

CYTOTAXONOMY OF POTENTILLA FRUTICOSA,  
ALLIED SPECIES AND CULTIVARS<sup>1</sup>

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*With one plate*

DURING THE PAST SIX YEARS, a large collection of shrubby potentillas has been assembled at The Dominion Arboretum at Ottawa. Mr. H. L. J. Rhodes was responsible for collecting much of the material and for the taxonomic study; the author make chromosome-number determinations on some of the accessions. After Mr. Rhodes left the staff in 1956, the author assembled voucher specimens for the plants examined cytologically and inquired into the taxonomy of the group in order to classify the specimens as accurately as possible.

The shrubby potentillas are a very difficult group from a taxonomic viewpoint. A thorough study is needed of synonymy, type-specimens, morphological characteristics and range of variation. An adequate taxonomic treatment is not yet available for all of the species and cultivars. The cytological results presented in this paper should prove helpful for future taxonomic treatments.

All the specimens listed below are deposited in The Herbarium of the Botany and Plant Pathology Division (DAO). The chromosome-numbers were determined in permanent section-smears of root tips prepared by schedule B of Bowden (1949) except that the prefixation treatment in cold water was omitted. The slides are deposited in the permanent slide-files of the Cytogenetic Section. The chromosomes of these potentillas are small but distinct, well-fixed and well-stained and are ideal for making accurate counts.

*Potentilla fruticosa* L., *sensu stricto*

Collections from Northern Europe; tetraploid,  $2n = 28$ . **England:** Teesdale, below Cronkle Scar on the River Tees, transplanted to Cambridge; Arboretum plots, *Bowden*, July 8, 1957, two cuttings. **Sweden:** Öland, transplanted to Göteborg, *C. Blom*, Sept. 1953; Arboretum plots, *Bowden*, June 15 and Aug. 9, 1956,  $2n = 28$  determined on five seedlings. Turesson (1938) also found the tetraploid number in plants from Öland.

Collections of cultivated plants, presumably of European origin; tetraploid,  $2n = 28$ . *P. fruticosa grandiflora* from the Arnold Arboretum, Arboretum plots, *Rhodes 9198* and *Bowden*, June 14 and Aug. 9, 1956. *P. fruticosa micranda* from Louis Frères, France, *J. M. Gillett*, June 27, 1939; *B. O'Connor*, July 3, 1953, and *Bowden*, June 19, July 16 and Aug. 9, 1956; *P. fruticosa micranda* from

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Späth, Germany, *J. M. Gillett*, July 22, 1939 and *Bowden*, June 19, July 13 and Aug. 9, 1956. Material of *P. fruticosa* of European origin was consistently tetraploid,  $2n = 28$ .

### "*Potentilla fruticosa*," North American Collections

Field collections; diploid,  $2n = 14$ . UNITED STATES: NEW YORK: Seneca Co.: Junius Bog, *Rhodes 4126*. CANADA: NOVA SCOTIA: Halifax Co.: Higginsville, *I. V. Hall 53-479-1*; Inverness Co.: Black River, *E. C. Smith et al 10261*. QUEBEC: Matepédia: Lac au Sauman: *Mulligan & Bassett 1338*. ONTARIO: Carleton Co.: Lavergne Bay, *Rhodes & Calder 3746, 3736, 3738*; Mud Lake, *Rhodes & Boivin 4134*. Lanark Co.: McGowan Lake, *Dore 14523*. Renfrew Co.: McNeill Bay, *Rhodes & Rae 4182*, and Arboretum plots, *Rhodes & Drummond 9112*. Bruce Co.: Southampton, *Rhodes & Rae 4300*; Manitoulin Island: South Bay Mouth, *Rhodes & Rae 4297*; Murphy Point, *Rhodes & Rae 4295 & 4296*; Thunder Bay: Schreiber, *Rhodes 8554*. NORFOLK Co.: Vittoria, *Bowden 55-53-1*. MANITOBA: 5 miles east of Dauphin, *Rhodes 4739*; 7 miles east of Roblin, *Rhodes & Skinner 4740*; 8 miles east of Eriksdale, *Rhodes 4400*; Ricker, *Rhodes 4368*; Stony Mountain, *Rhodes 4380*, Poplarfield, *Rhodes 4407*; Neepawa, *Rhodes 5159*; Experimental Station, Morden, cultivated plants originally from north of The Pas, *Rhodes 51-249-23*. SASKATCHEWAN: Big Muddy Valley, 20 miles from Montana border, *Rhodes 4938*; Cypress Hills Park, *Rhodes 8553* and three specimens, Arboretum plots, *Bowden*, June 21, July 13 and Aug. 9, 1956. ALBERTA: Junction of Hy. 1 with Hy. from Radium Hot Springs, *Rhodes 8549*, and two specimens, Arboretum plots, *Bowden*, June 14 and Aug. 9, 1956. MACKENZIE: Arboretum plots grown from plant collected at Yellowknife by W. J. Cody, *Bowden*, June 11, 1956. BRITISH COLUMBIA: Kinbasket River delta on ne. side of Kinbasket Lake, *Calder & Savile 11952* and Arboretum plots, *Bowden*, June 18, 1956; Mt. Cheam near Rosedale, *Rhodes & Bitterlick 8268* and Arboretum plots, *Bowden*, July 13, 1956; Bridesville, *Rhodes 8543*; 21 miles east of Golden, *Rhodes 8545* and Arboretum plots, *Bowden*, June 19 & Aug. 9, 1956; Dempster Creek, 8 miles west of Field, *Rhodes 8546*; Kicking Horse Pass, 10 miles east of Field, *Rhodes 8547* and Arboretum plots, *Bowden*, June 12, 1956. ALASKA: Kenai Peninsula, about 2 miles east of Hope, *Calder 5236*.

All of these plants were diploid,  $2n = 14$ . Meiosis was studied in the pollen mother cells of *Rhodes 8545*, from 21 miles east of Golden, B. C.; there were regularly 7 bivalents ( $n = 7$ ).

Cultivated collections from the Dominion Arboretum plots, presumably of North American origin; diploid,  $2n = 14$ . From unknown source, grown since 1889, *Rhodes & Mills 2311*; four different accessions from the Montreal Botanical Garden (MTJB 6668, 11196, 3987, and 407), *Bowden*, June 14, June 18, June 21 and July 13, 1956, respectively; from the Arnold Arboretum, *Bowden*, June 21, 1956.

Plants of *P. fruticosa* from North America thus proved to be consistently diploid,  $2n = 14$ . The diploid chromosome-number was found in material from Edmonton, Alberta, by Turesson (1938) and in plants from several populations in Manitoba by Löve (1954).

From these data, it is clearly established that North American populations of *P. fruticosa* are diploid, while the plants from Öland, Sweden, and

Teesdale, England, are tetraploid. Raven and Walters (1956) have pointed out that there are only a few localities in Northern Europe where *P. fruticosa* exists in the wild. Juzepczuk (1941) states that the species grew from European USSR to Western and Eastern Siberia. Rydberg (1908) gave the range as "Labrador to Alaska, California, New Mexico, and New Jersey; also in Siberia and Western Europe." There is considerable variation in the morphology of the North American plants of this species and there is some variability in the European material. Some of the minute morphological differences between the European plants and the North American plants are very likely associated with the difference in chromosome-number; for example, the petals and peduncles of the European plants are thicker. However, when many specimens were examined it was difficult to find consistent morphological differences by which the diploid North American specimens could be distinguished from the tetraploid European plants. Perhaps the tetraploid European populations evolved from a diploid closely related to the diploid yellow-flowered North American plants and, for that reason, it is difficult to obtain strong morphological differences. However, later workers may still find some satisfactory morphological differences between the diploid North American specimens and the tetraploid European populations. If such differences can be found, the diploid North American plants would deserve taxonomic recognition as a distinct taxon, either a distinct species, or a subspecies of *P. fruticosa*.

In the Hortus Cliffortianus, Linnaeus (1737) listed several localities where this species grew in England and Sweden. He included ". . . in Anglia ad ripam meridionalem Tesae fluvii infra vicum Thorp . . . & in Oelandiae Sueciae insula proveniat." Linnaeus (1745) stated that the species occurred in southern Öland. Linnaeus (1753) recorded that *P. fruticosa* was found in "Eboraco [York], Anglia, Oelandia australi, Sibiria." In the Linnaean Society Herbarium in London, one of Linnaeus' specimens of *P. fruticosa* is preserved; it is Savage Catalogue no. 655.1 and on the back of the sheets is written "Sibiria." In the British Museum collection of specimens from the Clifford Herbarium (Hortus Cliffortianus), there is a well-preserved specimen that has large flowers similar to specimens from Teesdale, England and Öland, Sweden. Rydberg (1908) listed the type locality of the species as "England." The name *P. fruticosa* L., *sensu stricto*, applies to the tetraploid plants from Teesdale and Öland. Until the taxonomy and nomenclature of the North American populations can be clarified, the present author lists them as "*P. fruticosa*," diploid North American collections.

### *Potentilla parvifolia* Fisch. in Lehm.

Cultivated plants in the Dominion Arboretum, from various sources, originally from Eastern Asia; diploid,  $2n = 14$ . Two different accessions from the Montreal Botanical Garden: MTJB 3433, Bowden, June 21, 1956, *Rhodes* 4004; and MTJB 254, Bowden, June 19, 1956; Experimental Station, Morden, Man., *Rhodes* 4358; A. M. Cocks & Sons, Winona, Ont., *Rhodes* 4001; Sheridan Nurseries, received as 'Gold Drop', *Rhodes* 4003; Woodland Nurseries, Cooksville, Ont., received as

'Woodland Gold', *Bowden*, June 21, 1956 and *Rhodes 3731*; Hillier & Sons, Winchester, England, *Bowden*, June 19, 1956 and *Rhodes 9205*; Hillier & Sons, from Prof. Lyttol's Garden, *Bowden*, June 19, 1956; Hillier & Sons, Forrest col., *Bowden*, June 18, 1956.

There is general agreement concerning the taxonomy of this small-leaved species with bright yellow flowers; cf. Fletcher (1950), Handel-Mazzetti (1939), Juzepczuk (1941) and Rhodes (1954). The chromosome-number of *P. parvifolia* suggests that it is a segregate diploid species in Eastern Asia.

#### *Potentilla davurica* Nestl. (= *P. glabra* Lodd.)

Cultivated plants in the Dominion Arboretum, originally from Eastern Asia; diploid,  $2n = 14$ . Sheridan Nurseries, Ont., specimen with glabrous leaves, without flowers, four-year-old dwarf plant, *Bowden*, Aug. 28, 1956; Hillier & Sons, Winchester, England, received as *P. glabra* Lodd. (typical), specimen with glabrous leaves, without flowers, four-year-old dwarf plant, *Bowden*, Aug. 28, 1956; Hillier & Sons, received as *P. glabra rhodocalyx*, almost glabrous leaves, *Bowden*, Aug. 28, 1956; Hillier & Sons, received as *P. glabra* Lodd. var. *kansu* collected by Farrer, some hairs on leaves, etc., and numerous white flowers on dwarf shrub, *Rhodes 9114* and *Bowden*, June 12, 1956.

There is considerable confusion concerning the application of the name *P. davurica* Nestl. The leaves of Nestler's plants were glabrous ("utrinque glabra") and the plant came from Eastern Asia ("Hab. in Davuria"). Loddiges' *P. glabra* was said to be a native of Siberia, was glabrous ("perfectly smooth in all its parts") and presumably had white flowers (received by him as *P. fruticosa alba*). Handel-Mazzetti (1939) thought that *P. davurica* was a hybrid (*P. glabra*  $\times$  *P. parvifolia*). Fletcher (1950) used the name *P. glabra* Lodd. for the white-flowered plant. In Rhodes' key (1954), *P. davurica* (typical) was applied to plants with "leaves glabrous; plant dwarf." The above specimens are listed under *P. davurica* to indicate that they are more glabrous than the other collections from Eastern Asia. Since only some of the plants have bloomed, I do not know if all the collections will have white flowers or if some are yellow-flowered. The first two collections had very glabrous leaves and were dwarf shrubs; they were so distinct from all the other collections that they seemed to me to merit recognition. A much more detailed study is needed on these and the next collections listed before the taxonomy of these plants can be precisely known. Hara (1952) has already discussed the taxonomic problems of these Eastern Asiatic taxa.

#### *Potentilla arbuscula* D. Don

Cultivated plants in the Dominion Arboretum, originally from Eastern Asia; diploid;  $2n = 14$ . Hillier & Sons, Winchester, England, received as *P. glabra* var. *mandshurica*, *Bowden*, June 15 and June 21, 1956; Hillier & Sons, received as *P. arbuscula* erect form, *Bowden*, June 11, 1956; The Montreal Botanical Garden, MTJB 4444, received as *P. fruticosa mandshurica*, *Bowden*, June 19,



Herbarium specimen of the triploid ( $2n = 21$ ) *Potentilla arbuscula* 'Snowflake,'  
Montreal Botanical Garden No. 1324-45; photograph by W. J. Cody.

1956; Hillier & Sons, received as "*veitchii*," Bowden, June 11, 1956; and Hillier & Sons, received as *P. rigida*, specimen without flowers, Bowden, Aug. 28, 1956.

Except for the last, all the specimens have white flowers. The leaves are characteristically pubescent, with long, white, silky hairs on the upper surfaces and also some pubescence on the lower surfaces, although Fletcher (1950) stated that "the typical plant is glabrous on the lower leaf-surface." Hara (1952) reported  $2n = 14$  in plants listed as *P. fruticosa* L. var. *arbuscula* (D. Don) Maxim. from Honshu.

#### *Potentilla arbuscula* 'Snowflake'

Cultivated plants in the Dominion Arboretum; triploid,  $2n = 21$ . This is the first triploid reported in the genus. Dansereau (1955) gave a review-list of chromosome numbers in *Potentilla* and stated that no triploids had been recorded.

Specimens preserved: Montreal Botanical Garden, MTJB 1324-45, *Rhodes* 1775 and Arboretum plots, *Rhodes & Vrugtman* 9134 and Bowden, June 19, 1956 (Plate 1). Open-field-pollinated seed of a plant of cultivar 'Snowflake' from Sheridan Nurseries, Toronto, was grown. Several specimens of the parental plant were preserved (*Rhodes* 4002 and 6156) but a chromosome-count was not made on the plant. Of four seedlings studied, two were diploid,  $2n = 14$ , one was  $2n = 15$ , and one was pentaploid,  $2n = 35$ . The specimen of the last is: Arboretum plots, Bowden, June 12, 1956.

#### *Potentilla arbuscula* D. Don var. *albicans* (Rehd. et Wilson) Hand.-Mazz.

Cultivated collections in Arboretum plots; hexaploid,  $2n = 42$ . Alpenglöw Gardens, Michaud & Co., New Westminster, B.C., *Rhodes* 2808; Hillier & Sons, Winchester, England, received as *P. davurica beesii*, Bowden, June 25 and July 13, 1956; Hillier & Sons, received as *P. sulphurescens vilmoriniana*, Bowden, June 14 and 15, 1956.

The plant from Alpenglöw Gardens had bright-yellow flowers; the other two accessions had pale-yellow flowers. All the specimens had both surfaces of the leaves densely covered with a white shining silky indumentum as mentioned by Fletcher (1950).

#### *Potentilla arbuscula* D. Don var.

Cultivated collections; octoploid,  $2n = 56$ . Arboretum plots (received as *Potentilla*, *Purdom* 841, from the Arnold Arboretum in 1921), *N. Taylor*, June 13, 1946, *Rhodes* 1577, and *Rhodes & Mills* 2313.

The plants of diploid, triploid and octoploid *P. arbuscula* had white flowers. The flowers of dried herbarium specimens tend to turn yellowish with age. One would expect tetraploid plants to occur in this complex. It remains for future biosystematic studies to clarify the taxonomy of these plants, particularly the relationship of white and yellow flower-colors, and whether or not the glabrous plants that I have listed under *P. davurica*

Nestl. are specifically distinct from the more pubescent plants listed under *P. arbuscula* D. Don.

#### *Potentilla* × *rehderiana* Hand.-Mazz.

These plants were said to be hybrids between *P. parvifolia* and *P. glabra* var. *mandshurica*. Our accessions were diploid,  $2n = 14$ .

Cultivated specimens in the Dominion Arboretum plots: Two accessions from the Montreal Botanical Garden, MTJB 837, *Bowden*, June 19, 1956, and MTJB 5485, *Rhodes* 4355; from the Arnold Arboretum, *Bowden*, June 21, 1956. The last specimen shows the characteristics of *P. parvifolia* very strongly.

#### *Potentilla* × *friedrichsenii* Späth

Handel-Mazzetti (1939) stated that this name was applied to hybrids of *P. fruticosa* × *P. glabra*. Our three accessions were diploid,  $2n = 14$ . The diploid number suggests that if this taxon is a hybrid between these two species, then the *P. fruticosa* parent was a diploid plant, not the tetraploid from Sweden or England. I do not know the chromosome-number of *P. fruticosa* in the area from the European USSR to the Pacific coast of Asia but possibly there may be diploids there. As already shown, the North American plants of *P. fruticosa* are diploid.

Cultivated specimens in the Dominion Arboretum plots: from Basel Botanical Garden, Basel, Switzerland, *Rhodes*, June 16, 1950; from University of St. Andrews, Scotland, received as *P. fruticosa veitchii*, *Rhodes*, June 16, 1950; from Hillier & Sons, received as *P. friedrichsenii leucantha*, *Bowden*, June 12, 1956.

#### Miscellaneous Collections

These last accessions were received under various names. I was not able to refer any of the specimens with certainty to the taxa listed above. These undetermined specimens were all diploid,  $2n = 14$ . Some of the plants may be hybrids.

Specimens preserved from Dominion Arboretum plots: the Montreal Botanical Garden, MTJB 1821, received as *P. fruticosa* 'Friesengold', *Bowden*, June 21, 1956; Alpenglöw Gardens, New Westminster, B.C., received as *P. fruticosa pyrenaica*, *Rhodes* 2809; The Montreal Botanical Garden, MTJB 1136, received as *P. fruticosa*, *Bowden*, June 11, 1956; Manitoba Hardy Plant Nursery, Dropmore, Man., received as *P. davurica*, *Bowden*, June 19, 1956; Hillier & Sons, received as *P. davurica* from France, *Bowden*, June 11, 1956; Hillier & Sons, received as *Potentilla* 'Katherine Dykes', *Rhodes & Vrugtman* 9138; Hillier & Sons, received as *P. davurica* 'Nyewoods form', *Bowden*, June 11, 1956; Hillier & Sons, received as *P. davurica* 'Lady Daresbury's form', *Rhodes & Vrugtman* 9137 and *Bowden*, June 11, 1956.

#### SUMMARY

Plants of *Potentilla fruticosa* L., *sensu stricto*, from Teesdale, England, and Öland, Sweden, are tetraploid ( $2n = 28$ ); North American populations of "*P. fruticosa*" are diploid ( $2n = 14$ ). *Potentilla parvifolia* and

*P. davurica* (*glabra*) from Eastern Asia are diploid. *Potentilla arbuscula* from Eastern Asia is a polyploid complex; diploids, one triploid ( $2n = 21$ ), hexaploids ( $2n = 42$ ) and one octoploid ( $2n = 56$ ) are so far known. The cytological data should be helpful when a thorough biosystematic study is made of the shrubby potentillas.

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