

Communication

Silphium × *missouriense* (Asteraceae, Heliantheae), the nothospecies name for an already reported interspecific hybrid

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Abstract

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Several species and some interspecific hybrids of the North American genus *Silphium* (Asteraceae, Heliantheae) are now widely tested and partly used as promising new crops for various agricultural applications, such as biomass production for bioenergy and fodder; some species and (or) hybrids may also be potentially invasive. Six species and at least three hybrids of *Silphium* are cultivated at the M.M. Gryshko National Botanical Garden in Kyiv, Ukraine. Despite reliable reports of various spontaneous and (or) artificial hybrids, no hybrid names formed according to Chapter H of the *International Code of Nomenclature for algae, fungi, and plants* have been proposed in *Silphium*. The absence of convenient and informative hybrid (nothospecific) names in *Silphium* hampers communication in agricultural and botanical fields. It prevents the proper nomenclature for future cultivars of hybrid origin from further developing. In 2011, Jesse and Yatskievych reported and described morphologically a putative natural hybrid between *Silphium integrifolium* and *Silphium laciniatum* found in the State of Missouri; however, they provided only a hybrid formula, without formal naming of a nothospecies. Here we validate the nothospecies name for this hybrid, *Silphium* × *missouriense* Rakhmetov, Yatsk. & A.S. Mosyakin, nothosp. nov. (*Silphium integrifolium* × *Silphium laciniatum*) and indicate its holotype (MO-2382470) collected in the USA, Missouri, Jackson County. That name, based on a natural hybrid, will also be applicable to all artificial hybrids and cultivars resulting from crossing the same parent species.

Keywords: hybrid, new crops, nomenclature, nothospecies, *Silphium*, taxonomy, Ukraine.

INTRODUCTION

Silphium L. (Asteraceae, Heliantheae) is a genus of ca. 20–22 currently recognised species, naturally occurring in North America, from southeastern Canada to the central and eastern parts of the USA. Some species of the genus (especially *S. perfoliatum* L., less

commonly other taxa) are also known as cultivated, escaped and locally naturalised in some other parts of the world, mainly in several countries of Europe and Asia (Clevinger & Panero, 2000; Clevinger, 2006; Yatskievych, 2006; POWO, 2026, etc.). Many currently recognised species of this genus are taxonomically challenging and morphologically variable, with

infraspecific taxa described or recognised by various authors (Perry, 1937; Clevinger, 2004, 2006; Yatskievych, 2006). At least some of these morphological variants (morphotypes) may be of hybrid origin.

MATERIALS AND METHODS

Nomenclatural aspects of the present article follow the rules of botanical nomenclature as outlined in the *International Code of Nomenclature for algae, fungi, and plants* (ICN), the *Madrid Code* edition currently in force (Turland et al., 2025). Nomenclatural practice regarding actual and potential cultivars of *Silphium* follows the *International Code of Nomenclature for Cultivated Plants* (Brickell et al., 2016). Methodological aspects of the discovery and identification of the natural hybrid of *Silphium* in Missouri are described in the article by Jessee & Yatskievych (2011). Horticultural aspects and methods of research and breeding of various cultivars of crops and ornamentals (including *Silphium*) at the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine are outlined, with proper references, by Zaimenko et al. (2025) and Rakhmetov (2018).

RESULTS AND DISCUSSION

Evidence of interspecific hybridisation in *Silphium*

Interspecific hybrids in *Silphium* have been reported in several publications (Fisher, 1959, 1966; Settle, 1967; Weber, 1968; Redfearn, 1980; Yatskievych, 2006; Jessee & Yatskievych, 2011) and even experimentally tested in cultivation (Reinert et al., 2020a, 2020b; Rakhmetov et al., 2019, 2020b, 2024b). For example, because of a biosystematic study of *Silphium integrifolium* Michx., Settle & Fisher (1972) reported naturally occurring putative hybrids between *Silphium integrifolium* and *Silphium speciosum* Nutt. and between *Silphium integrifolium* and *Silphium asperrimum* Hook. and commented that all of them are morphologically similar. It has also been suggested that the taxon known as *Silphium pinnatifidum* Elliott (1824: 462) or *Silphium terebinthinaceum* Jacq. var. *pinnatifidum* (Elliott) A. Gray is of hybrid origin, resulting from the hybridisation event (or events) between *Silphium laciniatum* L. and *Silphium terebinthinaceum*.

Jessee & Yatskievych (2011) have reported and described morphologically a putative natural hybrid between *Silphium integrifolium* and *Silphium laciniatum*; however, they have provided only a hybrid formula, without formal naming of a hybrid or nothospecies.

Despite rather reliable reports of various spontaneous and (or) artificial hybrids in the genus, no hybrid names formed according to Chapter H of the *International Code of Nomenclature for algae, fungi, and plants* (*Madrid Code*: Turland et al., 2025) have been proposed in *Silphium* yet.

Silphium hybrids as potential new crops, and the need for nothospecific names

Since several species and interspecific hybrids of *Silphium* are currently considered as promising new crops for various agricultural applications, such as biomass production for bioenergy, fodder, etc. (Claussen, 2015; Cumplido-Marin et al., 2020; Gansberger et al., 2015; Greve et al., 2023; Kowalska et al., 2022; Kowalski, 2007; Peni et al., 2020; Rakhmetov et al., 2019, 2020a, 2020b, 2024b; Reinert et al., 2020a, 2020b; Van Tassel et al., 2017; Wever et al., 2019) and, at the same time, some species and (or) hybrids may be also potentially invasive (Ende et al., 2024; Zavialova, 2017, etc.), we consider it useful to formally describe some *Silphium* hybrids obtained and (or) cultivated by the first author and his team at the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine in Kyiv (Rakhmetov et al., 2019, 2020a, 2020b, 2024b) and to validate nothospecies names for selected infraspecific hybrids. The absence of such convenient and informative hybrid (nothospecific) names hampers communication in agricultural and botanical fields and prevents further development of the proper nomenclature for future cultivars of hybrid origin, with names to be formed in accordance with the *International Code of Nomenclature for Cultivated Plants* (Brickell et al., 2016). Using hybrid formulas for this purpose is not as convenient as hybrid binomials for nothospecies.

Having in mind these and other considerations, we previously validated the name *Rumex kioviensis* Rakhmetov, A.S. Mosyakin & Mosyakin (Rakhmetov et al., 2024a) for a hybridogenous species resulting from earlier artificial hybridisation between *Rumex patientia* L. and *Rumex tianschanicus* Losinsk. (Po-

lygonaceae). This hybridogenous species is now widely tested and used as a new crop in several countries of Europe and Asia (Rakhmetov et al., 2024a).

The earliest records of the introduction and cultivation of *Silphium perfoliatum* at the M.M. Gryshko National Botanical Garden (then known as the Central Botanical Garden of the Academy of Sciences of Ukraine) in Kyiv, Ukraine, date back to the late 1960s. Seeds were obtained from various commercial and non-commercial sources through seed exchange between botanical gardens. At present, the following species are introduced and cultivated at the National Botanical Garden: *Silphium perfoliatum* L. (the most common species in cultivation), *Silphium asteriscus* L. s. str. (incl. *Silphium scaberrimum* Ell.), *Silphium asteriscus* var. *trifoliatum* (L.) Clevinger (≡ *Silphium trifoliatum* L.), *Silphium integrifolium* Michx., *Silphium laciniatum* L., and *Silphium terebinthinaceum* Jacq. However, large-scale research and breeding projects, as well as experiments with artificial hybridisation of *Silphium* taxa at that botanical garden, were initiated later, in the early 1980s. They were associated with attempts to obtain and breed promising *Silphium* lineages for large-scale cultivation as new crops with various uses, mainly for biomass production. As a result, several promising lineages and hybrids have been obtained. The first Ukrainian cultivar of *Silphium perfoliatum* was officially registered in the *State Register of Varieties Suitable for Distribution in Ukraine* in 1996 (Uteush, 1991; Uteush & Lobas, 1996; Rakhmetov, 2018; Rakhmetov et al., 2020, 2024b).

A special article is under preparation by Rakhmetov and his team, with detailed descriptions and validations of nothospecific names for some hybrids cultivated in Ukraine, at the New Crops Department of the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine, and elsewhere. However, before publishing such names for artificial hybrids that have emerged in cultivation, we think it would be useful to validate the hybrid name for a natural hybrid that has already been discovered in the state of Missouri, the USA, and discussed and described morphologically by Jessee & Yatskievych (2011). The voucher specimen of this hybrid, along with vouchers of its putative parental species, is available at the Herbarium of the Missouri Botanical Garden (St Louis, MO; herbarium acronyms here and below follow *Index Herbariorum*; Thiers, 2026). Morpho-

logical characters of that voucher specimen and the characters described in detail by Jessee & Yatskievych (2011) for that natural hybrid correspond well to the characters of our artificial hybrids cultivated at the M.M. Gryshko National Botanical Garden in Kyiv.

The Ukrainian authors of the present article also think that the naming priority of description and type designation should be given to the natural hybrid, already reported from the US and morphologically characterised by Jessee & Yatskievych (2011), over cultivated artificial hybrids of the same origin (i.e., based on the same parent species). Thus, we propose the nothospecies name for this hybrid, with reference to its earlier description, and designate its holotype based on the available MO specimen. According to Art. H.4.1 of the *ICN* (Turland et al., 2025), which states that a name based on a natural hybrid will also apply to all artificial hybrids that result from crossing the same parent species, there can be only one correct name corresponding to a particular hybrid formula. Additional morphological details from cultivated plants are provided below to complement the 2011 description.

Taxonomy and nomenclature

Silphium × *missouriense* Rakhmetov, Yatsk. & A.S. Mosyakin, **nothosp. nov.** (*Silphium integrifolium* Michx. × *Silphium laciniatum* L.)

Type (holotype): UNITED STATES OF AMERICA: “Missouri, Jackson [County]. S side of the Kansas City Metropolitan Area. Jerry Smith Farm Park, between 131st Street and 139th Street, along E side of the loop trail running N from the parking lot off Prospect Avenue, ca. 20 m below the viewing platform at the end of W spur toward the middle of the loop trail. Open, restored upland prairie. 1 plant noted, ca. 1 m tall, with numerous *Silphium laciniatum*; closest *Silphium integrifolium* plants located ca. 70 m away.

Putative hybrid between *Silphium integrifolium* and *Silphium laciniatum*. Upper leaves opposite, sessile, and slightly lobed; median and lower leaves alternate, progressively longer, petiolate and more deeply lobed; basal and lower stem leaves absent at this time.” 3 October 2011. L. Jessee s.n. MO-2382470, accession number 6335772 (Fig. 1). Image and additional data are available from: <https://www.tropicos.org/specimen/100430747> and <https://www.tropicos.org/image/100168725>.



Fig. 1. The holotype of *Silphium* × *missouriense* Rakhmetov, Yatsk. & A.S. Mosyakin, Herbarium MO, MO-2382470, Accession Number 6335772.

For the valid publication of the nothospecific name, it is sufficient to provide a direct reference to the earlier morphological description published by Jessee & Yatskievych (2011), as required by Art. 32.4 and 38.1 of the *ICN* (Turland et al., 2025). However, for readers' convenience, we reproduce here the mentioned description, in part.

Description (according to Jessee & Yatskievych, 2011: 2–3):

“The putative hybrid generally appears irregularly intermediate between the parents [...]. It does not have basal leaves present at maturity, but the leaves tend to be strongly and progressively larger from the distal portion of the stem to its proximal portion. The uppermost cauline leaves are opposite and sparsely serrate to shallowly few-lobed, with progressively more proximal leaves showing an increase in the number and depth of the lobes. Bipinnatifid leaves are not produced.

Stem pubescence tends to be similar to that of *Silphium integrifolium* in the dense, short hairs, but scattered, longer, more strongly bulbous-based hairs are present distally in the hybrid [...]. Leaf pubescence is less easily diagnosed, but the trichomes on the proximal portion of the abaxially raised midvein are longer in *Silphium laciniatum* than in *Silphium integrifolium*, with the hybrid variable but somewhat intermediate.

In quantitative features of the head (overall size, phyllary length, number of rays, etc.), the hybrid is also more or less intermediate. Involucral bracts are + intermediate in both shape and maximum size [...]. Receptacular bracts are too variable in shape depending on position in the head to be of use in distinguishing the parents. However, one qualitative feature of these bracts that is difficult to quantify or photographically illustrate is their pubescence. In *Silphium integrifolium*, the chaffy bracts are pubescent dorsally with short, stiff, ascending hairs in the distal half. The apical margin is ciliate with short hairs that are not much longer than the surface trichomes. In contrast, receptacular bracts of *Silphium laciniatum* are pubescent dorsally in only the distal portion with trichomes that are somewhat longer than those in *Silphium integrifolium*. The margins are ciliate with a fringe of hairs longer than those on the surface. The bracts thus appear minutely comose or bearded apically (under magnification).

Achenes of the hybrids generally appear flat and inviable [...]. They lack the embedded glands characteristic of the putative parents and generally appear pale at maturity. In other respects, the achenes of the parents are too similar to offer morphological contrasts.”

The article by Jessee & Yatskievych (2011: 3) also contains the useful comparative Table 1, “Selected morphological characteristics of *Silphium integrifolium*, *Silphium laciniatum*, and their putative hybrid.”

Etymology: The name of the hybrid commemorates the State of Missouri, where this natural hybrid has been found. Also, it is a tribute to botanists and amateurs of Missouri, and particularly those of the Missouri Botanical Garden (St. Louis, MO), a prominent centre of North American and global taxonomic and economic botany and plant conservation.

The parental species collected in the same locality are also represented in the MO Herbarium:

Silphium integrifolium: MO-2382467, Accession Number 6335773 (<https://www.tropicos.org/specimen/100430738>).

Silphium laciniatum: MO-2382468, Accession Number 6335774; and MO-2382469, Accession Number 6335775 (one specimen mounted on two sheets: <https://www.tropicos.org/specimen/100430745>).

Hybrids between *Silphium integrifolium* and *Silphium laciniatum* cultivated at the M.M. Gryshko Botanical Garden of the National Academy of Sciences of Ukraine in general morphologically correspond to the above description; however, they are more variable, which is quite expectable because numerous individual plants were involved in hybridisation and cultivation, and the variation observed in a population is evidently much wider than the morphological traits of an individual plant (the holotype). The most evident variation among hybrid plants cultivated in Kyiv, going beyond the original morphological description reproduced above, is observed in the leaf shape. Some *Silphium integrifolium* × *Silphium laciniatum* hybrids cultivated at the M.M. Gryshko National Botanical Garden have leaves (especially the lower ones) that more closely resemble those of *Silphium laciniatum*. Additional herbarium specimens of these cultivated plants are available at the KW (National Herbarium of Ukraine) and the KWHA herbaria in Kyiv.

Concluding remarks

We hope that dedicated searches for natural hybrids between other *Silphium* species within their native ranges will yield additional records of other hybrid combinations. For example, as of 3 December 2025, there are three observations of a putative hybrid *Silphium integrifolium* × *Silphium perfoliatum* available at *iNaturalist* (https://www.inaturalist.org/observations?taxon_id=1569637), all from the US: (1) Konza Prairie Biological Research Station, Riley County, Kansas, observed 20 October 2024 (<https://www.inaturalist.org/observations/248362292>); (2) Charles Prairie, Faville Grove Sanctuary, Lake Mills, Jefferson County, Wisconsin, observed 18 June 2025 (<https://www.inaturalist.org/observations/290668778>) and 31 July 2025 (<https://www.inaturalist.org/observations/302653250>).

In addition to field observations, a critical reappraisal of herbarium specimens deposited in various US herbaria (including some small and local ones) could also be useful for identifying possible natural hybrids in *Silphium*. Further studies of hybridisation in *Silphium*, both in the field and in the laboratory, might provide additional insights into the role of hybridisation in the evolution of the genus. Also, available (but still preliminary) data demonstrate that the hybrids are promising as biotechnology and biomass-producing crops and their specific cultivars.

Plants representing at least three artificial interspecific hybrid combinations of *Silphium* are currently being tested in cultivation at the M.M. Gryshko National Botanical Garden in Kyiv (Rakhmetov et al., 2019, 2020a, 2020b, and unpublished data). These hybrids and their perspective morphotypes (cultivars) will be discussed and described in a separate publication, now in preparation by the Ukrainian authors.

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