Thaiszia - J. Bot., Košice, 6: 25-38, 1996

THAISZIA
Journal of Botany

Thymus chromosome numbers from Carpathians and Pannonia

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MÁRTONFI P. & MÁRTONFIOVÁ L. (1996): *Thymus* chromosome numbers from Carpathians and Pannonia. – Thaiszia – J. Bot. 6: 25-38, 1996. – ISSN 1210-0420.

ABSTRACT: The paper gives a critical review of literature data on chromosome numbers in the genus *Thymus* sect. *Serpyllum* from Carpathians and Pannonia. At the same time 21 new data for 9 species of the genus are present. In two cases they represent the first datum for the species given: *T. alternans* KLOKOV 2n=56 and *T. bihoriensis* (A. KERN.) JALAS 2n=28. Several aspects of the chromosome numbers and their relations to the microevolution of species in the genus *Thymus* are discussed.

KEYWORDS: *Thymus*, karyology, Carpathians, Pannonia

Introduction

Taxonomic complexity of the genus *Thymus* and great difference among the authors as far as their conception of species or other taxa in this genus is concerned, make difficult even the complex evaluation of karyological situation. In literature many times single data are found and the mistakes in taxa determination cannot be excluded, especially when herbarium specimens are difficult to obtain. In addition, an attitude of particular authors to the interpretation of taxa is not always sufficiently clear. Above all the following authors contributed to more complex view of chromosome numbers in the genus or, at least, in certain region: VAARAMA 1949, JALAS 1948, SHIMOYA 1952, BONNET 1959, 1961a, 1961b, 1966, 1967, JALAS & POHJO 1965a, 1965b, JALAS & KALEVA 1966, 1967, KALEVA 1969, TRELA-SAWICKA 1968, 1970, 1972; JALAS &

UOTILA 1976, MORALES VALVERDE 1986a, 1986b, GOGINA 1990, FUNAMOTO & al. 1993.

In the region of Carpathians and Pannonia the genus *Thymus* is represented exceptionally by species from the sect. *Serpyllum* (MILLER) BENTH. (JALAS 1971). In revision (MÁRTONFI, in prep.) of *Thymus* in the area mentioned, 11 species are distinguished: *T. alpestris* TAUSCH, *T. alternans* KLOKOV, *T. bihoriensis* JALAS, *T. comosus* HEUFF., *T. froelichianus* OPIZ, *T. glabrescens* WILLD. (subsp. *glabrescens* only), *T. pannonicus* ALL., *T. praecox* OPIZ (with subsp. *praecox* and subsp. *polytrichus* (A. KERN.) JALAS), *T. pulcherrimus* SCHUR (with subsp. *pulcherrimus* and subsp. *sudeticus* (LYKA) P. A. SCHMIDT), *T. pulegioides* L. (subsp. *chamaedrys* (FR.) GUŞUL. only) and *T. serpyllum* L. With regards to this taxonomic conception also the chromosome numbers in this paper are discussed.

Material and methods

Two methods were employed for chromosome number determination. In both cases chromosomes were counted in root tip meristems. For the samples collected before 1995 the pre-treatment by p-dichlorbenzene during 3 hours was used, the samples were fixed in mixture of 96 % ethanol and glacial acetic acid in the ratio 3:1, macerated in 60°C warm nHCl and stained with lactopropionic-orceine. For the samples collected later than 1994 the pre-treatment by 0.002 M solution of hydroxyquinoline was used, the samples were fixed in the mixture of 96 % ethanol and glacial acetic acid 3:1, macerated in 60°C warm nHCl and stained in 10 % Giemsa solution in Sörensen phosphate buffer pH 6.9. Herbarium specimens are deposited in KO.

Results and discussion

Literature data concerning chromosome numbers in the genus *Thymus* from Carpathians and Pannonia are not very rich. Substantial for the region are the works of TRELA-SAWICKA (1968, 1970, 1972) above all. Numerous data are given also by JALAS (1948), JALAS & POHJO (1965), JALAS & KALEVA (1965, 1967). Sporadic new data are brought by VÁCHOVÁ in MÁJOVSKÝ & al. (1974, 1976) and TASENKEVIČ (1989). The survey of these data is presented in Tab. 1. In the following part of the paper new chromosome counts for the genus *Thymus* are given. For two of the species studied no data have been published so far (*T. alternans*, 2n=56, Fig. 1; *T. bihoriensis*, 2n=28, Fig. 2). The datum for *T. serpyllum* is, at the same time, the first published datum for the region studied, although there are many data for this species from the adjacent regions (e. g. JALAS 1948, TRELA-SAWICKA 1968).

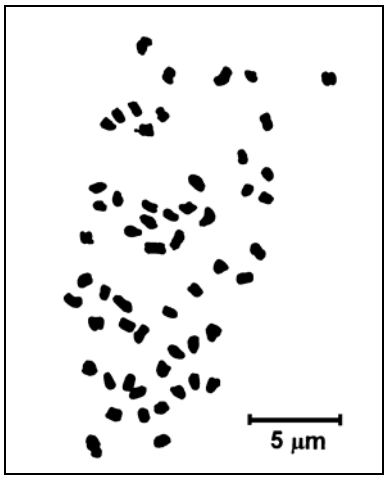
T. alpestris **2n=28**

Loc.: northern Slovakia, Spišská Magura Mts., Ždiar, near the Magurka hill (1198 m), ca 1185 m above s. l.; 21. VII. 1988; leg. MÁRTONFI; KO 8872, cult. sub PMI 1108.

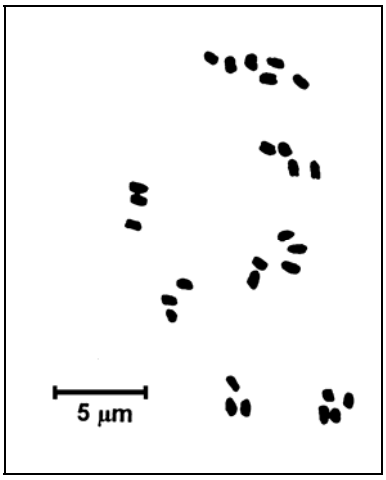
T. alternans **2n=56**

Loc.: northeastern Slovakia, Bukovské vrchy Mts., near the path across the fields, W from Runina; 31. VII. 1995; leg. MÁRTONFI; KO sine no., cult. sub PMI 2206.

Fig. 1-2. Root tip metaphase plates of *Thymus* species.



1. *T. alternans* KLOKOV (2n=56).



2. *T. bihoriensis* (A. KERN.) JALAS (2n=28).

T. bihoriensis **2n=28**

Loc.: Romania, Munţii Bihorului Mts., calcareous rocks between the Albac and Scărişoara villages, ca 1000 m above s. l.; 16. VII. 1995; leg. MÁRTONFI; KO sine no., cult. sub. PMI 1963.

T. glabrescens **2n=56**

Loc.: eastern Slovakia, Slanské vrchy Mts., near the road on the north of Slanec village; ca 480 m above s. l.; 22. VI. 1988; leg. MÁRTONFI; KO 8859, cult. sub PMI 1034.

Loc.: Slovakia, Slovenský kras karst, Jablonov nad Turňou, steep slope below Kukudičova skala hill, ca 520 m above s. l.; 27. VI. 1988; leg. MÁRTONFI; KO 8861, cult. sub PMI 1081.

T. pannonicus **2n=28**

Loc.: eastern Slovakia, glade near the tourist path from Kysak village in the direction of Jánošíkova bašta hill (523 m above s. l.), ca 500 m above s. l.; 19. VI. 1988; leg. MÁRTONFI; KO 8852; cult. sub PMI 1026.

Loc.: eastern Slovakia; Kavečany - Suchá dolina valley not far from Košice, near the road, ca 420 m above s. l.; 16. VI. 1988; leg. MÁRTONFI; KO 8864, cult. sub PMI 1020.

Loc.: eastern Slovakia, Slovenský kras karst, Drienovec - Drienovské kúpele bath; quarry, ca 250 m above s. l.; 15. VI. 1988; leg. MÁRTONFI; KO 9003, cult. sub PMI 1012.

Tab. 1. Survey of literature data on chromosome numbers with the genus *Thymus* from Carpathians and Pannonia.

Taxon	Original determination	2n	Authority	Source	Location of voucher
T. alpestris	*T. alpestris* TAUSCH	28	JALAS (1948)	Romania	H
T. alpestris	*T. alpestris* TAUSCH	28	TRELA-SAWICKA (1968)	5 loc.: Poland, Tatra Mts.: Border of lake Morskie Oko, 1393 m; slope of Gubałówka, 1123 m; Valley Chochołowska, 1140 m; Hala Pyszna, 1240 m; Hala Smytnia, 1100 m.	Inst. Plant Anat. Cytol. Cracow
T. alpestris	*T. alpestris* TAUSCH ex KERN.	28	VÁCHOVÁ in MÁJOVSKÝ et al. (1976)	Slovakia: Západné Tatry Mts., Kamenistá dolina valley, ca. 1520 m above s. l.	SLO
T. alpestris(?)	*T. pulcherrimus* SCHUR[1]	28	TASENKEVIČ (1989)	Ukraine: Prov. of Verchovinsk, Čičvin Mt., 1650 m above s. l.	Inst. Bot., Ľvov.
T. comosus	*T. comosus* HEUFF.	28	JALAS (1948)	Romania	H
T. comosus	*T. comosus* HEUFF.	28	KALEVA (1969)	Romania, region of Arges, Călimăneşti - Căciulata[2]	H
T. glabrescens	*T. glabrescens* WILLD.	56	JALAS & KALEVA (1967)	Romania, Region of Cluj, Turda. On a rock at the eastern end of the Turda Pass.	H
T. glabrescens	*T. glabrescens* WILLD.	56	TRELA-SAWICKA (1970)	9 loc.: Slovakia: Plain Koniar near the town Plešivec; Plain of Zadiel (Hrhov); Piešťany; Brzotín; Rožňava; Muránska Veľká Lúka; Muráň; Slovenská Ľupča; Valley Stratená;	Inst. Plant Anat. Cytol. Cracow
T. glabrescens	*T. illyricus* RONN. f. *nyaradyanus* (LYKA) NYÁR.	58	JALAS & KALEVA (1966)	Romania, Region of Cluj, Turda. In a pasture at the northwestern end of the Turda Pass.	H
T. pannonicus	*T. marschallianus* WILLD.	28	JALAS & KALEVA (1966)	2 loc.: Romania, Region of Cluj, on the roadside south of Turda; Region of Cluj, ca. 2 km east of the town of Turda, on steppe fragments between salt springs.	H

Tab. 1. - continued

T. pannonicus	*T. marschallianus* WILLD.	28	TRELA-SAWICKA (1970)	9 loc.: Slovakia: Silica; Plain of Silica; Plain of Zádiel (Hrhov); Turňa; Piešťany; Krásnohorské Podhradie; Lehota; Lúka; Hrádok	Inst. Plant Anat. Cytol. Cracow
T. pannonicus	*T. kosteleckyanus* OPIZ	28	TRELA-SAWICKA (1970)	6 loc.: Slovakia: Turňa; Brzotín; Lehota; Rožňava; Lúka; Vernár	Inst. Plant Anat. Cytol. Cracow
T. praecox	*T. humifusus* BERNH.	58	JALAS & KALEVA (1966)	Hungary, Tihany forest[3]	H
T. praecox	*T. praecox* OPIZ	58	TRELA-SAWICKA (1970)	5 loc.: Slovakia: Plain Koniar near the town Plešivec; Turňa; Krásna Hôrka near the town Rožňava; Valley Stratená; Vernár	Inst. Plant Anat. Cytol. Cracow
T. pulcherrimus	*T. pulcherrimus* SCHUR	56	JALAS & KALEVA (1967)	Poland, Prov. of Kraków, valley of the River Dunajec, Castle Czorsztyn	H
T. pulcherrimus subsp. *sudeticus*	*T. carpaticus* ČELAK.	56	TRELA-SAWICKA (1968)	5 loc.: Poland, Pieniny Mts.: Sokolica - Lower part of the slope, 670 m; Peak of Trzy Korony, 982 m; Gorge Homole, 600 m; Sczawnica Niżna, 460 m; Poland, Tatra Mts.: Raptawicka Turnia, 1500 m	Inst. Plant Anat. Cytol. Cracow
T. pulcherrimus subsp. *sudeticus*	*T. sudeticus* OPIZ	56	VÁCHOVÁ in MÁJOVSKÝ et al. (1976)	Slovakia: Belanské Tatry Mts., below the Belanská cave.	SLO
T. pulcherrimus subsp. *pulcherrimus*	*T. pulcherrimus* SCHUR	60	TRELA-SAWICKA (1968)	5 loc.: Poland, Tatra Mts.: Zakopane, bottom of Krokiew, 900 m; Valley Chochołowska, 1100 m; Valley Kościeliska, 950 m; Valley Mała Łąka, 1150m; Zbójnicka Turnia, 1450 m	Inst. Plant Anat. Cytol. Cracow
T. pulegioides	*T. pulegioides* L.	28	JALAS & KALEVA (1967)	Poland, Prov. of Kraków, Western Carpathians, Gorge Mts., W part, ca 600 m, pastureland	H

Tab. 1. - continued

T. pulegioides	*T. pulegioides* L. subsp. *montanus* (W. et K.) RONN.	28	JALAS (1948)	Romania	H
T. pulegioides	*T. pulegioides* L. subsp. *pulegioides*	28	TRELA-SAWICKA (1968)	23 loc.: Poland, Bieszczady: Polonina Caryńska; Ustrzyki Dolne; Poland, Tatra Mts.: Valley Kościeliska; Hala Kondratowa; Kalatówki; Valley Strążyska; Poland, Pieniny Mts.: Wierchliczka; Pass Szopka; Castle of Niedzica; Peak of Trzy Korony; Szlachtowa; Szczawnica; Krościenko; Way to Przehyba; Poland, Beskidy: Rajcza; Babia Góra; Nowy Sącz; Rabka; Żywiec; Maków Podhalański; Gródek upon Dunajec; Kowaniec near Nowy Targ, Rożnów near Nowy Sącz[2]	Inst. Plant Anat. Cytol. Cracow
T. pulegioides	*T. pulegioides* L.	28	TRELA-SAWICKA (1970)	10 loc.: Slovakia: Komárno; Zvolen; Krásnohorské Podhradie; Lúka; Rožňava; Muránska Veľká Lúka; Banská Bystrica; Muráň; Valley Stratená; Žilina	Inst. Plant Anat. Cytol. Cracow
T. pulegioides	*T. pulegiodes* L. subsp. *pulegioides*	30[4]	TRELA-SAWICKA (1968)	2 loc.: Poland, Tatra Mts., Zakopane; Poland, Beskidy, Rychwałd	Inst. Plant Anat. Cytol. Cracow

[1] Identification doubtful or mistake due to taxonomic confusion, voucher specimen not seen
[2] Another sample of T. comosus was studied by the author and also showed the number 2n=28, but origin of seeds is obscure. For details see text.
[3] There are mentioned three samples, but the second one with 2n=54 is made doubtful already by author („None of the preparation very succesful"); the third one is mentioned as 2n=58 for three different root-tips, whilst two different metaphase plates in one preparation did not show more than 2n=53-54.
[4] Probably 2n=28 + 2B, for details see text.

Loc.: Slovakia, Slovenský kras karst, Plešivec, near the road leading to Plešivecká planina plane, ca 280 m above s. l.; 27. VI. 1988; leg. MÁRTONFI; KO 8867, cult. sub PMI 1045.

Loc.: eastern Slovakia, Kavečany - Suchá dolina near the Košice, meadow above road; 480 m above s. l.; 16. VI. 1988; leg. MÁRTONFI; KO 8865; cult. sub PMI 1018.

T. praecox* subsp. *praecox **2n=56**

Loc.: eastern Slovakia, Slovenský kras karst; Turňa nad Bodvou, castle hill, limestone, 320 m above s. l.; 15. VI. 1988; leg. MÁRTONFI; KO 8856, cult. sub PMI 1015.

T. pulcherrimus* subsp. *sudeticus **2n=56**

Loc.: central Slovakia, Muráň, Muránska planina plane, Veľká lúka meadow towards Cigánka hill; 23. VI. 1988; leg. MÁRTONFI, KO 8855; cult. sub PMI 1036.

T. pulegioides **2n=28**

Loc.: eastern Slovakia, Poráč, Poráčska dolina valley, below Červené skaly rocks, ca 580 m above s. l.; 7. VIII. 1987; leg. MÁRTONFI; KO 8945, cult. sub 87/22TH.

Loc.: eastern Slovakia, forest margin south of Vinné village, ca 190 m above s. l.; 13. VII. 1988; leg. MÁRTONFI; KO 8917, cult. sub PMI 1069.

Loc.: northern Slovakia, Nová Ľubovňa, near the Kolačkovský potok brook; east from Hŕbok hill; 20. VII. 1988; leg. MÁRTONFI; KO 8889, cult. sub PMI 1102.

Loc.: northern Slovakia, Zborov, near Rakovec brook, ca 390 m above s. l.; 12. VII. 1988; leg. MÁRTONFI; KO 8912, cult. sub PMI 1061.

Loc.: eastern Slovakia, Slovinky, near the road, west from Slovinky village, 480 m above s. l.; 7. VIII. 1987; leg. MÁRTONFI; KO 8944, cult. sub 87/15TH.

Loc.: central Slovakia, green in Zlatno village; 23. VI. 1988; leg. MÁRTONFI; KO 8936; cult. sub PMI 1041.

Loc.: eastern Slovakia, Stropkov, below Baňa hill (371 m), ca 350 m above s. l.; 29. VII. 1988; leg. MÁRTONFI; KO 8887, cult. sub PMI 1124.

Loc.: Slovakia, Muráň, Muránska planina plane, Maretkiná, path to Poludnica hill; 23. VI. 1988; leg. MÁRTONFI; KO 9009, cult. sub PMI 1040.

T. serpyllum **2n=24**

Loc.: south Moravia (Czech Republic), sands near the railway, south of Bzenec village; 5. VII. 1987; leg. MÁRTONFI; KO 8853, cult. sub 87/27TH.

Notes to the new chromosome numbers and literature data

[the species name and chromosome number is always followed by the number of localities in Carpathians and Pannonia (given in brackets), where this chromosome number was counted, literature data and also newly published data are included here]

***T. alpestris,* 2n=28 (8 loc.).** Diploid species, close relative of the species *T. pulegioides*, characterised probably by only stable cytotype in the whole of its Sudeten and Carpathian region. Probably also the datum from another locality in East Carpathians (TASENKEVIČ 1989) is related to this species (for more detail, see *T. pulcherrimus*).

***T. alternans,* 2n=56 (1 loc.).** The first datum for this species, obtained from a number of individuals from one locality in the territory of Slovakia, where it was found only recently (MÁRTONFI 1996). No data on chromosome numbers for this species from other area of its distribution (species is Eastern Carpathian subendemic) have been known. Ecological demands are very similar to that of the species *T. pulegioides* (2n=28), with which it was frequently confused in the past, above all when the allelotrichous indument of the stem is neglected. Sometimes it was confused also as a hybrid between *T. pannonicus* (also 2n=28) and *T. pulegioides*, or, as the case may be, it was interpreted in very narrow sense, on the basis of the original description by KLOKOV (1954): „calyx inter nervos albidus, nervis atrivirentibus", while the given characters of this species may vary substantially. *T. alternans* is probably the species from the group of evolutionarily younger taxa, which could arise by alopolyploidization as a tetraploid; as the possible parent taxa probably *T. pulegioides* from the subsect. *Alternantes* KLOKOV and some representative of the subsect. *Isolepides* (BORBÁS) HALÁCSY can be considered (cf. JALAS 1970).

***T. bihoriensis,* 2n=28 (1 loc.).** The first datum for this species, which is a Transsylvanian endemic. It probably represents an old, specialised type in the genus *Thymus* from the period of divergent evolution of the genus. After its rise it stabilised in limited area in ecologically clear-cut niches and never expanded to larger territory.

***T. comosus,* 2n=28 (2 loc.).** JALAS (1948) published the chromosome number for this Transsylvanian endemic for the first time without specification of the locality from Romania. He obtained the seed sample probably from the Botanical Garden in Cluj (similarly to the species *T. alpestris* and *T. pulegioides* mentioned in the same paper) and grew the plants in the Botanical Garden of Helsinki University. Chromosome number of this plant, which was still alive, was counted again and confirmed in 1966 (JALAS & KALEVA 1967). These authors give also another chromosome counts for this species, however, the origin of the material is rather obscure. Further count 2n=28 was obtained from plant coming from the Garden of Vácrátót, Hungary. However they give also the result, not published by the time, when T. POHJO found the somatic numbers 58-60 for two samples of *T. comosus* received from Alpengarten im Belvedere as *T. hirsutus* var. *alpicans* and from Frohnleiter - Steiermark as *T. brevicaulis* var. *dalmaticus*. According to the authors the plants correspond well to description of *T. comosus* and they consider

it the first case of obvious infraspecific polyploidy within the genus *Thymus*. With regards to doubtful origin of the seeds, where nothing suggests that they should come from the territory of Romania, we assume that the case of 2n=58-60 does not represent a trustworthy count for this species. KALEVA (1969) considers doubtful also another datum related to *T. comosus* (2n=28), when seed sample was obtained from Cluj, Univ. Babes-Bolyai, because the locality given (Region of Mangalia, Vama Veche) is a long way from the species distribution known. KALEVA (1969), however, gives another reliable datum from Romania (see Tab. 1) again with 2n=28. This number seems to be characteristic for this species which thus belongs to the group of diploid taxa with stenotopic occurrence.

***T. froelichianus*.** From the area studied no chromosome counts have been known. This species often classified with *T. pulegioides* as a subspecies (*T. pulegioides* L. subsp. *carniolicus* (BORBÁS) P. SCHMIDT) or a variety (*T. pulegioides* L. var. *vestitus* (LANGE) JALAS), occurs only in two localities in western part of the region studied (cf. ČÁP 1979). It is probably the northeastern enclave of its overall distribution. Chromosome number 2n=28 (BONNET 1961a) is known from France and 2n=56 (MORALES VALVERDE 1986a) from Spain. With regards to unclear taxonomic situation it is not sure if the Spanish populations given under the name *T. froelichianus* are the same taxon as the populations from other parts of Europe.

***T. glabrescens* subsp. *glabrescens*, 2n=56 (12 loc.),** 2n=58 (1 loc.). The uniformity of chromosome numbers of this species (or subspecies) from Carpathians and Pannonia is remarkable. Even if rather doubtful (with regards to the determination of original specimen) datum 2n=58 (JALAS & KALEVA 1966) is not neglected, the chromosome numbers are tetraploid in any case, with typical number 2n=56. The same chromosome number was found also in many localities outside this territory, e. g. from Russia (JALAS & KALEVA 1967, GOGINA 1990) and Poland (TRELA-SAWICKA 1968). Data given by TRELA-SAWICKA (1968) from the territory north from Carpathians are, however, interesting by some other chromosome numbers. The number 2n=56 is given for all hairy forms of *T. glabrescens* (as *T. austriacus* BERNH.) and for bigger part of the data related to glabrous forms. In these forms, however, also 2n=28, 32 and 58 were found. At the same time she writes that in the most of investigated plates of the cytotypes with 56 and 58 somatic chromosomes, two chromosomes with trabants could be discerned and, on the other hand, the study of cytotypes with 2n=28 and 32 failed to reveal their occurrence in the somatic plates. These results can be connected with the probable hybrid origin of the species *T. glabrescens* and, as the case may be, with its possible polytopic origin. The opinions on the origin of this species are, however, not uniform. GOGINA (1990) studied populations of one of the morphotypes of *T. glabrescens*, which classified as *T. loevyanus* OPIZ in Podmoskovje region. Chromosome number for this type is 2n=56 and exceptionally 2n=48-50. [In other part of the work (p. 145), however, 2n=28 is given as well]. She assumes that *T. loevyanus* arose as a hybrid between *T. pulegioides* and *T. marschallianus* auct. non WILLD. (=*T. pannonicus* ALL.). She grew morphologically very similar plants resulting from this very case of experimental hybridization. These hybrids had 2n=28 (identically with both parents) and the author supposes that in the case of *T. loevyanus* the genetic material was duplicated. Further she assumes that these

thoughts could be extended also to the species *T. glabrescens*. However, the situation does not seem to be so simple, because *T. glabrescens* is a very polymorphous taxon, sometimes even with an outline of monopodial branching, which would point to an old hybrid probably between *T. pannonicus* and some representative from the subsection *Pseudomarginati* (H. BRAUN ex BORBÁS) JALAS (cf. JALAS 1971), as supposed already by JALAS & KALEVA (1970). Polytopic origin of the species is possible as well. In the studied territory of Carpathians and Pannonia this taxon is probably exclusively tetraploid and probably of uniform origin. Chromosome number could, in this way, help to determine morphologically extreme types.

***T. pannonicus,* 2n=28 (22 loc.).** This diploid chromosome number is obviously the stable number for this species (including its nomination by various synonyms). Besides the localities from Carpathians and Pannonia this number was confirmed in a many cases from various parts of distribution area of this species (JALAS 1948, JALAS & POHJO 1965, JALAS & KALEVA 1967, TRELA-SAWICKA 1972, MARKOVA 1983, GOGINA 1990). MARKOVA (1983) besides the number 2n=28 (Bulgaria, Sofia, near Klisura) gives the only different datum for this species, 2n=35 for *T. pannonicus* ALL. var. *latifolius* (BESSER) JALAS (Bulgaria, Stara Planina Mt, near Goliza, voucher in SOM). This could probably be a hybrid between *T. pannonicus* and some taxon with higher chromosome number. These cases are, however, relatively rare.

***T. praecox,* 2n=56 (1 loc.), 2n=58 (6 loc.).** Data from Carpathians and Pannonia are related only to the subsp. *praecox*. For this subspecies further data from outside this territory are known. From the territory of Switzerland 2n=56 is reported (2 loc., as *T. praecox* or as *T. humifusus*, JALAS & POHJO 1965), from the Czech Republic 2n=58 (1 loc., JALAS & KALEVA 1967) and 2n=54 (JAVŮRKOVÁ-JAROLÍMOVÁ in MĚSÍČEK & JAROLÍMOVÁ 1992), from Poland 2n=56 (4 loc., TRELA-SAWICKA 1972) and 2n=56 from France (1 loc., LOON & JONG 1978). The situation is similar also for the subsp. *polytrichus*, where the chromosome numbers given under various names of taxa (*T. praecox* subsp. *polytrichus, T. polytrichus* A. KERN., *T. alpigenus* A. KERN.) from the territories outside Carpathians, are the following: the most frequent 2n=56 (JALAS & POHJO 1965, BONNET 1967, LÖVE & LÖVE 1982), but also 2n=54, 2n=ca. 52, 2n= ca. 54, 2n=55-56 (JALAS & POHJO 1965). At least a part of data, published by JALAS & KALEVA (1966) under the label „the polyploid complex of the Alps" with the values 2n=50-52, 2n=ca. 50, 2n=54 a 2n=56 is probably related to this taxon. When all these data considered, it must be stated that taxa from the agg. *T. praecox*, which occur in the region of Carpathians and Pannonia, show considerable karyological differentiation, which is probably the result of polyploidization and aneuploidization in the course of evolutionary processes and perhaps also the consequence of polytopic origin of the taxa.

***T. pulcherrimus* subsp. *sudeticus,* 2n=56 (8 loc.), *T. pulcherrimus* subsp. *pulcherrimus,* 2n=60 (5 loc.).** From the data for this species, which is Carpathian endemic, it appears that both subspecies are karyologically well differentiated. JALAS (1971) assumes that the whole species should very likely be considered a derivative from intersubsectional hybridization between members of *Pseudomarginati* and marginate

Alternantes. Datum 2n=28 given by TASENKEVIČ (1989) is better considered a confusion with mountain species *T. alpestris*.

***T. pulegioides,* 2n=28 (45 loc.),** 2n=30 (2 loc.). The species is very variable from the point of view of morphology in the whole its area and classified according to author's opinion usually into several subspecies. All the data from outside the territory of Carpathians are related to 2n=28, or n=14 (for example VAARAMA 1947, JALAS 1948, GADELLA & KLIPHUIS 1963, JALAS & POHJO 1965, JALAS & KALEVA 1966, BONNET 1967, JALAS & KALEVA 1967, KALEVA 1969, BRAND & al. 1979, MORALES VALVERDE 1986a, GOGINA 1990). Extreme numbers from two localities - 2n=30 (TRELA-SAWICKA 1968) are not highly probable and can perhaps be explained by the occurrence of B-chromosomes: 2n=28+2B. Such case was recorded twice for *T. pulegioides* from Byelorussia (DMITRIEVA 1986, PARFENOV & DMITRIEVA 1988).

***T. serpyllum,* 2n=24 (1 loc.).** It is remarkable, that in this paper the first datum for this species from the territory of Carpathians and Pannonia is published. Evaluation of the data from further parts of its distribution area is partially complicated by wide conception of the species used by some authors, where this collective species represent often all the section *Serpyllum.* The species in narrow conception has obviously one stable cytotype 2n=24, which is given by a number of authors (LÖVE & LÖVE 1942, JALAS 1948, JALAS & POHJO 1965, TRELA-SAWICKA 1968, GOGINA 1990, JAVŮRKOVÁ-JAROLÍMOVÁ in MĚSÍČEK & JAROLÍMOVÁ 1992).

Sect. *Serpyllum* and chromosome number relation within the genus *Thymus*

From the point of view of karyology, but also systematics, it is impossible to evaluate the representatives of the sect. *Serpyllum* from Carpathians and Pannonia in isolation from other members of the section and without considering the whole genus *Thymus*. Although with different opinion on the genus classification, GOGINA (1990) prepared the scheme of basic directions of taxa migration in the genus. She supposes that the genus arose only after the rise of the Atlantic Ocean and the separation of America, since in aborigenous flora of America no representative of the genus is present. The largest section of the genus, sect. *Serpyllum* has its evolutionary centre in Balkan, from where it spread above all to the north and then it continued to east and west. Migration from Balkan reached the territory of Carpathians and Pannonia. For several taxa (*T. pulegioides, T. pannonicus*, *T. serpyllum*) it was the basis for their further expansion, but also the place of further evolutionary processes, which gave rise above all to evolutionary older diploid endemic taxa (*T. comosus, T. bihoriensis*), and later also to tetraploid ones (*T. pulcherrimus, T. alternans*), probably as a result of intersubsectional hybridization. The explanation of origin of the taxa *T. glabrescens* and *T. praecox*, is rather problematic, in our opinion they arose polytopically in many places of Europe. It appears, that *T. glabrescens* in Carpathians and Pannonia is morphologically very variable taxon, it has uniform origin connected with intensifying of speciation in drier geological periods, while *T. praecox* was influenced probably by migration and hybridization of various types, which arose above all in mountain systems of Europe and

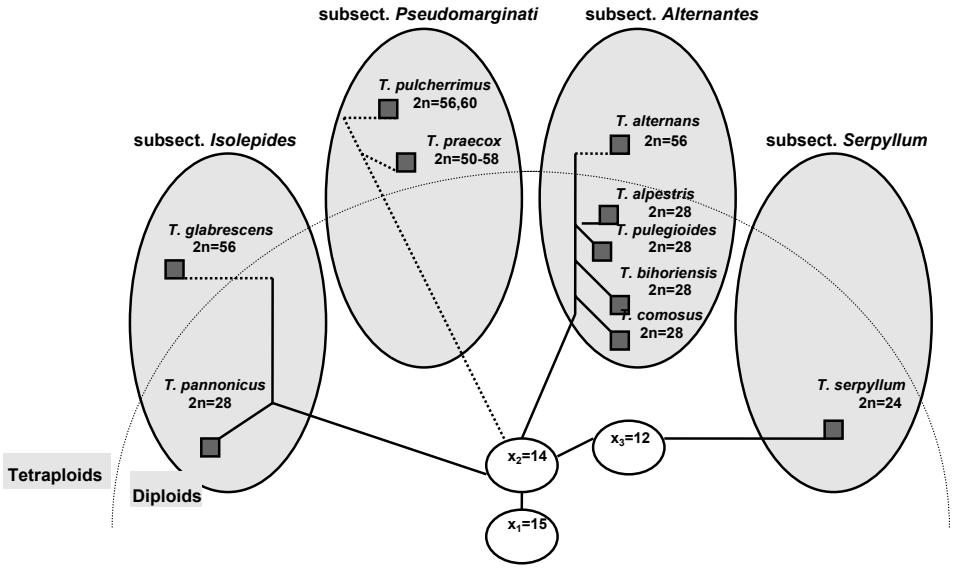


Fig. 3. Position of taxa of the genus *Thymus* sect. *Serpyllum* from Carpathians and Pannonia with regards to karyological data.

later they adapted also to different and in various ways differentiated ecological conditions in belts with lower altitude (cf. Fig. 3).

The question of basic chromosome number in the genus *Thymus* remains a problem. It was dealt with by many authors. Detailed survey of various opinions is presented by GOGINA (1990). Various authors proposed the basic numbers x=6, 7, 9, 10, 15 and other derived from them. GOGINA (1990) endorses a hypothesis about the basic chromosome number x=7, preferred also by other authors (BONNET 1958, TRELA-SAWICKA 1972), above all owing to the chromosome number 2n=14 found in the genus. Further she assumes that basic number x=15 could arise as a result of combination of haploid genomes x=7 and x=8, although at the present time any evidence confirming such processes is missing. Even more, when x=7 and frequent multiple polyploidization is present, it difficult to explain why hexaploids with 2n=42 do not occur in the genus. JALAS (1948) also supported the opinion that the basic chromosome number in the genus *Thymus* is x=7, however, later he changed his position (JALAS & KALEVA 1967) and suppose, that primary basic number in the genus *Thymus* might well be as high as x=15 (t. j. one of the basic numbers proposed for the genus by LÖVE & LÖVE 1961). This would be in accordance with the situation found in *Origanum* and *Micromeria*. From the number x=15 a dysploid downward sequence of secondary basic numbers x=14, x=13, x=12 can be derived. It allows good explanation of various chromosome numbers

occurring in the genus *Thymus*. When various aspects of the karyological data and also of further character sets are taken into consideration, we can do nothing but agree with main evolutionary trends causing speciation in *Thymus* as proposed by JALAS & KALEVA (1967): 1. dysploidy, 2. formation of tetraploids, 3. probable aneuploidy at tetraploid level and 4. hybridization without sterility barriers between tetraploids of different origin.

Acknowledgements

The present study was supported by Slovak Scientific Grant Agency (grant No. 1/1137/94).

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Received: 12 September 1996
Revised: 25 October 1996
Accepted: 31 October 1996