A Study on the Morphological and Cytological Features of Aster leiophyllus Complex (Compositae) in Kyushu, Japan

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Abstract The Aster leiophyllus complex is taxonomically complicated and includes many related taxa representing polyploid series. It has been reported that two taxa of this group are distributed in Kyushu. However, there are many herbarium specimens collected in Kyushu which cannot be identified to either of them. In this study, morphological variations were examined in relation to ploidy level, and taxonomic consideration was given. As a result, three species and one variety are recognized in Kyushu: A. leiophyllus var. leiophyllus (2x, 6x), A. semiamplexicaulis (2x), A. leiophyllus var. intermedius (4x) var. nov. and A. satsumensis (2x) sp. nov. The distribution range of diploid A. leiophyllus var. leiophyllus is limited to a small area of Fukuoka, Nagasaki and Miyazaki, while the hexaploids occur widely in and around volcanic regions such as Mts. Aso-Kuju, Unzen and Kirishima. A. leiophyllus var. intermedius is distributed in the north-eastern part, A. semiamplexicaulis in Oita and the northern part of Miyazaki, and A. satsumensis mostly in the southern part of Kyushu.

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Key words: Aster leiophyllus, morphological variation, polyploid complex, taxonomy.

The Aster ageratoides sensu Kitamura (1937, 1981) comprises a well-developed polyploid complex distributed widely in East Asia. In this taxon, two distinctly different karyotypes are known. One karyotype is called as L-type, which has long chromosomes only, the other is LS-type which has long and short chromosomes half and half within a karyotype. The plants with L-type karyotype are morphologically variable, and regarded as a taxonomic complex. A polyploid series ranging from diploid to nonaploid half except for heptaploid in Japan (Huziwara, 1953, 1954, 1955, 1956, 1957a, b; Irifune, 1990; Irifune et al., 1985). Previous authors called this complex variously; A. ageratoides subsp. amplexifolius complex (Irifune, 1990), A. ageratoides subsp. leiophyllus group (Matsuda & Shinohara, 1985; Matsuda & Suyama, 1980), A. leiophyllus complex (Soejima, 1992). Here, I follow my previous paper (Soejima, 1992) and use the name A. leiophyllus complex.

The Aster leiophyllus complex is morphologically variable comprising many taxa. Natural introgression and/or inter- and intraspecific hybridization between the taxa of the complex are believed to happen occasionally (Kitamura, 1937, 1981). Thus the taxonomy within this complex is difficult, and interpretations of the boundaries and the interrelationships among the taxa are commonly conflicting.

In Kyushu, two taxa of the Aster leiophyllus complex, 'Shiro-yomena' (A. ageratoides var. adustus, A. ageratoides var. harae f. leucanthus, A. ageratoides ssp. leiophyllus, A. leiophyllus) and 'Inaka-giku' (A. ageratoides ssp. amplexifolius, A. semiamplexicaulis) have been known to be distributed (Amakawa, 1975; Baba ed., 1964; Hara, 1952; Hatusima ed., 1986; Hatusima, 1989; Kitamura, 1937, 1981; Ohwi, 1953; Toyama, 1980; Yamashiro et al. ed., 1969). But among specimens in the herbaria, there are many specimens collected in
Kyushu which cannot be identified to either of the two species nor to other taxa of the *A. leiophyllus* complex. In general, the existence of polyploid series may be one of the factors of taxonomical difficulties. Although diploid, tetraploid and hexaploid are reported in Kyushu (Irifune, 1987, 1990; Irifune et al., 1985), the relationships between taxa and ploidy levels were not discussed. The aim of this paper is to recognize the morphological variation of the *A. leiophyllus* complex in connection with the ploidy level and to discuss the taxonomy of the complex in Kyushu.

**Materials and Methods**

Plants were collected from 56 populations in Kyushu (Table 1, Fig. 1). The aerial parts of the plants were kept as herbarium voucher specimens for morphological analyses. The subterranean parts were cultivated in pots at Tokyo Metropolitan University to be used for cytological investigations. The voucher specimens are kept in MAK.

The three largest leaves were chosen from each specimen and examined for eight morphological characters (Fig. 2). The methods of morphological and cytological analyses followed are those of Soejima (1992).

For taxonomical consideration, the specimens in the herbaria KYO, MAK, TI and TNS were studied.

**Results**

I. Cytological features

1. Ploidy level

The basic chromosome number of the genus *Aster* is *x*=9 (Huziwara, 1953, 1954, 1955, 1956, 1957a, b). In the present study, diploid, tetraploid, pentaploid and hexaploid were observed. Pentaploids were rather few and occurred in populations with diploids and/or hexaploids. The ploidy level observed in each population is shown in Table 1 and Fig. 1.

In the *Aster leiophyllus* complex, the length of chromosomes in a karyotype is relatively constant, and in a karyotype, the length of the shortest chromosome is longer than one half of the length of the longest one. Many observed plants have one to five B chromosomes in a karyotype which can be easily distinguished from normal ones by their extremely small size. The number of B chromosomes is stable within an individual plant but varies even within a population and seems to have no taxonomic significance. The numbers of B chromosomes were not taken into consideration in this study.

Two diploids are obtained from a population of Fukuoka Prefecture. Among 14 plants from six populations of Nagasaki Prefecture, three plants from the populations of NS1 & 2 are diploids, while other eleven plants of NS3~6 are all hexaploids. Six diploids, one pentaploid and six hexaploids are found in the population of KM2, in Kumamoto Prefecture. Diploids, tetraploids and hexaploids are found in 65 plants from 14 populations in Oita Prefecture. Nine diploids are found in the populations of OI15 & 16. The populations OI1~4, 6~8 & 10 consist of tetraploids. Hexaploids occur in OI9, 12~14. Three pentaploids are also found in the population of OI14. From 12 populations of Miyazaki Prefecture, 44 plants were examined. MZ6~8 are the populations of hexaploids, and all the other ten populations consist of diploids. In Kagoshima Prefecture, all 52 plants examined from 12 populations are diploids.

During my field trip in Saga Pref., the northern part of Nagasaki Pref. and the southern part of Kumamoto Pref., I could not find the plants of this complex except for a population.


Table 1. Collection sites and ploidy level

<table>
<thead>
<tr>
<th>Population no.</th>
<th>Locality</th>
<th>Voucher specimen</th>
<th>Ploidy level (No. of plants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FO1</td>
<td>Chikushi-gun, Nakagawa T., Furryduo</td>
<td>Soejima 900561</td>
<td>—</td>
</tr>
<tr>
<td>FO2</td>
<td>Fukuoka C., Sawara-ku, Hinata pass</td>
<td>Soejima 900562</td>
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<tr>
<td>NS1</td>
<td>Hirado C., Mt. Shijiki</td>
<td>Soejima 900563</td>
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<tr>
<td>NS2</td>
<td>Oomura C., Kuroki</td>
<td>Soejima 900564</td>
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<tr>
<td>NS3</td>
<td>Minamitakaki-gun, Kunimi T., Uematsu</td>
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<td>NS4</td>
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<td>Minamitakaki-gun, Arikae T., Oona</td>
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<td>Minamitakaki-gun, Obama T., Kitano</td>
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<td>KM1</td>
<td>Aso-gun, Oguni T., Nishizato</td>
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<td>Aso-gun, Oguni T., Kamiida</td>
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<td>Bungotakada C., Hashirimizu pass</td>
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<td>Hayami-gun, Yamaga T., Hisashi</td>
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<td>Usa-gun, Ajimu T., Higashishiya</td>
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<td>Oita-gun, Yufuin T., Kawakita</td>
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<td>OI10</td>
<td>Kusu-gun, Kokone T., Kabeyu</td>
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<td>Naori-gun, Kujuu T., Kujii</td>
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<td>Takeda C., Ogawa</td>
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<td>OI13</td>
<td>Takeda C., Takeda</td>
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<td>Takeda C., Takeda</td>
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<td>Oita C., Kaminushiguni</td>
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<td>Usuki C., Nakausuki</td>
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<td>Kobayashi C., Mizunote</td>
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<td>MZ10</td>
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<td>MZ11</td>
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<td>MZ12</td>
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<td>Kimotsuki-gun, Satia T., Hetsuka</td>
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<td>Sendai C., Nishikata</td>
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<td>KS13</td>
<td>Idzumi C., Kamiookawauchi</td>
<td>Soejima 891145</td>
<td>2x(3)</td>
</tr>
</tbody>
</table>

of NS1, in Hirado Isl., Nagasaki.

2. Distribution of diploids, tetraploids and hexaploids in Kyushu (Fig. 1)

The occurrence of diploids is not uniform in Kyushu. Although the diploid plants are scattered widely throughout the sampling localities, most of them are clustered in the southern part of Kyushu. A few diploids appear disjunctly in some populations of Fukuoka, Nagasaki, Kumamoto and Oita.

Although there are many tetraploid populations in the north-eastern part of Kyushu, no tetraploids are found in the other localities of Kyushu.

Fig. 1 Collection sites and distribution of cytotypes. Open circles represent diploids, solid triangles tetraploids, solid circles hexaploids, a star pentaploid. Small closed circles represent populations, the ploidy levels of which are not known. For abbreviations, see Table 1.
The occurrence of hexaploids tends to be concentrated in and around the three volcanic regions, namely Unzen (NS3~6), Aso-Kuju (KM2, OI9, 12~14) and Kirishima (MZ6~8).

II. Karyotype features

Diploids have nine pairs of normal chromosomes often with a few B-chromosomes. In most diploids, each chromosome of the longest pair has a satellite located on the short arm, and the others do not have a satellite (Fig. 3A). The diploids of the populations of southern Kyushu (MZ1~5, KS1, 2, 4~13) have different karyotype. They have one or two additional satellites on the chromosomes of the second pair. The additional satellites are sometimes on the end of the long arm (Fig. 3B) and sometimes on the short arm.

Tetraploids have 18 pairs and hexaploids have 27 pairs of normal chromosomes often with several B-chromosomes. The karyotypes of tetraploids and hexaploids seem to be multiple of the diploid with two satellite chromosomes. Among the 36 chromosomes of tetraploids, each of the four longest ones has a satellite on the short arm, and among the 54 chromosomes of hexaploids, there are six chromosomes with a satellite on the short arm.

III. Morphological variations

1. Hair density

Diploids show a wide variation range for hair density. The hair density is represented by HD (hair number counted within 4 mm² on the abaxial surface of the leaf). The range of HD varies from 0 to more than three-hundreds. Figure 4 shows the variation range of HD of
Fig. 3  Somatic metaphase chromosomes. A: *A. semiamplexicaulis* (OI16), B: *A. satsumensis* (KS8). Arrows indicate chromosomes with a satellite on the distal end of the short arm. An arrow head indicates chromosome with a satellite on the distal end of the long arm.

Fig. 4  The variation of HD. A box shows the range between average plus-minus standard deviation. Each end of the bars mean minimum and maximum value in a population respectively. All the individuals of the populations NS3 and NS6 have hairless leaves; HD = 0. For abbreviations and the morphological types of each population, see Tables 1 & 2.

Fig. 5  Hairs on the abaxial surface of the leaf. A: OI15 (D-3), B: OI8 (T-1). ×150, Bar = 200μm.
some populations. Although the variation seems to be continuous from lower to higher, it is possible to divide the diploids into three subgroups based on both the hair density and hair length. The length of the hair varies that the longest hair is as three to four times as long as the shortest ones (Fig. 5). The shortest ones (Fig. 5A) consist of one or two cells, while the longest ones (Fig. 5B) of three to four cells. There is a tendency that the plant having dense hairs has long hairs and intermingled short ones, and the density of long hairs is higher than that of short hairs. The plant of low hair density has short hairs only. The gland density on the abaxial surface of the leaves is almost in proportion to the hair density. But the variation range of the gland density is narrower than that of hair density. Therefore, the hair density is used to classify this complex into subgroups. The morphologically recognized subgroups distinguished mainly based on hair density are tentatively named as types D-1, D-2 and D-3. The morphological features of each type are described below (Table 2).

Type D-1: HD = 0 ~ 30, hairs short. The diploids of this type scarcely have hairs nor glands on the abaxial surface of the leaves. Stem is also glabrous. The diploids of the populations FO2, NS1, MZ9-12 belong to this type.

Type D-2: HD = 50 ~ 150, hairs short and numerous with a few long hairs on the abaxial

<table>
<thead>
<tr>
<th>Table 2. The morphological types of each population</th>
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<tbody>
<tr>
<td>D-1</td>
</tr>
<tr>
<td>D-2</td>
</tr>
<tr>
<td>D-3</td>
</tr>
<tr>
<td>T-1</td>
</tr>
<tr>
<td>H-1</td>
</tr>
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</table>

Fig. 6  The abaxial surface of the leaves.  A: OI12 (H-1), B: OI8 (T-1), C: MZ5 (D-2), D: OI15 (D-3).  x50,  Bar = 1mm.
surface of the leaves (Fig. 6C). There are densely suppressed short hairs on the stem. All the diploids obtained from Kagoshima and Miyazaki prefectures except for ones from the populations MZ6-12 belong to this type. The diploids of the populations NS2 and KM2 are also included in this type.

Type D-3: HD=150~300, abaxial surface of the leaves and stem densely pilose with long hairs and intermingled short ones (Fig. 6D). There are a lot of glands on the abaxial surface of the leaves. The diploids of the populations OI15 & 16 belong to this type.

Compared with the diploid plants, the tetraploids and hexaploids show a rather narrow variation range of hair density, and each of them cannot be divided into any morphological subgroups. The tetraploids and hexaploids are tentatively named as T-1 and H-1 and the morphological features are described below.

Type T-1: HD=(5~)10~50(~90), most hairs short, with exceptional occurrence of long hairs (Fig. 6B). The hair density of this type varies widely from ca. 10 to near 100 in the value of HD. All the tetraploids obtained in this study belong to this type.

Type H-1: HD=0~5, rarely more than 20, hairs short. The plant body is almost glabrous, and the hairs, if present, are short (Fig. 6A). They have scarcely glands. All the hexaploids obtained in this study belong to this type.

A few pentaploids are obtained from two populations, OI14 and KM2. The hair density of them is low; HD=0~20.

2. Leaf shape

Fig. 7 Scatter diagrams of leaf shapes. Each plot represents an individual plant. For abbreviations, see Fig. 2.
Figure 7 shows the variation in broad part of a leaf of the *Aster leiophyllus* complex in Kyushu. Almost all the plants examined have oblong-lanceolate or lanceolate leaves; the ratios $L_2/W_1 = 2.0 \sim 4.0$, $W_1/W_2 = 1.0 \sim 4.0$. The graph is plotted for the plants of which the ploidy levels are known. It seems that the diploid plants tend to have more elongated, and wider based leaves than those of tetraploid and/or hexaploid.

**Discussion**

1. **Taxonomic treatments of the *Aster leiophyllus* complex in Kyushu**

Five subgroups are recognized within the *Aster leiophyllus* complex in Kyushu based on the ploidy level and morphological features. Three of the five subgroups are diploid, one of the others is tetraploid and the other haploid. Gene flow between the ploidy levels must be greatly limited. However, as pointed out by Tateoka (1975), gene flow may not be of crucial consequence for a species to maintain its unity, thus different ploidy levels can coexist within a taxonomic unity. In conclusion, I recognize three species and one variety in Kyushu. The taxonomical treatment and its morphological features are described below.

*Aster leiophyllus* Fr. et Sav. var. *leiophyllus* ; D-1 and H-1

The two subgroups, D-1 and H-1 resemble each other having a glabrous or nearly glabrous leaf (Fig. 4) and stem, and scarcely have galls on the abaxial surface of the leaf. The hairs, if extant, are short, one or two cells long. It is noted that the diploids of the populations NS1 and MZ9–12, and the hexaploids of OI14 are a little more hairy (HD = 15–30) than typical plants of var. *leiophyllus*.

*Aster leiophyllus* Fr. et Sav. var. *intermedius* Soejima var. nov.; T-1

The subgroup T-1 has an intermediate variation range of HD between *Aster leiophyllus* var. *leiophyllus* and *A. semiamplexicaulis*. Concerning the hair density, it resembles *A. satsumensis* (D-2), but *A. satsumensis* does not seem to be the direct progenitor of T-1 because of their karyotype features. All the tetraploids observed in this study have four satellite chromosomes. They should have been derived from diploids with two satellite chromosomes. On the other hand, most plants of *A. satsumensis* have three or four satellite chromosomes in the diploid karyotype. Therefore, T-1 should be treated as an independent taxon from *A. satsumensis*. The hairs of *A. leiophyllus* var. *leiophyllus* and T-1 are mostly short and those of *A. semiamplexicaulis* are mostly long. These cytological and morphological features show closer resemblance of T-1 to *A. leiophyllus* var. *leiophyllus* than to *A. satsumensis* and/or *A. semiamplexicaulis*. I regard this subgroup as a variety of *A. leiophyllus* and propose the new name *Aster leiophyllus* var. *intermedius*.

*Aster satsumensis* Soejima sp. nov. ; D-2

The plants of the subgroup D-2 have many long hairs and galls but not so many as the plants of D-3. The variation range of HD of this subgroup seems to be continuous from lower to higher, which is intermediate between those of D-1 and D-3 (Fig. 4). D-2 is distributed mainly in the southern part of Kyushu and has wider distribution area than D-1 and/or D-3 in Kyushu. Most plants of this taxon have three or four satellite chromosomes (Fig. 3B). Here I propose a new species *Aster satsumensis* Soejima sp. nov. for this taxon. All the diploids of *A. satsumensis* in Miyazaki and Kagoshima prefectures have three or four satellite chromosomes. The diploids of NS2 and KM2, which are morphologically difficult to be distinguished from D-2 and be included in this taxon, have two satellite chromosomes. Irifune (1990) investigated the karyotype of the *Aster leiophyllus* complex in Kyushu. He observed seventy-nine diploids having three or four satellite chromosomes and eight diploids with two satellite chromosomes in Miyazaki and Kagoshima. According to him, all the
diploid plants of the other localities except for one diploid in the population of Tomari, Notsu T., Oita Pref., have only two satellite chromosomes.

*A. semiamplexicaulis* Makino; D-3

The subgroup D-3 is characterized by extremely dense, long hairs and plenty of glands on the abaxial surface of the leaf. This subgroup is identified to *A. semiamplexicaulis* Makino (Syn.: *A. ageratoides* ssp. *amplexifolius*).

2. Notes on the distribution pattern of the *Aster leiophyllus* complex in Kyushu

Usually, the plants of *Aster leiophyllus* complex appear commonly on the road side or forest margin. However, in Saga Pref., the northern part of Nagasaki Pref. and the

![Map of Kyushu showing distribution of Aster leiophyllus complex](image)

*Aster leiophyllus* var. *leiophyllus*

2x: ●, 6x: ●, unknown: ○

*A. leiophyllus* var. *intermedius*

4x: ▲, unknown: △

*A. saisumensis*

2x: ■, unknown: □

*A. semiamplexicaulis*

2x: ★, unknown: ☆

Fig. 8  Distribution of the *Aster leiophyllus* complex in Kyushu. The ploidy level of the specimens of herbarium is unknown.
southern part of Kumamoto Pref., I could not find them except for a population; NS1. Although 'Shiro-yomena' (*A. ageratoides* ssp. *leiophyllus*) is reported to be common in Saga Pref. (Baba, 1964), the occurrence of the complex in this prefecture may be rarer than in the other prefectures in Kyushu. My investigation is insufficient in Fukuoka, northern part of Miyazaki and the northern part of Kumamoto prefectures. For these places, herbarium

Fig. 9 Type specimen of *Aster leiophyllus* Fr. et Sav. var. *intermedius* Soejima
specimens are surveyed (Fig. 8).

The occurrence of diploid *Aster leiophyllus* var. *leiophyllus* is rare in Kyushu. In this study, the diploids obtained from three disjunct localities; western Fukuoka (FO2), Hirado Is., Nagasaki (NS1) and southern Miyazaki (MZ9-12). The hexaploids occur commonly in the volcanic regions, such as Unzen, Aso-Kuju and Kirishima. According to the herbarium specimens, *A. leiophyllus* var. *leiophyllus* also occur in Kumamoto (Fig. 8).

*Aster leiophyllus* var. *intermedius* occur commonly in the northern part of Oita. In the herbaria, there are specimens of var. *leiophyllus* and var. *intermedius* collected in Fukuoka, Oita and the northern part of Miyazaki (Fig. 8).

*Aster semiamplexicaulis* is rare in Kyushu. In this study, the occurrence of this taxon in Kyushu is restricted to the small area in Oita. Only three herbarium specimens are identified to *A. semiamplexicaulis*. Two of them were collected in Oita, and the another in the northern part of Miyazaki (Fig. 8). About the distribution of this taxon, see the note of the description of *A. satsumensis*.

*Aster satsumensis* is common in the southern Kyushu; southern part of Miyazaki and Kagoshima. A few plants of this taxon are also collected from the northern part of Kyushu, Nagasaki and Kumamoto.

3. The taxonomical position of the pentaploids of OI14 (Oita Pref.) and KM2 (Kumamoto Pref.)

Three pentaploids and a hexaploid are obtained in the population OI14. The pentaploids resemble to the sympatric hexaploid. Both have oblong-lanceolate or lanceolate leaves with a few short hairs on the abaxial surface. The hexaploids in the other region of Kyushu, such as populations NS3-6, OI12, 13, KM2 and MZ6-8, have glabrous leaves; HD = 0-5 (-10). The hexaploids and pentaploids of OI14 have more hairs; HD = 15-20 (Fig. 4). Here, both the pentaploids and the hexaploid are identified to *A. leiophyllus* var. *leiophyllus*, tentatively. However, it is possible that tetraploid plants of *A. leiophyllus* var. *intermedius* which also occur near the population OI14, related to the origin of these pentaploids and/or hexaploid.

In the population KM2, a pentaploid appears sympatric with some diploids and hexaploids. The diploids of this population are identified to *A. satsumensis* and the hexaploids to *A. leiophyllus* var. *leiophyllus*. The morphological appearance of the pentaploid resembles that of the hexaploids and is identified to var. *leiophyllus*.

In summary, three species and one variety of the *Aster leiophyllus* complex are distributed in Kyushu: *A. leiophyllus* var. *leiophyllus* consisting of diploid and hexaploid, *A. leiophyllus* var. *intermedius* (tetraploid), *A. semiamplexicaulis* (diploid) and *A. satsumensis* (diploid).

**Descriptions for new taxa**

1. *Aster leiophyllus* Fr. et Sav. var. *intermedius* Soejima, var. nov. Fig. 9.


*Aster ageratoides* Turcz. subsp. *amplexifolius* (Sieb. et Zucc.) Kitamura, pro parte. excl. typ. 

Folia caulina oblongo-lanceolata, basi cuneata, sessilia, paginis adaxialibus sparse pilosa, pilis plumque brevibus cum aliquot pilis longis. 


This variety is distinguished from var. *leiophyllus* by hair density on the leaf beneath.
In contrast to the glabrous leaf of var. *leiophyllus*, var. *intermedius* has much short hair on the leaf beneath.

Perennial suffrutescent rhizomatous herbs. Stems erect ca. 50 cm tall, densely pilose. Leaves scarcely pubescent on abaxial side of leaf, mostly short hairs with a few long ones.

Fig. 10 Type specimen of *Aster satsumensis* Soejima
Basal leaves withering at anthesis, cauline leaves evenly scattered, middle ones 6-10 cm long, 2-3.5 cm broad, oblong-lanceolate, cuneate at base, sessile, acuminate at apex, with 4-7-paired shallow teeth. Capitula in loose corymbs, 0.6-1.0 cm broad. Phyllaries entire 2.5-4 mm long, 1.5-2 mm broad, obtuse at apex, herbaceous, finely pubescent. Ray flowers 10-15; ligules 7-10 mm long, 1.7-3 mm broad, white. Disc flowers yellow. Pappus simple, dirty white or reddish, 4.5-6 mm long. Flowers in October to November.

Distr.: Western Honshu, Shikoku and Kyushu (Fukuoka, Oita, Miyazaki). In half-shaded places beside forest or roadside.


Note: Kitamura (1937) described, "In the northern Kiushiu and in the western Chugoku, Aster ageratoides subsp. leiophyllus is very rare, and substituted by intermediate forms between subsp. leiophyllus and ovatus". And he doubted whether the plants should be treated as hybrids or as a distinct subspecies. He cited five specimens of Kyushu which are kept in KYO as the plants of "intermediate forms". Two of the five specimens are identified to var. intermedius (Oct. 12, 1935). K. Nakajima; Oct. 27, 1935. K. Nakajima) and the others to var. leiophyllus. They are not hybrids between subsp. leiophyllus and subsp. ovatus in respect to the karyotype character. Because the L-type karyotype of var. intermedius cannot be yielded from hybridization between L-type var. leiophyllus and L-type var. ovatus.

2. Aster satsumensis Soejima, sp. nov. Fig. 10. Aster ageratoides subsp. amplexifolius (Sieb. & Zucc.) Kitam. in J. Jap. Bot. 12: 646 (1936), pro parte. excl. typ.

Folia paginis adaxialibus pilosa, pilis brevibus pilis longis abundantioribus. Folia caulina sessilia, lanceolata vel oblongo-lanceolata, apice acuminata, basi leviter attenuata ad truncata, vel interdum attenuata-cuneata, margine serrata, dentibus 4-7 paribus.

Type: Kyushu: Kagoshima Pref., Idzumi C., Kami-okawauchi, Nov. 5, 1989, Soejima 891145 (MAK).

Perennial suffrutescent rhizomatous herbs. Stems erect ca. 50 cm tall, densely pilose. Leaves distinctly 3-nerved, sparsely scabrous above, densely pilose beneath, in which short hairs abundant more than long hairs, interspersed with sessile glistening glands; basal leaves withering at anthesis, cauline leaves evenly scattered, middle ones 6-10.5 cm long, 1.5-3 cm broad, lanceolate or oblong lanceolate, sharply narrowed to base, then slightly attenuate to truncate or sometimes attenuate-cuneate at base, sessile, acuminate at apex, with 4-7-paired shallow teeth. Capitula in loose corymbs, 0.6-1.0 cm broad. Phyllaries entire 2.5-4 mm long, 1.5-2 mm broad, obtuse at apex, herbaceous, finely pubescent. Ray flowers 10-15; ligules 7-10 mm long, 1.7-3 mm broad, white. Disc flowers yellow. Pappus simple, dirty white or reddish, 4.5-6 mm long. Achenes 2.5-4 mm long, 0.7-1.5 mm broad, flat, obovate, brown, covered with sparse silky hairs.

Distr.: Endemic to Kyushu (Nagasaki, Kumamoto, Miyazaki, Kagoshima). On half-shaded places beside the forest or roadside.
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SOEJIMA: *Aster leiophyllus* in Kyushu

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Notes: *Aster satsumensis* is separated from *A. semiamplexicaulis* by the difference of hair density and hair length. *A. satsumensis* has lower hair density on the leaf beneath than that of *A. semiamplexicaulis*. And *A. satsumensis* has many short hairs with long ones, while *A. semiamplexicaulis* has mostly long hairs with intermingled short ones. Most plants of *A. satsumensis* have three or four satellite chromosomes while *A. semiamplexicaulis* always has two satellite chromosomes.

According to "Plant List of Kagoshima Prefecture" (Hatusima ed., 1986), *A. semiamplexicaulis* (Syn: *A. ageratoides* ssp. *amplexifolius*) is commonly distributed all over the prefecture. Considering the distribution of *A. semiamplexicaulis* and *A. satsumensis*, it is probably the misidentification of *A. satsumensis* caused from the morphological resemblance between *A. satsumensis* and *A. semiamplexicaulis*.

Two of the eight specimens in Kyushu cited as *A. ageratoides* subsp. *amplexifolius* in Kitamura (1937) are identified to *A. satsumensis* (Aug. 24, 1923. Z. Tashiro; Nov. 2, 1919. Z. Tashiro).

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### 摘 要

副島顕子：九州におけるシロヨメナ群の形態的、細胞学的研究

シロヨメナ群 *Aster leiophyllus* complex は複雑な倍数体複合体で、分類の困難なグループである。従来、九州にはこの群のうちシロヨメナとイナカギの2種が分布するとされていたが、両者の中間的な形態で、どちらともいえない個体がしばしば出現している。これまでの地方植物誌や図鑑などでは、そのような個体はシロヨメナかイナカギのどちらかにあてはめられていたようである。本研究では、九州全域にわたる採集品に基づいて、形態変異の解析、および染色体数の観察を行い、九州のシロヨメナ群に関する分類学的な再検討を試みた。その結果、九州には2倍体と6倍体のシロヨメナ *Aster leiophyllus* var. *leiophyllus*, 2倍体のイナカギ *Aster semiamplexicaulis* のほか、両者の中間的な形質をもつが区別可能な二つの分類群が認められた。これら二つの分類群を新分類群と認め、ここに記載した。

*ケシロヨメナ* *Aster leiophyllus* Fr. et Sav. var. *intermedius* Soejima はシロヨメナ *Aster leiophyllus* var. *leiophyllus* によく似ているが、葉の裏の毛の量がシロヨメナよりも多く、また短い毛しかつたくシロヨメナに対して長い毛が混じることで区別される。九州の東北部の他、中国地方、四国に分布し、4倍体のみがみつかっている。

サツマシロギク *Aster satsumensis* Soejima はケシロヨメナよりもさらに毛の量が多く、長毛も見つかつ、イナカギよりは毛の量が少ない。九州の南部に普通で、2倍体のみがみつかっている。他のシロヨメナ群の2倍体の核型では、付随染色体が2本しかないが、サツマシロギクでは通常、付随体がある染色体を3または4本もつ。

九州のシロヨメナ群の検索表
August 1993

SOEJIMA: Aster leiophyllus in Kyushu

1. 叶の裏面は無毛、毛はわずかにあっても短い。2倍体、6倍体（5倍体）。
   ................................. シロヨメナ  A. leiophyllus Fr. et Sav. var. leiophyllus

1. 叶の裏面に毛が多い。
2. 短毛が少なく、長軟毛が多い。2倍体、……イナカギク A. semiamplexicaulis Makino
3. 短毛が多い。

................................. ケシロヨメナ  A. leiophyllus Fr. et Sav. var. intermedius Soejima

3. 長軟毛が多い。2倍体、............................ サツマシロギク  A. satsumensis Soejima

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