Turczaninowia 27, 4: 22–28 (2024)
DOI: 10.14258/turczaninowia.27.4.3
http://turczaninowia.asu.ru

ISSN 1560–7259 (print edition)
TURCZANINOWIA
ISSN 1560–7267 (online edition)

УДК 581.527.7+576.316(571.151)

Chromosome numbers of alien species in the flora of Republic of Altai. Post VIII

E. Yu. Zykova[1, 2*], T. V. Pankova[1, 3], M. N. Lomonosova[1, 4]

[1] *Central Siberian Botanical Garden SB RAS, Zolotodolinskaya St., 101, Novosibirsk, 630090, Russian Federation*

[2] *E-mail: elena.yu.zykova@gmail.com; ORCID iD: https://orcid.org/0000-0002-1847-5835*

[3] *E-mail: ankova_tv@mail.ru, ORCID iD: https://orcid.org/0000-0003-3661-0719*

[4] *E-mail: mlomonosova@mail.ru, ORCID iD: https://orcid.org/0000-0003-0510-5349*

** Corresponding author*

Keywords: Asteraceae, Balsaminaceae, Colchicaceae, Cucurbitaceae, diploids, Fabaceae, invasive species, Lamiaceae, polyploids, Ranunculaceae, Rubiaceae, species dispersal, Vitaceae.

Summary. Chromosome numbers (2*n*) of 13 alien plant species from the families Asteraceae, Balsaminaceae, Colchicaceae, Cucurbitaceae, Fabaceae, Lamiaceae, Ranunculaceae, Rubiaceae, and Vitaceae are reported based on the material collected in Republic of Altai. To determine chromosome number (ploidy level), the method of direct counting in metaphase on root meristem was used. Among the species studied, chromosome numbers for *Lamium maculatum* (2*n* = 18), *Clematis terniflora* (2*n* = 32), *Galium aparine* (2*n* = 22) were first examined for Russian Federation; for *Colchicum speciosum* (2*n* = 38), *Aquilegia vulgaris* (2*n* = 14) – first for Asian Russia; for *Impatiens parviflora* (2*n* = 26), *Thladiantha dubia* (2*n* = 18), *Galium mollugo* (2*n* = 44) – first for Siberia; for *Impatiens glandulifera* (2*n* = 18) – first for West Siberia; *Cyclachaena xanthiifolia* (2*n* = 36), *Solidago canadensis* (2*n* = 18), *Trifolium hybridum* (2*n* = 16) were first studied for Republic of Altai. General distribution and the history of floristic findings of these species in Republic of Altai are given. Previously published data on chromosome numbers from Russia are cited.

Числа хромосом чужеродных видов во флоре Республики Алтай: сообщение 8

Е. Ю. Зыкова, Т. В. Панкова, М. Н. Ломоносова

Центральный сибирский ботанический сад СО РАН, ул. Золотодолинская, д. 101, г. Новосибирск, 630090, Россия

Ключевые слова: диплоиды, инвазионные виды, полиплоиды, расселение видов, Asteraceae, Balsaminaceae, Colchicaceae, Cucurbitaceae, Fabaceae, Lamiaceae, Ranunculaceae, Rubiaceae, Vitaceae.

Аннотация. Приводятся данные о числах хромосом (2*n*) для 13 чужеродных видов из семейств Asteraceae, Balsaminaceae, Colchicaceae, Cucurbitaceae, Fabaceae, Lamiaceae, Ranunculaceae, Rubiaceae, Vitaceae, полученные на материале из Республики Алтай. Для определения чисел хромосом (уровня плоидности) использован метод прямого подсчёта в метафазе корневой меристемы. Впервые для России определено число хромосом у *Lamium maculatum* (2*n* = 18), *Clematis terniflora* (2*n* = 32) и *Galium aparine* (2*n* = 22); впервые для Азиатской части России – у *Colchicum speciosum* (2*n* = 38) и *Aquilegia vulgaris* (2*n* = 14); впервые для Сибири – у *Impatiens parviflora* (2*n* = 26), *Thladiantha dubia* (2*n* = 18), *Galium mollugo* (2*n* = 44); впервые для Западной Сибири – у *Impatiens glandulifera* (2*n* = 18); впервые для Республики Алтай – у *Cyclachaena xanthiifolia* (2*n* = 36), *Solidago canadensis*

Поступило в редакцию 25.04.2024
Принято к публикации 10.11.2024

Submitted 25.04.2024
Accepted 10.11.2024

(2*n* = 18), *Trifolium hybridum* (2*n* = 16). Для всех исследованных видов приводятся сведения по общему распространению, истории расселения на территории Республики Алтай, а также литературные данные по числам хромосом с территории России.

We continue to study chromosome numbers and ploidy level of alien species in the flora of Republic of Altai (Zykova et al., 2023). This paper reports the chromosome numbers of 13 species.

A significant part of the species are invasive on the territory of Republic of Altai: *Solidago canadensis*, *Impatiens glandulifera*, *Trifolium hybridum*, *Galium aparine*, *G. mollugo* (Zykova, 2023), as well as invasive in a number of Siberian regions (Ebel et al., 2014) and potentially invasive (according to our observations) in the flora of Republic of Altai: *Cyclachaena xanthiifolia*, *Impatiens parviflora*, *Aquilegia vulgaris*, *Thladiantha dubia*. Most of them are species that have disappeared from cultivation. The others, *Cyclachaena xanthiifolia*, *Impatiens parviflora*, *Galium aparine*, *G. mollugo*, are accidentally introduced.

The chromosome numbers were determined by direct counting in metaphase on root meristem squash preparations. The method was described in our previous article (Lomonosova et al., 2018). For *Impatiens parviflora*, *Thladiantha dubia*, *Galium mollugo* the chromosome number was determined for the first time on material from the territory of Siberia, for *Colchicum speciosum*, *Aquilegia vulgaris* – first for Asian Russia, for *Lamium maculatum*, *Clematis terniflora, Galium aparine* – from the territory of Russian Federation. For all species, the references on chromosome numbers revealed from the samples collected in Russia are given. The information on chromosome numbers outside Russia can be found in Rice at al. (2015).

Latin names of plants are given according to the "Catalog of Life" (Bánki, 2024). The herbarium specimens (vouchers) are deposited in the Herbarium of the Central Siberian Botanical Garden SB RAS (NS, Novosibirsk).

Asteraceae

Cyclachaena xanthiifolia (Nutt.) Fresen (≡ *Iva xanthifolia* Nutt.), **2*n* = 36**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, Kommunistichesky Ave., wasteland near the «Zapadny» shopping center. 26 VI 2023. E. Yu. Zykova", E121–1723 (NS0053134).

Annual. North American species, spread throughout the world. An invasive species in Siberia (Terekhina, 2016). In Republic of Altai, it was first discovered in 2012 in the Chemal district (Zykova, 2014), and has now also been found in Gorno-Altaisk city (Zykova, 2020) and in the Mayma district (Ebel et al., 2022).

The chromosome number is given for the first time for Republic of Altai. The same number was identified for Altai (Krasnikov et al., 2003) and Khabarovsk (Agapova et al., 1990, and references therein) Territories, Amur (Shatokhina, 2006) and Saratov (Probatova et al., 2009) Regions. Polyploid.

Solidago canadensis L., **2*n* = 18**

"Russian Federation, Republic of Altai, Mayma district, airport vicinity, by the country road. 30 VIII 2023. E. Yu. Zykova", E284–5323 (NS0055649) (Fig. 1A).

Perennial. North American species, grown as an ornamental. It has been discovered in Republic of Altai since the end of the 20th century (Zolotukhin, 2012). Currently, it is an invasive species, widespread in the northern regions of Republic of Altai (Zykova, 2023).

The chromosome number is given for the first time for Republic of Altai. The same chromosome number is determined for Novosibirsk Region (An'kova, Zykova, 2021) and Primorye Territory (Probatova, 2014, and references therein). Diploid.

Balsaminaceae

Impatiens glandulifera Royle, **2*n* = 18**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, Stroiteley street, wasteland. 25 VI 2023. E. Yu. Zykova", E119–1623 (NS0053127) (Fig. 1B).

Annual. A Western Himalayan species distributed throughout the Holarctic. Invasive species in Republic of Altai (Zykova, 2023).

The chromosome number is given for the first time for the West Siberia. The same number is determined for Irkutsk Region (Chepinoga, 2014, and references therein), Krasnoyarsk (Stepanov, 2018) and Primorye (Probatova, 2014, and references therein) Territories. Diploid.

Impatiens parviflora DC., **2*n* = 26**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, surroundings of the curtain-tulle factory, river bank Mayma. 22 VIII 2023. E. Yu. Zykova, D. I. Zykov", E153–5023 (NS0053131) (Fig. 1C).

Annual. A Central Asian species that spread throughout Eurasia. It was first discovered in Republic of Altai at the end of the 20th century in the Onguday district (Baykov, 1996), currently common in Gorno-Altaysk city (Zykova, 2015), found in the Mayma district (Ebel et al., 2022). Potentially invasive species in Republic of Altai.

This is the first report of the chromosome number from Siberia. $2n = 20$ has been indicated in Amur Region (Korobkov et al., 2013). Diploid.

Colchicaceae

Colchicum speciosum Steven, **$2n = 38$**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, vicinity of the national theater, wasteland. 8 IX 2023. E. Yu. Zykova", E183–6123 (NS0050937) (Fig. 1D).

Perennial. The natural range covers the Caucasus, Iran, and Asia Minor. A popular ornamental plant in Siberia. In Republic of Altai, outside of culture, has been registered in Gorno-Altaysk city (Zykova, 2024).

This is the first report of the chromosome number for Asian Russia. The same chromosome number was determined in material from Krasnodar Territory (Persson, 2009). Polyploid.

Cucurbitaceae

Thladiantha dubia Bunge, **$2n = 18$**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, central park, near the buildings. 31 VIII 2023. E. Yu. Zykova", E166–5523 (NS0053129).

Perennial. An East Asian species cultivated and wild in Eurasia. In Republic of Altai it was first discovered in 2006 in the Chemal district (Ebel, 2008) and is currently actively spreading throughout the northern regions. Potentially invasive species in Republic of Altai.

This is the first report of the chromosome number for this species in Siberia. The same number is known from Primorye (Probatova, 2014, and references therein) and Khabarovsk (Probatova, Sokolovskaya, 1988) Territories. Diploid.

Fabaceae

Trifolium hybridum L., **$2n = 16$**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, furniture factory district, river bank Mayma, pebble. 22 VII 2023. E. Yu. Zykova, D. I. Zykov", E298–4123 (NS0055660); "Russian Federation, Republic of Altai, Mayma district, Mayma village, Sportivny lane, vacant area near a housing complex. 3 IX 2023. E. Yu. Zykova", E174–5723 (NS0055656) (Fig. 1E).

Perennial. The native range of this species covers Europe, the Caucasus, and Asia Minor. In Siberia, it began to be cultivated as a fodder and honey crop at the end of the 19th century, from where it penetrated into disturbed habitats, where it naturalized. In Republic of Altai it has been found sporadically since the mid-20th century in northern districts, and in Ust-Koksa district (NS; Krylov, Sergievskaya, 1964). Currently it is an invasive species in Republic of Altai (Zykova, 2023).

The chromosome number is given for the first time for Republic of Altai. The same number was identified for Novosibirsk (Krasnikov, Shaulo, 1990), and Irkutsk (Chepinoga, 2014, and references therein) Regions, Republic of Buryatia (Chepinoga, 2014, and references therein), Primorye (Probatova, 2014, and references therein), Krasnodar and Stavropol (Magulaev, 1987) Territories. $2n = 32$ was determined from Irkutsk Region (Chepinoga, 2014, and references therein) and Krasnodar Territory (Magulaev, 1987). Diploid.

Lamiaceae

Lamium maculatum (L.) L., **$2n = 18$**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, furniture factory district, overgrown flowerbed. 22 VII 2023. E. Yu. Zykova, D. I. Zykov", E136–4223 (NS0053130).

Perennial. European-Mediterranean-Asian Minor species. The forms are cultivated in Siberia as an unpretentious ground cover plant. In Republic of Altai, out of culture, discovered in Gorno-Altaysk city (Zykova, 2024).

This is the first report of the chromosome number on the material collected outside of crops for the Russian Federation. Our data match the chromosome counts, previously contacted by different authors (Rice et al., 2015). Diploid.

Ranunculaceae

Aquilegia vulgaris L., **$2n = 14$**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, furniture factory district, river bank Mayma, pebble. 22 VII 2023. E. Yu. Zykova, D. I. Zykov", E232–4123 (NS0055655) (Fig. 1F).

Perennial. European species. A popular ornamental plant in Siberia. In Republic of Altai, outside of culture, it is relatively rare, noted since the end of the 20th century (Ebel et al., 2022).

This is the first report of the chromosome number for Asian Russia. The same chromosome num-

ber was determined in material from Leningrad Region (Vasilyeva, 1990). Diploid.

Clematis terniflora DC., **2*n* = 32**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, vicinity of the national theater, wasteland. 8 IX 2023. E. Yu. Zykova", E182–6123 (NS0058638).

Perennial. East Asian species. In Siberia it is widely used as an ornamental plant. In Republic of Altai, outside culture noted in Gorno-Altaysk city (Zykova, 2019).

This is the first report of the chromosome number for this species in Russian Federation. The same number is indicated for the native part of the area from China (Wang et al., 2017). Polyploid.

Rubiaceae

Galium aparine L., **2*n* = 22**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, Panfilovtsev street, wasteland near the «Dynamo» stadium. 3 VII 2023. E. Yu. Zykova", E246–2123 (NS0055654) (Fig. 1G), E247–2123 (NS0055650); "Russian Federation, Republic of Altai, Gorno-Altaysk city, Magistralnaya street, by the road. 8 VII 2023. E. Yu. Zykova, D. I. Zykov" E245–2423 (NS0055653).

Annual. A species with a cosmopolitan area. The first locations in Republic of Altai were discovered at the beginning of the 20th century along the "Chuyskiy trakt" in the Onguday district (NS0046016, NS0046018). Currently, it is an invasive species in Republic of Altai, distributed in most regions of the republic (Zykova, 2023).

This is the first report on diploid chromosome number for *G. aparine* from Russia. In the most part of the world this species is polyploid (Rice et al., 2015). 2*n* = 44 is indicated for Republic of Crimea (Probatova, Kazanovsky, 2018). Diploid.

Galium mollugo L., **2*n* = 44**

"Russian Federation, Republic of Altai, Mayma district, airport vicinity, by the country road. 30 VIII 2023. E. Yu. Zykova", E253–5323 (NS0055664) (Fig. 1H).

Perennial. Eurasian species. It is an invasive species in Republic of Altai (Zykova, 2023), the first occurrences have been recorded since the end of the 20th century in the northern and central districts (Studenikina, 1999; Zykova, 2002; Pyak, Ebel, 2001).

This is the first report of the chromosome number for this species in Siberia. The same number is known from Primorye Territory (Probatova, 2014, and references therein) and Pskov Region (Agapova et al., 1993, and references therein). 2*n* = 22 was determined for Republic of Tatarstan (Probatova et al., 2022). Polyploid.

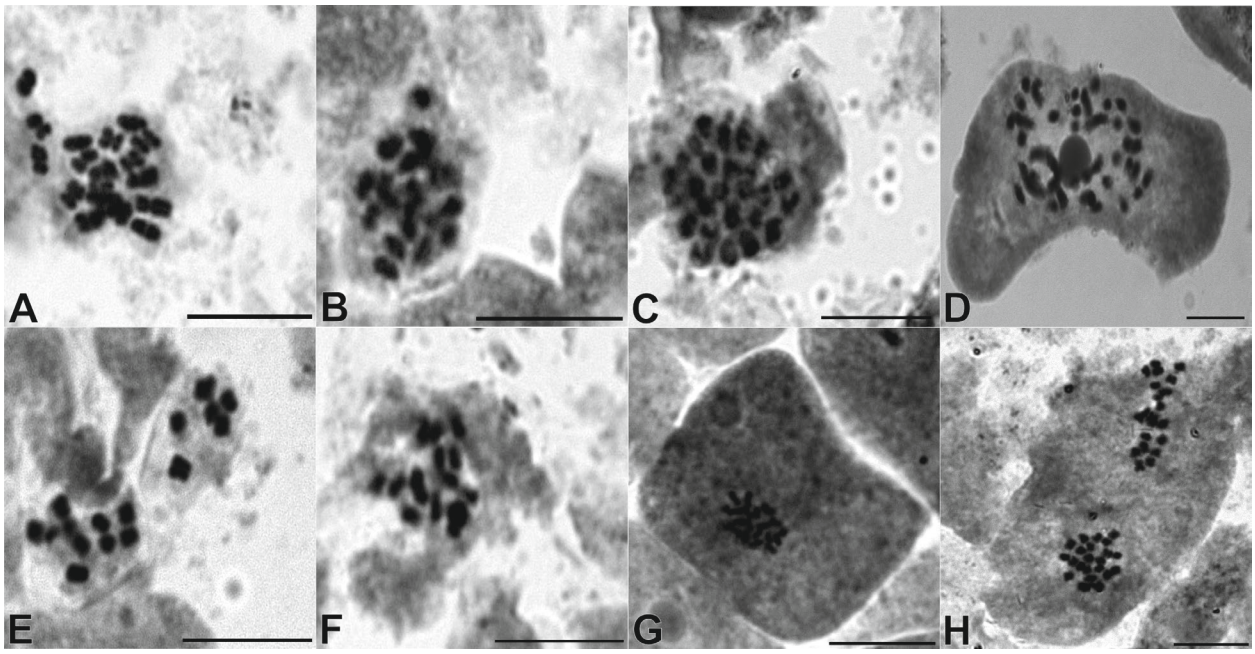

Fig. 1. Mitotic metaphases: A – *Solidago canadensis*, 2*n* = 18; B – *Impatiens glandulifera*, 2*n* = 18; C – *Impatiens parviflora*, 2*n* = 26; D – *Colchicum speciosum*, 2*n* = 38; E – *Trifolium hybridum*, 2*n* = 16; F – *Aquilegia vulgaris*, 2*n* = 14; G – *Galium aparine*, 2*n* = 22; H – *Galium mollugo*, 2*n* = 44; Scale = 10 μm.

Vitaceae

Parthenocissus quinquefolia (L.) Planch., **2*n* = 40**

"Russian Federation, Republic of Altai, Gorno-Altaysk city, «Stroiteley» street, by the road. 4 IX 2023. E. Yu. Zykova", E177–6023 (NS0053135).

Perennial. A North American species grown in Siberia as an unpretentious hanging plant. In Republic of Altai, departure from culture was noted in Gorno-Altaysk city, Mayma and Turochak districts (Zykova, 2015; Zykova et al., 2019).

The number 2*n* = 40 was registered in material from Republic of Altai (An'kova et al., 2019). Polyploid.

Conclusion

The chromosome numbers in 13 adventive species found in the flora of Republic of Altai were studied. Nine of them are invasive and potentially invasive species in Republic of Altai: polyploids *Galium mollugo, Cyclachaena xanthiifolia, Impatiens parviflora* and diploids *Solidago canadensis, Impatiens glandulifera, Trifolium hybridum, Galium aparine, Aquilegia vulgaris, Thladiantha dubia*. Among other alien species *Parthenocissus quinquefolia, Clematis terniflora*, *Colchicum speciosum* are polyploids, *Lamium maculatum* is diploid. Our data on the chromosome numbers of adventive species from Republic of Altai make a significant contribution to the understanding of their karyology.

Acknowledgements

The study was carried out within the framework of the State Assignment of the Central Siberian Botanical Garden SB RAS (AAAA-A21-121011290024-5).

REFERENCES / ЛИТЕРАТУРА

Agapova N. D., Arkharova K. B., Vakhtina L. I., Zemskova E. A., Tarvis L. V. 1990. *Chisla khromosom tsvetkovykh rasteniy flory SSSR: Aceraceae – Menyanthaceae* [*Chromosome numbers of flowering plants of the USSR flora: Aceraceae – Menyanthaceae*]. Leningrad: Nauka. 509 pp. [In Russian] (***Агапова Н. Д., Архарова К. Б., Вахтина Л. И., Земскова Е. А., Тарвис Л. В.*** Числа хромосом цветковых растений флоры СССР: Aceraceae – Menyanthaceae. Л.: Наука, 1990. 509 с.).

Agapova N. D., Arkharova K. B., Vakhtina L. I., Zemskova E. A., Tarvis L. V., Safonova I. N. 1993. *Chisla khromosom tsvetkovykh rasteniy flory SSSR: Moraceae – Zygophyllaceae* [*Chromosome numbers of flowering plants of the USSR flora: Moraceae – Zygophyllaceae*]. Vol. 2. St. Petersburg: Nauka. 480 pp. [In Russian] (***Агапова Н. Д., Архарова К. Б., Вахтина Л. И., Земскова Е. А., Тарвис Л. В., Сафонова И. Н.*** Числа хромосом цветковых растений флоры СССР: Moraceae – Zygophyllaceae. Т. 2. СПб.: Наука, 1993. 480 с.).

An'kova T. V., Zykova E. Yu. 2021. Alien species in the Novosibirsk City, Russia. In: *Botanica Pacifica plant chromosome data 1* (N. S. Probatova, ed.). *Botanica Pacifica* 10(1): 110. DOI: 10.17581/bp.2021.10103

An'kova T. V., Zykova E. Yu., Ebel A. L. 2019. IAPT/IOPB chromosome data 31/2. Ed. K. Marhold. *Taxon* 68(6): 1375–1376; E6–E7. DOI: 10.1002/tax.12176

Bánki O., Roskov Y., Döring M., Ower G., Hernandez Robles D. R., Plata Corredor C. A., et al. 2024. *Catalogue of Life Checklist* (version 2023-10-16). Leiden, Netherlands: Catalogue of Life. DOI: 10.48580/df7lv (Accessed 10 April 2024).

Baykov K. S. 1996. *Impatiens* L. In: *Flora Sibiri* [*Flora of Siberia*]. Vol. 10. Novosibirsk: Nauka. P. 62. [In Russian] (***Байков К. С.*** *Impatiens* L. // Флора Сибири. Т. 10. Новосибирск:Наука, 1996. С. 62).

Chepinoga V. V. 2014. *Chromosome numbers of plant species from Baikal Siberia*. Novosibirsk: Nauka. 417 pp. [In Russian] (***Чепинога В. В***. Хромосомные числа растений флоры Байкальской Сибири. Новосибирск: Наука, 2014. 417 с.).

Ebel A. L. 2008. New and rare species of flowering plants to the flora of the Altai Mountain Country. *Turczaninowia* 11, 4: 77–85. [In Russian] (***Эбель А. Л.*** Новые и редкие виды цветковых растений для флоры Алтайской горной страны // Turczaninowia, 2008. Т. 11, № 4. С. 77–85).

Ebel A. L., Ebel T. V., Zykova E. Yu., Mikhailova S. I. 2022. Floristic findings in the Western Siberia and the Southern Ural. *Turczaninowia* 25, 3: 207–216. [In Russian] (***Эбель А. Л., Эбель Т. В., Зыкова Е. Ю., Михайлова С. И.*** Флористические находки в Западной Сибири и на Южном Урале // Turczaninowia, 2022. Т. 25, № 3. С. 207–216). DOI: 10.14258/turczaninowia.25.3.19

Ebel A. L., Strelnikova T. O., Kupriyanov A. N., Anenkhonov O. A., Ankipovich E. C., Antipova E. M., et al. 2014. Invasive and potential invasive species of Siberia. *Byull. Glavn. bot. sada (Moscow)* [*Bulletin of Main Botanical Garden*] 1(200): 52–61. [In Russian] (***Эбель А. Л., Стрельникова Т. О., Куприянов А. Н., Аненхонов О. А., Анкипович Е. С., Антипова Е. М., и др.*** Инвазионные и потенциально инвазионные виды Сибири // Бюл. Глав. ботан. сада, 2014. № 1 (вып. 200). С. 52–61).

Korobkov A. A., Kotseruba V. V., Probatova N. S., Shatokhina A. V., Rudyka E. G. 2013. IAPT/IOPB chromosome data 15. K. Marhold (ed.). *Taxon* 62(5): 1074–1077; E11–E15.

Krasnikov A. A., Schaulo D. N. 1990. Chromosome numbers in representatives of some families of vascular plants in the flora of the Novosibirsk region. II. *Bot. Zhurn.* 75(1): 118–120. [In Russian] (***Красников А. А., Шауло Д. Н.*** Числа хромосом представителей некоторых семейств сосудистых растений флоры Новосибирской области. II // Бот. журн., 1990. Т. 75, № 1. С. 118–120).

Krasnikov A. A., Zhirova O. S., Lomonosova M. N., Smirnov S. V. 2003. Chromosome numbers of Asteraceae from the southern Siberia and Kazakhstan. *Bot. Zhurn.* 88(9): 151–153. [In Russian] (***Красников А. А., Жирова О. С., Ломоносова М. Н., Смирнов С. В.*** Числа хромосом представителей семейства Asteraceae из Южной Сибири и Казахстана // Бот. журн., 2003. Т. 88, № 9. С. 151–153).

Krylov P. N., Sergievskaya L. P. 1964. *Trifolium* L. In: *Flora Zapadnoy Sibiri* [*Flora of Western Siberia*]. Vol. 12(2). Tomsk: Tomsk University Press. P. 3362. [In Russian] (***Крылов П. Н., Сергиевская Л. П.*** *Trifolium* L. // Флора Западной Сибири. Т. 12(2). Томск: Изд-во ТГУ, 1964. С. 3362).

Lomonosova M. N., Zykova E. Yu., An'kova T. V. 2018. Chromosome numbers of invasive species of the Altai Republic flora. II. *Turczaninowia* 21, 4: 63–72. DOI: 10.14258/turczaninowia.21.4.7

Magulaev A. Yu. 1987. A cytotaxonomical study of species belonging to the subgenus *Lotoidea* of the genus *Trifolium* (Fabaceae) from the flora of the Crimea and the Caucasus. *Bot. Zhurn.* 72(10): 1356–1363. [In Russian] (***Магулаев А. Ю.*** Цитотаксономическое изучение видов подрода *Lotoidea* рода *Trifolium* (Fabaceae) флоры Крыма и Кавказа // Бот. журн., 1987. Т. 72, № 10. С. 1356–1363).

Persson K. 2009. IAPT/IOPB chromosome data 7. K. Marhold (ed.). *Taxon* 58(1): 181–183; E3–E10.

Probatova N. S. 2014. *Chromosome numbers in vascular plants of the Primorye Territory (Russian Far East).* Vladivostok: Dalnauka. 343 pp. [In Russian] (***Пробатова Н. С.*** Хромосомные числа сосудистых растений Приморского края. Владивосток: Дальнаука, 2014. 343 с.).

Probatova N. S., Kazanovsky S. G. 2018. Chromosome numbers in some vascular plant species from the Crimea. *Botanica Pacifica* 7(1): 107–113. DOI: 10.17581/bp.2018.07104

Probatova N. S., Krivenko D. A., Chernyagina O. A. 2022. IAPT/IOPB chromosome data 38/9. K. Marhold (ed.). *Taxon* 71(6): 1358–1359; E27–E30.

Probatova N. S., Seledets V. P., Rudyka E. G., Gnutikov A. A., Kozhevnikova Z. V., Barkalov V. V. 2009. IAPT/IOPB chromosome data 8. K. Marhold (ed.). *Taxon* 58(4): 1284–1288; E11–E20.

Probatova N. S., Sokolovskaya A. P. 1988. Chromosome numbers in vascular plants from Primorye Territory, the Amur River basin, north Koryakia, Kamchatka and Sakhalin. *Bot. Zhurn.* 73(2): 290–293. [In Russian] (***Пробатова Н. С., Соколовская А. П.*** Числа хромосом сосудистых растений из Приморского края, Приамурья, Северной Корякии, Камчатки и Сахалина // Бот. журн., 1988. Т. 73, № 2. С. 290–293).

Pyak A. I., Ebel A. L. 2001. Materials to flora of Altai Mountains. *Turczaninowia* 4, 1–2: 86–94. [In Russian] (***Пяк А. И., Эбель А. Л.*** Материалы к флоре Алтая // Turczaninowia, 2001. Т. 4, № 1–2. С. 86–94).

Rice A., Glick L., Abadi S., Einhorn M., Kopelman N., Salman-Minkov A., Mayzel J., Chay O., Mayrose I. 2015. The Chromosome Counts Database (CCDB) – a community resource of plant chromosome numbers. *New Phytol.* 206(1): 19–25. URL: http://ccdb.tau.ac.il (Accessed 01 April 2024).

Shatokhina A. V. 2006. Chromosome numbers of some plants of the Amur Region flora. *Bot. Zhurn.* 91(3): 487–490. [In Russian] (***Шатохина А. В.*** Числа хромосом некоторых представителей флоры Амурской области // Бот. журн., 2006. Т. 91, № 3. С. 487–490).

Stepanov N. V. 2018. Chromosome numbers of some species from south of the Yenisei Siberia. *Turczaninowia* 21, 1: 35–40. [In Russian] (***Степанов Н. В.*** Числа хромосом некоторых видов с юга Приенисейской Сибири // Turczaninowia, 2018. Т. 21, № 1. С. 35–40). DOI: 10.14258/turczaninowia.21.1.5

Studenikina E. Yu. 1999. *Vysshiye sosudistyye rasteniya flory Biye-Katunskogo mezhdurechya v predelakh predgoriy i nizkogoriy Altaya* [*Higher vascular plants of the flora of the Biya-Katun interfluve within the foothills and low mountains of Altai*]. Barnaul. 121 pp. [In Russian] (***Студеникина Е. Ю.*** Высшие сосудистые растения флоры Бие-Катунского междуречья в пределах предгорий и низкогорий Алтая. Барнаул, 1999. 121 с.).

Terekhina T. A. 2016. *Cyclachaena xanthiifolia* (Nutt.) Fresen. In: *Chyernaya kniga flory Sibiri* [*Black book of the flora of Siberia*]. Novosibirsk: "Geo" Publ. Pp. 102–105. [In Russian] (***Терехина Т. А.*** *Cyclachaena xanthiifolia* (Nutt.) Fresen // Чёрная книга флоры Сибири. Новосибирск: Изд-во «Гео», 2016. С. 102–105).

Vasilyeva I. M. 1990. Chromosome numbers of some species of the genus *Aquilegia* (Ranunculaceae) of the flora of the USSR. *Bot. Zhurn.* 75(9): 1319. [In Russian] (***Васильева И. М.*** Числа хромосом некоторых видов рода *Aquilegia* (Ranunculaceae) флоры СССР // Бот. журн., 1990. Т. 75, № 9. С. 1319).

Wang N., Wang K.-L., Liu Q.-H., Liu Q.-C. 2017. Karyotype analysis of seven wild *Clematis species* [J]. *Acta Prataculturae Sinica* 26(11): 123–130. DOI: 10.11686/cyxb2017025

Zolotukhin N. I. 2012. Floristic records in Altai Republic. *Bull. Moscow Soc. Naturalists Biol. Ser.* 117, 3: 77–80. [In Russian] (***Золотухин Н. И.*** Флористические находки в Республике Алтай // Бюл. МОИП. Отд. биол., 2012. Т. 117, вып. 3. С. 77–80).

Zykova E. Yu. 2002. Flora of the city of Gorno-Altaisk and its environs. *Bot. Zhurn.* 87(1): 93–99. [In Russian] (***Зыкова Е. Ю***. Флора города Горно-Алтайска и его окрестностей // Бот. журн., 2002. Т. 87, № 1. С. 93–99).

Zykova E. Yu. 2014. New records of alien species in the Republic of Altai flora. *Bull. Moscow Soc. Natur. Biol. Ser.* 119, 1: 80–81. [In Russian] (***Зыкова Е. Ю.*** Новые находки адвентивных видов во флоре Республики Алтай // Бюл. МОИП. Отд. биол., 2014. Т. 119, вып. 1. С. 80–81).

Zykova E. Yu. 2015. Alien flora of the Republic of Altai. *Rastitelnyy mir Aziatskoy Rossii* [*Plant Life of Asian Russia*] 3(19): 72–87. [In Russian] (***Зыкова Е. Ю.*** Адвентивная флора Республики Алтай // Растительный мир Азиатской России, 2015. № 3(19). С. 72–87).

Zykova E. Yu. 2019. Findings of adventive species in the Altai Republic. *Bull. Moscow Soc. Natur. Biol. Ser.* 124, 6: 66–68. [In Russian] (***Зыкова Е. Ю.*** Находки адвентивных видов в Республике Алтай // Бюл. МОИП. Отд. биол., 2019. Т. 124, вып. 6. С. 66–68).

Zykova E. Yu. 2020. New record of alien species in the Altai Republic. *Bull. Moscow Soc. Natur. Biol. Ser.* 125, 4: 45–46. [In Russian] (***Зыкова Е. Ю.*** Новые местонахождения адвентивных видов в Республике Алтай // Бюл. МОИП. Отд. биол., 2020. Т. 125, вып. 4. С. 45–46).

Zykova E. Yu. 2023. Formation of the ranges of invasive plant species in the Altai Republic: results of the centennial naturalization. *Russian Journal of Biological Invasions* 14, 4: 540–558. DOI: 10.1134/S2075111723040203

Zykova E. Yu. 2024. Additions to the alien flora of the Republic of Altai. *Rastitelnyy mir Aziatskoy Rossii* [*Plant Life of Asian Russia*] 17(2): 139–145. [In Russian] (***Зыкова Е. Ю.*** Дополнения к чужеродной флоре Республики Алтай // Растительный мир Азиатской России, 2024. № 17(2). С. 139–145).

Zykova E. Yu., Ebel A. L., Ebel T. V., Sheremetova S. A. 2019. New findings of alien plants in the Republic of Altai. *Turczaninowia* 22, 1: 143–153. [In Russian] (***Зыкова Е. Ю., Эбель А. Л., Эбель Т. В., Шереметова С. А.*** Новые находки адвентивных видов растений в Республике Алтай // Turczaninowia, 2019. Т. 22, № 1. С. 143–153. DOI: 10.14258/turczaninowia.22.1.11

Zykova E. Yu., Pankova T. V., Lomonosova M. N. 2023. Chromosome numbers of adventive species in the flora of the Republic of Altai. Post VI. *Turczaninowia* 26, 1: 43–50. DOI: 10.14258/turczaninowia.26.1.4