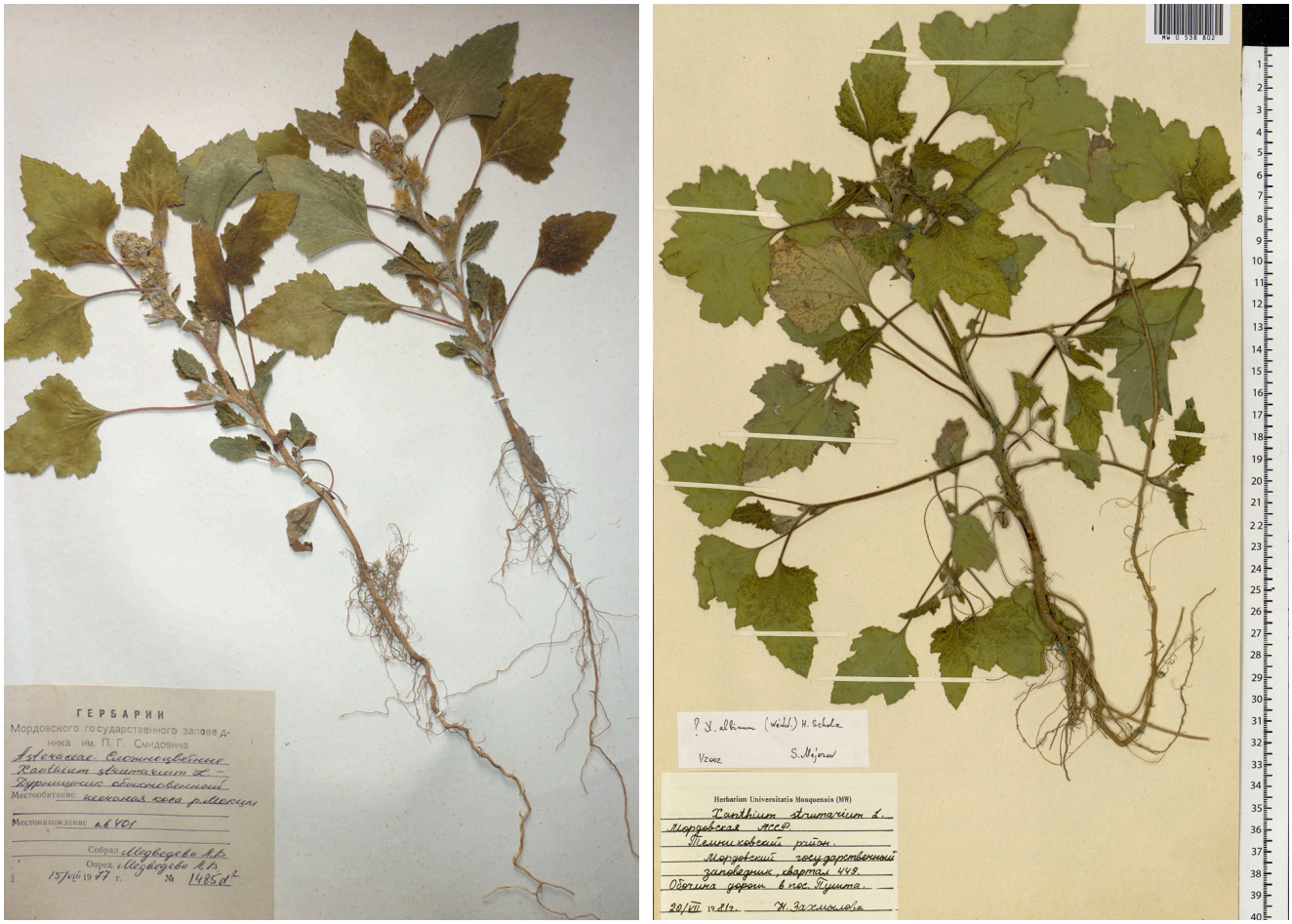

Fig. 1. Specimens of *Xanthium* sp. collected in the MSNR (European Russia) and stored in HMNR (left; source) and MW (right; source) herbarium collections.

allows us to suggest that, in Russian herbarium collections, some of *Xanthium* specimens, identified as *X. strumarium,* may actually be *X. orientale*.

This paper was aimed to revise the available information on the genus *Xanthium* in the Mordovia State Nature Reserve (hereinafter – MSNR). For this purpose, we studied the available relevant literature, non-published data, and *Xanthium* spp. specimens, collected in the MSNR.

Material and methods

To investigate the long-term history of the *Xanthium* research in the MSNR, we originally checked the archive of the Chronicles of Nature of the MSNR over 1935–2023. Additionally, we studied the set of the publications on the flora of the MSNR, including three floristic check-lists published until now, namely Kuznetsov (1960), Borodina et al. (1987), and Vargot et al. (2016).

Herbarium of Mordovia State Nature Reserve (HMNR) and Herbarium of Mordovia State University (GMU) have been checked manually by the authors. The digitised specimens in Herbarium of Lomonosov Moscow State University (MW) have been studied using a web-resource the Moscow Digital Herbarium (Seregin, 2023) (Fig. 1). Third author checked all herbarium specimens of *Xanthium* for the identification correctness.

Results and discussion

In the first check-list of the flora of the MSNR, *X. strumarium* has been indicated (Kuznetsov, 1960), but we are not aware of the herbarium specimens confirming this record. At the same time, we found

the first mentioning of *X. strumarium* in this protected area in the Chronicle of Nature of 1939, which was recently published (Kuznetsov, 2014, p. 189). In the second edition of the flora's check-list of the MSNR (Borodina et al., 1987), the genus *Xanthium* was represented by the taxon named as "*Xanthium rupicola* L.". It was obviously a mistake because such a taxon has never been described (although we can assume that *X. ripicola* Holub was meant). With this name, this *Xanthium* taxon has been mentioned for the flora of the MSNR until 2016. In the third edition of the flora's check-list (Vargot et al., 2016), this *Xanthium* taxon was spelled as "*Xanthium strumarium* L. [*X. rupicola* L.]", thus, by saving the previous mistake in a synonym. In the most recent publication on alien flora in the MSNR (Esina et al., 2022), this mistake has been corrected by excluding "*X. rupicola* L." from the name of this taxon.

The checking of the herbarium collections allowed us to find five specimens originally identified as *Xanthium strumarium* L. Four of them (including three in HMNR and one in GMU) are duplicates found at the sandy spit of a river bank: [USSR, Mordovian Autonomous Soviet Socialist Republic], Mordovia State Nature Reserve, quarter 401, sandy spit of the River Moksha, 15.08.1977, L.V. Medvedeva (HMNR, GMU), with approximate co-ordinates at 54.746° N, 43.075° E. The fifth specimen was found in the MW herbarium: [USSR, Mordovian Autonomous Soviet Socialist Republic], Mordovia State Nature Reserve, quarter 449, side of the road in the Pushta settlement, 20.07.1981, N. Zakhmylova (MW), with approximate co-ordinates at 54.713° N, 43.225° E. However, the revision of all herbarium specimens has allowed us to conclude that all these herbarium specimens are *Xanthium orientale*. Since there are no additional evidences of the presence of other *Xanthium* taxa in the MSNR, we conclude that only *X. orientale* is present in the flora of the protected area.

Thus, taking into account the mentioned above information, we conclude that the wrong name has been used for *Xanthium* plants in the MSNR during 85 years, i.e. from its first mentioning in 1939 (Kuznetsov, 2014, p. 189) until today. For *Xanthium* plants known in the MSNR, we propose using the name *X. orientale*. Of course, we cannot exclude the possible findings of *X. strumarium* in the future as a casual (sensu Richardson et al., 2000; Blackburn et al., 2011) species in the protected area. In addition, we propose to double-check carefully the identification correctness of *Xanthium* specimens in national, regional and local herbarium collections.

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References

Blackburn T.M., Pyšek P., Bacher S., Carlton J.T., Duncan R.P., Jarošík V., Wilson J.R.U., Richardson D.M. 2011 A proposed unified framework for biological invasions. Trends in Ecology and Evolution 26: 333–339. https://doi.org/10.1016/j.tree.2011.03.023

Borodina N.V., Dolmatova L.V., Sanaeva L.V., Tereshkin I.S. 1987 Vascular plants of the Mordovia State Nature Reserve. VINITI, Moscow, 79 pp. (In Russian)

Esina I.G., Khapugin A.A., Ershkova E.V. 2022 Alien flora of the Mordovia State Nature Reserve, Russia. Phytodiversity of Eastern Europe 16 (1): 5–60. (In Russian) https://doi.org/10.24412/2072-8816-2022-16-1-5-60

Essl F., Lenzner B., Bacher S., Bailey S., Capinha C., Daehler C., Dullinger S., Genovesi P., Hui C., Hulme P.E., Jeschke J.M., Katsanevakis S., Kühn I., Leung B., Liebhold A., Liu C., MacIsaac H.J., Meyerson L.A., Nuñez M.A., Pauchard A., Pyšek P., Rabitsch W., Richardson D.M., Roy H.E., Ruiz G.M., Russell J.C., Sanders N.J., Sax D.F., Scalera R., Seebens H., Springborn M., Turbelin A., van Kleunen M., von Holle B., Winter M., Zenni R.D., Mattsson B.J., Roura-Pascual N. 2020 Drivers of future alien species impacts: an

expert-based assessment. Global Change Biology 26: 4880–4893. https://doi.org/10.1111/gcb.15199

Foxcroft L.C., Moodley D., Nichols G.R., Pyšek P. 2023 Naturalized and invasive alien plants in the Kruger National Park, South Africa. Biological Invasions 25: 3049–3064. https://doi.org/10.1007/s10530-023-03098-0

Gudžinskas Z. 1997 Conspectus of alien plant species of Lithuania. 4. Asteraceae. Botanica Lithuanica 3 (4): 335–366.

Kaplan Z., Danihelka J., Dřevojan P., Řepka R., Koutecký P., Grulich V., Wild J. 2021 Distributions of vascular plants in the Czech Republic. Part 10. Preslia 93: 255–304.

Kuznetsov N.I. 1960 Flora of fungi, lichens, bryophytes and vascular plants in the Mordovia State Nature Reserve. Proceedings of the Mordovia State Nature Reserve 1: 71–128. (In Russian)

Kuznetsov N.I. 2014 Environment conditions and main features of the vegetation cover structure in the Mordovia State Nature Reserve. 1939. Proceedings of the Mordovia State Nature Reserve 12: 79–195. (In Russian)

Löve D., Dansereau P. 1959 Biosystematic studies on *Xanthium:* taxonomic appraisal and ecological status. Canadian Journal of Botany 37 (2): 173–208.

Lysenkov S.N., Galkina M.A. 2023 Genetic structure of *Solidago* × *niederederi* (Asteraceae) population in the «Aleksin Bor» Natural Monument (European Russia). Nature Conservation Research 8 (4): 1–8. https://doi.org/10.24189/ncr.2023.027

Magee D.W., Ahles H.E. 2007 Flora of the Northeast: A Manual of the Vascular Flora of New England and Adjacent New York, 2nd ed. University of Massachusetts Press, Amherst, 1264 pp.

Müller-Kiefer J., Tomasello S. 2022 Invasive or threatened? The decline of the old-world *Xanthium strumarium* (Asteraceae) in Italy based on herbarium records. Flora Mediterranea 32: 17–24. https://doi.org/10.7320/FlMedit32.017

Oswalt S., Oswalt C., Crall A., Rabaglia R., Schwartz M.K., Kerns B.K. 2021 Inventory and monitoring of invasive species. In: Poland T.M., Patel-Weynand T., Finch D.M., Miniat C.F., Hayes D.C., Lopez V.M. (eds) Invasive species in forests and rangelands of the United States. Springer, Cham, 231–242. https://doi.org/10.1007/978-3-030-45367-1_10

Pyšek P., Hulme P.E., Simberloff D., Bacher S., Blackburn T.M., Carlton J.T., Dawson W., Essl F., Foxcroft L.C., Genovesi P., Jeschke J.M., Kühn I., Liebhold A.M., Mandrak N.E., Meyerson L.A., Pauchard A., Pergl J., Roy H.E., Seebens H., van Kleunen M., Vilà M., Wingfield M.J., Richardson D.M. 2020 Scientists' warning on invasive alien species. Biological Reviews 95: 1511–1534. https://doi.org/10.1111/brv.12627

Reshetnikova N.M., Mayorov S.R., Skvortsov A.K., Krylov A.V., Voronkina N.V., Popchenko M.I., Shmytov A.A. 2010 Kaluga flora: annotated check-list of vascular plants in the Kaluga Region. KMK Scientific Press Ltd, Moscow, 760 pp. (In Russian)

Richardson D.M., Pyšek P., Rejmanek M., Barbour M.G., Panetta F.D., West C.J. 2000 Naturalization and invasion of alien plants: concepts and definitions. Diversity and Distributions 6 (2): 93–107. https://doi.org/10.1046/j.1472-4642.2000.00083.x

Sennikov A.N., Lazkov G.A. 2021 The first checklist of alien vascular plants of Kyrgyzstan, with new records and critical evaluation of earlier data. Contribution 1. Biodiversity Data Journal 9: e75590. https://doi.org/10.3897/BDJ.9.e75590

Seregin A.P. (ed.) 2023 Moscow Digital Herbarium: Electronic resource. Moscow State University, Moscow. https://plant.depo.msu.ru/

Stace C.A. 2019 New Flora of The British Isles. 4th edition. C & M Floristics, 1266 pp.

Tikhomirov V.N. (ed.) 1987 Determinant Key of Plants in the Meshchera. Part 2. Moscow State University, Moscow, 224 pp. (In Russian)

Tomasello S. 2018 How many names for a beloved genus? – Coalescent-based species delimitation in *Xanthium* L. (Ambrosiinae, Asteraceae). Molecular Phylogenetics and Evolution 127: 135–145. https://doi.org/10.1016/j.ympev.2018.05.024

van Kleunen M., Essl F., Pergl J., Brundu G., Carboni M., Dullinger S., Early R., González-Moreno P., Groom Q.J., Hulme P.E., Kueffer C., Kühn I.,

Máguas C., Maurel N., Novoa A., Parepa M., Pyšek P., Seebens H., Tanner R., Touza J., Verbrugge L., Weber E., Dawson W., Kreft H., Weigelt P., Winter M., Klonner G., Talluto M.V., Dehnen-Schmutz K. 2018 The changing role of ornamental horticulture in alien plant invasions. Biological Reviews 93: 1421–1437. https://doi.org/10.1111/brv.12402

Vargot E.V., Khapugin A.A., Chugunov G.G., Grishutkin O.G. 2016 Vascular plants of the Mordovia State Nature Reserve (an annotated species list). Commission of RAS on biodiversity conservation, IPEE RAS, Moscow, 68 pp. (In Russian)

Vinogradova Yu.K., Mayorov S.R., Khorun L.V. 2010 Black Data Book of flora of Central Russia: alien plant species in ecosystems of Central Russia. GEOS, Moscow, 512 pp. (In Russian)