

IAPT CHROMOSOME DATA

IAPT chromosome data 29

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DOI <https://doi.org/10.1002/tax.12130>

IAPT chromosome data 29/1

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All materials CHN.

The study was supported by the budgetary project of CSBG SB RAS No. 03 12-2016-0001 within the framework of the State Assignment and the Russian Foundation for Basic Research (grant 18-04-01030 to A.V. Agafonov).

POACEAE

Elymus charkeviczii Prob., $2n = 28$; Russia, Kamchatka Peninsula, A. Agafonov & B. Salomon s.n. (NSK 0064806, 0064807).

Elymus kamczadalarum (Nevski) Tzvelev, $2n = 28$, Russia, Kamchatka Peninsula, A. Agafonov & B. Salomon s.n. (NSK 0064814, 0064815).

Elymus komarovii (Nevski) Tzvelev, $2n = 28$, Russia, Buryatia Republic, D. Gerus & A. Agafonov s.n. (NSK 0064808, 0064809).

Elymus margaritae A.V. Agaf., Kobozeva & B. Salomon, $2n = 28$, Russia, Altai Republic, D. Nikonova & E. Kobozeva s.n. (NSK 0064816, 0064817).

Elymus peschkovae Tzvelev, $2n = 28$, Russia, Amurskaja oblast', O. Potemkin s.n. (NSK 0064810, 0064811).

Elymus subfibrosus (Tzvelev) Tzvelev, $2n = 28$, Russia, Kamchatka Peninsula, S. Asbaganov s.n. (NSK 0064812, 0064813).

Elymus uralensis (Nevski) Tzvelev, $2n = 28$, Russia, Bashkortostan Republic, A. Agafonov & S. Asbaganov s.n. (NSK 0065093, 0065094).

Elymus viridiglumis (Nevski) Czerep., $2n = 28$, Russia, Bashkortostan Republic, A. Agafonov & S. Asbaganov s.n. (NSK 0065091, 0065092).

IAPT chromosome data 29/2

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Chromosomes counted and DNA ploidy levels estimated by A. Krahulcová; CHN/FCM = chromosome number determined in mature plants collected in the field; CHN^N/FCM^N = chromosome number/DNA ploidy level determined in cultivated plants grown from seeds sampled in the field; collectors: AK = A. Krahulcová, AKL = A. Klaudivsová, BM = B. Mandák, FK = F. Krahulec, FS = F. Schuhwerk, GMS = G. Mateo Sanz, HK = H. Kudoh, JAR = J.A. Rosselló, JCH = J. Chrtek jun., JD = J. Danihelka, JL = J. Lihová, JS = J. Štěpánek, JŠT = J. Štěpánková, KM = K. Marhold, LM = L. Majeský, LT = L. Tassenkiewicz,

All materials for the IAPT Chromosome Data column should be submitted electronically to Karol Marhold (karol.marhold@savba.sk). The full version of this contribution is available in the online edition of TAXON appended to this article. The following citation format is recommended: Dorogina, O.V., Emtseva, M.V., Agafonov, A.V. & Asbaganov, S.V. 2019. IAPT chromosome data 29/1. In: Marhold, K. (ed.) & al., IAPT chromosome data 29. *Taxon* 68: 880, E1–E2.

MD = M. Duchoslav, *MŠ* = M. Štech, *OR* = O. Rotreklová, *PS* = P. Sekerka, *PT* = P. Tomšovic, *SB* = S. Bräutigam, *TP* = T. Pochynok, *TU* = T. Urfus, *VH* = V. Hadincová, *VJ* = V. Jarolímová, *VM* = V. Mahelka, *VV* = V. Vyshnevskiy, *ZK* = Z. Kaplan, *ZS* = Z. Skála; vouchers in PRA.

APIACEAE

Pimpinella nigra Mill., $2n = 2x = 20$, CHN; Czech Republic, *AK*, *JŠT* & *AKL* 74/90. $2n = 4x = 40$, CHN^s; Czech Republic, *FK* 130/90; CHN; Slovakia, *FK* 67/91.

Pimpinella saxifraga L., $2n = 2x = 20$, CHN; Czech Republic, *ZS* & *AKL* Z104/92, *FK* & *AK* 88/89, *FK* & *AK* 192/89. $2n = 4x = 40$, CHN; Czech Republic, *FK* & *AK* 111/87, *FK* & *AK* 164/89, *AK*, *JŠT* & *AKL* 54/90.

ASTERACEAE

Pilosella aurantiaca (L.) F.W.Schultz & Sch.Bip., $2n \sim 3x \sim 27$, FCM; Slovakia, *LM* 2154AU, *LM* 2157AU, *LM* 2158AU, *LM* 2160AU, *LM* 2162AU; FCM^s; Ukraine, *LT* 2120AU2, *LT* 2120AU4. $2n \sim 4x \sim 36$, FCM; Japan, *JL*, *KM* & *HK* JPAU58, *JL*, *KM* & *HK* JPAU61, *JL*, *KM* & *HK* JPAU45/90, *JL*, *KM* & *HK* JPAU45/20/22/8, *JL*, *KM* & *HK* JPAU80/10/1, *JL*, *KM* & *HK* JPAU80/10/2, *JL*, *KM* & *HK* JPAU80/10/4, *JL*, *KM* & *HK* JPAU64; Kazakhstan, *JŠ* 1656AU, *JŠ* 1657AU, *JŠ* 1658AU; Romania, *TU* 2122AU, *TU* 2123AU, *TU* 2124AU; FCM^s; Ukraine, *LT* 2007AU, *LT* 2008AU1, *TP* 2163AU, *VV* 2166AU. $2n = 5x = 45$, CHN; Czech Republic, *ZK* 2151/8AU. $2n \sim 5x \sim 45$, FCM; Czech Republic, *ZK* 2151/2AU, *FK* 2221AU; FCM^s; Ukraine, *LT* 2008AU2.

Pilosella bauhini (Schult.) Arv.-Touv., $2n = 4x = 36$, CHN; Slovakia, *FK* & *AK* 583BA. $2n \sim 4x \sim 36$, FCM; Montenegro, *BM* & *VH* 2002BA. $2n = 5x = 45$, CHN; Czech Republic, *FK* 1036BA. $2n \sim 5x = 45$, FCM; Bulgaria, *JCH* & *JŠT* 1160BA; Czech Republic, *FK* 937BA, *FK* 938BA, *FK* 590BA. $2n \sim 6x \sim 54$, FCM; Bulgaria, *JCH* & *JŠT* 1159BA; Czech Republic, *FK* 941BA, *FK* 1035BA, *FK* 1037BA.

Pilosella bauhini (Schult.) Arv.-Touv. subsp. *bauhini*, $2n = 5x = 45$, CHN; Czech Republic, *FK* & *VM* 1079BA. $2n \sim 5x \sim 45$, FCM; Czech Republic, *FK* 943BA, *FK* & *VM* 1080BA.

Pilosella bauhini subsp. *magyarica* (Peter) S.Bräut., $2n = 4x = 36$, CHN; Slovakia, *FK* 274/3BA.

Pilosella brachiata (DC.) F.W.Schultz & Sch.Bip., $2n > 5x = 48$, CHN (aneuploid); Czech Republic, *FK*, *OR* & *JD* 678BRA. $2n \sim 5x = 45$, FCM; Czech Republic, *FK* & *VM* 1171BRA, *FK* & *VM* 1172BRA.

Pilosella breviscapa (DC.) Soják, $2n \sim 2x \sim 18$, FCM; Andorra, *JCH*, *GMS* & *JAR* 1182aBREV.

Pilosella caespitosa (Dumort.) P.D.Sell & C.West, $2n \sim 4x \sim 36$, FCM; Poland, *FK* 2219.

Pilosella fusca (Vill.) Arv.-Touv., $2n \sim 4x \sim 36$, FCM; Austria, *FK*, *FS* & *AK* 807FU.

Pilosella glomerata (Froel.) Fr., $2n \sim 4x \sim 36$, FCM; Czech Republic, *FK* 1034GL.

Pilosella hoppeana (Schult.) F.W.Schultz & Sch.Bip., $2n \sim 2x \sim 18$, FCM; Austria, *FK*, *FS* & *AK* 794HO.

Pilosella macranthela (Nägeli & Peter) Soják, $2n \sim 4x \sim 36$, FCM; Czech Republic, *FK* & *SB* 579MAC.

Pilosella officinarum Vaill., $2n = 4x = 36$, CHN; Czech Republic, *FK* 308PI. $2n \sim 4x \sim 36$, FCM; Czech Republic, *FK* 942PI, *FK*, *OR* & *JD* 680PI; France, *PS* 2005PIa. $2n = 5x = 45$, CHN; Czech Republic, *FK* & *OR* 668PI; Slovakia, *LM* 2156. $2n = 6x = 54$, CHN; Romania, *TU* 2121; Slovakia, *LM* 2159. $2n \sim 6x \sim 54$, FCM; Slovakia, *FK* 1186PI; Slovenia, *FK* & *AK* 1176PI.

Pilosella pavichii (Heuff.) Arv.-Touv., $2n = 2x = 18$, CHN^s; Slovenia, *FK* 1175PIS. $2n \sim 2x \sim 18$, FCM; Slovenia, *AK* & *FK* 1177PIS, *FK* 1174PIS.

Pilosella piloselloides (Vill.) Soják, $2n \sim 4x \sim 36$, FCM; Croatia, *MD* 1552PIS, *MD* 1554PIS; Poland, *FK* 2218. $2n \sim 5x \sim 45$, FCM; Czech Republic, *FK*, *OR* & *JD* 677PIS.

Pilosella pseudopilosella (Ten.) Soják, $2n \sim 3x \sim 27$, FCM; Spain, *JCH*, *GMS* & *JAR* 1178cPSPI.

Pilosella scandinavica (Dahlst.) Schljakov, $2n \sim 4x \sim 36$, FCM; Czech Republic, *FK* 2220.

Pilosella stoloniflora (Waldst. & Kit.) F.W.Schultz & Sch.Bip., $2n \sim 6x \sim 54$, FCM; Austria, *FK*, *FS* & *AK* 792SF.

Pilosella subtardans (Nägeli & Peter) Soják, $2n \sim 4x \sim 36$, FCM; Spain, *JCH*, *GMS* & *JAR* 1181SUBT.

Tragopogon porrifolius L., $2n \sim 2x \sim 12$, FCM^s; concluded from 2C-value in eight progeny plants (range = 6.15–6.26 pg DNA); New Zealand, *FK* & *AK* TRAGPORNZ1, *FK* & *AK* TRAGPORNZ2, *FK* & *AK* TRAGPORNZ3, *FK* & *AK* TRAGPORNZ4, *FK* & *AK* TRAGPORNZ6, *FK* & *AK* TRAGPORNZ8, *FK* & *AK* TRAGPORNZ9, *FK* & *AK* TRAGPORNZ10.

Tragopogon pratensis L. subsp. *pratensis*, $2n \sim 2x \sim 12$, FCM; concluded from 2C-value (5.16 pg DNA); Czech Republic, *FK* & *ZK* TRAGPRAT7.

CAMPANULACEAE

Campanula patula L., $2n = 4x = 40$, CHN^s; Slovenia, *AK* 11/95, *AK* 12/95, *MŠ* 13/95.

LAMIACEAE

Galeopsis speciosa Mill., $2n = 2x = 16$, CHN; Czech Republic, *FK* 1/94.

RANUNCULACEAE

Pulsatilla vulgaris subsp. *grandis* (Wender.) Zämelis, $2n = 4x = 32$, CHN^s; Czech Republic, *PT*, *AK* & *VJ* 26/90.

VIOLACEAE

Viola arvensis Murray, $2n = 2x = 34$, CHN; Czech Republic, *FK* & *AK* V46C.

Viola tricolor subsp. *polychroma* (A.Kern.) Nyman, $2n = 2x = 26$, CHN; Czech Republic, *JCH* V51, *JŠ* V57B.

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All materials CNH; collected in the Republic of Kazakhstan, Almaty Region, collectors: *BO* = B. Osmonali, *MD* = M. Danilov, *ML* = M. Lomonosova; vouchers in NS.

This study was partially financially supported by the Russian Foundation for Basic Research (grants 15-29-02664; 19-04-00546 to M. Lomonosova) and by the Scientific program AAAA-A17-117012610055-3 of the Central Siberian Botanical Garden, SB RAS.

AMARANTHACEAE

Agriophyllum arenarium M.Bieb., $2n = 18$; *ML* & *MD* 1382b. *Atriplex tatarica* L., $2n = 18$; *ML*, *MD* & *BO* 1384b.

Bassia hyssopifolia (Pall.) Kuntze, $2n = 18$; *ML, MD & BO 1384a*.
Blitum virgatum L. (*Chenopodium foliosum* Asch.), $2n = 18$; *ML, MD & BO 1374b*.
Chenopodium karoii (Murr) Aellen, $2n = 36$; *ML, MD & BO 1377a*.
Chenopodium strictum Roth, $2n = 36$; *ML & MD 1373a*.
Corispermum chinganicum Iljin, $2n = 18$; *ML & MD 1381a*.
Suaeda altissima (L.) Pall., $2n = 18$; *ML, MD & BO 1387*.
Suaeda linifolia Pall., $2n = 18$; *ML, MD & BO 1386c*.
Suaeda salsa (L.) Pall., $2n = 36$; *ML, MD & BO 1384d*.
Suaeda stellatiflora G.L.Chu, $2n = 18$; *ML, MD & BO 1384k*.

IAPT chromosome data 29/4

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UMBELLIFERAE/APIACEAE

Aulacospermum roseum Korovin, $2n = 18$; Tajikistan, *EK, UU & AK 13-15* (MW).
Eryngium macrocalyx Schrenk, $2n = 16$; Tajikistan, *EK, UU & AK 130-15* (MW).
Heracleum olgae Regel & Schmalh., $2n = 22$; Kyrgyzstan, 9 Sep 2015, *EK & UU s.n.* (MW).
Heracleum pinnatum C.B.Clarke, $2n = 22$; India, *UU 12-16; UU 13-16* (MW).
Pimpinella peregrina L., $2n = 18$; Tajikistan, *EK, UU & AK 131-15* (MW).
Pleurospermum uralense Hoffm., $n = 9$; Kazakhstan, 19 Jun 2015, *UU s.n.* (MW).
Prangos ornata Kuzmina, $2n = 22$; Tajikistan, 12 Sep 2015, *EK, UU & AK s.n.* (MW).
Sanicula giraldii H. Wolff, $n = 8$; Kazakhstan, 18 Jun 2015, *UU s.n.* (Herbarium of Altaiskii Botanical Garden, Kazakhstan).
Semenovia dasycarpa (Regel & Schmalh.) Korovin ex Pimenov & V.N.Tikhom., $n = 11$; Tajikistan, *MP, EK & UU 23-15* (MW).
Semenovia dissectifolia Ukrainsk. & Kljuykov, $2n = 22$; Tajikistan, *EK, UU & EZ 19-11; EK, UU & EZ 49-11* (MW).
Semenovia heterodonta (Korovin) Manden., $n = 11$; Tajikistan, *MP, EK & UU 2-12* (MW).
Semenovia imbricata Ukrainsk. & Kljuykov, $2n = 22$; Tajikistan, *EK, UU & EZ 13-11; EK, UU & EZ 24-11* (MW).
Semenovia pamirica (Lipsky) Manden., $2n = 44$; Tajikistan, *EK, UU & EZ 48-11* (MW); $2n = 22$; Tajikistan, *MP, EK, UU & D. Navrusschoev 103-13* (MW).
Semenovia transiliensis Regel & Herder, $2n = 22$; Kazakhstan, *MP & EK 2-11* (MW).
Semenovia vachanica Ukrainsk. & Kljuykov, $2n = 22$; Tajikistan, *EK, UU & EZ 28-11* (MW).
Seseli afghanicum (Podlech) Pimenov, $n = 11$; Afghanistan, *MP, EK & UU 68-13* (MW).
Seseli tenuisectum Regel & Schmalh., $2n = 20$; Kyrgyzstan, *EK & UU 6-15* (MW); Tajikistan, *EK, UU & AK 8-15* (MW); 13 Sep 2015, *EK, UU & AK s.n.* (MW).
Stenocoelium athamantoides (M.Bieb.) Ledeb., $2n = 20$; Russia, 10 Aug 2015, *M.N. Dirks s.n.* (TK).

Trinia hispida Hoffm., $2n = 18$; Kazakhstan, *EK 6-14* (MW).
Turgenia latifolia (L.) Hoffm., $2n = 18$; Kazakhstan, 3 Jul 2015, *A.L. Ebel s.n.* (TK); Tajikistan, 8 Aug 2015, *AK s.n.* (MW); $2n = 32$; Tajikistan, 13 Sep 2015, *EK, UU & AK s.n.* (MW).

IAPT chromosome data 29/5

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All materials CHN; collectors: *EK* = E.V. Kljuykov, *EZ* = E.A. Zakharova; *FC* = F. Conti, *MP* = M.G. Pimenov, *SP* = S.E. Petrova, *UU* = U.A. Ukrainskaja; vouchers in MW.

This study was supported by grant 16-04-00525A from the Russian Foundation for Basic Research (RFBR).

UMBELLIFERAE/APIACEAE

Carum appuanum (Viv.) Grande, $2n = 22$; Italy, *EZ, EK & UU 23-14*.
Carum appuanum subsp. *bulgaricum* (Hartvig) Bechi & Garbari, $2n = 22$; Greece, *EZ & SP 16-15*.
Carum appuanum subsp. *palmatum* (Hartvig) Bechi & Garbari, $2n = 22$; Greece, *EZ & SP 10-15*.
Carum atlanticum Litard. & Maire, $2n = 22$; Morocco, *UU, EZ & MP 11-13*.
Carum flexuosum (Ten.) Nyman, $n = 10$; Italy, *EZ, FC, EK & UU 37-14; 2n = 20; Italy, *EZ, FC, EK & UU 34-14*.
Carum graecum Boiss. & Heldr., $n = 11$; Greece, *EZ & UU 29-12*.
Carum graecum subsp. *serpentinicum* Hartvig, $2n = 22$; Greece, *EZ & SP 23-15*.
Carum heldreichii Boiss., $n = 10$; Greece, *EZ & UU 11-12*.
Carum jahandiezii Litard. & Maire, $n = 11$, $2n = 22$; Morocco, *EZ, MP & UU 56-13*.
Carum lacuum Emb., $n = 11$, $2n = 22$; Morocco, *EZ, MP & UU 38-13*.
Carum meoides (Griseb.) Halácsy, $n = 10$; Greece, *EZ & UU 32-12*.
Hellenocarum multiflorum (Sm.) H. Wolff, $2n = 20$; Greece, *EZ & UU 1-12*.*

IAPT chromosome data 29/6

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All materials CHN; collected in Himachal Pradesh, India; collectors: *HS* = Harminder Singh, *PK* = Puneet Kumar; vouchers in BSD.

The study was supported by financial grant under SERB-DST-Start Up Research Grant (Young Scientists) (vide SERB sanction No. SB/YS/LS-182/2014 dated 8 September, 2015).

POACEAE

Alopecurus arundinaceus Poir., $n = 14$; *HS & PK 126487*.
Arthraxon prionodes (Steud.) Dandy, $n = 10$; *HS & PK 126330*.
Bromus pectinatus Thunb., $n = 14$; *HS & PK 126455*.

- Calamagrostis pseudophragmites* (Haller f.) Koeler, *n* = 15; HS & PK 126315.
- Chrysopogon gryllus* (L.) Trin., *n* = 10; HS & PK 126316.
- Dactylis glomerata* L., *n* = 7; HS & PK 126493.
- Digitaria sanguinalis* (L.) Scop., *n* = 36; HS & PK 126331.
- Elymus nutans* Griseb., *n* = 21; HS & PK 126485.
- Elymus semicostatus* (Nees ex Steud.) Melderis, *n* = 14; HS & PK 126337.
- Eragrostis minor* Host, *n* = 20; HS & PK 126480.
- Festuca rubra* L., *n* = 21; HS & PK 126490.
- Glyceria tonglensis* C.B.Clarke, *n* = 10; HS & PK 126341.
- Hordeum vulgare* L., *n* = 21; HS & PK 126410.
- Pennisetum orientale* Rich., *n* = 18; HS & PK 126321.
- Phacelurus speciosus* (Steud.) C.E.Hubb., *n* = 10; HS & PK 126421.
- Piptatherum munroi* (Stapf) Mez, *n* = 12; HS & PK 126416.
- Phleum alpinum* L., *n* = 14; HS & PK 126336.
- Poa alpina* L., *n* = 14; HS & PK 126449.
- Poa annua* L., *n* = 14; HS & PK 126317.
- Poa lahulensis* Bor, *n* = 7; HS & PK 126492.
- Poa stewartiana* Bor, *n* = 7; HS & PK 126311.
- Saccharum ravennae* (L.) L., *n* = 11; HS & PK 126326.
- Setaria viridis* (L.) P.Beauv., *n* = 9; HS & PK 126314.

IAPT CHROMOSOME DATA

IAPT chromosome data 29 – Extended version

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IAPT chromosome data 29/1

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* First chromosome count from the given regions.

The study was supported by the budgetary project of CSBG SB RAS No. 03 12-2016-0001 within the framework of the State Assignment and the Russian Foundation for Basic Research (grant 18-04-01030 to A. V. Agafonov).

POACEAE

Elymus charkeviczii Prob.

* $2n = 28$, CHN. Russia, Kamchatka Peninsula, Bistrinskii Rajon, Esso village, bushes along dirt-road, 55°55'00.84"N, 158°42'06.96"E, 2 Aug 1996, A. Agafonov & B. Salomon s.n. (NSK 0064806, 0064807) [Fig. 1A].

Elymus kamczadalarum (Nevski) Tzvelev

* $2n = 28$, CHN. Russia, Kamchatka Peninsula, Elizovskii Rajon, Sosnovka village, bushes along road, 53°05'02.76"N, 158°17'55.08"E, 29 Jul 1996, A. Agafonov & B. Salomon s.n. (NSK 0064814, 0064815) [Fig. 1B].

Elymus komarovii (Nevski) Tzvelev

* $2n = 28$, CHN. Russia, Buryatia Republic, Okinskii Rajon, meadow in open woodland near Gargan river, 52°05'58.80"N, 100°22'52.44"E, 4 Aug 2005, D. Gerus & A. Agafonov s.n. (NSK 0064808, 0064809) [Fig. 1C].

Elymus margaritae A.V.Agaf., Kobozeva & B.Salomon

* $2n = 28$, CHN. Russia, Altai Republic, Ust-Koksinskii Rajon, alm of Mt. Krasnaya, 52°05'58.80"N, 100°22'52.44"E, 1 Aug 2010, D. Nikonova & E. Kobozeva s.n. (NSK 0064816, 0064817) [Fig. 1D].

Elymus peschkovae Tzvelev

* $2n = 28$, CHN. Russia, Amurskaja Oblast', 60 km down Giljuy-river from Tinda town, sand bank, 54°56'13"N, 125°21'51"E, 28 Jul 1988, O. Potemkin s.n. (NSK 064810, 0064811) [Fig. 1E].

Elymus subfibrosus (Tzvelev) Tzvelev

* $2n = 28$, CHN. Russia, Kamchatka Peninsula, near Elizovo town, meadow on the border of deciduous forest, 53°12'01"N, 158°23'30"E, 30 Jul 2012, S. Asbaganov s.n. (NSK 0064812, 0064813) [Fig. 1F].

Elymus uralensis (Nevski) Tzvelev

* $2n = 28$, CHN. Russia, Bashkortostan Republic, Ural Range, near Novoabzakovo, birch woodland, 53°48'06"N 58°37'56"E, 30 Jul 2016, A. Agafonov & S. Asbaganov s.n. (NSK 0065093, 0065094) [Fig. 1G].

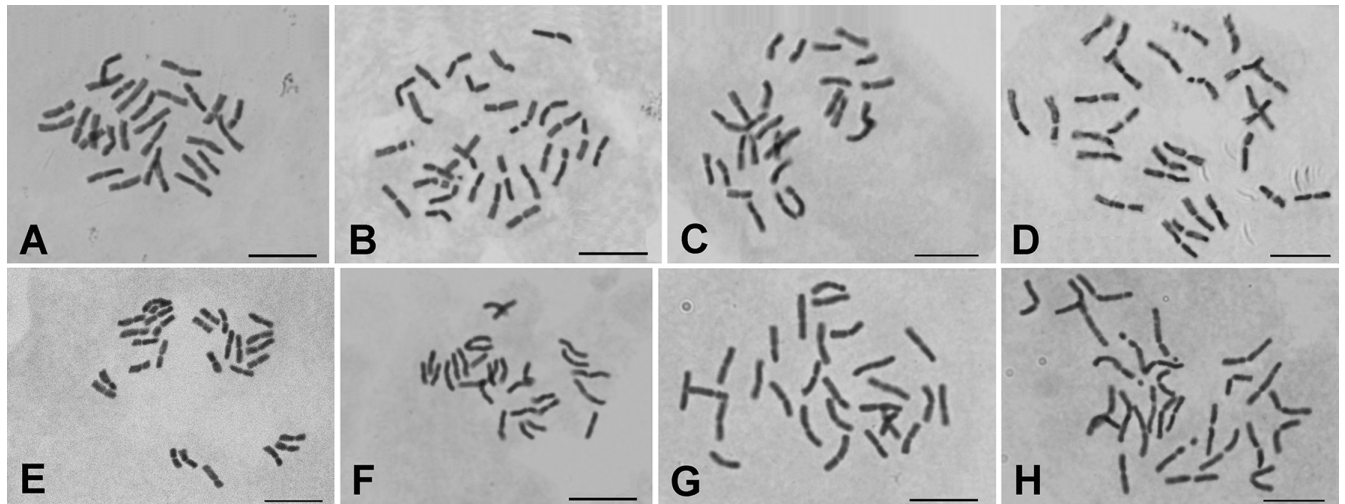


Fig. 1. Mitotic metaphases, $2n = 28$. **A**, *Elymus charkevicii*; **B**, *Elymus kamczadalarum*; **C**, *Elymus komarovii*; **D**, *Elymus margaritae*; **E**, *Elymus peschkovae*; **F**, *Elymus subfibrosus*; **G**, *Elymus uralensis*; **H**, *Elymus viridiglumis*. — Scale bars = 10 μm .

Elymus viridiglumis (Nevski) Czerep.

* $2n = 28$, CHN. Russia, Bashkortostan Republic, Ural Range, near Novoabzakov, Mt. Kurkak, high-grass meadow in a birch forest, 53°48'43"N 58°40'23"E, 28 Jul 2016, A. Agafonov & S. Asbaganov s.n. (NSK 0065091, 0065092) [Fig. 1H].

It is known that the allopolyploid genome of different species of the genus *Elymus* L. (Poaceae: Triticeae) is formed by at least five haploms of different origin (Dewey, 1984; Löve, 1984; Mason-Gamer & al., 2010). Earlier in the study of sequences of the nuclear gene encoding the enzyme granule bound starch synthase I (GBSSI), we obtained data that many endemic allopolyploid species of the genus *Elymus* from Siberia and the Far East of Russia contain the genomes St and H (Kobozeva & al., 2018). The presence of different gene clones on both genomes in most species allowed to admit the hexaploid constitution of some species with haploid formula $\text{St}_1\text{St}_2\text{H}$ or StH_1H_2 . That is why it was necessary to establish the exact number of chromosomes corresponding to either allotetraploidy or allohexaploid formula of each of the species.

As a result, the chromosome number $2n = 28$ was established in all studied species, which corresponds to the genomic formula StH .

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IAPT chromosome data 29/2

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Anna Krahulcová counted the chromosomes, estimated both the DNA ploidy levels in *Pilosella* and the genome sizes (2C-values) in *Tragopogon*. If not otherwise stated, the chromosome counts/DNA ploidy levels/genome sizes refer to cultivated plants that originated from the field. In designated cases, the karyological data refer to cultivated progeny plants that were grown from seeds collected in the field. The nomenclature follows the database Euro+Med (2006–).

* First DNA ploidy level for the species.

** First chromosome count/DNA ploidy level/genome size for a given country.

APIACEAE

Pimpinella nigra Mill.

$2n = 2x = 20$, CHN. Czech Republic, south Moravia, Protected landscape area Pálava, Děvín Hill, town of Mikulov, ca. 400 m, 48°12'50"N, 16°38'40"E, 15 May 1990, A. Krahulcová, J. Štěpánková & A. Klaudivsová 74/90 (PRA).

$2n = 4x = 40$, CHN in cultivated progeny plants. Czech Republic, central Bohemia, village of Pitkovice (part of capital town of Praha), Nature monument Pitkovická stráž, 280 m, 50°01'30"N, 14°35'20"E, 14 Oct 1990, F. Krahulec 130/90 (PRA); CHN. **Slovakia, Cerová vrchovina Highlands, Soví vrch Hill between village of Hajnáčka and village of Šurice, 280 m, 48°13'30"N, 19°55'00"E, 1 Sep 1991, F. Krahulec 67/91 (PRA).

Pimpinella saxifraga L.

$2n = 2x = 20$, CHN. Czech Republic, southwestern Bohemia, Nature reserve Drahotínský les, between village of Hvožďany and village of Drahotín near town of Domažlice, serpentine rocks, 480 m, 49°30'50"N, 12°46'00"E, 4 Jun 1992, Z. Skála & A. Klaudivsová Z104/92 (PRA); Czech Republic, central Bohemia, National nature monument Hadce u Želivky, village of Bernartice, serpentine

rocks, 410–420 m, 49°41'15"N, 15°06'20"E, 20 Apr 1989 and 24 Aug 1989, *F. Krahulec & A. Krahulcová 88/89*, *F. Krahulec & A. Krahulcová 192/89* (PRA).

$2n = 4x = 40$, CHN. Czech Republic, northeastern Bohemia, Dobrošov Hill near town of Náchod, 620 m, 50°24'00"N, 16°11'45"E, 20 Aug 1987, *F. Krahulec & A. Krahulcová 111/87* (PRA); Czech Republic, northeastern Bohemia, village of Nový Hrádek near town of Náchod, ca. 570 m, 50°21'29"N, 16°14'34"E, 7 Aug 1989, *F. Krahulec & A. Krahulcová 164/89* (PRA); Czech Republic, southwestern Moravia, National nature reserve Mohelenská hadcová step, village of Mohelno, serpentine bedrock, 290 m, 49°05'50"N, 16°12'15"E, 14 May 1990, *A. Krahulcová, J. Štěpánková & A. Klaudivisová 54/90* (PRA).

ASTERACEAE

Pilosella aurantiaca (L.) F.W.Schultz & Sch.Bip.

$2n \sim 3x \sim 27$, FCM. **Slovakia, Čergov Mts, Minčol Mt, 1130–1140 m, 49°14'07"N, 20°59'17"E, Jul 2013, *L. Majeský 2154AU*, *L. Majeský 2157AU*, *L. Majeský 2158AU*, *L. Majeský 2160AU*, *L. Majeský 2162AU* (PRA). $2n \sim 3x \sim 27$, FCM in cultivated progeny plants. **Ukraine, Ivano-Frankivsk Region, Hryniavski Mts, village of Holoshyna, 1387 m, 47°53'59.6"N, 24°49'15.9"E, Sep 2012, *L. Tassenkiewicz 2120AU2*, *L. Tassenkiewicz 2120AU4* (PRA).

$2n \sim 4x \sim 36$, FCM. **Japan, Hokkaido, Kamikawa-gun, Bieicho, on road 70 near the border to Ashibetsu-shi, 510 m, 43°28'56.8"N, 142°22'10.8"E, 27 Jun 2003, *J. Lihová, K. Marhold & H. Kudoh JPAU58* (PRA); Japan, Hokkaido, Kamikawa-gun, Bieicho, Kibou-Bashi, 780 m, 43°27'34.8"N, 142°38'39.2"E, 27 Jun 2003, *J. Lihová, K. Marhold & H. Kudoh JPAU61* (PRA); Japan, Hokkaido, Hirutagun, Kutchango, Hirafu, lake Hangeotsu, 300 m, 42°50'48.2"N, 140°45'07.5"E, 22 Jun 2003, *J. Lihová, K. Marhold & H. Kudoh JPAU45/90*, *J. Lihová, K. Marhold & H. Kudoh JPAU45/20/22/8* (PRA); Japan, Hokkaido, Takomai-shi, Maruyama, upstream of Yufutsu river, 160 m, 42°45'22.6"N, 141°26'51.9"E, 5 Jul 2003, *J. Lihová, K. Marhold & H. Kudoh JPAU80/10/1*, *J. Lihová, K. Marhold & H. Kudoh JPAU80/10/2*, *J. Lihová, K. Marhold & H. Kudoh JPAU80/10/4* (PRA); Japan, Hokkaido, Uryu-gun, Horokanaicho, lake Shumarinai, 298 m, 44°18'06.4"N, 142°10'57.6"E, 29 Jun 2003, *J. Lihová, K. Marhold & H. Kudoh JPAU64* (PRA); **Kazakhstan, Almaty Region, Zalinskij Alatau Mts, valley of Kiši Almaty river, 2400–2450 m, 43°06'42"N, 77°04'30"E, 12 Jun 2008, *J. Štěpánek 1656AU*, *J. Štěpánek 1657AU*, *J. Štěpánek 1658AU* (PRA); **Romania, Hasmas Mts, ca. 5 km west of village of Trei Fântâni, 1341 m, 46°42'44.6"N, 25°47'04.3"E, 25 Jun 2013, *T. Urfus 2122AU*, *T. Urfus 2123AU*, *T. Urfus 2124AU* (PRA).

$2n \sim 4x \sim 36$, FCM in cultivated progeny plants. **Ukraine, Putylski Region, Hryniavski Mts, village of Shepit, 1105 m, 47°45'07"N, 25°06'21"E, 28 Jul 2011, *L. Tassenkiewicz 2007AU* (PRA); Ukraine, Putylski Region, Chorny Dil Mts, village of Sarata, 1456 m, 47°46'26.2"N, 24°57'43.1"E, 18 Jul 2011, *L. Tassenkiewicz 2008AU1* (PRA); Ukraine, town of Lviv, 340 m, 49°48'33.4"N, 24°00'42.3"E, 24 Nov 2013, *T. Pochynok 2163AU* (PRA); Ukraine, town of Lviv, 350 m, 49°47'25"N, 24°03'28"E, 3 Oct 2013, *V. Vyshnevskiy 2166AU* (PRA).

$2n = 5x = 45$, CHN. Czech Republic, Protected landscape area Jeseníky, Hrubý Jeseník Mts, corrie of Velká kotlina (bottom part), ca. 3.5 km northwest of village of Karlov pod Pradědem, 1310 m, 50°03'15.8"N, 17°14'23.4"E, 8 Jul 2013, *Z. Kaplan 2151/8AU* (PRA).

$2n \sim 5x \sim 45$, FCM. Czech Republic, Protected landscape area Jeseníky, Hrubý Jeseník Mts, corrie of Velká kotlina (bottom part), ca. 3.5 km northwest of village of Karlov pod Pradědem, 1310 m, 50°03'15.8"N, 17°14'23.4"E, 8 Jul 2013, *Z. Kaplan 2151/2AU*

(PRA); Czech Republic, Protected landscape area Jeseníky, Hrubý Jeseník Mts, village of Loučná nad Desnou, close to chapel and former chalet Vřesová Studánka, 1280 m, 50°08'43.5"N, 17°08'03.1"E, 8 Jul 2015, *F. Krahulec 2221AU* (PRA).

$2n \sim 5x \sim 45$, FCM in cultivated progeny plant. **Ukraine, Putylski region, Chorny Dil Mts, village of Sarata, 1456 m, 47°46'26.2"N, 24°57'43.1"E, 18 Jul 2011, *L. Tassenkiewicz 2008AU2* (PRA).

Pilosella bauhini (Schult.) Arv.-Touv.

$2n = 4x = 36$, CHN. Slovakia, Chočské vrchy Hills, village of Prosieck, 644 m, 49°09'30"N, 19°29'54"E, 15 Jul 2001, *F. Krahulec & A. Krahulcová 583BA* (PRA).

$2n \sim 4x \sim 36$, FCM. Montenegro, Durmitor National park, canyon of Tara river, village of Durđevica Tara, 649 m, 43°08'52"N, 19°17'49"E, 7 Sep 2011, *B. Mandák & V. Hadincová 2002BA* (PRA).

$2n = 5x = 45$, CHN. Czech Republic, central Moravia, town of Olomouc, city part of Holice, 210 m, 49°34'40"N, 17°17'00"E, 24 May 2005, *F. Krahulec 1036BA* (PRA).

$2n \sim 5x \sim 45$, FCM. Bulgaria, Pirin Mts, between chalet of Vihren and town of Bansko, 1950 m, 41°45'41"N, 23°25'02"E, 29 Jul 2004, *J. Chrtek & J. Štěpánková 1160BA* (PRA); Czech Republic, northeastern Bohemia, town of Česká Skalice, margin of the wood Rousín, 300 m, 50°23'00"N, 16°02'45"E, Sep 2004, *F. Krahulec 937BA*, *F. Krahulec 938BA* (PRA); Czech Republic, central Moravia, town of Olomouc, city part of Holice, 210 m, 49°34'40"N, 17°17'00"E, 20 May 2002, *F. Krahulec 590BA* (PRA).

$2n \sim 6x \sim 54$, FCM. Bulgaria, town of Godech, rocks in the valley of Nishava river ca. 2 km north of the town, 768 m, 43°01'48.1"N, 23°04'11.5"E, 3 Aug 2004, *J. Chrtek & J. Štěpánková 1159BA* (PRA); Czech Republic, central Moravia, town of Olomouc, city part of Holice, 210 m, 49°34'40"N, 17°17'00"E, 14 Apr 2005, *F. Krahulec 941BA* (PRA); Czech Republic, central Moravia, town of Olomouc, city part of Holice, 210 m, 49°34'40"N, 17°17'00"E, 24 May 2005, *F. Krahulec 1035BA*, *F. Krahulec 1037BA* (PRA).

Pilosella bauhini (Schult.) Arv.-Touv. subsp. *bauhini*

$2n = 5x = 45$, CHN. Czech Republic, north Moravia, Kotouč Hill near town of Štramberk, 358 m, 49°34'58"N, 18°07'14"E, 13 Jun 2006, *F. Krahulec & V. Mahelka 1079BA* (PRA).

$2n \sim 5x \sim 45$, FCM. Czech Republic, central Bohemia, Protected landscape area Kokořínsko–Máchův kraj, between village of Nosálov and village of Libovice, 418 m, 50°28'40"N, 14°39'33"E, 30 Apr 2005, *F. Krahulec 943BA* (PRA); Czech Republic, central Moravia, Kotouč Hill near town of Štramberk, 358 m, 49°34'58"N, 18°07'14"E, 13 Jun 2006, *F. Krahulec & V. Mahelka 1080BA* (PRA).

Pilosella bauhini subsp. *magyarica* (Peter) S.Bräut.

$2n = 4x = 36$, CHN. Slovakia, Štiavnicke vrchy Hills, village of Vyhne near town of Žarnovica, 370 m, 48°30'33"N, 18°47'37"E, 18 Sep 1999, *F. Krahulec 274/3BA* (PRA).

Pilosella brachiata (DC.) F.W.Schultz & Sch.Bip.

$2n > 5x = 48$ CHN (aneuploid). Czech Republic, south Moravia, National nature monument Dunajovické kopce, Janská hora Hill, village of Dolní Dunajovice, 242 m, 48°51'22"N, 16°33'07"E, 4 Jun 2002, *F. Krahulec, O. Rotreklová & J. Danihelka 678BRA* (PRA).

$2n \sim 5x \sim 45$, FCM. Czech Republic, central Moravia, town of Štramberk, 455 m, 49°35'24"N, 18°07'24"E, 13 Jun 2006, *F. Krahulec & V. Mahelka 1171BRA*, *F. Krahulec & V. Mahelka 1172BRA* (PRA).

Pilosella breviscapa (DC.) Soják

**2n ~ 2x ~ 18, FCM. Andorra, town of Pas de la Casa, close to Port d'Envalira saddle, 2413 m, 42°32'23"N, 01°43'06"E, 22 Jul 2006, *J. Chrtek, G. Mateo Sanz & J.A. Rosselló 1182aBREV* (PRA).

Pilosella caespitosa (Dumort.) P.D.Sell & C.West

2n ~ 4x ~ 36, FCM. Poland, foothills of Karkonosze Mts, village of Sosnówka south of town of Jelenia Góra, 390 m, 50°49'21"N, 15°43'41"E, 28 Jul 2015, *F. Krahulec 2219* (PRA).

Pilosella fusca (Vill.) Arv.-Touv.

**2n ~ 4x ~ 36, FCM. Austria, Allgäuer Alps, Kleinwalsertal, southeastern of village of Baad, ca. 1670 m, 47°19'12"N, 10°06'03"E, 20 Jul 2002, *F. Krahulec, F. Schuhwerk & A. Krahulcová 807FU* (PRA).

Pilosella glomerata (Froel.) Fr.

2n ~ 4x ~ 36, FCM. Czech Republic, central Moravia, Nature reserve Malý Kosíř, village of Slatinice na Hané, ca. 300 m, 49°33'30"N, 17°05'40"E, 23 May 2005, *F. Krahulec 1034GL* (PRA).

Pilosella hoppeana (Schult.) F.W.Schultz & Sch.Bip.

2n ~ 2x ~ 18, FCM. Austria, Allgäuer Alps, Kleinwalsertal, southeastern of village of Baad, ca. 1670 m, 47°19'12"N, 10°06'03"E, 20 Jul 2002, *F. Krahulec, F. Schuhwerk & A. Krahulcová 794HO* (PRA).

Pilosella macranthela (Nägeli & Peter) Soják

2n ~ 4x ~ 36, FCM. Czech Republic, north Bohemia, Ještědský hřeben Mts, village of Kryštofovo Údolí near town of Chrástava, 440 m, 50°46'04"N, 14°55'57"E, 7 Jul 2001, *F. Krahulec & S. Bräutigam 579MAC* (PRA).

Pilosella officinarum Vaill.

2n = 4x = 36, CHN. Czech Republic, southwestern Moravia, village of Rudíkov near town of Třebíč, 562 m, 49°18'07"N, 15°57'24"E, 19 May 2000, *F. Krahulec 308PI* (PRA).

2n ~ 4x ~ 36, FCM. Czech Republic, central Bohemia, Protected landscape area Kokořínsko–Máchův kraj, between village of Nosálov and village of Libovice, 418 m, 50°28'40"N, 14°39'33"E, 30 Apr 2005, *F. Krahulec 942PI* (PRA); Czech Republic, south Moravia, village of Dolní Dunajovice north of town of Mikulov, 278 m, 48°50'51"N, 16°33'34"E, 4 Jun 2002, *F. Krahulec, O. Rotreklová & J. Danihelka 680PI* (PRA); France, Pyrenees Mts, village of Font Romeu, Pic Carlit Mt, ca. 2350 m, 42°34'25"N, 01°57'48"E, Aug 2011, *P. Sekerka 2005PIa* (PRA).

2n = 5x = 45, CHN. Czech Republic, south Moravia, village of Kobeřice southeast of town of Brno, 328 m, 49°05'34"N, 16°53'20"E, 3 Jun 2002, *F. Krahulec & O. Rotreklová 668PI* (PRA); Slovakia, Čergov Mts, Vel'ký Minčol Mt north of village of Lipany, 1130–1140 m, 49°14'07"N, 20°59'17"E, Jul 2013, *L. Majeský 2156* (PRA).

2n = 6x = 54, CHN. Romania, Hasmas Mts, ca. 15 km east of town of Gheorgheni, 1341 m, 46°42'44.6"N, 25°47'04.3"E, 25 Jun 2013, *T. Urfus 2121* (PRA); Slovakia, Čergov Mts, Vel'ký Minčol Mt north of village of Lipany, 1130–1140 m, 49°14'07"N, 20°59'17"E, Jul 2013, *L. Majeský 2159* (PRA).

2n ~ 6x ~ 54, FCM. Slovakia, karst area Jelšavský kras, between village of Nandraž and village of Prihradzany near town of Revúca, 389 m, 48°35'40"N, 20°12'48"E, 27 Sep 2006, *F. Krahulec 1186PI* (PRA); **Slovenia, Julian Alps, Triglav National park, town of Bovec, village of Podnjivce, between parking place and waterfall Boka, 373 m, 46°19'05"N, 13°29'34"E, 9 Sep 2006, *F. Krahulec & A. Krahulcová 1176PI* (PRA).

Pilosella pavichii (Heuff.) Arv.-Touv.

**2n = 2x = 18, CHN in cultivated progeny plants. Slovenia, Julian Alps, Triglav National park, bank of Soča river southwest of town of Bovec, 368 m, 46°19'27"N, 13°32'54"E, 9 Sep 2006, *F. Krahulec 1175PIS* (PRA).

**2n ~ 2x ~ 18, FCM. Slovenia, Julian Alps, Triglav National park, town of Bovec, village of Trenta, in the valley southwest of spring of Soča river, 959 m, 46°24'14"N, 13°42'34"E, 10 Sep 2006, *A. Krahulcová & F. Krahulec 1177PIS* (PRA); Slovenia, Julian Alps, Triglav National park, along the road between town of Bovec and village of Trenta, 424 m, 46°20'15"N, 13°36'47"E, 9 Sep 2006, *F. Krahulec 1174PIS* (PRA).

Pilosella piloselloides (Vill.) Soják

**2n ~ 4x ~ 36, FCM. Croatia, Istria Peninsula, town of Novigrad, village of Tar, close to estuary of Mirna river, 7 m, 45°18'55"N, 13°36'55"E, Jun 2008, *M. Duchoslav 1552PIS, M. Duchoslav 1554PIS* (PRA); **Poland, foothills of Karkonosze Mts, village of Sosnówka south of town of Jelenia Góra, 390 m, 50°49'21"N, 15°43'41"E, 28 Jul 2015, *F. Krahulec 2218* (PRA).

2n ~ 5x ~ 45, FCM. Czech Republic, south Moravia, National nature reserve Dunajovické kopce, Janská hora Hill, village of Dolní Dunajovice, 242 m, 48°51'22"N, 16°33'07"E, 4 Jun 2002, *F. Krahulec, O. Rotreklová & J. Danihelka 677PIS* (PRA).

Pilosella pseudopilosella (Ten.) Soják

**2n ~ 3x ~ 27, FCM. Spain, Catalunya, Lleida Province, Serra de Cadí mountain ridge, village of Cornellana, Cap de la Fesa Mt, 2073 m, 42°16'29"N, 01°32'29"E, 23 Jul 2006, *J. Chrtek, G. Mateo Sanz & J.A. Rosselló 1178cPSPi* (PRA).

Pilosella scandinavica (Dahlst.) Schljakov

2n ~ 4x ~ 36, FCM. Czech Republic, Protected landscape area Jeseníky, Hrubý Jeseník Mts, Velká kotlina corrie near village of Karlova Studánka, ca. 900 m, ca. 50°02'N, 17°15'E, 8 Jul 2015, *F. Krahulec 2220* (PRA).

Pilosella stoloniflora (Waldst. & Kit.) F.W.Schultz & Sch.Bip.

**2n ~ 6x ~ 54, FCM. Austria, Allgäuer Alps, south foothill of Widdenstein Mt, 1990 m, 47°16'47"N, 10°07'22"E, 23 Jul 2002, *F. Krahulec, F. Schuhwerk & A. Krahulcová 792SF* (PRA).

Pilosella subardans (Nägeli & Peter) Soják

**2n ~ 4x ~ 36, FCM. Spain, Catalunya, Lleida Province, village of Tuixén, above the road to Coll de Port saddle, 1600 m, 42°13'00"N, 01°32'24"E, 23 Jul 2006, *J. Chrtek, G. Mateo Sanz & J.A. Rosselló 1181SUBT* (PRA).

Tragopogon porrifolius L.

**2n ~ 2x ~ 12, FCM in eight cultivated progeny plants. DNA ploidy level was concluded from 2C-values ranging from 6.15 to 6.26 pg DNA among individual plants. The respective 2C-values correspond to the diploid ploidy level in the species (Bennett & Leitch, 2012). New Zealand, South Island, town of Lyttelton, area of port utilities in Lyttelton Harbour, 4 m, 43°36'34"S, 172°42'31"E, 14 Mar 2004, *F. Krahulec & A. Krahulcová TRAGPORNZ1, F. Krahulec & A. Krahulcová TRAGPORNZ2, F. Krahulec & A. Krahulcová TRAGPORNZ3, F. Krahulec & A. Krahulcová TRAGPORNZ4, F. Krahulec & A. Krahulcová TRAGPORNZ6, F. Krahulec & A. Krahulcová TRAGPORNZ8*,

F. Krahulec & A. Krahulcová TRAGPORNZ9, F. Krahulec & A. Krahulcová TRAGPORNZ10 (PRA).

Tragopogon pratensis L.

$2n \sim 2x \sim 12$, FCM. DNA ploidy level was concluded from $2C$ -value = 5.16 pg DNA that corresponds to the diploid ploidy level in the species (Bennett & Leitch, 2012). Czech Republic, southwest Bohemia, village of Krsy, 630 m, 49°55'49"N, 13°03'44"E, May 2004, *F. Krahulec & Z. Kaplan TRAGPRAT7 (PRA).*

CAMPANULACEAE

Campanula patula L.

** $2n = 4x = 40$, CHN in cultivated progeny plants. Slovenia, Julian Alps, Planica valley western of town of Kranjska Gora, along a local road in ski-jump area, 920–950 m, 46°28'30"–46°28'50"N, 13°43'20"E, 17 Jun 1995, *A. Krahulcová 11/95, A. Krahulcová 12/95 (PRA)*; Slovenia, Julian Alps, village of Podkoren, ca. 840 m, 46°29'30"N, 13°45'10"E, 17 Jun 1995, *M. Štech 13/95 (PRA).*

LAMIACEAE

Galeopsis speciosa Mill.

$2n = 2x = 16$, CHN. Czech Republic, northeastern Bohemia, Nature reserve Zbytka, village of Bohuslavice, 260 m, 50°17'46"N, 16°03'44"E, 30 Apr 1994, *F. Krahulec 1/94 (PRA).*

RANUNCULACEAE

Pulsatilla vulgaris subsp. *grandis* (Wender.) Zämelis

$2n = 4x = 32$, CHN in cultivated progeny plants. Czech Republic, south Moravia, Nature reserve Šěvy, village of Bučovice, 235–265 m, 49°08'12"N, 16°58'27"E, 26 Apr 1989, *P. Tomšovic, A. Krahulcová & V. Jarolímová 26/90 (PRA).*

VIOLACEAE

Viola arvensis Murray

$2n = 2x = 34$, CHN. Czech Republic, National park Krkonoše, Krkonoše Mts, village of Černý Důl, ca. 650 m, 50°37'50"N, 15°41'00"E, 26 Jun 1992, *F. Krahulec & A. Krahulcová V46C (PRA).*

Viola tricolor subsp. *polychroma* (A. Kern.) Nyman

$2n = 2x = 26$, CHN. Czech Republic, National park Krkonoše, Krkonoše Mts, town of Rokytnice nad Jizerou, settlement of Horní Domky, ca. 850 m, 50°44'40"N, 15°29'20"E, 2 Jul 1992, *J. Chrtěk V51 (PRA)*; Czech Republic, National park Šumava, Šumava Mts, village of Kvilda, 1040 m, ca. 49°01'N, 13°35'E, 16 Jul 1992, *J. Štěpánek V57B (PRA).*

METHODS

CHN. — The somatic mitoses in root tips meristems of potted plants were used for the chromosome counts. The actively growing root tips were pretreated in a saturated water solution of α -bromonaphthalene for 3 hours at room temperature, rinsed in water and fixed in cold acetic-ethanol (1 : 3) overnight. The fixed material was stored in 70% ethanol at 4°C until required. After maceration in 1N HCl at 60°C for 5–7 min, the root tips were rinsed in water and the cut meristems were squashed in a drop of lacto-propionic orcein (Dyer, 1963). Only temporary slides were made.

FCM. — The DAPI flow cytometry was exclusively used for estimation of ploidy level in *Pilosella*. The sample preparation and FCM procedure followed Krahulcová & al. (2004). Relative fluorescence intensity was recorded by either flow cytometer Partec PA-II or flow cytometer CyFlow, both instruments (Partec, Münster,

Germany) equipped with a mercury arc lamp as source of excitation. Each individual sample of a fresh leaf was simultaneously analysed with the leaf tissue of internal standard with a known chromosome number. A significant variation in the monoploid DNA content was found among some species of *Pilosella* (Suda & al., 2007). Therefore, avoiding a potential bias in estimation of ploidy level, an appropriate internal standard of the genus *Pilosella* was chosen for each sample in order to exclude any excessively big difference in the monoploid genome sizes between analysed species and the internal standard. Internal standards used (mean DNA content adopted from Suda & al., 2007): *Pilosella aurantiaca* ($2n = 4x = 36$, $2C = 7.79$ pg DNA), *P. bauhini* ($2n = 5x = 45$, $2C = 10.07$ pg DNA), *P. lactucella* ($2n = 2x = 18$, $2C = 4.07$ pg DNA), *P. officinarum* ($2n = 4x = 36$, $2C = 6.89$ pg DNA). *Pilosella lactucella* was used as internal standard in most of the FCM analyses. For each measurement, 3000 nuclei were recorded. Coefficients of variation (%) of samples and internal standard were 0.88–5.14 (mean \pm s.e. = 2.03 \pm 0.83) and 1.12–5.02 (mean \pm s.e. = 2.42 \pm 0.98), respectively.

Genome size determination (propidium iodide staining) in *Tragopogon* generally followed the protocol published for *Cirsium* (Bureš & al., 2004), using a 488-nm argon ion laser as a source of excitation and the flow cytometer Partec PA-II (Partec, Münster, Germany). The genome size of each sample was estimated using *Pisum sativum* cv. 'Ctirad' ($2C = 9.09$ pg DNA) as an appropriate internal standard (Lysák & Doležel, 1998). The individual plants were repeatedly analysed three times on different days to minimize the effect of potential random instrument drift. The between-day difference among particular measurements of the genome size did not exceed the critical threshold of 2%, otherwise the respective measurement was discarded and the sample reanalysed. For each measurement, 5000 nuclei were recorded. Coefficients of variation (%) of samples and internal standard were 1.59–4.80 (mean \pm s.e. = 3.19 \pm 0.78) and 1.57–3.78 (mean \pm s.e. = 2.65 \pm 0.68), respectively.

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IAPT chromosome data 29/3

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The cytological studies have been carried out in metaphase cells in root tips of seedlings. Chromosome numbers in literature were checked using the *IPCN* (Goldblatt & Johnson, 1979–) and *CCDB* (Rice & al., 2015). Nomenclature corresponds to recent Floras or checklists.

This study was financially supported by the Russian Foundation for Basic Research (grants 15-29-02664; 19-04-00546 to M. Lomonosova) and by the Scientific program AAAA-A17-117012610055-3 of the Central Siberian Botanical Garden, SB RAS.

* First chromosome count for the species.

** First chromosome count for the Republic of Kazakhstan.

AMARANTHACEAE

**Agriophyllum arenarium* M.Bieb.

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, vicinity of Kapshagai town, 553 m, 43°54'02.0"N, 77°13'51.1"E, 21 Sep 2017, sandy dunes, *M. Lomonosova & M. Danilov 1382b* (NS).

Atriplex tatarica L.

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, solonchak, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1384b* (NS).

The current chromosome number report is in agreement with the previous one from East Kazakhstan (Lomonosova & al., 2003a,b).

Bassia hyssopifolia (Pall.) Kuntze

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, solonchak, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1384a* (NS).

Our chromosome count agrees with the known reports from Kazakhstan (Semiotrocheva, 1974; Zakharyeva, 1985).

***Blitum virgatum* L. (*Chenopodium foliosum* Asch.)

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, mountain ridge of Zailiiskii Alatau, Kararshasai site, 2420 m, 43°14'55.5"N, 77°57'30.8"E, 20 Sep 2017, edges of summer cattle parking, *M. Lomonosova, M. Danilov & B. Osmonali 1374b* (NS).

***Chenopodium karoii* (Murr) Aellen

$2n = 36$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, mountain ridge of Zailiiskii Alatau, Kararshasai site, 2220 m, 43°16'21.7"N, 78°06'30.0"E, 20 Sep 2017, agricultural site near the weather station, *M. Lomonosova, M. Danilov & B. Osmonali 1377a* (NS).

Chenopodium strictum Roth

$2n = 36$, CNH. Republic of Kazakhstan, Almaty Region, Almaty city, Main Botanical Garden, 43°13'29.85"N, 76°55'38.02"E, road side, 19 Sep 2017, *M. Lomonosova 1373a* (NS).

Our report corresponds to the counts from East Kazakhstan (Krasnikov & al., 2007; Lomonosova & al., 2003b, 2005).

***Corispermum chinganicum* Iljin

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, vicinity of Kapshagai town, 553 m, 43°54'02.0"N, 77°13'51.1"E, 21 Sep 2017, sandy dunes, *M. Lomonosova, & M. Danilov 1381a* (NS).

Suaeda altissima (L.) Pall.

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, road side, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1387* (NS).

This chromosome number confirms previous data from East Kazakhstan (Lomonosova & al., 2003a).

Suaeda linifolia Pall.

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, wet solonchak, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1386c* (NS).

Our data match the chromosome count from East Kazakhstan (Krasnikov & al., 2007).

Suaeda salsa (L.) Pall.

$2n = 36$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, solonchak, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1384d* (NS).

The same number was reported for this taxon from East Kazakhstan (Lomonosova & al., 2003b).

***Suaeda stellatiflora* G.L.Chu

$2n = 18$, CNH. Republic of Kazakhstan, Almaty Region, Enbekshikazakh District, vicinity of Kopa village, 656 m, 43°30'51.0"N, 75°48'39.0"E, solonchak, 22 Sep 2017, *M. Lomonosova, M. Danilov & B. Osmonali 1384k* (NS).

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IAPT chromosome data 29/4

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* First chromosome count for the species.

UMBELLIFERAE/APIACEAE

Aulacospermum roseum Korovin

$2n = 18$, CHN. Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Pangaz valley, 40°51.41'N, 70°18.10'E, 2500 m, 12 Sep 2015, *E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov 13-15* (MW) [Fig. 2A].

Eryngium macrocalyx Schrenk

$2n = 16$, CHN. Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Nadoksay, 40°46'N, 70°07'E, 13 Sep 2015, *E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov 130-15* (MW) [Fig. 2B].

Heracleum olgae Regel & Schmalh.

$2n = 22$, CHN. Kyrgyzstan, Batken Prov., Lajlak Distr., N slope of Turkestan ridge, Lajlak valley, 39°43.96'N, 70°01.18'E, 9 Sep 2015, *E.V. Kljuykov & U.A. Ukrainskaja s.n.* (MW) [Fig. 2E].

Heracleum pinnatum C.B. Clarke

$2n = 22$, CHN. India, Jammu & Kashmir, Ladakh Distr., S slope of Ladakh ridge, Pacha-Tokpa valley, near Namra, 34°19'N, 76°59'E, 3300 m, 30 Jul 2016, *U.A. Ukrainskaja 13-16* (MW); India, Jammu & Kashmir, Ladakh Distr., road Sarchu-Leh, Tanglang La Pass, N slope, between Rumpse and Loto, Khyamar Chu valley, clayey slope, 33°38'N, 77°44'E, 4127 m, 28 Jul 2016, *U.A. Ukrainskaja 12-16* (MW) [Fig. 2D].

Pimpinella peregrina L.

$2n = 18$, CHN. Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, SE slope of Boboy-ob mountain Oshoba valley, 40°44'N, 70°26'E, 1740 m, 14 Sep 2015, *E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov 131-15* (MW) [Fig. 2F].

Pleurospermum uralense Hoffm.

$n = 9$, CHN. Kazakhstan, East Kazakhstan Prov., Altai, near Ridder, road Ridder–Karagay, 50°20'N, 83°30'E, 19 Jun 2015, *U.A. Ukrainskaja s.n.* (MW) [Fig. 3A].

Prangos ornata Kuzmina

$2n = 22$, CHN. Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Pangaz valley, 40°51.41'N, 70°18.10'E, 2200 m,

12 Sep 2015, *E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov s.n.* (MW) [Fig. 2C].

**Sanicula giraldii* H. Wolff (*Sanicula uralensis* Kleopow ex Kamelin, Czubarov & Shmakov)

$n = 8$, CHN. Kazakhstan, East Kazakhstan Prov., Ridder, Altaiskii Botanical Garden, 50°20'N, 83°30'E, 18 Jun 2015, *U.A. Ukrainskaja* [Fig. 3B].

The buds were taken from the plants growing in botanical garden, the origin of the sample is Altai forest experimental station of KazNIIH, P-P-160, 26 Jul 1974 (Herbarium of Altaiskii Botanical Garden).

Semenovia dasycarpa (Regel & Schmalh.) Korovin ex Pimenov & V.N. Tikhom.

$n = 11$, CHN. Tajikistan, Rasht Distr., in the Surchob watershed, S slope of Alai ridge, Yarchytch valley, near Nasar-Ailjak, 39°22.84'N, 70°37.58'E, 2303 m, 7 Aug 2012, *M.G. Pimenov, E.V. Kljuykov & U.A. Ukrainskaja 23-12* (MW) [Fig. 3C].

**Semenovia dissectifolia* Ukrainsk. & Kljuykov

$2n = 22$, CHN. Tajikistan, Badakhshan, southeast slope of Ruschan ridge, near Koi-Tezek pass, 37°29'N, 72°48'E, 4271 m, 2 Aug 2011, *E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 19-11* (MW); Tajikistan, Badakhshan, Dzhavshangoz valley, mouth of Schalmatz river, 37°20'N, 72°33'E, 3800 m, 13 Aug 2011, *E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 49-11* (MW) [Fig. 4A].

Chromosome number for this recently described species (Ukrainskaja & al., 2013) was determined from germinated seeds taken from the type specimen (*E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 19-11*) and from material from one more locality.

**Semenovia heterodonta* (Korovin) Manden.

$n = 11$, CHN. Tajikistan, Varzob Distr., Hyssar ridge, Ansob pass, 39°05'N, 68°51'E, 3386 m, 31 Jul 2012, *M.G. Pimenov, E.V. Kljuykov & U.A. Ukrainskaja 2-12* (MW) [Fig. 3D].

**Semenovia imbricata* Ukrainsk. & Kljuykov

$2n = 22$, CHN. Tajikistan, Badakhshan, N slope of Schugnan ridge, in the Gunt watershed, Toguzbulok valley, mouth of Duzahdara river, NE slope, 37°40'N, 72°30'E, 3200 m, 1 Aug 2011, *E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 13-11* (MW); Tajikistan, Badakhshan, N slope of Schugnan ridge, Gunt valley, Chartymisky Zaval, 37°46'N, 72°43'E, 2 Aug 2011, *E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 24-11* (MW); Tajikistan, Badakhshan, S slope of Jazgulem ridge, Bartang valley, Khodorghiodara river, near Sponch, 37°59'N, 71°45'E, 2750 m, 7 Aug 2011, *E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 35-11* (MW) [Fig. 2L].

Chromosome number for this recently described species (Ukrainskaja & al., 2013) was determined from germinated seeds taken from the type specimen (*E.V. Kljuykov, U.A. Ukrainskaja & E.A. Zakharova 13-11*) and from the material from the other two localities.

**Semenovia pamirica* (Lipsky) Manden.

$2n = 22$, CHN. Tajikistan, Badakhshan, W Pamir, S slope of Southalitchurskii ridge, between Chukurkul Lake and Khorgusch pass, 37°33.46'N, 73°06.41'E, 3990 m, 12 Aug 2013, *M.G. Pimenov, E.V. Kljuykov, U.A. Ukrainskaja & D. Navrusschoev 103-13* (MW) [Fig. 4D].

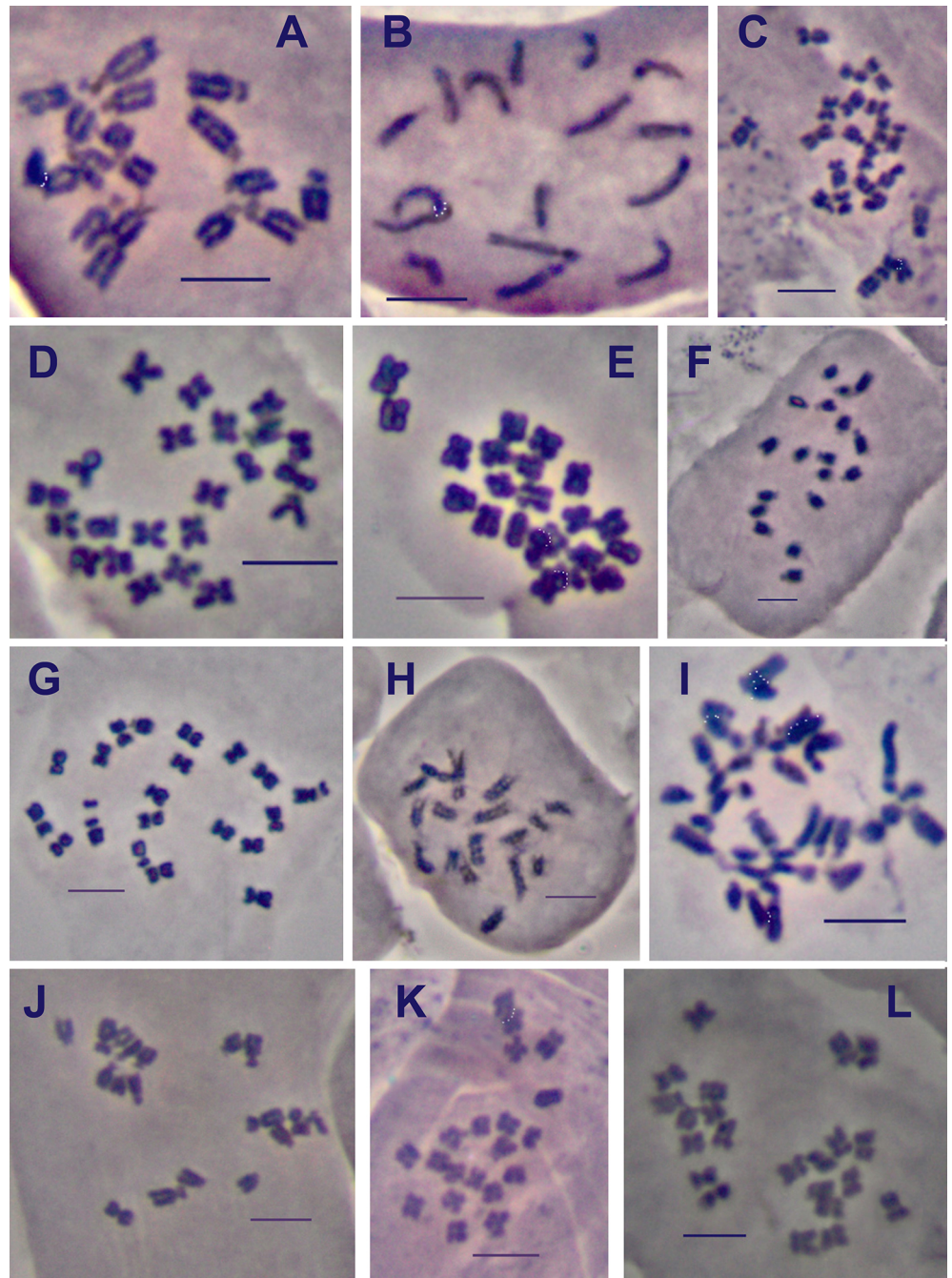


Fig. 2. Mitotic chromosomes. **A**, *Aulacospermum roseum*, $2n = 18$; **B**, *Eryngium macrocalyx*, $2n = 16$; **C**, *Prangos ornata*, $2n = 22$; **D**, *Heracleum pinnatum*, $2n = 22$; **E**, *Heracleum olgae*, $2n = 22$; **F**, *Pimpinella peregrina*, $2n = 18$; **G**, *Stenocoelium athamantoides*, $2n = 20$; **H**, *Trinia hispida*, $2n = 18$; **I**, *Turgenia latifolia*, $2n = 32$; **J**, *Turgenia latifolia*, $2n = 18$; **K**, *Seseli tenuisectum*, $2n = 20$; **L**, *Semenovia imbricata*, $2n = 22$. — Scale bars = 5 μm .

$2n = 44$, CHN. Tajikistan, Badakhshan, Dzhavschangoz valley, mouth of Schalmatz river, S slope, $37^{\circ}20'N$, $72^{\circ}33'E$, 3800 m, 13 Aug 2011, *E.V. Kljuykov*, *U.A. Ukrainskaja* & *E.A. Zakharova* 48-11 (MW) [Fig. 4E].

Semenovia transiliensis Regel & Herder

$2n = 22$, CHN. Kazakhstan, Alma-Ata Prov., Zailiiskii Alatau ridge, Malaya Alma-Atinka valley, $43^{\circ}08'N$, $76^{\circ}48'E$, 2600 m, 30 Aug 2011, *M.G. Pimenov* & *E.V. Kljuykov* 2-11 (MW) [Fig. 4B].

**Semenovia vachanica* Ukrainsk. & Kljuykov

$2n = 22$, CHN. Tajikistan, Badakhshan, W slope of Iskaschim ridge, Bogusch-dara valley, near vill. Bolo, Dargausheus river,

N slope, $37^{\circ}03'N$, $71^{\circ}34'E$, 3002 m, 5 Aug 2011, *E.V. Kljuykov*, *U.A. Ukrainskaja* & *E.A. Zakharova* 28-11 (MW) [Fig. 4C].

Chromosome number for this recently described species (Ukrainskaja & al., 2013) was determined from germinated seeds taken from the type specimen.

The genus *Semenovia* Regel & Herder is one of the taxonomically complicated genera in the tribe Tordylieae. The genus contains 30 species, distributed only in Asia (from Iran to China). Its greatest diversity can be observed in the mountains of Pamiro-Alai and Pamir. Many species of the genus are narrow endemics, being known for few localities. Species of the genus *Semenovia* are mostly middle- and high-mountain polycarpic perennials, rarely

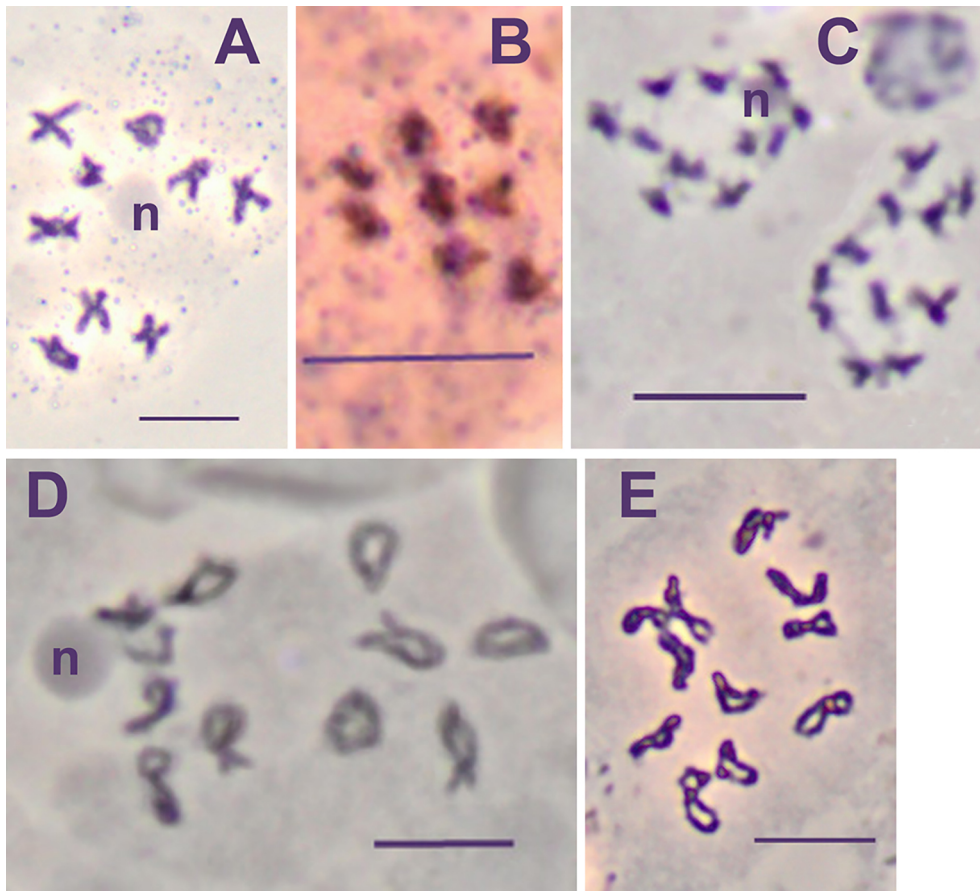


Fig. 3. Meiotic chromosomes. **A**, *Pleurospermum uralense*, $n = 9$; **B**, *Sanicula giraldii*, $n = 8$; **C**, *Semenovia dasycarpa*, $n = 11$; **D**, *Semenovia heterodonta*, $n = 11$; **E**, *Seseli afghanicum*, $n = 11$. — Scale bars = 10 μm ; n, nucleolus.

monocarpic biennials with taproots. Fruits are pubescent, elliptic, strongly compressed dorsally; commissure is broad. Dorsal ribs are filiform or slightly keeled, marginal ribs are winged, slightly thickened in the distal part.

Chromosome numbers were previously published for seven species of *Semenovia* (see Pimenov & al., 2002, 2006; Shner & al., 2004, 2009, 2012), all of them have $n = 11$ ($2n = 22$); for *Semenovia montana* Kamelin & V.M.Vinogr., $2n = 24$ was also reported (He & al., 1994), and B-chromosomes were possibly observed.

We have determined chromosome numbers of seven *Semenovia* species, five of them for the first time. All the studied species have $n = 11$ ($2n = 22$), however, for the high-mountain species *Semenovia pamirica* were observed both diploid ($2n = 22$) and polyploid ($2n = 44$) forms. Polyploid intraspecific variation is known in the related genus *Tetrataenium* (DC.) Manden. for *Tetrataenium nepalense* (D.Don) Manden. (Cauwet-Marc & al., 1980).

Seseli afghanicum (Podlech) Pimenov

$n = 11$, CHN. Afghanistan, Badakhshan, vicinities of Shewa Lake, descent from Gardzhwin pass to the lake, low retaining wall near the road, among big stones, 37°25.27'N, 71°21.60'E, 3500 m, 6 Aug 2013, M.G. Pimenov, E.V. Kljuykov & U.A. Ukrainskaja 68-13 (MW) [Fig. 3E].

**Seseli tenuisectum* Regel & Schmalh.

$2n = 20$, CHN. Kyrgyzstan, Batken Prov., Lajlak Distr., N slope of Turkestan ridge, Lajlak valley, Dgetykupuk river, E slopes,

39°43.96'N, 70°01.18'E, 1496 m, 9 Sep 2015, E.V. Kljuykov & U.A. Ukrainskaja 6-15 (MW); Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Pangaz valley, 40°50'N, 70°16.7'E, 1960 m, 12 Sep 2015, E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov 8-15 (MW); Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Nadoksay, 40°46'N, 70°07'E, 1714 m, 13 Sep 2015, E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov s.n. (MW) [Fig. 2K].

Stenocoelium athamantoides (M.Bieb.) Ledeb.

$2n = 20$, CHN. Russia, Altai region, Katun ridge, Akkem valley, 10 Aug 2015, M.N. Dirks s.n. (TK) [Fig. 2G].

Trinia hispida Hoffm.

$2n = 18$, CHN. Kazakhstan, West Kazakhstan Prov., vill. Prir-echnoe, 51°03.7'N, 52°25.14'E, 15 Jul 2014, E.V. Kljuykov 6-14 (MW) [Fig. 2H].

Turgenia latifolia (L.) Hoffm.

$2n = 18$, CHN. Kazakhstan, East Kazakhstan Prov., Altai, Manyrak ridge, vill. Sarchiy, 47°47'N, 84°44'E, 3 Jul 2015, A.L. Ebel s.n. (TK); Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, vicinity vill. Nau-Garzon, 40°55'N, 70°35'E, 8 Aug 2015, A. Kurbonov s.n. (MW) [Fig. 2J].

$2n = 32$, CHN. Tajikistan, Sudhd Prov., Asht Distr., S slope of Kurama ridge, Nadoksay, 40°46'N, 70°07'E, 13 Sep 2015, E.V. Kljuykov, U.A. Ukrainskaja & A. Kurbonov s.n. (MW) [Fig. 2I].

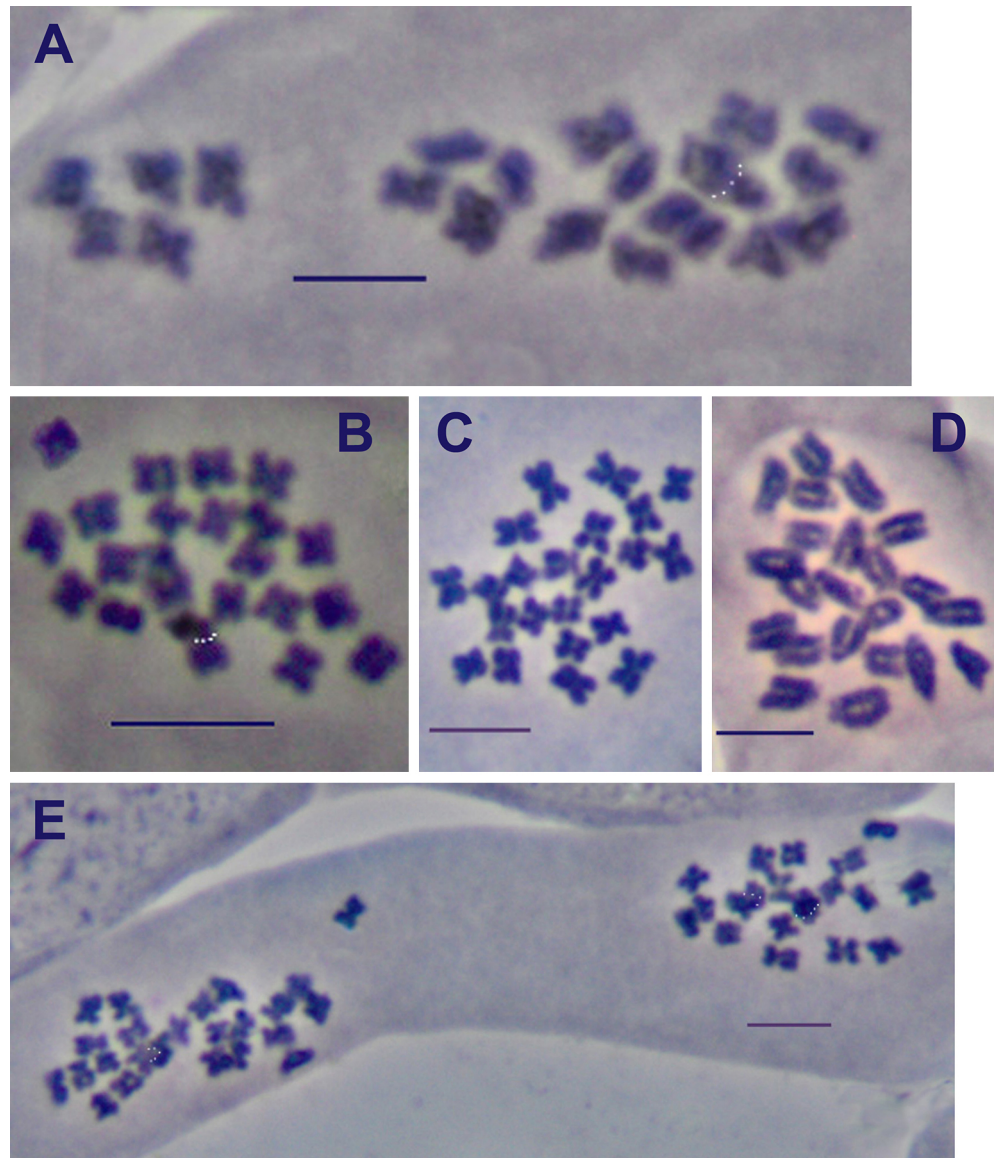


Fig. 4. Mitotic chromosomes.

A, *Semenovia dissectifolia*, $2n = 22$;

B, *Semenovia transiliensis*, $2n = 22$;

C, *Semenovia vachanica*, $2n = 22$;

D, *Semenovia pamirica*, $2n = 22$;

E, *Semenovia pamirica*, $2n = 44$. —

Scale bars = 5 μm .

The species is widespread in the Old World from Spain and North Africa to China, and has two cytotypes ($n = 9$ and $n = 16$) without any geographic pattern, and both of them were also found in Central Asia (Pimenov & al., 2002).

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IAPT chromosome data 29/5

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This study was supported by grant 16-04-00525A from the Russian Foundation for Basic Research (RFBR).

* First chromosome count for the species.

UMBELLIFERAE/APIACEAE

Carum appuanum (Viv.) Grande

$2n = 22$, CHN. Italy, Tuscany, Province Lucca, Apuan Alps, N-slope of the ridge, road Massa–Castelnuovo, turn to Levigliani, Túrrite Secca River, at the bridge, marble quarry, near the road, on calcareous rocks, 44°03.41'N, 10°16.24'E, 745 m, 18 Aug 2014, E.A. Zakharova, E.V. Kljuykov & U.A. Ukrainskaja 23-14 (MW) [Fig. 5D].

Carum appuanum subsp. *bulgaricum* (Hartvig) Bechi & Garbari

$2n = 22$, CHN. Greece, northern Greece, Nomos Pellis, Mt. Tzena, E-NE-facing slope, rocks, among the thorn cushion plants and the grass, 41°09.152'N, 22°13.253'E, 1849 m, 1 Sep 2015, E.A. Zakharova & S.E. Petrova 16-15 (MW) [Fig. 5C].

Carum appuanum subsp. *palmatum* (Hartvig) Bechi & Garbari

$2n = 22$, CHN. Greece, northern Greece, Nomos Kavalas, Mt. Pangeo, ca. 22 km W-NW of the village of Akrovuni, E-facing slope, calcareous rocks, in the grass, 40°54.21'N, 24°06.88'E,

1570 m, 30 Aug 2015, E.A. Zakharova & S.E. Petrova 1-15 (MW) [Fig. 5H].

Carum atlanticum Litard. & Maire

$2n = 22$, CHN. Morocco, Region Marrakesh-Tesift-El-Hauoz, High Atlas Mts., ca. 15 km E of Imlil, Tacheddirt Pass, rocks above the pass, 31°09.73'N, 07°48.30'W, 3150 m, 26 Aug 2013, U.A. Ukrainskaja, E.A. Zakharova & M.G. Pimenov 11-13 (MW) [Fig. 5B].

Carum flexuosum (Ten.) Nyman

$n = 10$, CHN. Italy, Abruzzo, Grand Sasso and Monti della Laga National Park, Grand Sasso, Vado di Corno Pass, NE-facing slope, calcareous scree. 42°27.36'N, 13°35.53'E, 1500 m, 23 Aug 2014, E.A. Zakharova, F. Conti, E.V. Kljuykov & U.A. Ukrainskaja 37-14 (MW) [Fig. 6A].

$2n = 20$, CHN. Italy, Abruzzo, the Grand Sasso and Monti della Laga National Park, Grand Sasso, Vado di Corno Pass, SE-facing slope, calcareous scree, 42°27.00'N, 13°35.45'E, 1865 m, 23 Aug 2014, E.A. Zakharova, F. Conti, E.V. Kljuykov & U.A. Ukrainskaja 34-14 (MW) [Fig. 5E].

The relations of the three European Mediterranean species of *Carum* (*C. flexuosum*, *C. heldreichii*, *C. meoides*) were interpreted quite differently in some local Floras. Pignatti (1982: 224–225) in *Flora d'Italia* synonymized *C. flexuosum* with *C. heldreichii*; Tutin (1968) in *Flora Europaea* considered *C. meoides* as a synonym of *C. heldreichii*, and Hartvig (1986) in *Mountain flora of Greece* accepted all the three taxa as separate species. Our recent comparative-morphological and molecular studies have shown that

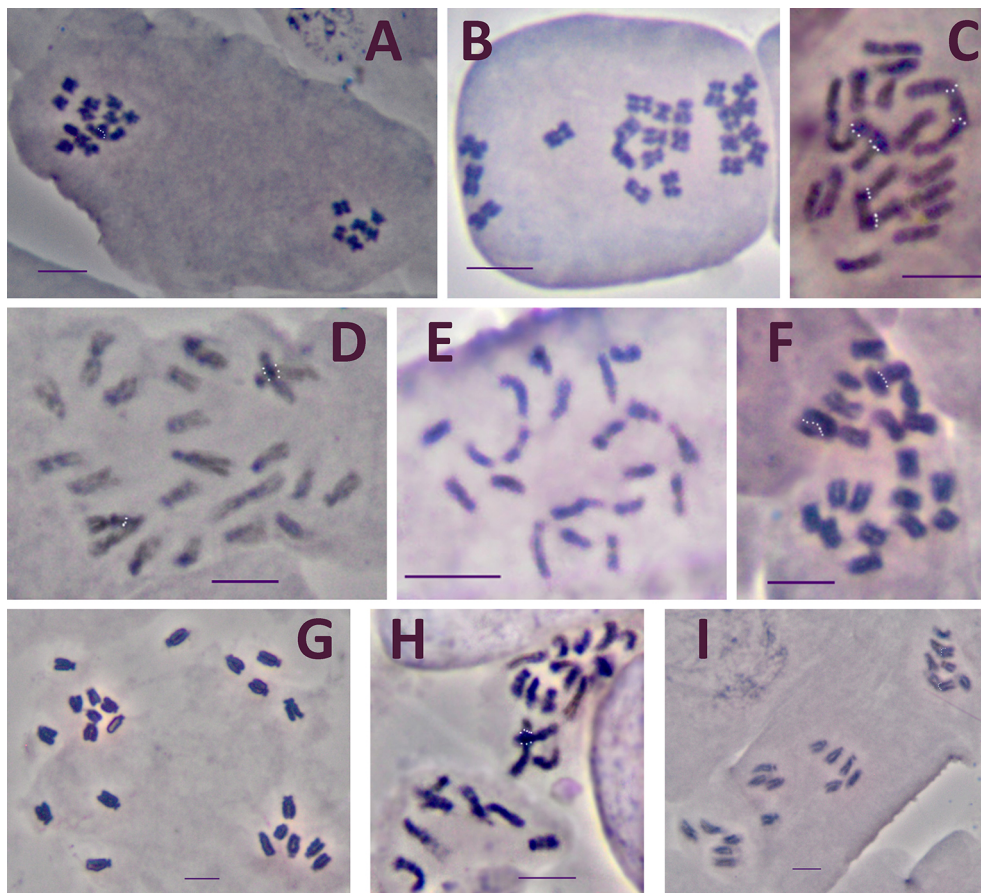


Fig. 5. Mitotic chromosomes. **A**, *Hellenocarum multiflorum*, $2n = 20$; **B**, *Carum atlanticum*, $2n = 22$; **C**, *Carum appuanum* subsp. *bulgaricum*, $2n = 22$; **D**, *Carum appuanum*, $2n = 22$; **E**, *Carum flexuosum*, $2n = 20$; **F**, *Carum graecum* subsp. *serpentinicum*, $2n = 22$; **G**, *Carum jahandiezii*, $2n = 22$; **H**, *Carum appuanum* subsp. *palmatum*, $2n = 22$; **I**, *Carum lacuum*, $2n = 22$. — Scale bars = 5 μm .

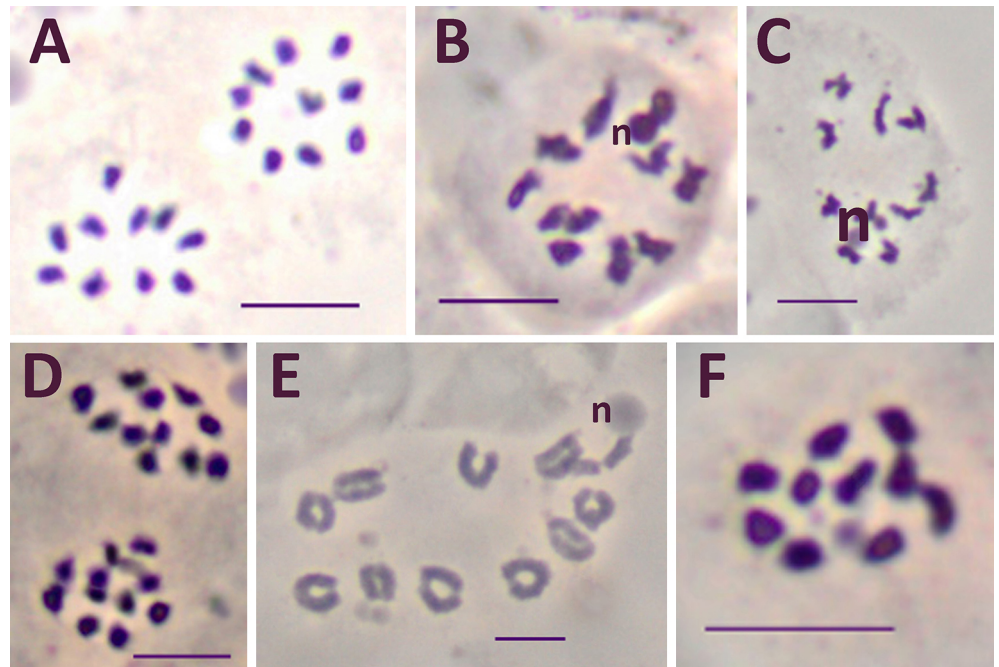


Fig. 6. Meiotic chromosomes. **A**, *Carum flexuosum*, $n = 10$; **B**, *Carum graecum*, $n = 11$; **C**, *Carum heldreichii*, $n = 10$; **D**, *Carum jahandiezii*, $n = 11$; **E**, *Carum lacuum*, $n = 11$; **F**, *Carum meoides*, $n = 10$. — Scale bars = 10 μm ; n, nucleolus.

C. flexuosum, *C. heldreichii* and *C. meoides* are independent species (Zakharova & al., 2012).

Carum flexuosum differs from *C. heldreichii* and *C. meoides* in life form (monocarpic plant with a vertical taproot vs. polycarpics with a caudex), in longer umbel rays and in a larger number of umbel rays, bracts and bracteoles. *Carum heldreichii* differs from *C. flexuosum* and *C. meoides* in white petals (vs. yellowish) and a lower number of mericarp vallecular vittae. The checking of *Carum* collections from several herbaria (B, FI, K, P, M, MSB) showed that only *C. flexuosum* occurs in Italy, whereas *C. heldreichii* is distributed in central Greece only and *C. meoides* in Greece, Albania and Serbia.

Chromosome number $n = 10$ for *C. flexuosum* (sub *C. carvifolium* (DC.) Arcang.) was reported from Abruzzo (Favarger, 1973), and our report confirms it. *Carum heldreichii* and *C. meoides* have the same chromosome number (see below).

Carum graecum Boiss. & Heldr.

$n = 11$, CHN. Greece, Peloponnesus, Nomos Achaïas, Chelmos, Aroania Ridge, NE-facing slope, 3.5 km SW of Zarouchla, forest belt, in the middle part of the stream, dry riverbed, among the stones, 37°57.66'N, 22°15.40'E, 1381 m, 3 Jul 2012, E.A. Zakharova & U.A. Ukrainskaja 29-12 (MW) [Fig. 6B].

Carum graecum subsp. *serpenticum* Hartvig

$2n = 22$, CHN. Greece, northern Greece, Nomos Kastorias, ca. 8 km S of Eptakhori, above the village of Zouzouli, in woodland of *Pinus nigra*, N-NE facing slope, stony slope, in the grass, 40°10.098'N, 21°01.395'E, 1264 m, 3 Sep 2015, E.A. Zakharova & S.E. Petrova 23-15 (MW) [Fig. 5F].

**Carum heldreichii* Boiss.

$n = 10$, CHN. Greece, central Greece, Nomos Viotias, Parnassos, to N of Arachova, N-NW-facing slope, under the rocks, in the grass, 38°32.34'N, 22°35.40'E, 2000 m, 28 Jun 2012, E.A. Zakharova & U.A. Ukrainskaja 11-12 (MW) [Fig. 6C].

**Carum jahandiezii* Litard. & Maire

$n = 11$, $2n = 22$, CHN. Morocco, region Meknes-Tafilalet, Middle Atlas Mts., between Col du Zad Pass and Aguelmame Sidi-Ali Lake, 33°01.89'N, 05°04.15'W, 2062 m, 5 Sep 2013, E.A. Zakharova, M.G. Pimenov & U.A. Ukrainskaja 56-13 (MW) [Figs. 5G, 6D].

**Carum lacuum* Emb.

$n = 11$, $2n = 22$, CHN. Morocco, region Meknes-Tafilalet, High Atlas Mts., Plateau des Lacs, 3 km N of Imilchil, 32°10.64'N, 05°37.87'W, 2100 m, 2 Sep 2013, E.A. Zakharova, M.G. Pimenov & U.A. Ukrainskaja 38-13 (MW) [Figs. 5I, 6E].

Carum meoides (Griseb.) Halácsy

$n = 10$, CHN. Greece, Peloponnesus, Nomos Achaïas, Chelmos, Aroania Ridge, 4.5 km to SW of Zarouchla, tree line, in the higher third part of the stream, on the right side, N-facing slope, steep, under the rocks, in the grass, 37°57.64'N, 22°14.98'E, 1466 m, 3 Jul 2012, E.A. Zakharova & U.A. Ukrainskaja 32-12 (MW) [Fig. 6F].

We confirm three previous reports for this species from Greece, published as *C. adamovicii* Halácsy (Strid & Franzén, 1981) and as *C. rupestre* Boiss. & Heldr. (Franzén & Gustavsson, 1983; Barea & al., 1998).

Hellenocarum multiflorum (Sm.) H. Wolff

$2n = 20$, CHN. Greece, central Greece, Nomos Viotias, Arachova, near the church, limestone slope, 38°28'N, 22°35'E, 27 Jun 2012, E.A. Zakharova & U.A. Ukrainskaja 1-12 (MW) [Fig. 5A].

Carum L. is one of the taxonomically complicated genera of the Apiaceae (Umbelliferae) family. At an early stage of scientific plant systematics, the numerous species from different countries and continents were described within *Carum* or attributed to it based on habit similarity with *Carum carvi* L. and a rather simple fruit structure, mainly characterized by glabrous mericarps with almost equal ribs

and solitary vallecular vittae. Further morphological investigations showed that the genus was largely polyphyletic and many species were already transferred from *Carum* to other genera (Boissier, 1872: 819–1091; Drude, 1897–1898; Korovin, 1927; Wolff, 1927; Kljuykov, 1985, 1986). The recent studies based on molecular and morphological data have confirmed traditional *Carum* is polyphyletic (Papini & al., 2007; Zakharova, 2010, 2015; Zakharova & al., 2012, 2016). The generic type, *Carum carvi* L., and the most closely related four Caucasian species (*C. caucasicum* (M.Bieb.) Boiss., *C. meifolium* (M.Bieb.) Boiss., *C. grossheimii* Schischk., *C. porphyrocoleon* (Freyn & Sint.) Woronow) form *Carum* s.str. (Zakharova & al., 2012). As a result of our research, some more species have been transferred to other genera (Zakharova & al., 2012, 2014, 2016), however, till now the taxonomic position of the Mediterranean and Siberian species of the genus has remained unclear.

Hellenocarum was established by Wolff (1927) and based on two species transferred by him from *Carum* (*C. lumpeanum* Dörf. & Hayek, *C. multiflorum* (Sm.) Boiss.). Engstrand (1973) and Kljuykov (1985) confirmed the independence of the genus on the basis of detailed analysis of morphological characters that has been corroborated by the recent molecular studies of the genus (Papini & al., 2007; Zakharova & al., 2012, 2016).

Chromosome numbers were previously published for 10 species of *Carum* s.l. and for *Hellenocarum multiflorum* (Sm.) H. Wolff (see Bechi & al., 1996; Pimenov & al., 2002). Five of them (*C. appuanum*, *C. atlanticum*, *C. buriaticum* Turcz., *C. graecum*, *C. proliferum* Maire) have $n = 11$ ($2n = 22$); for *C. komarovii* Karjagin that has been transferred to *Aegopodium* L. (Zakharova & al., 2012), $2n = 22$ was reported too (Daushkevich & al., 1995). Three species (*C. flexuosum*, *C. meifolium*, *C. meoides*) and *Hellenocarum multiflorum* have $n = 10$ ($2n = 20$). Intraspecific aneuploid variation ($n = 10, 11$) is known for *Carum carvi* ($n = 10$ for about 80% and $n = 11$ for about 20% of 55 chromosome number reports that were published), as well as for its Caucasian variety *C. carvi* var. *roseum* Trautv. ($n = 10$ for two and $n = 11$ for one of published reports) and for another representative of *Carum* s.str., *C. caucasicum* ($n = 10$, two reports; $n = 11$, one report) (Pimenov & al., 2002; Šimková, 2007; Chepinoga & al., 2010; El Alaoui-Faris & al. 2012; Shner & al. 2016). Intraspecific aneuploid variation was reported also for *Carum verticillatum* (L.) W.D.J.Koch that has been restored as the monotypic genus *Trocdaris* Raf. (Zakharova & al., 2012): $n = 11$ for two and $n = 10$ for one of published reports (see Pimenov & al., 2002).

In the present contribution we publish data on chromosome numbers of some Mediterranean species of *Carum* s.l. collected in connection with revision of this complicated taxonomic complex. We have determined chromosome numbers of 8 species and 3 subspecies of *Carum* s.l. and of *Hellenocarum multiflorum*. For six species we have confirmed the previous reports, chromosome numbers of three species (*C. heldreichii*, *C. jahandiezii*, *C. lacuum*) have been determined for the first time.

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IAPT chromosome data 29/6

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The study was supported by financial grant under SERB-DST-Start Up Research Grant (Young Scientists) (vide SERB sanction No. SB/YS/LS-182/2014 dated 8 September, 2015). Authors are thankful to Director, Botanical Survey of India for providing necessary facilities.

POACEAE

Alopecurus arundinaceus Poir.

$n = 14$, CHN. India, Himachal Pradesh, Chamba, Pangi, Sural, 33°08.839'N, 76°25.915'E, 3111 m, along a stream, 6 Jun 2016, *H. Singh & P. Kumar 126487* (BSD).

Arthraxon prionodes (Steud.) Dandy

$n = 10$, CHN. India, Himachal Pradesh, Chamba, Pangi, Phindruu, 33°02.902'N, 76°25.617'E, 3273 m, dry region, 3 Sep 2016, *H. Singh & P. Kumar 126330* (BSD).

Bromus pectinatus Thunb.

$n = 14$, CHN. India, Himachal Pradesh, Chamba, Pangi, Upper Karyuni Sere, 33°03.496'N, 76°26.724'E, 2977 m, on dry exposed sun-facing slope, 13 Jun 2016, *H. Singh & P. Kumar 126455* (BSD).

Calamagrostis pseudophragmites (Haller f.) Koeler

$n = 15$, CHN. India, Himachal Pradesh, Chamba, Pangi, Hudan, 33°05.456'N, 76°27.168'E, 3291 m, on the slopes, 2 Sep 2016, *H. Singh & P. Kumar 126315* (BSD).

Chrysopogon gryllus (L.) Trin.

$n = 10$, CHN. India, Himachal Pradesh, Chamba, Pangi, towards Killar from Hudan, 33°05.398'N, 76°27.077'E, 3268 m, on grassy slopes, 2 Sep 2016, *H. Singh & P. Kumar 126316* (BSD) [Fig. 7A].

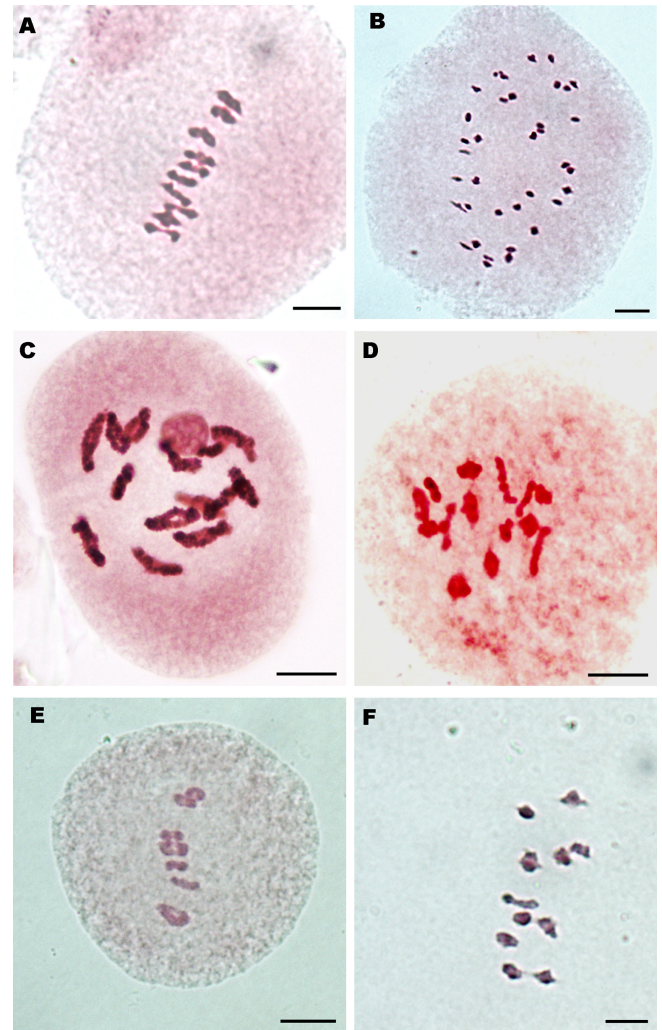


Fig. 7. **A**, *Chrysopogon gryllus*, PMC at metaphase I, $n = 10$; **B**, *Digitaria sanguinalis*, PMC at metaphase, $n = 36$; **C**, *Elymus semicostatus*, PMC at diakinesis, $n = 14$; **D**, *Phleum alpinum*, PMC at metaphase, $n = 14$; **E**, *Poa lahulensis*, PMC at metaphase I, $n = 7$; **F**, *Saccharum ravennae*, PMC at metaphase I, $n = 11$. — Scale bars = 10 μm .

Dactylis glomerata L.

$n = 7$, CHN. India, Himachal Pradesh, Chamba, Pangi, Sural, 33°08.446'N, 76°26.365'E, 3290 m, near water stream, 15 Jun 2016, *H. Singh & P. Kumar 126493* (BSD).

Digitaria sanguinalis (L.) Scop.

$n = 36$, CHN. India, Himachal Pradesh, Chamba, Pangi, Phindruu, 33°02.904'N, 76°25.615'E, 2273 m, dry open slopes, 3 Sep 2016, *H. Singh & P. Kumar 126331* (BSD) [Fig. 7B].

Elymus nutans Griseb.

$n = 21$, CHN. India, Himachal Pradesh, Chamba, Pangi, Sural, 33°08.587'N, 76°25.209'E, 3008 m, dry open slope, 15 Jun 2016, *H. Singh & P. Kumar 126485* (BSD).

Elymus semicostatus (Nees ex Steud) Melderis

$n = 14$, CHN. India, Himachal Pradesh, Chamba, Pangi, Leo, 32°59.674'N, 76°32.874'E, 3091 m, open moist slopes, 19 Jul 2017, *H. Singh & P. Kumar 126337* (BSD) [Fig. 7C].

Eragrostis minor Host
n = 20, CHN. India, Himachal Pradesh, Chamba, Pangi, towards Sural, 33°07.430'N, 76°21.690'E, 2600 m, along roadside, 15 Jun 2016, *H. Singh & P. Kumar 126480* (BSD).

Festuca rubra L.
n = 21, CHN. India, Himachal Pradesh, Chamba, Pangi, Sural, 33°08.953'N, 76°27.068'E, 3404 m, on alpine slopes, 15 Jun 2016, *H. Singh & P. Kumar 126490* (BSD).

Glyceria tonglensis C.B.Clarke
n = 10, CHN. India, Himachal Pradesh, Chamba, Pangi, Phindruu, 32°59.179'N, 76°33.918'E, 3124 m, open slopes, 19 Jul 2017, *H. Singh & P. Kumar 126341* (BSD).

Hordeum vulgare L.
n = 21, CHN. India, Himachal Pradesh, Chamba, Pangi, Tantan, 33°05.969'N, 76°23.160'E, 2913 m, near water channel, along field edge, 6 Jun 2016, *H. Singh & P. Kumar 126410* (BSD).

Pennisetum orientale Rich.
n = 18; India, Himachal Pradesh, Chamba, Pangi, Phindruu, 33°04.731'N, 76°24.721'E, 2585 m, on the edges, moist places, 3 Sep 2016, *H. Singh & P. Kumar 126321* (BSD).

Phacelurus speciosus (Steud.) C.E.Hubb.
n = 10, CHN. India, Himachal Pradesh, Chamba, Pangi, near Punto Bridge, 33°04.529'N, 76°24.552'E, 2239 m, along the downhill trek, between rocks, 11 Jun 2016, *H. Singh & P. Kumar 126421* (BSD).

Phleum alpinum L.
n = 14, CHN. India, Himachal Pradesh, Chamba, Pangi, Chasakh Bhatari, 32°56.041'N, 76°37.672' E, 3571 m, open alpine grasslands, 17 Jul 2017, *H. Singh & P. Kumar 126336* (BSD) [Fig. 7D].

Piptatherum munroi (Stapf) Mez
n = 12, CHN. India, Himachal Pradesh, Chamba, Pangi, Tatan, 33°05.694'N, 76°23.651'E, 2763 m, along dry trek route, 6 Jun 2016, *H. Singh & P. Kumar 126416* (BSD).

Poa alpina L.
n = 14, CHN. India, Himachal Pradesh, Chamba, Pangi, Bhagotu, 33°00.885'N, 76°16.845'E, 3499 m, near the glacier region, alpine grasslands, 12 Jun 2016, *H. Singh & P. Kumar 126449* (BSD).

Poa annua L.
n = 14, CHN. India, Himachal Pradesh, Chamba, Pangi, Hudan, 33°05.257'N, 76°26.661'E, 3218 m, near roadside, wet area, 2 Sep 2016, *H. Singh & P. Kumar 126317* (BSD).

Poa lahulensis Bor
n = 7, CHN. India, Himachal Pradesh, Chamba, Pangi, Sural, 33°08.950'N, 76°27.088'E, 3407 m, alpine meadows, 15 Jun 2016, *H. Singh & P. Kumar 126492* (BSD) [Fig. 7E].

Poa stewartiana Bor
n = 7, CHN. India, Himachal Pradesh, Chamba, Pangi, Hudan, 33°05.495'N, 76°28.216'E, 3534 m, alpine grasslands, 9 Sep 2016, *H. Singh & P. Kumar 126311* (BSD).

Saccharum ravennae (L.) L.
n = 11, CHN. India, Himachal Pradesh, Chamba, Pangi, near Phindruu, 33°03.787'N, 76°25.214'E, 2421 m, dry slopes, along roadside, 3 Sep 2016, *H. Singh & P. Kumar 126326* (BSD) [Fig. 7F].

Setaria viridis (L.) P.Beauv.
n = 9, CHN. India, Himachal Pradesh, Chamba, Pangi, Hudan, 33°05.376'N, 76°27.719'E, 3454 m, moist slopes, 2 Sep 2016, *H. Singh & P. Kumar 126314* (BSD).