Thaiszia - J. Bot., Košice, 9: 31-40, 1999

THAISZIA
JOURNAL OF
BOTANY

Chromosome numbers of some species of the Slovak Flora

AUGUSTÍN MURÍN[1], ZDENKA SVOBODOVÁ[2], JOZEF MÁJOVSKÝ[1] & VIERA FERÁKOVÁ[1]

[1]Department of Botany, Faculty of Sciences, Comenius University, Révová 39, 811 02 Bratislava, Slovakia; phone/fax: +421 7 5319603
[2]Department of Botany, University of Agriculture, 949 01 Nitra, Slovakia

MURÍN A., SVOBODOVÁ Z., MÁJOVSKÝ J. & FERÁKOVÁ V. (1999): Chromosome numbers of some species of the Slovak flora. – Thaiszia - J. Bot. 9: 31-40. – ISSN 1210-0420.

ABSTRACT: The chromosome numbers for 25 species of the Slovak flora are presented. Some of them are interesting from various reasons and only few are new for regional flora or for science. They are as follows: *Aira elegantissima* 2n=14; *Allium angulosum* 2n=16; *A. carinatum* 2n=16 (1 ref.), 24 (2 refs.); *A. oleraceum* 2n=32 (7 refs.); *A. paniculatum* 2n=16; *A. rotundum* 2n=48; *A. sphaerocephalon* 2n=16; *A. ursinum* 2n=14; *A. vineale* 2n=32 (3 refs.); *Allysum desertorum* 2n=32; *Bromus carinatus* 2n=56; *Cirsium brachycephalum* 2n=34; *Eragrostis pilosa* 2n=20; *Hesperis sylvestris* subsp. *sylvestris* 2n=12; *Linaria* × *kocianovichii* 2n=24; *Ornithogalum kochii* 2n=18; *Panicum capillare* 2n=18; *P. miliaceum* 2n=36 (2 refs.); *Plantago media* subsp. *stepposa* 2n=24; *P. tenuiflora* 2n=24; *Peplis portula* 2n=10; *Pilosella alpicola* 2n=18; *Ranunculus reptans* 2n=32; *Senecio jacobea* 2n=40 (12 refs.); 80 (4 refs.), *Tragus racemosus* 2n=40.

KEYWORDS: chromosome numbers, vascular plants, Slovakia.

Introduction

Although majority of the plant species of the Slovak flora has already been studied karyologically (cf. MÁJOVSKÝ, MURÍN & al. 1987), there are still some taxa with unknown chromosome numbers, or others which should be reexamined or which are interesting with regard to the new data given in Chromosome Number Indexes issued at some intervals by some authors (cf. part "References").

Material and methods

Living plant samples for karyological analyses were collected from natural habitats and individual localities are given along with the results in the text.

Permanent squash slides were made by means of cellophane technique (MURÍN 1960), and the temporary squashes were made in a drop of propionic orcein. Commonly the root tips were used for squashes after pretreatment with the saturated p-dichlorobenzene. Usually 10 well spread c-metaphases were evaluted. Data mentioned in the relevant literature have been compared with the results obtained using also data introduced by MÁJOVSKÝ, MURÍN & al. (1987) and completed with the references in later Chromosome Indexes.

Results

Aira elegantissima SCHUR
Present count
2n=14 MURÍN, loc.: Dubová – Budmerice, Biely vŕšok, leg. D. MAGIC
Previous data and comment
2n=14 (8 refs. in MÁJOVSKÝ, MURÍN & al. 1987),
This species seems to be well established as diploid also in Slovakia.

Allium angulosum L.
Present count
2n=16 MURÍN, loc.: Village of Devín, floodplain of the Morava river, leg. V. FERÁKOVÁ
Previous data and comment
2n=16 (19 refs.), 32 (3 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 6 FRIZEN & al. 1988, 32 NAUSCIAN & POLYAKOV 1989.
The repeating of our previous counts were made because of the presence of tetraploids (2=32) in Slovak flora. The new count indicates that the diploids are most common not only in Slovakia, but also in other parts of the world.

Fig. 1. Somatic chromosomes 2n=24 in *Allium carinatum*.

Allium carinatum L.
Present counts
2n=16 MURÍN, loc.: Bukovské vrchy Mts., Smolník, leg. A. MURÍN & J. MÁJOVSKÝ
2n=24 MURÍN, loc.: Malé Karpaty Mts., Brezová pod Bradlom, leg. J. MÁJOVSKÝ, (Fig. 1)
2n=24 MURÍN, loc.: Záhorská nížina Lowlands, Studienka pri Rudave, U Holbičkov, leg. J. MÁJOVSKÝ
Previous data and comment
2n=16 (12 refs.), 24 (18 refs.) cf. MÁJOVSKÝ, MURÍN & al. 1987; 16, 24+0-1B WETSCHNIG 1992, 24 SOLIMAN 1990 ut subsp. *carinatum*, 16 SOLIMAN 1990 ut subsp. *pulchellum*.
Because two levels of ploidy for the taxon were already known (in Slovak flora as well) some more data were interesting. The results indicate both diploids and triploids in Slovakia. Clear karyogeography could not be still suggested. Only some characteristics for triploids, i. e. a higher number of bulbils in the inflorescences and a higher level of pollen abortion were observed. This might help to distinguish the two ploidy levels also in herbarium material and complete karyogeography, at least for few countries where both cytotypes occur. Also the karyotypes are interesting because three types of nucleolar chromosomes in some populations are observed e.g. in the triploid one near Brezová pod Bradlom.

Allium oleraceum L.
Present counts
2n=32 MURÍN, loc.: Malá Fatra Mts., Párnica, leg. A. MURÍN
2n=32 MURÍN, loc.: Malé Karpaty Mts., Chlmec, leg. A. MURÍN
2n=32 MURÍN, loc.: Východoslovenská nížina Lowlands, Komárany, leg. A. MURÍN
2n=32 MURÍN, loc.: Chočské and Prosečianske vrchy Mts., Podbiel, Biela skala, leg. A. MURÍN
2n=32 MURÍN, loc.: Devínska Kobyla Mt., leg. V. FERÁKOVÁ
2n=32 MURÍN, loc.: Brezovské kopce Hills, Bradlo, leg. V. FERÁKOVÁ
2n=32 MURÍN, loc.: Ipeľsko-rimavská brázda, Šurice, leg. A. MURÍN
Previous data and comment
2n=32 (11 refs.), 40 (7 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 32, 40 LAANE & LIE 1985, 32 POGAN & al. 1986, JOACHIMIAK 1990, 32, 40, 48 WETSCHNIG 1992.
In the survey it is shown that prevailing chromosome number is 2n=32 which means the tetraploid one. However, surprising is rather high number of pentaploids with 2n=40. Therefore we were searching for such also in Slovak flora, but we did not found similar case.

Allium paniculatum L.
2n=16 MURÍN, loc.: Podunajská nížina Lowlands, Kurta hegy, leg. Z. SVOBODOVÁ
Previous data and comment
2n= 16 (8 refs.), 16+B, 32 cf. BOLKHOVSKIKH & al. 1969, 16 SOPOVA 1972, BARROS 1973, 16, 24 KOLLMANN 1973, 16 RUIS REJON 1976, 16 VOSA 1976,

1977, 16+2B CHESHMEDJIEV 1979, LOON 1980, 16 VAN LOON 1980, 16 VAN LOON & KIEFT 1980, 48 FERNANDEZ CASAS & GARCIA VILLARACO 1981, 32 TORNADORE 1981 ut subsp. *fuscum* (WALDST. &. Kit.) ARCANG., 16 PASTOR 1982, 32 VAN LOON & VAN SETTEN 1982, 48 VAN LOON & OUDEMANS 1982 ut subsp. *fuscum*, 32 JOHNSON 1982 ut subsp. *fuscum*, 16, 16+3B, 32 VAKHTINA & KUDRYASHOVA 1985, 24 ÖZHATAY 1984 ut subsp. *fuscum*, 16 PANICOLAU 1984 ut subsp. *fuscum*, 16, 40 ÖZHATAY 1984 ut subsp. *paniculatum*, 16 ÖZHATAY 1984 ut subsp. *villosulum* (HALÁCSY)STEARN, 8+0-2B RUÍZ REJÓN & al. 1986, 32 DALGAARD 1986, 16 ÖZHATAY 1986 ut subsp. *paniculatum*, 32 MONTMOLLIN & al. 1986, 16, 24, 32, 40 TZANAUKADIS & VOSA 1988, 16, 24 TZANAUKADIS & VOSA 1988, 16 GALLAND 1988 ut subsp. *breviscapum*, LIT. & MAIRE, 24 ÖZHATAY 1990 ut subsp. *fuscum*, 16 ÖZHATAY 1990 ut subsp. *villosulum*, 16, 32 KARAVOKYROU & TZANOUDAKIS 1991, 16 POGOSIAN 1991.
Although there are many counts e. g. 2n=16, 24, 32, 40 and 48 in the literature, they might belong to other taxa. According to the karyotype of the plants comming from one site in Slovakia (MURÍN unpubl.) we can expect that it might be subsp. *marginatum* (JANKA)SOÓ, (cf. SOÓ 1980) However, further studies of this taxon are needed.

Allium rotundum L.
Present count
2n=48 MURÍN, loc.: Podunajská nížina Lowlands, Senec, Martinský les, leg. J. MÁJOVSKÝ
Previous data and comment
2n=16 (6 refs.), 32 (4 refs.), 38, 40, 48 (1 ref.), cf. MÁJOVSKÝ, MURÍN &. al. 1987; 16, 32 KUDRYSHOVA 1990, 16 POGOSIAN 1991, 32 ÖZHATAY & al. 1993

Allium sphaerocephalon L.
Present count
2n=16 MURÍN, loc. Ipeľsko-rimavská brázda, Vyšná Pokoradz, leg. V. FERÁKOVÁ
Previous data and comment
2n=16 (27 refs.), 32 (1 ref.) cf. MÁJOVSKÝ, MURÍN & al. 1987; 16 TZAUNOUDAKIS 1985 ut subsp. *arvense* (GUSS.)ARCANG., 24 LOIDL & JONES 1986; 16, 16+1B, 16+2B GUILLEN & REJÓN 1984, 16 TZANAUDAKIS ut subsp. *sphaerocephalon*, 16 ÖZHATAY 1990 ut subsp. *sphaerocephalon*, 16 KARAVOKYROU & TZANOUDAKIS 1991 ut var. *aegetum* HELDR. & HAL., 16 GALLAND 1988

Allium ursinum. L.
Present count
2n=14 MURÍN, loc. Malé Karpaty Mts., Bratislava, Železná Studienka, leg. A. MURÍN
Previous data and comment
2n=14 (27 refs.) cf. MÁJOVSKÝ, MURÍN & al. 1987; 14 LOIDL 1984, 14 TZANOUDAKIS & VOSA 1988, 14 LOIDL & al. 1989, 14 SEMERENKO 1990, 14 WETSCHNIG 1992, 14 MAGULAEV 1992

All the counts for this species are the same including our results. Moreover, the chromosomes appear to be metacentric or nearly so (Fig 2.), what indicates an older origin (cf. STEBBINS 1971), but the basic chromosome number x=7 is not in line with this statement. The known chromosome numbers in the genus *Allium* L. with x=7 counts only 58 whereas x=8 was found in 192 species i. e. prevailing number of karyologically studied taxa and indicating secondary origin of this group with x=7.

Allium vineale L.
Present count
2n=32 MURÍN, loc.: Podunajská nížina Lowlands, Krasňany, leg. A. MURÍN
2n=32 MURÍN, loc.: Malé Karpaty Mts., Rača, leg. A. MURÍN
2N=32 MURÍN, loc.: Malé Karpaty Mts., Pezinok, leg. A. MURÍN
Previous data and comment
2n=32 (17 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987; 32, 40 LAANE & LIE 1985, 32 TZANOUDAKIS 1985, 32 ÖZHATAY 1986, 32 ÖZHATAY 1990, 32 POGOSIAN 1991, 32 WETSCHNIG 1992, 32+0-2s HOLLINGSWORTH & al. 1992 ut subsp. *vineale*.
All the data indicate the same tetraploid chromosome number (including ours) except that with 2n=40 i. e. pentaploid, found by LAANE & LIE 1985.

Allysum desertorum STAPF
Present count
2n=32 MURÍN, loc.: Podunajská nížina Lowlands, Marcelová, leg. J. MÁJOVSKÝ
Previous data and comment
2n=16 PODLECH & DIETERLE 1969, 32 MULLIGAN, ANCHEV in LÖVE 1975, STRID & FRANZÉN in LÖVE 1981.
Most of the counts including ours indicate the tetraploid status. As expected the diploid number found by PODLECH & DIETERLE might be evolutionary older one. The question remains, however, where else the diploids can occur.

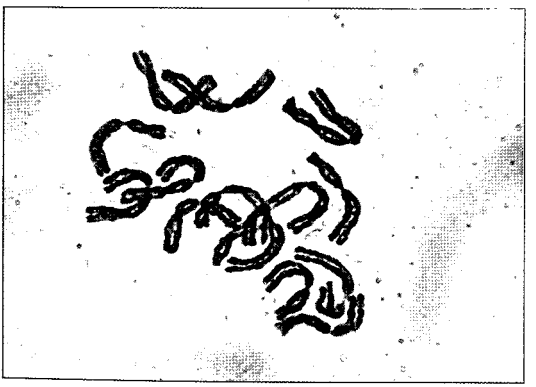

Fig. 2. Somatic chromosomes 2n=14 in *Allium ursinum* subsp. *ursinum*.

Bromus carinatus HOOK & ARN.
Present results
2n=56 MURÍN, loc.: Podunajská nížina Lowlands, Nitra, Nerudova street, leg. Z. SVOBODOVÁ
Previous data and comment
2n=56 (9 refs.), cf. BOLKHOVSKIKH & al. 1969; 56 POHL & DAVIDSE 1971, 56 DAVIDSE & POHL 1972, 1974, 56 MIREK 1982.
As shown in this survey all data including the present one indicate the same chromosome number.

Cirsium brachycephalum JUR.
Present count
2n=34 MURÍN, loc.: Podunajská nížina Lowlands, Hroboňovo, leg. J. MÁJOVSKÝ
Previous data and comment
2n=34 MURÍN & MÁJOVSKÝ 1983, 68 PÓLYA, 34 MURÍN & SVOBODOVÁ 1992.
Our counts, both the previous and present ones indicate the diploid status of the taxon growing in Slovakia.

Eragrostis pilosa (L.) P. BEAUV.
Present count
2n=20 MURÍN, loc.: Štiavnické vrchy Mts., Čajkov, leg. Z. SVOBODOVÁ
Previous data and comment
2n=40 (9 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 36 BIR & SAHNI 1983, 30 BIR & SINGH 1983, 20, 36, 40 BIR & SAHNI, 40 DEVESA 1990, 36, 72 BIR & CHAUHAN 1990.
Both morphological and karyological analyses are needed for explanation of the presence of diploids in Slovak flora.

Hesperis sylvestris CRANTZ subsp. *sylvestris*
Present count
2n=12 MURÍN, loc. Burda, Bajtava, leg. Z. SVOBODOVÁ
Previous data and comment
It seems to be the first count from the territory of Slovakia.

Linaria x *kocianovichii* ASCH.
Present count
2n=24 MURÍN, loc.: Podunajská nížina Lowlands, Belianske kopce, leg. J. MÁJOVSKÝ
Previous data and comment
It seems to be the first tetraploid count for plants from Slovakia designed as *Linaria belanensis* MÁJOVSKÝ prov. No chromosome data could be found in the literature as yet.

Ornithogalum kochii PARL.
Present count
2n=18 MURÍN, loc.: Malé Karpaty Mts., Svätý Jur, Pustý kostolík, leg. A. MURÍN
Previous data and comment
2n=14 (1 ref.), 15 (1 ref), 16 (2 refs.), 18 (7 refs.), cf. LÖVE & LÖVE 1974; 2 n=18 (3 refs.). cf. MÁJOVSKÝ, MURÍN & al. 1987, 18 MORET & GALLAND 1992.
We have repeated the counting once again from above mentioned locality in order to find some variability as shown in the survey in literature. But till now we could not find any.

Panicum capillare L.
Present count
2n=18 MURÍN, loc.: Podunajská nížina Lowlands, Nové Zámky, leg. Z. SVOBODOVÁ
Previous data and comment
2n=18 (8 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 18 VAHIDY & al. 1987, 18 KIEHN & al. 1991, 18 MURÍN 1993.
All the mentioned data are the same and indicate the diploid status of this taxon.

Panicum miliaceum L.
P. miliaceum subsp. *agricolum* H. SCHOLZ & MIKOLÁŠ
Present counts
2n=36 MURÍN, loc.: Podunajská nížina Lowlands, Šurany, leg. Z. SVOBODOVÁ
P. miliaceum subsp. *ruderale* (KITAG.) TZVELEV
2n=36 MURÍN, loc.: Podunajská nížina Lowlands, Veľké Zálužie, leg. Z. SVOBODOVÁ
Previous data and comment
2n=36 (13 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 36 SINHA & al. 1990.
There are some problems with determination of the species s. l., as the subsp. *ruderale* (KITAG.) TZVELEV was found to be diploid with 2n=18. Therefore some more counts were made from Slovak regional flora.

Plantago media L. subsp. *stepposa* (KUPRIANOVA) SOÓ
Present count
2n=24 MURÍN, loc.: Tríbeč Mts., Zobor Mt., Dražovce, leg. Z. SVOBODOVÁ
Previous data and comment
2n=12 BORHIDI 1968 ut *P. stepposa* KUPRIANOVA, 12 BASSET 1969 ut. *P. stepposa*, 12 LÖVE A. & KJELQUIST 1974, 24 ZEMSKOVA 1977, 24 MAGULAEV 1982, 12 LÖVE & LÖVE 1982, 24 MALAKHOVA 1990; 24 HOLLINGSWORTH & al. 1992, 24 UHRÍKOVÁ in LETZ & al. 1999
Another tetraploid report from Slovakia.

Plantago tenuiflora WALDST. & KIT.
Present count
2n=24 MURÍN, loc.: Podunajská nížina Lowlands, Tvrdošovce, leg. Z. SVOBODOVÁ
Previous data and comment
2n=24 (5 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987.

Peplis portula L.
Present count
2n=10 MURÍN, loc.: Západné Beskydy Mts., Oravská Priehrada, Slanický kostol, leg. J. MÁJOVSKÝ & A. MURÍN
Previous data and comment
2n=10 (6 refs.), cf. LOVE & LÖVE 1974, 2n=10 DMITRIEVA 1986, 10 HOLLINGSWORTH & al. 1992.
All the given data indicate the diploid status of the species.

Pilosella alpicola (SCHLEICH. ex GAUDIN) F. W. SCHULTZ & SCH. BIP., subsp. *ullepitschii* (BŁOCKI) ZAHN
Present count
2n=18 MURÍN, loc.: Vysoké Tatry Mts., Mengušovská dolina Valley, ca. 2150 a. s. l., leg. L. PACLOVÁ
Previous data and comment
2n=? It seems to be first count for this taxon.

Ranunculus reptans L.
Present count
2n=32 MURÍN, loc.: Vysoké Tatry Mts., leg. L. PACLOVÁ
Previous data and comment
2n=32 (7. refs.), cf. BOLKHOVSKIKH & al. 1969, 32 ZHUKOVA 1969, 32 KAPOOR & LÖVE A. 1970, 32 GOEPPERT 1974, 32 ZHUKOVA & PETROVSKY 1976, 32 KROGULEVICH 1976, 32 AGAPOVA 1980, 32 YURTZEV & ZHUKOVOVA 1982, LÖVE & LÖVE 1982, 32 ZHUKOVOVA 1982, 32, 48 LAVRENKO & SERDITOV 1985, 32 BIR & THAKUR 1986, 32 SOKOLOVSKAYA & al. 1989, 32 PARFENOV & DMITRIEVA 1988.
As shown above, all the previous counts as well as ours are in agreement and indicate the tetraploid status of the species studied, which is a very rare of Slovak flora found only in last time by Dr. PACLOVÁ (PACLOVÁ & ŠOLTÉSOVÁ 1993)

Senecio jacobea L.
Present counts
2n=40 MURÍN, loc.: Štiavnické vrchy Mts., Lehôtka pod Brehy, leg. J. MÁJOVSKÝ
2n=40 MURÍN, loc.: Považský Inovec Mts., Bezovec, leg. J. MÁJOVSKÝ & A. MURÍN
2n=40 MURÍN, loc.: Strážovské vrchy Mts., Ostrá Malenica, leg. A. MURÍN
2n=40 MURÍN, loc.: Strážovské vrchy Mts., Manín, Záskalie, leg. A. MURÍN
2n=40 MURÍN, loc.: Liptovská kotlina, Liptovská Mara, Havránok, leg. V. FERÁKOVÁ

2n=40 MURÍN, loc. Ipeľsko-rimavská brázda, Lučenec, Halier, leg. J. MÁJOVSKY
2n=40 MURÍN, loc.: Strážovské vrchy Mts., Bojnice, leg. A. MURÍN & J. MÁJOVSKY
2n=40 MURÍN, loc.: Šarišská vrchovina Mts., Fintice, leg. Ľ. DOSTÁL
2n=40 MURÍN, loc.: Čergov Mts., Kamenica, leg. Ľ. DOSTÁL
2n=40 MURÍN, loc.: Spišské vrchy Mts., Nižné Ružbachy, leg. Ľ. DOSTÁL
2n=40 MURÍN, loc.: Nízke Beskydy Mts., Topoľovka, leg. J. MÁJOVSKÝ & A. MURÍN
2n=40 MURÍN, loc.: Bukovské vrchy Mts., Uličˇ, leg. A. MURÍN & J. MÁJOVSKY
2n=40 MURÍN, loc.: Spišské kotliny, Primovce, leg. E. KRÁLIK & J. MÁJOVSKÝ
2n=40 MURÍN, loc.: Turčianska kotlina, Štiavnička, leg. D. BERNÁTOVÁ
2n=40 MURÍN, loc.: Východoslovenská nížina Lowlands, Obišovce, leg. L. MIHOKOVÁ
2n=40 UHRÍKOVÁ 1984: loc. Veľká Fatra Mts., Dedošovská dolina, leg. D. BERNÁTOVÁ
2n=80 MURÍN, loc.: Burda, leg. MURÍN & MÁJOVSKÝ
2n=80 MURÍN, loc.: Tríbeč Mts., Zobor Mt., leg. J. MÁJOVSKÝ
2n=80 MURÍN, loc.: Záhorská nížina Lowlands, Skalica, Vintoperk, leg. J. ZÁBORSKÝ
2n=80 MURÍN, loc.: Slovenský kras Karst, Turňa, leg. J. MÁJOVSKÝ & J. ZÁBORSKÝ
2n=80 MURÍN, loc.: Východoslovenská nížina Lowlands, Košice, Hradová, leg. L. MIHOKOVÁ
Previous data and comment
2n=40 (17 refs.), 2n=80 (2 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 2n=20 KUZMANOV & al. 1979a, 40 STEPANOV 1992.
Although the chromosome number 2n=40 prevails, there are also some octoploids mentioned in this survey and what is even more interesting are the diploid plants reported by KUZMANOV & al. 1979a.

Tragus racemosus (L.) ALL.
Present count
2n=40 MURÍN, loc.: Podunajská nížina Lowlands, Marcelová, sands, leg. Z. SVOBODOVÁ
Previous data and comment
2n=40 (8 refs.), cf. MÁJOVSKÝ, MURÍN & al. 1987, 40 BALTISBERGER & LEUCHTEMANN 1991.
All the data are the same and confirm the tetraploid status of the species.

Acknowledgement

Our sincere thanks are due to all botanists who collected and suppllied me (A. M.) with the material for karyological analyses, Dr. L. PACLOVÁ, †Dr. Ľ. DOSTÁL, Dr. D. BERNÁTOVÁ, Dr. L. MÁRTONFIOVÁ (MIHOKOVÁ), Dr. E. KRÁLIK, Dr. Ing. D. MAGIC, Ing. V. MIKOLÁŠ, Dr. J. ZÁBORSKÝ.

References

Because the full list of references would enlarge this paper more than twice we had to shorten this part and refer only to the main Chromosome Number Indexes where the relevant data for particular species and years of publication of the chromosome counts have already been given „in extenso".

BOLKHOVSKIKH Z., GRIF V., MATVEYEVA O. & ZAKHARYEVA O. (1969): Khromosomnye chisla tsvetkovykh rasteniy. – Leningrad, 926 pp.

GOLDBLATT P. (1981): Index to plant chromosome numbers 1975-1978. - Missouri Botanical Garden, 553 pp.

GOLDBLATT P. (1984): Index to plant chromosome numbers 1979-1981. - Missouri Botanical Garden, 472 pp.

GOLDBLATT P. (1985): Index to plant chromosome numbers 1982-1983. – Missouri Botanical Garden, 224 pp.

GOLDBLATT P. (1988): Index to plant chromosome numbers 1984-1985. – Missouri Botanical Garden, 264 pp.

GOLDBLATT P. & JOHNSON D. E. (1990): Index to plant chromosome numbers 1986-1987. – Missouri Botanical Garden, 243 pp.

GOLDBLATT P. & JOHNSON D. E. (1991): Index to plant chromosome numbers 1988-1989. – Missouri Botanical Garden, 238 pp.

GOLDBLATT P. & JOHNSON D. E. (1994): Index to plant chromosome numbers 1990-1991. – Missouri Botanical Garden, 267 pp.

GOLDBLATT P. & JOHNSON D. E. (1996): Index to plant chromosome numbers 1992-1993. – Missouri Botanical Garden, 276 pp.

LETZ R., UHRÍKOVÁ A. & MÁJOVSKÝ J. (1999): Chromosome numbers of several interesting taxa of the flora of Slovakia. – Biologia, Bratislava, 54: 43-49.

MÁJOVSKÝ J. & HEGEDÜŠOVÁ Z. (1997): 10. Linaria Mill. – In: GOLIAŠOVÁ K. (ed.): Flóra Slovenska V/2, pp. 97-116. – Veda, Bratislava.

MÁJOVSKÝ J., MURÍN A. & al. (1987): Karyotaxonomický prehľad flóry Slovenska. – Veda, Bratislava, 436 pp

PACLOVÁ L. & ŠOLTÉSOVÁ A. (1993): Iskerník zakoreňujúci (Ranunculus reptans L.) - nový druh pre flóru Slovenska. – Biológia, Bratislava 48: 14.

SOÓ R. (1980): A magyar flóra és vegetácio rendszertani – növényföldrajzi kézikönyve VI. – Akadémiai Kiadó, Budapest, 557 pp.

Received: 24 August 1998
Revised: 10 June 1999
Accepted: 8 July 1999