植物研究雑誌
J. Jpn. Bot.
68: 88–93 (1993)

Chromosome Numbers of Seven Japanese *Eriocaulon* Species

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日本産ホシクサ属7種の染色体数

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(Received on September 30, 1992)

The chromosome numbers for seven species of *Eriocaulon* indigenous to Aomori Prefecture and Hokkaido, Japan, were reported here for the first time. The somatic chromosome numbers observed were 2n=24 except for *E. monococcon* with 2n=48. From the results of the counts so far known the basic chromosome numbers were considered to be x=4, 5, and 9.

The genus *Eriocaulon* (Eriocaulaceae) consists of 400 species (Cronquist 1981), the great majority of which are plants of swampy soils with wide distribution in the tropical and subtropical regions of both hemispheres. In spite of the large genus, chromosome studies have been reported for only 16 species as shown in the appendix 1. In Japan the monograph of the genus *Eriocaulon* was published by Satake (1940), and some fragmentary studies were reported by several workers (Satake and Koyama 1955, Koyama 1956, Hatusima and Koyama 1956, Tatewaki and Ito 1965, Ito 1969, Takahashi and Suzuki 1988). There are about 40 Japanese species (Satake 1982), but there is no cytological information on them. This paper is an attempt to extend chromosome information in taxonomic treatments of the Japanese *Eriocaulon*.

Materials and Methods

Living plants were collected from six localities in Aomori Pref. and Hokkaido as listed in Table 1. They were transplanted in paper cups with moss in Asahikawa for identification of the plant name and for the chromosome counts.

For the counts of the somatic chromosome number, the root tips were used. They were treated with 0.002M 8-hydroxyquinoline for 5–6 hours, fixed in a 3:1 mixture of alcohol and acetic acid for several seconds, and transferred to 1N-HCl at about 55°C for about 5 seconds thereafter. They were squashed in 1% aceto-orsein.

The voucher specimens are deposited in the Herbarium of Biological Laboratory, Asahikawa College, Hokkaido University of Education.

Results

Table 1 shows the results of chromosome counts

of seven species, whose chromosome numbers are reported here for the first time.

1. *Eriocaulon decemflorum* Maxim.: 2n=24, Fig. 1.

The species is distributed throughout Japan from Hokkaido to Kyushu, and occurs in wet places both in lowlands and mountains.

This is characterized by having wholly dimerous flowers. Counts of 2n=24 were obtained for 15 plants from two populations.

2. *Eriocaulon miquelianum* Koernicke: 2n=24, Fig. 2.

This species is distributed in Japan and China. According to the current floristic manuals (Kitamura et al. 1964, Sugimoto 1973, Ohwi 1975, 1983, Satake 1982) in Japan, Hokkaido is excluded from this range, but I collected this species at Shizukawa, Tomakomai City, Iburi district, although Ito (1969) reported the occurrence of var. *involucuratum* Nakai from Shimosarobetsu Genya, Rumoi district, northern Hokkaido.

Counts of 2n=24 were for 10 plants from Tomakomai.

3. *Eriocaulon monococcon* Nakai: 2n=48, Fig. 3.

This species is endemic to Japan and is distributed Hokkaido and Honshu.

This species is characterized by having pistillate flowers with unilocular ovaries and single stigmas. Counts of 2n=48 were made for 10 plants collected from the Kushiro mire. According to my morphological observation, the number of stigma varies from one to two in the same individual. It is interesting cytologically that although this species resembles *E. miquelianum* in appearance and in the features of its flowers, its chromosome number is distinctly different, i.e. 2n=48.

4. *Eriocaulon hondoense* Satake: 2n=24, Fig. 4.

This species is distributed throughout Japan and Korea, and grows commonly on wet lowlands.

Although the general appearance of both *E. hondoense* and *E. miquelianum* resembles each other, these species can be distinguished from each other by the features of floral bracts: the former is glabrous, while the latter is pubescent. Counts of 2n=24 were made for five plants collected from paddy fields.

Table 1. Chromosome number and sampling locality of seven *Eriocaulon* species

Species and Locality	No. of plants examined	2n
Eriocaulon decemflorum Maxim.		
Kashiwabara, Tomakomai City, Hokkaido	5	24
Shizukawa, Tomakomai City, Hokkaido	10	24
Eriocaulon miquelianum Koernicke		
Shizukawa, Tomakomai City, Hokkaido	10	24
Eriocaulon monococcon Nakai		
Akanuma, Kushiro mire, Hokkaido	10	48
Eriocaulon hondoense Satake		
18-sen, 7-go, Takasu Cho, Hokkaido	5	24
Eriocaulon kusiroense Miyabe et Kudo		
Near Akanuma, Kushiro mire, Hokkaido	15	24
Eriocaulon robustius (Maxim.) Makino		
Kudoji, Hirosaki City, Aomori Pref.	5	24
Nobusha, Rumoi City, Hokkaido	5	24
Arashiyama, Asahikawa City, Hokkaido	5	24
Eriocaulon sachalinense Miyabe et Nakai		
Ukijima mire, Kamikawa Cho, Hokkaido	10	24

5. *Eriocaulon kusiroense* Miyabe et Kudo ex Satake: 2n=24, Fig. 5.

This species is endemic to Japan, and occurs on peat bogs in Kushiro district, eastern Hokkaido.

Counts of 2n=24 were for 10 plants from Kushiro mire.

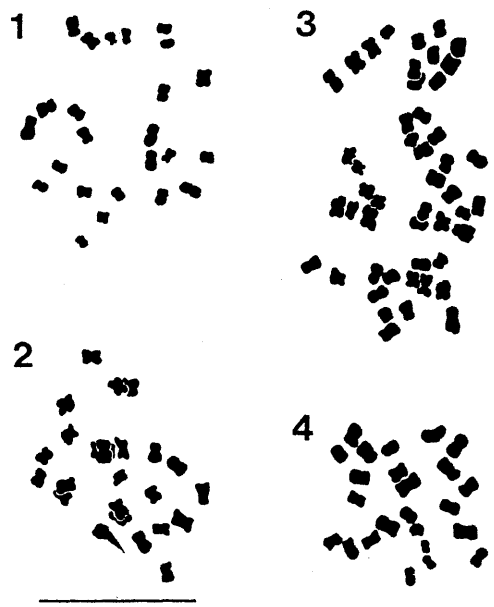
6. *Eriocaulon robustius* (Maxim.) Makino: 2n=24, Fig. 6.

This species is distributed throughout Japan and is quite common in paddy fields in lowlands.

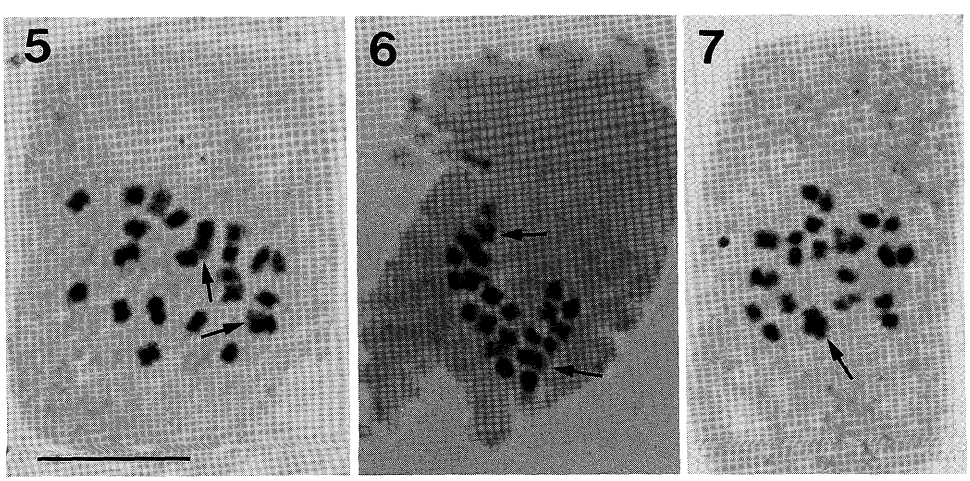
The materials used here were collected from paddy fields in both Hokkaido and Aomori Pref. Counts of 2n=24 were made for 15 plants from three localities.

7. *Eriocaulon sachalinense* Miyabe et Nakai: 2n=24, Fig. 7.

This species occurs on peat bogs in Ukijima mire, Kamikawa district, central Hokkaido (Ito 1969), and is distributed in Sakhalin and N. Amur (Woroschilov 1982). The general appearance resembles *E. atrum, E. kusiroense* and *E. nanellum*. The counts of 2n=24 for 10 plants were obtained. Although the majority of plants in the Ukijima population referred to *E. sachalinense* which is characterized by having dimerous flowers (Nakai 1928, Satake 1940, 1982), some plants have di- and trimerous flowers in the same individual,



Figs. 1–4. Somatic chromosomes. 1. *Eriocaulon decemflorum,* 2n=24 (Shizukawa, Tomakomai). 2. *E. miquelianum,* 2n=24 (Shizukawa, Tomakomai). 3. *E. monococcon,* 2n=48 (Akanuma, Kushiro mire). 4. *E. hondoense,* 2n=24 (18-sen, 7-go, Takasu). Scale bar: 10 μm.



Figs. 5–7. Somatic chromosomes. 5. *Eriocaulon kusiroense,* 2n=24 (Near Akanuma, Kushiro mire). 6. *E. robustius,* 2n=24 (Nobusha, Rumoi). 7. *E. sachalinense,* 2n=24 (Ukijima Mire, Kamikawa). Arrows indicate the overlapping chromosomes. Scale bar: 10 μm.

such as those of *E. kusiroense.*

Discussion

In the classification of *Eriocaulon,* the floral characteristics are very important, especially being dimerous or trimerous. Japanese *Eriocaulon* is divided into two groups, one with dimerous flowers and the other with trimerous flowers. Among seven species examined, *E. decemflorum* belongs to the dimerous group, and the rest to the trimerous group. Two kinds of chromosome numbers were counted: 2n=48 for *E. monococcon* (trimerous), and 2n=24 for the rest. There is no difference between the dimerous species and trimerous ones in the chromosome number.

The basic chromosome number of *Eriocaulon* has been considered to be X=8 and 9 (Darlington and Wylie 1955, Löve and Löve 1961) since Erlandsson (1942) first reported two kinds of the chromosome numbers: 2n=32 (n=16) for *E. cinereum* and *E. truncatum,* and 2n=36 for *E. sexangulare.* The chromosome number 2n=24 found in this study is already reported from the Far Eastern Russia by Sokolovskaya and Probatova (1985). Considering that all six species with 2n=24, assumed triploid of X=8, have good fertility, the basic chromosome number X=4 is better suggested than X=8.

Further, as seen in the appendix 1, it is suggested that *Eriocaulon* is a multibasic genus with a fairly wide range of basic chromosome numbers. *E. sieboldianum* was reported to have n=9 (Mehra and Sachdeva 1971), which is the lowest haploid number so far known in the genus. Also the haploid number of n=15 for *E. gracile* by Larsen (1966) and n=20 for *E. compressum* by Cave (1967) have been reported, and these figures suggest 5 as the basic chromosome number. So, the species of 2n=30 and 2n=40 is seemingly hexaploid and octaploid, respectively.

Thus, from the cytological data so far available it may be said that 4, 5 and 9 are the existing basic chromosome numbers in the genus *Eriocaulon,* of which 9 may be the secondary basic chromosome number derived from 4 and 5.

I wish to express my cordial thanks to Prof. Dr. Koji Ito, Graduate School of Environmental Science, Hokkaido University, for his useful discussion on the taxonomic treatment of *Eriocaulon* species and for the critical reading of this manuscript. I am also indebted to Dr. Yuichi Kadota of the National Science Museum for kind information on the literature, and Mr. Yukio Matsuda, Matsumoto City, for his advice on the cultivation of *Eriocaulon* plants.

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要 旨

日本には約40種のホシクサ属植物が知られているが，染色体数についての報告はない．今回，次の7種の染色体数を初めて観察した．イトイヌノヒゲ 2n＝24，イヌノヒゲ 2n＝24，エゾホシクサ 2n＝48，ニッポンイヌノヒゲ 2n＝24，クシロホシクサ 2n＝24，ヒロハイヌノヒゲ 2n＝24，カラフトホシクサ 2n＝24．

上記の観察結果から次のような結論を得た．

1．花の2数性を示すイトイヌノヒゲも3数性の種も染色体数は 2n＝24 で，数性の違いと染色体数との関連はみられない．

2．ホシクサ属の基本数としてこれまで X＝8 と9が知られている．今回観察された 2n＝24 の植物は X＝8 とすると3倍体となるが，種子の稔性が良いことから，基本数として8よりは4が妥当と考えられる．さらにこれまで報告された染色体数の検討から，9は4＋5に由来すると考えられる．

Appendix 1. Previously reported chromosome numbers for *Eriocaulon*

Species	Chromosome number	References
E. achiton Koern.	2n=30 n=ca. 15	Larsen 1966
E. chinorossicum Kom.	2n=24	Sokolovskaya and Probatova 1985
E. cinereum R. Br.	2n=32	Erlandsson 1942
E. compressum Lam.	n=20	Cave 1967
E. gracile Mart.	2n=30 n=15	Larsen 1966
E. henryanum Ruhl.	2n=ca. 56	Larsen 1966
E. oryzetorum Mart.	2n=ca. 60, 90	Larsen 1966
E. parkeri Robins.	2n=ca. 48	Löve and Löve 1958
E. pellucidum Michaux	2n=32	Löve and Löve 1958, 1982
	n=10	Parfitt 1981
E. robusto-brownianum Ruhl.	2n=ca. 110	Larsen 1966
	2n=34	Mallikarjuna et al. 1987
E. scariosum Smith	2n=36	Larsen 1966
	2n=64	Briggs 1966
E. schimperi Korn. ex Engl.	2n=ca. 80	Hedberg and Hedberg 1977
E. septangulare With.	2n=ca. 60	Hare 1950
	2n=64	Löve and Löve 1958
	2n=32, 64	Moldenke 1969
	2n=64	Kapoor and Ramcharitar 1982
E. sexangulare L.	2n=36	Erlandsson 1942
E. sieboldianum Sieb.	n=9	Mehra and Sachdeva 1971
E. truncatum Hamil.	2n=32	Erlandsson 1942
	2n=30	Larsen 1966