



## A karyological study of *Micranthes manchuriensis* (Engl.) Gornall & H. Ohba (Saxifragaceae) from Primorsky Krai, Russia

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### ABSTRACT

A karyotype study of *Micranthes manchuriensis* (Engl.) Gornall & H. Ohba (Saxifragaceae) from two localities in the Primorsky Krai, Russia, confirmed its chromosome number to be  $2n = 30$ . The karyogram of *M. manchuriensis* is formulated as  $13m + 2sm$ , with one pair of satellite chromosomes.

**Keywords:** chromosome, karyotype, *Saxifraga manchuriensis*, Russian Far East

### РЕЗЮМЕ

Фукуда Т., Колдаева М.Н., Икеда Х. Кариологическое исследование *Micranthes manchuriensis* (Engl.) Gornall & H. Ohba (Saxifragaceae) из Приморского края, Россия. Кариологическое исследование *Micranthes manchuriensis* (Engl.) Gornall & H. Ohba (Saxifragaceae) из Приморского края, Россия показало, что число хромосом у исследованных растений  $2n = 30$ . Карнограмма *M. manchuriensis* описывается формулой  $13m + 2sm$ , с одной парой сателлитных хромосом.

**Ключевые слова:** хромосома, кариотип, *Saxifraga manchuriensis*, российский Дальний Восток

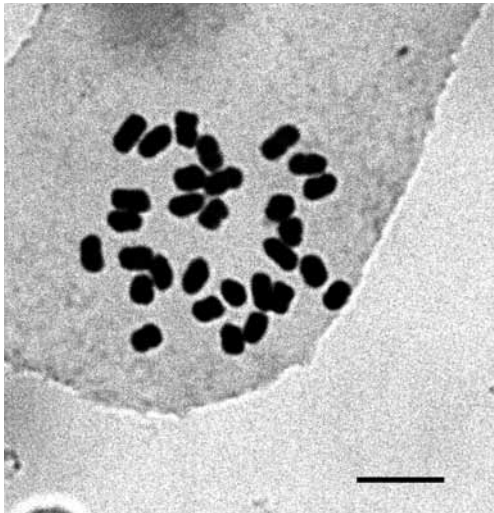
*Micranthes manchuriensis* (Engl.) Gornall & H. Ohba (Saxifragaceae) is a perennial herb, distributed in Russia (Primorsky Krai), northern China, and the Korean peninsula (Zhmylev 1996, Barkalov et al. 2011). It is similar to *M. nelsoniana* (D. Don) Small in having round to reniform leaves with triangular-deltoid teeth, a paniculate inflorescence, and white petals. It grows on the banks of streams and on moist riverine rocks. Engler (1872) treated it as a variety of *Saxifraga punctata* L. (= *M. nelsoniana*). However, it differs from *M. nelsoniana* in having thick leaves, flowering stems with dense septate hairs, and congested, almost capitate inflorescences (Siplivinsky 1976, Voroshilov 1982, Charkevich 1989, Webb & Gornall 1989, Zhmylev 1996, Barkalov et al. 2011, Akiyama et al. 2012). The only chromosome number of *Micranthes manchuriensis* was reported by Sokolovskaya (1966) as  $2n = 30-32$ .

In June 2015, we collected *Micranthes manchuriensis* from two localities in Primorsky Krai, Russia (Table 1), and a karyological study was performed to confirm the chromosome number.

Root tips were pretreated in 0.002M 8-hydroxyquinoline solution for 12 hours at 5°C, fixed with Farmer's solution (glacial acetic acid: 99 % ethanol = 1:3) and kept in a refrigerator at 5°C for more than 10 hours. The root tips were then macerated in 1N HCl for 10 minutes at 60°C, stained with 1 % aceto-orcein for 10–20 minutes, and squashed. Mitotic metaphase chromosomes were observed for 8 individuals. The karyotype was analyzed for one individual (Fukuda with Koldaeva, No. 2015-BG-1). Voucher specimens are deposited in the Botanical Garden-Institute of the Far Eastern Branch, Russian Academy of Sciences, Vladivostok (VBGI).

**Table 1** Locality, somatic chromosome number, and voucher specimen of *Micranthes manchuriensis* used in this study

Locality	Latitude & longitude	2n	Voucher
Lazovsky District, under waterfall of Elomovsky River	43°14'45"N, 133°43'05"E	30	T. Fukuda with V. Bakalin 2015-Elw-2
		30	T. Fukuda with V. Bakalin 2015-Elw-6
		30	T. Fukuda with V. Bakalin 2015-Elw-8
Lazovsky District, along Elomovsky River, ca. 4 km lower stream from waterfall	43°13'45"N, 133°45'34"E	30	T. Fukuda with V. Bakalin 2015-Elm-1-11
		30	T. Fukuda with V. Bakalin 2015-Elm-2-10
		30	T. Fukuda with V. Bakalin 2015-Elm-2-13
Vladivostok, Botanical Garden-Institute FEB RAS	43°13'23"N, 131°59'39"E	30	T. Fukuda with M. Koldaeva 2015-BG-1
		30	T. Fukuda with M. Koldaeva 2015-BG-2



**Figure 1** Photomicrographs of somatic metaphase chromosomes of *Micranthes manchuriensis*; collected along Elomovsky River, Lazovsky District (Fukuda with Bakalin No. 2015-Elm-1-11). Bar = 5  $\mu$ m

The results of the study are shown in Table 2. All eight of the individuals investigated had a chromosome number of  $2n=30$  (Table 2, Figs. 1 and 2). The chromosomes were 1.1–3  $\mu$ m long and gradually reduced in size, without clear modality. Satellite chromosomes were observed on the 3rd pair of chromosomes. The chromosome complement was formulated as  $2n=30=13m+2sm$ . Although Sokolovskaya (1966) reported chromosome numbers of  $2n=30\text{--}32$ , we confirmed the chromosome number of *Micranthes manchuriensis* to be  $2n=30$ .

A variety of chromosome numbers have been reported for *Micranthes*, ranging from  $2n=28$  to ca. 88 (see Zhukova & Petrovsky 1987). Several different chromosome numbers have been reported for *M. nelsoniana*, a close relative of *M. manchuriensis*:  $2n=28$  has been reported frequently, from several localities, such as Altai (as “*S. punctata* s.l.”: Sokolovskaya & Strelkova 1938, 1948 in Zhukova & Petrovsky 1971), NW Canada (Packer 1964 in Mulligan & Porsild 1969), NW Taimyr (as “*S. aestivalis*”: Devyatov et al. 1997), Krasnoyarsk (as “*S. aestivalis*”: Funamoto & Smirnov 2012),



**Figure 2** Karyogram of *Micranthes manchuriensis*; from Botanical Garden-Institute FEB RAS, Vladivostok (Fukuda with Koldaeva No. 2015-BG-1). Bar = 5  $\mu$ m

and south Kamchatka (Fukuda et al., in press);  $2n=30$  was reported for one variety, var. *porsildiana* (Calder & Savile) Gornall & H. Ohba from NE Asia (Zhukova & Petrovsky 1987; Devyatov et al. 1997), and  $2n=26$  for another variety, var. *reniformis* (Ohwi) S. Akiyama & H. Ohba from Sakhalin (Fukuda et al., in press). These reports suggest that *M. nelsoniana* includes infraspecific aneuploids, some of which are correlated with morphological differentiation to some extent. It is possible that *M. manchuriensis* arose from a *M. nelsoniana*-like ancestor through a change in a small number of chromosomes. Such differences in chromosome numbers or aneuploidization, as well as polyploidization appear to be important in the evolution of *Micranthes*.

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**Table 2** Arm length, ratio and chromosome type for each chromosome pair (chromosome pair number correspond to those in Fig. 2)

Chromosome pair No.	1		2		3		4		5		6		7		8	
Long arm ( $\mu$ m)	1,50	1,50	1,34	1,42	1,26	1,14	1,22	1,13	1,22	1,25	1,09	1,21	1,00	0,86	1,07	0,80
Short arm ( $\mu$ m)	1,47	1,40	1,07	1,02	0,71	0,57	0,97	0,95	0,88	0,86	0,56	0,64	0,80	0,72	0,85	0,84
Total length ( $\mu$ m)	2,96	2,90	2,40	2,43	1,97	1,71	2,19	2,08	2,10	2,11	1,65	1,85	1,80	1,58	1,92	1,64
Arm ratio	1,02	1,07	1,26	1,39	1,77	2,02	1,26	1,20	1,39	1,45	1,96	1,91	1,24	1,19	1,25	0,95
Chromosome type	m	m	m	m	sm	sm	m	m	m	m	sm	sm	m	m	m	m

Chromosome pair No.	9		10		11		12		13		14		15	
Long arm ( $\mu$ m)	1,04	0,97	0,90	0,99	0,90	0,88	0,89	0,87	0,85	0,87	0,91	0,81	0,723	0,684
Short arm ( $\mu$ m)	0,88	0,77	0,78	0,76	0,74	0,69	0,71	0,82	0,73	0,72	0,56	0,61	0,489	0,479
Total length ( $\mu$ m)	1,92	1,74	1,68	1,75	1,64	1,57	1,60	1,69	1,58	1,59	1,47	1,42	1,212	1,163
Arm ratio	1,18	1,25	1,15	1,29	1,21	1,27	1,25	1,06	1,16	1,20	1,63	1,34	1,48	1,43
Chromosome type	m	m	m	m	m	m	m	m	m	m	m	m	m	m

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