

## 富山県産オオバコの染色体数

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Yoshikane Iwatsubo, Kiyō Ogino, Goro Kodate and Naohiro Naruhashi : **Chromosome numbers of *Plantago asiatica* L. (Plantaginaceae) in Toyama Prefecture, central Japan**

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Based on  $x=6$ , *Plantago asiatica* L. is constituted by a polyploid series of diploid with  $2n=12$  (McCullagh 1934 ; Chen 1988), hyper-diploid with  $2n=14$  (Yurtsev et al. 1975), tetraploid with  $n=12$  (Ishikawa 1916 ; Sinoto 1946 ; Fujiwara 1955 a ; Subramanyam and Kamble 1966) and  $2n=24$  (Ishikawa 1916 ; Sinoto 1925, 1946 ; Fujiwara 1955 b, 1956 ; Rahn 1957 ; Larsen 1966 ; Subramanyam and Kamble 1966 ; Matsuo and Noguchi 1989 ; Nishikawa 1990), and hexaploid plants with  $2n=36$  (Vasudevan 1976 ; Ge et al. 1985 ; Hsu et al. 1987). In Japan, this species is exclusively known to be tetraploid with  $n=12$  (Ishikawa 1916 ; Sinoto 1925 ; Fujiwara 1955 a) and  $2n=24$  (Ishikawa 1916 ; Shinoto 1925 ; Ikeno 1929 ; Fujiwara 1955 b, 1956 ; Matsuo and Noguchi 1989 ; Nishikawa 1990). However, the earlier chromosome studies for Japanese *P. asiatica* are still insufficient, because each of them is based on one or a few individuals. Thus the authors examined *P. asiatica* cytologically to find out whether the species includes additional polyploids other than the tetraploid.

The article records the chromosome numbers of 923 individuals collected from 121 localities in Toyama Prefecture situated on the Japan Sea side of Honshu.

#### Materials and methods

A total of 923 individuals were collected from 121 localities in Toyama Prefecture in 1999. The collection localities were randomly chosen. These plants were first grown in vinyl pots at the experimental garden of Toyama University. Chromosome numbers were ascertained from root tip

cells of the potted plants. The root tips collected from the potted plants were pretreated in a 2 mM 8-hydroxyquinoline solution for one hour at room temperature, and subsequently held at 5°C for 15 h. These root tips were fixed in a glacial acetic acid and absolute ethanol mixture (1:3) for one h, soaked in 1 N HCl at room temperature for a few hours, and subsequently macerated in 1 N HCl at 60°C for 11.5 min. After immersed in tap water, the root tips were stained in 1.5 % lacto-propionic orcein, and the ordinary squash technique was applied for the examination of somatic chromosome numbers. Voucher specimens are kept at the Toyama Science Museum (TOYA).

#### Results and discussion

All sampling sites and chromosome numbers of *P. asiatica* are shown in Table 1. In 923 individuals observed, 866 individuals were tetraploid with  $2n=24$  (Fig. 1 A), one individual was a hypo-tetraploid with  $2n=23$ , and 56 individuals were hexaploid with  $2n=36$  (Fig. 1 B).

In the studied area, the majority of *P. asiatica* were tetraploid with  $2n=24$ , in accordance with the earlier reports for Japanese *P. asiatica* (Ishikawa 1916 ; Shinoto 1925 ; Fujiwara 1955 b, 1956 ; Larsen 1966 ; Matsuo and Noguchi 1989 ; Nishikawa 1990). However, hexaploid individuals are also found in 12 localities (Fig. 2). One hypo-tetraploid individual with  $2n=23$  found in a tetraploid population at Gofuku in Toyama City (Table 1) is thought to be an accidental aneuploid plant that occurred incidentally in the progeny of a tetraploid plant with  $2n=24$ .

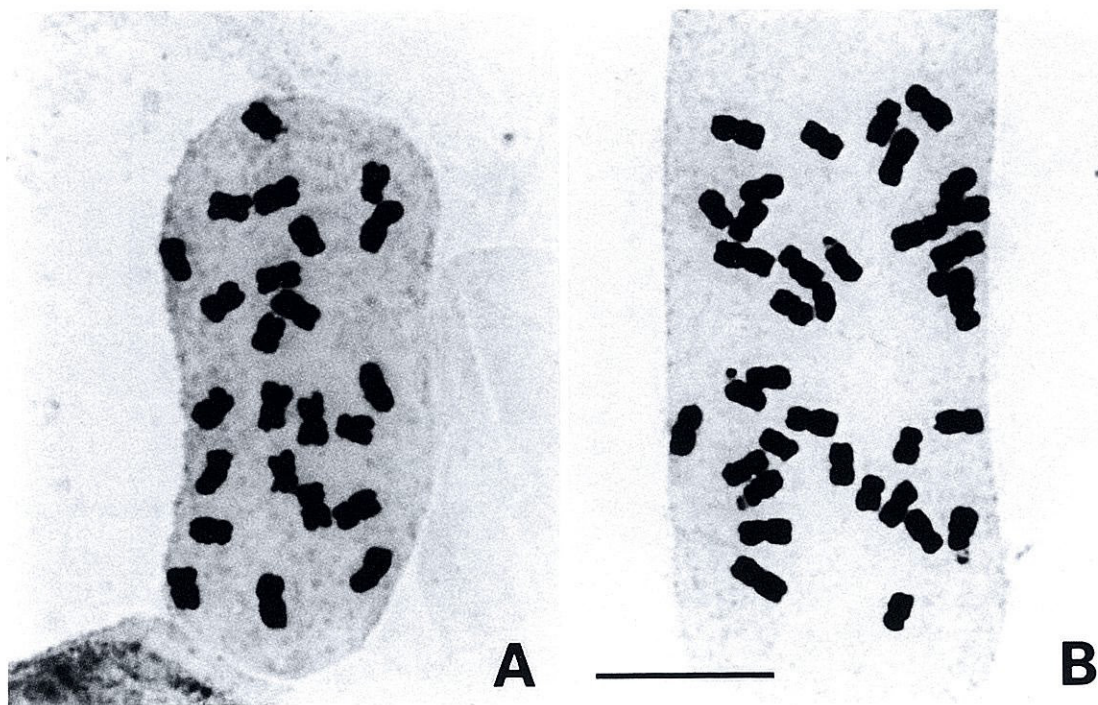


Fig. 1. Somatic metaphase chromosomes of *Plantago asiatica*. A:  $2n=4x=24$ ; B:  $2n=6x=36$ . Bar = 10  $\mu$ m.

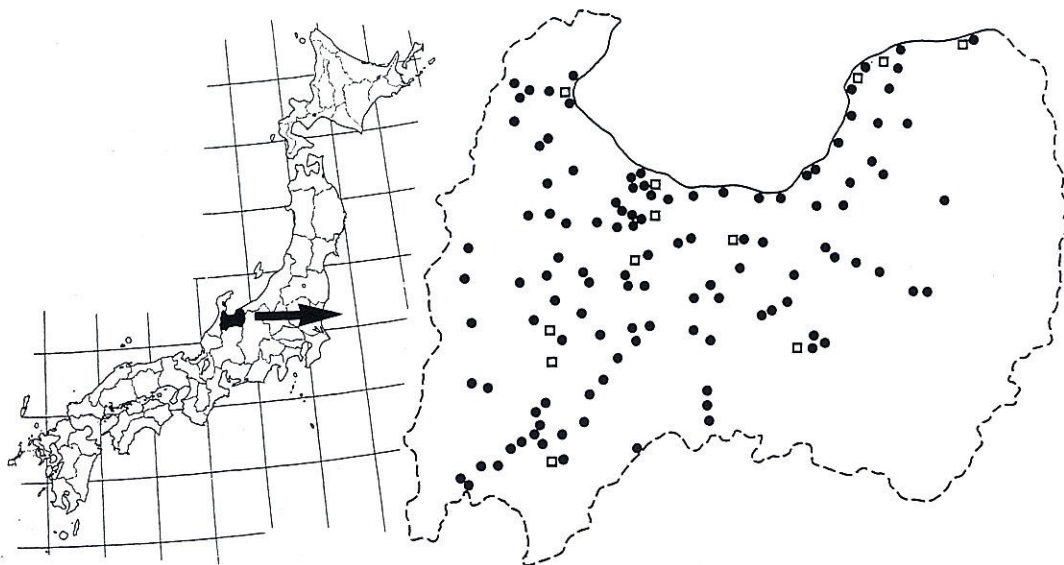


Fig. 2. Geographical distribution of 4x and 6x *Plantago asiatica* in Toyama Prefecture. ● :  $2n=4x=24$ ; □ :  $2n=6x=36$ .

Table 1. Chromosome numbers, collection localities and number of individuals examined (in parentheses) of *Plantago asiatica* in Toyama Prefecture

Chromosome number	Collection locality
2n=23	<b>Toyama City</b> : Gofuku, (1).
2n=24	<b>Shimoniikawa-gun</b> : Joyama, Asahi-machi, (4) ; Aoki, Nyuzen-machi, (6) ; Yoshiwara, Nyuzen-machi, (5) ; Sogatake, Unaduki-machi, (8) ; Tochiya, Unaduki-machi, (7). <b>Kurobe City</b> : Aramata, (5) ; Hamaishida, (6) ; Ikuji, (5) ; Kagamino, (5) ; Ogyu, (7). <b>Uozu City</b> : Kannondo, (5) ; Kitaonieminami, (5) ; Dozaka, (7) ; Shimajiri, (5). <b>Nakaniikawa-gun</b> : Banbajima, Kamiichi-machi, (5) ; Geda, Kamiichi-machi, (4) ; Iori, Kamiichi-machi, (5) ; Sakka, Kamiichi-machi, (49) ; Shakuseni, Kamiichi-machi, (4) ; Yomogizawa, Kamiichi-machi, (5) ; Ashikuraji, Tateyama-machi, (20) ; Miyaji, Tateyama-machi, (5) ; Nicchu-uwano, Tateyama-machi, (5) ; Uwazue, Tateyama-machi, (4) ; Inari, Funahashi-mura, (5). <b>Namerikawa City</b> : Hamayotsuya, (5) ; Higashikanaya, (4) ; Kamioura, (5) ; Kasagi, (5) ; Uonomi, (7). <b>Toyama City</b> : Gofuku, (49) ; Hiraoka, (5) ; Iwasetenjinmachi, (5) ; Kanaya, (50) ; Kosugi, (5) ; Kuriyama, (4) ; Mizuhashi-tsujigado, (5) ; Mukaishinjo, (4) ; Nagaresugi, (5) ; Sannokuma, (5) ; Tsukiokamachi, (5) ; Uchiide, (3). <b>Kaminiikawa-gun</b> : Nagatsuki, Ohsawano-machi, (3) ; Zike, Ohsawano-machi, (5) ; Hara, Ohyama-machi, (20) ; Kamidaki, Ohyama-machi, (5) ; Wada, Ohyama-machi, (5). <b>Nei-gun</b> : Chisato, Fuchu-machi, (6) ; Sotowano, Fuchu-machi, (5) ; Takatsuka, Fuchu-machi, (5) ; Fukujima, Yatsuo-machi, (5) ; Masama, Yatsuo-machi, (5) ; Nishikuzusaka, Yatsuo-machi, (5) ; Shirakimine, Yatsuo-machi, (6) ; Tochiori, Yatsuo-machi, (50) ; Kodani, Yamada-mura, (3) ; Yanaigo, Yamada-mura, (4) ; Inotani, Hosoiri-mura, (7) ; Ioridani, Hosoiri-mura, (4) ; Katakake, Hosoiri-mura, (5). <b>Imizu-gun</b> : Kamo, Shimo-mura, (5) ; Honkaihotsu, Ohshima-machi, (5) ; Kobayashi, Ohshima-machi, (5) ; Hibari, Kosugi-machi, (5) ; Sanga, Kosugi-machi, (3) ; Taikoyama, Kosugi-machi, (5) ; Mitoda, Daimon-machi, (6) ; Shima, Daimon-machi, (5). <b>Shinminato City</b> : Kaiomachi, (28) ; Kataguchi, (1) ; Kataguchikugue, (9) ; Tsukurimichi, (6). <b>Takaoka City</b> : Ishimaru, (4) ; Junichojima, (5) ; Nakaho, (5) ; Suda, (5) ; Tonoshima, (5). <b>Himi City</b> : Ao, (50) ; Busshoji, (5) ; Hokone, (5) ; Kumanashi, (5) ; Kume, (5) ; Ohno, (3) ; Okubo, (5) ; Saiwaicho, (7) ; Taniya, (5). <b>Tonami City</b> : Gotani, (5) ; Higashiishimaru, (5) ; Nagashima, (5) ; Nakano, (11) ; Seridani, (5) ; Takando, (5) ; Takanosu, (5). <b>Higashitonami-gun</b> : Komaki, Shogawa-machi, (6) ; Hidayaa, Inami-machi, (7) ; Minamihara, Johana-machi, (5) ; Ohgaya, Johana-machi, (4) ; Abetto, Toga-mura, (3) ; Kitajima, Toga-mura, (6) ; Momosegawa-ichinose, Toga-mura, (5) ; Momosegawa-shimotaniuchi, Toga-mura, (7) ; Ainokura, Taira-mura, (5) ; Higashinakae, Taira-mura, (5) ; Ohkuzushima, Taira-mura, (5) ; Ohshima, Taira-mura, (5) ; Soyama, Taira-mura, (5) ; Sugio, Taira-mura, (6) ; Takasorei, Taira-mura, (5) ; Kaimukura, Kamitaira-mura, (5) ; Kozu, Kamitaira-mura, (6) ; Nishiakaomachi, Kamitaira-mura, (4) ; Sukanuma, Kamitaira-mura, (4). <b>Nishitonami-gun</b> : Fukuokashin, Fukuoka-machi, (5) ; Kawanishi, Fukumitsu-machi, (5). <b>Oyabe City</b> : Hirazakura, (5) ; Nobana, (5).
2n=36	<b>Shimoniikawa-gun</b> : Joyama, Asahi-machi, (6) ; Ikari, Nyuzen-machi, (8). <b>Kurobe City</b> : Aramata, (1). <b>Kaminiikawa-gun</b> : Saikakuchi, Ohyama-machi, (6). <b>Toyama City</b> : Mukaishinjo, (4) ; Sannokuma, (5). <b>Imizu-gun</b> : Tesaki, Kosugi-machi, (5). <b>Shinminato City</b> : Kataguchi, (5). <b>Himi City</b> : Saiwaicho, (1). <b>Higashitonami-gun</b> : Kanaya, Shogawa-machi, (6) ; Abetto, Toga-mura, (2) ; Shimohara, Toga-mura, (8).

In the three levels of polyploidy reported till now for this species, diploid ( $2n=12$ ) is reported from China (Chen 1988) and Russia (Yurtsev et al. 1975), tetraploid ( $2n=24$ ) is from India (Subramanyam and Kamble 1966), Japan (Ishikawa 1916; Sinoto 1925; Ikeno 1929; Fujiwara 1955 a, b; Matsuo and Noguchi 1989; Nishikawa 1990), Sweden (Rahn 1957) and Thailand (Larsen 1966), and hexaploid ( $2n=36$ ) is from China (Ge et al. 1985) and Russia (Vasudevan 1976). The present study disclosed the presence of hexaploid *P. asiatica* in Japan.

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岩坪美兼・荻野聖代・小館吾朗・鳴橋直弘：富山県産オオバコの染色体数

オオバコ科オオバコ属のオオバコ (*Plantago asiatica* L.) には、2倍体 ( $2n=12$ )、高2倍体 ( $2n=14$ )、4倍体 ( $2n=24$ )、6倍体 ( $2n=36$ ) が報告されている。これまで日本では、 $2n=24$  の4倍体のみが知られていた。

富山県内の121か所から採集した923個体のオオバコについて、染色体数を調べた結果、866個体は $2n=24$ の4倍体であり、56個体は $2n=36$ の6倍体であった。また1個体は $2n=23$ の低4倍体であった。

この観察から、富山県内には $2n=24$ の4倍体が多いものの、 $2n=36$ の6倍体も広く存在することが明らかになった。

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