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中国特有牛筋条属的核形态及其系统位置*

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摘要：报道了以3个不同居群为材料进行的牛筋条属核形态学研究结果。其间期核和前期核分别为简单染色体中心型和中间型。染色体长度界于1.66μm至0.87μm之间，核型公式为2n＝28m＋6sm，核型分类为1A型。相同的染色体基数及其与苹果亚科成员近似的核型，支持将牛筋条属置于苹果亚科，而不赞同将其归属于李亚科或另立亚科的观点。

关键词：牛筋条属；核形态；系统位置
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The Karyomorphology and Systematic Position of the Chinese Endemic Genus *Dichotomanthes*

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Abstract：Results of studies on the karyomorphology of three populations of the monotypic genus *Dichotomanthes* Kurz are presented in this paper. The interphase nuclei and prophase chromosomes are categorized to be of simple chromocenter type and of proximal type respectively. The metaphase chromosomes range from 1.66μm to 0.87μm in length. The karyotype is formulated as 2n＝34＝28m ＋ 6sm，and the karyotypic asymmetry is of 1A type. The same basic chromosome number and similar chromosome morphology of *Dichotomanthes* to those of members in the Maloideae support the point of view that *Dichotomanthes* belongs to Maloideae.

Key words：*Dichotomanthes*；Karyomorphology；Systematic position

Dichotomanthes Kurz is a monotypic genus endemic to southwestern China's Yunnan and Sichuan Provinces，with the only species *D. tristaniaecarpa* Kurz. As one of the key groups in the phylogenetic study of Rosaceae，its systematic position has been paid much attention and has long been a controversial matter. It was wrongly referred to the family Lythraceae when Kurz（1873）established the genus. Later，Hemsley（1886）treated it as a genus in Rosaceae，close to *Pygeum* of the subfamily Prunoideae，on the ground that *Dichotomanthes* has the characters of epi－perigynous flower，dry single carpel and superior 1－locular ovary with 2 ovules，this view was supprorted by Rehder（1916）.

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In fruit, however, the hard and dry carpel of *Dichotomanthes* is surrounded by red and thick hypanthium (fleshy calyx) and thus make its fruit appear similar to a pome, so this genus may also have some affinity with the members in Maloideae (Yu *et al*, 1985, 1974; Yu, 1984; Challice, 1981). Most interestingly, Gladkova (1969) considered *Dichotomanthes* to be a quite isolated genus in Rosaceae and suggested an independent subfamily Dichotomanthoideae. This last treatment was accepted by Takhtajan (1997).

Cytological evidence is of significance in solving the phylogenetic problems in Rosaceae, particularly in those at high ranks, such as the subfamilial division. The karyotype of *Dichotomanthes*, except that its chromosome number was reported to be 2n = 34 (Gladkova, 1969), has not been reported. This paper presents results of our study on the karyomorphology of the genus with a point of view of providing some insights into its phylogenetic relationships and systematic position.

Materials and Methods

Seeds or shoot tips of *D. tristaniaecarpa* were collected from Tengchong and Mengzi counties, and Kunming of Yunnan Province, China. The voucher specimens (Li－Hua Zhou 97141, 97148, 97139) were deposited in the Herbarium of Kunming Institute of Botany, Chinese Academy of Sciences (KUN).

The roots or shoot tips were pretreated with 0.05% colchicine for 4～6 hours and then fixed in the 3∶1 mixture of absolute ethanol and glacial acetic acid for 30 minutes. After being macerated in 1 mol / L HCl for 10 minutes at 60℃, they were stained with carbol fuchin and then squashed.

The karyomorphological classification of interphase nuclei and prophase chromosomes followed Tanaka (1977, 1971). The karyotype formula was based on measurements of chromosomes at metaphase of mitosis. The symbols used to describe the karyotype followed Levan *et al* (1964). The classification of karyotype asymmetry followed Stebbins (1971).

Results

In interphase nuclei (Plate Ⅰ∶1), several darkly stained chromocenters were observed. The chromocenters showed irregularly protruded rough surface of which gradually transformed into diffused chromatin. The interphase nuclei are of simple chromocenter type in Tanaka's classification.

In prophase chromosomes (Plate Ⅰ∶2), hetero－and euchromatic segments were distinguishable, and the heterochromatic segments were distributed mainly in the proximal regions. The prophase chromosomes belong to the proximal type in Tanaka's classification.

In the three populations studied, metaphase chromosomes were all counted, based on 5 cells, to be 2n＝34 (Plate Ⅰ∶ 3～4), ranging from 1.66～0.87 μm in length (Table 1). The average length of the chromosomes is 1.24 μm. The karyotype formula is 2n＝34＝28m ＋ 6sm. The karyotype asymmetry is categorized as of 1A type.

Discussion

The basic chromosome number of x＝17 in *Dichotomanthes tristaniaecarpa*, which was first reported by Gladkova (1969), was confirmed by our observations of three populations from Yunnan. The

Table 1 Measurement of mitotic metaphase chromosomes of *Dichotomanthes tristaniaecarpa*

Chro. No.	Length (μm)	Relative length	Arm ratio	Type	Chro. No.	Length (μm)	Relative length	Arm ratio	Type
1	1.07+0.59=1.66	3.93	1.81	sm	18	0.72+0.47=1.19	2.83	1.53	sm
2	1.02+0.62=1.64	3.89	1.64	sm	19	0.66+0.53=1.19	2.83	1.25	m
3	0.93+0.60=1.53	3.63	1.55	sm	20	0.59+0.57=1.16	2.75	1.03	m
4	0.90+0.58=1.48	3.51	1.52	sm	21	0.6+0.56=1.16	2.75	1.07	m
5	0.85+0.61=1.46	3.47	1.39	m	22	0.6+0.56=1.16	2.75	1.07	m
6	0.82+0.59=1.41	3.35	1.39	m	23	0.6+0.55=1.15	2.73	1.09	m
7	0.78+0.63=1.41	3.35	1.24	m	24	0.61+0.54=1.15	2.73	1.13	m
8	0.83+0.56=1.39	3.30	1.48	m	25	0.68+0.46=1.14	2.71	1.47	m
9	0.66+0.65=1.31	3.11	1.02	m	26	0.68+0.46=1.14	2.71	1.47	m
10	0.69+0.61=1.30	3.09	1.13	m	27	0.58+0.55=1.13	2.68	1.05	m
11	0.7+0.59=1.29	3.06	1.18	m	28	0.56+0.55=1.11	2.64	1.02	m
12	0.74+0.53=1.27	3.02	1.40	m	29	0.60+0.50=1.10	2.61	1.2	m
13	0.65+0.62=1.27	3.02	1.05	m	30	0.58+0.50=1.08	2.56	1.16	m
14	0.63+0.61=1.24	2.94	1.03	m	31	0.56+0.49=1.05	2.49	1.14	m
15	0.64+0.56=1.20	2.85	1.14	m	32	0.55+0.49=1.04	2.47	1.12	m
16	0.64+0.55=1.19	2.83	1.16	m	33	0.57+0.46=1.03	2.45	1.34	m
17	0.72+0.47=1.19	2.83	1.53	sm	34	0.49+0.38=0.87	2.07	1.29	m

Note: Chro. No. = Chromosome number

karyotype is reported here for the first time.

In Rosaceae, basic chromosome number is one of the most important characters in classifying the taxa of high ranks. The difference in basic chromosome number is fairly clear-cut among four subfamilies of Rosaceae (Darlington and Wylie, 1955; Sax, 1932): 9 in Spiraeoideae, 7, 8 and 9 in Rosoideae, 8 in Prunoideae and 17 in Maloideae.

It appears that, in Gladkova's (1969) treatment of *Dichotomanthes* as an independent subfamily Dichotomanthoideae, the systematic significance of the number of carpels and of the position of ovary was over-emphasized. In fact, character of single carpel appears in genera of different subfamilies in Rosaceae, such as *Stephenandra*, *Adenostoma* and *Neillia* of Spiraeoideae and *Spenceria* of Rosoideae (Yu *et al*, 1985, 1974). In Maloideae, the number of carpels ranges from one to five. The position of ovary also varies from taxa to taxa, for example, semi-inferior in *Cotoneaster* and inferior in *Crataegus*.

In our opinion, the fruit type seems to be more distinct in Maloideae than those two characters mentioned above and thus may be more important in the phylogenetic considerations of the family. Actually, the fruit of *Dichotomanthes* is very similar to those of Maloideae in structure and origination. In a new form we collected recently from Yunnan①, we found that the thick and fleshy hypanthium completely surrounded the dry carpel (equal to pyrene of *Cotoneaster*). The fruit appeared nearly the same

① Zhou L H, 1999. The phylogenetic study of the genus *Dichomanthes* (Rosaceae), with special reference to phylogenetic problems of the genus *Cotoneaster*. Unpublished dectoral thesis of the Kunming Institute of Botany.

as a pome in structure.

Hence, the fruit type and the cytological evidence strongly suggest that *Dichotomanthes* should belong to the subfamily Maloideae, while the treatment of *Dichotomanthes* as a genus in Prunoideae or as an independent subfamily should be rejected. The karyotype of *Dichotomanthes*, which consists of median and submedian chromosomes, is basically the same as 2A type in *Malus* and *Pyrus* of the subfamily Maloideae (Chen *et al*, 1993), and thus further suggests their relatively close relationship. The close affinity of *Dichotomanthes* and the members of Maloideae is also supported by much evidence from anatomy, embryology, flower ontogeny and palynology (Zhou, 1999; Zhou *et al*, 2000).

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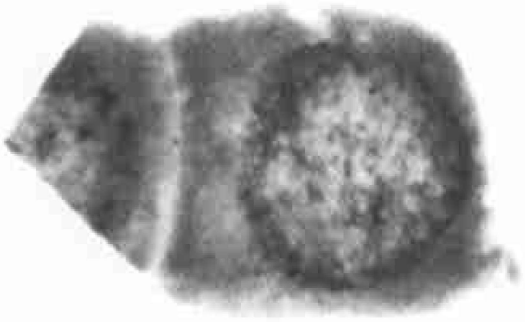
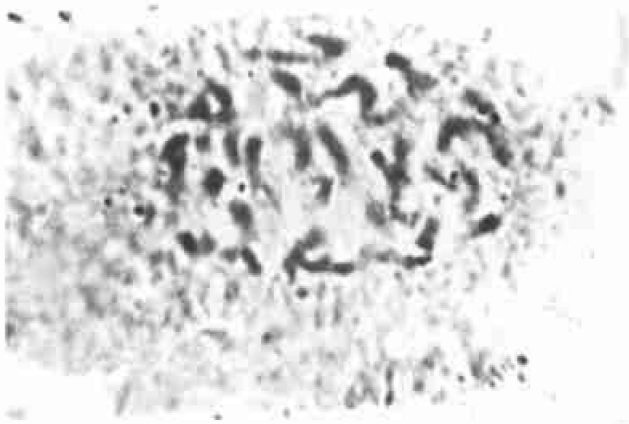
Explanation of Plate Ⅰ

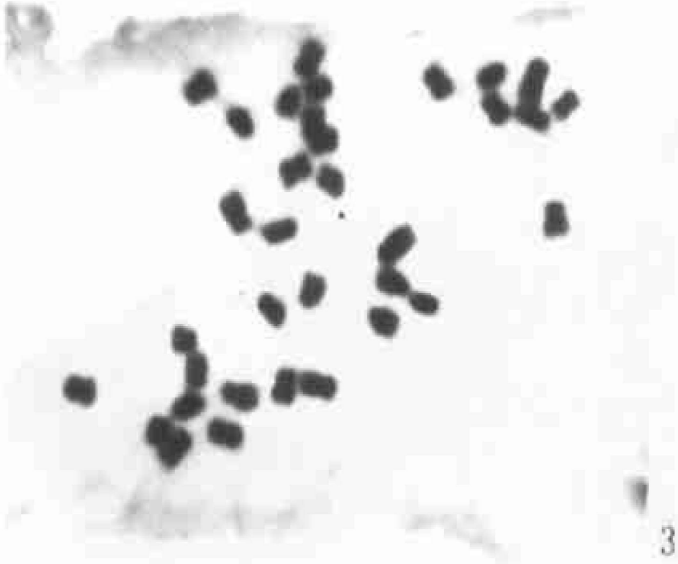
Photomicrographs of nuclei and chromosomes of *Dichotomanthes tristaniaecarpa* Kurz. 1. Interphase nuclei (×1591); 2. Prophase (×1591); 3. Metaphase (×4610); 4. Karyotype



1

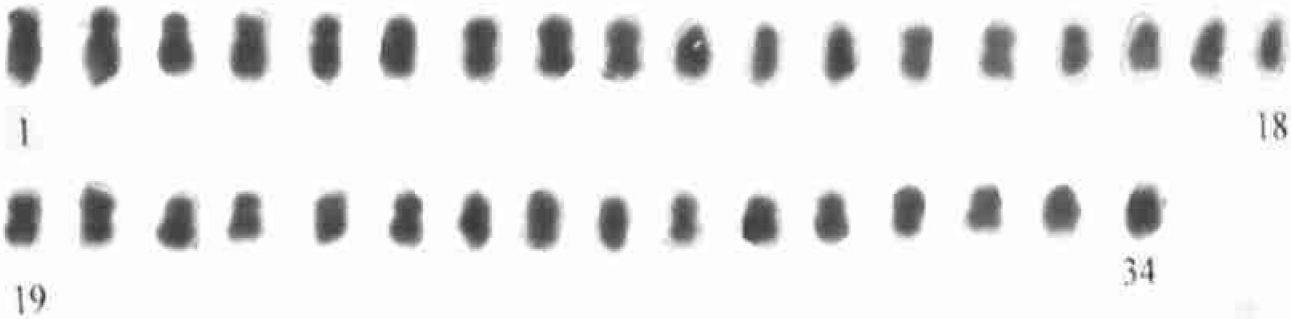


2



3

4



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See explanation at the end of text