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

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Summary. Chromosome numbers ($2n$) of 12 alien plant species are reported based on the material collected in the Republic of Altai. To determine chromosome number (ploidy level), the method of direct counting in metaphase of root meristem was used. Among species studied, chromosome numbers for *Asperugo procumbens* L. ($2n = 48$), *Hylotelephium spectabile* (Boreau) H. Ohba ($2n = 50$), *Sedum hispanicum* L. ($2n = 40$), *Euphorbia cyparissias* L. ($2n = 40$), *Verbascum densiflorum* Bertol. ($2n = 32+0-4B$) were first examined for the Russian Federation; for *Linum austriacum* L. ($2n = 18$) – from Asian Russia; for *Erigeron annuus* (L.) Pers. ($2n = 27$), *Rorippa sylvestris* (L.) Besser ($2n = 32$) – first for Siberia; for *Medicago sativa* L. ($2n = 32$) – for West Siberia; *Melilotus officinalis* (L.) Pall. ($2n = 16$), *Viola tricolor* L. ($2n = 26$) were first studied for the Republic of Altai. For all species studied, information is provided on the general distribution, the degree of naturalization in the Republic of Altai, as well as literary data on chromosome numbers from the territory of the Russian Federation.

Числа хромосом чужеродных видов во флоре Республики Алтай: сообщение 9

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Ключевые слова: инвазивные виды, кариологическое изучение, расселение видов, Asteraceae, Boraginaceae, Brassicaceae, Crassulaceae, Euphorbiaceae, Fabaceae, Linaceae, Scrophulariaceae, Violaceae.

Аннотация. Приводятся данные о числах хромосом ($2n$) для 12 чужеродных видов, полученные на материале из Республики Алтай. Для определения чисел хромосом (уровня пloidности) использован метод прямого подсчёта в метафазе корневой меристемы. Впервые для России определено число хромосом у *Asperugo procumbens* L. ($2n = 48$), *Hylotelephium spectabile* (Boreau) H. Ohba ($2n = 50$), *Sedum hispanicum* L. ($2n = 40$), *Euphorbia cyparissias* L. ($2n = 40$), *Verbascum densiflorum* Bertol. ($2n = 32+0-4B$); впервые для Азиатской части России – у *Linum austriacum* L. ($2n = 18$); впервые для Сибири – у *Erigeron annuus* (L.) Pers. ($2n = 27$), *Rorippa sylvestris* (L.) Besser ($2n = 32$); впервые для Западной Сибири – у *Medicago sativa* L. ($2n = 32$); впервые для Республики Алтай – у *Melilotus officinalis* (L.) Pall. ($2n = 16$), *Viola tricolor* L. ($2n = 26$). Для всех исследованных видов приводятся сведения по общему распространению, степень натурализации в Республике Алтай, а также литературные данные по числам хромосом с территории России.

We continue the karyological study of alien species in the flora of southern Siberia on the material from the Republic of Altai (Zykova et al., 2024). Data on the chromosome numbers of 12 alien species were obtained. Among them, four species are invasive in the Republic of Altai: *Rorippa sylvestris*, *Medicago sativa*, *M. varia*, *Melilotus officinalis* (Zykova, 2023), three species have been successfully naturalized: *Asperugo procumbens*, *Euphorbia cyparissias*, *Viola tricolor*, five species have recently been discovered on the territory of the republic and so far classified as accidentally introduced species (ephemerophytes): *Hylotelephium spectabile*, *Sedum hispanicum*, *Linum austriacum*, *Verbascum densiflorum*, *Erigeron annuus*. Most species penetrated into the flora of the Republic of Altai from culture; three species are xenophytes, accidentally introduced: *Asperugo procumbens*, *Rorippa sylvestris*, and *Verbascum densiflorum*. For six species, chromosome numbers were studied for the first time on the material from the territory of Russia, for two species – from the territory of Siberia. Latin names of plants are given according to the “Catalogue of Life” (Banki, 2024). 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). Metaphase plates were observed under 100× magnification by the Axioscope 40 (Karl Zeiss, Axio Lab) and photographed by the AxiCam MRc 5 digital camera (AxioVision 4.8 software). The herbarium specimens (vouchers) are deposited in the Herbarium of the Central Siberian Botanical Garden SB RAS (NS, Novosibirsk).

ASTERACEAE

Erigeron annuus (L.) Pers.

2n = 27: “Russian Federation, the Republic of Altai, Mayma district, Mayma village, Sportivny Lane, wasteland near a housing complex. 3 IX 2023. E. Yu. Zykova”, E202–5723 (NS0055658) (Fig. 1A).

Annual. North American species, grown and distributed throughout the Holarctic. In the Republic of Altai ephemerophyte, two locations are known in the Choya district (Zykova et al., 2019) and one in the Mayma district (Zykova, 2024).

This is the first report of the chromosome number from Siberia. The same chromosome number was known in collections from the Sakhalin Region (Probatova et al., 2007, and references therein) and from the Kabardino-Balkarian Republic (Probatova, Krivenko, 2022); **2n = 18** was determined for

the Sakhalin Region (Probatova et al., 2007, and references therein).

Polyploid.

BORAGINACEAE

Asperugo procumbens L.

2n = 48: “Russian Federation, the Republic of Altai, Ulagan district, Aktash village, along the village streets. 26 VII 2013. E. Yu. Zykova”, E264–6813 (NS0055659).

Annual. A weedy species with a Holarctic range, naturalized in the Republic of Altai. It is found in the central and south-eastern regions, judging by the nature of the habitats. The species is alien, probably an archaeophyte (Zykova, 2015).

This is the first report of the chromosome number on the material collected for the Russian Federation. The same chromosome number was known in the European part of the area (Rice et al., 2015).

Polyploid.

BRASSICACEAE

Rorippa sylvestris (L.) Besser

2n = 32: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, an area of the furniture factory, river bank of Mayma, pebble. 22 VII 2023. E. Yu. Zykova, D. I. Zykov”, E291–4123 (NS0059798) (Fig. 1B); “Russian Federation, the Republic of Altai, Gorno-Altaysk city, central park, near the buildings. 31 VIII 2023. E. Yu. Zykova”, E292–5523 (NS0055657).

Perennial. European species with a cosmopolitan secondary range. An invasive species in Siberia (Ebel, 2016) and in the Republic of Altai (Zykova, 2023).

This is the first report of the chromosome number from Siberia. The same chromosome number was reported from the Primorye Territory (Probatova, 2014, and references therein); **2n = 40** was mentioned for the Sakhalin (Probatova et al., 2007, and references therein) and the Leningrad (Agapova et al., 1990, and references therein) Regions, **2n = 48** – from the Krasnodar Territory (Agapova et al., 1990, and references therein).

Polyploid.

CRASSULACEAE

Hylotelephium spectabile (Boreau) H. Ohba

2n = 50: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Kommunisticheskoy Ave., near the roads. 18 VIII 2023. E. Yu. Zykova, D. I. Zykov”, E339–4723 (NS0058610).

Perennial. An East Asian species cultivated throughout the world and sometimes going wild. In the Republic of Altai was recently noted outside of culture, ephemerophyte.

This is the first report of the chromosome number on the material collected for the Russian Federation.

Polyploid.

***Sedum hispanicum* L.**

2n = 40: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Choros-Gurkina street, river bank of Mayma, between the stone slabs of the blind area. 22 VII 2023. E. Yu. Zykova, D. I. Zykov”, E333–4023 (NS0058615).

Perennial. An European-Mediterranean species cultivated and distributed throughout the Holarctic. Recently discovered outside culture in the Republic of Altai, ephemerophyte.

This is the first report of the chromosome number on the material collected in the Russian Federation. Chromosome numbers $2n = 14, 28, 30, 40, 41,$ and 42 have been reported for this species from Europe (Rice et al., 2015).

Polyploid.

EUPHORBIACEAE

***Euphorbia cyparissias* L.**

2n = 40: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Stroiteley street, wasteland. 25 VI 2023. E. Yu. Zykova”, E199–1623 (NS0059797) (Fig. 1C).

Perennial. An European-Mediterranean species with a cosmopolitan secondary range. It is actively grown in the Republic of Altai and naturalized (Zykova, 2024).

This is the first report of the chromosome number on the material collected from the Russian Federation.

Polyploid.

FABACEAE

***Medicago sativa* L.**

2n = 32: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, river bank Mayma, covered with pebbles. 11 VIII 2018. E. Yu. Zykova”, E236–1618 (NS0055662) (Fig. 1D).

Perennial. An Eastern Mediterranean species with a cosmopolitan secondary range. One of the most valuable and widespread forage crops. An invasive species in Siberia (Kovrigina, Tarasova, 2016) and in the Republic of Altai (Zykova, 2023).

This is the first report of the chromosome number for Western Siberia. The number $2n = 16$ was

revealed in collections from the Stavropol Territory (Agapova et al., 1990, and references therein), $2n = 42$ was known in collections from the Irkutsk Region (Chepinoga, 2014, and references therein).

Polyploid.

***Medicago varia* Martyn**

2n = 32: “Russian Federation, the Republic of Altai, Mayma district, Mayma village, Sovetskaya street, at the fences. 13 IX 2023. E. Yu. Zykova”, E294–6323 (NS0059800) (Fig. 1E).

Perennial. A species with a Holarctic range, potentially invasive in Siberia (Ebel et al., 2014), invasive in the Republic of Altai (Zykova, 2023).

The same chromosome number was known in collections from the Novosibirsk (Zykova et al., 2022) and Irkutsk (Krivenko et al., 2015) Regions, the Khabarovsk Territory (Probatova et al., 2017), the Republic of Dagestan (Krivenko et al., 2021), we also confirmed the tetraploid level of samples from Gorno-Altaysk ($2n \approx 32$) by method of flow cytometry (Zykova et al., 2021).

Polyploid.

***Melilotus officinalis* (L.) Pall.**

2n = 16: “Russian Federation, the Republic of Altai, Mayma district, airport vicinity, by the country road. 30 VIII 2023. E. Yu. Zykova”, E227–5323 (NS0055663) (Fig. 1F).

Biennial. A species with a cosmopolitan area, grown as a fodder and melliferous plant. An invasive species in Siberia (Khrustaleva, 2016) and in the Republic of Altai (Zykova, 2023).

The chromosome number is given for the first time for the Republic of Altai. The same number was identified for the Novosibirsk (Pankova et al., 2023) and the Irkutsk (Chepinoga, 2014, and references therein) Regions, Primorye Territory (Probatova, 2014, and references therein), the Sakhalin Region (Probatova et al., 2017), and from the Krasnodar and Stavropol Territories, Kabardino-Balkarian and Chechen Republics, the Republic of Dagestan, the Republic of North Ossetia – Alania (Agapova et al., 1990, and references therein).

Diploid.

LINACEAE

***Linum austriacum* L.**

2n = 18: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Biyskaya street, flowerbeds. 18 VII 2023. E. Yu. Zykova, D. I. Zykov”, E218–3723 (NS0050940) (Fig. 1G).

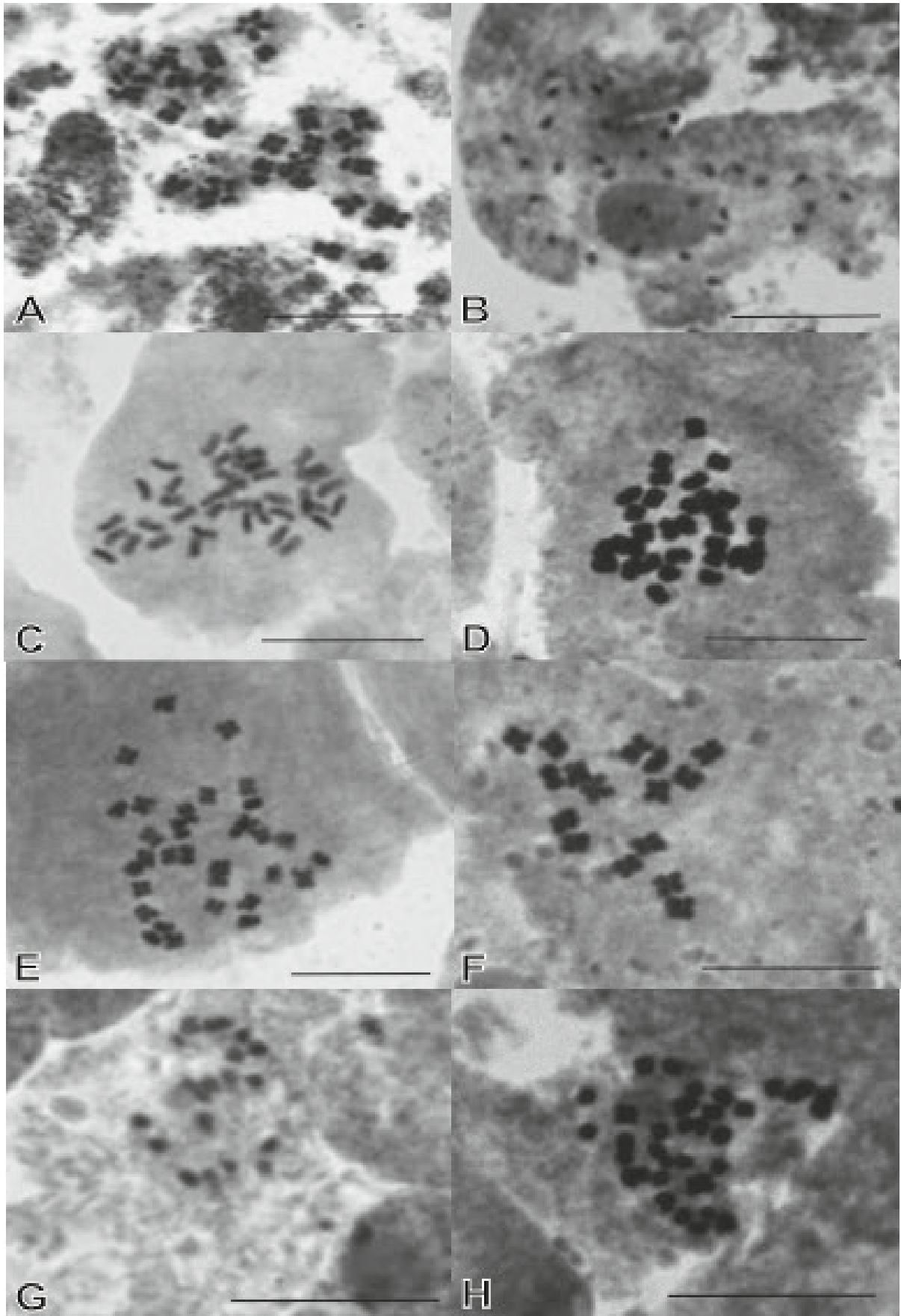


Fig. 1. Mitotic metaphases: A – *Erigeron annuus*, $2n = 27$; B – *Rorippa sylvestris*, $2n = 32$; C – *Euphorbia cyparissias*, $2n = 40$; D – *Medicago sativa*, $2n = 32$; E – *Medicago varia*, $2n = 32$; F – *Melilotus officinalis*, $2n = 16$; G – *Linum austriacum*, $2n = 18$; H – *Verbascum densiflorum*, $2n = 32$; Scale = 10 μm .

Perennial. An European-Mediterranean species. In Siberia it is grown as an ornamental plant and is rare outside cultivation. Recently discovered in the Republic of Altai, ephemerophyte (Shaulo et al., 2024).

This is the first report of the chromosome number on the material collected from Asian Russia. The same number was identified for the Chechen Republic, the Republic of Dagestan, the Republic of North Ossetia–Alania and Stavropol Territory (Magulaev, 1984).

Diploid.

SCROPHULARIACEAE

Verbascum densiflorum Bertol.

$2n = 32+0-4B$: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Panfilovtsev street, wasteland near the “Dynamo” stadium. 3 VII 2023. E. Yu. Zykova”, E334–2123 (NS0058611) (Fig. 1H).

Biennial. An European-Caucasian species. In Siberia it is unknown anywhere except the Republic of Altai, where the species was found in Gorno-Altaysk city, ephemerophyte.

This is the first report of the chromosome number on the material collected from the Russian Federation. Chromosome numbers $2n = 32, 34, 36$ have been reported for this species from Europe (Rice et al., 2015).

Polyploid.

VIOLACEAE

Viola tricolor L.

$2n = 26$: “Russian Federation, the Republic of Altai, Gorno-Altaysk city, Zavodskaya street, by

the road. 2 IX 2023. E. Yu. Zykova”, E244–5623 (NS0059799).

Annual or biennial. An European species often grown as an ornamental. In the Republic of Altai it is rarely found in the northern regions, naturalized (Zykova, 2015).

The chromosome number is given for the first time for the Republic of Altai. The same number has been determined for the Altai Territory (An'kova, Zykova, 2018), Irkutsk Region (Chepinoga, 2014, and references therein), Kamchatka Territory (Probatova, Chernyagina, 2019).

Polyploid.

Conclusion

The chromosomal numbers of 12 species alien to the Republic of Altai were studied, ten of them are polyploids, two are diploids. One of the diploids species is *Melilotus officinalis*, which is invasive on the territory of the republic, the other is *Linum austriacum*, recently discovered, with an uncertain invasive status.

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