SYSTEMATICS OF *OSMORHIZA* RAF. (APIACEAE: APIOIDEAE)[1]

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ABSTRACT

The genus *Osmorhiza* comprises ten species and two subspecies of woodland umbellifers native to temperate Asia and the Americas. Quantitative evaluation of nine morphological characters supports the recognition of two distinct subgenera: *Glycosma,* with a single species, *O. occidentalis,* and *Osmorhiza,* with the remaining nine species. The typical subgenus is further divided into three sections, each with three species. A complete synonymy and detailed description is provided for each taxon, along with an analytical key to the subgenera, sections, species, and subspecies. Phytogeographic data indicate that western North America is the center of distribution and diversity, and possibly the center of origin for *Osmorhiza,* although members of the genus are found in eastern North America as well as Asia and Central and South America. The amphitropical disjunctions between North and South America observed in the ranges of *O. chilensis* and *O. depauperata* (both sect. *Nudae*) are most likely the result of long-distance dispersal by migratory birds. By contrast, the disjunct populations of these taxa that occur in the Great Lakes region and eastern North America probably represent remnants of a more widespread, pre-Pleistocene distribution. The three species comprising *Osmorhiza* sect. *Osmorhiza* (the North American *O. claytonii* and *O. longistylis,* and the Asian *O. aristata*) provide an example of the classical eastern North American–eastern Asian pattern of disjunction. Although these taxa are very similar morphologically, the populations probably represent members of a relatively stable floristic assemblage that has persisted in these areas for a long period; the possibility that there has been any recent contact between these disjunct taxa through Beringia seems remote. The members of *Osmorhiza* sect. *Mexicanae* (*O. brachypoda, O. mexicana,* and *O. glabrata*) exhibit a somewhat broken distribution from northern California to central Argentina, and possibly represent derivatives of a common ancestral taxon that migrated southward along a chain of mountain tops with suitable temperate climatic conditions at some time during the Pliocene or Pleistocene. Ethnobotanical evidence indicates that at least five species of *Osmorhiza* were used for medicinal purposes by native Indian peoples of North America. The roots and greens of two species were also consumed as food by both North and South American Indians.

TAXONOMIC HISTORY

Osmorhiza (Apiaceae: Apioideae) is a small genus of perennial woodland herbs with representatives in temperate Asia and the Americas. Members of the genus typically flower in the spring, setting fruit by mid-summer. These fruits (schizocarps), which are armed with retrorse bristles in all but one species, are well adapted for epizoochory. Plants of *Osmorhiza,* commonly known as Sweet Cicely, may be quite abundant in some areas, but they rarely form uninterrupted stands, even under the most favorable of conditions.

Osmorhiza was first recognized as a distinct genus by Rafinesque in 1818, but it was not until the following year (Rafinesque, 1819a) that this

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name was validly published. Prior to that, specimens of *Osmorhiza* had been referred to three other genera: *Chaerophyllum* L. (Thunberg, 1784; Persoon, 1805), *Myrrhis* Miller (Michaux, 1803; Sprengel, 1813), and *Scandix* L. (Muhlenberg, 1813). During the next 80 years many new species were described in the genus. However, it was not until 1888, when Coulter and Rose published their "Revision of North American Umbelliferae," that an attempt was made to clarify the taxonomy of *Osmorhiza.* Twelve years later Coulter and Rose (1900) revised their previous treatment of the North American members of the genus, recognizing 12 taxa, including three new species. Mathias and Constance (1944), in their review of the Umbelliferae for the "North American Flora," listed eight species and two varieties of *Osmorhiza.*

Osmorhiza was treated for the first time on a world-wide basis by Constance and Shan (1948), who recognized the conspecificity of the North and South American populations now included in *O. chilensis* and *O. depauperata.* These authors included all the Asian populations of the genus under *O. aristata,* and described one new species, *O. bipatriata.* However, they acknowledged that "newer techniques" (i.e., biosystematic techniques) were not used in their study; they based their conclusions entirely on the examination and comparison of herbarium specimens.

Work on the current study was begun in 1974, at which time only two eastern North American species, *O. claytonii* and *O. longistylis,* were considered. Later, the scope of our work was expanded to a systematic investigation of the entire genus. Toward this end several approaches have been used, including (1) quantitative evaluation of nine morphological characters, (2) mapping of each species, (3) comparative examination of available type material, and (4) a broad survey of the literature on the genus. In addition, an analysis of electrophoretic banding patterns of water soluble seed proteins for most *Osmorhiza* species was conducted (Lowry & Young, 1979; Lowry, 1980).

In addition to the nearly 400 collections of *Osmorhiza* on deposit in ILL, approximately 8,500 specimens from 48 herbaria were studied. Photographs of type specimens unavailable for loan were received from LE and SGO. Voucher specimens for the more than 200 collections made by the first author are deposited in ILL, along with photographs of all type material examined.

The quantitative morphological data presented here support a revised taxonomy for *Osmorhiza* in which ten species and one subspecies are recognized. Two well delimited subgenera are distinguished, one of which is further divided into three sections. These conclusions are further supported by seed protein data (Lowry & Young, 1979; Lowry, 1980). Phytogeographic evidence indicates that western North America is the center of distribution and diversity, and possibly the center of origin for *Osmorhiza,* although members of the genus have migrated to and survived in eastern North America as well as in Asia and in Central and South America. Nomenclatural problems within the genus are dealt with, and a brief discussion of the ethnobotany is given.

Nomenclature

Generic names. Species of *Osmorhiza* were originally placed in three other genera: *Chaerophyllum* L., *Myrrhis* Miller, and *Scandix* L. In 1818 Rafinesque published three alternative generic names for these taxa: *Washingtonia, Osmorhiza,* and *Gonatherus.* These were, however, invalidly published under Art. 34.1(a) of the "International Code of Botanical Nomenclature" (Voss et al., 1983), because they were not accepted by the author in the original publication. They may also be nomina nuda because they appear not to meet the requirements of Art. 41.2 of the "Code" (cf. Lowry & Jones, 1978; Lowry, 1985). In the same year Nuttall (1818) validly published the name *Uraspermum* for this taxon. Rafinesque (1819a), however, rejected *Uraspermum* Nutt., considering it too similar to (i.e., an incorrectly spelled later homonym of) *Urospermum* Scopoli, a genus of Asteraceae, and validated the name *Osmorhiza* with a reference to the description of *Uraspermum* Nutt. (Lowry & Jones, 1977, 1978). This interpretation has been followed by nearly all subsequent authors, although most have incorrectly considered Rafinesque (1819b) as the first place of valid publication for the name *Osmorhiza. Uraspermum* Nutt., however, cannot be treated as a later homonym since it is not spelled exactly like *Urospermum* Scopoli (cf. Art. 64.1 of the "Code"). Strict application of the rules of nomenclature would thus appear to require accepting the name *Uraspermum* Nutt. for the taxa currently recognized in *Osmorhiza.* In order to avoid this clearly undesirable change and to maintain nomenclatural stability, a proposal has been made to conserve the generic name *Osmorhiza* against *Uraspermum* (Lowry, 1985).

Subgeneric names. Two subgenera are recognized within *Osmorhiza,* one with nine species, including the type for the genus (i.e., the type of *O. claytonii*), and one with a single species, *O. occidentalis.* When *O. occidentalis* was first described it was placed in a new, monotypic genus, *Glycosma,* by Nuttall (in Torrey & Gray, 1840), who provided both generic and specific descriptions. Drude (in Engler & Prantl, 1897), following Torrey (1859), judged this species to be an *Osmorhiza,* but placed it in a separate subgenus, citing Nuttall's generic name *Glycosma* as the basionym; the correct name for this subgenus is: *Osmorhiza* subg. *Glycosma* (Nutt.) Drude in Engl. & Prantl.

Sectional names. Three sections are recognized within *Osmorhiza* subg. *Osmorhiza* (Lowry & Jones, 1979b; Lowry, 1980). Constance and Shan (1948) published names for all three of these: (1) *Aristatae,* (2) *Mexicanae,* and (3) *Nudae,* although not validly, because none of them was accompanied by a Latin description or diagnosis or a reference to a previously and effectively published Latin description or diagnosis of the same taxon (cf. Arts. 32.1 and 36.1 of the "Code"). Because the section *Aristatae* includes the type of the genus, its epithet is a synonym for *Osmorhiza* sect. *Osmorhiza.* Constance and Shan's sectional names *Mexicanae* and *Nudae* are validated herein.

Specific epithets. Rafinesque (1830: 249) published three new species: *Osmorhiza dulcis, O. vilosa* [sic], and *O. cordata.* This publication reads as follows: "*Osmorhiza dulcis,* Raf. 1817 (*Myrrhis claytoni* Mx?) Sweet Sisily [sic]. Root fusiform, with a sweet smell and taste, near aniseed [sic], edible, carminative, expectorant, demulcent, useful for coughs with *Malva,* for flatulent bowels with *Heracleum,* Eq. to *Angelica.* Children are fond of this root, may be poisoned by mistaking for it, two sp. of the same genus or *Myrrhis* Auct. called *Poison* or *Bastard Sisily* [sic], distinctive by the roots less aromatic, foliage the same, but in *O. dulcis* base of the folioles acute, in my *O. vilosa* [sic] or *M. longistylis* obtuse, in *O. cordata* Raf. cordate. These last produce, when eaten, effects similar to those of the virulent Umbellate . . . ." Traditionally, placement of these names in synonymy has been based solely on this reference; *O. dulcis* under *O. claytonii,* and *O. vilosa* and *O. cordata* under *O. longistylis.* The type specimen of *O. dulcis* (PH!) is, however, clearly a plant of *O. longistylis,* not *O. claytonii* as suggested by Rafinesque; *O. dulcis* is therefore a synonym of *O. longistylis.* The correct placement of the names *O. vilosa* and *O. cordata* may be inferred from Rafinesque's reference itself. *Osmorhiza dulcis* is said to have more aromatic roots than *O. vilosa* and *O. cordata*; the roots of *O. longistylis* are more aromatic than those of *O. claytonii* (Lowry & Jones, 1979a). Since *O. vilosa* is a synonym for *O. longistylis,* by inference *O. vilosa* and *O. cordata* belong in synonymy under *O. claytonii.* Rafinesque probably confused *O. claytonii* and *O. longistylis* when suggesting the synonymy for his new names.

Rydberg (1894) validly published the combination *Osmorhiza aristata* (Thunb.) Rydb. Nearly all subsequent authors have incorrectly attributed this combination to Makino and Yabe (in Makino, 1903), however; the only apparent exceptions are Constance (1972), Lowry and Jones (1979a), and Lowry (1980).

Accurate determination of the holotype of *Osmorhiza mexicana* Griseb. was possible only with the kind assistance of Professor Dr. G. Wagenitz (GOET). According to Wagenitz (pers. comm.), Grisebach usually marked voucher specimens he considered new by placing an "*m*" (for *mihi*), after the new name, while other vouchers were marked with "Gr." Examination of the authentic material from the Grisebach Herbarium at GOET shows that *Schaffner 37* is marked "*Osmorhiza mexicana m*" in Grisebach's hand, while two other specimens (*Mandon 594* and *Lorentz & Hieronymus 668*) are marked "*Osmorhiza mexicana* Gr." Thus, the Schaffner collection has been annotated as the holotype, whereas the other specimens are paratypes.

Lectotypes are designated here for four specific epithets: *O. brevistylis* DC., *O. depauperata* Philippi, *O. laxa* Royle, and *Myrrhis renjifoana* Philippi. There are several syntypes for each of these names, and extensive search in the literature has not revealed previous lectotypification for any of them.

The name *Myrrhis longistylis* Torrey (1824: 310) was published with the following type information: "In wet meadows near Albany, New York. *Tracy.* Near Geneva, N. Y. *Paine.* June. Near Hudson, N. Y. *Alsop,* & c." These specimens would by syntypes, although none of them has been located. An authentic collection by Paine marked "*Myrrhis* n. sp." in Torrey's hand (at

NY) is therefore designated as the neotype for *Myrrhis longistylis* Torrey.

ETHNOBOTANY

Species of *Osmorhiza* were used in a variety of ways by native peoples in many parts of North America, and by at least one tribe in South America. Available information indicates that *O. brachypoda, O. chilensis, O. claytonii, O. longistylis,* and *O. occidentalis* were used for medicinal purposes, while *O. chilensis* and probably *O. depauperata* were also consumed as food. Many uses of *Osmorhiza* by Indians of North America were reviewed by French (1971).

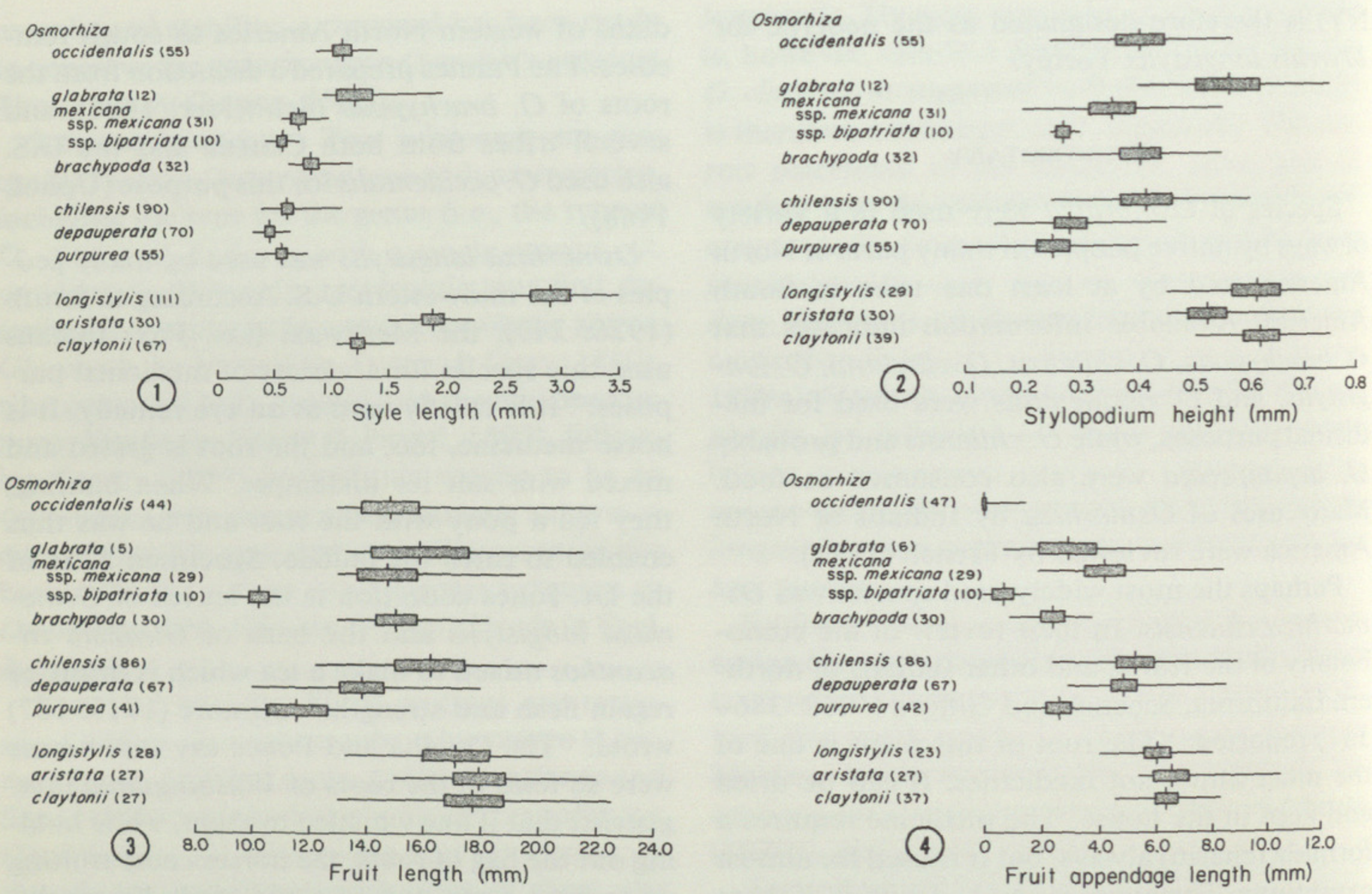
Perhaps the most widely used species was *Osmorhiza chilensis.* In their review of the ethnobotany of the Karok and other Indians of northern California, Schenck and Gifford (1952: 386–387) reported: "The root of this plant is one of the most important medicines. It can be dried and kept in the house. The medicine requires a formula (charm) always, but it is used for almost everything. The house is smoked with it, if there has been illness in the house. The root is thrown on the fire at dances. If put under the pillow at night, it keeps sickness away. For headache, a little piece of the root is chewed. If a person is grieving over a lost relative, medicine is made from the root (with formula) and the mourner is bathed with the medicine. A piece of the root is carried as protection against the 'devil.' In the spring the young tops are eaten as greens. It is very good luck to find it growing in a place where it has never been seen before. Georgia Orcutt [a local Indian woman] says this is the only herb that is dried and kept on hand in the house. It is good for 'everything'." Gunther (1945) reported that the Swinomish Indians of northwestern Washington chewed the roots of *Osmorhiza brevipes* (= *O. chilensis*) as a powerful love charm. She also noted that the Lummi and Skagit tribes of the same area did not seem to use *Osmorhiza.* Schneider (1906) indicated that the seeds of "*O. longistylis*" (certainly *O. chilensis*) were used by California Indians (probably the Paiutes) for medicinal purposes, primarily as a cough remedy. According to Steedman (1930: 480), the Thompson Indians of interior British Columbia ate the roots of *Osmorhiza chilensis*; she stated that "they are known for their delicate flavor and are especially appetizing because of their aromatic character."

Other species of *Osmorhiza* were used by Indians of western North America as cough remedies. The Paiutes prepared a decoction from the roots of *O. brachypoda* (Schneider, 1906), and several tribes from both Canada and the U.S. also used *O. occidentalis* for this purpose (Uphof, 1968).

Osmorhiza longistylis was used by many peoples of the midwestern U.S. According to Smith (1928: 249), the Meskwaki (i.e., Fox) Indians used this species for a variety of medicinal purposes: "It is chiefly used as an eye remedy. It is horse medicine, too, and the root is grated and mixed with salt for distemper. When hunting, they fed a pony with the root and he was thus enabled to catch the buffalo. Specimen *5154* of the Dr. Jones collection is the leaves of *Osmorhiza longistylis* and the bark of *Gleditsia triacanthos* mixed to make a tea which is drunk to regain flesh and strength." Gilmore (1919: 107) wrote: "The Omaha and Ponca say that horses were so fond of the roots of *Washingtonia* [*longistylis*] that if one whistled to them, while holding out the bag of roots, the horses came trotting up to get a taste, and so could easily be caught. An Omaha said that the roots were pounded up to make poultices to apply to boils. A Winnebago medicine-man reported the same treatment for wounds. A Pawnee said that a decoction of the roots was taken for weakness and general debility."

Smith (1932: 391) indicated that the Ojibwe (i.e., Ojibwa) Indians apparently did not distinguish between *Osmorhiza longistylis* and the closely related *O. claytonii.* He stated: "A tea for making parturition easier is prepared from the roots. The licorice flavor of the tea is said to be good for a sore throat." *Osmorhiza claytonii* was used by the Menomini Indians of northern Wisconsin to gain weight (Smith, 1923).

Osmorhiza was also used by Indians in southern South America. According to Mrs. Natalie Goodall of Harberton, Argentina (in a letter to Mrs. Helen Sharsmith, dated May 12, 1965, a copy of which was obtained from Dr. Lincoln Constance), *Osmorhiza* "was one of the three plants eaten by the [Yahgan] Indians besides fungi . . . . The owwunim [a Yahgan name] was eaten raw—leaves, stems, and roots, or the roots were baked in the fire . . . . My mother-in-law says that she often saw the Indians eating it as a child. Now it is hard to say, as there are only about four Yahgans left, two of them work in Harberton, but have forgotten their language." It is likely that the Yahgans did not distinguish between



FIGURES 1–4. Mean, standard deviation, range of variation, and sample size of quantitative morphological characters in *Osmorhiza* spp.—1. Style length (mm).—2. Stylopodium height (mm).—3. Fruit length (mm).—4. Fruit appendage length (mm).

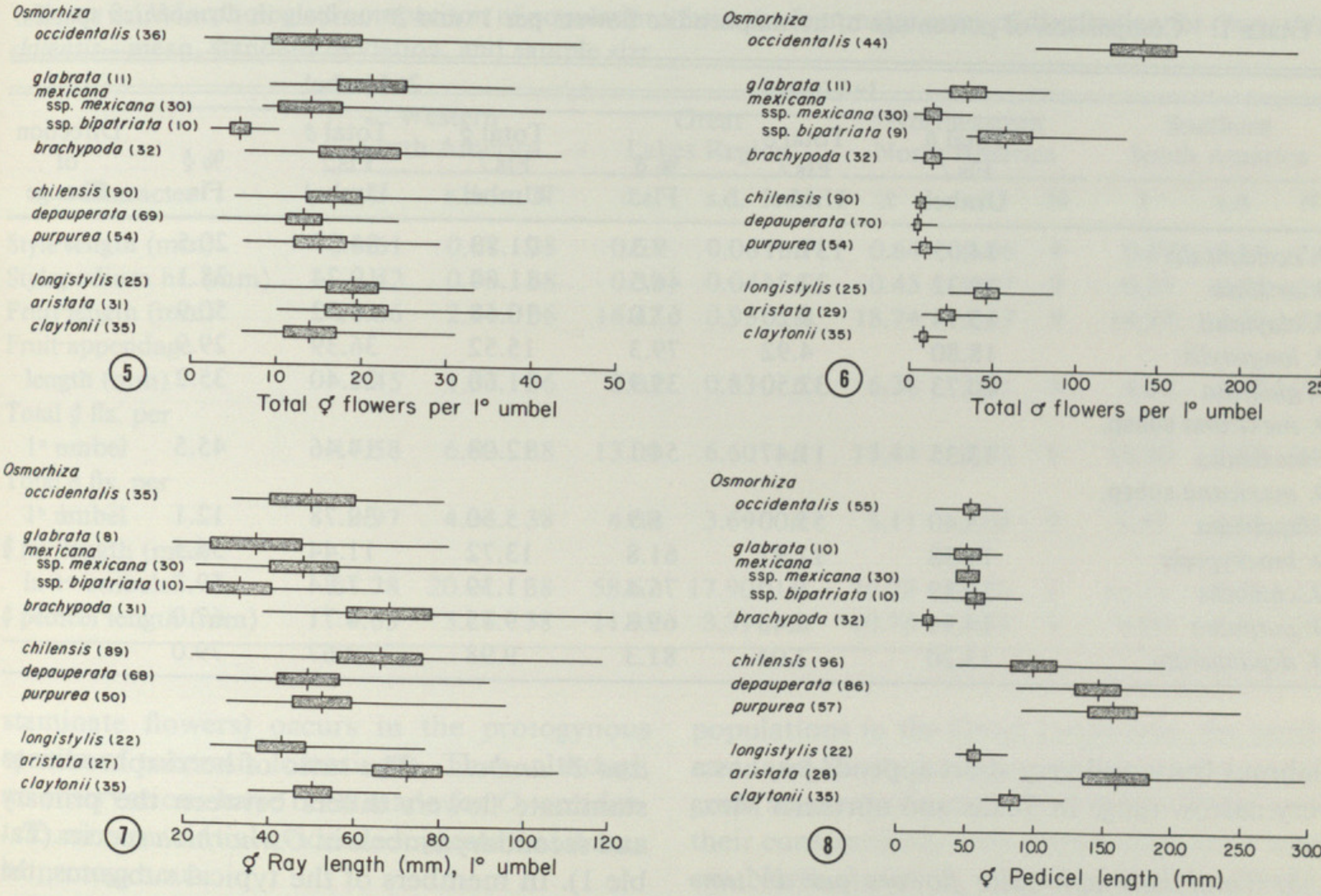
Osmorhiza depauperata and *O. chilensis,* both of which grow throughout southern South America, often together. If they did, however, Mrs. Goodall's comments probably apply to *O. depauperata,* a specimen of which (*Y. Mexia 7925*), collected in Tierra del Fuego, Argentina, has written on its label "Awanim (Yeagan)."

The widespread use of these plants by native North and South Americans would suggest that other Indian groups, whose ethnobotany has not been studied, also used species of *Osmorhiza.* It is even possible that *O. aristata* was used by the people of Asia, although no record of this has been found.

MORPHOLOGY

Nine morphological characters, selected for their potential diagnostic value, were evaluated for all 11 taxa of *Osmorhiza.* Representative specimens were selected for study from across the geographic range of each taxon. The quantitative value for each character was obtained by taking the average of four measurements per specimen (occasionally two or three). Statistical significance of the data was determined using contingency table analysis solved by chi square. We tested the null hypothesis that departures from random expectation are attributable to chance alone (Woolf, 1968). Mean, standard deviation, and range of variation of quantitative characters are presented in Figures 1–8. Sample sizes are given in parentheses. Comparison of values from the geographically disjunct areas of *Osmorhiza chilensis, O. depauperata,* and *O. aristata* is given in Tables 2–4, respectively.

1. *Style length.* This is a diagnostic character for the members of *Osmorhiza* sect. *Osmorhiza* (*O. longistylis, O. aristata,* and *O. claytonii*) but is of little taxonomic value for the other species (Figs. 1, 9a–c). Statistical analysis of style length values for members of section *Osmorhiza* yielded a chi square significant far beyond the 0.0005 probability level. The members of this section can readily be separated when this character is used in conjunction with geographic distribution. *Osmorhiza aristata,* with intermediate style length values, occurs only in Asia, whereas *O. longistylis* and *O. claytonii,* both of which are found in eastern North America, show no overlap in their ranges of values (Lowry, 1976; Lowry & Jones, 1979a; Ostertag & Jensen, 1980). Sev-



FIGURES 5–8. Mean, standard deviation, range of variation, and sample size of quantitative morphological characters in *Osmorhiza* spp.—5. Total hermaphrodite flowers per 1° umbel.—6. Total staminate flowers per 1° umbel.—7. Hermaphrodite ray length from 1° umbels (mm).—8. Pedicel length of hermaphrodite flowers (mm).

eral authors have relied entirely on style length to distinguish *O. longistylis* from *O. claytonii* (e.g., Deam, 1940; Steyermark, 1963).

2. *Stylopodium height*. The high-conic stylopodia of *Osmorhiza chilensis* are distinctive, and separate it from the other members of the section *Nudae*, which have low-conic to depressed stylopodia (Figs. 2, 9i–k). Statistical analysis of this character for the members of *O.* sect. *Nudae* resulted in a highly significant chi square. Furthermore, *O. glabrata* is distinguishable from the other members of the section *Mexicanae* by its fairly high, conic stylopodia (Fig. 2).

3. *Fruit length*. This character is diagnostic for the taxa included in *Osmorhiza* sect. *Nudae* (Figs. 3, 9i–k). These species are, in fact, distinguishable almost exclusively on the basis of fruit characters, including length and shape of the schizocarps, and size and shape of the stylopodium. Statistical analysis of fruit length measurements for the members of *O.* sect. *Nudae* yielded a highly significant chi square ($P \ll 0.0005$).

4. *Fruit appendage length*. The two subgenera of *Osmorhiza* are separable on the basis of presence or absence of caudate appendages on the base of the mericarps. All ten taxa comprising the typical subgenus have appendages of varying lengths, while they are lacking entirely from the fruits of *O. occidentalis* (*O.* subg. *Glycosma*), with a few rare exceptions (Figs. 4, 9). Within the typical subgenus, *O. purpurea* is distinct from the other members of the section *Nudae* by having short appendages. Similarly, *O. mexicana* subsp. *bipatriata* has shorter appendages than the other taxa in *O.* sect. *Mexicanae.*

Constance and Shan (1948) pointed out that the caudate appendages, along with the retrorse bristles on the fruits of most species, play an important role in dispersal. It is interesting to note that *O. chilensis* and *O. depauperata,* both of which have wide disjunctions in their ranges, have conspicuously armed fruits. By contrast, *O. occidentalis,* which lacks both appendages and bristles, has a continuous and somewhat restricted range in western North America. Similarly, *O. mexicana* subsp. *bipatriata,* with essentially

TABLE 1. Comparison of percentage of hermaphrodite flowers per 1° and 2° umbels in *Osmorhiza* species.

	1° Umbel			2° Umbel			
	Total ⚥ Fls./ Umbel	Total ♂ Fls./ Umbel	% ⚥ Fls.	Total ⚥ Fls./ Umbel	Total ♂ Fls./ Umbel	% ⚥ Fls.	Direction of Change
O. occidentalis	14.05	137.61	9.3	21.73	84.37	20.5	+
O. aristata	19.32	22.24	46.5	11.84	19.24	38.1	−
O. claytonii	13.94	8.20	63.0	10.68	10.32	50.9	−
O. longistylis	18.80	4.92	79.3	15.52	36.39	29.9	−
O. glabrata	20.73	32.50	39.9	11.60	21.40	35.2	−
O. mexicana subsp. *mexicana*	13.35	11.47	54.1	12.08	14.46	45.5	−
O. mexicana subsp. *bipatriata*	5.40	55.00	8.9	5.50	39.78	12.1	+
O. brachypoda	19.38	11.97	61.8	13.72	11.44	54.5	−
O. chilensis	16.49	5.10	76.4	11.39	7.84	59.2	−
O. purpurea	14.96	6.46	69.8	9.75	4.71	67.0	−
O. depauperata	13.20	3.04	81.3	9.98	2.67	79.0	−

glabrous fruits and very short appendages, has a very narrow range in Texas and northern Mexico.

5. *Total hermaphrodite flowers per 1° umbel.* Species of *Osmorhiza* are andromonoecious, a feature common to many genera of Apiaceae; their inflorescences contain both hermaphrodite and functionally staminate flowers. The staminate flowers have well-developed stylopodia that secrete nectar, but lack styles and functional ovaries, and consequently do not develop fruit (Lowry & Jones, 1979a; Lowry, 1980; see also Bell, 1971). The total number of hermaphrodite flowers produced in the primary umbels is quite uniform among *Osmorhiza* species (Fig. 5). Plants of each species produce similar numbers of fruits in their primary umbels (see below for the significance of this character).

6. *Total staminate flowers per 1° umbel.* This character is diagnostic in several ways. The two subgenera of *Osmorhiza* may be separated on the basis of this character; plants of *O. occidentalis* (*O.* subg. *Glycosma*) produce, on the average, more than twice as many staminate flowers per umbel as those of any taxon in *Osmorhiza* subg. *Osmorhiza* (Fig. 6). Furthermore, the members of *O.* sect. *Osmorhiza* are easily distinguishable from each other on the basis of this character. Values for the Asian *O. aristata* are intermediate between those for the North American *O. claytonii* and *O. longistylis* (Fig. 6). Statistical analysis of data for these three taxa yielded a very large chi square ($P \ll 0.0005$).

7. *Percentage of hermaphrodite flowers per 1° and 2° umbels.* The ratio of hermaphrodite to staminate flowers differs between the primary and secondary umbels in *Osmorhiza* species (Table 1). In members of the typical subgenus, the primary umbel has a higher percentage of hermaphrodite flowers than does the secondary umbel. Therefore, the primary umbels of these plants contribute relatively more to the gene pool of the next generation through their ovules than do the secondary umbels. The only exception to this pattern in *O.* subg. *Osmorhiza* is *O. mexicana* subsp. *bipatriata,* for which there is a slight increase in the percentage of hermaphrodite flowers from primary to secondary umbel. This may be the result of the remarkably low number of hermaphrodite flowers in its primary umbels. This pattern of increasing "maleness" (or decreasing "femaleness") with successively later flowering umbels is correlated with protandry in the hermaphrodite flowers of many apiaceous taxa, including *Ligusticum canadense* (L.) Britt. and *Daucus carota* L. (Bell, 1971), and *Osmorhiza longistylis* (Torrey) DC. (Robertson, 1888), as well as the other species of *Osmorhiza* subg. *Osmorhiza*.

By contrast, *O. occidentalis* (subg. *Glycosma*) shows a strong trend toward increasing "femaleness" from primary to later-flowering umbels (Table 1). In these populations, the percentage of hermaphrodite flowers is more than twice as high in the secondary as compared to the primary umbel. Schlessman (1978, 1982) has shown that a similar increasing percentage of hermaphrodite flowers (expressed as a decreasing percentage of

TABLE 2. Morphological comparison of populations from the four major areas of distribution for *Osmorhiza chilensis*—mean, standard deviation, and sample size.

	Western North America			Great Lakes Region			Northeastern North America			Southern South America		
Character	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N
Style length (mm)	0.61	0.08	38	0.57	0.06	6	0.64	0.06	9	0.69	0.14	24
Stylopodium ht. (mm)	0.42	0.09	38	0.38	0.04	6	0.43	0.07	9	0.37	0.08	24
Fruit length (mm)	16.66	2.71	36	16.42	0.93	6	18.74	1.47	9	14.97	1.72	22
Fruit appendage length (mm)	5.45	1.37	36	5.02	0.83	6	6.38	1.01	9	4.92	1.17	22
Total ☿ fls. per 1° umbel	17.58	6.02	38	13.00	6.60	6	15.44	6.33	9	16.50	7.53	24
Total ♂ fls. per 1° umbel	3.97	4.33	38	4.00	3.69	6	3.11	3.06	9	9.37	6.58	24
☿ ray length (mm) in 1° umbels	61.78	20.01	38	58.67	17.90	6	79.78	24.76	9	65.11	19.19	23
☿ pedicel length (mm)	9.65	3.26	38	11.39	3.39	6	10.78	3.83	9	9.00	3.51	29

staminate flowers) occurs in the protogynous species of tuberous lomatiums. Thus, although no observations have been made for *O. occidentalis,* circumstantial evidence suggests that it may be protogynous.

8. *Hermaphrodite ray length in 1° umbels.* Two types of rays are typically produced in the umbels of *Osmorhiza* species, those whose umbellets contain both hermaphrodite and staminate flowers (hermaphrodite rays), and those with umbellets composed entirely of staminate flowers (staminate rays). Hermaphrodite rays are generally rather stiff when the fruits reach maturity, ranging from 20 to 120 mm long, while staminate rays wither after flowering, and rarely exceed 10 mm. Hermaphrodite ray length is a useful diagnostic feature for distinguishing *O. aristata* from *O. longistylis* and *O. claytonii* (Fig. 7). This character is also useful for separating *O. brachypoda* from the other members of *O.* sect. *Mexicanae* (Fig. 7).

9. *Pedicel length of hermaphrodite flowers.* This is an excellent character for separating *O. aristata* from its North American relatives (Fig. 8). The pedicels in this species are, on the average, more than twice as long ($P \ll 0.0005$) as in plants of *O. longistylis* and *O. claytonii.*

10. *Comparison of disjunct populations of Osmorhiza species.* Comparison of values for morphological characters from the four geographically disjunct areas of *O. chilensis* (western North America, the Great Lakes region, northeastern North America, and southern South America) shows a remarkable similarity among the populations (Table 2). While a number of populations in the Great Lakes area, the northeast, and South America appear to have undergone some divergence, there is no doubt as to their conspecificity with populations from western North America, where the species possibly originated.

Similarly, populations of *O. depauperata* from these same disjunct areas are morphologically very similar to one another (Table 3). While some divergence has occurred in South America, the specimens examined from this area are clearly within the range of variation found within the species in western North America.

Constance and Shan (1948) recognized two varieties of *Osmorhiza aristata,* the variety *laxa,* from southwestern China and the Himalayan region, and the typical variety from the Altai region and eastern Asia. These varieties were distinguished on the basis of leaf characters; plants from Sachalin and Siberia show a maximum of leaf dissection, those from Japan are intermediate, and those from the Himalayas have leaves that are much less divided. Although this variation in leaf dissection is indeed recognizable, there is no apparent correlation with other morphological characters. Quantitative values for these characters for populations from eastern Asia and the Himalayan region are quite similar, and do not support the recognition of infraspecific taxa within *O. aristata* (Table 4).

PHYTOGEOGRAPHY

Nearly 8,000 herbarium specimens were examined to determine the limits of geographic

TABLE 3. Morphological comparison of populations from the four major areas of distribution for *Osmorhiza depauperata*—mean, standard deviation, and sample size.

	Western North America			Great Lakes Region			Northeastern North America			Southern South America		
Character	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N
Style length (mm)	0.46	0.07	33	0.46	0.10	7	0.46	0.09	7	0.55	0.08	9
Stylopodium ht. (mm)	0.27	0.06	33	0.31	0.08	7	0.27	0.06	7	0.29	0.06	9
Fruit length (mm)	13.74	1.56	32	14.11	0.83	7	14.79	0.86	7	12.28	1.68	8
Fruit appendage length (mm)	4.98	0.93	32	4.75	0.47	7	5.21	0.56	7	4.00	0.76	8
Total ⚥ fls. per 1° umbel	13.21	4.21	33	11.33	1.75	6	13.86	2.41	7	12.22	3.46	9
Total ♂ fls. per 1° umbel	3.09	3.30	33	0.05	1.23	6	2.57	1.40	7	4.22	5.02	9
⚥ ray length (mm) in 1° umbels	49.17	15.69	32	42.50	10.07	6	50.50	20.19	7	55.33	10.79	9
⚥ pedicel length (mm)	14.34	3.56	33	14.50	3.36	7	16.74	4.32	7	15.05	2.72	10

distribution for *Osmorhiza* species. Distribution was mapped for each taxon by placing dots on a base map; one dot (or occasionally two) for counties in the U.S., and one dot per locality for other areas. A number of important collections reported by Hultén (1947), Constance and Shan (1948), Shishkin (1950), and Liu (1977) not available for study were mapped as circles. In general, the ranges obtained are in agreement with those given by other authors, notably Hultén (1947), Constance and Shan (1948), Constance (1963), Wood (1972), and Marquis and Voss (1981).

OSMORHIZA SECT. OSMORHIZA. Two species, *O. claytonii* and *O. longistylis*, are widely distributed in eastern North America and are sympatric over much of their ranges (Lowry, 1976; Lowry & Jones, 1979a). Both occur on the Gaspé Peninsula, in Nova Scotia, and in southern Quebec and Ontario, and reach their eastern limits south along the Atlantic Coast. In the south, *O. claytonii* ranges from the southern Appalachian Mountains of North Carolina and Tennessee to the Ozark Plateau, approximately along the 35th parallel. In the west, this species reaches its limits along a line close to the 100th meridian, with extensions into north-central Nebraska and southwestern Manitoba (Fig. 10).

The range of *O. longistylis* extends farther to the south, reaching from the Piedmont Upland of central Georgia and South Carolina to Arkansas, eastern Oklahoma, and adjacent Texas. In the west, this species is found throughout the upper Great Plains, and has its limits along the base of the Rocky Mountains in Colorado, Wyoming, Montana, and Alberta (Fig. 11).

The third member of this section, *O. aristata*, occurs only in Asia, ranging from Sachalin and the lower Amur basin, through Japan, Korea, Taiwan, central and southern China, to the Hi-

TABLE 4. Morphological comparison of populations of *Osmorhiza aristata* from eastern Asia and the Himalayan Region—mean, standard deviation, and sample size.

	Eastern Asia			Himalayan Region		
Character	$\bar{x}$	s.d.	N	$\bar{x}$	s.d.	N
Style length (mm)	1.91	0.18	25	1.78	0.22	5
Stylopodium height (mm)	0.52	0.07	25	0.51	0.09	5
Fruit length (mm)	17.59	1.61	23	20.00	1.68	4
Fruit appendage length (mm)	6.27	0.99	23	7.91	1.82	4
Total ⚥ fls. per 1° umbel	19.30	6.42	26	19.60	11.26	5
Total ♂ fls. per 1° umbel	23.04	9.73	25	17.25	7.23	4
⚥ ray length (mm) in 1° umbels	71.09	14.17	23	80.29	26.18	4
⚥ pedicel length (mm)	14.63	3.45	24	23.92	4.84	4

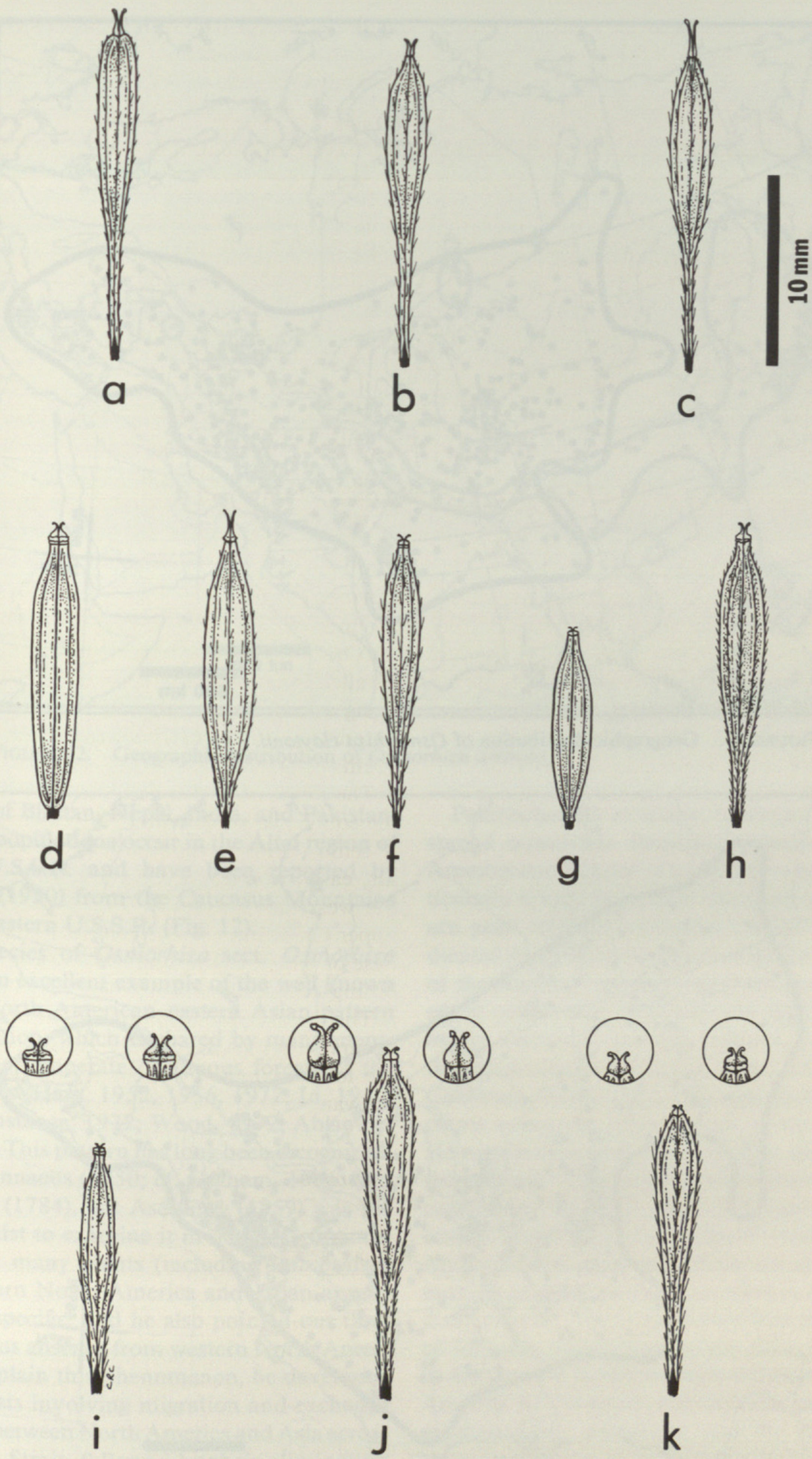


FIGURE 9. Drawings of the fruit of *Osmorhiza* species.—a. *O. aristata*.—b. *O. claytonii*.—c. *O. longistylis*.—d. *O. occidentalis*.—e. *O. glabrata*.—f. *O. mexicana* subsp. *mexicana*.—g. *O. mexicana* subsp. *bipatriata*.—h. *O. brachypoda*.—i. *O. purpurea*.—j. *O. chilensis*.—k. *O. depauperata*.

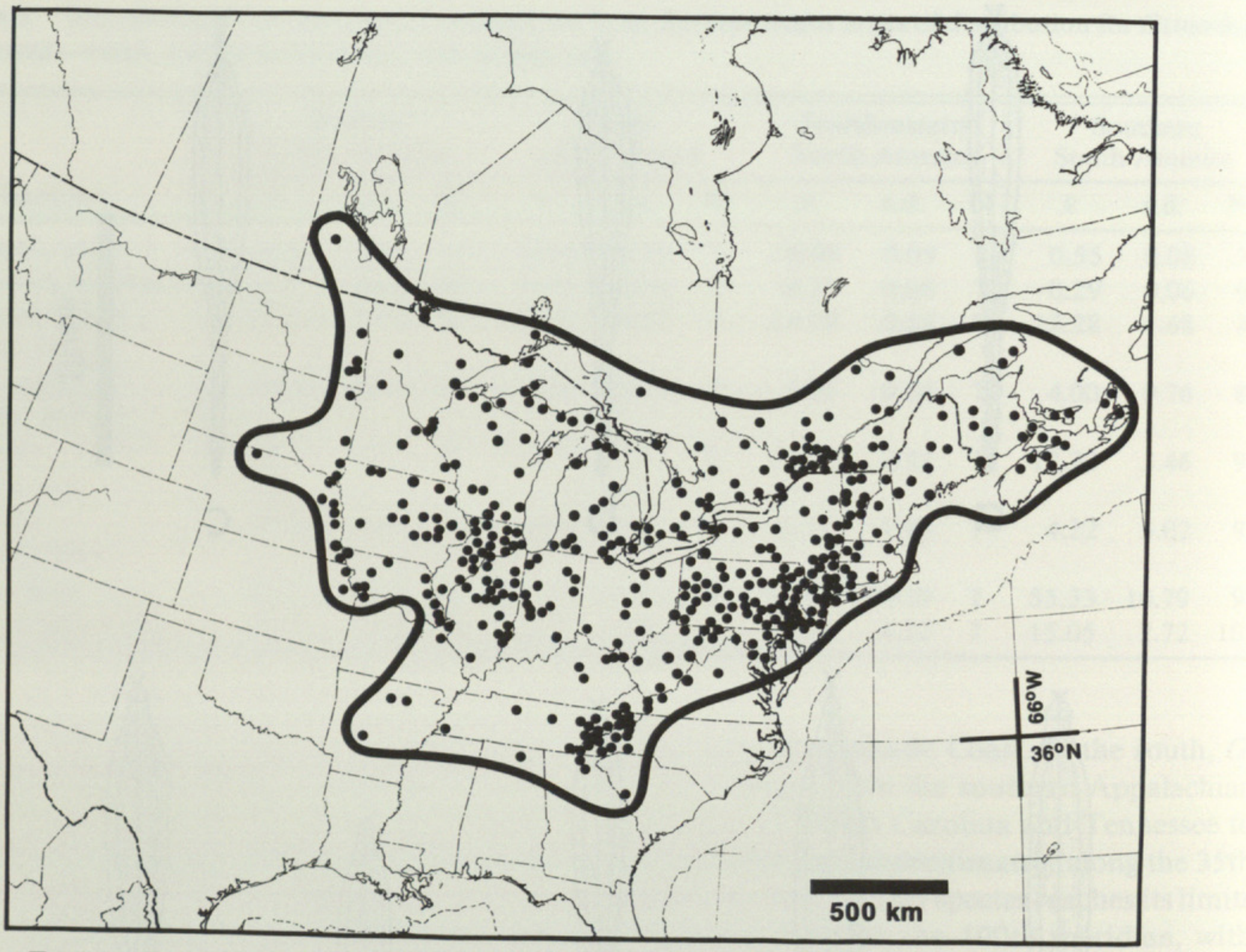


FIGURE 10. Geographic distribution of *Osmorhiza claytonii*.

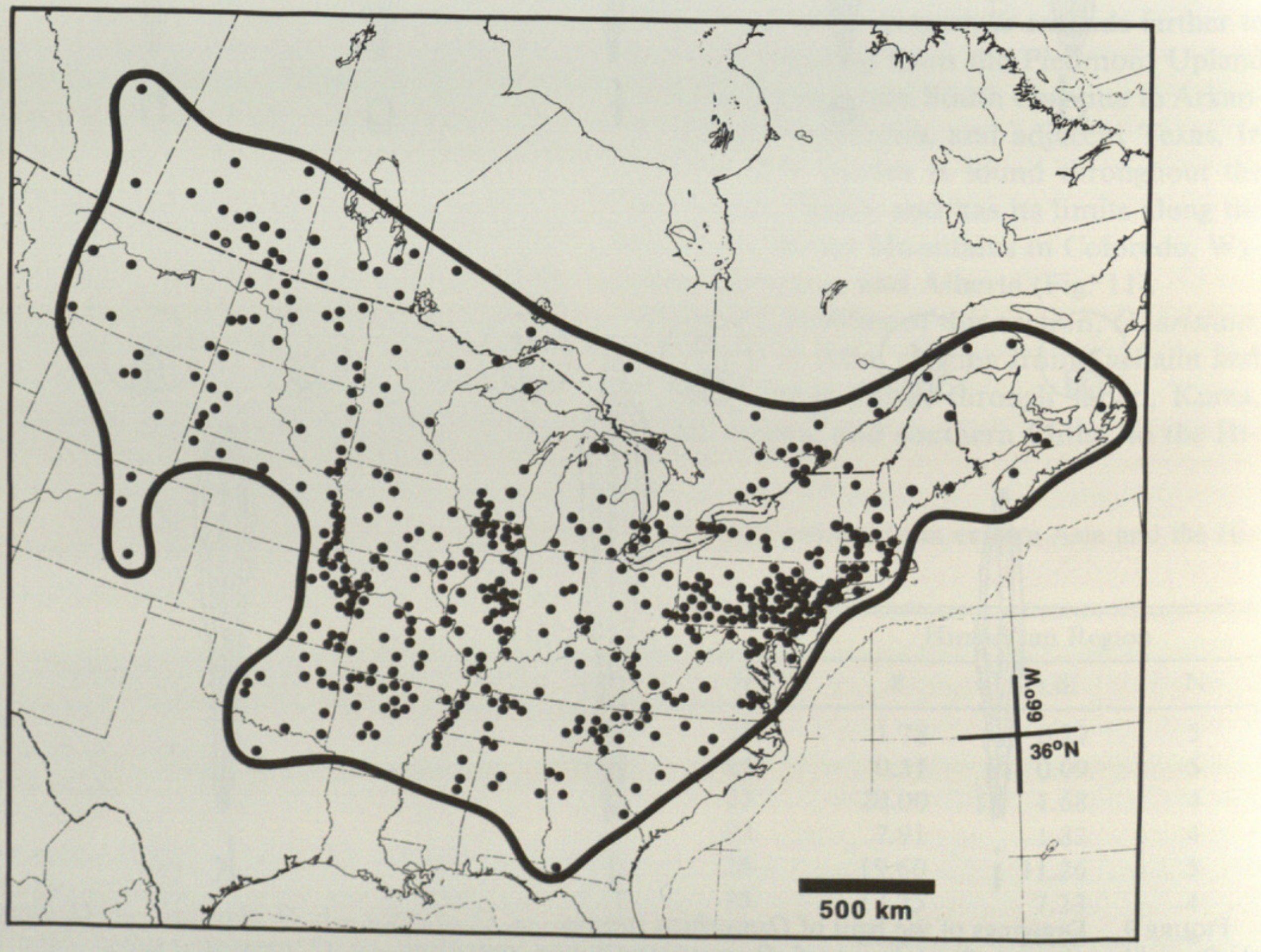


FIGURE 11. Geographic distribution of *Osmorhiza longistylis*.

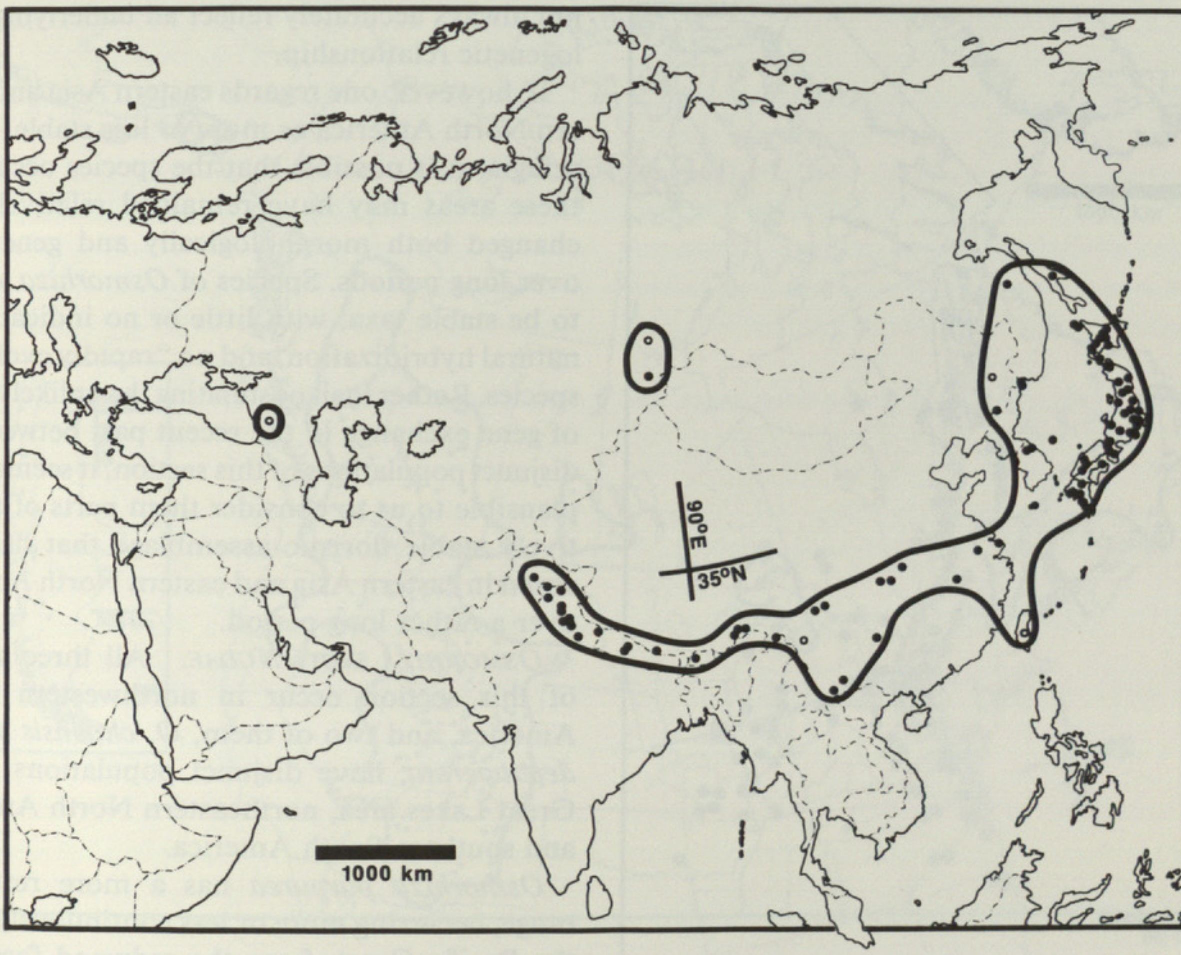


FIGURE 12. Geographic distribution of *Osmorhiza aristata*.

malayas of Bhutan, Nepal, India, and Pakistan. Disjunct populations occur in the Altai region of central U.S.S.R. and have been reported by Shishkin (1950) from the Caucasus Mountains of southeastern U.S.S.R. (Fig. 12).

The species of *Osmorhiza* sect. *Osmorhiza* provide an excellent example of the well known eastern North American–eastern Asian pattern of disjunction, which is shared by many members of the temperate deciduous forests of the two regions (Hara, 1952, 1956, 1972; Li, 1952, 1972; Constance, 1972; Wood, 1972; Ablaev et al., 1974). This pattern has long been recognized, e.g., by Linnaeus (1750; cf. Graham, 1966) and Thunberg (1784), but Asa Gray (1859) was the first botanist to examine it in detail. Gray indicated that many plants (including *Osmorhiza*) from eastern North America and Japan appear to be conspecific, and he also pointed out their conspicuous absence from western North America. To explain this phenomenon, he developed a hypothesis involving migration and exchange of species between North America and Asia across the Bering Strait, followed by their elimination from western North America and northeastern Asia during the Pleistocene.

Paleobotanical evidence confirms the widespread occurrence throughout much of North America and Eurasia of a number of genera, particularly woody ones, now restricted to the eastern parts of both continents. Wolfe (1969) indicated that certain members of the Tertiary flora of the Pacific Northwest survived changing climatic conditions, especially the shift from wet to dry summers, in relict habitats, particularly the mountains of southern Oregon and northern California. Wood (1972: 112) suggested that many plants occupying other regions of the Northern Hemisphere survived in a similar manner. He then stated: "The largest, and ecologically most complex, of the relict areas are eastern Asia and eastern North America; those of western North America and Europe-Asia Minor are smaller, and many genera that formerly occurred in them have disappeared." Wood concluded that the pattern of formerly widespread genera being restricted in distribution to eastern Asia and eastern North America by "orogenic movements, gradual climatic cooling, volcanism, and the Pleistocene glaciations seems to be well established."

The three species of *Osmorhiza* sect. *Osmorhiza* exhibit remarkable morphological similar-

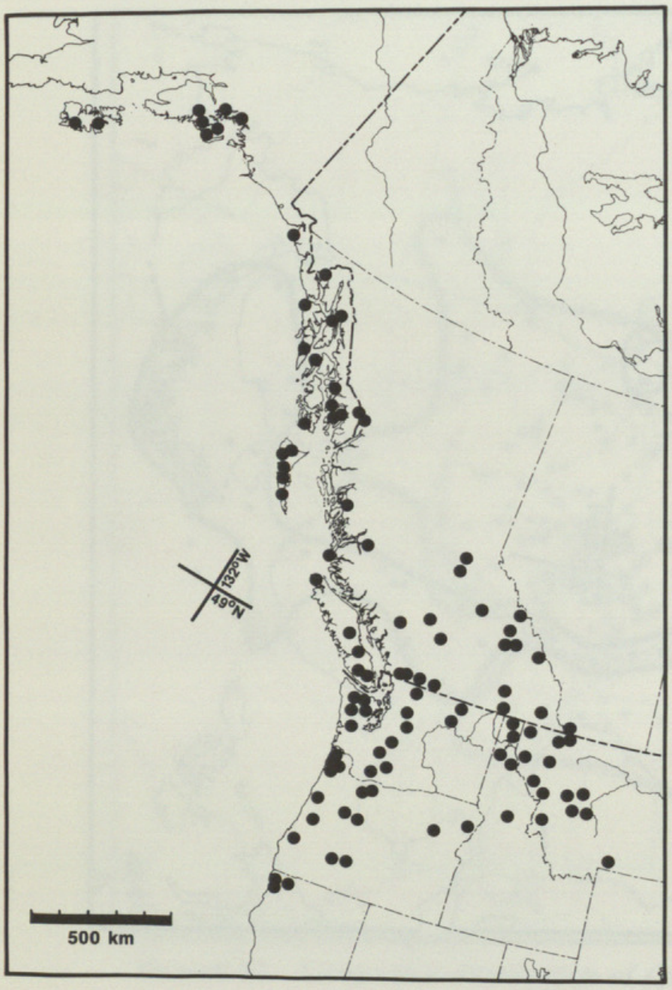


FIGURE 13. Geographic distribution of *Osmorhiza purpurea*.

ity and have been regarded as conspecific by a number of authors (e.g., Gray, 1859; Clarke, 1879; Kuntze, 1891; Boivin, 1968). Constance and Shan (1948) suggested that this similarity may be ascribed to one of two factors: either there has been a relatively recent contact between the Asian and North American populations through Beringia, or these species have differentiated from a once widespread common ancestral population at a very slow rate. While Wood's reasoning, as outlined above, tends to support the latter, Li (1972) took a different view, arguing that the observed morphological similarities between populations of eastern Asia and eastern North America may be the result of geographic and ecological similarities between these areas. He pointed out that the two areas lie at roughly the same latitude, are situated in the same relative position on their respective continents, are tempered by ocean currents from the south, and share features of their topography, soil, temperature ranges, precipitation distributions, etc. Li believed that these morphological similarities were probably the result of parallel evolution, and may not always accurately reflect an underlying phylogenetic relationship.

If, however, one regards eastern Asia and eastern North America as more or less stable, mesic refugia, it is possible that the species occupying these areas may have remained relatively unchanged both morphologically and genetically over long periods. Species of *Osmorhiza* appear to be stable taxa, with little or no indication of natural hybridization, and no "rapidly evolving" species. Rather than postulating the unlikely event of gene exchange in the recent past between the disjunct populations of this section, it seems more plausible to us to consider them parts of a relatively stable floristic assemblage that has persisted in eastern Asia and eastern North America over a rather long period.

OSMORHIZA SECT. *NUDAE*. All three species of this section occur in northwestern North America, and two of them, *O. chilensis* and *O. depauperata*, have disjunct populations in the Great Lakes area, northeastern North America, and southern South America.

Osmorhiza purpurea has a more restricted range, occurring more or less continuously along the Pacific Coast, from the redwood forests of northwestern California to Kodiak Island in southwestern Alaska. Inland, populations are found through the Cascade Mountains of Oregon and Washington eastward to the Rocky Mountains of Idaho, northwestern Montana, and extreme southwestern Alberta, and in much of southern British Columbia (Fig. 13).

Osmorhiza depauperata occurs sporadically in western North America, from the Warner Mountains of northeastern California, through Oregon, Washington, and central British Columbia, to the northern "pan-handle" and the Kenai Peninsula in Alaska. This species is much more commonly represented in the Rocky Mountains, where it ranges from southern Arizona and New Mexico northward to British Columbia, Alberta, and the extreme southwestern part of the Mackenzie District. Disjunct populations of *O. depauperata* are recorded from the Black Hills of South Dakota and the Cypress Hills in Alberta and Saskatchewan, and scattered populations are found across the Prairie Provinces of Canada in central Alberta, eastern Saskatchewan, and in Riding Mountain National Park, Manitoba. In the Great Lakes region, populations occur along the northern shore of Lake Superior, on Manitou Island in Lake Michigan, near Lake Nipigon in Ontario, and on Charlton Island in the James

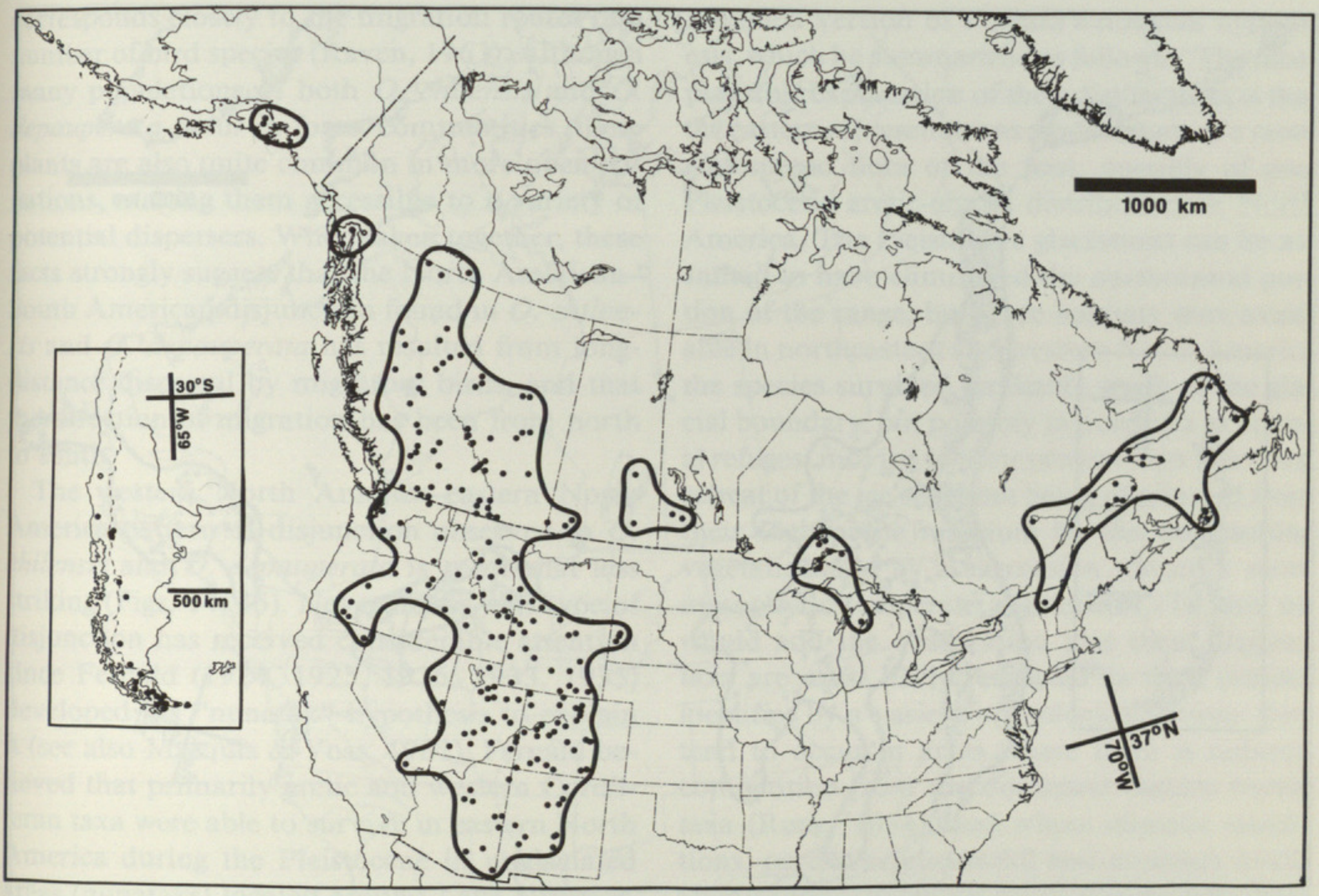


FIGURE 14. Geographic distribution of *Osmorhiza depauperata*.

Bay Region (over 600 km to the northeast). In the east, *O. depauperata* ranges from Vermont and Lake Saint John in Québec, through the Gaspé Peninsula, Anticosti and Mingan Islands, to eastern Nova Scotia, Newfoundland, and southeastern Labrador. This species is also represented in South America, where it extends from Tierra del Fuego northward through the Andes of southern Argentina, reaching its northern limit at Termas de Chillán in Prov. Ñuble, Chile (Fig. 14).

Osmorhiza chilensis shows a similar overall pattern of distribution, and is sympatric with *O. depauperata* throughout much of its range, although it is much less common in the southern Rocky Mountains, particularly in Arizona and New Mexico. By contrast, populations of *O. chilensis* are common along the west coast, ranging from southern California, through Oregon and Washington, to Vancouver Island, the Queen Charlotte Islands, and southeastern Alaska. Occurrence of this species has also been reported from the coast of southwestern Alaska, with its range extending as far west as Unalaska Island in the Aleutian Chain (Hultén, 1947). With the exception of two populations in south-central Alberta, *O. chilensis* appears to be absent from the Prairie Provinces of southern Canada. In the Great Lakes area, it is widely distributed along the western and southern shores of Lake Superior, eastward to Lake Huron and the Georgian Bay; in eastern North America the range extends from northern New Hampshire and Maine, through the Gaspé Peninsula, New Brunswick, and Nova Scotia, to Newfoundland. South American populations occur from the Tierra del Fuego through the Andes and along the central Chilean coast northward to Prov. Aconcagua, Chile (Fig. 15).

Two well known types of disjunction are exemplified by *O. chilensis* and *O. depauperata*; amphitropical disjunctions between North and South America, and disjunctions between western and eastern North America.

Similarities between the floras of temperate western North America and southern South America were recognized over 100 years ago by Gray and Hooker (1880). Since then, many botanists have dealt with this subject (e.g., Engler, 1882; Reiche, 1907; DuRietz, 1940; Campbell, 1944; Constance, 1963; Raven, 1963; and Moore, 1972). Constance (1963) suggested that *Osmo-*

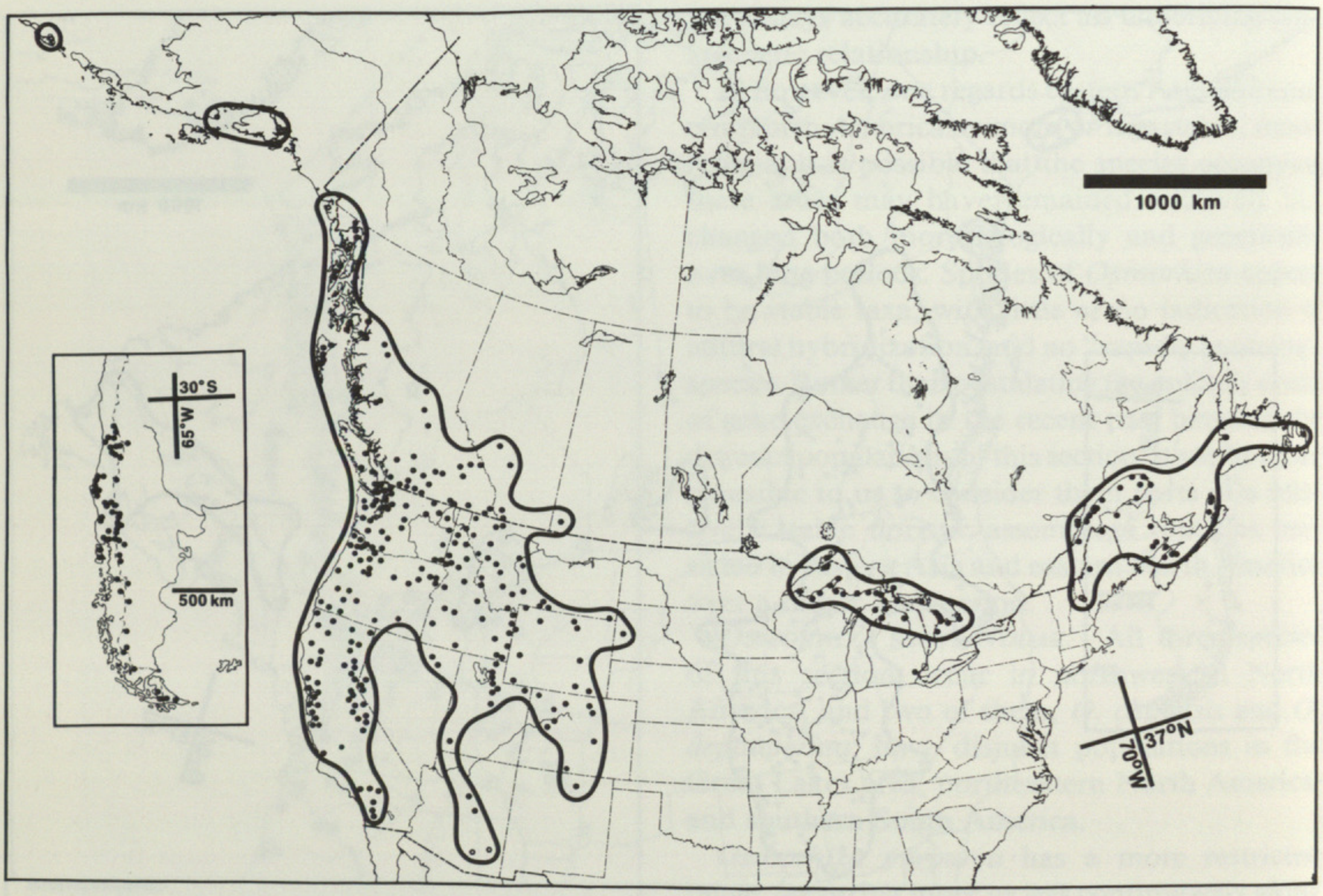


FIGURE 15. Geographic distribution of *Osmorhiza chilensis.*

rhiza chilensis and *O. depauperata* may have reached South America by a step-wise migration through the tropics along a route now marked by the members of the section *Mexicanae.* Raven listed about 130 species or species-pairs, including *O. chilensis* and *O. depauperata,* that exhibit patterns of disjunction between temperate North and South America. He also discussed the important factors concerning this pattern, which he summarized as follows: "(1) North and South American populations are closely related; (2) the plants are almost without exception self-compatible and often autogamous; (3) they constitute an unbalanced assemblage entirely unrepresentative of the floras of the two extratropical areas; (4) they grow almost exclusively in open communities, not in woodland or scrub associations; (5) there are no corresponding cases among terrestrial vertebrates and very few among the insects; and (6) the floras of the two areas have been distinct since at least the middle Cretaceous and are still very distinct at present." Raven (1963: 166) concluded that the only reasonable explanation to account for these facts is that "at least the great majority of the plants reached their disjunct areas by long-distance dispersal relatively recently." He noted further that, for temperate species, the Pliocene or Pleistocene were the most likely times for this kind of dispersal, and that the majority of species involved migrated from north to south. The distribution patterns of *O. chilensis* and *O. depauperata* fit very well into this overall syndrome. There is no doubt that the North and South American populations of each of these species are very closely related. Although a few South American populations of both taxa seem to have undergone some morphological divergence, the majority of them appear to be virtually identical to their North American counterparts. Conversely, a number of morphological variants of both species that occur in North America seem to be absent from South America.

Observations made as part of this study suggest that *Osmorhiza* species are facultatively autogamous, a condition that would permit even a single propagule to establish a new population. Both *O. chilensis* and *O. depauperata* produce fruit armed with caudate appendages and numerous retrorse bristles, making them well adapted for epizoochory. Furthermore, the amphitropical pattern of disjunction for these taxa corresponds closely to the migration routes of a number of bird species (Raven, 1963). Although many populations of both *O. chilensis* and *O. depauperata* occur in forest communities, these plants are also quite common in more open situations, making them accessible to a variety of potential dispersers. When taken together, these facts strongly suggest that the North American–South American disjunction found in *O. chilensis* and *O. depauperata* has resulted from long-distance dispersal by migratory birds, and that the direction of migration has been from north to south.

The western North America–eastern North America pattern of disjunction observed in *O. chilensis* and *O. depauperata* is somewhat less striking (Figs. 14, 15). Nevertheless, this type of disjunction has received considerable attention since Fernald (1924, 1925, 1926, 1933, 1935) developed his "nunatak" hypothesis to explain it (see also Marquis & Voss, 1981). Fernald believed that primarily arctic and western Cordilleran taxa were able to survive in eastern North America during the Pleistocene in unglaciated areas (nunataks) located around Lake Superior, on the Gaspé Peninsula, in the Long Range of Newfoundland, and in the Torngat Mountains of Labrador. Applying Willis's (1922) "age and area" hypothesis, Fernald (1925: 243) interpreted the failure of these eastern disjuncts to extend their ranges following the glaciations as evidence of their "antiquity," stating that "at the close of the Pleistocene they were already too old and conservative to pioneer, although they were able to linger as localized relicts in their special undisturbed crannies and pockets."

Many of Fernald's arguments have not withstood the test of time. All of his nunataks were in fact glaciated (Wood, 1972), and there is no reason why the plants involved could not have migrated to their present sites following the Pleistocene (Schofield, 1969, and references therein). Furthermore, the concept of senescence of species is no longer tenable (cf. Wood, 1972).

An alternative explanation for this pattern of disjunction is given by Stebbins (1935), who argued that each species involved migrated eastward at the end of the Pleistocene along the front of the receding ice sheet, becoming progressively more rare to the east. However, this hypothesis does not, by itself, explain the restriction of the majority of these taxa to the Great Lakes area and the northeast.

Schofield (1969: 200) adopted a somewhat modified version of Fernald's nunatak hypothesis, which he summarized as follows: "The most plausible explanation of their disjunctions is that the eastern representatives are remnants of a more widespread flora of the past, possibly of pre-Pleistocene arctic-alpine distribution in North America. The Pleistocene glaciations can be assumed to have eliminated the northcentral portion of the range, but since habitats were available in northeastern and western North America the species survived, probably south of the glacial boundary, but possibly in nunataks or coastal refuges, moving to their present sites following retreat of the ice sheet but being eliminated from their Pleistocene refugium by the encroaching vegetation and by a succession toward a more mesophytic temperate vegetation." To this we would add the observation that these disjunct taxa are most likely restricted to their present localities by a variety of ecological factors: they tend to occur in areas where there is reduced competition from the dominant eastern boreal taxa (Rune, 1954), and where climatic conditions, particularly snowfall and moisture availability during the spring, are more similar to those of western North America.

Schofield's hypothesis, as modified above, seems to be the most plausible to explain the western North American–eastern North American pattern of disjunction observed in *Osmorhiza chilensis* and *O. depauperata.* Nowhere in the literature have we found any suggestion that long-distance dispersal may have played a role in producing this type of disjunction; at least in the case of *Osmorhiza,* this type of dispersal would seem unlikely because the distribution of these plants does not seem to be correlated with the migration routes of any birds. Movement over shorter distances, however (e.g., from the Rocky Mountains into Saskatchewan and Manitoba), may be the result of epizoochory following the Pleistocene glaciations.

Osmorhiza sect. *Mexicanae.* The representatives of this section form a "three-link chain" extending from the southwestern United States to central Argentina and Chile. The northernmost link is represented by *Osmorhiza brachypoda,* which has a relatively restricted distribution, ranging from the mountains of southwestern California northward through the Coast Range to Mount Diablo in Alameda County, and through the Sierra Nevada to Nevada and Sierra Counties, California. Disjunct populations occur in the Mazatzal Mountains of central Arizona

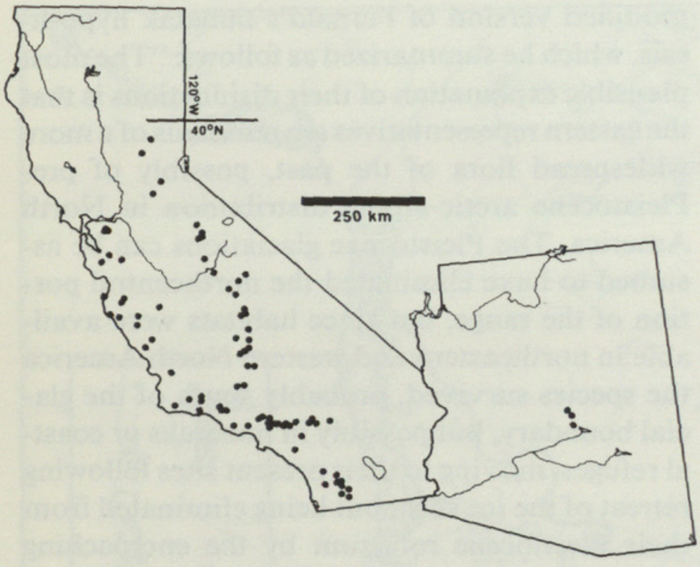


FIGURE 16. Geographic distribution of *Osmorhiza brachypoda.*

(Fig. 16), although they have not been collected since 1938.

Osmorhiza mexicana has an extended, although interrupted, range from southwestern Texas to northern Argentina. *Osmorhiza mexicana* subsp. *bipatriata* is known from only three localities: Madera del Carmen, Coahuila, and Cerro Potosí, Nuevo León, Mexico, and Mount Livermore, Jeff Davis Co., Texas. It is very possible, however, that this taxon also occurs on some of the other, as yet unexplored, mountains of Coahuila and Nuevo León. *Osmorhiza mexicana* subsp. *mexicana* reaches its northern limit in the Sierra Mohinora of Chihuahua and occurs together with subspecies *bipatriata* on Cerro Potosí. The typical subspecies ranges southward through the mountains of Mexico, Guatemala, and Costa Rica, into South America, where it occurs from the Páramo de Ruiz in Tolima, Colombia, through the Cordillera Oriental of southern Peru and adjacent Bolivia, and the mountains of northwestern Argentina, reaching its southern limit in the Sierra Grande of Córdoba, Argentina (Fig. 17).

Osmorhiza glabrata is restricted to the central Andes, ranging over a distance of less than 750 km from Prov. Santiago, Chile, to southern Neuquén, Argentina (Fig. 18).

The members of *Osmorhiza* sect. *Mexicanae* form a more or less continuous chain between northern California and central Argentina, "substantially bridging the gap which separates the discrete populations of the amphitropical taxa" in North and South America (Constance, 1963: 113). As Constance pointed out, however, it is

FIGURE 17. Geographic distribution of *Osmorhiza mexicana*.—*O. mexicana* subsp. *mexicana* (●).—*O. mexicana* subsp. *bipatriata* (□).

difficult to imagine a polytopic origin of both *O. chilensis* and *O. depauperata* from an extant or extinct member of the section *Mexicanae* both to the north and south of the equator.

Although one may be tempted to think of *O. brachypoda* and *O. glabrata* as northern and southern derivatives, respectively, of *O. mexicana*, there is no evidence to support this idea. A more plausible hypothesis is that all three species are derivatives of a once widespread common ancestral population whose distribution spanned the tropics, much as *O. mexicana* does today. According to Constance (1963), the

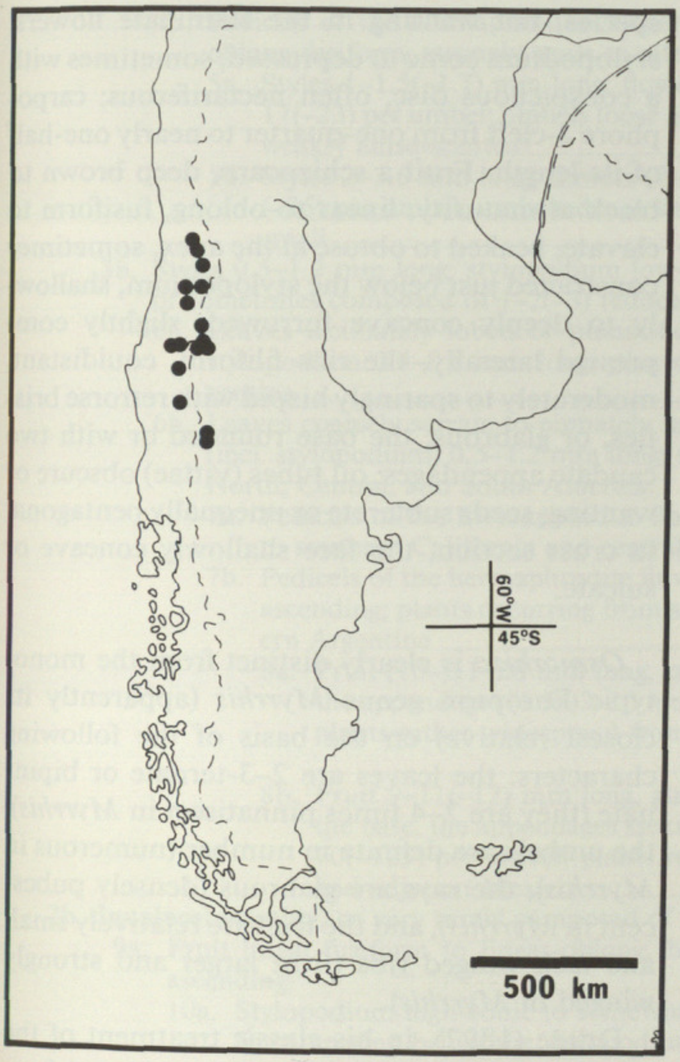


FIGURE 18. Geographic distribution of *Osmorhiza glabrata.*

mountains of Mexico and Central America were uplifted during the Pliocene or Pleistocene, orogenic movements that would have provided a chain of mountain tops with temperate climatic conditions suitable for the survival of such ancestral plants.

OSMORHIZA SUBG. *GLYCOSMA.* The sole member of this subgenus, *O. occidentalis,* is quite common in the somewhat drier areas throughout much of the western United States and adjacent Canada. It is widely distributed in the Rocky Mountains, ranging from southern Utah and southwestern Colorado northward to extreme southwestern Alberta and southern British Columbia, with eastward extensions into the Big Horn Mountains of Wyoming and the Big Snowy Mountains of Montana. To the west, the range of *O. occidentalis* extends through the mountains of the Great Basin in Nevada, eastern Oregon, and southwestern Idaho, to the northern Sierra Nevada, and the Coast Ranges of northern California and Oregon. This species also occurs in the Olympic and Cascade Mountains of Washington, the Blue Mountains of Oregon, Washington, and Idaho, and in the Willamette Valley and western foothills of the Cascade Mountains in Oregon, but it has not been recorded in the central and eastern parts of the Cascades.

No major disjunctions occur in the range of *O. occidentalis,* but this is not surprising when one considers how poorly adapted its fruits seem to be for long-distance dispersal; the schizocarps are relatively large; they lack caudate appendages and retrorse bristles (Fig. 9d).

Constance and Shan (1948) erroneously included *Osmorhiza glabrata* in their section "*Glycosmae*" (= subg. *Glycosma*), leaving the group with a large North American–South American disjunction that is difficult to explain. If the affinities of *O. glabrata* are, however, recognized as lying with members of the section *Mexicanae,* the problem is eliminated.

The phytogeographic evidence presented here indicates that North America is the center of diversity, distribution, and possibly also the center of origin for the genus *Osmorhiza.* Although none of the presumably related genera (e.g., *Myrrhis, Chaerophyllum, Scandix*) occurs in the area, both subgenera of *Osmorhiza,* and eight of ten species, are represented here. Furthermore, *O.* subg. *Glycosma,* which appears to have retained many ancestral characters, is restricted to western North America, and all three sections of the typical subgenus have members in this continent.

SYSTEMATIC TREATMENT

Osmorhiza Raf., Amer. Monthly Mag. & Crit. Rev. 4: 192. Jan. 1819, nom. cons. prop. TYPE: *Myrrhis claytonii* Michaux [= *Osmorhiza claytonii* (Michaux) C. B. Clarke].

Washingtonia Raf., Amer. Monthly Mag. & Crit. Rev. 2: 176. 1818, nom. nud., non *Washingtonia* H. Wendland (1879), nom. cons.

Osmorhiza Raf., Amer. Monthly Mag. & Crit. Rev. 2: 176. 1818, nom. nud.

Gonatherus Raf., Amer. Monthly Mag. & Crit. Rev. 2: 176. 1818, nom. nud.

Uraspermum Nutt., Gen. Amer. pl. 192. 1818, nom. rejic. prop.

Osmorhiza Raf., J. Phys. Chim. Hist. Nat. Arts 89: 157. 1819. nom. cons. prop. (cf. Lowry, 1985).

Spermatura Reichb., Consp. Reg. Veg. 141. 1828.

Glycosma Nutt. in Torrey & A. Gray, Fl. N. Amer. 1: 639. 1840.

Schudia Molina ex C. Gay, Fl. Chilena 143. 1874, pro syn.

Elleimataenia Koso-Poljansky, Bull. Soc. Imp. Naturalistes Moscou 29: 164. 1916.

Plants andromonoecious, slender to robust, perennial, herbaceous, aromatic, caulescent, dying back to a basal rosette of leaves; stems erect to spreading-ascending or decumbent, solitary to densely clustered, branching, fistulose, pubescent to glabrous. Roots fusiform, thick, fascicled, diffusely to extensively branched, surmounted by a branched caudex. Leaves alternate, basal and cauline, membranaceous, bipinnate or 2–3-ternate; leaflets lanceolate to orbicular, serrate to pinnately divided, with mucronate ultimate segments; petiole bases sheathing the stem, with their membranous margins densely ciliate to glabrous. Umbels twice compound, loose to somewhat constricted; peduncles terminal and lateral, erect to ascending or spreading, usually exceeding the leaves; involucre wanting, or composed of 1–several narrow, foliaceous, ciliate bracts; rays ascending to widely divaricate or reflexed, slender, unequal, the peripheral ones being longer; umbellets few to numerous, often of two kinds, those bearing hermaphrodite flowers or a mixture of hermaphrodite and staminate flowers (referred to as "hermaphrodite" umbellets), and those bearing only staminate flowers (referred to as "staminate" umbellets); involucel wanting, or of several linear to ovate, acuminate, ciliate, spreading to reflexed bractlets; pedicels ascending to widely divaricate, those of the hermaphrodite flowers longer than those of the staminate flowers. Hermaphrodite flowers in each umbellet borne peripherally to the staminate flowers (if any), sometimes slightly irregular; calyx wanting; corolla white, greenish white, or yellow, or tinged with green, pink, or purple, the petals spatulate to ovate, the apex with an inflexed appendage; anthers about 0.5 mm long, smaller in the staminate flowers, inflexed before anthesis, spreading as the flower opens; styles spreading to divaricate, variable in length depending on the species, but wanting in the staminate flowers; stylopodium conic to depressed, sometimes with a conspicuous disc, often nectariferous; carpophore 2-cleft from one-quarter to nearly one-half of its length. Fruit a schizocarp, deep brown to black at maturity, linear to oblong, fusiform to clavate, beaked to obtuse at the apex, sometimes constricted just below the stylopodium, shallowly to deeply concave furrowed, slightly compressed laterally, the ribs filiform, equidistant, moderately to sparingly hispid with retrorse bristles, or glabrous, the base rounded or with two caudate appendages; oil tubes (vittae) obscure or wanting; seeds subterete or unequally pentagonal in cross section, the face shallowly concave or sulcate.

Osmorhiza is clearly distinct from the monotypic European genus *Myrrhis* (apparently its closest relative) on the basis of the following characters: the leaves are 2–3-ternate or bipinnate (they are 2–4 times pinnatisect in *Myrrhis*), the umbels are definite in number (numerous in *Myrrhis*), the rays are glabrous (densely pubescent in *Myrrhis*), and the fruit are relatively small and lack winged ribs (fruit larger and strongly winged in *Myrrhis*).

Drude (1897), in his classic treatment of the Umbelliferae, placed *Osmorhiza* in his subfamily Apioideae, tribe Scandicineae, subtribe Scandicinae, along with the clearly related genera *Chaerophyllum* L., *Myrrhis* Miller, and *Scandix* L. A number of other genera, many of which are likely related to *Osmorhiza,* but some of which clearly are not, were also included in this subtribe. Bentham (1867) placed *Osmorhiza* in his series Heterosciadiae, tribe Ammineae, subtribe Scandicineae, along with the three genera mentioned above, as well as some others.

ANALYTICAL KEY

1a. Fruit glabrous, lacking caudate appendages; staminate umbellets 3–10 per umbel; staminate flowers (75–)90–225 per umbel; plants very robust; stems (1–)3–6(–8), densely clustered; leaves bipinnate; corolla yellow to greenish yellow .... (*Osmorhiza* subg. *Glycosma*)
One species .... 1. *Osmorhiza occidentalis*

1b. Fruit hispid with retrorse bristles (glabrous in *O. mexicana* subsp. *bipatriata*), with caudate appendages; staminate umbellets 0–4(–6) per umbel; staminate flowers 0–90(–125) per umbel; plants slender to rather stout; stems 1–3(–5), not densely clustered; leaves 2–3-ternate; corolla white, or tinged with green, pink, or purple .... (*Osmorhiza* subg. *Osmorhiza*)

2a. Involucel conspicuous, composed of 1–6 spreading to reflexed, foliaceous bractlets.

3a. Styles (including stylopodium) 1–3.6 mm long; stylopodium high-conic; involucre composed of (1–)2–3(–5) bracts .... (*Osmorhiza* sect. *Osmorhiza*)

4a. Pedicels of the hermaphrodite flowers (5–)9–30 mm long; rays 4.5–11 cm long; fruit linear-clavate, obtuse or abruptly acute at the apex; plants restricted to Asia .... 2. *Osmorhiza aristata*

4b. Pedicels of the hermaphrodite flowers 4–10(–15) mm long; rays 1.5–8 cm long; fruit oblong-fusiform, strongly acute to attenuate at the apex; plants of North America.
5a. Styles 1–1.5(–1.7) mm long; flowers 4–7(–8) per umbellet; staminate flowers (2–)7–17(–23) per umbel; umbels loose and uncongested; roots rank-smelling, or sometimes weakly anise-scented .... 3. *Osmorhiza claytonii*
5b. Styles 2–3.6 mm long; flowers (7–)9–18 per umbellet; staminate flowers (23–)35–75 (–86) per umbel; umbels dense and congested; roots with a strong, sweet, anise-like smell .... 4. *Osmorhiza longistylis*
3b. Styles 0.5–1.2 mm long; stylopodium low-conic to somewhat depressed; involucre wanting, or sometimes composed of 1–2(–3) reduced bracts .... (*Osmorhiza* sect. *Mexicanae*)
6a. Leaves laciniately lobed or pinnatifid; styles (incl. stylopodium) (0.9–)1–2 mm long; stylopodium 0.4–0.8 mm long; plants restricted to the central Andes of Chile and Argentina .... 5. *Osmorhiza glabrata*
6b. Leaves coarsely serrate to pinnately lobed or divided at the base, never laciniate; styles (incl. stylopodium) 0.5–1.2 mm long; stylopodium 0.2–0.5 mm long; plants occurring in North, Central, and South America.
7a. Pedicels of the hermaphrodite flowers 1–4.5 mm long, ascending; plants restricted to southern California and central Arizona .... 7. *Osmorhiza brachypoda*
7b. Pedicels of the hermaphrodite flowers (2–)3.5–7.5 mm long, spreading to spreading-ascending; plants occurring from southwestern Texas and northern Mexico to northern Argentina .... 6. *Osmorhiza mexicana*
8a. Fruit (10–)11–20 mm long, moderately to densely hispid with retrorse bristles, the appendages (1.5–)2–10 mm long; staminate flowers (0–)5–25(–35) per umbel; plants rather widespread from northern Mexico southward .... 6a. *Osmorhiza mexicana* subsp. *mexicana*
8b. Fruit 9–11(–12) mm long, glabrous, or occasionally with a few bristles toward the base, the appendages lacking, or to 1.8 mm long; staminate flowers (33–)40–70(–125) per umbel; plants restricted to three localities in southwestern Texas and adjacent Mexico .... 6b. *Osmorhiza mexicana* subsp. *bipatriata*
2b. Involucel wanting, or very rarely composed of 1(–2) minute bractlets .... (*Osmorhiza* sect. *Nudae*)
9a. Fruit linear-fusiform to linear-oblong, beaked at the apex; rays and pedicels spreading-ascending.
10a. Stylopodium high-conic to somewhat gibbous, lacking a disc, (0.2–)0.3–0.6 mm long; fruit tapering below the stylopodium, not constricted, 12–21(–25) mm long, the appendages 2.5–8.5(–10) mm long .... 8. *Osmorhiza chilensis*
10b. Stylopodium strongly depressed, with a conspicuous disc, 0.1–0.4 mm long; fruit constricted below the stylopodium, 8–15(–16) mm long, the appendages 1–5 mm long .... 9. *Osmorhiza purpurea*
9b. Fruit clavate, obtuse at the apex; rays and pedicels strongly divaricate to nearly reflexed .... 10. *Osmorhiza depauperata*

I. **Osmorhiza** Raf. subg. **Glycosma** (Nutt.) Drude. *Glycosma* Nutt. in Torrey & A. Gray, Fl. N. Amer. 1: 639. 1840. *Myrrhis* § [sect.] *Glycosma* (Nutt.) A. Gray, Proc. Amer. Acad. Arts 7: 346. 1868. *Osmorhiza* subg. *Glycosma* (Nutt.) Drude in Engl. & Prantl, Nat. Pflanzenfam. 3^{8}: 153. 1897. *Washingtonia* subg. *Glycosma* (Nutt.) Coult. & Rose, Contr. U.S. Natl. Herb. 7: 62. 1900. *Osmorhiza* sect. *Glycosmae* (Nutt.) Constance & Shan, Univ. Calif. Publ. Bot. 23: 112. 1948, nom. nud. TYPE: *Glycosma occidentalis* Nutt. [= *Osmorhiza occidentalis* (Nutt.) Torrey].

Plants robust; stems densely clustered, (1–)3–6(–8), often glaucous. Root system deep, extensively branched. Leaves bipinnate; petiole bases finely ciliate to glabrous. Primary umbel with fewer hermaphrodite and more staminate flowers than the secondary and later flowering umbels; staminate umbellets 3–10 per umbel; staminate flowers (75–)90–225 per umbel; corolla yellow to greenish yellow. Fruit glabrous, without caudate appendages.

When *Osmorhiza occidentalis* was first described, Nuttall (in Torrey & Gray, 1840) placed it in a new, monotypic genus *Glycosma*. Plants belonging to this genus were distinguished from those of *Osmorhiza* by having unappendaged, glabrous fruit. Torrey (1859), Drude (1897), and Coulter and Rose (1900) united these genera, although in the latter two treatments *Glycosma* was retained as a separate subgenus.

Osmorhiza occidentalis is quite distinct from the other members of the genus. However, the morphological differences between *O. occidentalis* and the other species of *Osmorhiza* are much less pronounced than those between either of these groups and related genera such as *Myrrhis*, *Chaerophyllum*, and *Scandix*. Furthermore, *Os-*

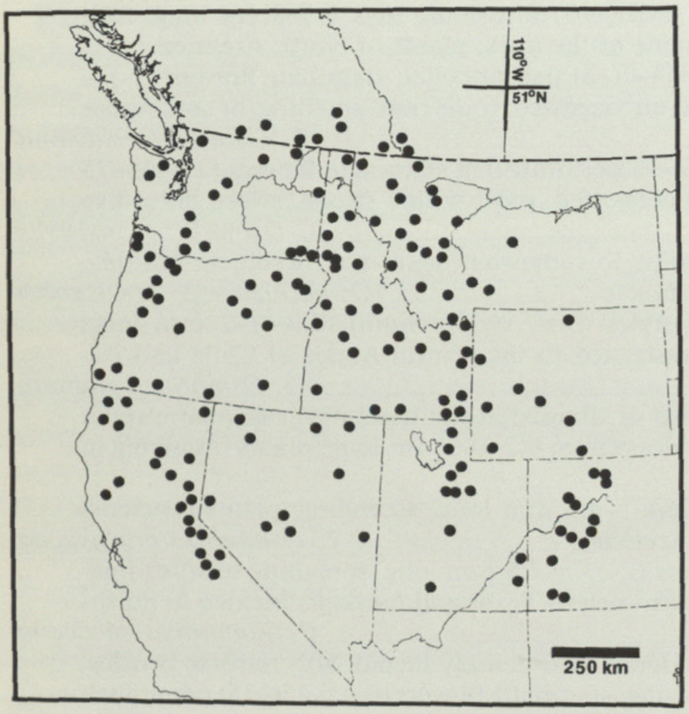


FIGURE 19. Geographic distribution of *Osmorhiza occidentalis.*

morhiza, as treated here, is considered to represent a distinct monophyletic group. For these reasons, *Glycosma occidentalis* is included in *Osmorhiza* and placed in the monotypic subgenus *Glycosma.*

1. Osmorhiza occidentalis (Nutt.) Torrey. *Glycosma occidentalis* Nutt. in Torrey & A. Gray, Fl. N. Amer. 1: 639. 1840. *Osmorhiza occidentalis* (Nutt.) Torrey, Bot. Mex. bound. surv. 71. 1859. *Myrrhis occidentalis* (Nutt.) A. Gray, Proc. Amer. Acad. Arts 7: 346. 1868. *Washingtonia occidentalis* (Nutt.) Coult. & Rose, Contr. U.S. Natl. Herb. 7: 67. 1900. TYPE: U.S.A. Oregon: "Western side of the Blue Mountains," *Nuttall s.n.* [lectotype, NY! (designated by Coulter & Rose, Contr. U.S. Natl. Herb. 7: 67. 1900); isolectotypes, BM!, GH!].

Myrrhis bolanderi A. Gray, Proc. Amer. Acad. Arts 7: 346. 1868. *Glycosma bolanderi* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 8: 386. 1872. *Osmorhiza occidentalis* var. *bolanderi* (A. Gray) Jepson, Madroño 1: 120. 1922. TYPE: U.S.A. California: Mendocino Co., Lambert's Lake, *Bolander 6525* [lectotype, GH! (designated by Coulter & Rose, Contr. U.S. Natl. Herb. 7: 68. 1900); isolectotypes, K!, MO!, NY!].

Glycosma ambiguum A. Gray, Proc. Amer. Acad. Arts 8: 386. 1872. *Osmorhiza ambigua* (A. Gray) Coult. & Rose, Rev. N. Amer. Umbell. 119. 1888. *Myrrhis ambigua* (A. Gray) E. Greene, Fl. francisc. 332. 1892. *Washingtonia ambigua* (A. Gray) Coult. & Rose, Contr. U.S. Natl. Herb. 7: 69. 1900. TYPE: U.S.A. Oregon: Marion Co., foot of the Cascade Mts., Wolford's Orchard, Silver Creek, *Hall 217* [lectotype, GH! (designated by Coulter & Rose, Contr. U.S. Natl. Herb. 7: 69. 1900); isolectotypes, F!, GOET!, K!, MO!, NY!].

Glycosma maxima Rydb., Bull. Torrey Bot. Club 40: 67. 1913. TYPE: U.S.A. Utah: Juab Co., Mt. Nebo, *Rydberg & Carlton 7585* (holotype, NY!; isotype, RM!).

Plants robust, (3–)4–12 dm high; stems (1–)3–6(–8), erect or slightly ascending at the base, villous to hirsute just below the nodes, villosulous to glabrous elsewhere, and often glaucous. Root system deep, extensively branched, the roots with a strong, heavy anise-like fragrance. Leaves bipinnate, oblong to ovate, (8–)10–22 cm long, hirsutulous or more often glabrous; leaflets broadly lanceolate to ovate, 2–10(–12) cm long, 1–4(–5) cm wide, acute, serrate and incised or lobed at the base; petioles 5–25(–30) cm long. Umbels rather constricted; peduncles 2–4(–5), terminal and lateral, 6–18(–22) cm long; involucre wanting, or occasionally composed of 1–2 minute, linear, foliaceous, ciliate, spreading bracts; rays spreading-ascending to nearly erect, (2.8–)3–8 (–9.5) cm long; umbellets (3–)5–15 per umbel, (1–)3–10(–12) of them producing only staminate flowers; involucel wanting, or sometimes of 1 (–2) minute, linear-lanceolate, acuminate, ciliate bractlets; pedicels (7–)9–22(–25) per hermaphrodite umbellet, (6–)8–16(–18) per staminate umbellet, spreading to ascending, those of the hermaphrodite flowers (2–)2.5–7(–10) mm long, those of the staminate flowers 2–4.5(–6) mm long. Hermaphrodite flowers (1–)2–6 per umbellet, (1–)8–20(–45) per umbel, staminate flowers (6–)8–20(–22) per hermaphrodite umbellet, (73–)100–200(–225) per umbel; corolla yellow to greenish yellow, rather showy; styles plus stylopodium (0.7–)0.9–1.4(–1.8) mm long, stylopodium (0.1–)0.3–0.6 mm long, low-conic, with a conspicuous disc; carpophore cleft about one-third of its length. Fruit linear-fusiform, slightly constricted below the apex, rather deeply concave furrowed, (12–)13–22 mm long, the ribs glabrous throughout, the caudate appendages lacking, or very rarely to 1.5 mm long. $n = 11$ (Bell & Constance, 1957). Figures 9d and 19.

Flowering period. May to early July.

Habitat. Moist to rather dry forests, thickets, and open slopes.

Common names. Bald cicely, Mountain

sweet cicely, Sheep cicely, Sierra sweet cicely, Sweetanise, Sweetroot, Western sweet cicely, Western sweetroot.

Representative specimens. U.S.A. CALIFORNIA: Alpine Co., Red Lake, 2,440 m, *Johnson 130* (CS, NY, UC); Humboldt Co., NW slope of Black Mt., 760 m, *Tracy 8810* (CAS, JEPS, MO, NY, UC); Modoc Co., S slope of Eagle Peak, 2,440 m, *Alexander & Kellogg 5101* (UC); Mono Co., Sweetwater Canyon Creek, Sweetwater Mts., 2,440 m, *Alexander & Kellogg 3924* (JEPS, MO, UC); Nevada Co., S of Donner Pass, 2,600 m, *Heller 7183* (CAS, MICH, MO, NY, P, RM, UC); Sierra Co., *Lemmon 89* (MO, NY); *Rose 34375* (K); Siskiyou Co., Shackelford Creek, 1,220 m, *Butler 1668* (CAS, MO, NMC, RM, UC); Tehama Co., 1 km S of Lassen Chalet, *Lowry 849* (ILL, UC). COLORADO: Garfield Co., 10 km W of Triangle Park, *Klinger & Blumquist*, 10 July 1959 (CS); Gunnison Co., Ruby, *Baker 723* (MO, NY, UC); La Plata Co., Bob Creek, W La Plata Mts., 3,050 m, *Baker et al. 177* (MICH, MO, NY, RM, UC); Larimer Co., Rabbit Ears, *Goodding 1563* (MO, NY, RM, UC); Montezuma Co., 19 km N of Mancos, *Colyer 26* (CS); Pitkin Co., Maroon Lake, White River Natl. Forest, 2,900 m, *R. A. Nelson 7720* (CS); Rio Blanco Co., 1 km SW of Wilson Creek Camp, 2,350 m, *S. Tabar & J. Walker 368* (CS); Routt Co., Mts. S of Steamboat Springs, 2,595 m, *Porter 5960* (MO, NY, RM, SMU, TEX, UC). IDAHO: Bannock Co., Mint Creek Canyon, S of Pocatello, *Lingenfelter 685* (NY, UC, WTU); Blaine Co., Boulder Creek Canyon, 2,440 m, *Thompson 14092* (CAS, MICH, MO, NY, UC, WTU); Bonneville Co., 17.5 km SW of Victor, *Lowry 1118* (ILL, UC); Cassia Co., Black Pine Mts., 2,135 m, *N. H. Holmgren 3798* (NY, UC); Elmore Co., Dog Mt., N of Pine, 2,440 m, *Hitchcock & Muhlick 8726* (NY, UC, WTU); Fremont Co., above Blair Lake, Centennial Mts., 2,665 m, *Lowry 2609* (ILL, MONT, MONTU, UC); Lemhi Co., Quartzite Mt., *Hitchcock 14218* (MO, NY, WTU); Owyhee Co., 3 km S of Silver City, *Baker 8248* (NY, WTU); Teton Co., S of Victor, *Christ 5302* (NY); Twin Falls Co., 1.5 km S of Magic Mt. Ski Area, *Holmgren & Holmgren 6013* (UC). MONTANA: Beaverhead Co., Red Rock Lakes, *Lowry 1325* (ILL, MO, UC); Cascade Co., *Hawkins s.n.* (MONT); Fergus Co., Half Moon Ridge, Big Snowy Mts., *Hitchcock 16083* (CAS, MO, MONT, NY, RM, UC, WTU); Gallatin Co., Bridger Mts., *Rydberg & Bessey 4597* (K, MONT, RM, UC); Glacier Co., Midvale, *Umbach 389* (CAS, MONT, WIS); Granite Co., 3 km W of Skalkaho Rd. Summit, *Hitchcock & Muhlick 14479* (MO, NY, UC, WTU); Missoula Co., Missoula, *Kirkwood 1228* (CAS, MO, MONT, UC); Park Co., 3 km S of Livingston, *Booth 62156* (MONT); Silver Bow Co., Humbug Spires, *Lowry 2886, 2913* (ILL, MONT, MONTU, UC). NEVADA: Elko Co., Ruby Mts., *Gentry & Davidse 1806* (ILL, NY, RM, TEX, UC); Humboldt Co., Pine Forest Range, *Holmgren & Reveal 1202* (MICH, NY, TEX, UC); Lander Co., Kingston Canyon, Toiyabe Mts., *Tidestrom 10889* (MO); Nye Co., N Kawich Range, 2,045 m, *Beatley & Reveal 11221* (CAS, NY, UC); Washoe Co., Hunter Creek, W of Reno, 1,830 m, *Kennedy 1861* (CAS, MO, NY, RM, UC); White Pine Co., Snake Range, *Holmgren & Reveal 1097* (NY, TEX, UC). OREGON: Baker Co., Powder River, *Cusick 1819* (JEPS, UC); Clackamas Co., *Goodding & Evinger*, 27 June 1927 (OSC); Clatsop Co., Saddle Mt., 715 m, *Chambers 3461* (OSC, NY); Crook Co., 3 km W of Ochoco Summit, *Kruckeberg 2153* (RM, UC, WTU); Deschutes Co., *Ireland 2663* (ORE); Grant Co., 7 km S of Long Creek, *Lowry 1094* (ILL, MO, NY, OSC, UC); Harney Co., Steens Mt., *Lowry 894* (ILL, OSC, UC); Jackson Co., Green Springs Mt., *Constance et al. 3629* (NY, SMU, UC); Klamath Co., 1.5 km N of Keno, *Peck 9426* (CAS, MO, NY); Lake Co., Crane Mt., *Thompson 13236* (CAS, MO, NY, WTU); Marion Co., Silver Creek, *Hall 217* (F, GH, GOET, K, MO, NY); Tillamook Co., *Chambers 4096* (OSC); Washington Co., Gales Creek, near Forest Grove, *Thompson 615* (CAS, MO, WTU); Wheeler Co., Wolf Mt., *Cronquist 7540* (CAS, K, NY, RM, UC, WTU). UTAH: Cache Co., Spring Hollow Canyon, 1,615 m, *Maguire 13739* (RM, UC); Garfield Co., 16 km E of Cedar Breaks, 2,450 m, *Graham 8679* (MO); San Juan Co., Abajo Mts., *Goodman & Hitchcock 1399* (MO); Summit Co., W Fork Bear River, Uintah Mts., *Payson & Payson 4936* (CAS, MO, RM, UC); Utah Co., Provo, 2,440 m, *M. E. Jones 5587* (MO, NY, RM, UC). WASHINGTON: Asotin Co., Blue Mts., above Indian Tom Cr., *Cronquist 5900* (MICH, NY, SMU, UC); Chelan Co., Tumwater Canyon, near Leavenworth, *Thompson 8451* (CAS, MO, NY, UC, WTU); Clallam Co., Mt. Angeles, 1,525 m, *Thompson 7470* (CAS, K, MO, UC, WTU); Jefferson Co., Hurricane Ridge, *Kuramoto*, 18 July 1966 (ILL); Kittitas Co., Upper Cle Elum River, *Kruckeberg 2976* (CAS, NY, RM, UC, WTU); Okanogan Co., Billy Goat Pass, 1,525 m, *Thompson 10881* (MO, NY, WTU); Spokane Co., Mt. Carleton, *Kraeger 282* (NY, UC); Yakima Co., Mt. Aix, 1,830 m, *Thompson 15056* (CAS, MICH, MO, NY, SMU, UC, WTU). WYOMING: Big Horn Co., Big Horn Mts., 2,835 m, *Gierisch 1790* (CS); Carbon Co., Lost Creek, Medicine Bow Mts., *Porter 4076* (CAS, RM, SMU, TEX, UC); Sublette Co., Middle Piney Lake, 2,500 m, *Porter 5034* (CAS, MO, RM, SMU, TEX); Teton Co., 5 km W of Teton Pass, *Lowry 1123* (ILL, UC); Uinta Co., Teton Mts., *Nelson & Nelson 6472* (BM, ILL, K, MO, NY).

CANADA. ALBERTA: Chief Mt. Int'l. Hwy., Waterton Lakes Nat'l. Park, 1,375 m, *Breitung 15930* (NY, UC); Red Rock Canyon, Waterton Lakes, 1,525 m, *de Vries 2102* (DAO); Mountain Hill, W of Pincher Creek, *Moss 56* (DAO); W of Beaver Mines, *Moss 825* (DAO). BRITISH COLUMBIA: near int'l. boundary, between Columbia River and Kettle River, 1,220 m, *Macoun 64628* (NY); near Ainsworth, 1,525 m, *Macoun*, 10 July 1890 (NY); Lightning Lake, Manning Prov. Park, 1,220 m, *Beamish & Vingtman 60770* (DAO, ILL); km 30, Flathead Rd., *Bell & Davidson 150* (DAO); 9 km SW of Rossland, *Calder et al. 9460* (DAO); Mt. Apex, SW of Penticton, *Calder & Savile 11750* (DAO, UC); 1.5 km E of Phoenix, *Calder & Savile 33076* (DAO); 21 km W of Kaslo, 900 m, *McCabe 6572* (UC); 3 km N of Howell Creek Bridge on Flathead Rd., 1,525 m, *Taylor & Ferguson 1018* (DAO, UC); 13 km N of Flathead Customs, *Taylor & Ferguson 2039* (DAO).

II. **Osmorhiza** Raf. subg. **Osmorhiza**

Osmorhiza subg. *Euosmorhiza* Drude in Engl. & Prantl, Nat. Pflanzenfam. 3[8]: 153. 1897. nom. illeg.

Scandix subg. *Uraspermum* (Nutt.) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916.

Plants slender to rather stout; stems not densely clustered, 1–3(–5), never glaucous. Root system shallow to deep, diffusely branched. Leaves 2–3-ternate; petiole bases moderately to densely ciliate. Primary umbel with more hermaphrodite and fewer staminate flowers than the secondary and later flowering umbels; staminate umbellets 0–4(–6) per umbel; staminate flowers 0–90(–125) per umbel; corolla white, or variously tinged with green, pink, or purple. Fruit hispid with retrorse bristles, or occasionally glabrous, with short to very long caudate appendages (rarely lacking).

IIa. Osmorhiza Raf. sect. **Osmorhiza**

Uraspermum § [sect.] *Osmorhiza* (Raf.) Kuntze, Lexicon 582. 1904, pro parte.
Scandix 2. [sect.] *Urascandix* Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916, pro parte.
Osmorhiza sect. *Aristatae* Constance & Shan, Univ. Calif. Publ. Bot. 23: 112. 1948, nom. nud.

Involucre composed of (1–)2–3(–5) linear to lanceolate, reflexed bracts; involucel conspicuous, composed of 3–6 reflexed bractlets. Styles (including stylopodium) 1–3.6 mm long, stylopodium 0.4–0.8 mm long, high-conic, lacking a disc.

There is no doubt that the three members of *Osmorhiza* sect. *Osmorhiza* (*O. claytonii, O. aristata,* and *O. longistylis*) are very closely related, and constitute a monophyletic assemblage; many authors (e.g., Gray, 1859; Clarke, 1879; Kuntze, 1891; Boivin, 1968) have even treated them as conspecific. These taxa, however, appear to represent distinct, natural populations. The Asian *O. aristata* is intermediate between the North American *O. claytonii* and *O. longistylis* for many characters but is clearly distinct for a number of others, including pedicel length and fruit shape.

The North American representatives of this section are completely separable from each other by many characters, including style length, total number of flowers per umbel, number of staminate flowers per umbellet, and pollen grain morphology (Lowry, 1976; Lowry & Jones, 1979a). Every one of the more than 2,250 herbarium specimens examined was clearly referable to one or the other of the two species; not a single individual exhibiting an intermediate combination of characters has been found. While pollen flow is likely in the numerous sympatric populations, there is no indication of any natural hybridization or gene flow between *O. claytonii* and *O. longistylis.*

Palynological evidence also supports the treatment of *Osmorhiza claytonii* and *O. longistylis* as distinct at the specific level (Lowry, 1976; Lowry & Jones, 1979a). The pollen grains of the two species have significantly different ratios of polar axis length to equatorial diameter (P/E ratio). Those of *O. claytonii* are generally prolate in shape, i.e., their P/E ratios are between 1.33 and 2.00 (Erdtman, 1969; Kapp, 1969). By contrast, the grains of *O. longistylis* are perprolate, with P/E ratios greater than 2.00.

2. Osmorhiza aristata (Thunb.) Rydb. *Chaerophyllum aristatum* Thunb., Fl. Jap. 119. 1784. *Myrrhis aristata* (Thunb.) Sprengel, Pl. Umbell. 29. 1813. *Uraspermum aristatum* (Thunb.) Kuntze, Revis. gen. pl. 1: 270. 1891, pro parte. *Osmorhiza aristata* (Thunb.) Rydb., Bot. surv. Nebr. 3: 37. 1894, pro parte (exclusive of North American populations). *Scandix aristata* (Thunb.) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. TYPE: Japan. *Thunberg s.n.* (holotype, UPS!).

Osmorhiza laxa Royle, Ill. bot. Himal. 233, pl. 52, fig. 1. 1839. *Washingtonia laxa* (Royle) Koso-Polj. in Fedtschenko, Fl. Asiat. Ross. 15: 52. 1920. *Washingtonia longistylis* var. *laxa* (Royle) Koso-Polj. in Fedtschenko, Fl. Asiat. Ross. 15: 52. 1920, pro syn. *Osmorhiza aristata* var. *laxa* (Royle) Constance & Shan, Univ. Calif. Publ. Bot. 23: 130. 1948. TYPE: India. Punjab: "Simore [Sirmur] in the Himalayan Mountains," *Royle s.n.* [lectotype (designated herein), K!; isolectotype, K!].
Osmorhiza japonica Siebold & Zucc., Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. IV. 2: 203. 1843. Based on *Chaerophyllum aristatum* Thunb.
Osmorhiza amurensis F. Schmidt ex Maxim., Pr. fl. Amur. 129. 1859. *Scandix amurensis* (Maxim.) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. *Washingtonia amurensis* (Maxim.) Koso-Polj. in Fedtschenko, Fl. Asiat. Ross. 15: 50. 1920, pro syn. TYPE: U.S.S.R. Khabarovsk Krai: on the lower Amur River, near the vicinity of the mouth of the Dondon, at Dshare, in deciduous woodland places, scattered, *K. I. Maximowicz,* 18 July 1855 [holotype, LE; photograph of holotype, ILL!; plus two authentic specimens (possibly isotypes), K!, LE, photographs at ILL!].
Osmorhiza claytonii (Michaux) C. B. Clarke in Hook., Fl. Brit. India 2: 690. 1879, pro parte (exclusive of *M. claytonii* Michaux and *M. longistylis* Torrey).
Osmorhiza aristata var. *montana* Makino, J. Jap. Bot. 2: 7. 1918. *Osmorhiza montana* (Makino) Makino, J. Jap. Bot. 5: 28. 1928. *Osmorhiza amuren-*

sis var. *montana* (Makino) Kitagawa, Rep. Inst. Sci. Res. Manchoukuo 2: 279. 1938. TYPE: Japan. Honshu: Totigi, Nikko, Shimotsuke, *T. Makino s.n.* (The holotype has not been located.)

Washingtonia claytonii subsp. *orientalis* Koso-Polj. in Fedtschenko, Fl. Asiat. Ross. 15: 51. 1920. (No type material has been located.)

Washingtonia claytonii subsp. *occidentalis* Koso-Polj. in Fedtschenko, Fl. Asiat. Ross. 15: 51. 1920. (No type material has been located.)

Plants rather stout, 3–8(–10) dm high; stems 1–2(–3), erect to ascending, villous to glabrate. Root system rather deep, spreading, with an anise-like scent. Leaves 2–3-ternate, deltoid to broadly ovate, 7–20 cm long, hirsutulous (especially along the veins) to glabrescent; leaflets oblong-oval to ovate-deltoid, (1.5–)2.5–9 cm long, 1–6 cm wide, obtuse to acuminate, coarsely serrate, incised, sparsely lobed to deeply pinnatifid at the base; petioles 5–25 cm long. Umbels loose; peduncles 2–3(–4), terminal and lateral, (3.5–)5–25 cm long; involucre composed of 1–3(–5) linear to lanceolate, foliaceous, ciliate, reflexed bracts, or sometimes wanting, each (1–)2–10(–25) mm long, (0.3–)0.5–1.3(–4.5) mm wide; rays spreading to ascending, (3.5–)4.5–11 cm long; umbellets 3–6 per umbel; involucel of (3–)4–5 linear to lanceolate, acuminate, ciliate to hirsutulous bractlets, each (1–)2.5–10(–11) mm long, 0.5–1.7(–2) mm wide, strongly reflexed; pedicels (4–)5–15 per umbellet, spreading, those of the hermaphrodite flowers (5–)9–30(–33) mm long, those of the staminate flowers 2.5–9(–10) mm long. Hermaphrodite flowers 2–6(–7) per umbellet, (10–)15–30(–38) per umbel, staminate flowers (2–)3–7(–11) per umbellet, (7–)15–40 (–50) per umbel; corolla white, somewhat showy; styles plus stylopodium 1.5–2.2(–2.4) mm long, stylopodium (0.4–)0.45–0.7 mm long, high-conic, lacking a disc; carpophore cleft about to the middle. Fruit linear-clavate, obtuse or abruptly acute at the apex, concave furrowed, (13–)15–22(–23) mm long, the ribs sparingly to moderately hispid with retrorse bristles, especially toward the base, the caudate appendages (4.5–)5.5–11 mm long. $n = 11$ (Wanscher, 1932). Figures 9a and 12.

Flowering period. April to early June.

Habitat. Moist woods, at lower and middle elevations.

Common names. Ihari (Nepalese), Hsiang Kên Ts'ao Shu (Chinese), Miyama-yabu-ninzin, Nagajirami, Nagazirami, Onaga-yabu-ninzin, Yabu-ninjin, Yabu-ninzin (all Japanese).

Representative specimens. CHINA. GUIZHOU: *Cavalerie & Fortunat 2961* (K, P, UC). HUBEI: *Henry 5789* (BM, K, P); S of Wushan, *Wilson 1044, pars* (K, NY, P); Paok'ang, *Wilson 1044, pars* (P). JIANGSU: P'ang-huang-chen, *Chiao & Cheo 3541* (NY). JIANGXI: Lushan Mts., *Chung & Sun 295* (NY). JILIN: Manchuria, *Komarov 1158* (BM, K, P). SICHUAN: Pao-hsing-hsien, *Chu 3336, 3495* (BM); Tchen-keou-tin, 1,400 m, *Farges 72* (K, P, UC); Cheto Valley, Kangting (Tachienlu) Dist., 3,100 m, *Smith 10963* (BM); Kiala, *Soulié 1143* (P); S of Wushan, *Wilson 1044, pars* (K). XIZANG: Rongshar Valley, N of Mt. Everest, 2,900 m, *Hingston 183* (K); 28°25'N, 97°55'E, 3,250 m, *Kingdon-Ward 10092* (BM); Valley of Lilung Chu, between Charko and Lilung, 29°04'N, 93°56'E, 3,100 m, *Ludlow et al. 4460* (BM); Peding, Tsangpo Valley, 29°30'N, 94°20'E, 3,000 m, *Ludlow et al. 4533* (BM); Pe, 29°31'N, 94°54'E, 2,960 m, *Ludlow et al. 5320* (BM). YUNNAN: Ma-eul-chan, 3,000 m, *Delavay 3902* (P); Yungning, *Handel-Mazzetti 7049* (N—not seen; reported in Constance & Shan, 1948); N of Mengzi, 2,600 m, *Henry 10233* (K, MO, NY). ZHEJIANG: W of Tien-mu, *Hu 1654* (UC).

JAPAN. HOKKAIDO: Hakodate-si, Jesso Island, near Hakodate, *Albrecht s.n.* (K); Hakodate, *Faurie 473* (P); Iwanai-tyo, Iwanai, *Faurie 7024* (P); Kamikawa-tyo, foot of Mt. Kuro-dake, *Hiroe 6628* (UC); Minami-huramo-tyo, Mt. Tomamu, *Hiroe 6730* (UC); Monbetu-tyo, Monbetu, *Faurie 709* (K, P); Rebun-tyo, Rebun Island, *Hiroe 7611* (UC); Risiri-tyo, Mt. Rishiri, Rishiri Island, *Hiroe 7541* (UC); Rubesibe-tyo, Onneyu, *Okamoto,* 18 Aug. 1958 (UC); Sapporo-si, Sapporo, *Tokubuchi,* 26 June 1891 (MO, NY); Yubari-si, foot of Mt. Yubari, *Hiroe 6630* (UC). HONSHU: Akita-ken, Yokobori, *Yushun,* 23 July 1905 (NY); Aomori-ken, Moura, W coast of Natsudomari-hanto, *Mimoro et al. 3551* (MO); Gunma-ken, Ikao, *Lyle,* May 1908 (BM); Hukusima-ken, Asakawa, *Mizushima,* 27 Apr. 1952 (UC); Ibaraki-ken, foot of Mt. Tsukuba, *Furuse,* 18 Apr. 1956 (UC); Iwate-ken, Nagamachi, *Iishiba,* 16 May 1926 (UC); Kanagawa-ken, Yamakita, *Faurie 3303* (P); Kyoto-hu, Mt. Otoko, *Hiroe 13565* (NY, UC, WIS); Miyagi-ken, Ninomaru, *Mori & Yashima,* 24 May 1973 (MO); Nagano-ken, Mt. Kiso-ontake, *Okuhara,* 28 Aug. 1955 (UC); Nara-ken, Mt. Kasuga, *Hiroe 16236* (UC); Niigata-ken, Niigata, *Faurie 79* (P); Osaka-hu, Mt. Chihaya, 600 m, *Hiroe 13159* (NY, UC, WIS); Saitama-ken, Karisaka Pass, *Kobayashi,* 3 Aug. 1961 (UC); Siga-ken, foot of Mt. Ibuki, *Hiroe 68* (K, NY, UC, WIS); Sizuoka-ken, ascent way of Fujinomiya, Mt. Fuji, 2,000 m, *Hiroe 12683* (UC); Tokyo-to, Komae, *Suzuki 77007* (UC); Totigi-ken, Lake Kirikomi, Nikko City, *Ono & Kobayashi,* 4 Aug. 1963 (UC); Toyama-ken, Yatsuo village, 17 km SW of Toyama, *Kirino 172* (MO); Yamagata-ken, Kabuto-iwa, *Ohashi et al. 708124* [sic] (BR, MO); Yamaguchi-ken, Hakusan Shrine, base of Castle Mt., 41 km W of Hiroshima, *Charette 1680* (UC). KYUSHU: Kagosima-ken, *Masamune,* 4 Apr. 1923 (NY); Kumamoto-ken, Aso Volcanos, Kamisikimi Takamori, 650 m, *Tokio 374* (WIS); Nagasaki-ken, Nagasaki, *Faurie 3302* (BM, P); Oita-ken, Mt. Yuhu, 1,200 m, *Tokio 1009* (WIS). SHIKOKU: Kagawa-ken, Mt. Ohtaki, 800 m, *Hiroe 15500* (UC).

KOREA. CHEJU DO: Cheju-do Island, *Jaquet 881* (K). KANGWON DO: Ullung Island, Kyongsang-Pukto, *Chung 2290* (MICH); Mt. Odae, *Chung 2728* (MICH). KYONGGI DO: Kwangnung, *Chung 2614, 7404* (MICH).

BHUTAN. Chalimarphe Timpu, 2,290 m, *Cooper 1405* (BM); Drugge Dzong, 3,050 m, *Ludlow et al. 16209* (BM).

NEPAL. PĀLPA: Lukarban Khola, W of Beni, 3,000 m, *Stainton et al. 451* (BM); Lete, S of Tukucha, Kali Gandahi Valley, 3,000–3,200 m, *Stainton et al. 1034, 5600* (BM).

INDIA. HIMACHAL PRADESH: Raiengarb Mut, 2,135 m, *Gamble 26799* (K); Swajaui Maidan, Parbatti Valley, 3,050 m, *Nath 123* (NY); Kulu-Lahoul, Punjab, *Drummond 23122, 23131, 23132* (K, UC); Nagzuda, Simla Hills, 2,250 m, *Hooker f. & Thomson*, 9 June 1849 (K, P). JAMMU: Jangla, 2,750 m, *Dudgeon & Kenoyer 386* (MO); Jammu, 2,000 m, *Hooker f. & Thomson*, 31 May 1868 (K). KASHMIR: Pahlgam, E Liddar River, 43 km N of Anantnag [Islamabad], 2,290 m, *Dickason 845* (MICH); Pahlgam, 2,200 m, *Stewart 9271* (NY). UTTAR PRADESH: below Budhi, Byans, Kumaun, 2,600 m, *Duthie 5595* (BM, K); Bamon Valley, 2,135 m, *Duthie*, 15 May 1897 (P); Jaunsar Bahar, near Kinani Pani, 2,600 m, *Gamble 1136* (K); Jaunsar, Chaelipup, *Gamble 23589* (K); Kedar Kantah Mts., *Jacquemont 830* (P); Kumaon, Lahai, 2,285 m, *Strachey & Winterbottom s.n.* (BM, BR, K); Garhwal, *Thomson 1254* (K).

PAKISTAN. KASHMIR: Kishenganga Valley, Rd. to Nanga Parbat via the Gangabal Lakes, Keran, 1,850 m, *Stewart & Stewart 17544* (NY, UC).

U.S.S.R. ALTAYSKIY KRAY: Teletskoe Ozero Tulkuy, *Koshurnikova & Vishniovskya*, 19 July 1927 (NY). KHABAROVSKIY KRAY: lower Amur River, at Dshare, *Maximowicz*, 18 July 1855 (K, LE). PRIMORSKIY KRAY: Kedrovaja Padj Reservation, SW of Vladivostok, *Gorovoy 8* (UC); S Ussuriysk, Pos'yet Dist., *Saberkin 890* (NY). SACHALIN: Sachalin Island, *Schmidt s.n.* (K).

Royle (1839) considered Himalyan populations of *Osmorhiza* conspecific with short-styled populations in North America now treated as *O. claytonii* (Michaux) C. B. Clarke, and accepted the name *O. brevistylis* DC. for them. Similarly, several authors (e.g., Gray, 1859; Hayata, 1911, 1912) incorrectly applied the name *O. longistylis* (Torrey) DC. to Asian populations of *Osmorhiza*.

Constance and Shan (1948) treated all the Asian representatives of *Osmorhiza* under *O. aristata*, although they distinguished two varieties on the basis of characters of the leaves. Quantitative evaluation of morphological characters, however, does not support the recognition of infraspecific taxa within *O. aristata* (Table 4).

3. Osmorhiza claytonii (Michaux) C. B. Clarke. *Myrrhis claytonii* Michaux, Fl. bor.-amer. 1: 170. 1803. *Chaerophyllum claytonii* (Michaux) Persoon, Syn. sp. pl. 1: 320. 1805. *Osmorhiza claytonii* (Michaux) C. B. Clarke in Hook., Fl. Brit. India 2: 690. 1879, sensu stricto (exclusive of *M. longistylis* Torrey and *O. laxa* Royle). *Washingtonia claytonii* (Michaux) Britt. in Britt. & Brown, Ill. fl. 2: 530. 1897. *Scandix claytonii* (Michaux) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. TYPE: U.S.A. "*In montibus* Alleghanis," *A. Michaux s.n.* (holotype, P!).

Scandix dulcis Muhlenb., Cat. pl. 31. 1813. *Myrrhis dulcis* (Muhlenb.) D. Eaton, Man. bot. 326. 1818. *Uraspermum dulce* (Muhlenb.) Farwell, Amer. Midl. Naturalist 9: 273. 1925. Based on *Myrrhis claytonii* Michaux.

Uraspermum hirsutum Bigelow, Fl. boston. 112. 1824. TYPE: U.S.A. Massachusetts: "Woods on the Concord turnpike," *Bigelow s.n.* (No type material has been located.)

Osmorhiza brevistylis DC., Prodr. 4: 232. 1830. *Myrrhis brevistylis* (DC.) Dietr., Syn. pl. 2: 984. 1840. *Uraspermum aristatum* α [subsp.] *brevistyle* (DC.) Kuntze, Revis. gen. pl. 1: 270. 1891. *Osmorhiza aristata* var. *brevistylis* (DC.) Boivin, Phytologia 17: 104. 1968. TYPE: U.S.A. New York: Range Co., West Point, *Torrey s.n.*, 1828 [lectotype (designated herein), G-DC!; isolectotypes (2), G-DC!].

Osmorhiza villosa Raf., Med. fl. 2: 249. 1830 (as "*vilosa*"). (No type material has been located.)

Osmorhiza cordata Raf., Med. fl. 2: 249. 1830. (No type material has been located.)

Uraspermum aristatum α [subsp.] *brevistyle* [var.] *subintegrifoliolum* Kuntze, Revis. gen. pl. 1: 270. 1891. (No type material has been located.)

Uraspermum dulce var. *laevicaule* Farwell, Amer. Midl. Naturalist 9: 273. 1925. TYPE: U.S.A. Michigan: Oakland Co., Pontiac, *O. A. Farwell 5267* [lectotype, BLH! (designated by McVaugh et al., Bull. Cranbrook Inst. Sci. 34: 79. 1953); isolectotype, GH].

Osmorhiza claytonii f. *brevipilosa* Salamun, nom. inval. Although this name was provided with a Latin diagnosis and citation of a type specimen, it was never effectively published, having only been proposed in Salamun's dissertation (1950: 82).

Plants rather stout, 4–8(–10) dm high; stems 1–2(–3), erect to ascending, villous, villosulous, or sometimes essentially glabrous. Root system shallow, more or less horizontally spreading, the roots fibrous and limber, rank smelling, or sometimes weakly anise-scented. Leaves 2–3-ternate, more or less broadly ovate, 10–30 cm long, hirsutulous; leaflets ovate to lanceolate, (3–)4–8 cm long, 1.5–3 cm wide, acute or acuminate, serrate-dentate, often parted or divided at the base; petioles 5–15 cm long. Umbels loose; peduncles 2–3 (–4), terminal and lateral, 3–10(–13) cm long; involucre wanting, or often composed of 1–2(–3) minute, linear-lanceolate, foliaceous, ciliate, reflexed bracts; rays ascending, 2–8(–10) cm long; umbellets 3–5 per umbel; involucel of 3–5 linear-lanceolate, attenuate, ciliate bractlets, each 2–5

(–6) mm long, 0.4–1 mm wide, strongly reflexed; pedicels 4–7(–8) per umbellet, ascending, those of the hermaphrodite flowers (4–)6–12(–15) mm long, those of the staminate flowers (3–)3.5–5.5 (–7) mm long. Hermaphrodite flowers 2–5(–7) per umbellet, (6–)10–23(–31) per umbel, staminate flowers 0–5(–6) per umbellet, (2–)7–17(–23) per umbel; corolla white, inconspicuous; styles (including stylopodium) 1–1.5(–1.7) mm long, stylopodium 0.5–0.75(–0.8) mm long, high-conic, lacking a conspicuous disc; pollen prolate in shape; carpophore cleft about one-fourth of its length. Fruit oblong-fusiform, tapering to a short, attenuate beak at the apex, concave furrowed, (10–)12–22(–25) mm long, the ribs sparingly to moderately hispid with retrorse bristles, especially toward the base, the caudate appendages 4.5–8.5 mm long. $n = 11$ (Bell & Constance, 1957). Figures 9b and 10.

Flowering period. April to early June.

Habitat. Dense to open deciduous forests, tending toward the more moist, lower areas.

Common names. Clayton sweetroot, Hairy sweet cicely, Sweet jarvil, Woolly sweet cicely.

Representative specimens. U.S.A. ALABAMA: Madison Co., Huntsville, *Baker,* 23 May 1897 (MO, NY). ARKANSAS: Independence Co., *Thomas 38940* (TENN). CONNECTICUT: Hartford Co., Southington, *Bissell 83* (NY). DELAWARE: Newcastle Co., near Wilmington, *Canby s.n.* (NY). GEORGIA: Union Co., *Duncan 22356* (GA). ILLINOIS: Bureau Co., *Evers 80102* (ILLS); Champaign Co., Brownfield Woods, N of Urbana, *Lowry 1206* (ILL); Crawford Co., *Evers 43236* (ILLS); Hancock Co., *M. J. Warnock 215* (ILL); Lake Co., Waukegan, *Umbach 5355* (UC); La Salle Co., Starved Rock State Park, *Greenman et al. 27* (GH, NY, UC); Lee Co., 5 km NE of Franklin Grove, *G. N. Jones 15839* (ILL, MO); Macon Co., Spittler Woods, Mt. Zion, *Lowry 545* (ILL, MO, UC); McLean Co., Funk's Grove, S of Bloomington, *Lowry 1140* (ILL); Piatt Co., Allerton Park, near Monticello, *Lowry 211* (ILL, MO). INDIANA: Adams Co., 3 km W of Geneva, *Deam 50233* (WIS); Fountain Co., Portland Arch, *Lowry 1208* (ILL); Lake Co., 6 km N of Schneider, *Salamun,* 5 Aug. 1947 (ILL, UC); Morgan Co., 4.5 km N of Martinsville, *Heiser & Smith,* 19 May 1950 (ILL, MO, UC); Parke Co., Turkey Run St. Park, *Salamun,* 6 Aug. 1947 (ILL, MO). IOWA: Clayton Co., Pike's Peak, McGregor, *Shimek,* 8 Aug. 1922 (UC); Dickinson Co., 3 km W of Milford, *Thorne 12907* (UC); Hardin Co., Iowa Falls, *Shimek,* 27 July 1922 (NY); Poweshiek Co., Grinnell, *M. E. Jones 146* (GOET, NY). KANSAS: Doniphan Co., *Stephens 58060* (KANU); Leavenworth Co., *A. S. Hitchcock 701* (GH, NY, RM). KENTUCKY: Carter Co., Carter Caves, *Brown 3940* (NY); Greenup Co., 4.5 km from Boyd Co. line, *Smith et al. 3580* (F, GH, NY, US); Madison Co., Berea, *McFarland 4294* (MO). MAINE: Aroostook Co., Fort Fairfield, *Fernald 51* (GH, MO, UC, US); Knox Co., Camden, *LeBean,* 13 Aug. 1913 (WIS); Somerset Co., Skowhegan, *Eaton,* 30 June 1903 (LL, NY). MARYLAND: Alleghany Co., Cumberland, *Shriver s.n.* (NY); Howard Co., Ellicott City, *Arsène,* 26 July 1916 (MO). MASSACHUSETTS: Berkshire Co., Florida, Deerfield River, *Fernald & Long 10088* (GH); Middlesex Co., Malden, *Manning,* 6 June 1881 (NY). MICHIGAN: Arenac Co., Mud Lake, *Sharp et al.,* 20 June 1961 (MICH); Baraga Co., Big Limestone Mt., L'Anse, *Fassett 21037* (WIS); Cheboygan Co., Monroe Lake, *Ehlers 374* (GH, MO, US); Emmet Co., 3 km W of Mackinac City, *McVaugh 9430* (MICH, MO); Gogebic Co., Gogebic Lake, *Fassett 19868* (F, MO, NY, WIS); Keweenaw Co., Isle Royale, *McFarlin 2149* (MONT); Schoolcraft Co., 8 km W of Gulliver, *Salamun,* 19 July 1946 (ILL, MO). MINNESOTA: Clearwater Co., Floating Bog Bay, *Grant 2885* (MO, NY, UC); Cook Co., Mineral Center, *Rosendahl & Butters 4590* (GH, NY); Saint Louis Co., Duluth, *Lakela 2071* (MO); Wabasha Co., 10 km N of Reed's Landing, *M. J. Warnock 1463* (ILL). MISSOURI: Dallas Co., 8 km SW of Bennett Springs, *Conrad 3496* (MO); Jackson Co., Kansas City, *MacKenzie,* 16 May 1896 (MO, NY); Lincoln Co., Mill Creek, NE of Silex, *Steyermark 25981* (F, MO); Mercer Co., 5 km NE of Saline, *Palmer & Steyermark 41324* (MO, NY). NEBRASKA: Cherry Co., NE of Valentine, *Churchill 4489* (MO, NY); Cuming Co., 2 km SSE of Beemer, *Churchill 5516* (NY); Dixon Co., Ponca, *Clements 2564* (US); Washington Co., 4 km NW of Fort Calhoun, *Churchill 5328* (MO). NEW HAMPSHIRE: Grafton Co., N Woodstock, *Fernald 386* (BM, BR, CAS, DUKE, G, GH, K, KANU, MO, MONTU, NY, PH, RM, SMU, TENN, TEX, UC, US). NEW JERSEY: Bergen Co., W of Englewood, *Wilson,* 19 July 1915 (NY); Middlesex Co., Plainfield, *Tweedy s.n.* (GOET). NEW YORK: Chautauqua Co., Bemus Pt., Lake Chautauqua, *Churchill,* 2 Aug. 1896 (MO); Greene Co., Big Hollow, *Barnhart 2344* (NY); Herkimer Co., 2.5 km SW of Dart Lake, *Smith 2504* (WIS); Monroe Co., Webster, *Matthews 4164* (UC); Rensselaer Co., Brunswick, *House 26381* (MO, TEX). NORTH CAROLINA: Haywood Co., 1 km NW of Blue Ridge Parkway on Hwy. 276, *Lowry 1153* (ILL); Macon Co., 1 km SW of Swain Co. line on Hwy. 19, *Lowry 1152* (ILL, UC); McDowell Co., Curtis Creek, Blue Ridge Parkway, 825 m, *Feddema 3028* (RM); Mitchell Co., 1 km S of Hwy. 226 on Penland Rd., *Lowry 1155* (ILL, NY, UC); Yancey Co., 6 km NNW of Swiss, *Lowry 1154* (ILL, NY, UC). NORTH DAKOTA: Cass Co., Fargo, *Shunk s.n.* (MONT); Grand Forks Co., *Facey s.n.* (reported in Rhodora 74: 393. 1972); Richland Co., Leonard, *Stevens 1343* (UC). OHIO: Athens Co., Athens, *Abbot 12* (NY); Cuyahoga Co., Cleveland, *Greenman 710* (GH, MO); Scioto Co., Camp Gordon, Friendship, *Demaree 10648* (CAS, GH, MO). PENNSYLVANIA: Armstrong Co., *Wahl 5315* (PH); Berks Co., 3 km W of Upper Black Eddy, *Fogg 8665* (MO, PH); Cambria Co., *Wahl 9325* (PH); Juniata Co., 1.5 km NE of Peru Mills, *Wahl 10730* (PH, UC); Warren Co., *Pohl 2461* (PH). SOUTH CAROLINA: McCormick Co., *Radford 31734* (KANU). SOUTH DAKOTA: Brookings Co., Warren's Woods, *Williams & Thordaer,* 17 June 1893 (MO); Roberts Co., Big Stone Lake, *Over 14409* (US). TENNESSEE: Davidson Co., Joelton, *Svenson 93* (GA, GH); Grainger Co., *Sharp 43562* (TENN); Greene Co., Paint Creek, 1 km N of French Broad River, *Bufford et al. 18119* (MO); Knox Co., Lane's Creek, *Sharp & Herster 584* (NY).

VERMONT: Bennington Co., Red Mt., Arlington, *Seymour 21637* (MO); Caledonia Co., Peacham, *Blanchard s.n.* (MO, NY, RM); Windsor Co., Norwich, *Brown,* 20 June 1946 (SMU). VIRGINIA: Fairfax Co., Dead Run, E of Plummer's Island, *Mathias 1394* (CAS, GH, MO, NY, RM, UC, US); Smythe Co., Chatham Hill Gap, Walker Mt., *Small,* 13 June 1892 (F, GH, K, MO, P, UC). WEST VIRGINIA: Cabell Co., Pleasant Valley, *Williams & Gilbert 445* (F, GH, MO, NY, SMU); Ohio Co., Wheeling, *Mertz 1042* (F). WISCONSIN: Bayfield Co., *Koch 6881* (KANU); Forest Co., 13 km SE of Crandon, *Stearns,* 23 June 1946 (NY); Green Co., 7 km W of Monticello, *Salamun,* 10 July 1947 (ILL, MO); Outagamie Co., Appleton, *Chandler,* 18 May 1896 (UC); Trempeauleu Co., NW of Trempeauleu, *M. J. Warnock 1470* (ILL).

CANADA. MANITOBA: 6.5 km N of Moon Lake, Riding Mt. Nat'l. Park, *Mosquin 6066* (DAO). NEW BRUNSWICK: Albert Co., *Roberts 64-1655* (DAO); Charlotte Co., Grand Manan, *Weatherby & Weatherby 7327* (GH, US); Westmorland Co., *Dore 45235* (DAO). NOVA SCOTIA: Cape Breton Co., George River, *Bissell & Linder 22050* (GH); Inverness Co., Mabou, *Robinson 229* (NY); Victoria Co., Dingwall, Aspy Bay, *Churchill,* 7 July 1909 (MO). ONTARIO: Algoma Dist., *Jenkins 4909* (DAO); Carleton Co., March Twp., *Cody & Calder 480* (DAO, MO); Grey Co., 1.5 km SW of Meadford, *Soper & Shields 4603* (MO); Manitoulin Dist., Manitoulin Island, *Salamun,* 20 July 1946 (ILL, MO); Muskoka Dist., *Minshall 3076* (DAO); Oxford Co., 8 km N of Thamesford, *Soper & Shields 4506* (MO); Rainy River Dist., 8 km below Rainy River, *Garton 8670* (DAO); Russell Co., 1.5 km SE of Cumberland, *Cody & Calder 540* (DAO, MO); Thunder Bay Dist., N bank of Pigeon River at Middle Falls, *Garton 2062* (DAO, MO). PRINCE EDWARD ISLAND: Kings Co., Bear River, *Fernald & St. John 11140* (GH, UC, US). QUÉBEC: Charlevoix Co., *Cayouette 57-247* (DAO); Gaspé Co., *Lemieux 14506* (DAO); Labelle Co., Bellerive, *Lucien & Eloi 248* (UC); Lac-Saint-Jean Co., *Bouchard 70-520* (DAO, G); Matane Co., Mt. Nicolabert, Joffre, *Fernald & Pease 25208* (GH); Richmond Co., Cleveland, *Chamberlain & Knowlton,* 26 July 1923 (GH, MO); Terrebonne Co., Lac Tremblant, *Churchill,* 8 Aug. 1922 (GH, MO).

Osmorhiza claytonii is fairly uniform throughout its range. Although two varieties have been recognized on the basis of quantity of pubescence (Farwell, 1925; Salamun, 1950), examination of a large number of specimens shows that this character is highly variable in *O. claytonii,* and neither variety is upheld in this interpretation (Lowry, 1976; Lowry & Jones, 1979a).

4. **Osmorhiza longistylis** (Torrey) DC. *Myrrhis longistylis* Torrey, Fl. U.S. 310. 1824. *Osmorhiza longistylis* (Torrey) DC., Prodr. 4: 232. 1830. *Uraspermum aristatum β* [subsp.] *longistyle* (Torrey) Kuntze, Revis. gen. pl. 1: 270. 1891, pro parte (with two varieties: *laciniatum* and *subintegrifoliolum*). *Washingtonia longistylis* (Torrey) Britt. in Britt. & Brown, Ill. fl. 2: 530. 1897. *Scandix longistylis* (Torrey) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. *Osmorhiza aristata* var. *longistylis* (Torrey) Boivin, Phytologia 17: 104. 1968. TYPE: "In wet meadows near Albany, N.Y. *Tracy.* Near Geneva, N.Y. *Paine.* June. Near Hudson, N.Y. Alsop & c." (None of these syntypes has been located; only an authentic specimen collected by Paine was found, and is herein designated the neotype.) Canada. Québec: Montreal, *Paine s.n.* (neotype, NY!).

Osmorhiza dulcis Raf., Med. fl. 2: 249. 1830. *Myrrhis dulcis* (Raf.) Raf., Good book 53. 1840, pro syn., non *Scandix dulcis* Muhlenb. TYPE: U.S.A. "Mts Alleghy [sic]," *Rafinesque s.n.* [lectotype, PH! (designated by Lowry & Jones, Amer. Midl. Naturalist 101: 26. 1979); possible syntypes, G!, PH!].

Chaerophyllum dulce Fischer ex Steud., Nom. bot. 1: 339. 1841, non *Scandix dulcis* Muhlenb. (No type material has been located.)

Osmorhiza claytonii (Michaux) C. B. Clarke in Hook., Fl. Brit. India 2: 690. 1879, pro parte (exclusive of *M. claytonii* Michaux and *O. laxa* Royle).

Osmorhiza aristata (Thunb.) Rydb., Bot. surv. Nebr. 3: 37. 1894, pro parte (exclusive of Asian populations).

Osmorhiza longistylis var. *villicaulis* Fern., Rhodora 10: 52. 1908. *Washingtonia longistylis* var. *villicaulis* (Fern.) Coult. & Rose, Contr. U.S. Natl. Herb. 12: 443. 1909. *Uraspermum aristatum* var. *villicaulis* (Fern.) Farwell, Pap. Michigan Acad. Sci. 1: 96. 1931. TYPE: U.S.A. Pennsylvania: Lancaster Co., On the Conestoga, near Binkley's Bridge, in limestone, *A. A. Heller,* 21 June 1901 (holotype, GH!; isotypes, F!, G!, US!).

Osmorhiza longistylis var. *brachycoma* S. F. Blake, Rhodora 25: 110. 1923. *Washingtonia longistylis* var. *brachycoma* (S. F. Blake) House, Bull. New York State Mus. 254: 529. 1924. TYPE: U.S.A. Maryland: Montgomery Co., slope in woods, vicinity of Cabin John, *S. F. Blake 6902* (holotype, US!; isotypes, GH!, TEX!).

Osmorhiza longistylis var. *imbarbata* Salamun, Amer. Midl. Naturalist 47: 253. 1952. TYPE: U.S.A. South Dakota: Lawrence Co., wooded bank of Spearfish Creek in Spearfish Canyon, approx. ¼ mi. N of Bridal Veil Falls, *A. L. Thorne,* 12 Aug. 1949 (holotype, UWM!; isotype, WIS!).

Plants rather stout, 6–10(–12) dm high; stems 1–2(–3), erect, densely pilose to villous, or often glabrous. Root system rather deep, tending toward vertical orientation, the roots carnose (breaking with a snap), with a sweet, anise-like scent. Leaves 2–3-ternate, broadly ovate, 8–25 cm long, sparsely hirsutulous (especially along the veins) to glabrescent; leaflets ovate to oblong-lanceolate, (3–)4–10 cm long, 2–5 cm wide, acute, serrulate-dentate, often incised or parted at the base; petioles 5–16 cm long. Umbels loose; peduncles 2–4, terminal and lateral, 5–13 cm long; involucre composed of 1–3(–4) linear to lanceolate, foliaceous, ciliate, reflexed bracts, each 5–10(–15) mm long, 1–1.5 mm wide; rays ascending, 1.5–5(–7.5) cm long; umbellets 4–6(–8) per umbel, (0–)1–3 of them producing only staminate flowers; involucel of 4–6 linear-lanceolate to ovate, acuminate, ciliate bractlets, each 2.5–6(–7) mm long, 0.7–1.8 mm wide, often strongly reflexed; pedicels (7–)9–18 per hermaphrodite umbellet, 3–13 per staminate umbellet, ascending, those of the hermaphrodite flowers 4–8(–9) mm long, those of the staminate flowers 3–6(–8) mm long. Hermaphrodite flowers (2–)3–5(–7) per umbellet, (8–)15–30(–33) per umbel, staminate flowers (3–)4–10(–14) per hermaphrodite umbellet, (23–)35–75(–86) per umbel; corolla white, showy; styles (including stylopodium) 2–3.6 mm long, stylopodium (0.4–)0.5–0.75(–0.8) mm long, high-conic, lacking a disc; pollen perprolate in shape; carpophore cleft about one-third of its length. Fruit oblong-fusiform, acute at the apex, concave furrowed, (10–)15–21(–22) mm long, the ribs sparsely to moderately hispid with retrorse bristles, especially toward the base, the caudate appendages 4–8 mm long. $n = 11$ (Wanscher, 1932; Bell & Constance, 1957). Figures 9c and 11.

Flowering period. April to early June.

Habitat. Dense to open deciduous forests, tending toward the somewhat drier, upland sites.

Common names. Aniseroot, Longstyle sweetroot, Smoother sweet cicely.

Representative specimens. U.S.A. ALABAMA: Lauderdale Co., *Murchison 171* (AUA); Tuscaloosa Co., Warrior River above Hurricane Creek, *Harper 144* (F, GH, MO, NY, US). ARKANSAS: Benton Co., Sulphur Springs, *Demaree 4974* (GH, MO, ORE); Fulton Co., Salem, *Demaree 26020* (UC); Hot Springs Co., Dripping Springs, *Scully 938* (UC, US). COLORADO: Boulder Co., Boulder Creek, Boulder, 1,615 m, *Weber,* 7 July 1954 (CAS, UC); Larimer Co., Spring Canyon, *Osterhout 344* (F, RM). CONNECTICUT: Fairfield Co., vicinity of Green's Farm, *Pollard 37* (US); Newcastle Co., Mt. Cuba, *Commons,* 25 June 1875 (MO). DISTRICT OF COLUMBIA: Washington, *Pennell 15005* (PH). GEORGIA: Burke Co., Shell Bluff, *Pyron & McVaugh 2494* (GA); Decatur Co., *Anderson,* 30 May 1923 (RM). ILLINOIS: Champaign Co., Brownfield Woods, N of Urbana, *Lowry 1207* (ILL); Cook Co., Riverdale, *Greenman 2627* (GH, MO); Du Page Co., Naperville, *Umbach,* 8 June 1897 (MO); Grundy Co., *Evers 72569* (ILLS); Jo Daviess Co., Apple River Canyon State Park, *G. N. Jones 15859* (ILL, MO); Macon Co., Spittler Woods, Mt. Zion, *Lowry 546* (ILL, MO, NY, UC); McLean Co., Funk's Grove, S of Bloomington, *Lowry 1141* (ILL); Piatt Co., Allerton Park, near Monticello, *Lowry 540* (ILL). INDIANA: Blackford Co., Hartford, *Deam 1078* (NY); Lawrence Co., Bedford, *Kriebel 1879* (DUKE, GH); Marion Co., Indianapolis, *Friesner 16672* (GH, MO, NY, SMU). IOWA: Appanoose Co., Sedan, *Shimek,* 15 May 1902 (WIS); Decatur Co., *Fitzpatrick & Fitzpatrick,* 24 May 1897 (F, GH, NY); Dubuque Co., NW of Luxembourg, *Shimek,* 2 July 1929 (UC); Emmet Co., Ft. Defiance St. Park, *Hayden 9426* (MO); Poweshiek Co., Grinnell, *M. E. Jones 145* (CAS, GOET, NY, RM, UC). KANSAS: Cowley Co., Winfield, *White s.n.* (MO); Crawford Co., *Holland 381* (KANU); Douglas Co., N of Baldwin, *Croat 116* (MO); Greenwood Co., *Stephens 2925* (KANU, SMU); Miami Co., 5 km SSE of Fontana, *Brooks et al. 11958* (KANU, MO); Riley Co., *Norton 700* (GH, MO, NY, P, RM, US). KENTUCKY: Fayette Co., Lexington, *Short s.n.* (GH, NY, UC); Greenup Co., Big Woods, 4.5 km from Boyd Co. line, *Smith et al. 3581* (GH, NY, US); Henry Co., 0.5 km N of Sand Ripple Creek, *Gentry 932* (NY); Union Co., McCotrey School, *Shacklett 296* (GH, NY, SMU). MAINE: Aroostook Co., Ft. Fairfield, *Fernald 2020* (GH); Hancock Co., Somersville, *Rand,* 18 July 1898 (UC); Kennebeck Co., Vassalboro, *Chamberlain s.n.* (GH). MARYLAND: Montgomery Co., near Cabin John, *Blake 6902* (GH, TEX, US). MASSACHUSETTS: Berkshire Co., New Marlboro, *Churchill,* 13 June 1919 (GH, MO); Essex Co., Manchester, *Chamberlain s.n.* (NY); Suffolk Co., Waverley, *Andrews,* 16 July 1892 (ILL). MICHIGAN: Emmet Co., 3 km S of Good Hart, *McVaugh 9282* (MICH, MO); Houghton Co., Calumet, *Minns s.n.* (GH); Ingham Co., E Lansing, *Lowry 1142* (ILL); Monroe Co., 5.5 km SE of Milan, *Robertson 109* (MICH). MINNESOTA: Chisago Co., Center City, *Taylor s.n.* (NY, RM, UC, US); Clearwater Co., Bear Pt., *Moyle 207* (GH, NY, UC, US); Pipestone Co., Pipestone Nat'l. Mon., *Moore 23192* (ILL). MISSISSIPPI: Desoto Co., *Kral 8582* (LAF); Oktibbeha Co., *Lott,* 28 Apr. 1940 (MISSA); Tate Co., *Pullen 64276* (GA, LAF). MISSOURI: Franklin Co., Arboretum, Gray's Summit, *Sharp 201* (MO); Grundy Co., 20 km W of Spickard, *Steyermark 11036* (MO); Harrison Co., W of Blythedale, *Steyermark 10976* (MO); Osage Co., S of Meta, *Steyermark 69719* (MO); Phelps Co., 6.5 km SE of St. James, *Steyermark 22179* (UC); Wright Co., 3 km SE of Cedar Gap, *Steyermark 23671* (F, MO, UC). MONTANA: Cascade Co., Lower Falls of the Missouri, *Williams 275* (MONT, US); Fallon Co., *Stephens 23282* (KANU); Gallatin Co., Bozeman, *Blankinship,* 18 Aug. 1898 (MO, MONT); Stillwater Co., Absarokee, *Hawkins,* 15 June 1918 (MONT, WIS). NEBRASKA: Antelope Co., Neligh, *Harper,* 30 May 1888 (WIS); Blaine Co., Halsey, *Pool,* 21 June 1912 (MO); Richardson Co., 1.5 km N of Barada, *Reynolds 3085* (MO, UC); Sioux Co., *Stephens 16324* (KANU). NEW HAMPSHIRE: Cheshire Co., Walpole, *Fernald 417* (GH); Grafton Co., Lebanon, *Kennedy s.n.* (GH). NEW JERSEY: Burlington Co., Vincetown, *Long 9790* (GH); Gloucester Co., *Fogg 8564* (PH). NEW YORK: Delaware Co., N Harpersfield, *Topping 166* (ILL, US); Erie Co., Buffalo, *Kinnicutt s.n.* (NY); St. Lawrence Co., Hermon, *Phelps 1615* (GH, US); Suffolk Co., Cold Spring Harbor, *Banker 2830* (NY). NORTH CAROLINA: Buncombe Co., 1.5 km N of Warren Wilson College, *Lowry 1144* (ILL); Lee Co., 3 km E of Moncure, *Wood 857* (MO). NORTH DAKOTA: Benson Co., Peninsula of Lake Ibsen, *Lunell,* 8 July 1901 (NY, RM, US); Golden Valley Co., *Ste-*

phens 49996 (KANU); Pembina Co., 3 km S of Walhalla, *Willenbring 687* (MO); Richland Co., Abercrombie, *Bergman 1769* (MO, RM, UC). OHIO: Coshocton Co., *Moldenke 12516* (UC); Hamilton Co., Madisonville, Cincinnati, *Lowry 547* (ILL, MO, UC); Preble Co., Devil's Backbone, near Camden, *Cobbe 104* (CAS, G, UC); Scioto Co., Camp Gordon, Friendship, *Demaree 10647* (CAS, GH, MO, SMU, UC). OKLAHOMA: Canadian Co., Devil's Canyon, *Goodman 5060* (OKL, UC); Cherokee Co., Camp Egan, E of Tahlequah, *Goodman 6811* (ILL, OKL); Creek Co., Sapulpa, *Bush 1059* (MO, NY). PENNSYLVANIA: Berks Co., *Berkheimer 16799* (PH); Centre Co., *Wahl 17229* (PH); Elk Co., Benezett, *Wahl 612* (GH, PH); Lancaster Co., Conestoga, near Binkley's Bridge, *Heller*, 21 June 1901 (F, G, GH, US); Lebanon Co., *Wherry*, 23 May 1959 (PH); Somerset Co., *Pohl 5574* (PH). RHODE ISLAND: Kent Co., Warwick, *Congdon*, 3 June 1877 (CAS, MO, NY). SOUTH CAROLINA: Lancaster Co., *Bozeman et al. 8812* (AUA, CAS). SOUTH DAKOTA: Brookings Co., Brookings, *Thornber*, 4 July 1894 (ARIZ, MO, UC); Harding Co., W Short Pines, *Visher 459* (F); Lawrence Co., NW of Whitewood, *D'Arcy 5761* (MO). TENNESSEE: Cheatham Co., 2.5 km SE of Ashland City, *Kral 26796* (UC); Davidson Co., Nashville, *Gattinger*, 28 Mar. 1886 (F, NY, US); Knox Co., Knoxville, *Ruth 442* (MO); Lauderdale Co., *Sharp 12115* (TENN). TEXAS: Tarrant Co., near Trinity, *Ruth 601* (NY, PH, US). VERMONT: Addison Co., Hancock, *Dutton*, 21 June 1914 (GH, MO); Lamoille Co., *Knowlton*, 18 July 1916 (PH). VIRGINIA: Fairfax Co., Dead Run, E of Plummer's Island, *Mathias 1392* (CAS, GH, MO, NY, UC, US); James City Co., 1 km W of Williamsburg, *Grimes 3601* (NY); Surry Co., Claremont Wharf, *Fernald & Long 8386* (GH, MO, NY, US). WEST VIRGINIA: Berkeley Co., E of Martinsburg, *A. G. Jones 4218* (ILL, MO); Monongalia Co., Monongahela River, *Millspaugh 173* (NY); Pendleton Co., Snowy Mt., *Rydberg 9122* (NY, PH). WISCONSIN: Brown Co., Green Bay, *Schuette s.n.* (F); Iowa Co., Blue Mounds, *Clikenian et al.*, 5 June 1932 (UC); Walworth Co., *Salamun*, 12 June 1948 (ILL, MO). WYOMING: Big Horn Co., mouth of Dry Medicine Lodge Canyon, *Dueholm 9509* (RM); Converse Co., 16 km W of Douglas, *Porter 4511* (RM, WTU); Sheridan Co., Tongue Creek, N of Big Horn Coal Mine, 1,100 m, *Brink 1366* (ILL, MO).

CANADA. ALBERTA: Edmonton Dist., *Moss 6363* (DAO); Medicine Hat Dist., *Macoun 858* (GH). MANITOBA: Portage-la-Prairie Dist., 4 km N of Portage-la-Prairie, *Boivin & Breitung 6501* (DAO); Winnipeg Dist., Winnipeg, *Johnson 1044* (NY); Thalberg, *Krivda*, 20 June 1960 (NY); Ft. Ellice, *Macoun & Herriot 77116* (NY). NEW BRUNSWICK: Charlotte Co., St. Andrews, *Malte 843/29* (GH, US); Kent Co., Bass River, *Fowler*, 5 July 1873 (GOET, WIS). NOVA SCOTIA: Cumberland Co., Clay, Green Bay, *Roland 41583* (GH). ONTARIO: Elgin Co., St. Thomas, *Macoun 81729* (F); Hastings Co., Ox Pt., near Point Anne, *Soper & Shields 4656* (MO); Manitoulin Dist., S of Little Current, Manitoulin Island, *Fernald & Pease 3448* (GH, US); Northumberland Co., Presqu'ile Park, *Soper & Shields 4644* (MO); Rainy River Dist., *Garton 8862* (DAO); Thunder Bay Dist., Middle Falls on Hwy. 61, *Garton 2061* (MO, DAO). QUÉBEC: Bonaventure Co., Restigouche River, Matapedia, *Collins & Fernald s.n.* (GH); Gaspé Co., *Dansereau 180* (DAO); Missisquoi Co., *Perron 66-210* (DAO); Papineau Co., *Charlebois 1401* (DAO); Temiscamingue Co., Baie Girard, *M.-Victorin 8546* (GH, NY); Vaudreuil Co., *Gervais & Lavigne*, 4 June 1959 (G). SASKATCHEWAN: Assiniboia Dist., 8 km S of Estevan, *Boivin & Perron 11823* (DAO); Lake Centre Dist., Outlook, *Boivin & Alex 9848* (DAO); Moose Jaw Dist., Moose Jaw Creek, *Macoun 858* (NY); Qu'Appelle Dist., Qu'Appelle River, near mouth of Lake Katepwe, *Boivin & Dore 7591* (DAO); Wood Mountain Dist., 1.5 km S of Willowbunch, *Boivin & Gillett 8838* (DAO); Cypress Hills, *Breitung 4719* (DAO, MO).

Clarke (1879) included all representatives of *Osmorhiza* sect. *Osmorhiza*, including *O. longistylis*, under the name *O. claytonii*. Similarly, MacMillan (1892) included *O. longistylis* in his broad concept of *Myrrhis aristata*.

Three varieties of *Osmorhiza longistylis* have been described on the basis of quantity of indument (Fernald, 1908; Blake, 1923; Salamun, 1952). This character, however, was found to be highly variable, and thus none of these infraspecific taxa is upheld (Lowry, 1976; Lowry & Jones, 1979a).

IIb. Osmorhiza Raf. sect. **Mexicanae** Constance & Shan ex Lowry & Jones, sect. nov. TYPE: *O. mexicana* Griseb.

Uraspermum § *Osmorhiza* (Raf.) Kuntze, Lexicon 582. 1904, pro parte.

Scandix 2. [sect.] *Urascandix* Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916, pro parte.

Osmorhiza sect. *Mexicanae* Constance & Shan, Univ. Calif. Publ. Bot. 23: 112. 1948, nom. nud.

Involucrum deficiens vel interdum ab 1–3 bracteis parvis constitutum; bracteae lineares vel lanceolatae, patentes vel reflexae; involucellum generaliter conspicuum, ab 1–6 bracteolis patentibus vel reflexis constitutum. Styli cum stylopodio 0.5–1.2 mm longi, stylopodium 0.2–0.8 mm longum, depresso-conicum vel depressum, saepe cum disco conspicuo.

Involucre wanting, or sometimes composed of 1–3 small, linear to lanceolate, spreading to reflexed bracts; involucel generally conspicuous, composed of 1–6 spreading to reflexed bractlets. Styles plus stylopodium 0.5–1.2 mm long, stylopodium 0.2–0.8 mm long, low-conic to somewhat depressed, often with a conspicuous disc.

5. Osmorhiza glabrata Philippi. Linnaea 28: 653. 1856. *Uraspermum glabratum* (Philippi) Kuntze, Revis. gen. pl. 1: 270. 1891. TYPE: Chile. Bío-Bío: Santa Barbara, *C. Gay 1514* (holotype, SGO; photograph of holotype, ILL!; 2 possible syntypes, P!).

Myrrhis renjifoana Philippi, Anales Univ. Chile 85: 725. 1894. *Elleimataenia renjifoana* (Philippi)

Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 164. 1916. TYPE: Chile. Ñuble: Valle de las Nieblas, near Termas de Chillán, *F. Philippi 2029* [lectotype, SGO (no. 053472) (designated herein); photographs of lectotype, ILL!, UC!; isolectotype, SGO (no. 041594); photograph of isolectotype, ILL!].

Plants rather stout, 1–5(–6) dm high; stems 1–2(–3), erect to ascending, villous to hirsutulous, or often glabrate. Root system rather deep. Leaves ternate-bipinnate, deltoid to broadly ovate, 5–10(–13) cm long, glabrous to hirsutulous along the veins and rachis; leaflets ovate, (0.6–)1–2.5 cm long, 0.5–1.3 cm wide, acute or acuminate, laciniately lobed to parted or pinnatifid, with linear to linear-lanceolate ultimate divisions; petioles 4–12(–15) cm long. Umbels loose to somewhat congested; peduncles 2–3, terminal and lateral, 4–15 cm long; involucre wanting; rays stiffly ascending, (1–)1.5–8(–9.5) cm long; umbellets (2–)3–13 per umbel, 1–5(–6) of them producing only staminate flowers; involucel of (0–) 1–2 minute, linear, acuminate, ciliate bractlets; pedicels (3–)4–10 per hermaphrodite umbellet, 2–7(–9) per staminate umbellet, stiffly ascending to nearly erect, those of the hermaphrodite flowers (2–)2.5–7(–9) mm long, those of the staminate flowers (1.5–)2.3–5.5(–6.5) mm long. Hermaphrodite flowers (2–)3–5 per umbellet, (9–)15–30(–38) per umbel, staminate flowers (1–)2–7(–9) per hermaphrodite umbellet, (7–)15–60(–82) per umbel; corolla white, rather inconspicuous; styles (including stylopodium) (0.9–)1–2 mm long, stylopodium 0.4–0.8 mm long, conic, often with a conspicuous disc; carpophore cleft about one-third of its length. Fruit linear-fusiform, acute at the apex, concave furrowed, (13–)14–20(–25) mm long, the ribs glabrous to moderately hispid with retrorse bristles, especially toward the base, the caudate appendages (0.5–)1–6 mm long. Figures 9e and 18.

Flowering period. November to January (with one collection flowering in April).

Habitat. Seasonally moist *Nothofagus* forests to open, grassy slopes.

Common names. Glabrate sweet cicely, Andean sweet cicely.

Representative specimens. ARGENTINA. NEUQUÉN: Dept. Alumine, Parque Nac. Lanin, *Eskuche 934* (UC, WIS); Dept. Huiliches, Lago Huechu-Lauquen, *Castellanos 20507* (UC); Dept. Minas, Lagunas Epu-laquén, 1,600 m, *Boelcke et al. 10978* (UC); Cordillera del Viento, 2,000 m, *Boelcke et al. 11634* (UC); Paso del Macho, 2,280 m, *Boelcke et al. 13955* (UC).
CHILE. BÍO-BÍO: Sierra Velluda, *Poeppig 905* (BM, BR, P). COLCHAGUA: San Fernando, Termas Vegas del Flaco, *Montero O. 1214* (UC); Cordillera de Colchagua, *Pirian 159* (GH); Termas Vegas del Flaco, 2,500 m, *Zöllner 6430* (UC). CURICÓ: hills NE of Los Baños, the Quebrada, 2,500 m, *Aravena 33301* (UC). MALLECO: Volcán Longuimay, 1,500 m, *Constance & Sparre 3580* (BM, F, K, MICH, MO, UC, US). ÑUBLE: Cordillera de Chillán, *Germain s.n.* (BM, G, K); Termas de Chillán, *Jaffuel 2035, 2837, 3715, 3717* (GH); Chillán, *Philippi 3469* (UC), *s.n.* (photographs in F, NY, UC); Baños de Chillán, *Philippi & Borchers s.n.* (BM), *Werdermann 1571* (NY). SANTIAGO: Río Yeso, Lag. Pinquenes, 2,500 m, *Biese 800* (NY); Maipo, 2,700 m, *Claude-Joseph 2964* (US); Valdes-Tál (Volcántal), 2,800 m, *Grandjot s.n.* (MO, UC); valley of the Maipo River, near the Baths of Colima, 2,500 m, *Zöllner 9715* (ILL). TALCA: Laguna Maule, 2,400 m, *Zöllner 5824* (ILL, UC).

Constance and Shan (1948: 120) included *Osmorhiza glabrata* in their section "*Glycosmae*" [= subg. *Glycosma*], stating that it "is remarkable for its close similarity to *O. occidentalis.*" However, the evidence presented here indicates that the affinities of *O. glabrata* lie with *O. mexicana* and *O. brachypoda* rather than with *O. occidentalis.* Constance and Shan's misinterpretation of the relationships of *O. glabrata* most likely was due to the very limited amount of material available to them; they cite only nine collections of this species.

In their discussion of *Osmorhiza glabrata,* Constance and Shan (1948: 120) stated, "The single specimen which caused the most trouble in our study was *Pennell 12487,* from Baños de Chillán, Chile. This plant has the ascending rays and long styles of *O. glabrata,* but combines these characteristics with appendaged, bristly fruit and subentire leaflets. We can only suggest that the plant in question may be the result of interbreeding between *O. glabrata* and either *O. chilensis* or *O. obtusa* [= *O. depauperata*], all three of which occur in this area." We have tried to locate this specimen, with no success. In any case, Pennell's collection is probably much less of an anomaly than Constance and Shan suggest; appendaged, bristly fruits are not at all uncommon in *O. glabrata.* Furthermore, the occurrence of subentire leaflets in this specimen may represent an intermediate between *O. glabrata* and *O. mexicana* subsp. *mexicana.* The existence of such a specimen would not be surprising because the two taxa involved are closely related, and this would seem a more reasonable explanation than assuming intersectional hybridization involving *O. glabrata* and either *O. chilensis* or *O. depauperata.*

Clos (1848) erroneously interpreted plants referable to *O. glabrata* as being conspecific with the European species *Myrrhis odorata* (L.) Scopoli.

6. Osmorhiza mexicana Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 147. 1879. *Washingtonia mexicana* (Griseb.) Rose, Contr. U.S. Natl. Herb. 8: 337. 1905. TYPE: Mexico. *Schaffner 37* (holotype, GOET!; 2 isotypes, P!). [The holotype is marked in Grisebach's hand "*Osmorhiza mexicana m(ihi)*," his annotation for the original material. Several paratypes in GOET are marked by Grisebach "*Osmorhiza mexicana* Gr.," his annotation for authentic material other than the holotype, according to G. Wagenitz, GOET.]

Uraspermum aristatum β [subsp.] *brevistyle* var. *laciniatum* Kuntze, Revis. gen. pl. 1: 270. 1891. (No type material has been located.)

Plants slender to rather stout, stems 1–2, erect to ascending. Leaves 2–3-ternate, villous or pilose, especially on the veins below; leaflets ovate to ovate-oblong, acute to acuminate, coarsely serrate to divided at the base. Umbels loose to rather open; involucre wanting, or often composed of 1–2 linear, foliaceous, ciliate bracts; rays spreading-ascending; involucel of 1–4 linear, acuminate, ciliate bractlets. Styles (including stylopodium) 0.5–1 mm long, stylopodium low-conic to somewhat depressed, often with a disc; carpophore cleft about one-fourth of its length. Fruit variable in characters depending on the subspecies.

At their morphological extremes, the two subspecies of *Osmorhiza mexicana* (subsp. *mexicana* and subsp. *bipatriata,* see below) are very distinct. A number of truly intermediate collections, however, mark a transition between these taxa. For example, two specimens from Cerro Potosí, Nuevo León, Mexico (*C. H. Mueller 2231* and *R. A. Schneider 1108*) have fruit with retrorse bristles and short caudate appendages, but are in most other respects similar to specimens of the subspecies *bipatriata.* Typical representatives of both subspecies also occur on Cerro Potosí. Another collection, *G. C. Rzedowski 22915,* from Hidalgo, exhibits a similar intermediate combination of characters. Also, a number of collections from northern Mexico clearly referable to the subspecies *mexicana* have remarkably short fruit, indicating a certain similarity to the subspecies *bipatriata.* Furthermore, many individuals of otherwise typical *O. mexicana* subsp. *bipatriata* observed on Cerro Potosí (*Lowry & M. J. Warnock 3182, 3188*) have fruit armed with a few bristles toward the base, while others have completely glabrous fruit.

The strong similarity and intermediacy observed between the two subspecies of *Osmorhiza mexicana* has not gone unnoticed in the past. Constance and Shan (1948: 121) stated that *O. mexicana* subsp. *bipatriata* "was not included in the 'North American Flora,' because only the Mexican specimens had come to the attention of Mathias and Constance at the time that account was published (1944), and these had been regarded as somewhat aberrant representatives of *O. mexicana* (subsp. *mexicana*)."

Although Constance and Shan (1948) described the taxon *Osmorhiza bipatriata* as a distinct species they, too, recognized its strong resemblance to the plants of *O. mexicana,* citing two of the intermediates mentioned above (*Mueller 2231* and *Schneider 1108*).

6a. Osmorhiza mexicana Griseb. subsp. **mexicana**

Plants slender to rather stout, 4–8(–10) dm high; stems hirsutulous throughout. Root system rather deep, the roots weakly to rather strongly anise-scented. Leaves 2–3-ternate, broadly ovate to deltoid, 5–12(–15) cm long, villous or pilose, especially below; leaflets ovate, (1.5–)2–4 cm long, 1.5–2.5 cm wide, acute to acuminate, coarsely serrate to incised and pinnately lobed at the base; petioles 6–14 cm long. Umbels rather loose; peduncles 2–3(–4), terminal and lateral, 7–15 cm long; involucre wanting, or sometimes composed of 1–2 linear, foliaceous, ciliate bracts, each (2–)5–10 (–13) mm long, 0.3–1 mm wide; rays spreading-ascending, 2.2–10(–11) cm long; umbellets 2–5(–7) per umbel; involucel of (1–)2–4 linear, acuminate, ciliate bractlets, each (1.5–)2.5–9.5 mm long, 0.3–1 mm wide, spreading to reflexed; pedicels (2–)5–11 per umbellet, spreading-ascending, those of the hermaphrodite flowers (1–)2–8.5(–12) mm long, those of the staminate flowers 2–5(–6) mm long. Hermaphrodite flowers (2–)3–6 per umbellet, (8–)12–32 (–41) per umbel, staminate flowers (0–)2–7 per umbellet, (0–)5–25(–35) per umbel; corolla white or greenish white, somewhat showy; styles (including stylopodium) 0.6–1 mm long, stylopodium 0.2–0.5(–0.6) mm long, low-conic to somewhat depressed, often with a conspicuous disc.

Fruit linear-oblong, tapering to a short beak at the apex, concave furrowed, (10–)11–20 mm long, the ribs moderately to densely hispid with retrorse bristles, especially toward the base, the caudate appendages (1.5–)2–8.5(–10) mm long. $n = 11$ (Bell & Constance, 1966; Constance et al., 1976). Figures 9f and 17.

Flowering period. Late May to July (Mexico); July (Central America); November and December (South America).

Habitat. Moist forests, at middle and higher elevations.

Common names. Mexican sweet cicely, Mexican sweetroot, Cillandrillo (Mexican Indian; Oaxaca).

Representative specimens. ARGENTINA. CATAMARCA: Dept. Andalgalá, Comné Esquina Grande, *Jörgensen 1812* (F, GH, MO, US). CÓRDOBA: Dept. Calamuchita, Sierra Arhala de Córdoba, *Hieronymus,* 3 Dec. 1878 (UC); El Vallecito, Sierra Grande, 2,000 m, *A. T. Hunziker 8651* (UC, WTU); La Cumbrecita, 1,500 m, *Roig 17767* (UC). JUJUY: Dept. Santa Bárbara, Sierra El Centinela, 1,950 m, *Cabrera et al. 17299* (UC, WIS). SALTA: Dept. Guachipas, Alemania, 1,300 m, *Venturi 9810* (GH, K, MO). TUCUMÁN: Questa del Garabatal, Sierra del Tucumán, *Lorentz & Hieronymus 863* (GOET); near la Cienega, *Lorentz & Hieronymus 668* (GOET).

BOLIVIA. COCHABAMBA: N of Yungas, 3,200 m, *Buchtien 659* (GH, NY, US). LA PAZ: Prov. Murillo, upper Valle de Zongo, 3,500 m, *Solomon 5228* (MO), *Tate 194* (NY); near Sorata, 3,100 m, *Mandon 594* (BM, G, GH, GOET, K, NY, P, UC).

COLOMBIA. TOLIMA: Paramó de Ruiz, 3,500 m, *Lehmann 3074* (BM, K, US), *Pennell 3101* (NY, US).

COSTA RICA. ALAJUELA: San Juan, Cerrido, *Brenes,* 21 Jan. 1906 (NY). CARTAGO: Volcán de Irazú, 2,750 m, *Kuntze 2270* (K, NY); 3,000 m, *Pittier & Durand 4073* (US); Chicuá, Irazú, 2,750 m, *J. León 2680* (CR); Près du sommet de l'Irazú, 3,000 m, *Tonduz 4273* (BR, CR); Sabana larga, S of Volcán de Irazú, 2,900 m, *Pittier 44* (K), *200* (BR, CR, US). SAN JOSÉ: Cerro de las Vueltas, 2,800 m, *Standley & Valerio 43592* (K, US), *43669* (US).

GUATEMALA. CHIMALTENANGO: Chichavac, 2,500 m, *Skutch 499* (CAS, MICH); Volcán de Agua, 2,450 m, *Johnston 809* (F). HUEHUETENANGO: near Hacienda de Chaucol, Sierra de los Cuchumatanes, 3,350 m, *Nelson 3645* (GH, NY, US), *Skutch 1210* (F, GH); near Tunima, Sierra de los Cuchumatanes, 3,450 m, *Steyermark 48383* (F, UC); Cerro Chémal, Sierra de los Cuchumatanes, 3,750 m, *Steyermark 50307* (F). QUEZALTENANGO: Volcán Santo Tomás, *Steyermark 34714* (F, UC); 5 km N of Ostuncalco, Sierra Madre, 2,600 m, *Williams et al. 25467* (GH, NY, US). SACATEPEQUEZ: Volcán de Agua, above Santa María, *Bell & Duke 16987* (UC). SAN MARCOS: San Luis, 3.8 km W of Ixchiguan on road to Tacana, 3,450 m, *Beaman 3247* (GH, UC, US). SOLOLÁ: Volcán Tolimán, side facing Volcán Atitlán, 2,900 m, *Steyermark 47581* (F).

MEXICO. CHIAPAS: near San Cristobal, *Nelson 3188* (US). CHIHUAHUA: La Rocha, Sierra Mohinora, 2,300 m, *Correll & Gentry 23138* (GH, LL), *Nelson 4864* (GH, US); 16 km SW of Guadalupe y Calvo, Cerro Mohinora, *Straw & Forman 2013* (UC). DISTRITO FEDERAL: Miguel-Hidalgo Park, 3,200 m, *Bell & Duke 16778* (GH, K, MICH, MO, NY, TEX, UC); Desierto de los Leones, *Kenoyer 562* (MICH), 9 July 1938 (ARIZ), *MacDaniels 83* (F), *Sharp & Gilly 22* (MICH); Contreras, *Lyonnet 1623* (US); Sierra de Ajusco, 2,450 m, *Pringle 6615* (BM, BR, CAS, F, G, GH, GOET, K, MO, NY, P, PH, RM, UC, US); Cuarto Dinamo, 3,100 m, *A. Ventura A. 3586* (G); Los Dinamos, 3,000 m, *A. Ventura A. 3492* (G). HIDALGO: 3.8 km SW of Cabrera on Hwy. 105, 2,800 m, *Bell & Duke 16813* (MICH, TEX, UC); El Chico Nat'l. Park, 16 km NE of Pachuca, 2,750 m, *Weller 582* (UC); Real del Monte, 2,800 m, *Hernandez X. 464* (LL), *Sharp 44593* (UC); Cerro de las Ventanas, 6 km N of Pachuca, 2,900 m, *Rzedowski 26813* (CAS, MICH). JALISCO: Nevado de Colima, 2,700 m, *McVaugh 10047* (MICH, UC), *12853* (K, MICH, SMU, UC, US), *Gregory & Eiten 295* (GH, MICH, MO). MÉXICO: Valleé de Mexico, *Bourgeau 781* (BR, GH, K, UC, US); Méson Viejo, Temascaltepec, *Hinton 1308* (F, GH, K, US); Las Cruces, Temascaltepec, 3,260 m, *Hinton 4899* (BM, K, US), *Pringle 5208* (MO, US); Crucero-Agua Blanca, Temascaltepec, *Hinton et al. 8324* (ARIZ, BM, G, GH, K, LL, MO, NY, PH, TEX, UC, WTU); Vaqueria del Jacal, 3,000 m, *Liebermann 12240* (F, MO, US); Ixtapaluca, above Río Frio, 3,000 m, *Sharp & Gilly 69* (MICH). MICHOACAN: *Arsène s.n.* (CAS). MORELOS: 9.25 km W of Tres Cumbres, 2,800 m, *Steingraeber & Steingraeber 150* (UC, WIS). NUEVO LEÓN: Cerro El Infernillo, S of Galeana, 2,750 m, *Bell & Duke 16563* (UC); Hwy. 51, 40 km S of junction with Hwy. 54, 2,400 m, *Lowry & Warnock 3181a* (MO); Ojo de Agua, foot of Cerro Potosí, 2,000 m, *Sharp 45711* (NY, UC). OAXACA: Cerro de Cabeza de Vaca, trail to Cerro San Felipe, 2,750 m, *Bell & Duke 16884* (UC); Sierra San Felipe, 3,000 m, *Pringle 5547* (F, US); Cordillera de Oaxaca, 2,750 m, *Galeotti 2751* (G, K); 21 km N of Ixtlán de Juárez, 2,800 m, *Weller 566* (UC). PUEBLA: Orizaba, 3,000 m, *Liebmann 12241* (F, GH, US), *Müller 1722* (GH, NY), *Rose & Hay 5726* (US), *Standley 12241* (UC); 3,650 m, *Seaton 195* (F, GH, US); Popocatepetl, *Rose & Hay 6249* (US); Esperanza, *Purpus 7456* (MO, NY, UC, US). SAN LUIS POTOSÍ: Sierra de Alvarez, Sierra Madre Oriental, 2,300 m, *Palmer 127* (US), *Pennell 17883* (PH, US). VERACRUZ: near El Puerto, 2,350 m, *Sharp 44680* (GH, NY).

PERU. CUZCO: Ollantiatambo, 3,000 m, *Cook & Gilbert 747* (US); Veronica, between Cuzco and Machupichu, 3,500 m, *Rauh & Hirsch P1026* (UC); between Cachu-pampa and Chile-chile, 2,500 m, *Vargas 9697* (GH, K, MO, UC), 3,000 m, *Vargas 1352* (F).

Weddell (1861) and Hemsley (1880) considered Central and South American populations as *Osmorhiza brevistylis* DC.

6b. Osmorhiza mexicana Griseb. subsp. **bipatriata** (Constance & Shan) Lowry & Jones, comb. et stat. nov. *Osmorhiza bipatriata* Constance & Shan, Univ. Calif. Publ. Bot.

23: 121. 1948. TYPE: U.S.A. Texas: Jeff Davis Co., in wet ground at spring, W branch Madera Canyon on slope of Mt. Livermore, Davis Mts., *L. C. Hinckley,* 26 July 1937 (holotype, NY!; isotypes, or possibly paratypes, because label data are not identical to those of the holotype, ARIZ!, GH!).

Plants slender, 2–7 dm high; stems sparingly hirsutulous to glabrescent. Root system somewhat shallow, with a weak anise-like scent. Leaves 2–3-ternate, ovate to broadly ovate, 4–10(–14) cm long, villous or pilose, especially on the veins below; leaflets ovate to ovate-oblong, (0.7–)1.2–4 cm long, 0.5–3 cm wide, acute to acuminate, coarsely serrate-laciniate to lobed or divided at the base; petioles 4–10(–12) cm long. Umbels loose and rather open; peduncles 1–3, terminal and often lateral, 3–15(–18) cm long; involucre wanting, or often composed of 1(–2) linear, foliaceous, ciliate bracts, each 4–10 mm long, 0.5–0.8 mm wide; rays spreading-ascending, (1.4–) 1.6–6.5 (–7.5) cm long; umbellets (2–)3–9 per umbel, (0–)1–4(–6) of them producing only staminate flowers; involucel of 1–4 linear, acuminate, ciliate bractlets, each (2–)3–4.5 mm long, 0.3–1 mm wide, spreading; pedicels (3–)4–20 (–22) per hermaphrodite umbellet, (3–)4–17 per staminate umbellet, spreading, those of the hermaphrodite flowers (3–)4–7.5(–8) mm long, those of the staminate flowers (1.5–)2–3.5(–4) mm long. Hermaphrodite flowers 1–3 per umbellet, (2–)5–10 per umbel, staminate flowers (4–)6–21 per hermaphrodite umbellet, (33–)40–70(–125) per umbel; corolla white, or sometimes tinged with purple, pink, or green, rather inconspicuous; styles (including stylopodium) 0.5–0.75 mm long, stylopodium 0.25–0.3 mm long, low-conic, often with a conspicuous disc. Fruit linear-fusiform, tapering into a short beak at the apex, concave furrowed, 9–11(–12) mm long, the ribs glabrous, or with a few retrorse bristles at the base, the caudate appendages lacking, or sometimes to 1.8 mm long. Figures 9g and 17.

Flowering period. June and July.
Habitat. Moist, generally shaded ravines and canyons, from 2,100 to over 2,750 m.
Common names. None.

REPRESENTATIVE SPECIMENS. U.S.A. TEXAS: Jeff Davis Co., Upper Madera Canyon, NW side of Mt. Livermore, 2,300 m, *Hinckley 408* (F, NY), *3589* (NY, UC), *B. H. Warnock & Hinckley 4147* (NY), *B. H. Warnock 7479* (SMU, TEX).
MEXICO. COAHUILA: NW of Campo Cinco, Madera del Carmen, 2,400 m, *Lowry & M. J. Warnock 3130, 3149* (ILL, MEXU, MO, NY, TEX, UC), *Fryxell 2689* (UC), *2703* (CAS); Upper Dos Canyon, Madera del Carmen, 2,450 m, *Fryxell 2722* (MO, UC). NUEVO LEÓN: 2.2 km below microwave tower, Cerro Potosí, 3,000 m, *Lowry & M. J. Warnock 3188* (ILL, MEXU, MO, NY, TEX, UC); microwave tower, Cerro Potosí, 3,200 m, *McGregor et al. 252* (UC), *339* (NY, SMU, UC); Cerro Potosí, *Schneider 1043* (F).

The following collections exhibit combinations of characters intermediate between *O. mexicana* subsp. *mexicana* and subsp. *bipatriata*:

MEXICO. HIDALGO: Penas Largas, near Tezoantla, 2,750 m, *Rzedowski 22915* (CAS, MICH, ORE, TEX). NUEVO LEÓN: Canyon below Las Canoas, Cerro Potosí, *Mueller 2231* (GH); Hacienda La Jolla, 2,600 m, *Schneider 1108* (F).

7. **Osmorhiza brachypoda** Torrey in Durand, J. Acad. Nat. Sci. Philadelphia II, 3: 89. 1855. *Myrrhis brachypoda* (Torrey) E. Greene, Fl. francisc. 332. 1892. *Washingtonia brachypoda* (Torrey) A. A. Heller, Cat. N. Amer. pl. 5. 1898. *Scandix brachypoda* (Torrey) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. TYPE: U.S.A. California: Nevada Co., near the banks of Deer Creek, Nevada City, *H. Pratten,* July 1851. (This specimen has not been located.)

Osmorhiza brachypoda var. *fraterna* Jepson, Fl. Calif. 2: 670. 1936. TYPE: U.S.A. California: San Bernardino Co., Arroyo Seco, San Gabriel Mts., 600 m, *F. W. Peirson 451a* (holotype, JEPS!).

Plants rather stout, 3–8 dm high; stems 1–2 (–3), erect, villous to hirsutulous. Root system rather deep, the roots weakly to moderately anise-scented. Leaves 2–3-ternate, ovate to deltoid, 10–18(–20) cm long, hirsutulous, especially below and along the veins; leaflets ovate, 2–6(–8) cm long, 1–4 cm wide, acute or obtuse, coarsely serrate, incised and pinnately lobed at the base; petioles 5–18(–22) cm long. Umbels somewhat congested, peduncles 2–4, terminal and lateral, 9–18 cm long; involucre wanting, or often composed of 1–3 small (or very rarely large and leaf-like), linear-lanceolate, foliaceous, ciliate bracts; rays spreading-ascending, (3.3–)3.8–12(–12.5) cm long; umbellets 2–5 per umbel; involucel of 2–6(–7) linear to lanceolate, acute, ciliate bractlets, each (1–)2–9.5(–15) mm long, (0.3–)0.5–1.3(–5) mm wide, spreading or reflexed; pedicels (2–)4–14(–16) per umbellet, ascending, those of the hermaphrodite flowers 1–4.5(–7.5) mm long, those of the staminate flowers (2–)2.8–6(–6.5) mm long.

Hermaphrodite flowers (1–)2–10 per umbellet, (6–)10–35(–43) per umbel, staminate flowers (0–)1–6(–8) per umbellet, (0–)5–30(–40) per umbel; corolla greenish white, somewhat inconspicuous; styles (including stylopodium) (0.6–)0.7–1.2(–1.3) mm long, stylopodium 0.2–0.5(–0.6) mm long, low-conic to somewhat depressed, often with a conspicuous disc; carpophore cleft about one-third of its length. Fruit oblong-fusiform, tapering to a narrow beak at the apex, deeply concave furrowed, (12–)13–18(–20) mm long, the ribs densely hispid with retrorse bristles, especially toward the base, the caudate appendages (0.5–)0.9–3.8(–4) mm long. $n = 11$ (Constance et al., 1976). Figures 9h and 16.

Flowering period. March to early May.

Habitat. Seasonally moist forests at lower to fairly high elevations in the mountains.

Common names. California cicely, California sweet cicely, Orris root, Sweet cicely.

Representative specimens. U.S.A. ARIZONA: Gila Co., Collom Camp, base of Mazatzal Mts., 1,200 m, *Collom 866* (ARIZ, UC); Hells Canyon, Mazatzal Mts., *Harrison et al. 7815, 7830* (ARIZ). CALIFORNIA: Amador Co., 2.5 km E of Oleta, *Raven 9123* (CAS, JEPS); Contra Costa Co., Mt. Diablo, 300 m, *Bowerman 2108* (CAS, UC); Kern Co., mouth of Kern Canyon, Greenhorn Mts., *Benson 3342* (CAS, NY, RM); Los Angeles Co., Evey Canyon, N of Claremont, *Lowry 1481, 1482* (ILL); Monterey Co., Arroyo Seco Camp, 29 km NW of Greenfield, Santa Lucia Mts., 760 m, *Constance 3311* (ARIZ, CAS, G, K, MO, NY, RM, UC); Orange Co., Silverado Canyon, Santa Ana Mts., 380 m, *Munz & Harwood 3722* (NY, RM); Riverside Co., Temescal, *Hall 886* (UC); San Benito Co., Idria, *Ferris 7028* (CAS, NY); San Bernardino Co., near San Bernardino, 350 m, *Parish 4165* (BM, K, NY, UC); San Diego Co., Cuyamaca, *Abrams 3838* (BM, CAS, G, K, MO, NY, UC, Z); Santa Barbara Co., Santa Barbara, *Elmer 3879* (CAS, K, MO, NY, WIS, Z); Santa Clara Co., Alum Rock Park, *Heller 8481* (G, MO, NY, WIS); Sierra Co., Downieville, *Bigelow s.n.* (NY); Tuolumne Co., Hetch-Hetchy Trail, Yosemite Nat'l. Park, 1,500 m, *Hall & Babcock 3379* (ARIZ, NY, RM, UC); Ventura Co., Sulphur Mt. Spring, Sulphur Mts., *Abrams & McGregor 24* (CAS, G, NY, Z).

IIc. Osmorhiza Raf. sect. **Nudae** Constance & Shan ex Lowry & Jones, sect. nov. TYPE: *O. chilensis* Hook. & Arn.

Uraspermum § *Osmorhiza* (Raf.) Kuntze, Lexicon 582. 1904, pro parte.

Scandix 2. [sect.] *Urascandix* Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916, pro parte.

Osmorhiza sect. *Nudae* Constance & Shan, Univ. Calif. Publ. Bot. 23: 113. 1948, nom. nud.

Involucrum deficiens vel raro ab 1(–2) bracteis minutis constitutum; involucellum deficiens vel raro ab 1(–2) bracteolis minutis constitutum. Styli cum stylopodio 0.2–1.1 mm longi, stylopodium 0.1–0.6 mm longum, conicum vel leviter depressum, saepe cum disco conspicuo.

Involucre wanting, or rarely composed of 1(–2) minute bracts; involucel wanting, or rarely composed of 1(–2) minute bractlets. Styles (including stylopodium) 0.2–1.1 mm long, stylopodium 0.1–0.6 mm long, conic to somewhat depressed, often with a conspicuous disc.

8. Osmorhiza chilensis Hook. & Arn., Bot. Beechey Voy. 26. 1830. TYPE: Chile. Concepción: Concepción, *Lay & Collie,* 9–20 Oct. 1825. (This specimen has not been located.)

Osmorhiza berterii DC., Prodr. 4: 232. 1830. *Myrrhis berterii* (DC.) Dietr., Syn. pl. 2: 984. 1840. *Uraspermum berteroi* [sic] (DC.) Kuntze, Revis. gen. pl. 1: 270. 1891. TYPE: Chile. "*in sylvis umbrosis prope Tagua-Tagua,*" *C. Bertero 446* (holotype, G-DC!; isotypes, G!, GH!, P!).

Schudia chilensis Molina ex Clos in C. Gay, Fl. chil. 3: 143. 1848, pro syn.

Scandix clavata Banks & Sol. ex Hook. f., Fl. antarct. 2: 288. 1846, pro syn.

Osmorhiza nuda Torrey, Pacific railroad rep. 4[1]: 93. 1857. *Uraspermum nudum* (Torrey) Kuntze, Revis. gen. pl. 1: 270. 1891. *Myrrhis nuda* (Torrey) A. A. Heller, Cat. N. Amer. pl. 5. 1898. *Osmorhiza divaricata* var. *nuda* (Torrey) M. E. Jones, Bull. Montana State Univ., Biol. Ser. 15: 42. 1910. *Scandix nuda* (Torrey) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. TYPE: U.S.A. California: Napa Co., Shady woods, *J. M. Bigelow,* 27 Apr. 1853 or 1854 [lectotype, NY! (designated by Coulter & Rose, Contr. U.S. Natl. Herb. 7: 66. 1900); isolectotypes, GH!, K!].

Osmorhiza berterii var. *glacilior* Philippi, Anales Univ. Chile 85: 726. 1894. TYPE: Chile. "In Andibus provinciae l. d." Chihuim, *O. Philippi,* Jan. 1887 (holotype, SGO; photograph of holotype, ILL!).

Osmorhiza divaricata Nutt. ex Britt. in Britt. & Brown, Ill. fl. 2: 531. 1897, pro syn. *Washingtonia divaricata* (Nutt. ex Britt.) Britt. in Britt. & Brown, Ill. fl. 2: 531. 1897. *Scandix divaricata* (Nutt. ex Britt.) Koso-Polj., Bull. Soc. Imp. Naturalistes Moscou 29: 143. 1916. *Osmorhiza nuda* var. *divaricata* (Nutt. ex Britt.) Jepson, Madroño 1: 119. 1923. *Uraspermum divaricata* [sic] (Nutt. ex Britt.) Farwell, Amer. Midl. Naturalist 12: 70. 1930. TYPE: U.S.A. "Oregon woods," *Nuttall s.n.* [lectotype, NY! (designated by Coulter & Rose, Contr. U.S. Natl. Herb. 7: 65. 1900); plus two authentic specimens (likely syntypes): "Columbia plains," *Nuttall s.n.* (BM!); "Columbia woods," *Nuttall s.n.* (GH!)].

Washingtonia brevipes Coult. & Rose, Contr. U.S. Natl. Herb. 7: 66. 1900. *Osmorhiza brevipes* (Coult. & Rose) Suksd., Allg. Bot. Z. Syst. 12: 5. 1906. *Os-*

morhiza nuda var. *brevipes* (Coult. & Rose) Jepson, Madroño 1: 119. 1923. *Urasperum* [sic] *brevipes* (Coult. & Rose) Farwell, Amer. Midl. Naturalist 12: 70. 1930. TYPE: U.S.A. California: Siskiyou Co., Mt. Shasta and vicinity, *E. Palmer 2481* (holotype, US!).

Washingtonia intermedia Rydb., Mem. New York Bot. Gard. 1: 289. 1900. *Osmorhiza intermedia* (Rydb.) A. A. Heller, Mont. Coll. Agric. Sci. Stud., Bot. 1: 93. 1905. TYPE: U.S.A. Montana: Gallatin Co., Bridger Mts., 2,150 m, *P. A. Rydberg & E. A. Bessey 4595* [lectotype, NY! (designated by Constance & Shan, Univ. Calif. Publ. Bot. 23: 139. 1948); isolectotypes, K!, MONT!, US!].

Uraspermum barbatum Farwell, Amer. Midl. Naturalist 12: 70. 1930. TYPE: U.S.A. Michigan: Keweenaw Co., rocky woods, Copper Harbor, *O. A. Farwell 8490* [lectotype, BLH! (designated by McVaugh et al., Bull. Cranbrook Inst. Sci. 34: 79. 1953); isolectotype, GH! ("isotype" fide Constance & Shan, Univ. Calif. Publ. Bot. 23: 139. 1948)].

Plants slender to rather stout, 3–12(–15) dm high; stems 1–3(–4), erect, villous to hirsutulous, or sometimes essentially glabrous. Root system rather deep, well developed, the roots with a weak carrot- or anise-like scent. Leaves biternate, orbicular to broadly ovate, 4–18(–23) cm long, appressed-hispidulous to villosulous (especially along the veins), or sometimes nearly glabrous; leaflets ovate-lanceolate to nearly orbicular, (2–)3–8(–10) cm long, 1–5 cm wide, obtuse or acute, coarsely serrate to incised, parted or divided at the base; petioles 5–16 cm long. Umbels rather loose; peduncles 2–4, terminal and lateral, 5–25 cm long; involucre wanting, or rarely composed of 1(–2) minute (to very rarely large and leaf-like), linear-lanceolate, foliaceous, ciliate, spreading bracts; rays spreading-ascending, (1.5–) 2–12(–13) cm long; umbellets 3–8 per umbel; involucel wanting, or rarely of 1(–2) minute, linear-lanceolate, foliaceous, ciliate bractlets; pedicels (2–)3–9 per umbellet, spreading-ascending, those of the hermaphrodite flowers 4–20(–25) mm long, those of the staminate flowers (1–)2–7(–9) mm long. Hermaphrodite flowers (1–)2–6 per umbellet, (5–)9–30(–39) per umbel, staminate flowers 0–4 per umbellet, 0–18(–25) per umbel; corolla greenish white (rarely pink?), rather inconspicuous; styles (including stylopodium) 0.4–1.1(–1.2) mm long, stylopodium (0.2–)0.3–0.6 mm long, high-conic to somewhat gibbous, lacking a disc; carpophore cleft about one-fourth of its length. Fruit linear-oblong, tapering to a slender beak at the apex, concave furrowed, (11–) 12–21(–25) mm long, the ribs moderately to densely hispid with retrorse bristles, especially toward the base, the caudate appendages (2–)2.5–8.5(–10) mm long. $n = 11$ (Bell & Constance, 1957; Constance et al., 1976). Figures 9j and 15.

Flowering period. April to early July (North America), November and December (South America).

Habitat. Moist forested areas to somewhat drier, open, often disturbed areas.

Common names. Common sweet cicely, Mountain sweet cicely, Mountain sweetroot, Spreading sweetroot, Sweet cicely, Sweetroot, Western sweet cicely, Western sweetroot, Wood cicely, Asta de Cabra.

Representative specimens. U.S.A. ALASKA: Hyder, *McCabe 8426* (UC); Salmon River, W of Hyder, *Robuck 1348* (RM); Deer Mt., 2 km E of Ketchikan, *McCabe 8644* (UC); Sitka, *Eastwood 966* (CAS); Todd, SE Chichagof Island, *Scamman 328* (DAO, photograph); Haines Hwy., mile 31, *Walsh & Moore 6113* (NY); Yakutat, *Piper 4280, 4283* (UC); Shaw Island, N of Cape Douglas, *Anderson 1382* (US); Unalaska Island, *Eyerdam 2256* (cited in Hultén, 1947). ARIZONA: Coconino Co., Oak Creek Canyon, 1,375 m, *Demaree 41249* (NY); Gila Co., under Mogollon Rim, 1,800 m, *Collom 753* (MO, US); Graham Co., Mt. Graham, *Peebles et al. 4483* (US). CALIFORNIA: Butte Co., Jonesville, 1,550 m, *Copeland 391* (ARIZ, BM, BR, CAS, K, MO, NY, RM, UC, WIS); Fresno Co., Huntington Lake, 2,135 m, *Grant 1173* (ARIZ, JEPS); Humboldt Co., Lady Bird Johnson Grove, Redwood Nat'l. Park, *Lowry 791, 795* (ILL); Lake Co., Summit Lake, near Mt. Sanhedrin, *Heller 5879* (CAS, G, ILL, NY, RM, UC); Lassen Co., Diamond Mt., near Susanville, 2,000 m, *M. E. Jones*, 28 June 1897 (BM, CAS, MO); Los Angeles Co., Lily Spring, Mt. Hawkins, San Gabriel Mts., *Thorne 41257* (RSA, UC); Mendocino Co., Noyo, *Constance 2518* (BM, CAS, NY, RM, UC); Modoc Co., Deep Creek, Warner Mts., 1,825 m, *Constance 3103* (K, MO, NY, UC); Monterey Co., Pfeiffer St. Park, *Mathias 1300* (RM, SMU, UC); Placer Co., Emigrant Gap, *M. E. Jones 2734* (BM, BR, CA, MO, NY, UC); San Diego Co., Stonewall Mine, Cuyamaca Mts., 1,400 m, *Parish 4421* (BM, CAS, JEPS, K, MO, NY); Santa Clara Co., W of Los Gatos, *Heller 7430* (CAS, G, MO, NY, UC, WIS); Siskiyou Co., NE base of Mt. Eddy, *Heller 12467* (CAS, G, ILL, MO, NY, UC, WIS); Sonoma Co., Petrified Forest, *Heller 5737* (CAS, G, MO, NY, RM, UC); Tehama Co., 1 km S of Lassen Chalet, *Lowry 851* (ILL); Tuolumne Co., Sullivan Creek, 1 km W of Twain Harte P.O., 1,220 m, *Alexander & Kellogg 3673* (JEPS, NY, UC). COLORADO: Archuleta Co., Piedra River, 11 km N of Arboles, 2,250 m, *H. D. Harrington 4108* (CS); Boulder Co., Boulder, 1,650 m, *Hanson C262* (ARIZ, MO); Garfield Co., 1.5 km N of Douglas Pass, *M. J. Warnock 1699* (ILL); Mesa Co., SW slope of Hightower Mt., *Kufeld K-73* (CS); Moffat Co., NE of Five Springs (Douglas Mountain) overlooking Conway Draw, 2,300 m, *J. Walker & S. Tabar 349* (CS); Rio Blanco Co., Cow Creek, 4.5 km from confluence with Piceance Creek Road, 2,195 m, *W. R. Erickson & D. Bartman 688* (CS). IDAHO: Bannock Co., Mt. Putnam, *Davis 4672* (NY); Benewah Co., 16 km S of St. Maries, *Christ 10927* (NY, UC); Bonneville Co., 17.5 km SW of Victor, *Lowry 1116* (ILL, MO, NY, RM, UC); Clearwater Co., E Fork Potlatch River, *Cronquist & Jones 5977* (CAS, NY, SMU, TEX, UC); Custer Co., Morse Canyon, Lemhi Mts., *Hitchcock & Muhlick 11275* (NY, UC); Idaho Co., Clearwater River, 6.5 km below Lowell, *Constance & Rollins 1608* (MO, UC, WTU); Lemhi Co., Jessie Creek, 1,375 m, *Payson & Payson 1884* (CAS, MO, NY, RM); Lewis Co., Mission Creek, *St. John et al. 6345* (NY, WTU); Nez Perce Co., Potlatch River, *Heller & Heller 7006* (ILL, WIS). MAINE: Aroostook Co., Ft. Kent, *MacKenzie 3509* (MO, NY); Somerset Co., E of Knight's Pond, Squaretown, *Fassett 3658* (WIS). MICHIGAN: Alger Co., Miner's Falls, near Munising, *Fernald & Pease 3450* (MICH, NY); Alpena Co., Thunder Bay Island, *Dodge*, 23 June 1907 (MICH); Baraga Co., Big Limestone Mt., L'Anse, *Fassett 21055* (WIS); Gogebic Co., 17 km NW of Ironwood, *Voss 6238* (MICH); Keweenaw Co., Copper Harbor, *Fernald & Pease 3452* (K, MICH, WIS); Wayne Co., Livonia, *Farwell 9442* (BLH). MONTANA: Beaverhead Co., Red Rock Lakes, 2,000 m, *Lowry 2580* (ILL, MONT, UC); Carter Co., 1.5 km S of Alzada, *Booth 2661* (MONT); Flathead Co., Columbia Falls, *Williams*, 22 June 1894 (MO, NY, RM); Glacier Co., Florence Falls, Glacier Nat'l. Park, 1,615 m, *Stickney 1764* (MONT); Lake Co., Flathead Lake, *Hitchcock 17734* (RM, UC, WTU); Madison Co., Bear Trap Canyon, 1,415 m, *Lowry 2560* (ILL, MO, MONT, MONTU, NY, RM, UC); Missoula Co., Grant Creek, *Kirkwood 1230* (MONT, NY); Silver Bow Co., Humbug Spires, 2,050 m, *Lowry 1999* (ILL). NEVADA: Elko Co., Lamoille Canyon, Ruby Mts., 2,285 m, *Holmgren 1354* (UC); Washoe Co., Little Valley, 2,000 m, *Baker 1363* (G, MO, NY, RM, UC). NEW HAMPSHIRE: Coos Co., Carter Notch, *Forbes s.n.* (GH); Alpine Cascade, Gorham, *Pease 16432* (GH). NEW MEXICO: Taos Co., 14.5 km S of Talpa, *Correll & Correll 33135* (TEX). OREGON: Clatsop Co., Lee Wooden Co. Park, *Lowry 1310* (ILL, MO, OSC, UC); Columbia Co., 16 km NW of Scapoose, *Lowry 593* (ILL); Douglas Co., Iverson Co. Park, *Lowry 1319* (ILL, MO, NY, OSC, UC); Grant Co., 7 km S of Long Creek, 1,460 m, *Lowry 1095* (ILL, MO, NY, OSC, UC); Harney Co., *Train*, 6 June 1935 (OSC); Hood River Co., Herman Creek Trail, *Lowry 706* (ILL, MO, OSC, UC); Jefferson Co., Jack Creek, 16 km W of Camp Sherman, *Lowry 747* (ILL, OSC); Marion Co., Silver Creek, *Hall 216* (GOET, MO, NY); Multnomah Co., Forest Park, Portland, *Lowry 626* (ILL, MO, OSC, UC); Tillamook Co., Bay City, *Morrill 162* (WTU); Wallowa Co., 0.5 km S of Wallowa Lake, 1,340 m, *Constance & Jacobs 1304* (MO, UC); Wheeler Co., 3 km NE of Ochoco Divide, *Lowry 1092* (ILL, OSC, UC). SOUTH DAKOTA: Lawrence Co., Deadwood, *Carr 130* (MO, NY, RM, WIS); Lead City, 1,800 m, *Rydberg 724* (NY). UTAH: Cache Co., Logan Canyon, 1,550 m, *Maguire 3637* (RM, UC); Salt Lake Co., City Creek Canyon, *M. E. Jones 1852* (BM, BR, G, NY, RM); Washington Co., 5 km E of Pine Valley, 2,135 m, *Gould 1846* (ARIZ, CAS, NY, UC). WASHINGTON: Chelan Co., Stehekin, 400 m, *Rose 48178* (SMU, UC); Columbia Co., Godman Spring, Blue Mts., 1,750 m, *Constance et al. 1162* (CAS, MO, UC, WIS); Grays Harbor Co., Montesano, *Heller & Heller 3975* (G, MO, NY, UC); Jefferson Co., N Fork Quinalt River, *Lowry 254a* (ILL); King Co., Seattle, *Thompson 10395* (CAS, MO, NY, WTU); Kittitas Co., 5 km W of Teanaway Junction, Wenatchee Mts., *Hitchcock 17258* (RM, UC, WTU); Klickitat Co., Bingen, *Suksdorf 10037* (BM, CAS, ILL, K, MO, NY, UC); San Juan Co., Friday Harbor, *Zeller & Zeller 768* (CAS, K, MO, NY); Skamania Co., 50 km E of Camas, *Lowry 713* (ILL); Spokane Co., Clarks Spring, N of Spokane, *Kreager 44* (NY, UC, WTU); Whatcom Co., Fairhaven Coll., Bellingham, *Lowry 629* (ILL, MO, NY, UC). WISCONSIN: Bayfield Co., 4 km S of Little Sand Bay, *Iltis & Kawano 20503* (BM, UC). WYOMING: Campbell Co., 4 km SW of Rockypoint, *Dueholm 2962* (RM); Carbon Co., S Brush Creek Campground, *Lowry 1131* (ILL, MO, NY, RM, UC); Fremont Co., Sinks Canyon, Popo Agie River, W of Lander, 2,200 m, *Scott 909* (NY, RM); Lincoln Co., Cottonwood Lake, SE of Afton, *Porter 3776* (CAS, RM, TEX); Teton Co., 5 km W of Teton Pass, *Lowry 1120* (ILL, RM, UC); Uinta Co., Teton Mts., *Nelson & Nelson 6473* (G, ILL, MO, NY, RM).

CANADA. ALBERTA: Cameron Lake, Waterton Lakes Nat'l. Park, 1,660 m, *Breitung 16175* (DAO, UC); Chief Mt., Waterton Lakes, 1,525 m, *Breitung 16842* (SMU, UC); Nordegg River, *Brinkman 4072* (DAO); Olds, *Fletcher 739* (DAO); 13 km W of Pincher Creek, *Moss 86* (DAO). BRITISH COLUMBIA: 13 km N of Flathead Customs Sta., 1,370 m, *Taylor & Ferguson 2044* (DAO); 5 km NNE of Nelson, *Calder & Savile 9405* (DAO, UC); Carbonate, Selkirk Mts., 820 m, *Shaw 219* (MO, NY, RM); Glacier Nat'l. Park, *Lowry 1012* (ILL, MO, NY, UC); 13 km W of Revelstoke, *Lowry 1016* (ILL); Friday Creek, S of Princeton, *Lowry 1020* (ILL, UC); Manning Prov. Park, *Lowry 1026a* (ILL); 11 km N of Boston Bar, *Taylor & Staudt 4197* (DAO, UC); 11 km SE of Vedder's Crossing, *Lowry 1036* (ILL, MO, NY, UC); 3 km S of Pemberton, *Lowry 644* (ILL); NW tip Saturna Island, Gulf Islands, *Calder & MacKay 28775* (DAO); Cowitcham Lake, Vancouver Island, *Rosendahl & Johnson 1857* (DAO); Ucluelet, *Macoun 78607* (NY); 16 km NE of 150 Mile House, 1,000 m, *Calder et al. 19030* (DAO); Bella Coola, *McCabe 123, 1402* (UC); Reid Lake, NW of Prince George, *Eastham 14780* (DAO); 5.5 km SW of Telkwa, *Calder et al. 15259* (DAO); 4 km W of Skeena Crossing, 250 m, *Calder et al. 13021* (DAO, UC); Skidegate Mission, Graham Island, *Calder 21427* (DAO, UC); Haines Rd., km 73.5, NW of Haines, 200 m, *Taylor et al. 1406* (DAO). NEW BRUNSWICK: Albert Co., Goshen, *Squires & Christie*, 26 June 1963 (DAO); Restigouche Co., 1 km SE of Summit Depot, *Cunningham*, 21 July 1960 (DAO). NEWFOUNDLAND: N of Doctor Hill, *Fernald & Long 28771* (K); Frenchman's Cove, Bay of Islands, *Waghorne*, 24 June 1895 (DAO, photo ex QK). NOVA SCOTIA: Inverness Co., Brigend, *Smith et al. 2589* (DAO, UC); Kings Co., Kentville, *Prince & Atwood 1011* (CAS, WIS). ONTARIO: Algoma Dist., Garden River, *Fassett 13282* (WIS); Bruce Co., Kincardine, *Anderson & Fassett 21585* (UC, WIS); Manitoulin Dist., Excelsior, Manitoulin Island, *Fassett 14833* (WIS); Thunder Bay Dist., Talus Lake, Sibley Twp., *Taylor et al. 1146* (UC). QUÉBEC: Charlevoix Co., St. Chrétien, *Cinq-Mars et al. C69-25* (DAO); Gaspé Co., Percé, *Collins & Fernald 119* (ILL, K, LL, NY, UC); Matane Co., 8 km S of Mt. Joli, *Scoggan 13595* (NY, UC); Rivière-du-Loup Co., Rivière-du-Loup, *Churchill*, 8 Aug. 1902 (SMU). SAS-

KATCHEWAN: Cypress Hills Park, *Breitung 4720, 8102* (DAO, UC).

ARGENTINA. CHUBUT: Futaleufu, Lago Futalaufquen, *Burkart 19823* (P, UC); Río Futaleufu, *Castellanos*, 24 Jan. 1945 (NY); Colonia 16 de Octobre, *Lahitte 52212* (UC); Senguerr, Lago Fontana, *Moreno s.n.* (NY); Languiñeo, Pa pa Chica, *Soriano 2488* (UC). MENDOZA: Tunuyan, Cerro de las Piedras, *Ruiz Leal 3106* (BM, UC). NEUQUÉN: Aluminé, Lago Quillén, *Valle et al. 3074* (K); Huiliches, Lago Huechulafquen, Parque Nac. Lanín, *Correa 5537* (UC); Laguna Verde, Parque Nac. Lanín, 980 m, *Correa et al. 5774* (UC); Lacár, Hua Hum, *Cabrera 11229* (UC), *DeBarba 1754* (BR, MO, TEX), *O'Donell 2331* (NY); San Martín de los Andes, *Hunziker 6910* (UC), *Ruiz Leal & Roig 18128* (UC), *Ruiz Leal 20265* (UC), *O'Donell 2399* (NY); Los Lagos, Parque Nac. Nahuel Huapí, *DeBarba 1548* (TEX), *2110* (K); Minas, Lagunas Epu-Lauquén, Aduana Vieja, 1,300 m, *Boelcke et al. 10826* (UC). RIO NEGRO: Bariloche, Parque Nac. Nahuel Huapí, *Boelcke 5246, 5659, 5842* (UC), *Boelcke & Hunziker 3417* (UC), *Cabrera & Job 98* (NY), *DeBarba 95* (NY, UC), *1127* (P), *Descole 25* (NY), *Meyer 7456* (NY); Entre Llao-Llao y Bahia López, *Meyer 8002* (NY). SANTA CRUZ: Lago Argentino, Parque Nac. "Los Glaciares," *Correa et al. 2998* (UC); Cerro Mayo, *James 3002* (BM, UC); Lago Argentino, *Ruiz Leal 26558* (UC); Lago Buenos Aires, Río Jeinemeni, entre Lago Buenos Aires y Codo Río Mayer, 500 m, *von Platen & Greiner 150* (MO, Z). TIERRA DEL FUEGO: Ushuaia, Estancia Harberton, *Constance et al. 3860* (UC), *Goodall 481* (MICH), *549* (MICH, NY), *3585* (UC); Lago Roca, *Goodall 2439* (UC); Estancia Fique, *Ruiz Leal & Roig 15117* (UC).

CHILE. ACONCAGUA: Los Ojos de Agua, *Bridger 475* (K); Zapallar (El Tigre), *Johow*, Nov. 1908 (ILL), *Looser*, 13 Oct. 1953 (UC), *Möller*, 8 Dec. 1951 (UC). ARAUCO: Contulmo, Cerro Santa Elena, *Ricardi 9248* (UC). AYSÉN: Coihaique, cercanías del Lago Seco, 750 m, *Schlegel 2321* (F); Pto. Puyuhuapi, Río Pascue, 8 m, *Schwabe 45* (NY). CAUTÍN: Temuco, *Elliot 276* (BM, NY); Temuco, Truf-Truf, *Montero O. 6371* (UC); Temuco, Fundo Huilquilco, 2 km S of Quepe, *Moore 312* (K, UC); Vilcún, 330 m, *Hollermayer 334* (UC); Pucón, La Peninsula Entrada, 250 m, *Mahu 11425* (ILL); Victoria, 16 km from Termas de Tolhuaca on rd. to Curacautin, 950 m, *Morrison & Wagenknecht 17486* (G, K, UC); Volcán Llaima, 1,100 m, *Werdermann 1246* (BM, CAS, F, G, K, MO, NY, UC, Z); Pass to Longuimay, 1,000 m, *Zöllner 5617* (ILL). CHILOÉ: Ancud, Chiloé Island, *MacMillan & Erlanson 11* (MICH); Cucao Laguna, Chiloé Island, *Philippi & Borchers*, 2 Feb. 1885 (BM). CONCEPCIÓN: Lota, *Brooke 6964* (BM); Concepción, *D'Urville 289* (P), *Holway 139* (NY); probably Talcahuano, *Poeppig s.n.* (UC). LLANQUIHUE: 10 km W of Los Muermos, *Constance & Sparre 3573* (UC); Valle Cayutue, *Rudolph 4925* (UC). MAGALLANES: 50 km SW of Puerto Natales, rd. to Punta Arenas, 30 m, *Eyerdam et al. 24181* (K, MO, UC); Sandy Point, *Lechler 1186* (GOET); Estancia Vicuña, 200 m, *Moore 2178* (K, UC); Seno Almirantazgo, ca. 8 km from mouth of Río Azopardo, 20 m, *Moore 2307* (UC). MALLECO: Fundo Solano, Los Alpes, Cord. Nahuelbuta, 1,200 m, *Eyerdam 10333* (F, UC); 1 km W of Agua Fria, W of Angol, Sierra Nahuelbuta, 650 m, *Hutchison 293* (K, UC); Termas de Tolhuaca, 1,100 m, *Looser 2746* (UC), *Solomon & Solomon 4479* (MO), *Zöllner 10201* (MO); Parque Nac. de Nahuelbuta, *Mahu 5767, 8272, 8417, 8733, 8734, 8735, 11451* (ILL), *Pincheira 7881, 8218* (ILL). ÑUBLE: Termas (Baños) de Chillán, 1,750 m, *Moore 414* (UC), *Philippi & Borchers s.n.* (BM). O'HIGGINS: La Leona, Rancaque, *Bertero 446* (P), *Guillemin 446* (P); Agua de la Vida, *Borchers s.n.* (GOET); Baños, Cauquenes, *Philippi*, Sept. 1896 (BM); upper valley of River Cachapoal, *Zöllner 9892* (ILL). OSORNO: Termas de Puyehue, 350 m, *Sparre 2128* (K). SANTIAGO: Manzano, *Looser*, 11 Nov. 1928 (UC); Quebrada de Macul, 1,100 m, *Pisano V. & Baraona L. 1572* (UC); Los Valdes, near Río Maipo, 2,500 m, *Zöllner 2079* (ILL). VALDIVIA: Valdivia, *Bridges 768* (K), *DeCandolle m. 418* (P), *Gay 124* (P), *Hohenacher 481* (K), *Hollermayer 334* (BR); Cabo Blanco, Río Cruces, *Klempau s.n.* (UC); La Unión Reserva Forestal Llancacura, *Mahu 11424* (ILL). VALPARAÍSO: Valparaíso, *Bertero 74* (F, NY, UC—all photos ex B), *Cuming 335* (K); Limache (Lliu-Lliu), *Garaventa H. 2270* (UC), *Bertero*, Oct. 1828 (BM), *Bertero 1163* (G, P), *Steudel 1163* (P); Laguna Verde, *Garaventa H. 2378* (UC); Granizo, Cajón Grande, foot of Cerro Campana, near Olmue, 15 km E of Limache, *Meyer 9704* (MO, UC), *Zöllner*, Nov. 1977 (ILL); 8 km from La Dormida on trail to Las Vizcachas, 1,100 m, *Morrison 16832* (G, K, MO, UC); Quilpué, *Zöllner 8353* (MO).

Constance and Shan (1948) were the first to recognize the conspecificity of North and South American populations of *Osmorhiza chilensis*. Previous to that, the North American material had been referred to a variety of names, including *Osmorhiza brevipes, O. divaricata, O. intermedia, O. nuda,* and *Uraspermum barbatum,* while South American specimens were identified as either *O. berterii* or *O. chilensis*. However, the similarity of plants from the two areas was mentioned by Coulter and Rose (1895) and Reiche (1902).

It has been established that the names *Osmorhiza chilensis* and *O. berterii* were both published in 1830 (Constance & Shan, 1948; cf. also Jackson, 1893; Rickett, 1945). While the month of publication for *O. berterii* most likely is September, that for *O. chilensis* is not known. However, Hooker and Arnott (1833), J. D. Hooker (1846), and Gray (1854) accepted the name *O. chilensis,* placing *O. berterii* in synonymy under it, and it was on this basis that Constance and Shan (1948) adopted the former name. We have uncovered no additional evidence that would require a different interpretation.

Bongard (1833) included Alaskan populations of *Osmorhiza chilensis* in *O. brevistylis* DC. Similarly, W. J. Hooker (1840) used an expanded concept of *O. brevistylis* to include populations from western North America now included in *O. chilensis.*

9. **Osmorhiza purpurea** (Coult. & Rose) Suksd., Allg. Bot. Z. Syst. 12: 5. 1906. *Washingtonia purpurea* Coult. & Rose, Contr. U.S. Natl. Herb. 7: 67. 1900. *Osmorhiza chilensis* var. *purpurea* (Coult. & Rose) Boivin, Naturaliste Canad. 93: 644. 1966. TYPE: U.S.A. Alaska: Sitka, *F. V. Coville & T. H. Kearney, Jr.*, 14–17 June 1889 (holotype, US!).

Washingtonia leibergii Coult. & Rose, Contr. U.S. Natl. Herb. 7: 66. 1900. *Osmorhiza leibergii* (Coult. & Rose) Blankinship, Mont. Coll. Agric. Sci. Stud., Bot. 1: 93. 1905. TYPE: U.S.A. Washington: Chelan (formerly Okanogan) Co., Sandy slopes of Nason Creek, (branch of the Wenatchee River) 1,370–2,133 m, *J. H. Sandberg & J. B. Leiberg 666* [holotype, US!; isotypes, BM!, BR!, CAS!, MO!, NY!, ORE!, P!, UC! (or possibly paratypes, as label data are not identical to those of the holotype)].

Plants slender, 2–6(–8) dm high; stems 1–2 (–3), erect to ascending, sparingly hirsutulous to glabrescent. Root system relatively deep, well developed, the roots with a weak carrot- or anise-like scent. Leaves (1–)2–3-ternate, orbicular to deltoid or broadly ovate, 3–10(–12) cm long, sparingly hirsutulous along the veins and margins, to glabrous; leaflets lanceolate to ovate, 1.5–6(–8) cm long, 0.5–4 cm wide, acute or acuminate, coarsely serrate to incised, lobed or deeply divided at the base; petioles 5–10(–12) cm long. Umbels rather loose; peduncles 2–3(–4), terminal and lateral, 3–9(–11) cm long; involucre wanting, or very rarely consisting of 1 minute, linear-lanceolate, foliaceous, ciliate, spreading bract; rays spreading-ascending, (2.7–)3–9.5(–11) cm long; umbellets (2–)3–7 per umbel, sometimes 1–2 of them producing only staminate flowers; involucel wanting; pedicels (2–)3–9 per hermaphrodite umbellet, 3–5 per staminate umbellet (when present), spreading-ascending, those of the hermaphrodite flowers (8–)9–25(–33) mm long, those of the staminate flowers 2–5(–6) mm long. Hermaphrodite flowers (1–)2–6 per umbellet, (6–)10–22(–29) per umbel, staminate flowers 0–5 per hermaphrodite umbellet, 0–18 (–24) per umbel; corolla purplish or greenish white, somewhat inconspicuous; styles (including stylopodium) (0.3–)0.4–0.8(–0.9) mm long, stylopodium 0.1–0.4 mm long, strongly depressed, with a conspicuous disc; carpophore cleft about one-fourth of its length. Fruit linear-fusiform, with an apical beak that is strongly constricted below the stylopodium, concave furrowed, (7–)8–15(–16) mm long, the ribs glabrous above and slightly to moderately hispid with retrorse bristles below, the caudate appendages 1–5(–6) mm long. $2n = 22$ (Taylor & Mulligan, 1968). Figures 9i and 13.

Flowering period. Late April to July.

Habitat. Moist coniferous forests in areas with considerable, regular precipitation.

Common names. Purplish sweet cicely, Purple sweet cicely, Purple sweetroot.

Representative specimens. U.S.A. ALASKA: Deer Mt., Revillagigedo Island, *McCabe 8644* (UC); Loring, *Chamberlain 20* (US); Yes Bay, *Gorman 23* (K, NY); Texas Creek Summit, NW of Hyder, *McCabe 8934* (UC); Misty Fjords Nat'l. Mon., *Vorobik 413* (ORE); Mt. Dewey, Wrangell Island, *Cowles 1288* (ILL); Washington Bay, Kuiu Island, *Eyerdam 8340* (G, SMU); Sitka, *Jepson 489* (JEPS); Young Bay, Admiralty Island, *Robuck 1311* (RM); Douglas Island, S of Juneau, *Trelease 4527* (US); Juneau, *Anderson 6322* (DAO, RM, TEX); Mt. Harris, St. Elias Mts., *Cowles 1402* (ILL, MO); Thum Bay, Knight Island, Prince William Sound, 300 m, *Eyerdam 3425* (ILL, K, MO, UC); Port San Juan, Evans Island, *Eyerdam 5969* (ILL, MO); Mt. Marathon, W of Seward, *Calder 5096* (DAO, NY, UC); Stetson Creek Valley, NW of Seward, *Calder 6479* (DAO, WTU); Three Saints Bay, Kodiak Island, *Eyerdam 386* (K). CALIFORNIA: Del Norte Co., Wilson Creek, between Requa and Crescent City, *Abrams & Bacigalupi 8323* (CAS, RM); Redwood Nat'l. Park, *Lowry 785a* (ILL, UC); Siskiyou Co., *Muth 396* (CAS). IDAHO: Bonner Co., Hope, *Dunkle 457* (NY); Kootenay Co., Packsaddle Peak, 2,600 m, *Sandberg et al. 845* (BM, K, MO, NY); Shoshone Co., Sohons Pass, 1,650 m, *Leiberg 1427* (CAS, K, NY, RM, UC). MONTANA: Glacier Co., Midvale, *Umbach 249* (MONT, RM, WIS); Park Co., 10 km W of Four Mile Ranger Sta., Boulder River Canyon, *Hitchcock 16381* (CAS, NY, UC, WTU). OREGON: Clackamas Co., S slope of Mt. Hood, 1,250 m, *Lowry 1073* (ILL, MO, OSC, UC); Clatsop Co., 1 km W of Washington Co. line on Hwy. 26, *Lowry 3092* (ILL, MO, OSC, UC); Jefferson Co., E base of Three Fingered Jack, 2,100 m, *Constance 3465* (BM, ILL, NY, RM, UC, WIS); Klamath Co., Crater Lake, *Baker 7126* (NY, WTU); Tillamook Co., Neahkahnie Mt., *Lowry 910* (ILL, MO, NY, OSC, UC). WASHINGTON: Chelan Co., Stevens Pass, *Sandberg & Leiberg 4028* (ILL, MICH, MO, NY, US, WIS, WTU); Grays Harbor Co., Colonel Bob Lookout, 1,250 m, *Thompson 7275* (CAS, K, MO, UC, WTU); Jefferson Co., N Fork Quinault River, *Lowry 254* (ILL); Okanogan Co., Mt. Bonaparte, *St. John et al. 5341* (MO, UC, WTU); Snohomish Co., Perry Creek Trail, 1,000 m, *Thompson 14712* (MICH, MO, NY, UC, WTU).

CANADA. ALBERTA: Cameron Lake, Waterton Lakes Nat'l. Park, 1,650 m, *Boivin & Gillett 8979* (DAO). BRITISH COLUMBIA: 16 km N of Bull River, *Taylor & Ferguson 2714* (DAO); S Fork Kaslo Creek, near Kokanee Glacier, *McCabe 4779* (UC); Glacier Nat'l. Park, *Haber & Shchpanek 1492A* (CAS, NY); Illecillewaet Valley, Selkirk Mts., *Brown 273* (MO, NY); Quiniscoe

Lake, Ashnola Range, *Calder et al. 19635* (DAO, NY, UC); Manning Prov. Park, *Lowry 1026* (ILL, UC); Copper Canyon, 800 m, *Schmidt 51-53* (DAO); Lake Bootahnie, Marble Mts., 1,500 m, *Thompson & Thompson 122* (WTU); Moat Lake, Forbidden Plateau, Vancouver Island, *Calder & MacKay 32303* (DAO, UC); Indianpoint Lake, NE of Bakerville, *McCabe 319* (UC); Mt. Fougner, Bella Coola, *Calder et al. 20417* (DAO); Safety Cove, Calvert Island, *McCabe 4189* (UC); Swanson Bay, Graham Reach, *McCabe 3458* (UC); 5 km WNW of Tyee, E of Prince Rupert, *Calder et al. 15038* (DAO); Bigsby Inlet, Moresby Island, *Calder et al. 34908* (DAO); trail to Mercer Lake from Empire Anchorage, Graham Island, *Calder & Savile 21494* (DAO, UC); Stewart, *Whited 1226* (MO).

Osmorhiza purpurea is clearly a distinct species, although it is often confused with the closely related *O. chilensis*. *Osmorhiza purpurea* is the only taxon in the section *Nudae* that does not exhibit disjunctions to the Great Lakes region, northeastern North America, and southern South America. Constance and Shan (1948) noted that the fruits of this species seem equally well adapted for long-distance dispersal as those of *O. chilensis* and *O. depauperata*. *Osmorhiza purpurea*, however, has a very restricted habitat preference, occurring only in areas with substantial, regular precipitation, often at higher elevations or along the Pacific Coast, in sharp contrast with its more widespread relatives.

Coulter and Rose (1900) published two names for plants now included in *O. purpurea*: *Washingtonia leibergi* and *W. purpurea*. When these taxa were combined by Mathias and Constance (1944), they adopted the name *Osmorhiza purpurea*, and accordingly, under Art. 57 of the "Code" (Voss et al., 1983), this choice of epithet must be followed.

10. Osmorhiza depauperata Philippi, Anales Univ. Chile 85: 726. 1894. TYPE: Chile. Ñuble: Valle de las Nieblas, near Termas de Chillán, *F. Philippi 2030* [lectotype (designated herein), SGO (no. 041589); photograph of lectotype, ILL!; isolectotype, SGO (no. 053461); photograph of isolectotype, ILL!].

Washingtonia obtusa Coult. & Rose, Contr. U.S. Natl. Herb. 7: 64. 1900. *Osmorhiza obtusa* (Coult. & Rose) Fern., Rhodora 4: 154. 1902. TYPE: U.S.A. Wyoming: Park Co., Ishawood (i.e., Ishawooa) Creek, *J. N. Rose 476* (holotype, US!).

Osmorhiza obtusa var. *cupressi-montanum* Boivin, Canad. Field-Naturalist 65: 20. 1951. *Osmorhiza chilensis* var. *cupressimontana* (Boivin) Boivin, Naturaliste Canad. 93: 644. 1966. TYPE: Canada. Saskatchewan: Cypress Hills Park, aspen woods, *A. J. Breitung 4742* (holotype, DAO!).

Plants slender, 1.5–6.5(–8) dm high, stems 1–3(–5), erect to spreading-ascending or decumbent, sparsely to rather densely hirsutulous, or sometimes glabrescent. Root system rather deep, well developed, the roots with a weak carrot- or anise-like scent. Leaves 2–3-ternate, orbicular to broadly ovate, 4–10(–12) cm long, sparingly hispidulous to glabrous; leaflets broadly lanceolate to ovate, 1.5–5(–6) cm long, 1–3 cm wide, obtuse or acute, coarsely serrate to incised, parted, or divided at the base; petioles 3–20(–23) cm long. Umbels open, peduncles 1–3, terminal and often lateral, 5–15 cm long; involucre wanting, or rarely consisting of 1 minute (to very rarely large and leaf-like), linear-lanceolate, foliaceous, ciliate, spreading bract; rays widely spreading to nearly reflexed, (2.5–)3–9(–10) cm long; umbellets 2–6 per umbel; involucel wanting, or rarely of 1–2 small, linear-lanceolate, foliaceous, ciliate bractlets, each 0.3–2.5 mm long, 0.2–0.4 mm wide; pedicels (2–)3–7 per umbellet, widely divaricate, those of the hermaphrodite flowers (4–)8–12(–32) mm long, those of the staminate flowers 2–12 (–13) mm long. Hermaphrodite flowers 2–6 per umbellet, (3–)7–20(–25) per umbel, staminate flowers 0–2(–3) per umbellet, 0–10(–15) per umbel; corolla greenish white, rather inconspicuous; styles (including stylopodium) 0.3–0.6(–0.7) mm long, stylopodium (0.1–)0.2–0.4(–0.5) mm long, low-conic to depressed, with or without a disc; carpophore cleft about one-third of its length. Fruit clavate, obtuse at the apex, concave furrowed, (9–)10–18(–19) mm long, the ribs moderately to densely hispid with retrorse bristles, especially toward the base, the caudate appendages (2.5–)3–8.5(–9) mm long. $n = 11$ (Bell & Constance, 1960; Constance et al., 1976); $2n = 22$ (Crawford & Hartman, 1972). Figures 9k and 14.

Flowering period. April to early July (North America); November and December (South America).

Habitat. Moist to fairly dry forests, woodlands, and open slopes.

Common names. Blunt-fruit sweet cicely, Blunt-fruit sweetroot, Blunt-fruited sweet cicely, Bluntseed sweetroot, Snub cicely, Sweet cicely.

Representative specimens. U.S.A. ALASKA: Denver Trail, E of Skagway, *Anderson 1735* (K); Pt. Gustavus, Glacier Bay, *Coville & Kearney 729* (US); Valdez, *Piper 4288* (US); Kenai Lake, *Calder 5688* (DAO); Cooper

Landing, W of Kenai Lake, *Anderson 6882* (RM); 12 km E of mouth of Moore River, Kenai Peninsula, *Lutz 105* (RM). ARIZONA: Apache Co., Lukachukai Mts., 2,700 m, *Goodman & Payson 2816* (CAS, MONT, MONTU, NY, UC, WTU); Cochise Co., Chiricahua Mts., *Ferris 9950* (MICH, TEX, UC); Coconino Co., Humphreys Peak, San Francisco Mts., *MacDougal 397* (ARIZ, G, NY, P, RM, UC); Pima Co., Santa Catalina Mts., *Goodman & Hitchcock 1253* (MO, NY, RM). CALIFORNIA: Modoc Co., Warner Mts., 1,850 m, *Constance 3104* (K, MO, NY, UC). COLORADO: Boulder Co., Boulder Creek, below Eldora, 2,500 m, *G. N. Jones 33299* (CS, ILL); Clear Creek Co., Georgetown, 2,500 m, *M. E. Jones 514* (BR, CAS, MISSA, NY, UC); Delta Co., Cedaredge, 2,150 m, *Baker 240* (K, RM, UC); El Paso Co., Jack Brook, 2,600 m, *Clements & Clements 236* (NY, RM); Garfield Co., S of Rifle, *Osterhout 2151* (NY, RM, WIS); Gunnison Co., Elko Park, N of Gothic, *Mathias 3264* (UC); La Plata Co., La Plata, *Baker et al. 849* (BM, K, MICH, MO, NY, RM); Mineral Co., near Pagosa Peak, 2,750 m, *Porter 3932* (CAS, RM, UC, WTU); Montezuma Co., Upper W Mancos Canyon, 3,000 m, *Baker et al. 188* (BM, G, K, MICH, MO, NY, RM); Rio Blanco Co., Black Sulphur Creek, 5.5 km SW of confluence with Swizer Gulch, 2,115 m, *W. R. Erickson 594* (CS); Summit Co., near Breckenridge, *MacKenzie 295* (MO, RM, WIS). IDAHO: Bingham Co., Wolverine Creek, Blackfoot Mts., *Holmgren & Murttala 5415* (NY, UC); Bonneville Co., 18 km SW of Victor, *Lowry 1114* (ILL); Cassia Co., Pole Canyon, SE of Burley, 2,000 m, *Holmgren & Jensen 3499* (NY, WTU); Clark Co., Centennial Mts., 2,350 m, *Lowry 2485* (ILL, MONT, UC); Custer Co., Challis Creek, 1,800 m, *Macbride & Payson 3332* (CAS, K, MO, NY, RM, UC); Fremont Co., Henry's Lake, 1,800 m, *Payson & Payson 1946* (CAS, MO, NY, RM). MICHIGAN: Keweenaw Co., Isle Royale, *McFarlin 2049* (MICH, MONT); Leelanau Co., E end of Manitou Island, *Richards 3123* (MICH). MINNESOTA: Cook Co., Mountain Lake, *Butters et al. 303* (NY). MONTANA: Beaverhead Co., Centennial Mts., 2,450 m, *Lowry 2426* (ILL, MO, MONT, MONTU, NY, RM, UC); Carbon Co., Red Lodge, *Hawkins*, 22 July 1919 (MONT); Deerlodge Co., Storm Lake, *Hitchcock & Muhlick 14845* (MO, NY, UC, WTU); Gallatin Co., Mystic Lake, *Blankinship 220* (BM, MO, MONTU); Silver Bow Co., Humbug Spires, 1,900 m, *Lowry 2269* (ILL, MONT, UC). NEVADA: Clark Co., Little Falls, Charleston Mts., 2,400 m, *Clokey 8050* (ARIZ, CAS, ILL, MO, MONTU, NY, RM, UC, WTU); Elko Co., Lamoille Canyon, 2,450 m, *Millan & McKnight 168* (NY); White Pine Co., Snake Creek, Snake Range, 2,950 m, *Holmgren & Reveal 1627* (NY). NEW MEXICO: Grant Co., Hillsboro Peak, Black Range, 3,050 m, *Metcalfe 1206* (MO, NY); Lincoln Co., 11 km W of Ruidoso, 2,750 m, *Hinckley 726* (ARIZ, NY, TEX, UC); Otero Co., Cloudcroft, *Wooton*, 30 June 1899 (ILL, MO, NMC, NY, RM); Santa Fe Co., Santa Fe Canyon, E of Santa Fe, *Heller & Heller 3822* (BM, CAS, K, MO, NY, P, UC). OREGON: Deschutes Co., Paulina Creek, 2,090 m, *Leiberg 555* (K, NY, UC); Jackson Co., Wimer, *Hammond 157a* (CS); Klamath Co., Crater Lake Nat'l. Park, 1,850 m, *Heller 13469* (CAS, ILL, WTU). SOUTH DAKOTA: Lawrence Co., S of Deadwood, *Churchill 5707* (MO, NY). UTAH: Duchesne Co., 6 km S of Moon Lake, 2,350 m, *Harrison & Larsen 7612* (MO, RM); Garfield Co., Henry Mts., 2,400 m, *McVaugh 14681* (CAS, MICH, NY, SMU, TEX); Grand Co., Post Canyon, Uintah and Ouray Ind. Res., 110 km S of Ouray, 2,650 m, *Holmgren et al. 2313* (ARIZ, CAS, ILL, NY, TEX, UC, WIS, WTU); San Juan Co., Abajo Mts., *Goodman & Hitchcock 1437* (BM, MO, NY, RM); Utah Co., Slate Canyon, E of Provo, 2,450 m, *M. E. Jones 5580* (BM, MO, NY, RM, UC); Washington Co., 4.5 km E of Pine Valley, 2,150 m, *Gould 1793* (NY). VERMONT: Chittenden Co., Mt. Mansfield, *Greenman 691* (MO). WASHINGTON: Asotin Co., *Cronquist & Jones 5860* (WTU); Chelan Co., Wenatchie region, *Brandegee 794* (NY, UC); King Co., Seattle, *Talcott*, 15 May 1891 (MICH); Okanogan Co., Myers Creek, Chesaw, *St. John et al. 5186* (MO, NY, UC, WTU). WYOMING: Albany Co., Laramie Range, 2,500 m, *Hartman 3122* (RM); Big Horn Co., 42 km W of Burgess Junction, Big Horn Mts., *Lowry 1423* (ILL); Carbon Co., S Brush Creek Campground, Medicine Bow Mts., *Lowry 1132* (ILL, MO, NY, RM, UC); Sublette Co., Middle Piney Lake, 2,600 m, *Meyer & Meyer 2402* (MO, NY, UC); Teton Co., 5 km W of Teton Pass, *Lowry 1119* (ILL, MO, NY, RM, UC).

CANADA. ALBERTA: Cypress Hills, 1,450 m, *Boivin & Gillett 8929* (DAO); Chief Mt. Hwy., Waterton Lakes Nat'l. Park, 1,450 m, *Breitung 15881* (NY, UC); W face of Sandhills, *Brinkman 5470* (DAO, SMU); Elbow River Valley, Calgary, *Moodie 1056* (NY, UC); 3 km below Canmore, 1,300 m, *Ewan 18685* (UC); Elk Island Park, E of Ft. Saskatchewan, *Turner 4498* (DAO); Battle Lake, SW of Pigeon Lake, *Turner 5907* (DAO); Elysium Pass Trail, Jasper Nat'l. Park, *Lowry 944* (ILL, UC); Geraldine Lakes Trail, Jasper, *Lowry 961* (ILL, UC); near Atauwan Cabin, Slave Lake Dist., *Brinkman 4335* (NY); SW of Spirit River, *Moss 8415* (DAO); Saddle Hills, N of Sexsmith, *Moss 9948* (WIS); Wembley, *Wallace for Jenkins 734* (DAO). BRITISH COLUMBIA: Starvation Park, W of Waterton Lakes, 1,550 m, *Calder et al. 3416* (DAO); Sheep Mt., 55 km N of Natal, *Weber 2373* (NY, UC); 7 km WSW of Wycliffe, 950 m, *Taylor et al. 2635* (DAO, UC); 5 km W of Needles, *McCabe 6663* (UC); Friday Creek, 25 km S of Princeton, *Lowry 1021* (ILL, UC); Yoho Nat'l. Park, *Lowry 1005* (ILL, MO, RM, UC); 1.5 km NW of Falkland, 600 m, *Hitchcock & Martin 7466* (NY, RM); Botanie Valley, 1,200 m, *Beamish et al. 8204* (DAO); Three Mile, on Lac La Hache-Williams Lake Rd., *Calder et al. 18970* (DAO); 24 km SW of Kleena Kleene, *McCabe 606* (UC); 21 km W of Puntataenkut Lake, W of Quesnel, 1,150 m, *Calder et al. 18212* (DAO); Tezsli, Kluskus Lakes, *Lewicki 79* (WIS); Prince George, 600 m, *Florian 94* (DAO); 25 km W of Burns Lake, *Calder et al. 12780* (DAO); 5 km S of Ft. McLeod, *Calder et al. 12445* (DAO, UC); Pine River, 67 km W of Bissett Creek Bridge, W of Dawson Creek, *Taylor & Staudt 4169* (DAO, UC); near Hudson's Hope, *Raup & Abbe 3640* (NY); Wicked River, near Peace River, 600 m, *Raup & Abbe 3878* (NY); Wolverine Ridge, near Manson Creek Village, 1,050 m, *Calder et al. 13702* (DAO); 5 km S of Takla Landing, *McCabe 7916* (UC); Bear Lake, 40 km NW of Takla Lake, *McCabe 7998* (UC); Fairy Lake, SSW of Ft. Nelson, 1,400 m, *Calder & Kukkonen 27162* (DAO, UC); Laird Hotsprings, 500 m, *Calder & Gillett 25575* (CAS, DAO, UC); mile 578, Alaska Hwy., 550 m, *Calder & Gillette 25655* (DAO). MANITOBA: Mont Dauphin, Norgate, *Boivin et al. 10682* (DAO); 13 km W of Norgate, Riding Mt. Nat'l. Park, *Löve & Löve 6563* (DAO); Forestry Camp, Riding Mt. Nat'l. Park, *Rowe 305* (DAO). NORTHWEST TERRITORIES: Charlton Island, James Bay, *Porsild 4506* (DAO—photo ex CAN); Mt. Coty, 750 m, *Cody & Spicer 11787* (NY, SMU, UC). NEW BRUNSWICK: Madawaska Co., Claire, *Eaton M-89* (LL). NEWFOUNDLAND: Dildo, Notre Dame Bay, *Fernald & Wiegand 5952* (K, NY); Benoit's Cove, Humber Arm, Bay of Islands, *Fernald & Wiegand 3767* (BM); Frenchman's Cove, Bay of Islands, *Waghorne 15* (MO); Port au Port, *MacKenzie*, 30 July 1921 (NY, UC); Nameless Cove-Mistaken Cove, Straights of Belle Isle, *Wiegand et al. 28767* (GH, US); Forteau, Labrador, *Waghorne*, 8 Aug. 1893 (MO). NOVA SCOTIA: Inverness Co., Cape St. Lawrence, *Smith et al. 11183* (DAO). ONTARIO: Algoma Dist., *Marie-Victorin & Rolland-Germain 27340* (CAS); Thunder Bay Dist., Mortimer Island, Slate Islands, *Hosie et al. 2187* (UC); Pijitiwabik Bay, Lake Nipigon, *Garton 7248* (DAO). QUÉBEC: Gaspé Co., Grand River, *Fernald s.n.* (MICH, NY); Lac St. Jean—Ouest Co., Chambord, Roberval, *Leduc L-69-68* (DAO); Matane Co., Little Metis, *Fowler 25351* (MO, WIS); Rimouski Co., near Bic, Isle de Bic, *Forbes*, 25 June 1905 (RM); Rivière-du-Loup Co., Pt. de la Rivière du Loup, *Cayouette & Cinq-Mars*, 19 June 1944 (DAO); Saguenay Co., Rivière du Renard, Anticosti Island, *Marie-Victorin & Rolland-Germain 27139* (MO, WIS); Niapisca, Mingan Islands, *Hamel & Genereux 3140* (DAO). SASKATCHEWAN: Maple Creek Dist., Cypress Hills, *Hudson 1838* (DAO); Melfort Dist., McKague, *Breitung*, 30 Jan. 1935 (DAO); Qu'Appelle Dist., Cherry Lake, SE of Indian Head, *Jones & Ledingham 742* (DAO); Wallwort, *Breitung 651* (DAO, MO, UC).

ARGENTINA. CHUBUT: Río Senguerr, Lago La Plata, *Krapovickas 4241* (UC). NEUQUÉN: Los Lagos, Fortín Chacabuco, *Correa & Constance 3788* (UC); between Lago Correntoso and Lago Escondido, *Correa & Constance 3845* (G, K, UC); Correntoso, Lago Nahuel Huapí, *Edwards s.n.* (BM). RÍO NEGRO: Bariloche, Parque Nac. Nahuel Huapí, *Boelcke 5405, 5436* (UC); Estacis Lago Roca, 350 m, *James 411* (BM). SANTA CRUZ: Güer Aike, Estancia Stag River, Río Gallegos, *Tweedie 101a, 267* (K); Lago Argentino, Brazo Norte, valle de La Cristina, 850 m, *Vervoorst 4387* (MO). TIERRA DEL FUEGO: Ushuaia, Lago Fagnano, *Boelcke et al. 15236* (UC), *Moore 2845* (K); Harberton, *Constance et al. 3861* (UC), *Goodall 164, 1025* (UC); Bahía Aguirre, *Goodall 1422* (UC); Laguna Victoria, Isla de Los Estados, *Goodall 1579* (UC), *Moore 2079* (K); Estancia Viamonte, *Goodall 2823* (UC); Río Valdez, *Goodall 3405* (UC); Monte de las Carpas, *Goodall 4669* (UC); Ushuaia, *Hunziker 6522, 6560* (UC), *Vallerini 66* (UC), *Zöllner 8584* (MO), *Pennington 196 bis* (Z); Monte Olivia, *Hunziker 8206* (UC); Estancia la Esperanza, 210 m, *Mexia 7925* (BM, G, K, MO, NY, UC), *Moore 1540* (K); Sierra Alvaer, E of Paso Garibaldi, *Moore 1818* (K).

CHILE. MAGALLANES: Rosvig, 200 m, *Donat 346* (BM, CAS, K, NY); Sandy Pt., *Cunningham s.n.* (NY), *DeCandolle m. 1186* (P); Buncombe Bay, *Commerson s.n.* (P); Punta Arenas, 20 m, *Eyerdam et al. 24105* (G, K, UC), *Stafford 26* (NY), *Savatier 61, 76* (P), *McLean D.A.14* (BM), *Hatcher s.n.* (NY); Estancia Maria Cristina, 80 km NE of Punta Arenas, *Goodall 4018* (UC); Puerto Williams, Navarino Island, *Godley 884* (K, UC); Pecket Harbor, *Hombron s.n.* (P); Orange Harbor, *Hyades 472* (P), *U.S. S Pac. Expl. Exped.* (P); Port Famine, *Le Guillou s.n.* (P), *Marivault s.n.* (P); Estancia Cameron, NW shore Lago Blanco, *Moore 2145* (K, UC); Estancia Vicuña, 200 m, *Moore 2177* (UC); Port Galant, *Savatier s.n.* (P). ÑUBLE: Termas de Chillán, *Jaffuel 3765* (GH, cited in Constance & Shan, 1948). VALDIVIA: Valdivia, *Lechler 225* (GOET); *Philippi s.n.* (G).

Osmorhiza depauperata was described by Philippi (1894) from material collected in South America. At the time Constance and Shan (1948) prepared their treatment of *Osmorhiza*, they were uncertain as to the identity of this name, and tentatively placed it in synonymy under *O. chilensis*. Instead, they accepted the name *Osmorhiza obtusa* for the taxon with clavate fruit and divaricate rays and pedicels. In 1954, Constance visited the Museo Nacional de Historia Natural in Santiago, Chile, where he examined the type material of *Osmorhiza depauperata* (Constance, pers. comm.). Three years later, this name was first used for North American plants by Mathias and Constance (1957: 11), with the following footnote: "Examination of Philippi's type at Santiago, Chile, has verified the necessity of substituting this name [*O. depauperata*] for the heretofore accepted *O. obtusa* (C. & R.) Fernald." Although Philippi's type material is not available for loan, we were able to obtain photographs of the two specimens through the courtesy of Dra. Mélica Muñoz S., Curator of Botany at SGO. While examination of these photographs does not, by itself, reveal with certainty the identity of Philippi's specimens, information contained in Constance's notes on them indicates that the name *Osmorhiza depauperata* does indeed apply to the taxon earlier referred to as *O. obtusa*.

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