Typhonium jinpingense, a New Species from Yunnan, China, with the Lowest Diploid Chromosome Number in Araceae

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ABSTRACT. *Typhonium jinpingense* Z. L. Wang, H. Li & F. H. Bian (Araceae) from Yunnan, China, is described as a new species in Araceae. The karyotype of metaphase chromosomes in somatic cells is: $2n = 10 = 2m+2st+6sm$. This is the lowest diploid number so far reported in this family.

Key words: Araceae, chromosome numbers, *Typhonium.*

Fieldwork was conducted in the southeast part of Yunnan Province, China, in October 1999. The new species was found on a slope near a small stream with an elevation from 1000 to 1550 m in Jinping County, Yunnan Province, China. This plant was first collected and identified as *Typhonium blumei* Nicolson & Sivadasan, as the leaves were quite similar to this species. The plants were subsequently grown and propagated; so far, more than 20 individuals are cultivated in the Kunming Botanical Garden. From April to August 2000 four of them flowered, displaying quite different characteristics from *T. blumei.* After checking the chromosome number for several individuals, we found the lowest diploid chromosome number in Araceae reported to date. We checked the morphological characteristics carefully and compared them to all the species in the genus *Typhonium,* and realized this taxon is an undescribed species.

According to the revision of *Typhonium* (Sriboonma et al., 1994) and our recent investigations, 16 species and 4 varieties in the genus have been found in China thus far, belonging to 5 sections. Recently, Hetterscheid and Boyce (2000) merged the genus *Sauromatum* Schott (all 3 species found in China) with *Typhonium* Schott (Wang & Li, 1999). Thus the number of *Typhonium* species in China is now thought to be 19. However, based on species richness in neighboring countries (Hetterscheid et al., 2001; Hetterscheid & Nguyen, 2001), this is likely to be an underestimate of the actual number of *Typhonium* species in China, especially in the southern part of Yunnan Province.

MATERIALS AND METHODS

The plants were collected in the field from Jinping, Yunnan, China, and cultivated in the Kunming Botanical Garden for the taxonomic and cytological study.

For the taxonomic study, we first checked the characteristics carefully, using the key for *Typhonium* developed by Sriboonma et al. (1994) to determine which section the species belongs to. We then compared it to all described *Typhonium* species, including the species published subsequent to the 1994 revision.

For the cytological study, growing root-tips were pre-treated in 0.002 mol/L 8-hydroxyquinoline at room temperature for 3 hours, then fixed in Clarke (ethanol/acetic acid, 3:1) solution at 4°C for 30 minutes. They were then hydrolyzed in 1 mol/L hydrochloric acid at 60°C for 3–4 minutes. After being rinsed in distilled water 3 times, the root tips were dyed in Carbol Fuchsin solution for 1 hour, then squashed and sealed. Photos were taken using the method described in Li and Zhang (1991). The chromosomes were classified by arm ratio according to Leven and Fredga (1964). The karyotype classification followed the criteria developed by Stebbins (1971).

RESULTS

CYTOLOGICAL STUDY

The chromosome number was counted in more than 15 somatic cells, and the karyotype analysis was carried out in 1 good cell. The karyotype of the new species is described in Table 1 and illustrated in Figure 2. The chromosome number in somatic cells is 10, and the karyotypical formula is $2n = 2x = 10 = 2m+2st+6sm$. This species is a diploid. The length in somatic mitotic cells ranges from 2.9 μm to 6.1 μm, while the relative length of the chromosomes ranges from 6.5 to 13.2. The ratio of the longest chromosome (No. 1) to the shortest one (No. 10) is 2.04. The percentage with Long Arm/Short Arm >2:1 is 80%. The karyotypical asymmetry belongs to the 3B type.

Table 1. The parameters of somatic chromosomes in mitotic metaphase of *Typhonium jinpingense*.

Pair	TL	AR	PC
1	13.3	2.0	sm
2	12.7	2.6	sm
3	10.1	2.4	sm
4	7.7	3.3	st
5	6.6	1.4	m

Note: TL = Total relative length; AR = arm ratio; PC = position of centromere.

TAXONOMIC DESCRIPTION

Typhonium jinpingense Z. L. Wang, H. Li & F. H. Bian, sp. nov. TYPE: China. Yunnan Province: Jinping Xian, Shuangjin Bridge, road side by stream, 1200 m, 30 Oct. 1999, *F. H. Bian & R. Li 200* (holotype, KUN). [Cultivated in Kunming Botanical Garden, $2n = 10$.] Figure 1.

Haec species *Typhonio blumei* affinis, sed spathae tubo ovato, 1.5 cm longo, 5 mm diam., pallide viridi inferne, atropurpureo superne, lamina angusta, lanceolata, 11 cm longa, medio 1 cm lata, basi atropurpurea, cretacea supra basin, florum sterilium rudimentis clavatis, chromosomatibus $2n = 10$ differt.

Perennial herb, seasonally dormant, rhizome tuberous, irregularly cylindrical, brown, horizontal or erect, producing small gemmules and many filiform roots, 2–2.5 cm long, 0.7–1.0 cm diam. Leaves 1–3, petiole smooth, green, 10–17 cm long, 0.1 cm diam., sheathing below ca. 1.5–2 cm long; blade chartaceous, green, cordate, usually cordate-hastate or deeply cordate at base, 5–8 × 4–10 cm. Peduncle about 1 cm long. Spathe: tube ovoid, pale green, dark purple at the top, 1.5 cm long, 0.5 cm diam.; the blade narrowly lanceolate, chalky-white but dark purple at base, 11 cm long, 1 cm wide below the middle, spreading and slightly arching, the apex long-acuminate but not twisted. Spadix ca. 14 cm long, pistillate portion ca. 0.5 cm long, greenish, the style short, stigma dark purple, sterile portion ca. 0.4 cm long, densely covered proximally, erect, yellowish, clavate rudiments, with naked interstice to 2 cm long; staminate portion to 0.5 cm long, densely congested, yellow; terminal appendix cylindrical, erect, purple, ca. 10 cm long, 2 mm diam., sessile and not swollen at base, with very strong odor. Flowering from the end of April to August.

Distribution. Known only from Jinping County, southeastern Yunnan, China, in wet fields and roadsides by streams, altitude 1000–1550 m.

Discussion. *Typhonium* is commonly accepted as comprising five sections as described by Sriboonma et al. (1994). This new species belongs to section *Typhonium*. From the shape of the leaf blade, this new species is easily differentiated from the other Chinese *Typhonium* species, except *T. blumei*. It is distinguished from *T. blumei* in having the spathe tube pale green, dark purple at the top (not entirely dark purple), the blade narrowly lanceolate (not broadly ovate), dark purple, spreading and arching, apex long acuminate but not twisted, clavate sterile rudiments, erect, and in its chromosome number, $2n = 10$.

Based on recent comprehensive reviews of the cytology of the Araceae (Grayum, 1990; Mayo et al., 1997; Petersen, 1989, 1994), the chromosome numbers vary greatly between and also within genera, from $2n = 14$ (*Ulearum*) to $2n = 168$ (*Arisaema*). The lowest diploid number so far known in Araceae is $2n = 14$, observed in *Ulearum sagittatum* Engler; based on our results, *Typhonium jinpingense* ($2n = 10$) has the lowest chromosome number known to occur in the family. The chromosomes were easy to group into five pairs (Fig. 2), so *Typhonium jinpingense* is a diploid species and the basic chromosome number is 5. Other species of *Typhonium* have chromosome numbers of: $2n =$ 16, 18, 20, 26, 36, 52, 54, 65, >100 (Mayo at al., 1997), making it one of the most variable genera in this regard in Araceae.

Primary basic chromosome number is a main area of research in cytological studies. The discovery of the lowest diploid number in this study may spur further investigation of this aspect. Possibly the following questions will be proposed: Was it caused by extreme aneuploid reductions? Or is $2n = 10$ some kind of "ancestral number" only kept in *Typhonium*? We think the former is more likely. It is well known that very low chromosome numbers (as well as very high ones) are more common in advanced genera than in basal ones. Petersen (1994) postulated that very low chromosome numbers were explained as aneuploid reductions, from an ancestral number $x = 12$ or 14. Other authors proposed that there was an "original" series with $x = 5$, 6, 7, 8, and 9, and that all arose from 7 as they speculated the primary basic number as 7 (Jones, 1957; Larsen, 1969; Marchant, 1973). As stated by Mayo et al. (1997), reduction in diploid number occurs in various morphologically advanced genera. We agreed with this opinion: *Typhonium* is a much advanced genus in Araceae; such a low chromosome number was possibly reduced from a higher one. Other evidence came from our recent cytological studies in 9 *Typhonium* spe-

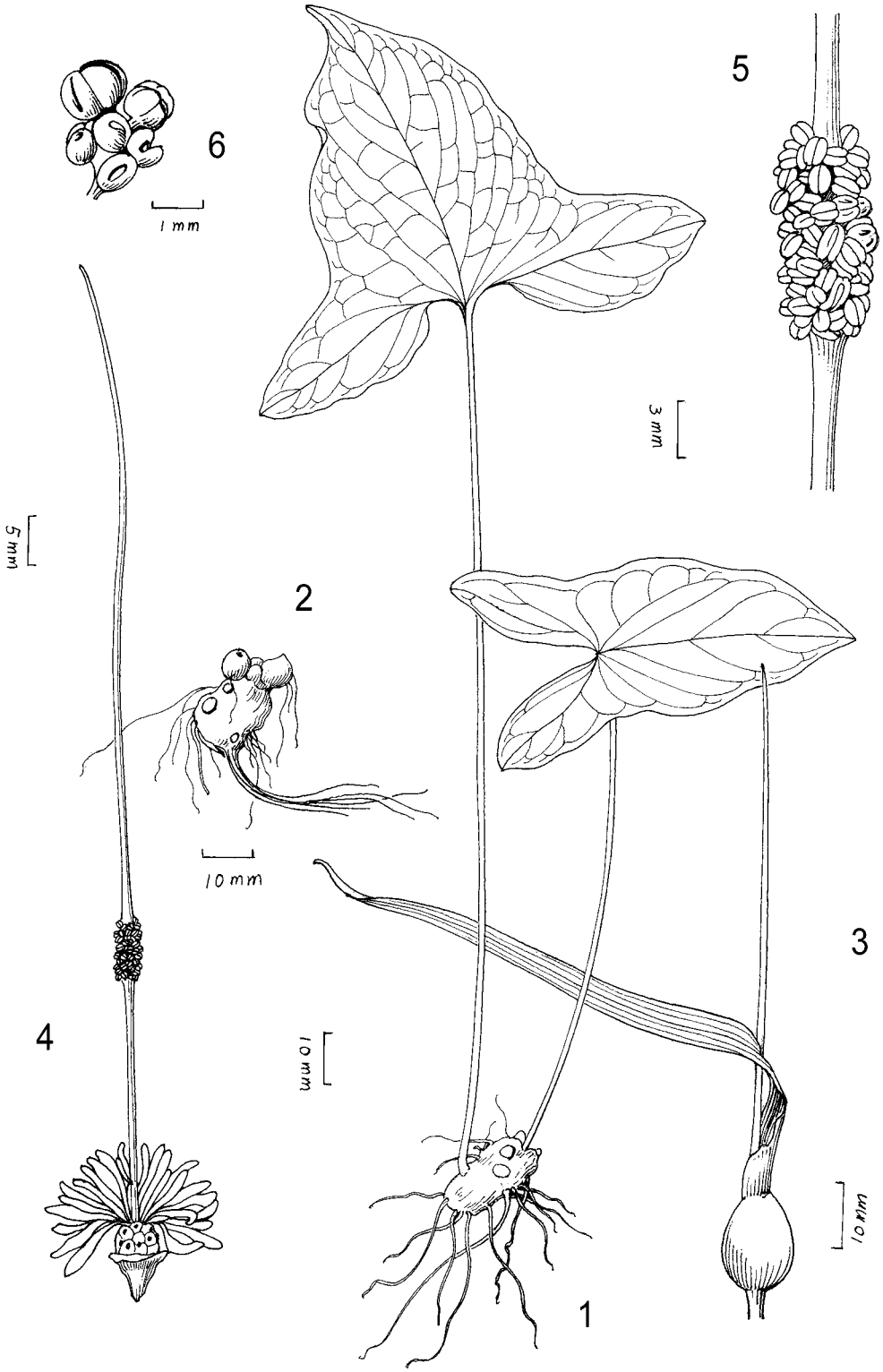

Figure 1. *Typhonium jinpingense* Z. L. Wang, H. Li & F. H. Bian. —1. Plant with rhizome. —2. Rhizome. —3. Spathe. —4. Spadix. —5. Male portion. —6. Male flower.

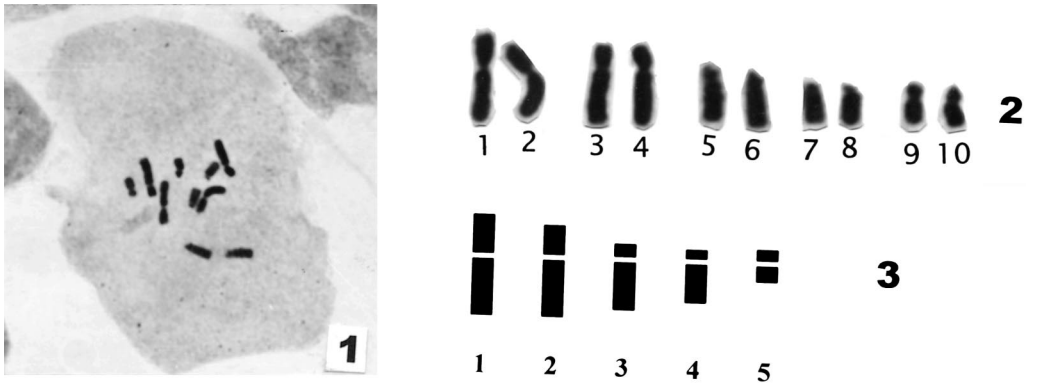

Figure 2. Cytological plates of *Typhonium jinpingense*. —1. Mitotic metaphase chromosomes in somatic cell. —2. Karyotype. —3. Idiogram.

cies. The chromosome number in somatic cells of these species is from 10 to 52, the karyotypical asymmetry for *T. giganteum* Engler belongs the 2A type, and 6 species, *T. calcicolum* C. Y. Wu, *T. kunmingense* H. Li, *T. blumei*, *T. trilobatum* (L.) Schott, *T. roxburghii* Schott, and *T. omeiense* H. Li, belong to the 2B type, while *T. jinpingense* and triploid *T. flagelliforme* (Loddiges) Blume, $2n = 3x = 24$, belong to the 3B type. It is commonly known that the more asymmetric the chromosome, the more advanced the species (Stebbins, 1971). The 3B type is more asymmetric than the 2A type and the 2B type. So, from the standpoint of karyotype, *T. jinpingense* and triploid *T. flagelliforme* may be considered to be the most advanced among the 9 *Typhonium* species studied.

Jinping County is an interesting place for the cytological study of *Typhonium*, as well as of the family Araceae. In addition to the new species with its low chromosome count, triploid *T. flagelliforme* $2n = 3x = 24$ was also found in this county, and the latter can easily be propagated by the stem, but is not yet found to bear fruits both in the wild and in the garden. The reason we chose the specific epithet is to emphasize the importance of this place.

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