Chromosome Numbers of Eight Species of *Aristolochia* (Aristolochiaceae) from East Asia

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Abstract Eight species representing two subgenera of *Aristolochia* from Japan, mainland China, Taiwan, and Korea were examined cytologically. Seven species of subgen. *Siphisia*, *Aristolochia kaempferi*, *A. liukiensis*, *A. shimadai*, *A. cucurbitifolia*, *A. westlandii*, *A. onoei* and *A. mandshurienstis*, of which the former five species were examined for the first time, were found to have 2n=32, while *A. debilis* of subgen. *Aristolochia* was confirmed to have 2n=14. The present study suggests that 2n=32 may be a widespread, rather than a rare chromosome number, in East Asiatic species of subgen. *Siphisia*. (Received August 28, 1991; Accepted December 10, 1991)

Key words: *Aristolochia*, Aristolochiaceae, chromosome number, cytotaxonomy.

*Aristolochia* L. is a large genus comprising more than 400 species of perennial herbs or shrubs and widely distributed in tropical to warm temperate regions almost all over the world (Schmidt, 1935; Pfeifer, 1966; Ma, 1989). The genus is subdivided into three distinct subgenera: *Aristolochia* (comprising about 330 species), *Pararistolochia* (Hutch. et Dalz.) O.C. Schmidt (about 10 species), and *Siphisia* (Raf.) Duch. (about 60 species) (Schmidt, 1935; Ma, 1989, 1990). Previous cytological studies have been concentrated on North and South American, and European species (Gregory, 1956; Fedrov, 1969; Nardi, 1984), although information is also available for some species from East Asia (Huziwara, 1962; Peng et al, 1986; Ma, 1989). In those studies, 2n=8, 10, 12, 14, 16, 24, 26, and 28 were reported for the species of the subgen. *Aristolochia*, and further stated that 2n=12 and 14 are common, and 2n=28 rare. Concerning species of the subgen. *Siphisia*, both 2n=28 and 32 have been observed, although the latter number is rare (Fedrov, 1969). No information is available yet for the subgen. *Pararistolochia*. In his revision of Asiatic species of *Aristolochia*, Ma (1989) considered that subgen. *Aristolochia* is cytologically characterized by diploid chromosome number 2n=14 (rarely 2n=12), while subgen. *Siphisia* is characterized by tetraploid number 2n=28.

After studying the chromosome numbers of eight species of *Aristolochia* from East Asia, we found that all of the species of subgen. *Siphisia* we examined possess 2n=32 chromosomes, and that the chromosome numbers for a few species do not agree with those reported earlier. In this paper we discuss the cytological characteristics of the eight species from East Asia, and compare them with those of the other species of the genus.

Materials and Methods

Almost all of the plants examined in this study were collected from native habitats, and were transplanted in pots at the experimental garden of Tokyo Metropolitan University, the botanical gardens, University of Tokyo, and Hirosaki University, Aomori Prefecture. Their
original sources, number of individuals examined and voucher specimens are presented in Table 1. Several of the plants examined are still under cultivation and, therefore, will be deposited in TI or MAK in near future as voucher specimens.

Karyological analysis was made by the following procedure. Root tips were pretreated with 0.002 M 8-hydroxyquinoline solution for 2.5–3 hr at room temperature and fixed with 45% acetic acid solution for 25 min. After being macerated in a 1 : 2 mixture of 45% acetic acid and 1N HCl for 30 sec at 60 C, the root tips were stained with 1% acetic orcein solution for overnight. Subsequently, they were squashed in the standard way.

Results and Discussion

Chromosome numbers of eight species are presented in Table 1. Chromosome numbers of Aristolochia kaempferi, A. liukiensis, A. shimadai, A. cucurbitifolia and A. westlandii are reported for the first time.

Table 1. Species examined and their collections

<table>
<thead>
<tr>
<th>Species</th>
<th>Chromosome number (2n)</th>
<th>Collectioni)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aristolochia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. cucurbitifolia Hayata</td>
<td>32</td>
<td>REPUBLIC OF CHINA. Mt. Alishan-(1).</td>
</tr>
</tbody>
</table>

1) The number of individuals examined is inserted in parentheses after a hyphen.
Aristolochia debilis of subgen. Aristolochia was 2n = 14, as reported previously (Ma, 1989). Its metaphase chromosomes were less than 1 μm long and have centromeres at median or submedian region (Fig. 1A & A').

In all of the seven other species of subgen. Siphisia, i.e., Aristolochia kaempferi, A. onoei, A. liukiensis, A. shimadai, A. cucurbitifolia, A. westlandii and A. mandshuriensis, chromosome number was 2n = 32, and morphology of their metaphase chromosomes are very similar (Fig. 1B & B', C, D). Metaphase chromosomes vary in length from about 1.2 μm to 0.5 μm, and have centromeres at median or submedian position. The longest submetacentric pair has a satellite at the distal region of its long arm, although it is not always visible.

Our results for Aristolochia mandshuriensis and A. onoei differ from those of the previous authors (Gregory, 1956; Huziwara, 1962; Ma, 1989), who reported 2n = 28 for the species. To clarify and assess the chromosome numbers of these two species further observations are needed on more numerous individuals from various populations.

As already mentioned in an introductory remark, the chromosome numbers known for the genus Aristolochia are 2n = 8, 10, 12, 14, 16, 24, 28 and 32 (Gregory, 1956; Fedrov, 1969; Nardi, 1984; Peng et al, 1986; Ma, 1989). Among these numbers, the numbers of 2n = 12, 14 and 28 were believed to be the most common numbers among North and South American, European, and Asiatic species, while the number, 2n = 32, has hitherto been known from only one species (A. californica) distributed in North America, and then regarded as a rare number in the genus (Morawetz, 1985). From the present study, however, the number 2n = 32 appears to be rather widespread in species of East Asia. Although an evolutionary relationship between 2n = 28 and 2n = 32 is uncertain, the presence of species having 2n = 14 and 2n = 16 suggests that the numbers 2n = 28 and 2n = 32 are probably of polyploid origin.

Taxonomically, Aristolochia debilis and the seven other species investigated are assigned
into subgenera. *Aristolochia* and *Siphisia*, respectively (Schmidt, 1935; Ma, 1989). In his revision of Asiatic species of *Aristolochia*, Ma (1989) states that most species of subgen. *Aristolochia* are cytologically characterized by diploid chromosome number 2n=2x=14 (rarely 2n=12), and those of subgen. *Siphisia* by tetraploid number 2n=4x=28. As described above, however, the seven species examined of subgen. *Siphisia* possess 2n=32. Therefore, subgen. *Siphisia* seems to be cytologically characterized by the two different numbers, 2n=28 and 2n=32, rather than a single chromosome number, 2n=28.

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**References**


**摘　要**

菅原 敬*, 郡田 仁**: 東アジア産ウマノスズクサ属植物 8 種の染色体数

本稿では、日本、台湾、中国、朝鮮半島等に分布するウマノスズクサ属 (*Aristolochia*) 植物 8 種の染色体数と中期染色体の形態について報告する。このなかの 5 種については初めての報告である。また、2 種については従来の報告と異なる結果が得られた。今回観察した 8 種のうち、Siphisia 亜属に属する 7 種 (*A. kaempferi, A. onoei, A. liukiensis, A. cucurbithifolia, A. shimadai, A. westlandii, A. mandshuriensis*) はいずれも 2n=32 で、*Aristolochia* 亜属に属する *A. debilis* は 2n=14 であった。これまで同属では、2n=8, 10, 12, 14, 16, 24, 28, 32 などの染色体数が報告され、そのなかで 2n=32 は北米の 1 種で一度報告されたのみで極めて希なものと見なされてきた。また東アジア産の *Aristolochia* 亜属は 2n=14 (2n=12 はまれ), Siphisia 亜属は 2n=28 で特徴づけられるものと考えられてきたが、今回の観察結果より、2n=32 は少なくとも東アジア産の *Siphisia* 亜属では広くみられる染色体数であることが明らかになった。(*〒036 弘前市文京町 3 弘前大学理学部生物学教室, **〒321—14 日光市花石町1842 東京大学理学部附属植物園日光分園*)