Katsuhiko KONDO*: A review of the *Drosera spathulata* complex**

近藤勝彦*: コモウセンゴケについて**

A single species with a polyploid series in its population may show relative uniformity in morphological characters. This is, indeed, the situation in regard to the *Drosera spathulata* complex.

Drosera spathulata Labill. is one of the most widely distributed species of *Drosera*, being found from Japan, Taiwan, Philippines, throughout southeastern Asia, down to New Zealand.

A chromosome count for *Drosera spathulata* was reported first by Heitz (2n=ca. 72: 1926). Next, Behre (1929) gave a chromosome number of 80 for this species. Probably Heitz and Behre used same type of horticultural material of *D. spathulata*, the locality of which was not reported in their publications. Rattenbury (1957) observed a somatic chromosome number of 20 of *D. spathulata* in a New Zealand population. Kobayashi (1950) counted 2n=50 and n=10 IV+10 I for *D. spathulata* in a population in Japan. Kondo (1966, 1969) reported 2n=60 and n=30 II for *D. spathulata* in a population in Aichi-Ken, Japan. However, a new chromosome count (2n=40: Fig. 1) for *D. spathulata* from an Australian population is reported here for the first time. Thus, *D. spathulata* has several different chromosome numbers: 2n=20, 40, 60, and 80.

Kress (1970) was the first to state that the cultivated *Drosera spathulata* which has 80 somatic chromosomes (Behre, 1929) should be placed in *D. aliciae* Hamet (Fig. 2-1). The horticultural plant *D. aliciae* has been cultivated in Europe, Japan, and many other countries for more than a half-century, and the source of this species as a horticultural plant seems indeterminable at the present time. According to various historical data of Japanese horticulturists, this plant lineage was introduced from Germany

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Table 1. Chromosome numbers in *Drosera spathulata* Labill.

Source	Chromosomes n	Chromosomes 2n	Author
unknown		ca. 72	Heitz, 1926
unknown (cult. Hamburger Botanischen Garten)		80	Behre, 1929
Japan	10 IV+10 I	50	Kobayashi, 1950
New Zealand		20	Rattenbury, 1957
Japan. Aichi-Ken: Miyoshi	30 II		Kondo, 1966
Japan. Aichi-Ken: Miyoshi		60	Kondo, 1969
Australia. N.S.W.: $1^1/_2$ miles west of top of Jamberoo Pass on road between Jamberoo and Robertson (Whitehead 3002, coll. February 18, 1971)		40	Kondo* (Kondo 1030)

* A new data of chromosome counts for *Drosera spathulata* is given.

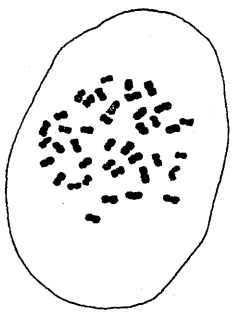

Fig. 1. Somatic chromosomes (× ca. 1450) showing tetraploid of *Drosera spathulata* Labill. from a N.S.W. population in Australia. Root tips of *D. spathulata* from Australia were utilized for the study of somatic chromosomes and were treated with 0.002mol. 8-oxyquinoline for two hours at room temperature (ca. 20°C) before they were fixed in standard Farmer's fluid. Root tips were hydrolyzed in the solution of one part of absolute HCl and 1 part of absolute ethanol, and squashed in aceto-carmine.

before the World War II, and since has been cultivated by various Japanese horticulturists. This horticultural variety introduced from Germany was called "Australian *Drosera spathulata*" or "German *Drosera spathulata*". More recently, I imported several individuals of *D. aliciae* for horticultural purposes from France and Germany, and compared this *D. aliciae* with "German *Drosera spathulata*" and found them to be identical. A more interesting discovery is that this horticultural *D. aliciae* is morphologically quite similar to *D. curviscapa* Salter which was sent from Africa to me. According to Obermeyer's paper (1970), *D. curviscapa* is a synonym of *D. aliciae*. Since Kress (1970) has already pointed out that the material of *D. spathulata* used by Behre (1929) and perhaps by Heitz (1926) is the same as *D. aliciae*, and that they have the same chromosome number (2n

=80), the name, "*D. spathulata*", used by Behre (1929) and by Heitz (1926) is ranked as only a synonym of *D. aliciae*. It is still questionable whether or not the horticultural plant *D. aliciae* is same as *D. curviscapa* since the original locality of this horticultural *D. aliciae* is unknown. Karyotype comparisons between both species have not been studied.

Drosera spathulata from Australian populations might give some suggestions about the origin of the cultivated *D. aliciae* since both are morphologically quite similar but different in size (Fig. 2-1 and 2-2). Some individuals of *D. spathulata* in Australia were collected by Mr. B. Whitehead (No. 3002) for this purpose on February 18, 1971. These individuals (Kondo 1030) have 40 somatic chromosomes, which is half the chromosome number of *D. aliciae*. It is possible that *D. aliciae* which is an octoploid species might have originated from a tetraploid *D. spathulata* by chromosome doubling ($40\times2=80$).

Among the Japanese native *Drosera spathulata*, a pentaploid plant was found by Kobayashi (1950). This plant showed 10 quadrivalent chromosomes and 10 univalent chromosomes at meiosis in PMC, and the 10 univalent

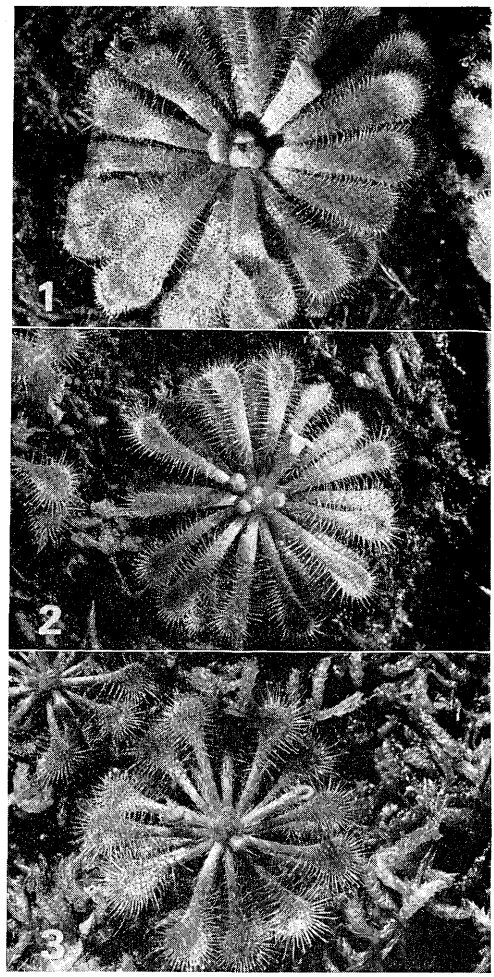

Fig. 2. 1: *Drosera aliciae* Hamet. 2: *Drosera spathulata* Labill. from a N.S.W. population in Australia. 3: *Drosera spathulata* Labill. from an Aichi-Ken population in Japan.

chromosomes were at random. However, Kobayashi pointed out that this pentaploid *D. spathulata* might be of hybrid origin. Kondo (1966, 1969) reported 2n=60 and n=30 II in *D. spathulata* in an Aichi-Ken population, Japan. Thirty bivalent chromosomes at meiosis in PMC were quite normal. Thus, in Japan there are two morphological types of *D. spathulata* that are geographically isolated from each other: the one growing on the eastern Pacific coast in Honshu is called the "Kanto-type", and the other on the western Pacific coast in Honshu is known as the "Kansai-type". Both are sympatric on central Pacific coast in Honshu, Japan.

If this species has several polyploid races with their various adaptations, it might help explain a trend in the migration of this species (Fig. 3). The ancestral race of *D. spathulata* which should be diploid may have originated somewhere in New Zealand, and spread outward, forming a tetraploid race by doubling the number of chromosomes ($20\times2=40$), and have adapted to Australia. During the northward distribution of this species doubling ($40\times2=80$) may have occurred again forming an octoploid race. Back crosses between octoploid plants and tetraploid plants also might have occurred and formed the hexaploid plants ($40+20=60$) which seems to be the typical type of *D. spathulata* (Fig. 2-3) on the central Pacific coast in Honshu, Japan. Kobayashi (1950) observed a meiotic abnormality which suggests hybridization of *D. spathulata* might occur easily. By this method the individual which contained 10 quadrivalents and 10 univalents at meiosis in PMC, might be a hybrid between *D. spathulata* and another species of *Drosera* which should be a diploid. In Japan, *D. spathulata* is sympatric with *D. rotundifolia* L. which is a diploid species and widely distributed in northern temperate and arctic zones. The pentaploid individual observed by Kobayashi (1950), which showed 10 quadrivalent chromosomes and 10 univalent chromosomes at meiosis in PMC indicates that one parent should be an auto-octoploid *D. spathulata* and the other might be the diploid *D. rotundifolia* which has a different genomic constitution from that of *D. spathulata*. Auto-octoploid plants of *D. spathulata* might be formed by a doubling of the chromosome number in an auto-tetraploid.

Drosera rotundifolia normally forms white-colored petals, but in various populations in central Pacific coast in Honshu, Japan, some *D. rotundifolia* show red- to pink-colored petals which are the color of *D. spathulata* petals

Koike and Maruyama (1965) considered it to be a form of *D. rotundifolia*. The author suggests that this form may be a hybrid between *D. rotundifolia* and *D. spathulata*, since both are sympatric in the area from which it came.

Since *Drosera* is entomophilous, gene-flow between *D. spathulata* and *D. rotundifolia* and between *D. spathulata* populations normally should be present. Introgressive hybridization between *D. spathulata* and *D. rotundifolia* might be very common from Tokai-chiho to Shizuoka-Ken, in the central Pacific coast of Honshu, Japan. After receiving new genes from *D. rotundifolia* by introgressive hybridization, *D. spathulata* might have been able to migrate into the eastern temperate zone of the Honshu Pacific coast. Moreover, this introgressive hybridization may help explain the presence of the two types of *D. spathulata*: the "Kanto-type" and the "Kansai-type".

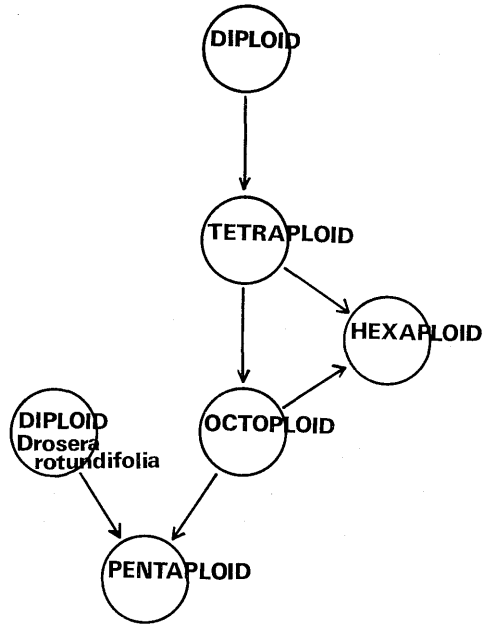

Fig. 3. Suggested interrelationships among species level of *Drosera spathulata* with known chromosome numbers.

In regard to the various chromosome races of the *Drosera spathulata* complex, there is no doubt about the size-differences between *D. aliciae*, *D. spathulata* in Australia, and the two types of *D. spathulata* in Japan, but it is very difficult to distinguish them by usual taxonomic characters.

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コモウセンゴケは日本を北限として東南アジアからオーストラリア東部，ニュージーランドにかけて広い分布が知られている。

コモウセンゴケの染色体数はいままでに 2n＝20, 50, 60, 80 の報告がある。筆者はホワイトヘッド氏 (Whitehead 3002) の協力のもとに，オーストラリア，ニュー・サウス・ウエルズ州産のコモウセンゴケから新しく 2n＝40 という染色体数を得た。そこでこれら異なった染色体数をもつコモウセンゴケの種内関係を考察してみた。ニュージーランド産の二倍体コモウセンゴケがコモウセンゴケの基本となるべきもので，この種の分布が南半球から北半球に広がっていったものとすれば，コモウセンゴケにおける染色体数の倍加と種の分化を関連づけることができよう。くわしくは英文中に述べておいた。

○マルバフヂバカマが東京で見つかった（久内清孝）　Kiyotaka Hisauchi: *Eupatorium rugosum* is found in Tokyo

箱根山中強羅の雑木林に古くから知られているマルバフヂバカマ *Eupatorium rugosum* Houtt. (＝*E. urticaefolium* Reichard) は，同地の住人，故沢田武太郎氏により写真入りで“箱根ニ咲ク北米ノまるばふぢばかま”の見出しで，本誌第3巻 (1926) p. 242 に記録されているが，それが本誌主幹の研究室の布女史により，高田馬場駅に近い武田薬品工業会社倉庫の空地で発見された。（東邦大学薬学部）