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1923年に小泉源一が京都比叡山で発見し，*Ligularia telphusaiformis* Koidz. と命名したカニオタカラコウを1939年に北村四郎がオタカラコウとモミジガサの雑種とした．北村は新雑種の属名を両親種の当時の属名 *Senecillis* と *Cacalia* とを組み合わせて，*Senecillicacalia* とした．しかし，*Senecillis* も *Cacalia* も廃棄名であり，それぞれの種の正しい属名は *Ligularia* と *Parasenecio* であるから，*Senecillicacalia* は国際植物命名規約（ウィーン規約）H.6およびH.8に基づいて学名ではない名称とみなされる．このためカニオタカラコウ属の新属名として *Ligularia* と *Parasenecio* とを組み合わせ ×*Liguparasenecio* と命名した．カニオタカラコウの学名は ×*Liguparasenecio telphusaiformis* (Koidz.) H. Ohashi & K. Ohashi となる．

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Kyoko SATO[a], Yoshikane IWATSUBO[b,*], Michihito OHTA[c], Taku MATSUHISA[d] and Naohiro NARUHASHI[b]: **Chromosome Numbers of *Taraxacum officinale* (*Asteraceae*) Distributed in Some High Mountains in Central Honshu, Japan**

中部地方の高山に分布するセイヨウタンポポの染色体数（佐藤杏子[a]，岩坪美兼[b,*]，太田道人[c]，松久　卓[d]，鳴橋直弘[b]）

Summary: Polyploidy in 1,289 individuals of *Taraxacum officinale*, which have invaded the flora of Mt. Tateyama, Mt. Norikuradake and Shiga Heights, were studied. They had either 2n = 3x = 24 or 2n = 4x = 32 chromosomes. These counts are consistent with the results of previous studies in the plains of Toyama Prefecture, central Japan (Sato et al. 2007). Triploid individuals were found in all the sites investigated in the three mountains, while tetraploid ones were restricted only to the sites at low altitudes. Moreover, tetraploid individuals were not found above a height of 2,100 m, which raises the possibility that tetraploid *T. officinale* has lower resistance at alpine habitats than triploid *T. officinale*.

Taraxacum officinale Weber (common dandelion; *Asteraceae*), an introduced perennial herbaceous plant, is distributed in almost all the plains in Japan. This taxon has many hundred apomictic microspecies and has a great variety of chromosome numbers characterized by the occurrence of a polyploid series of 2x (2n = 16), 3x (2n = 24), 4x (2n = 32), 5x (2n = 40) and 6x (2n = 48) in addition to several aneuploids worldwide (Fedorov 1969, Gill 1969), whereas naturalized *T. officinale* in Japan is known to have two forms with different chromosome numbers: triploids (Miyaji 1932, Okabe 1951, Takemoto 1954, 1956, 1961, Sato et al. 2004, 2007) and tetraploids (Sato et al. 2004, 2007). This plant is known to expand its area of distribution into the subalpine and alpine areas of a few high mountains in central Honshu, such as Mt. Hakusan (Nakayama et al. 2006), Mt. Yatsugatake, Mt. Norikuradake, Shiga Heights and Mt. Tateyama (Matsuhisa 2004). These alpine areas are protected nature conservation areas in the national parks of Japan, and the native *Taraxacum* taxa are either *T. alpicola* Kitam. or *T. yatsugatakense* H. Koidz. Introduced plants pose a threat to the native flora of

those high mountains since they aggressively compete with the native species (Nakayama et al. 2006). Thus, the distribution and polyploidy of *T. officinale* in the alpine and subalpine floras of those high mountains are of interest with respect to the protection of native *Taraxacum* species.

In Japan, the naturally formed hybrids between naturalized 3x *T. officinale* and native diploid *Taraxacum* of section Mongolica were found by Morita (1988), Watanabe et al. (1997a, 1997b, 1997c), Hamaguchi et al. (2000), Yamano et al. (2002), Shibaike and Morita (2002) and Shibaike et al. (2005). *Taraxacum officinale* and the hybrids found in Japan are usually difficult to distinguish from each other based on morphology (Watanabe et al. 1997a, Shibaike and Morita 2002), and we were unable to distinguish between *T. officinale* and the hybrid strains in the field. Therefore, we treated all samples as *T. officinale* in the present paper without attempting to discriminate between *T. officinale* and the hybrids. In Mt. Tateyama, Sato et al. (2004) found that all *T. officinale* plants distributed in the alpine area are triploid, whereas those found in the subalpine area include both triploid and tetraploid plants. The purpose of the present study is to ascertain whether the phenomenon found in *T. officinale* of Mt. Tateyama is similar also in other mountains or not.

Materials and Methods

A total of 1,289 individuals of *Taraxacum officinale* from 27 sites (Tables 1–3, Fig. 1) in Mt. Tateyama (36°34´N, 137°37´E), Mt. Norikuradake (36°06´N, 137°33´E) and Shiga Heights (36°42´N, 138°30´E) during the period 2004–2006 were used for the study. These plants were grown at the experimental garden at the University of Toyama. Chromosome counts of the somatic cells in the root tips of pot-grown plants were performed. Newly formed root tips in the potted plants were harvested and pretreated in approximately 2.1 mM 8-hydroxyquinoline solution at room temperature (approximately 25ºC) for 1 to 1.5 h and maintained at approximately 5ºC for 15 h. The root tips were fixed in a mixture of glacial acetic acid and absolute ethyl alcohol (1:3) at room temperature for an hour, macerated in 1N hydrochloric acid at 60ºC for 10 min and washed in tap water. They were stained and squashed in 1.5% lacto-propionic orcein. The data of 132 individuals in *T. officinale* collected in Mt. Tateyama reported by Sato et al. (2004) were also used contained in the present data of Mt. Tateyama.

Result and Discussion

The chromosome counts of *T. officinale* were determined for a total of 1,289 individuals collected from Mt. Norikuradake, Mt. Tateyama and Shiga Heights. They had either 2n = 24 (Fig. 2A) or 2n = 32 chromosomes (Fig. 2B). These counts are consistent with the results of previously reported studies in the alpine and subalpine area of Mt. Tateyama (Sato et al. 2004) and in the plains of Toyama Prefecture, central Japan (Sato et al. 2007).

In the plains of Toyama Prefecture, 155 individuals (40.2%) out of a total 386 individuals were tetraploid plants (Sato et al. 2007). Frequency of tetraploid plants, however, is very low in the three mountain areas: 1.4% in Mt. Tateyama, 10.7% in Mt. Norikuradake and 3.3% in Shiga Heights.

The details of chromosome counts of plants collected from the sites in the three mountains are as follows:

1. Mt. Tateyama

Chromosome counts were determined in 288 individuals collected from 11 sites situated between 1,470 m and 2,450 m. Triploid plants were found in all the 11 sites, while tetraploid plants were found only at two sites located at 1,620 m and 1,960 m.

Table 1. Chromosome numbers, collection sites and number of individuals of *Taraxacum officinale* examined in Mt. Tateyama

Altitude of collection site (locality)	Chromosome number		Total
	2n = 24	2n = 32	
2450 m (Murododaira)	112	–	112
2440 m (Murododaira)	44	–	44
2405 m (Murododaira)	22	–	22
2400 m (Murododaira)	9	–	9
2390 m (Murododaira)	6	–	6
2350 m (Kagamiishi)	2	–	2
2020 m (Ubagafutokoro)	3	–	3
1960 m (Mimatsu)	35	1	36
1840 m (Oiwake)	29	–	29
1620 m (Kobo)	19	3	22
1470 m (Daikandai)	3	–	3
	284 (98.6%)	4 (1.4%)	288

Table 2. Chromosome numbers, collection sites and number of individuals of *Taraxacum officinale* examined in Mt. Norikuradake

Altitude of collection site (locality)	Chromosome number		Total
	2n = 24	2n = 32	
2700 m (Tatamidaira)	320	–	320
2490 m	4	–	4
2130 m	39	–	39
1920 m (Meotomatsu Parking)	78	2	80
1680 m	52	25	77
1300 m	70	3	73
880 m	29	41	70
	592 (89.3%)	71 (10.7%)	663

Table 3. Chromosome numbers, collection site and number of individuals of *Taraxacum officinale*

Altitude of collection site (locality)	Chromosome number		Total
	2n = 24	2n = 32	
2170 m (Shibutoge)	38	–	38
2150 m	43	–	43
2100 m (Yokoteyama Parking)	42	–	42
1800 m	30	1	31
1680 m (Kumanoyu)	36	–	36
1650 m (Kasadake Parking)	29	4	33
1590 m (Hasuike)	39	–	39
1300 m	34	5	39
670 m	36	1	37
	327 (96.7%)	11 (3.3%)	338

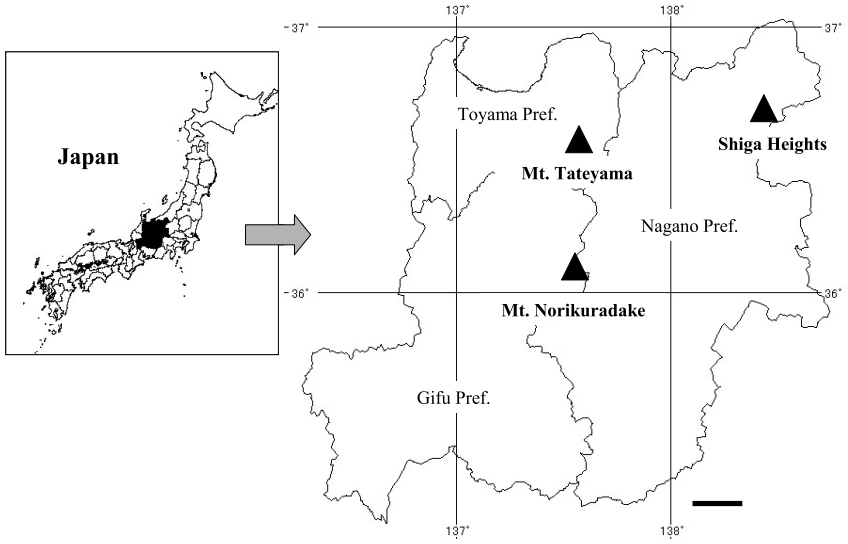

Fig. 1. Map showing the location of Mt. Tateyama, Mt. Norikuradake and Shiga Heights. Bar indicates 20 km.

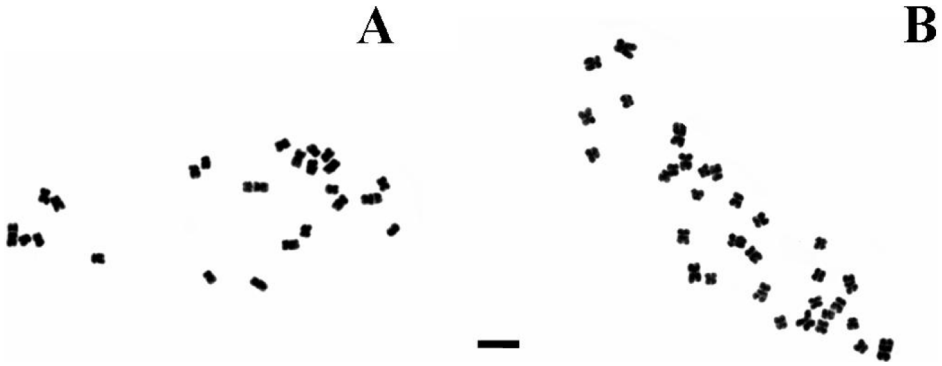

Fig. 2. Photographs of somatic metaphase chromosomes of *Taraxacum officinale* collected from Mt. Tateyama. A: 2n = 3x = 24. B: 2n = 4x = 32. Bar indicates 5 μm.

2. **Mt. Norikuradake**

Chromosome counts were determined in 663 individuals collected from seven sites situated between 880 m and 2,700 m. Triploid plants were found in all the seven sites. Tetraploid plants were found at four sites located between 880 m and 1,920 m.

3. **Shiga Heights**

Chromosome counts were determined in 338 individuals collected from nine sites situated between 670 m and 2,170 m. Triploid plants were found at all the sites. However, tetraploid plants were distributed in 4 sites situated at 670, 1,300, 1,650 and 1,800 m.

Triploid individuals were found in all the

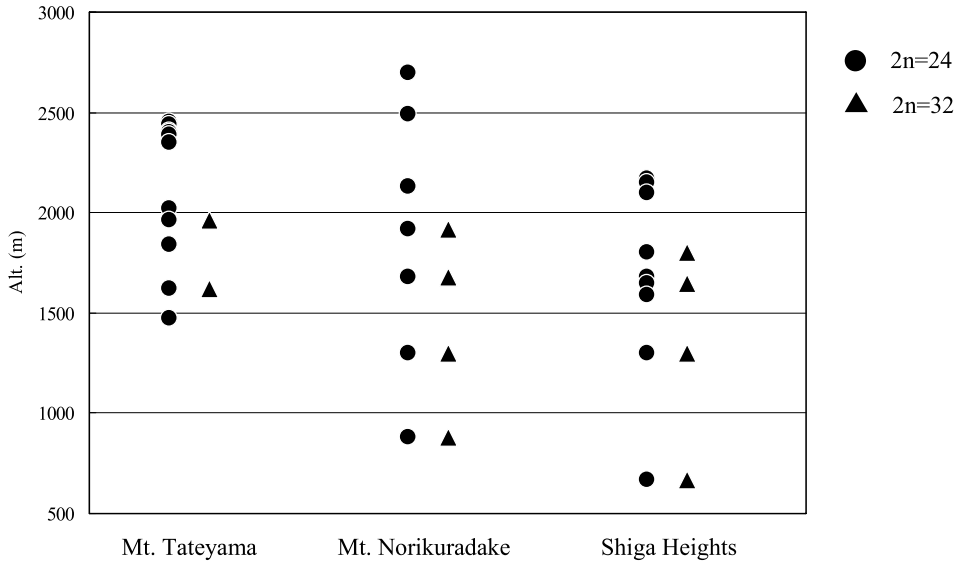

Fig. 3. Distribution of triploid (2n = 24) and tetraploid (2n = 32) individuals from altitude above sea level of *Taraxacum officinale* in Mt. Tateyama, Mt. Norikuradake and Shiga Heights. See Tables 1−3.

sites investigated in the three mountains, however, tetraploid ones were restricted only to sites at lower altitudes (Fig. 3).

Overall, the present study shows that tetraploid *T. officinale* is not distributed above a height of 2,100 m. Sato et al. (2007) reported that the two chromosome forms of *T. officinale* were distributed throughout all of the 10 localities studied, which indicates that the two forms are ubiquitously distributed in the plains of Toyama Prefecture. Thus, the present results raise the possibility that tetraploid *T. officinale* has lower resistance at alpine climate than triploid one.

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わが国のセイヨウタンポポには2n = 24の三倍体と2n = 32の四倍体が知られ，富山県内では，それらは同所的に生育することが知られている（Sato et al. 2004, 2007）．立山（富山県）においてセイヨウタンポポの染色体数を調べたところ，高山帯には三倍体だけが分布するのに対し，亜高山帯には三倍体と四倍体が分布していた（Sato et al. 2004）．この状況が一般的であるかどうかを明らかにするために，立山ではさらに試料数を増やし，詳細に調べるとともに，乗鞍岳（岐阜県）および志賀高原（長野県）の合計27ヵ所1,289個体のセイヨウタンポポを用いて，倍数性と標高との関係を調べた．その結果，三倍体と四倍体が観察された．観察した個体の九割以上は三倍体であり，いずれの山でも三倍体は標高に関係なく広く分布するのに対して，四倍体は立山，乗鞍岳および志賀高原の標高2,100 m 以上の地点では確認されなかった．

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