

Karyotype of *Myosoton aquaticum* (Caryophyllaceae)

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Chromosome numbers of *Myosoton aquaticum* were counted for 44 plants from 37 areas in Japan. All *M. aquaticum* plants examined showed a $2n = 28$ chromosomal count. The metaphase chromosomes ranged from 1.3 to 2.9 μm in length and 1.2 to 2.5 in arm ratio. On the basis of the nomenclature proposed by Levan et al. (1964), the 28 chromosomes were divided into 14 metacentric chromosomes and 14 submetacentric chromosomes, with the chromosome complement formulated as $2n = 28 = 14m + 14sm$.

Key words: Caryophyllaceae, karyotype, *Myosoton aquaticum*.

Myosoton (Caryophyllaceae) is a monotypic genus containing *Myosoton aquaticum* (L.) Moench, and is indigenous to temperate zones within Europe and Asia (Mabberley 1997). In Japan, this species is distributed in the lowlands, and often extends its range into the hills (Kitagawa 1982). The chromosome numbers for this species have been reported to be $2n = 20$ (Hsu 1968, as $n = 10$, under the name of *Stellaria aquatica* Scop., Frey 1969); $2n = 28$ (Heitz 1926, under *M. aquaticum*, Peterson 1936, under *M. aquaticum*, Blackburn and Morton 1957, Gadella and Kliphuis 1968, 1973, Uhríková and Murín 1970, Fernandes and Leitao 1971, Findlay and McNeill 1973, Kieft and van Loon 1978, Skalińska et al. 1978, Nishikawa 1981, under *M. aquaticum*, Tani 1981, under *S. aquatica*, van Loon and van Setten 1982, Zhang and Qiu 1995, under *M. aquaticum*, Javůrková-Jarolímová 1992, sec. Goldblatt and Johnson 2000, Lövkvist and Hultgård 1999, sec. Goldblatt and Johnson 2003) and $2n = 29$ (Javůrková-Jarolímová 1992, sec. Goldblatt and Johnson 2003). Previous

studies show that the plant with the $2n = 28$ chromosome count is the prevailing form; thus, the basic chromosome number of *Myosoton* is considered to be $x = 14$ (Darlington and Wylie 1955).

Karyotypic information offers a clue in clarifying related taxa because its descriptive features tend to maintain a greater consistency than any other characteristics; therefore, the karyotypic details of *Myosoton* are useful for the elucidation of closely related genera. This paper reports on the karyotype of *Myosoton aquaticum*.

Materials and Methods

This study used 44 *Myosoton aquaticum* plants collected from 37 areas in Japan (Table 1); voucher specimens of the plants examined are deposited in the Toyama Science Museum (TOYA). The karyotype examined was found in a plant collected at Gofuku, Toyama City in Toyama Prefecture, and its chromosomal form was expressed according to the nomenclature of Levan et al. (1964). The chromosome numbers were

Table 1. Collection localities and number of individuals examined of *Myosoton aquaticum*

| Collection locality | Number of individuals examined |
|--|--------------------------------|
| Sasagawa, Asahi-machi, Shimoniikawa-gun, Toyama Pref. | 1 |
| Yokoo, Asahi-machi, Shimoniikawa-gun, Toyama Pref. | 1 |
| Ogawaji, Uozu City, Toyama Pref. | 1 |
| Ohiwa, Kamiichi-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Tachi, Kamiichi-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Yunomiko, Kamiichi-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Rokurodani, Tateyama-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Yokoe, Tateyama-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Yoshiminenobiraki, Tateyama-machi, Nakaniikawa-gun, Toyama Pref. | 1 |
| Gofuku, Toyama City, Toyama Pref. | 4 |
| Ikeda, Toyama City, Toyama Pref. | 1 |
| Teramachi, Toyama City, Toyama Pref. | 1 |
| Sugusaka, Toyama City, Toyama Pref. | 2 |
| Wariyama Toyama City, Toyama Pref. | 1 |
| Yamadamura-Akamedani, Toyama City, Toyama Pref. | 1 |
| Yatsuomachi-Suwamachi, Toyama City, Toyama Pref. | 1 |
| Gotani, Tonami City, Toyama Pref. | 1 |
| Tsubono, Tonami City, Toyama Pref. | 1 |
| Kitayashiro, Himi City, Toyama Pref. | 2 |
| Kurakawa, Himi City, Toyama Pref. | 3 |
| Nakanami, Himi City, Toyama Pref. | 1 |
| Omata, Nanto City, Toyama Pref. | 1 |
| Tamukai, Nanto City, Toyama Pref. | 1 |
| Tanoshita, Nanto City, Toyama Pref. | 1 |
| Notojima-Susomachi, Nanao City, Ishikawa Pref. | 1 |
| Yakushimachi, Kanazawa City, Ishikawa Pref. | 1 |
| Kakumamachi, Kanazawa City, Ishikawa Pref. | 1 |
| Syoji, Fujikawaguchiko-machi, Minamitsuru-gun, Yamanashi Pref. | 1 |
| Fujimi, Fujimi-machi, Suwa-gun, Nagano Pref. | 1 |
| Maebuchi, Hata-machi, Higashichikuma-gun, Nagano Pref. | 1 |
| Kamiokacho-Higashiurushiyama, Hida City, Gifu Pref. | 1 |
| Okuhidaonsengo-Imami, Takayama City, Gifu Pref. | 1 |
| Ohbuchi, Fuji City, Shizuoka Pref. | 1 |
| Nyufune, Okabe-cho, Shida-gun, Shizuoka Pref. | 1 |
| Shimoyoshida, Shinshiro City, Aichi Pref. | 1 |
| Kawanami, Yogo-cho, Ika-gun, Shiga Pref. | 1 |
| Ohkubocho, Akashi City, Hyogo Pref. | 1 |
| Total | 44 |

determined using meristematic cells of the root tips through an ordinary squash technique. Newly-formed adventitious roots from the stem nodes were collected and pretreated in 1.9 mM 8-hydroxyquinoline fluids at room temperature (about 25°C) for one hour and then kept at 5°C for 15 hours. After being fixed in a mixture of glacial

acetic acid and absolute ethyl alcohol (1:3) at room temperature for one hour, the root tips were soaked in 1N HCl at room temperature for a few hours and were macerated in 1N HCl at 60°C for 11.5 minutes. They were then immersed in tap water, and stained and squashed in 1.5% lacto-propionic orcein.

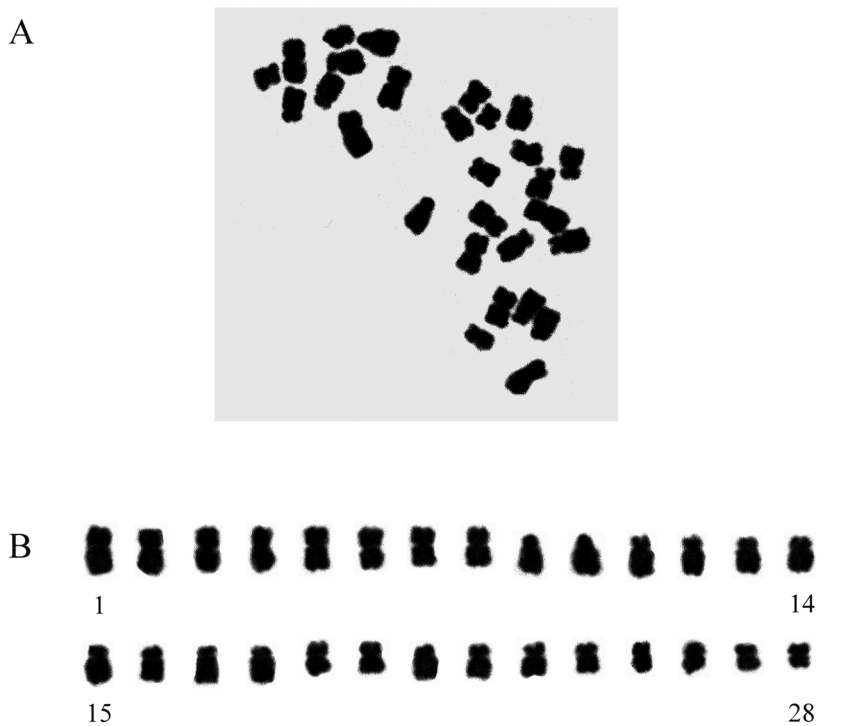


Fig. 1. Somatic metaphase chromosomes (A) and karyotype (B) of *Myosoton aquaticum*. Bar represents 5 μm .

Results and Discussion

All *Myosoton aquaticum* plants collected showed a $2n = 28$ chromosomal count (Fig. 1A), confirming the counts reported previously from Bulgaria, China, England, France, Italy, Japan, Netherlands, Poland, Portugal, Slovakia, Sweden, and Switzerland. The metaphase chromosomes ranged from 1.3 to 2.9 μm in length with an arm ratio of 1.2 to 2.5 (Table 2). On the basis of the nomenclature proposed by Levan et al. (1964), the 28 chromosomes were divided into 14 metacentric chromosomes and 14 submetacentric chromosomes, with the chromosome complement formulated as $2n = 28 = 14m + 14sm$. The karyotype found in this study was slightly different from one previously reported by Tani (1981) in the number of each chromosome form. Tani reported that the somatic chromosome complement of

this species was composed of four pairs of large metacentric chromosomes, two pairs of short metacentric chromosomes and eight pairs of submetacentric chromosomes: judging from the picture of metaphase chromosomes, some chromosomes appeared to be elongated. The deformation of these chromosomes, perhaps caused accidentally during preparation by the squashing procedure, may explain the difference of karyotypic formula between the results in this study and those previously reported. The present study – along with those of Tani (1981) and Nishikawa (1981) – indicates that the plant with $2n = 28$ is the prevalent form of *Myosoton aquaticum* in Japan.

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Table 2. Measurements at somatic metaphase chromosomes of *Myosoton aquaticum*

| Number | Length (μm) | Total (μm) | Arm ratio | Form |
|--------|--------------------------|-------------------------|-----------|------|
| 1 | 1.2+1.7 | 2.9 | 1.4 | m |
| 2 | 1.2+1.7 | 2.9 | 1.4 | m |
| 3 | 1.3+1.5 | 2.8 | 1.2 | m |
| 4 | 1.3+1.5 | 2.8 | 1.2 | m |
| 5 | 1.2+1.4 | 2.6 | 1.2 | m |
| 6 | 1.2+1.4 | 2.6 | 1.2 | m |
| 7 | 1.1+1.3 | 2.4 | 1.2 | m |
| 8 | 1.1+1.3 | 2.4 | 1.2 | m |
| 9 | 0.8+1.5 | 2.3 | 1.9 | sm |
| 10 | 0.8+1.5 | 2.3 | 1.9 | sm |
| 11 | 0.7+1.6 | 2.3 | 2.3 | sm |
| 12 | 0.7+1.6 | 2.3 | 2.3 | sm |
| 13 | 0.7+1.4 | 2.1 | 2.0 | sm |
| 14 | 0.7+1.4 | 2.1 | 2.0 | sm |
| 15 | 0.7+1.4 | 2.1 | 2.0 | sm |
| 16 | 0.7+1.4 | 2.1 | 2.0 | sm |
| 17 | 0.6+1.5 | 2.1 | 2.5 | sm |
| 18 | 0.6+1.5 | 2.1 | 2.5 | sm |
| 19 | 0.8+1.2 | 2.0 | 1.5 | m |
| 20 | 0.8+1.2 | 2.0 | 1.5 | m |
| 21 | 0.6+1.3 | 1.9 | 2.2 | sm |
| 22 | 0.6+1.3 | 1.9 | 2.2 | sm |
| 23 | 0.6+1.3 | 1.9 | 2.2 | sm |
| 24 | 0.6+1.2 | 1.8 | 2.0 | sm |
| 25 | 0.7+1.0 | 1.7 | 1.4 | m |
| 26 | 0.7+1.0 | 1.7 | 1.4 | m |
| 27 | 0.6+0.8 | 1.4 | 1.3 | m |
| 28 | 0.6+0.7 | 1.3 | 1.2 | m |

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佐藤杏子^a, 山崎貴博^b, 岩坪美兼^c: ウシハコベ (ナデシコ科) の核型

富山県, 石川県, 山梨県, 長野県, 岐阜県, 静岡県, 愛知県, 滋賀県, 兵庫県の37カ所より採集したウシハコベ *Myosoton aquaticum* (L.) Moench 44個体の染色体を観察したところ, すべて染色体基本数 $x = 14$ (Darlington and Wylie 1955) に基づく $2n = 28$ の二倍体であった. 本種は過去に国内では $2n = 28$ が, 国外では $2n = 20, 28, 29$ が知られていた. 核型分析を行ったところ, 染色体の長さは,

1.3–2.9 μm , 腕比は1.2–2.5であり, 核型式は $2n = 28 = 14m + 14sm$ で表された. サテライトは観察されなかった. 本研究の結果と過去の報告から, わが国のウシハコベは $2n = 28$ の細胞型が一般的であると考えられた.

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