Biosystematics of the Tribe Satureineae (Labiatae) in Canada II¹

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This paper is a continuation of my first paper on this tribe in this journal. In the present communication, biosystematic investigations on 10 species distributed in four genera have been carried out. The chromosome counts for two native species are reported for the first time.

Materials and methods

Living material of all these species was brought into cultivation at Waterloo either by transplanting rootstock or by raising plants from seeds. The techniques used during this study and the herbaria consulted have been described earlier (Gill 1977, 1979). Vouchers are kept in the herbarium of the University of Waterloo, Ontario, Canada.

Results and discussion

Origanum L.

An old world genus of 25 perennial species. Recognized by the many flowered terminal corymbose cymes with coloured bracts and by the corolla which is obscurely 2-lipped and has exerted stamens. In Canada it is represented by a single introduced species. The base number of 8 has been suggested by Darlington and Wylie (1955), but my own counts on material from India and Canada indicate a base number of 15 ($n=15$). Since 7 and 8 are the common base numbers with most other cytologically known species of this tribe, 15 could be a secondary base number for this genus.

O. vulgare L. $n=15$ (Fig. 1)

Brantford, Ontario, Can. 318

This confirms the previous recorded number of $2n=30$ by Rutland (1941), Gadella and Kliphus (1963) and Gill (1971), but differs from that of $2n=32$ by Scheerer (1939). Meiosis and pollen formation are normal. Not setting seed when bagged but setting normal seeds under open pollination. Various flying insects have been observed on the plants which presumably bring about the pollination.

Variation: The single population which I have been able to study showed very little variation both in the field and under cultivation, though the colour of the flower tended to become paler when the plant was grown in the greenhouse.

¹ This work was done at the University of Waterloo, Waterloo, Ontario, Canada.

Figs. 1-10. $\times 2500$. 1, *Origanum vulgare* $n=15$. 2, *Pycnanthemum tenuifolium* $2n=40$. 3, *Satureja acinos*. 4, *Pycnanthemum virginanum* $2n=80$. 5, *Satureja glabella* $n=10$. 6, *Satureja hortensis* $n=24$. 7, *Satureja douglasii* $n=10$. 8, *Satureja vulgaris* $n=10$. 9, *Thymus pulegioides* $n=14$. 10, *Thymus praecox* $n=12$.

Distribution and ecology (Map 1)

Native of Eurasia and introduced into North America as a garden herb, but no longer commonly grown. It has escaped from cultivation in a few places and is now locally naturalized in Prince Edward Island, Nova Scotia, the Saint Lawrence lowlands, southern Ontario and Vancouver Island. It is usually found on the stony borders of woods and thickets, dry pasture, gravelly slopes and along road sides. In Canada, it is naturalized in the south-eastern climatic region within the limits of 65°F. July isotherm and 30°F. January isotherm. Its absence in the prairie region is probably due to the severity of the winter.

Pycnanthemum Michx.

A North American genus of 19 perennial species (Chambers and Chambers 1971), readily recognized by the small flowers borne in crowded or capitate cymes terminating the main stem and branches, and by the 10–23 nerved calyx. In Canada, it is represented by two species. The base numbers for this genus are 18, 19 and 20 (Chambers 1961).

Key to the Canadian species

Stem glabrous, abundantly branched; leaves linear-lanceolate, tapering to the base; calyx teeth sharply acuminate *P. tenuifolium*

Stem pubescent chiefly on the angles; with few branches, leaves lanceolate, rounded at the base; calyx teeth triangular, not acuminate *P. virginianum*

P. tenuifolium Schrader 2n=40 (Fig. 2)

Nottingham, Pennsylvania, Morton s.n.

This is in agreement with the earlier report of 2n=40 (Chambers and Chambers 1971).

It is partially self compatible.

Variation: Herbarium material from Canada show little variation.

Distribution and ecology (Map 2)

Occurs on low ground around lakes and ponds in open woods and moist shady prairie. In Canada, it is a rare plant confined to a few localities in southern Ontario and Quebec. The flowering season is from July to September.

P. virginianum (L.) Durand and Jackson 2n=80 (Fig. 4)

Galt, Ontario. Can. 284

This is in line with the previous recorded number of 2n=80 (Chambers 1961, and Chambers and Chambers 1971). All the anthers were aborted and no meiotic stages could be found in any of the material which I studied.

Reproductive biology; Plants with aborted anthers set viable seeds under pollination bags. In nature also, the seed setting was normal suggesting that the plants are apomictic. Chambers and Chambers (1971) obtained similar results and stated that their material was apomictic. Male sterility appears to be due to anther abortion prior to or during the early stages of meiosis. Plants with normal anthers have been reported from the mid-western United States and are probably sexual (Chambers 1961).

Maps 1~4. 1, *Origanum vulgare* L. 2, *Pycnanthemum tenuifolium* Schrader. 3, *Pycnanthemum virginianum* (L.) Durand S. Jackson. 4, *Satureja acinos* (L.) Scheele.

Variation: The Canadian material shows little variation. In the United States, it shows considerable variation in pubescence and in the size of leaves and bracts.

Distribution and ecology (Map 3)

The habitat is similar to that in *P. tenuifolia*. In Canada, it is restricted to the Carolinian zone. Hot summers with a mean annual precipitation of 32" and a mild winter appear to be requirements for its distribution. Flowers from August to September.

Satureja L.

Briquet (1897) in his revision of the genus included genera such as *Acinos*, *Clinopodium*, *Calamintha*, *Gardoquia*, *Micromeria*, *Rizoa* and *Xenopoma* in his concept of *Satureja*. Clapham *et al.* (1962) do not follow Briquet's treatment of this genus and treat *Acinos*, *Calamintha*, *Clinopodium* and *Satureja* as separate genera. In North America, Fernald (1950), Koeppen (1957) and Epling and Jativa (1966) followed Briquet's treatment. Also in revision of the African species Brenan (1954), Hedberg (1957) and Morton (1962) have followed Briquet's treatment but stated that they were only doing this pending a revision of this genus in its main centre of distribution in Eurasia. I have followed the Briquet's treatment and include all the North American species within *Satureja*.

Using Briquet's (1897) concept of the genus it contains about 100 species of annual or perennial herbs, distributed in the warmer regions of both hemispheres. It is recognized by the 5–10 nerved tubular or campanulate calyx, bilabiate corolla with lower lip 3 lobed, 4 stamens, the upper pair shorter. In Canada, it is represented by 5 species, 3 of which are native. The base numbers for this genus are 6, 7, 8, 9, 10, 11 and 15 (Morton 1962).

Key to the Canadian species

1. Stem prostrate; flowers solitary and axillary on long pedicels, a plant of the Pacific climatic region *S. douglasii*
Stem erect, flowers in terminal or axillary glomerules 2
2. Leaves linear to lanceolate, about 4 times as long as broad 3
ovate-lanceolate to oblong, about 3 times as long as broad 4
3. Plant glabrous or pubescent only at the nodes, pedicel 3–10 mm long *S. glabella*
Plant pubescent throughout, leaves nearly sessile *S. hortensis*
4. Flowers in dense terminal and subterminal glomerules; bracts as long as the calyx; calyx 9–10 mm not gibbous *S. vulgaris*
Flowers 1–3 together, axillary, calyx 5–6 mm strongly gibbous on the lowerside *S. acinos*

S. acinos (L.) Scheele n=9 (Fig. 3)

syns. *Acinos arvensis* (Lam.) Dandy

Satureja arkansana (Nutt.) Briq.

Horning Mills, Ontario. Can. 48

Lapeche Beach, Gatineau Park, Quebec. N. A.¹ 2729

This confirms the earlier recorded number of $2n=18$ by Scheerer (1939) and Gadella and Klip. (1966). Meiosis and pollen formation are normal with 100% pollen stainability. The species is self compatible and self pollinated and it shows little variation except in overall size of the plant both in nature and under cultivation

Distribution and ecology (Map 4)

Native of Eurasia, introduced into North America as a weed and now commonly naturalized in calcareous waste places, old fields, along roadsides and on limestone pavement. Steyermark (1963) gives its range in Canada as extending from Quebec to Ontario, but collections dating back to 1959 exist for British Columbia and suggest that it may be a recent introduction in this province. On the eastern side of the country, it is common in the lower Great Lakes area and also common on Prince Edward Island. The flowering season is from June to August.

S. douglasii (Bth.) Briquet $n=10$ (Fig. 7)

The present report is a new report for this species and suggests a base number of 10 for this species. Meiosis and pollen formation are normal and it is self compatible and self pollinating. It shows no variation in nature and under cultivation.

Distribution and ecology (Map 5)

In Canada, it is confined to the Vancouver and Vancouver Islands areas, though there is a single northward record from Juneau in Alaska (Hulten 1968). The intervening areas are poorly collected and the plant may turn up there. High precipitation (40"-100") coupled with a moderate oceanic climate seem to be main requirements responsible for its restricted distribution. It flowers from June to August.

S. glabella (Michx.) Briquet $n=10$ (Fig. 5)

Tobermory, Bruce Peninsula, Ontario. N. A. 3696

This is the first recorded chromosome number for this species. Meiosis is normal. It does not set seeds when bagged, but normal seed setting occurred in open pollination.

Variation: Two named varieties i.e. *glabella* and *angustifolia* occur in North America. In the former, the leaves are oblanceolate, obtuse, 2-4 cm long and 1 cm wide with 2-4 teeth on either side. The plant lacks stolons. In the latter, the plant is stoloniferous, leaves linear, entire and 1-2 cm long. The plant investigated here belongs to var. *angustifolium* (Torr.) Svenson and is confined to beaches of Lake Erie, Huron and Michigan. It shows little variation in nature and under cultivation, except that flower colour varies from white to pale purple. Occasional 'albino' plants occur in nature.

Distribution and ecology (Map 6)

A plant of moist shallow soil on limestone pavements and hedges in southern Ontario and southern British Columbia. It flowers in July-September.

S. hortensis L. $n=24$ (Fig. 6)

Park Seed Company, South Carolina. Can. 334

¹ The designations N. A. and Can. refer to the collections made by Prof. J. K. Morton and L. S. Gill respectively.

Maps 5~8. 5, *Satureja douglasii* (Benth.) Briquet. 6, *Satureja glabella* (Michx.) Briquet. 7, *Satureja hortensis* L. 8, *Satureja vulgaris* (L.) Fritsch.

This agrees with the previous report of $2n=48$ (Mechelke 1954). Meiosis and pollen formation are normal. It is self compatible and self pollinated.

Distribution and ecology (Map 7)

Native of Europe and in North America cultivated as garden herb, occasionally escaping, but rarely becoming established. Collections exist from many scattered localities in the lower Great Lakes-St. Lawrence area and the Maritimes. There is also a single collection from Manitoba.

S. vulgaris (L.) Fritch $n=10$ (Fig. 8)

Horning Mills, Ontario. Can. 166

Port Arthur, Ontario. Can. 331

These reports confirm the earlier recorded number of $2n=20$ by Scheerer (1939) and Löve and Löve (1944). Meiosis and pollen formation are normal and it is self compatible and self pollinating, but frequently seed setting is only 50–70% successful even in open pollination.

Variation: Fernald (1950) describes the following varieties from North America.

1. *neogea* Fern. leaves ovate-elliptic, pubescent along the nerves, but never sub-lanate on the lower side and the upper surface with scattered hairs, corolla small and tube slender, native in North America.

2. *diminuta* (Simon) Fern. and Weig, leaves ovate, densely pubescent on both surfaces, strigose above, densely sub-lanate on the lower surface; corolla tube large and thick, introduced to North America.

Though the North American plants shows little variation in the degree of pubescence, but the range of variation is the same as in the European plants, and the North American material is inseparable from the European material. I am of the opinion that these trivial differences do not warrant a taxonomic rank. Under cultivation it shows little variation.

Distribution and ecology (Map 8)

Native in southern Canada from the Lakehead area of Ontario to Newfoundland. There is a single collection (Krajina s.n. in the herbarium, University of British Columbia) from southern British Columbia which probably represents an introduction into that area. Occurs on open stony ground and in moist open woods and thickets. Often found on limestone, but not confined to calcareous situations. The northern limit of its distribution follows the July isotherm of 60°F. and the 0°F. January isotherm. It flowers from June to September.

Thymus L.

Consists of about 50 species of herbs and small undershrubs, occurring in the north temperate regions. Recognized by small entire leaves, inflorescence in few flowered whorls in dense heads or interrupted spikes. In Canada, it is represented by two introduced species. The base numbers for the genus are 6, 7 and 9 (Darlington and Wylie 1955).

Key to the species

Stem abruptly angled; conspicuously pubescent only on the angles,

Maps 9~10. 9, *Thymus pulegioides* L. 10, *Thymus serpyllum* L.

inflorescence lax, elongate *T. pulegioides*
 Stem rounded and uniformly pubescent; inflorescence compact and
 capitate *T. praecox*

T. pulegioides L. $n=14$ (Fig. 9)

St. Stainless, Quebec. J.K.M. s.n.

This confirms the earlier recorded number of $2n=28$ (Vide Federov 1969). Zofia (1968) reported $2n=30$ from Poland. Meiosis and pollen formation are normal.

Distribution and ecology (Map. 9)

Native of Europe, introduced into North America as a garden herb and a rockery plant. Locally established in open dry calcareous situations in pasture and a long roadsides in Quebec, Prince Edward Island and British Columbia.

T. praecox Opiz. $n=12$ (Fig. 10)

Fergus, Ontario. N. A. 3179

This is in agreement with the earlier reports (Vide Federov 1969). It is self compatible and self pollinating.

Distribution and ecology (Map 10)

Locally abundant in rough pasture, dry open grassland and along roadsides in outcropping limestone. Mainly occurring in southeastern Canada from the Lakehead area of Ontario to Nova Scotia. However, a single collections exist from near Winnipeg and Vancouver, but these may represent garden specimens. It flowers from June to September. The material in most of the Canadian herbaria referred to *T. serpyllum* belong to this species.

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Summary

Chromosome numbers of 10 Canadian species have been determined and two of these counts are recorded for the first time. Reproductive biology and the variational trends in these taxa have been studied. Specific keys and the distribution maps are given. *Pycnanthemum virginianum* is found to be apomictic in Canada.

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