Polyploidy of Glechoma hederacea subsp. grandis（Labiatae）

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Yoshikane Iwatsubo[1], Yumiko Souma[1,2], Norihito Miura[1] and Naohiro Naruhashi[1] : **Polyploidy of *Glechoma hederacea* subsp. *grandis* (Labiatae)**

[1]Department of Biology, Faculty of Science, Toyama University, Gofuku 3190, Toyama 930–8555, Japan;
[2]Present address : Rokugaike 156, Kitaku, Nagoya 462–0002, Japan

Glechoma L. belonging to Labiatae is a small genus composed of ca. 10 species (Mabberley 1997). In the genus, *G. hirsuta* Waldst. et Kit. is distributed in Europe ; *G. hederacea* L. subsp. *hederacea* also ranges in Europe ; but *G. hederacea* subsp. *grandis* (A. Gray) H. Hara occurs in the Far East in Asia (Hara et al. 1954). At present, *G. hederacea* subsp. *hederacea* and *G. hirsuta* are naturalized in North America (Hara et al. 1954 ; Löve and Bernard 1959 ; Mabberley 1997). Chromosome number of *Glechoma* is known for the above mentioned two species and one variety. In *G. hirsuta*, all the reports of chromosome number from Hungary (Baksay 1956, in Fedorov 1969), Canada (Löve and Bernard 1959), Poland (Skalińska 1959 ; Skalińska and Pogan 1966), Bulgaria (Markova and Thu 1974) and Slovakia (Murín 1974, as *G. hederaceum* L. subsp. *hirsutum* (Waldst. et Kit.) Hermann) showed 2n=36 chromosomes. In *G. hederacea* subsp. *hederacea*, the chromosome number was reported as n=9 for plants from Netherlands and Norway (Sugiura 1940, under the name of *Nepeta glechoma* Benth. ; Laane 1971), n=9,18 or 2n=36 for plants in Canada (Löve and Bernard 1959 ; Mulligan 1961, 1984 ; Gill 1979, 1981), 2n=18 for cultivated plants in Japan (Suzuka and Koriba 1949 ; Suzuka 1950) and for plants in Finland (Sorsa 1963), 2n=18 and 24 for plants in Sweden (Löve and Löve 1942), 2n= 24 and 36 for plants from Poland (Zukowski and Slowinska 1979), 2n=36 for plants from Bulgaria (Markova and Ivanova 1973), Germany (Dersch 1974), Great Britain (Rutland 1941, as *Nepeta hederacea* Trev. ; Morton 1973 ; Hollingsworth et al. 1992), Hungary (Felföldy 1947, as *G. hederacea* L. f. *micrantha* (Boenn.) Rouy ; Pólya 1949, in Fedorov 1969), Netherlands (Gadella and Kliphuis 1963 ; Van den Brand et al. 1979), Poland (Skalińska 1959), Russia (Sokolovskaya et al. 1986), Slovakia (Murín 1974 ; Hrušovská-Osuská 1988, as *G. hederacea* agg.) and USA (Taylor 1949, as *Nepeta hederacea*), while in *G. hederacea* subsp. *grandis*, 2n=36 is reported from Japan (Tanaka 1953, as *G. hederacea* var. *grandis* (A. Gray) Kudo ; Hara et al. 1954 ; Nishikawa 1985). On the basis of the reported chromosome numbers in *G. hederacea*, two different basic chromosome numbers, x=6 (Hara et al. 1954) and x=9 (Sugiura 1940 ; Darlington and Wylie 1955 ; Skalińska et al. 1959 ; Morton 1973), were proposed for this species.

This article presents the chromosome numbers of *G. hederacea* subsp. *grandis* collected in Toyama Prefecture situated on the Japan Sea side of central Honshu, Japan, and deals with its basic chromosome number.

Materials and methods

One hundred and fifty seven individuals of *G. hederacea* subsp. *grandis* from wild populations in Toyama Prefecture in central Honshu, Japan, were used for the study (Table 1). Only one individual from each locality, so as to avoid resampling from the same clone, was used for the study. Chromosome numbers were determined in the root tip cells. Newly formed adventitious roots of ca.1.5 cm length from runners were collected and pretreated in a 2 mM 8–hydroxyquinoline aqueous solution for 1 hr at 25℃ and subsequently kept for 15 h at 6℃. They were fixed in a mixture of glacial acetic acid and absolute

ethyl alcohol (1 : 3) for 1 h, and soaked in 1 N HCl for a few hours followed by maceration in 1 N HCl at 60℃ for about 10 min. and then immersed in tap water for a few minutes to several hours. Meristems of the root tips were stained in a drop of 1.5% lacto-propionic orcein on the slide glass and ordinary squash technique was applied in preparation. Voucher specimens were deposited in the Toyama Science Museum (TOYA).

Results and discussion

Out of 157 individuals examined, 95 plants (60.5%) had 2n=36 chromosomes, 20 plants (12.7%) had 2n=45 chromosomes, and 42 plants (26.8%) had 2n=54 chromosomes (Table 1, Fig. 1). In the three counts, 2n=36 is the same count reported previously for this taxon (Tanaka 1953 ; Hara et al. 1954 ; Nishikawa 1985), whereas 2n =45 and 54 chromosomes are new counts. In the three counts, 2n=45 is the exact middle count of 2n=36 and 2n=54, and it is expected to represent the chromosome count of the hybrid between 2n =36 and 2n=54 plants. In the studied area, 2n= 45 plants are not many compared with 2n=36 or 2n=54 plants, and the 2n=45 plant had undeveloped anthers with unmatured pollens, whereas

Table 1. Chromosome numbers, collection localities of *Glechoma hederacea* subsp. *grandis* in Toyama Prefecture

Chromosome number	Collection locality
2n=36	**Shimoniikawa-gun** : Miyazaki, Asahi-machi ; Megawa, Nyuzen-machi ; Takase, Nyuzen-machi. **Kurobe City** : Kichijoji ; Maezawa ; Nakajin ; Nakayama ; Nishikoji ; Tamomi ; Wakaguri ; Yoshida. **Uozu City** : Dosaka ; Okuhirasawa ; Touzo. **Nakaniikawa-gun** : Inari, Funahashi-mura ; Goukakizawa, Kamiichi-machi ; Hirono, Kamiichi-machi ; Miyaji, Tateyama-machi ; Nichuwano, Tateyama-machi ; Taniguchi, Tateyama-machi ; Teratsubo, Tateyama-machi. **Namerikawa City** : Higashikanaya ; Kamiohura ; Sanga ; Tsubokawa. **Toyama City** : Anyoji ; Gofuku ; Hamakurosaki ; Hiraoka ; Kaigandorishinmachi ; Kinsenji ; Kuriyama ; Tsukioka. **Kaminiikawa-gun** : Fushiki, Ohsawano-machi ; Kasuga, Ohsawano-machi ; Kitashinmachi, Ohsawano-machi ; Shimoohkubo, Ohsawano -machi ; Ushigamase, Ohsawano-machi ; Hanasaki, Ohyama-machi ; Ohba, Ohyama-machi. **Nei-gun** : Shimoze, Fuchu-machi ; Sotowano, Fuchu-machi ; Yoshitani, Fuchu-machi ; Nakamura, Yamada-mura ; Otani, Yamada-mura ; Sukubo, Yamada-mura ; Soure, Yamada-mura ; Fukushima, Yatsuo-machi ; Hirabayashi, Yatsuo-machi ; Mitsumatsu, Yatsuo-machi ; Nishikuzusaka, Yatsuo-machi ; Ohdamo, Yatsuo-machi ; Yasojima, Yatsuo-machi. **Imizu-gun** : Mitoda, Daimon-machi ; Wakabayashi, Daimon-machi ; Hakko, Shimo-mura. **Shinminato City** : Tsukurimichi. **Takaoka City** : Ishidutsumi ; Iwatsubo ; Kojo ; Ohta. **Himi City** : Busshoji ; Kokubo ; Shimao ; Taniya. **Tonami City** : Gotani ; Miai ; Miyamorishin ; Yagi. **Higashitonami-gun** : Bande, Fukuno-machi ; Jabami, Iguchi-mura ; Inami, Inami-machi ; Izemi, Inami-machi ; Jiromaru, Johana-machi ; Minotani, Johana-machi ; Rindo, Johana-machi ; Saimyo, Johana-machi ; Sakuragaike, Johana-machi. Tatenohara, Johana-machi ; Nishiakaomachi, Kamitaira-mura ; Komaki, Shogawa-machi ; Shimone, Shogawa-machi ; Higashinakae, Taira-mura ; Iritani, Taira-mura ; Ohkuzushima, Taira-mura ; Abetto, Toga-mura. **Nishitonami-gun** : Hirotani, Fukumitsu-machi ; Hourinji, Fukumitsu-machi ; Nakanogo, Fukumitsu-machi ; Sodani, Fukumitsu-machi ; Kamimino, Fukuoka-machi ; Kamimukuta, Fukuoka-machi. **Oyabe City** : Shimokawazaki ; Takasaka ; Tsuzawa.
2n=45	**Shimoniikawa-gun** : Yokoo, Asahi-machi ; Unaduki, Unaduki-machi. **Kurobe City** : Fukuhira ; Shakado. **Uozu City** : Kyoden ; Sanga ; Shimajiri. **Nakaniikawa-gun** : Inamura, Kamiichi-machi ; Iori, Kamiichi-machi ; Yomogizawa, Kamiichi-machi ; Iwakuraji, Tateyama-machi ; Shibayama, Tateyama-machi. **Toyama City** : Nunose. **Kaminiikawa-gun** : Wada, Ohyama-machi. **Nei-gun** : Nirehara, Hosoiri-mura. **Imizu-gun** : Sanga, Kosugi-machi ; Taikoyama, Kosugi-machi. **Tonami City** : Ohta. **Higashitonami-gun** : Kaimukura, Kamitaira-mura ; Ainokura, Taira-mura.
2n=54	**Shimoniikawa-gun** : Joyama, Asahi-machi ; Miyazaki, Asahi-machi ; Aoki, Nyuzen-machi ; Yoshiwara, Nyuzen-machi. **Kurobe City** : Aratama. **Nakaniikawa-gun** : Geda, Kamiichi-machi ; Maruyama, Kamiichi-machi ; Nakaegami, Kamiichi-machi ; Uwazue, Tateyama-machi. **Toyama City** : Kosugi ; Minaminakada. **Kaminiikawa-gun** : Hara, Ohyama-machi ; Nakadaki, Ohyama-machi ; Jike, Ohsawano-machi. **Nei-gun** : Kaijaku, Fuchu-machi ; Shinmachi, Fuchu-machi ; Katakake, Hosoiri-mura ; Yanaigo, Yamada-mura ; Masama, Yatsuo-machi ; Nakaninbu, Yatsuo-machi ; Shimaji, Yatsuo-machi ; Sugidaira, Yatsuo-machi ; Tanokashira, Yatsuo-machi. **Takaoka City** : Joukoji ; Shibano. **Himi City** : Hokone. **Tonami City** : Seridani ; Takando ; Tsubono. **Higashitonami-gun** : Yasui, Fukuno-machi ; Ohgaya, Johana-machi ; Hosojima, Kamitaira-mura ; Suganuma, Kamitaira-mura ; Kanaya, Shogawa-machi ; Kagodo, Taira-mura ; Nakabatake, Taira-mura ; Ohnoden, Taira-mura ; Ohshima, Taira-mura ; Kitajima, Toga-mura ; Tochihara, Toga-mura. **Nishitonami-gun** : Mikkaichi, Fukuoka-machi ; Ohtaki, Fukuoka-machi.

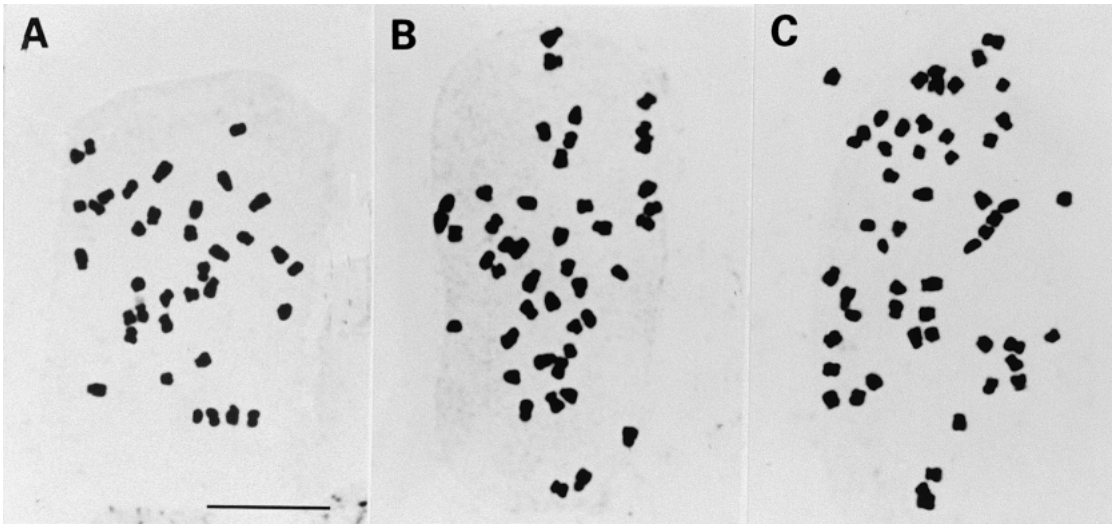

Fig. 1. Somatic metaphase chromosomes of *Glechoma hederacea* subsp. *grandis*. A, 2n=4x=36 ; B, 2n=5x=45 ; C, 2n=6x=54. Bar = 10 μm.

both of 2n=36 and 2n=54 plants had developed anthers with matured pollen grains (Miura et al. unpublished). On the basis of chromosome number and morphological features of anthers and pollens, the 2n=45 plant is considered to be the hybrid between 2n=36 and 2n=54 plants. In the two basic chromosome numbers, x=6 and 9, proposed for *G. hederacea* by previous workers (Sugiura 1940 ; Hara et al. 1954 ; Darlington and Wylie 1955 ; Skalińska 1959 ; Morton 1973), the variation of chromosome counts found in the study shows that the basic chromosome number of *G. hederacea* subsp. *grandis* is x=9. On the basis of this basic chromosome number, 2n=36, 45 and 54 plants are considered as tetraploids, pentaploids and hexaploids, respectively.

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岩坪美兼・相馬有美子・三浦憲人・鳴橋直弘：カキドオシ（シソ科）の倍数性

日本産のカキドオシ（*Glechoma hederacea* subsp. *grandis*）の染色体数は 2n=36（Tanaka 1953 ; Hara et al. 1954 ; Nishikawa 1985）が報告されている。この種（*Glechoma hederacea*）の染色体基本数としては x = 6 と 9 が提案されている（Sugiura 1940 ; Hara et al. 1954 ; Darlington and Wylie 1955 ; Skalińska et al. 1959 ; Morton 1973）。

この度，富山県産のカキドオシ 157 個体を対象に染色体数を調べた結果，95 個体（60.5%）は 2n =36, 20 個体（12.7%）は 2n=45，そして 42 個体（26.8%）が 2n=54 であった。2n=45 は，2n=36 と 2n=54 の中間数であること，全観察個体の 12.7% と最も少ないこと，そして富山県内で観察した範囲では 2n=45 の個体は，葯と花粉の発達が悪いことから，2n=36 と 2n=54 のカキドオシの間に生じた染色体系統間の雑種であろうと思われる。今回の観

察において，2n=36，45，54 の種内倍数性が見られたことから，日本産のカキドオシの染色体基本数は x=9 であることが明らかになり，2n=36，45，54 の植物体は，それぞれ四倍体，五倍体，六倍体であることが判明した。

(1〒930–8555　富山市五福 3190　富山大学理学部生物学科；2 現住所　〒462–0002　名古屋市北区六が池町 156)