

Veronica × *myriantha*, a New Hybrid from the Kansai District, Japan

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Veronica × *myriantha*, a new hybrid between *Veronica anagallis-aquatica* L. and *V. undulata* Wallich (Scrophulariaceae), collected on sandy wet riverbeds in the Kansai District, Japan, is described in this paper. The chromosome number, $2n=45$, is intermediate between those of the parental species. Its pollen grains are irregular in shape and have very low stainability. Although this hybrid has several morphological characteristics intermediate between *V. anagallis-aquatica* and *V. undulata*, it is distinct in having longer racemes where seed-bearing capsules are scarcely formed when mature.

In the Kansai District, *Veronica anagallis-aquatica* L. and *V. undulata* Wallich are found along slowly moving streams and ditches, on footpaths between rice fields and in other wet places at low altitudes. *Veronica anagallis-aquatica* L. is an introduced species. Though it seems to have been naturalized in Japan around in the early 20th century (Makino 1926), it has rapidly spreaded for the last ten years in the Kansai District. *Veronica undulata* Wallich is a native species. It was relatively common in Japan except Hokkaido, but its distribution range seems to have been gradually restricted.

During the course of my field study at the places where these two species coexisted, I found a plant which was very similar to both *V. anagallis-aquatica* and *V. undulata*, but differs in having lankily longer racemes with many flowers. As a result of my study, it became evident that the plant is recognized as a natural hybrid between *V. anagallis-aquatica* and *V. undulata*. In this paper the results of the investigations are reported and the taxonomic description of the new hybrid is given.

Materials and Methods

After selecting several habitats of *Veronica anagallis-aquatica* L., *V. undulata* Wallich and the new plant distributed in the Kansai District, field observations were carried out at monthly intervals from April, 1993, to December, 1994. External morphology and life history were investigated at the wild habitats. A few specimens from each population were transplanted to the botanical garden of Hyogo University of Teacher Education and used for observations of detailed morphological and cytological studies. Voucher specimens are deposited in the Herbaria of University of Tokyo (TI), Kyoto University (KYO) and Osaka Museum of Natural History (OSA).

For floral morphological studies, sizes of the flower parts, i.e., width of corolla, length of style plus stigma, length of filament, size of capsule and width of raceme were measured. On size of capsule and width of raceme, the largest values in fruiting time were measured in each individual. Number of flowers in a raceme was counted with the longest raceme in each individual. Leaf morphology, color of corolla, hairiness and other characters were also examined.

Table 1. Characteristics of *Veronica* × *myriantha* and its putative parental species

	<i>V. anagallis-aquatica</i>	<i>V. × myriantha</i>	<i>V. undulata</i>
Japanese name	Oo-kawajisha	Honaga-kawajisha	Kawajisha
Habitat	low wet places, common	low sandy wet riverbed, rare	low wet places, scattered
Height (cm)	20–100	20–100 (–120)	20–80 (–100)
Leaf	deep olive green, lanceolate to lanceolate- oblong, serrulate to nearly entire	deep to strong olive green, lanceolate to lanceolate-oblong, serrulate	strong olive green (meadow green), lanceolate, serrulate
Color of corolla	light purple with vivid purple veins	very light purple with light to strong purple veins	white to purplish white with pale purple veins
Width of corolla (mm)	6.4–9.0	5.5–7.0	3.7–5.7
Length of style plus stigma (mm)	2.6–4.1	1.8–2.5	1.0–1.8
Length of filament (mm)	2.6–3.7	2.0–2.7	1.2–2.4
Pedicle	ascending or upcurved	patent or arcuately ascending	ascending or upcurved
Capsule (mm)	3.4–4.2 long 3.2–4.2 wide	shriveled; seeds in a capsule are absent or few	2.4–3.2 long 2.5–3.0 wide
Number of flowers per raceme	30–70	100–150 or more	50–100 (–120)
Width of raceme in fruiting time (mm)	18–23	14–18	10–18
Hairiness	glabrous or sparsely glandular-pubescent in the raceme	usually glandular- pubescent in the raceme	usually glandular- pubescent in the raceme and on the stem
Pollen fertility (%)	97	5	95
Flowering time	spring to early summer and autumn	spring to early summer and rarely autumn	spring to early summer and rarely autumn
Life form	annual (frequently vegetatively reproduced)	annual	annual
Chromosome number	2n=36 n=18	2n=45	2n=54 n=27
Ploidy level (x=9)	tetraploid	pentaploid	hexaploid

Somatic chromosomes were observed in meristematic cells of the root tips. The root tips were pretreated with 0.002M 8-hydroxyquinoline solution for 4 hours at 5°C. After fixation in 3:1 mixture of ethanol and acetic acid for 2 hours, they were macerated in 1N HCl for 2 minutes at 60°C, and then stained with 2% aceto-orcein solution for overnight. Subsequently, they were squashed in the standard way. Meiotic chromosomes were observed in the pollen mother cells (PMCs). Young flower buds were fixed in 2:1:1 mixture of ethanol, chloroform and acetic acid for 4 hours, and the anthers were squashed in 2%

aceto-orcein.

Mature pollen grains from fully bloomed flowers were placed on a slide and a drop of ethanol was added. This was washed with xylene and then with ethanol. After being stained with 0.01% ethanol solution of gentian violet, to rinse off the superfluous pigment, ethanol was added to it until dry. Then the sediment was mounted with glycerin jelly. Pollen grains having its regular size and suitably stained were taken as fertile, and shrunk or misshapen pollen grains and the ones of which surface patterns were not normally stained were considered sterile. For scoring

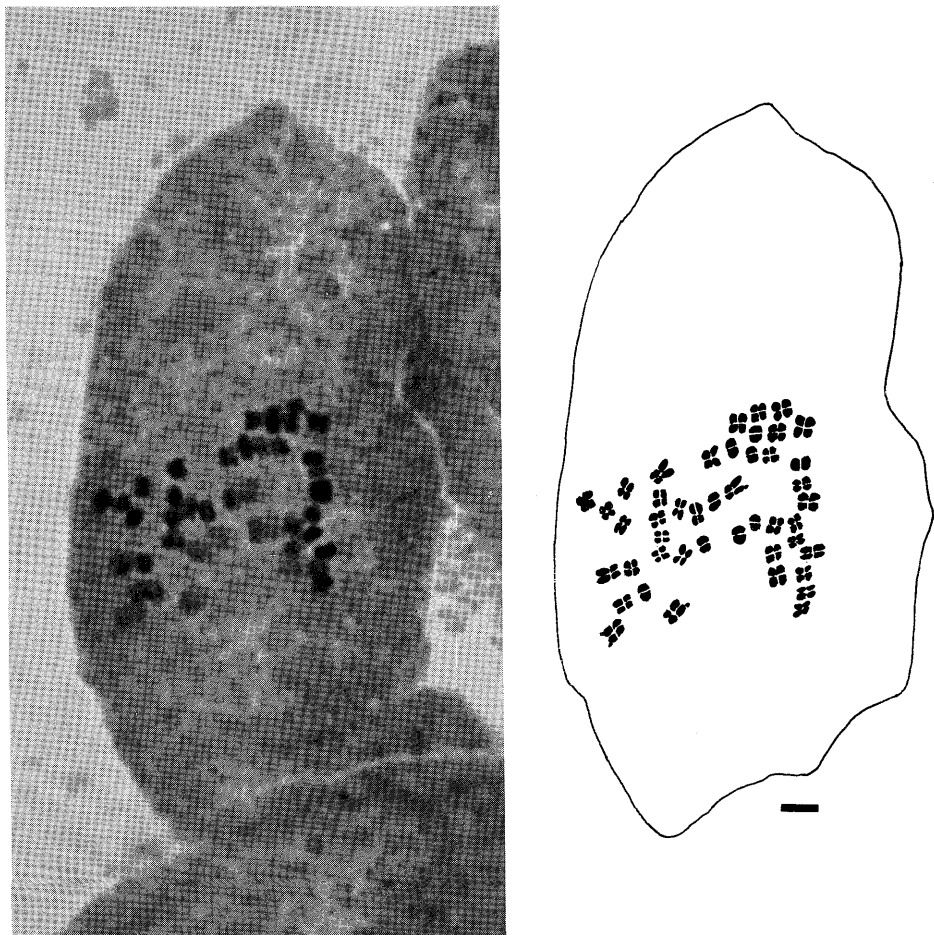


Fig. 1. Somatic metaphase chromosomes of *Veronica* × *myriantha*, $2n=45$ (Tos. Tanaka 4828 – Holotype). Bar indicates 2 μm .

pollen fertility percentage, more than 300 pollen grains of each individual were observed.

Results and Discussion

The new plants were found on sandy wet riverbeds along the Katsura River, the Yamato River and the Kako River, where *Veronica anagallis-aquatica* and *V. undulata* were more abundant.

Comparative accounts of characteristics of the new plant, *V. anagallis-aquatica* and *V. undulata* are presented in Table 1. The new plant has intermediate features between *V. anagallis-aquatica* and *V. undulata* in several morphological characters such as width of corolla, color of corolla, length of style plus stigma and length of filament. The leaf shape of the new plant is lanceolate to lanceolate-oblong, which is similar to that of *V. anagallis-aquatica*. The leaf

margin of the new plant is similar to that of *V. undulata* and more clearly serrulate than that of *V. anagallis-aquatica*.

As being already reported (Tanaka and Noguchi 1994), *V. anagallis-aquatica* and *V. undulata* are tetraploid and hexaploid of $x=9$, respectively. The new plant has been observed to have 45 chromosomes in the root tip cells (Fig. 1), which is considered to be a pentaploid, intermediate between *V. anagallis-aquatica* and *V. undulata*. The meioses of PMCs in *V. anagallis-aquatica* and *V. undulata* were normal. Pollen grains of the two species were fully formed and always more than 95% stainable. In contrast, the meiosis in the new plant was abnormal (Fig. 2). At first metaphase, though most of the chromosomes were bivalents or multivalents, several unpaired bivalents or multivalents, several unpaired

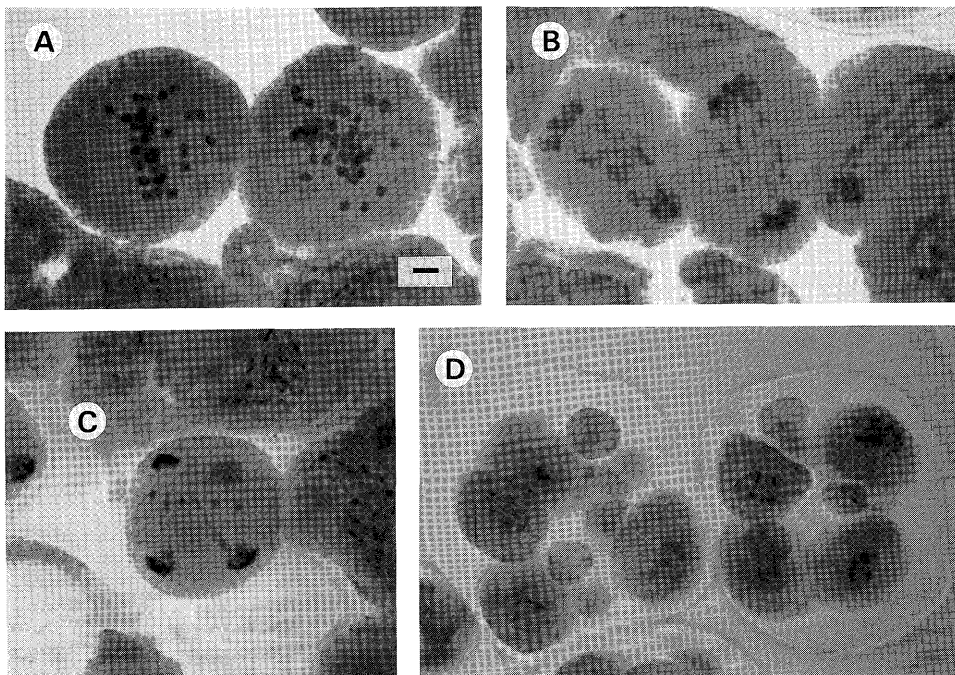


Fig. 2. Meiotic irregularities of PMCs in *Veronica* × *myriantha* (Tos. Tanaka 4828 – Holotype). Bar indicates 3 μ m.
 A: First metaphase with several unpaired univalents. B: First anaphase with chromatid bridges. C: Second telophase with lagging chromosomes forming micronuclei and a chromatid bridge. D: Abnormal tetrad with many micronuclei.

plane of the spindle were frequently found. First and second anaphase and telophase figures were often characterized by chromatid bridges and lagging chromosomes. At last, many micronuclei were formed, and a normal tetrad was scarcely observed. Pollen grains of the new plant were contracted, malformed and only about 5% normally stainable (Fig. 3).

The cytological nature strongly suggests that this new plant is a hybrid.

On the basis of morphological and cytological observations, I reached a conclusion that the plant represents a natural hybrid between *V. anagallis-aquatica* and *V. undulata*. The new hybrid is named *Veronica* × *myriantha* after the myriad flowers in the raceme.

Mature ones of this hybrid are readily distin-

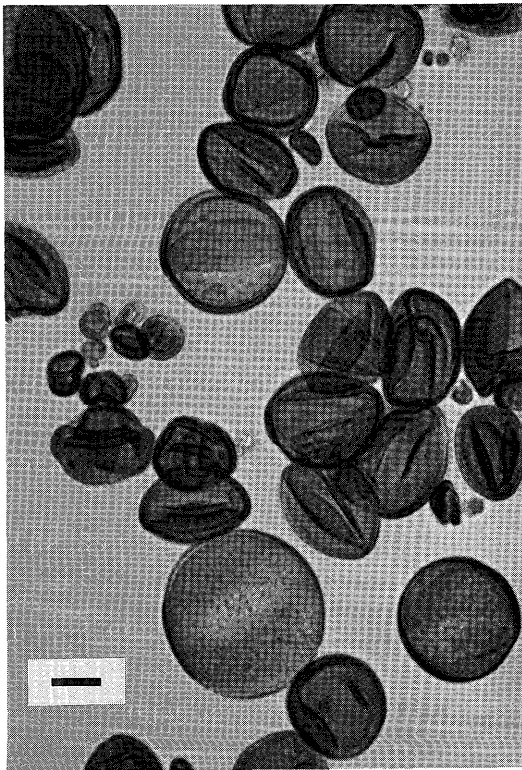


Fig. 3. Pollen grains of *Veronica* × *myriantha* (Tos. Tanaka 4843) stained with gentian violet in ethanol. Bar indicates 10 μ m.

guished from *V. anagallis-aquatica* and *V. undulata* by the lankily longer racemes composed of a great many shriveled calyxes on patent or arcuately ascending pedicels (Fig. 4). Capsules are aborted or scarcely seeded.

Both aerial and subterranean parts of the hybrid wither some time after anthesis. The life form is annual.

Though the height of the hybrid is usually in 20–100cm, I have also observed the vigorous ones, forming large clones with the height attaining ca. 120cm.

Veronica × *lackshewitzii* Keller (*V. anagallis-aquatica* L. × *V. catenata* Pennell), a natural interspecific hybrid of *Veronica* Sect. Beccabunga, is well known in Europe (Walters and Webb 1972, Hartl 1975) and in North America (Brooks 1976, Heckard and Rubtzoff 1977). In Japan, this is the first report concerning the hybrid of *Veronica* Sect. Beccabunga. The new hybrid may also be occurring at the places where two parental species coexist even outside the Kansai District.

Veronica* × *myriantha* Tos. Tanaka, *hybr. nov.
(Figs. 4-C and 5).

Veronica anagallis-aquatica L. × *Veronica undulata* Wallich.

Affinis *V. anagallis-aquaticae* et *V. undulatae*, sed racemis longioribus et capsulis copiosis abortivis differt.

Herba annua. Caulis 20–100 (–120) cm altus. Folia glabra opposita sessilia, plus minusve amplexicaulia; laminae lanceolatae vel oblongo-lanceolatae, serrulatae; folia juvenia petiolata ovata. Racemi longiores myrianthi glandulipilosi. Numerus florum in uno racemo 150 vel plus de planta maxima. Pedicelli patentes vel leviter arcuatim ascendentes. Corolla 5.5–7.0mm lata. Stylus cum stigmatibus 1.8–2.5mm longus. Filamentum 2.0–2.7mm longum. Pollen sterile. Capsula abortiva vieta. Chromosomata $2n=45$. Florescentia: vere-ineunte aestate, raro autumno.

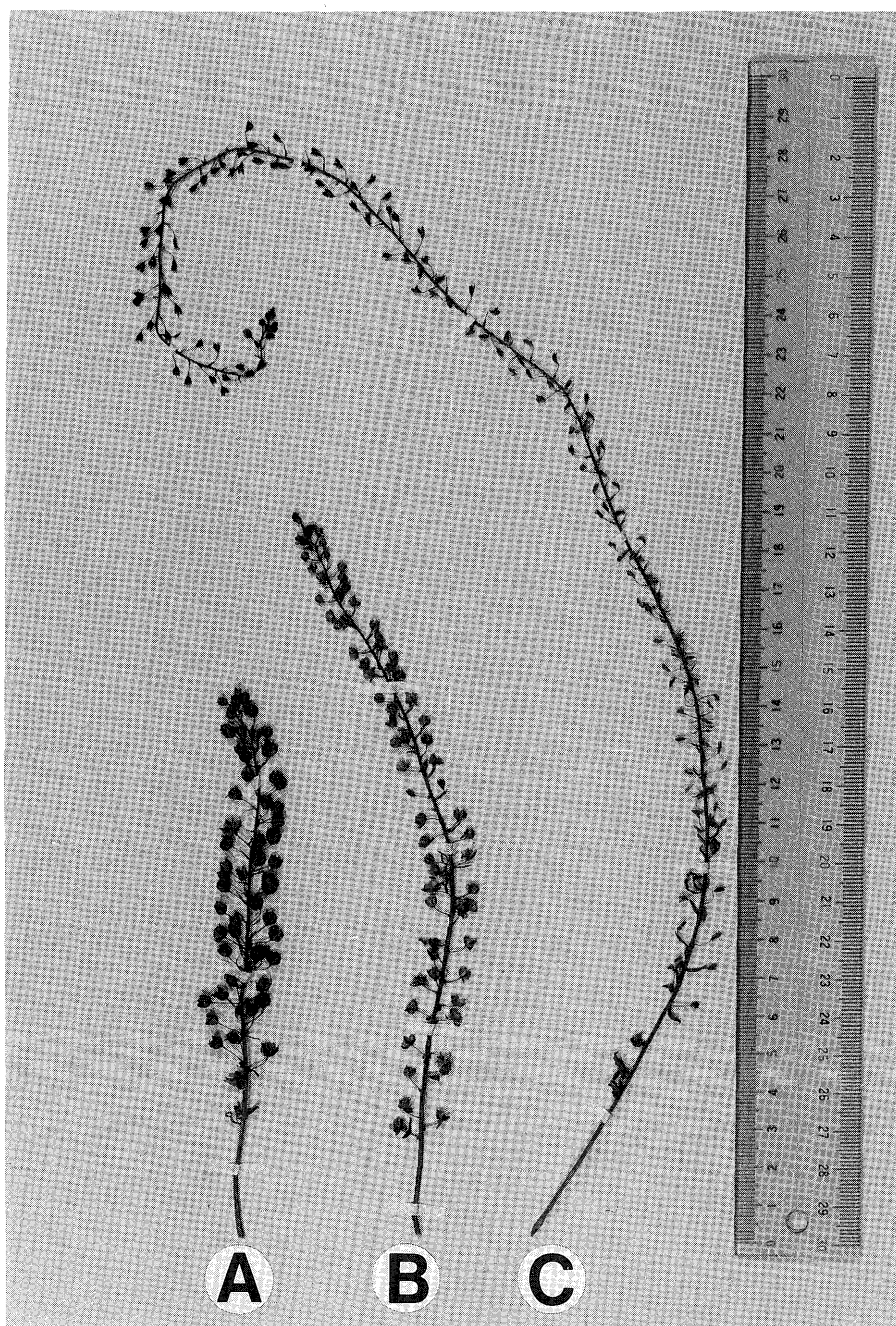


Fig. 4. Racemes in fruiting time. A: *Veronica anagallis-aquatica* L. (Kyoto Pref.: the Katsura River, Oyamazaki, Oyamazaki-cho, Otokuni-gun. Tos. Tanaka 4826, TI). B: *V. undulata* Wallich (Kyoto Pref.: the Katsura River, Oyamazaki, Oyamazaki-cho, Otokuni-gun. Tos. Tanaka 4827, TI). C: *V. ×myriantha* (Tos. Tanaka 4828 – Holotype).

Typus. Japan. Kyoto Pref.: the Katsura River, Oyamazaki, Oyamazaki-cho, Otokuni-gun, Jun. 23, 1994, Tos. Tanaka 4828 (Holotype in TI, Isotypes in KYO and OSA).

Nom. Jap.: Honaga-kawajisha (nov.).

Specimens examined. Kyoto Pref.: the Katsura River, Oyamazaki, Oyamazaki-cho, Otokuni-gun, cult. from a cutting of the holotype at Hyogo University of Teacher Education, Nov. 28, 1994, Tos. Tanaka 4843 (TI). Osaka Pref.: the Yamato River, Oi Fujiidera-city, Jun. 8, 1994, Tos. Tanaka 4820 (TI). Hyogo Pref.: the Kako River, Ichiba-cho, Ono-city, Jul. 6, 1994, Tos. Tanaka 4829 (TI). ditto, Nov. 7, 1994, Tos. Tanaka 4841 (TI).

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Endnote

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References

- Brooks R. E. 1976. A new *Veronica* (Scrophulariaceae) hybrid from Nebraska. *Rhodora* **78**: 773-775.
- Hartl D. 1975. *Veronica*. In: Gustav Hegi, *Illustrierte Flora von Mitteleuropa Band VI Teil 1*: 156-236. Verlag Paul Parey, Berlin.
- Heckard L. and Rubtsoff P. 1977. Additional notes on *Veronica anagallis-aquatica* × *catenata* (Scrophulariaceae). *Rhodora* **79**: 579-582.
- Makino T. 1926. A contribution to the knowledge of the flora of Japan. *J. Jpn. Bot.* **3**(9): 33-36.
- Tanaka T. and Noguchi J. 1994. Studies on *Veronica anagallis-aquatica* L. and *Veronica undulata* Wallich found in Keihanshin District, Japan. *Bull. Water Plant Soc. No. 52*: 5-15 (in Japanese with English summary).
- Walters S. M. and Webb D. A. 1972. *Veronica*. In: Tutin T. G. et al., *Flora Europaea* **3**: 242-251. Cambridge University Press, London.

田中俊雄：関西から発見されたクワガタソウ属の新雑種，ホナガカワヂシャ

オオカワヂシャ (*Veronica anagallis-aquatica* L.) とカワヂシャ (*V. undulata* Wallich) の分布調査を行っている際、両種が混生している京都府、大阪府そして兵庫県の都市部近郊の河川の水際で、両種によく似ているが、多数の花をつけた何本もの花序がひょろひょろと細長く伸び上がり、そのために不安定な形をしている植物を発見した。一つの花序内に含まれる花の数は、オオカワヂシャやカワヂシャよりも多く、十分に成長した個体では、150以上になるものもあるが、花冠幅や花冠色などの外部形態は、両種の間間的な形態を示していたので、この植物はオオカワヂシャとカワヂシャの間の雑種と推定された。そこで、これら3種類の植物の形態比較や細胞学的分析を詳細に行った。

中間形の植物の花冠幅、雄蕊長、雌蕊長などは、

オオカワヂシャとカワヂシャのほぼ中間値だった。体細胞染色体数は、オオカワヂシャとカワヂシャがそれぞれ $2n = 36$ と $2n = 54$ であるのに対して、中間形の植物では $2n = 45$ であった。中間形の植物の花粉母細胞の減数分裂は異常であり、形成された花粉の稔性率は、ゲンチアナ紫染色による観察で、約5%と極めて低かった。オオカワヂシャやカワヂシャの減数分裂は正常であり、花粉の稔性率はいずれも95%以上であった。

これらの事実から、この中間形の植物は、オオカワヂシャとカワヂシャを母種とする自然雑種であるとの結論に達し、学名と和名をつけて発表する。細長い花序に多数の花をつけることから、雑種名の種小名は *myriantha* とし、和名をホナガカワヂシャとした。