

富山県産セイヨウタンポポ (キク科) の染色体数

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Abstract

Chromosome numbers of *Taraxacum officinale* were examined in a total of 386 plants collected from 10 localities in the plains of Toyama Prefecture, central Honshu in Japan. They showed two chromosome counts of $2n=24$ (triploid) and 32 (tetraploid). Of 386 plants examined, 231 (59.8%) were triploids and 155 (40.2%) were tetraploids. The two chromosome forms of *T. officinale* were distributed throughout all of the 10 localities studied, which indicates that the two forms of *T. officinale* are ubiquitously distributed in the plains of Toyama Prefecture.

Key words : Asteraceae, Japan, polyploidy, *Taraxacum officinale*.

The genus *Taraxacum* Weber ex Wigg., a cosmopolitan herbaceous plant growing in Europe, America, Asia and Australia, has 60 species subdivided into about 2,000 apomictic lines named microspecies (Richards 1970, 1973; Mabberley 1997). *Taraxacum* is generally recognized as a monobasic genus with $x=8$ (Darlington and Wylie 1955). Diploid races of *Taraxacum* are usually known to be sexual, while polyploids are apomicts (Richards 1970). In this genus, *T. officinale* Weber is a well known cosmopolitan dandelion with a variety of chromosome numbers as listed in Table 1. Its diploids with $2n=16$ chromosomes, growing in central Europe, have many sexual races, while its triploids are nearly obligate apomicts (Stebbins 1971). Hybridization between the diploid races of *T. officinale* and the other *Taraxacum* species has also been recorded (Fürnkranz 1965). Many new apomictic races are thought to have appeared in the progeny of such hybrids (Stebbins 1971).

In Japan, *T. officinale* is an introduced plant, growing in plains and mountainous habitats. Morita (1988) had found natural hybrids between $3x$ *T. officinale* naturalized in Japan and native

diploid *Taraxacum* plants in sect. *Mongolica* during his field research. These natural hybrid plants are very similar in outer morphology to *T. officinale*, thus *T. officinale* and the hybrids are known to be difficult to discriminate from each other by their outer morphologies (Watanabe et al. 1997; Shibaike and Morita 2002). Thus, in this study, these were treated as *T. officinale*, distinguishing neither *T. officinale* nor natural hybrid plants. *Taraxacum officinale* in Japan is known to have $2n=24$ (Miyaji 1932; Okabe 1951; Takemoto 1954, 1956, 1961), $24+2B$ (Takemoto 1954), and 26 chromosomes (Takemoto 1956).

Recently, we found *T. officinale* with $2n=32$ and $2n=24$ in the mountainous habitat of Mt. Tateyama, located in the northern region of the Chubu district in central Japan (Sato et al. 2004). We report in this paper that these cytotypes are also prevalent in the plains of Toyama Prefecture, central Japan.

Materials and methods

A total of 386 plants of *T. officinale*, collected from 10 localities in Toyama Prefecture, central

Table 1. The chromosome numbers reported previously of *Taraxacum officinale*

n	2n	References
4	Panigrahi and Kamathy (1960)	
12	Tischler (1934, 1937), Rohweder (1937), Koul (1964)	
16	Tischler (1934), Rohweder (1937)	
24	Sharma (1970 (sec. Goldblatt 1981))	
8	Panigrahi and Kamathy (1960), Sharma and Chatterjee (1961)	
9	Panigrahi and Kamathy (1960)	
16	Fürnkranz (1960, 1966), Kashin et al. (2003)	
18	Fürnkranz (1960)	
21–23	Fürnkranz (1966)	
22	Belaeva and Siplivinsky (1975)	
22–24	Heitz (1926)	
24	Miyaji (1932), Poddubnaja-Arnoldi and Dianowa (1934, 1937 (sec. Fedorov 1969)), Pólya (1950), Okabe (1951), Takemoto (1954, 1956, 1961) Malecka (1958, 1962, 1968, 1971), Mulligan (1959, 1984 (as 24 I to 16 I+1 II+2 III)), Fürnkranz (1960, 1966), Koul (1963 (as 8 II+8 I and 24), 1964), Mehra et al. (1965), Sharma and Sarkar (1967–68 (sec. Moore 1973)), Chuhsanova et al. (1968), Taylor and Mulligan (1968), Chatterjee and Sharma (1969), Gill (1969), Murín and Váčová (1970), Arevshatian (1970, 1973), Lee (1970), Lee and Oh (1970), Fernandes and Queirós (1971), Lovka et al. (1971), Kartashova et al. (1974 a, 1974 b (sec. Goldblatt 1988)), Magulaev (1976 (sec. Goldblatt 1981)), Peng and Hsu (1977, 1978), Van Loon and de Jong (1978), Kliphuis and Wieffering (1979), Krasnikov (1986), Lavrenko and Serditov (1987), Luque and Díaz Lifante (1991), Zhai and An (1996), Zhai et al. (1997), Dmitrieva (2000 (sec. Goldblatt and Johnson 2006)), Kashin et al. (2003)	
24–26	Juel (1905)	
24+1B	Krasnikov (1990 (sec. Goldblatt and Johnson 1996))	
24+2B	Takemoto (1954), Dmitrieva and Parfenov (1985), Parfenov and Dmitrieva (1987), Dmitrieva (2000 (sec. Goldblatt and Johnson 2006))	
26	Takemoto (1956), Gill (1969), Fernandes and Queirós (1971), Gupta and Garg (1987), Gupta et al. (1989)	
27	Mehra et al. (1965), Gill (1969)	
32	Fürnkranz (1960), Mehra et al. (1965), Chatterjee and Sharma (1969), Gill (1969), Lavrenko and Serditov (1987), Lavrenko et al. (1988), Zhai and An (1996), Zhai et al. (1997), Kashin et al. (2003)	
34	Fürnkranz (1960)	
36	Fürnkranz (1960)	
37	Fürnkranz (1960)	
40	Gill (1969), Mehra and Remanandan (1969), Fernandes and Queirós (1971)	
44	Gill (1969)	
48	Gill (1969)	

Table 2. Collection localities, numbers of individuals and chromosome numbers of *Taraxacum officinale* in Toyama Prefecture

Locality	Number of individuals		
	2n=24	2n=32	Total
Miyazaki, Asahi-machi, Shimoikawa-gun	21 (51.2%)	20 (48.8%)	41
Miyano, Kurobe City	27 (65.9%)	14 (34.1%)	41
Kakizawa, Kamiichi-machi, Nakaniikawa-gun	23 (62.2%)	14 (37.8%)	37
Tabata, Toyama City	23 (63.9%)	13 (36.1%)	36
Furukawa, Toyama City	6 (18.8%)	26 (81.2%)	32
Gofuku, Toyama City	43 (84.3%)	8 (15.7%)	51
Nakajinzu, Yatsuo-machi, Toyama City	13 (34.2%)	25 (65.8%)	38
Kojo, Takaoka City	25 (80.6%)	6 (19.4%)	31
Ohzakai, Himi City	28 (73.7%)	10 (26.3%)	38
Tochihara, Toga-mura, Nanto City	22 (53.7%)	19 (46.3%)	41
Total	231 (59.8%)	155 (40.2%)	386

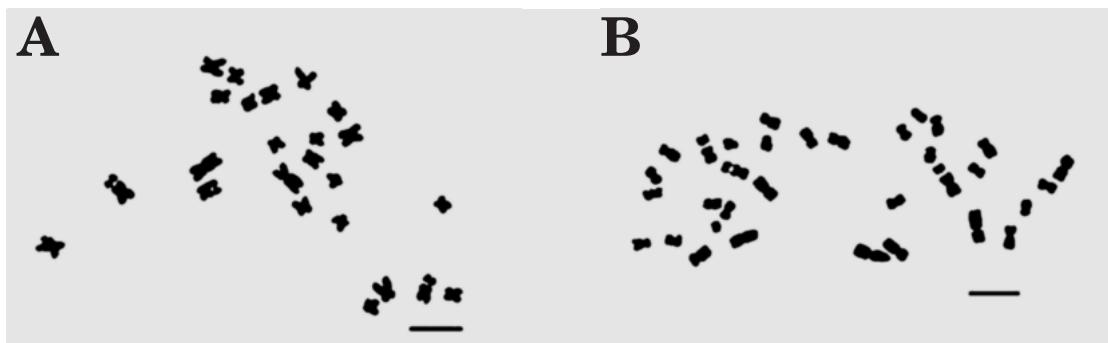


Fig. 1. Somatic metaphase chromosomes of *Taraxacum officinale* collected from Nakajinzu, Yatsuo-machi, Toyama City, Toyama Pref. A : $2n=24$. B : $2n=32$. Bar : 5 μ m.

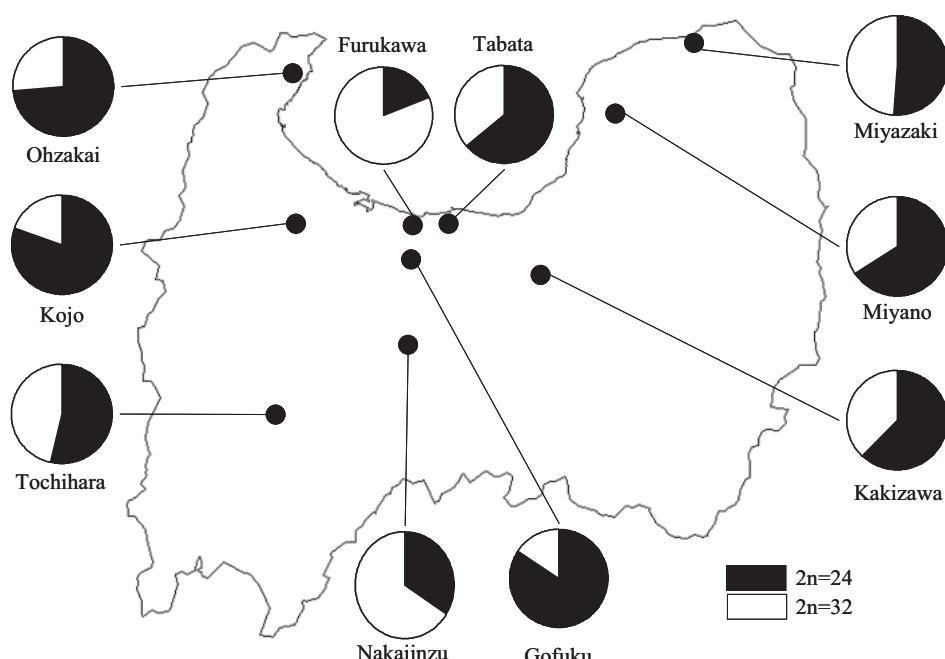


Fig. 2. Pie graphs showing the frequencies of two cytotypes 3x ($2n=24$) and 4x ($2n=32$) of *Taraxacum officinale* in Toyama Prefecture. Detailed localities are given in the Table 2.

Honshu in Japan, were used in this study (Table 2). In the 10 localities, each plant was collected at intervals of more than 20 meters. The plants were grown in plastic pots at the experimental garden of the University of Toyama. Their chromosome numbers were examined in meristematic cells, with fully spread metaphase chromosomes, from their root tips.

Newly formed root tips collected from the potted plants were pretreated in 2.2 mM 8-hydroxyquinoline solution at room temperature for

1 to 1.5 h and kept at ca. 5°C for 15 h. These root tips were fixed in a mixture of glacial acetic acid and absolute ethyl alcohol (1:3) at room temperature for 1 h, macerated in 1 N hydrochloric acid at 60°C for 10 minutes, and then washed in tap water. Meristems of the root tips were stained in 1 drop of 1.5% lacto-propionic orcein on a glass slide, and a common squash technique was applied in preparation.

Results and discussion

Taraxacum officinale studied had two chromosome forms: triploids with $2n=24$ chromosomes, and tetraploids with $2n=32$ chromosomes (Fig. 1). In Japan, *T. officinale* with $2n=24+2B$ chromosomes (Takemoto 1954), and with $2n=26$ chromosomes (Takemoto 1956) have also been recorded. In the present study, however, aneuploids and plants with B chromosomes were not detected. Of 386 plants examined, 231 (59.8%) were triploids and 155 (40.2%) were tetraploids. Both chromosome forms of *T. officinale* were found in each of the 10 localities studied. As shown in Table 2 and Fig. 2, the frequency of triploid *T. officinale* in the 10 localities ranged from 18.8% to 84.3%. The present study shows that both $2n=24$ and $2n=32$ forms of *T. officinale* are prevalent in the studied areas, which indicates that the two forms of *T. officinale* are distributed throughout the plains of Toyama Prefecture.

The analysis of ploidy level by flow cytometry revealed in Japanese *T. officinale* among others also triploid and tetraploid plants (Shibaike and Morita 2002; Shibaike 2005; Shibaike et al. 2005) and some of them are thought to have appeared in the progeny of hybrids between *T. officinale* and native sexual diploid *Taraxacum* by using allozyme marker (Watanabe et al. 1997) and DNA marker (Shibaike and Morita 2002). Flow cytometry can reveal ploidy level, however, it cannot be used to distinguish between plants with B chromosomes and aneuploids such as trisomics.

As shown in Table 1, *T. officinale* is known to have B chromosomes and a variety of aneuploids. In Japan, *T. officinale* with $24+2B$ (Takemoto 1954) and 26 chromosomes (Takemoto 1956) were also reported. In the present study, however, we found no B chromosomes or aneuploids in *T. officinale* distributed in Toyama Prefecture.

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佐藤杏子¹・岩坪美兼²・渡邊幹男³・芹沢俊介³・鳴橋直弘²：富山県産セイヨウタンポポ（キク科）の染色体数

富山県内 10 カ所より採集したセイヨウタンポポ (*Taraxacum officinale* Weber) 386 個体の染色体数を明らかにした。観察を行った 386 個体中 231 個体 (59.8%) は $2n=24$ の三倍体であり、155 個体 (40.2%) は $2n=32$ の四倍体であった。10 カ所すべての採集地で 2 つの細胞型が観察されたことから、富山県には遍在的に 2 つの細胞型が混生していることが明らかとなった。

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