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REVISION OF *BERBERIS*
(BERBERIDACEAE) IN CHILE
AND ADJACENT SOUTHERN
ARGENTINA¹

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ABSTRACT

Twenty species of *Berberis* are recognized in continental Chile, the Juan Fernández Islands, and adjacent southern Argentina, comprising a considerable reduction in species number from the works of earlier authors. Hybridization between species is common. Each species is described, and all are distinguished with a dichotomous key. Maps are provided for all species and photographs for all continental species. Notes on phenology, habitat, distribution, and distinguishing characters are included. One new combination, *B. chilensis* var. *brachybotria* (Gay) Landrum, is made. The following taxa are lectotypified: *B. brachyacantha* Phil. ex Reiche, *B. buxifolia* var. *antarctica* C. K. Schneid., *B. congestiflora* Gay, *B. crispa* Gay, *B. ferox* Gay, *B. brachybotria* Gay, *B. empetrifolia* var. *magellanica* C. K. Schneid., *B. florida* Phil., *B. horrida* Gay, *B. linearifolia* Phil., *B. montana* var. *chillanensis* C. K. Schneid., *B. mutabilis* Phil., *B. polymorpha* Phil., *B. variiflora* C. K. Schneid., *B. wawrana* C. K. Schneid., and *B. zahlbruckneriana* C. K. Schneid.

This paper is a more complete version of my treatment of *Berberis* for the Flora de Chile project being coordinated by the Universidad de Concepción, Concepción, Chile. For the sake of brevity,

many things, namely nomenclatural citations and synonymy, lists of representative specimens, illustrations, an index to collectors, and numbers and discussion of systematic criteria and geography,

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could not be included in the *Flora de Chile* but are provided here. I have also expanded coverage to follow phytogeography rather than political boundaries, including adjacent southern Argentina where many of the Chilean species grow. Many plants of the humid forests of southern South America grow on both sides of the Andes, but distributions are much less extensive in Argentina because of the Andean rain shadow. This is the case with seven species of *Berberis* (*B. darwinii*, *B. empetrifolia*, *B. ilicifolia*, *B. microphylla*, *B. montana*, *B. serratodentata*, and *B. trigona*). Two additional endemics of western Argentina have also been included, *Berberis comberi* and *B. grevilleana*. The major purpose of this paper is to make identification of *Berberis* as simple as possible for southwestern South America. A map of the regions of Chile is provided (Fig. 1).

The Berberidaceae are a family of about 15 genera and 650 species, widespread in the Northern Hemisphere and with a single genus, *Berberis*, extending into temperate and Andean South America.

In the most recent worldwide study of *Berberis*, Ahrendt (1961) recognized about 500 species with simple leaves (true *Berberis*) and approximately 200 species in the Northern Hemisphere genus *Mahonia* Nuttall with compound leaves; the latter genus is now commonly combined with *Berberis*. Thus, *Berberis* s. str. is a huge group, and if it is combined with *Mahonia*, the genus is even more vast. Such large groups are "taxonomic black holes," because no one can understand them in a reasonable number of years, or even a lifetime. It becomes extremely difficult to define useful taxonomic entities (e.g., subgenera or sections) because it is impossible to know more than a subset of the species well.

The simple-leaved species of *Berberis* have two important centers of diversity corresponding to the informal subgeneric groups first given names by Schneider (1908): the *Septentrionales* of Eurasia with ca. 300 species, and the *Australes* of South America with ca. 200 species (Ahrendt, 1961), most of which are Andean. The actual number may be much less, considering that Ahrendt recognized ca. 60 species in Chile and adjacent southern Argentina and I accept only 20.

Division between *Septentrionales* and *Australes* appears mainly to be geographically based. Red berries and deciduous leaves, found in many *Septentrionales*, are rare in South American species; foliaceous spines, dentate stamens, and deep orange flowers found in many *Australes* are rare or do not exist in *Septentrionales* (Ahrendt, 1961). Evaluation of the validity of *Septentrionales* and *Australes*, requiring a broad knowledge of both groups, is beyond the scope of the present study.

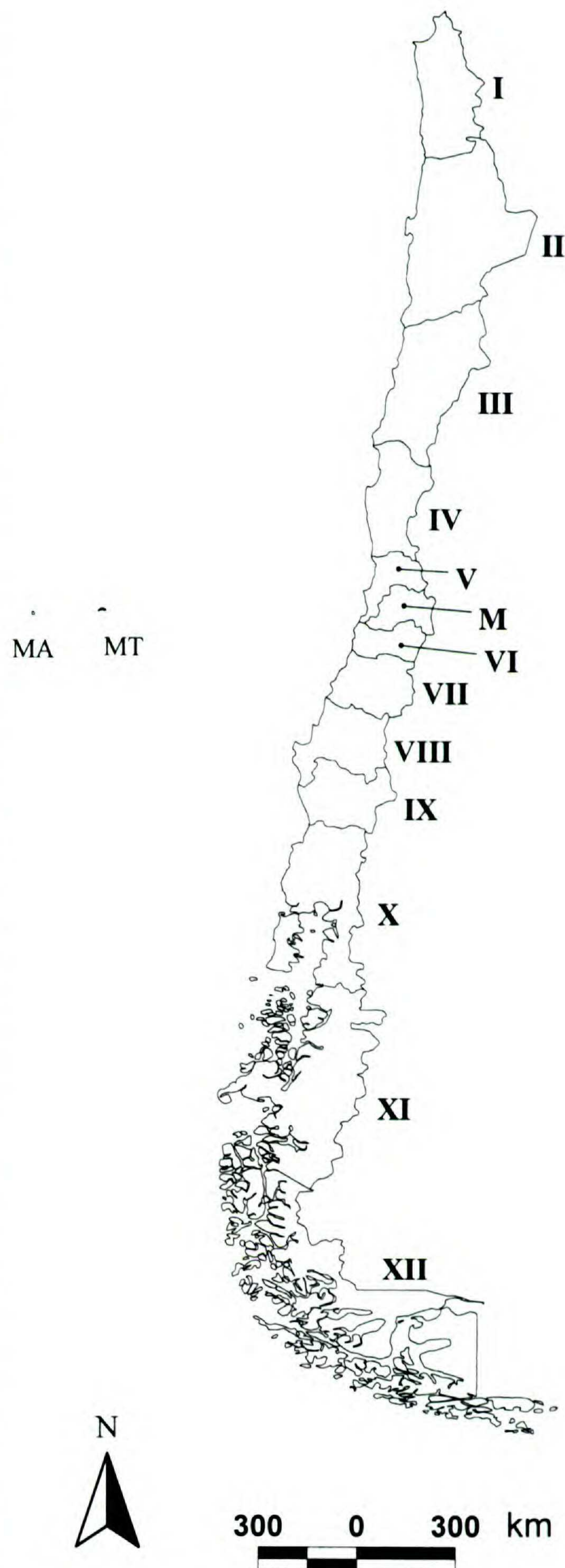


Figure 1. Regions of Chile. Más Afuera (MA) and Más a Tierra (MT) of the Juan Fernández Archipelago correspond to Región V. Made in Arizona State University Library Map Collection with data from ESRI (Environmental Systems Research, Inc.).

Prior to Ahrendt's treatment, Schneider (1905) divided *Berberis* s. str. into 21 sections, 6 of which occur in southwestern South America. Ahrendt (1961) divided *Berberis* s. str. into 29 sections, 8 of which are found in southwestern South America. Both authors often subdivided these sections into subsections. Their groups often conform to what I believe to be closely related species or even single species. In general, I recognize fewer species than they do. I differ from both authors in joining under one name *B. microphylla*, *B. buxifolia*, and *B. heterophylla*; they place each of these taxa in separate sections. I also differ with Ahrendt in submerging *B. pearcei* within *B. serratodentata*, species he placed in different sections.

SYSTEMATIC CRITERIA

Leaves of *Berberis* vary greatly in size and shape and in the tothing of the margin (Fig. 2). Intra-specific variation is great, and leaves of plants that have been browsed or cut over can be quite different from typical leaves. In spite of this variation, leaf morphology is of great taxonomic importance. The texture varies from membranous (e.g., *B. rotundifolia*) to stiffly coriaceous (e.g., *B. comberi*). Shape varies from subacicular to suborbicular, and leaf size is, of course, important. Venation may be of a reticulate-actinodromous type (Fig. 2A) with the midvein and some secondary veins of about equal importance, or a mixed craspedodromous type (Fig. 2D) with dominant midvein, or even an intermediate type (Fig. 2H). Leaves of a single plant may vary from type to type, but tendencies in venation are of taxonomic importance. The veins in both types tend to form loops, and some veins reach the margins. The leaf surfaces vary from smooth to papillose. The petioles often have a noticeable "joint" someplace between the blade and the twig. The portion below the "joint" often persists after the rest of the leaf has fallen.

Spines are the reduced leaves of long shoots and are variable in their morphology (Fig. 3), being foliaceous (Fig. 3A, D), star-like (Fig. 3B), palmate (Fig. 3C), or trifid (Fig. 3F, G). The leaves of short shoots are more or less normal in their morphology and occur as clusters in the axils of the spines. In *Berberis valdiviana* a nearly perfect intermediate between an elliptic leaf and a trifid spine occasionally can be found. Some species or individuals (or even particular branches) never develop spines, the leaves of the long shoots developing into typical leaves. Sometimes the spines are so similar to true leaves that they can easily be confused with them (Fig. 3A).

Flowers and fruits may be borne singly (Fig. 12B), in sessile umbels (13C), in pedunculate umbels (Fig. 13A), or racemes (13D). A pedunculate dense raceme to umbel is also possible (Figs. 4F, 10B). Panicle inflorescences are normally found only in *B. corymbosa*, among the species treated here, but are common farther north in the Andes.

Flowers may be yellow, orange, to red-orange and are usually uniform in color, but in *B. montana* the inner tepals are darker than the outer and the flower looks superficially like a miniature daffodil. The perianth typically has 5 or 6 whorls of 3 tepals, the inner 2 whorls with 2 nectariferous glands on the lower inner surface. The next whorl or two whorls toward the outside are somewhat larger, and the more exterior whorls decrease in size, the outermost being bract-like.

Six stamens are located opposite the inner two whorls of tepals. Two tooth-like projections just below the anther (Fig. 4H) can be found in some species, but are absent in others.

The pistils are mostly of two types, those with an elongate style (Fig. 4D) and those with little or no style (Fig. 4G). Species of the Juan Fernández Archipelago seem to be intermediate. Ovule number is sometimes important.

Fruits are always dark purple, bluish, or black, but are sometimes covered with a waxy bloom. The seeds are usually separate at maturity, but in *B. comberi* and *B. grevilleana* they are fused together in a mass.

In general, *Berberis* is known for possessing a rich array of alkaloids, and the species of Chile have been particularly well studied (see summary of Fajardo, 1992). I have not attempted to analyze the results of these studies from a taxonomic perspective, but perhaps this can be done in the future.

SPECIES GROUPS

I am opposed to accepting formal sections or subsections at present because I think it is still impossible to know whether they have any phylogenetic basis. Geography seems to have played an important role in Schneider's and Ahrendt's subgeneric classifications, their sections generally being confined to a geographic area. However, species from widely separated places in South America can look very similar, and even species from other continents can closely resemble some Chilean species. Certainly, homoplasy has been pervasive in *Berberis*. The best approach for future studies of the genus probably will be regional revisions. Nonetheless, two clusters appear among the southwestern South

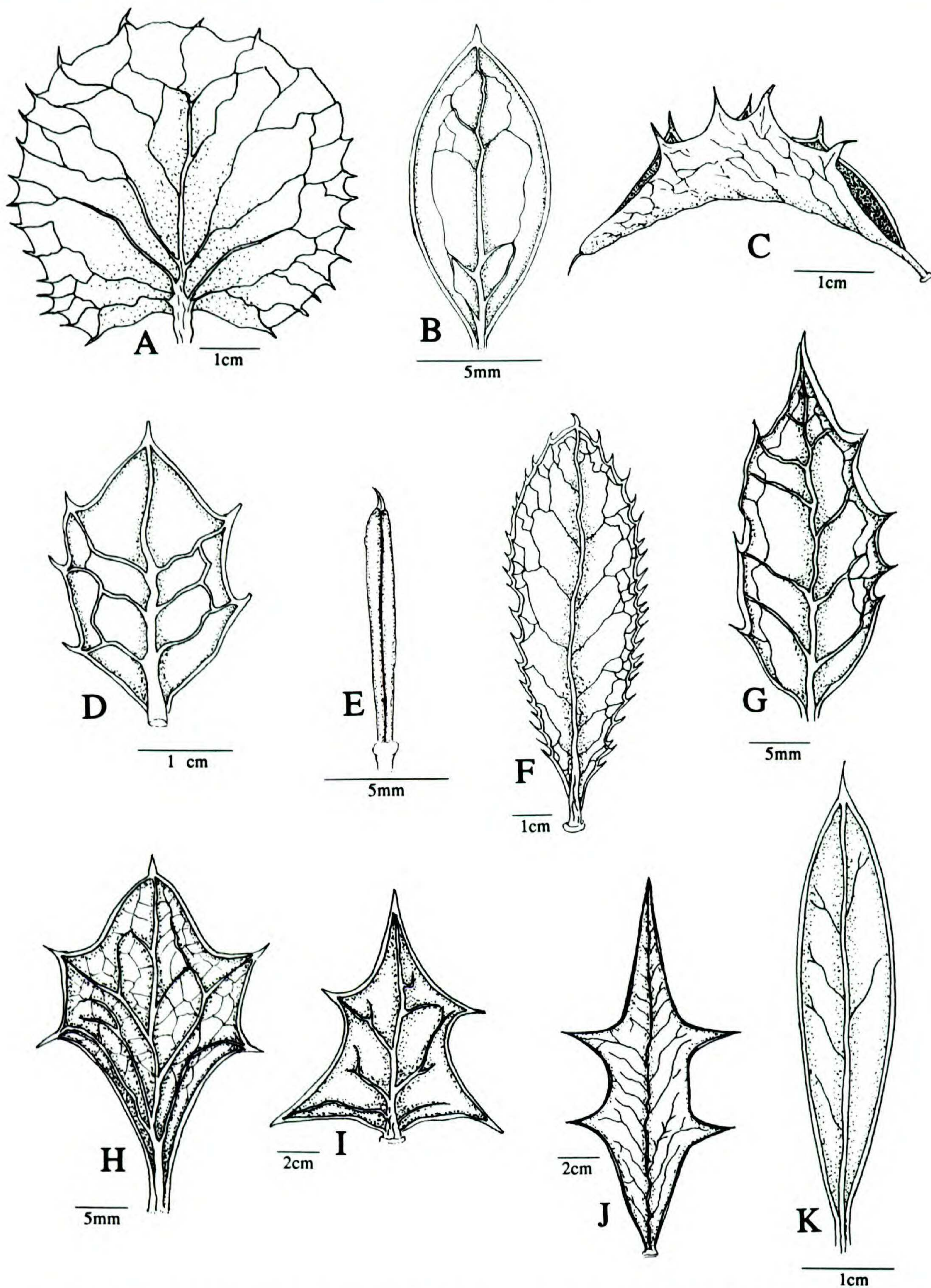


Figure 2. Leaves of various species of *Berberis*. —A. *B. actinacantha*, southern form (7952). —B. *B. microphylla* (8153). —C. *B. chilensis* var. *chilensis* (7907). —D. *B. darwinii* (8148). —E. *B. empetrifolia* (8182). —F. *B. serratodentata* (8112). —G. *B. chilensis* var. *brachybotria* (Bricker 186). —H. *B. grevilleana* (8340). —I. *B. comberi* (8353). —J. *B. comberi* (8379). —K. *B. trigona* (8007). All collections by Landrum except for G.

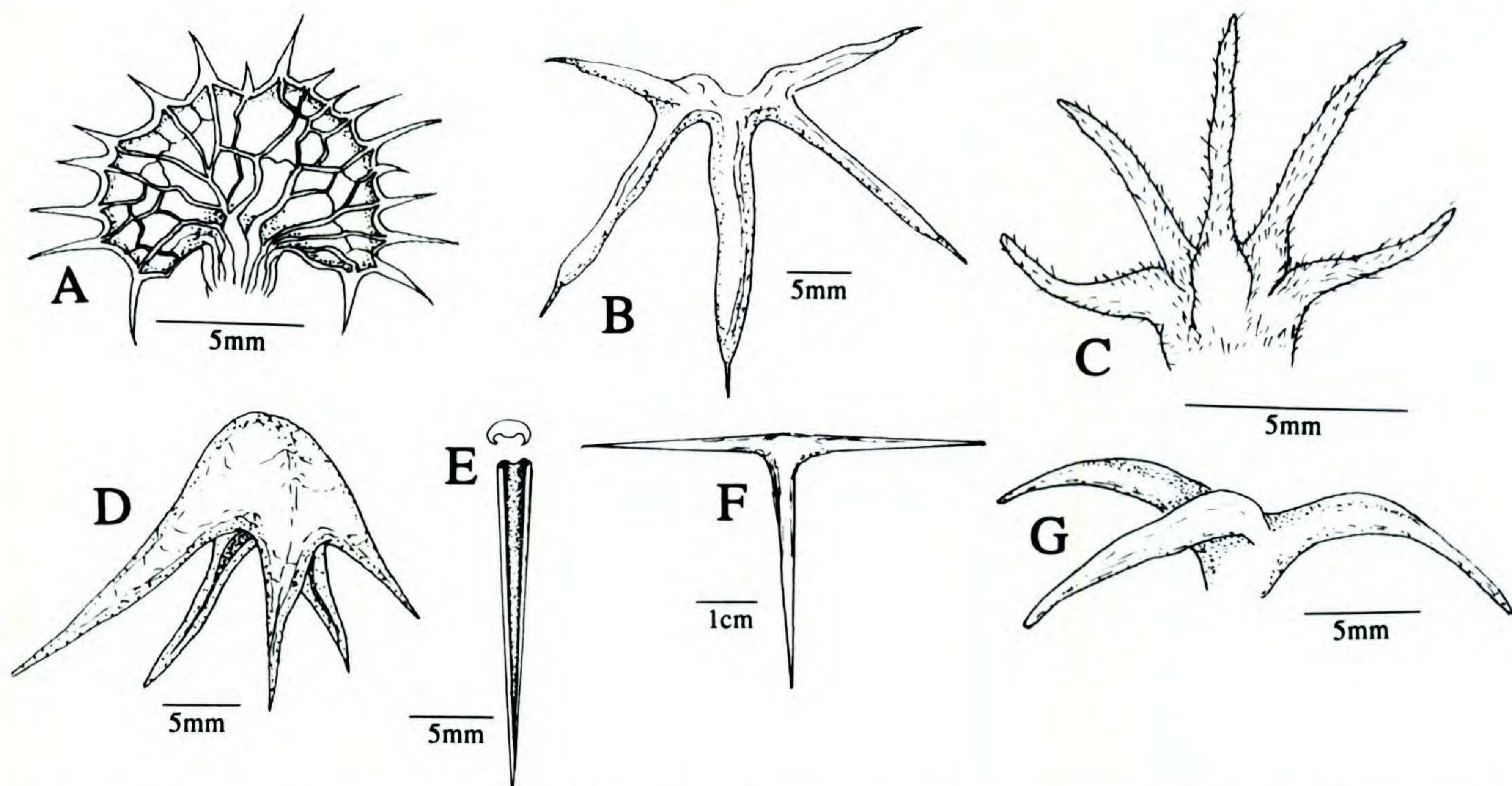


Figure 3. Spines of various species of *Berberis*. —A. *B. actinacantha*, foliaceous spine (7548). —B. *B. actinacantha*, star-like spine (7887). —C. *B. darwinii*, palmate spine (Burkhardt 57[3]). —D. *B. rotundifolia*, foliaceous spine (7951). —E. *B. microphylla*, one arm of a trifid spine from below and in section (8153). —F. *B. grevilleana* (8340), straight trifid spine. —G. *B. trigona*, recurved trifid spine (8007). All collections by Landrum except for C.

American species that seem to have some phylogenetic basis. Using these as a start, one might try to discover more members in other areas.

The first group generally has umbellate inflorescences, foliaceous spines, predominantly reticulate-actinodromous venation, short styles, and stamens with lateral teeth just below the anther. It includes at least *B. actinacantha*, *B. congestiflora*, *B. rotundifolia*, and *B. horrida*. Species that are perhaps similar, but that lack one or more characters typical of this group, are *B. empetrifolia*, *B. microphylla*, *B. glomerata*, *B. grevilleana*, and *B. comberi*.

A second group shares racemose inflorescences, relatively large 3-parted spines, predominantly mixed craspedodromous venation, long styles, and stamens without lateral teeth. It includes *B. chilensis*, *B. litoralis*, and *B. valdiviana*. Other species that seem to be related but lack one or more typical characters are *B. darwinii*, *B. ilicifolia*, *B. trigona*, *B. serratodentata*, and *B. negeriana*. *Berberis laurina* Billbg. of Brazil and Uruguay probably belongs to this group, being quite similar to *B. litoralis* and *B. valdiviana*.

Berberis montana, *B. corymbosa*, and *B. masafuerana* do not clearly belong to either group. In *B. corymbosa* the inflorescence and style are similar to *B. jobii* Orsi and *B. jujuyensis* Job, both of northwestern Argentina.

GEOGRAPHY

Stuessy and Taylor (1995) have provided an extensive synthesis of numerous phytogeographic studies of the Chilean flora. The following discussion is, of course, much shorter and restricted in scope.

The sclerophyllous mediterranean matorral of central Chile and the wet temperate forests of southern Chile and adjacent southern Argentina with rainfalls sometimes exceeding 4 m (Cabrera, 1971) together comprise an island of relatively abundant plant growth surrounded by ocean on the west and south, the Atacama Desert in the north, and the Patagonian Desert in the east. It is an area of high endemism. For instance, among the dominant woody plant groups, all species of Fagaceae, Monimiaceae, Lauraceae, Cunoniaceae, Flacourtiaceae, Eucryphiaceae, Araliaceae, Celastraceae, Elaeocarpaceae, Podocarpaceae, Cupressaceae, Araucariaceae, and nearly all species of Cornaceae, Proteaceae, and Myrtaceae are endemic. Many genera are endemic, including the following woody plants and epiphytes: *Jubaea*, *Myoschilos*, *Boquila*, *Lardizabala*, *Peumus*, *Pitavia*, *Valenzuelia*, *Bridgesia*, *Berberidopsis*, *Sarmienta*, *Mitraria*, *Asteranthera*, *Saxegothaea*, *Fitzroya*, *Pilgerodendron*, *Amomyrtus*, *Tepualia*, and *Legrandia*. Three angiosperm families are endemic: Aextoxicaceae, Gomortega-

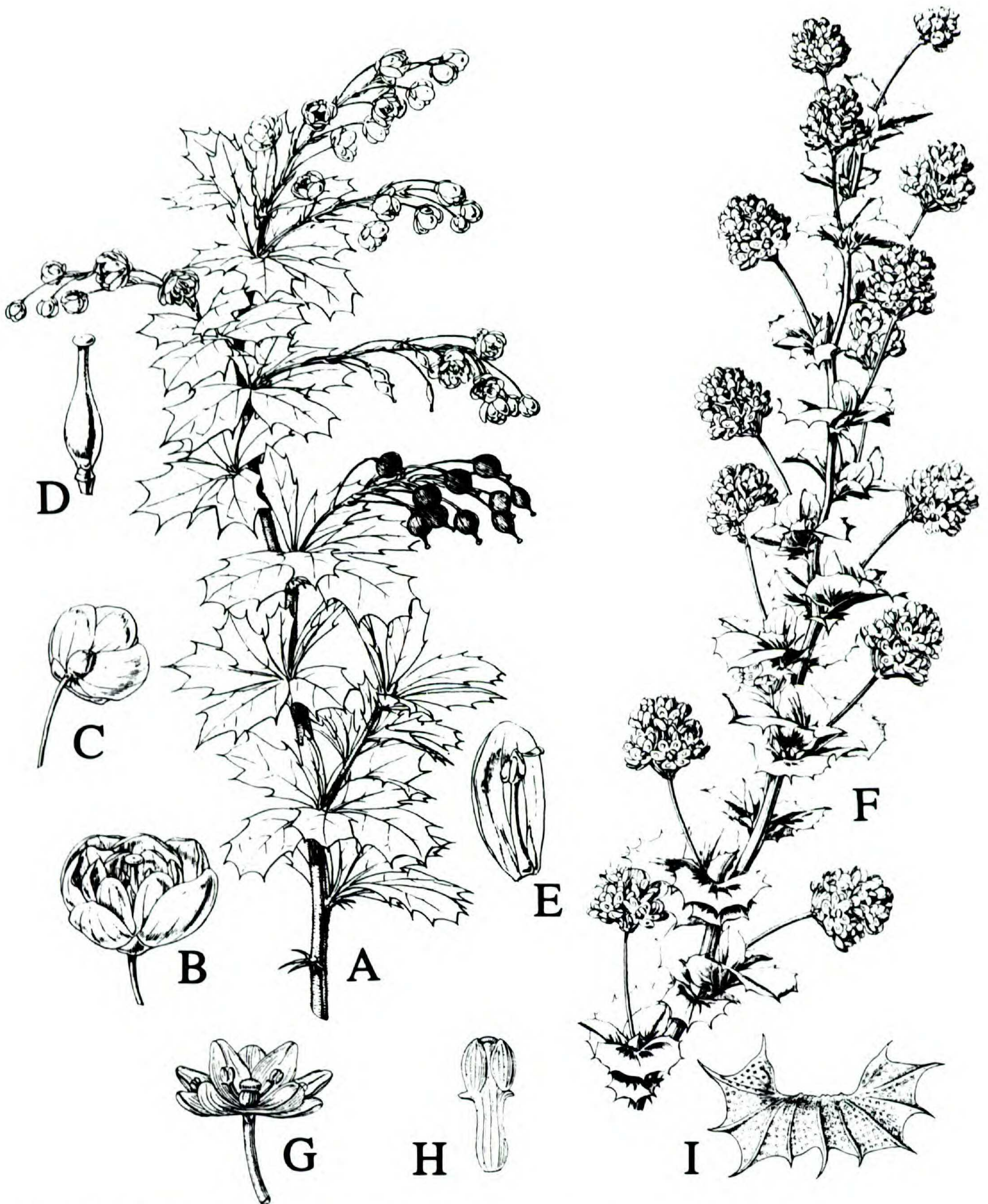


Figure 4. A–E. *Berberis darwinii*. —A. Branch with fruits and flowers. —B. Open flower from above. —C. Open flower from below. —D. Pistil with elongate style. —E. Single tepal with stamen. Reproduced from W. J. Hooker, *Icon. Pl.* 7, t. 672. 1844. F–I. *B. congestiflora*. —F. Flowering branch. —G. Open flower (note essentially sessile stigma). —H. Stamen with tooth-like appendages. —I. Foliaceous spine. Reproduced from lámina 3 of the *Atlas of C. Gay's Historia física y política de Chile 1845–1854* and a copy of the same in C. Muñoz (1966), *Sinopsis de la flora chilena*, fig. 36.

ceae, and Misodendraceae (Cronquist, 1981). Such a high degree of endemism, especially at the higher taxonomic levels, generally indicates long isolation. Various factors have contributed to the isolation of the flora of southwestern South America: continental drift, desertification of northern Chile and Patagonia, and the rise of the Andes (Stuessy & Taylor, 1995).

Berberis is diverse in southwestern South America. If the two species of the Juan Fernández Islands and the two species of the adjacent Patagonian Desert (*B. comberi* and *B. grevilleana*) are excluded, then there are still 16 species of *Berberis*, sometimes quite dissimilar, in continental Chile and adjacent Argentina in this southwestern South American "island" of vegetation. Thus, it is unlikely that *Berberis* is a recent introduction, for if that were the case, only several introductions or rapid divergent evolution could account for the diversity. But if *Berberis* is a long-time resident of southern South America, the diversity is more understandable. In fact, leaf fossils that are apparently of *Berberis* have been found in the early Tertiary of Neuquén and Santa Cruz, Argentina (Berry, 1938; Fergulio, 1949; Orsi, 1976).

Disjunct genera with some species in other parts of South America or in Australasia are another notable feature of the southwestern South American flora. For instance, *Myrceugenia*, *Azara*, *Escallonia*, *Crinodendron*, *Quillaja*, *Lithrea*, *Blepharocalyx*, and *Myrcianthes* have disjunct species in southeastern Brazil. *Berberis* has the same disjunct geography in South America. Other genera are disjunct in Australasia, e.g., *Nothofagus*, *Laurelia*, *Gevuina*, *Lomatia*, and *Eucryphia*.

I have hypothesized (Landrum, 1981) that much of the flora of temperate South America can be divided into two groups based on modern patterns of distribution and that these correspond to two ancestral floras that merged in southern South America in the Tertiary. I believe one group was living in southern South America since at least the early Tertiary, and members of this flora are often disjunct in eastern temperate South America. *Berberis* belongs to that group. I believe another group entered southern South America from Antarctica, and these are often disjunct in Australasia, *Nothofagus* being the most well-known example. *Nothofagus* appeared first in the fossil record of southernmost South America as pollen in the late Cretaceous and slowly migrated northward to its approximate present distribution by the Miocene (Tanai, 1986). The Antarctic Peninsula was very near, or in contact with, southernmost South America from the late Cretaceous to about the mid-Oligocene, the best

connection probably being early (Cunningham et al., 1995). Therefore, *Nothofagus* and associated plant groups may have entered South America early but have not migrated rapidly northward. Warmer climates and meeting with a resident South American vegetation may have been factors slowing that migration.

Genera of southwestern South America are sometimes disjunct in the central and northern Andes. My explanation for this pattern is that the uplift of the Andes, which caused drying in Argentina, cutting off migration to eastern South America, also provided a pathway to the north for temperate genera. They were in fact pre-adapted to the cold mountainous habitats where sufficient rainfall was available. The southern tip of this pathway still exists in northwestern Argentina, where moisture-laden winds from the northeast support the Yunga (subtropical forest) vegetation (Cabrera, 1971) and where, for instance, *Blepharocalyx*, *Myrcianthes*, *Azara*, *Escallonia*, and *Crinodendron* grow. All are disjunct in eastern temperate South America and southwestern South America. Yunga vegetation is now separated by hundreds of kilometers of mountains and desert from similar vegetation in southwestern South America. The Andes have provided a pathway south for northern genera such as *Alnus* and *Juglans* (Digilio & Legname, 1966) that reach the Yunga vegetation but go no farther.

Between 27 and 19 million years ago there was a major tectonic episode in Bolivia (Sempere et al., 1990) and presumably farther south in the Andes. The uplift of the Andes caused climatic drying that changed warm woodlands to grassland in southern Argentina, as indicated by the appearance of grazing mammals (Marshall & Sempere, 1993: 349) in six different lineages (Patterson & Pascual, 1972: 282). As the Andes continued to rise a more severe rain shadow was created by 15 million years ago. The desertification of northern Chile occurred in late Oligocene-Miocene time, or about the same time as the desertification of Patagonia, being caused also by the uplift of the Andes that cut off the subtropical winds from the east and by the development of the cold Humboldt Current from Antarctica (Marshall & Sempere, 1993: 340; Galli-Olivier, 1967). In Antarctica, the source of the Humboldt Current, glaciers were reaching sea level in the late Oligocene and an ice sheet developed in East Antarctica in the Miocene (Shackelton & Kennett, 1975). Pitman et al. (1993) calculated that the separation of South America and Antarctica was complete by 30 million years ago. Thus, the southwestern South

American "island" of vegetation became increasingly isolated from 30 to 15 million years ago and probably has not been in contact with other similar vegetations since.

One might speculate that since the Berberida-ceae are mainly a Northern Hemisphere group, the South American *Berberis* must have migrated from North America. Direct migration would be relatively recent, since the union of North and South America occurred ca. 2.5 million years ago (Goldblatt, 1993). Island hopping between continents has been hypothesized for some mammal groups as early as the late Oligocene (Marshall & Sempere, 1993: 330) and could be hypothesized for *Berberis* as well. Even if *Berberis* reached northern South America early, somehow it would have had to migrate to temperate southern South America rapidly to appear in the fossil record there and to reach the now isolated flora of southwestern South America. *Juglands* and *Alnus*, obvious arrivals for North America, never reached southwestern South America. I believe it is more probable that *Berberis* was already diverse in southern South America before North and South America united and that migration has subsequently been northward.

When and how did *Berberis* s. str. (simple-leaved species), which has an additional center of diversity in Asia, reach South America? The answer is beyond the scope of this paper, but the best connection between northern and southern continents in the late Cretaceous would have been through Africa (Raven & Axelrod, 1974) and *Berberis* s. str. does grow in Africa (Ahrendt, 1961). Raven and Axelrod have hypothesized this same African route for the related family Lardizabalaceae with about 30 species, most of which are Asian, but with 2 endemic monotypic genera in southwestern South America.

TAXONOMY

Berberis L., Sp. Pl. 330. 1753. TYPE: *Berberis vulgaris* L. (lectotype, designated by Britton & Brown (1913)).

Shrubs or small trees, often spiny; spines the reduced leaves of long shoots, palmate to leafy, or 3-parted, rarely simple; bracts present at the bases of new vegetative growth or inflorescences, ovate to lanceolate. Leaves alternate, simple in South America, sometimes compound in North America and Asia, evergreen or deciduous, arranged singly along the stems or more frequently in rosettes (short shoots) in the axils of spines; margins entire or spinescently toothed. Inflorescence a solitary flower, a sessile or pedunculate umbel, or a raceme. Flowers yellow, orange, to red-orange, the perianth typically with 5 or 6 whorls of 3 tepals; tepals of inner 2 whorls with 2 nectariferous glands on the lower inner surface; middle whorl (or sometimes 2 whorls) with somewhat larger tepals; outer whorls of gradually smaller tepals, the outermost bract-like; stamens 6, the anthers about equaling the filaments in length, sometimes with tooth-like appendages just below the anthers; pistil barrel-shaped to urceolate, 1-celled, the ovules up to 10, the style pronounced or not; stigma pel-tate; placenta basal to lateral; fruit a berry; seeds one to a few.

The common names "calafate" and "michay" are applied to many species of Chilean *Berberis*. They are probably not consistently used for particular species.

KEY TO THE SPECIES OF *BERBERIS* IN CHILE AND ADJACENT SOUTHERN ARGENTINA

- 1a. Spines foliaceous or star-like, with (3–)5 or more pointed arms radiating from a \pm foliaceous blade (Fig. 3A, B, D).
 - 2a. Lower leaf surface with raised, reticulate veins, covered with stiff, erect hairs *B. horrida*
 - 2b. Lower leaf surface smooth, the veins only slightly raised if at all.
 - 3a. Leaf blades at anthesis submembranous; leaf margins nearly all entire, with only a few teeth sometimes present; peduncle plus rachis (if any) of inflorescence 1–4 cm long *B. rotundifolia*
 - 3b. At least some leaf blades at anthesis coriaceous; some leaf margins toothed; peduncle and rachis of inflorescence 0–5 cm long.
 - 4a. New leaves appearing on flowering branches with entire margins, glaucous beneath; inflorescence with the peduncle plus rachis 2–5 cm long; flowers per inflorescence up to 25; pedicels 2–4 mm long *B. congestiflora*
 - 4b. New leaves appearing on flowering branches with toothed margins, not notably glaucous beneath; inflorescence with the peduncle plus rachis 0–3 cm long; flowers per inflorescence up to 14; pedicels 3–20 mm long *B. actinacantha*
- 1b. Spines lacking, or if present without a foliaceous blade, with (1–)3–5 arms (Fig. 3C, F, G).
 - 5a. Inflorescence a panicle or umbel; spines lacking or insignificant; leaves mostly entire; fruit with a style ca. 1 mm long and stigma 1.5–2 mm wide; endemic to Más a Tierra Island, Juan Fernández Archipelago *B. corymbosa*
 - 5b. Inflorescence a raceme, umbel, or solitary flower; spines often present and robust; fruit often with a

- style less than 1 mm long and stigma often less than 1.5 mm across; continental or growing on Más Afuera Island, Juan Fernández Archipelago.
- 6a. Leaves entire, subacicular to linear, up to ca. 1 cm wide, mainly 3 or more times as long as wide.
- 7a. Leaves subacicular, 1–1.2 mm wide; flowers generally solitary *B. empetrifolia*
- 7b. Leaves linear, 4–10 mm wide; flowers in umbels.
- 8a. Style 1.5–3 mm long; spines 3–18 mm long *B. trigona*
- 8b. Style less than 0.5 mm long; spines 7–33(–40) mm long *B. microphylla*
- 6b. Leaves toothed or entire, variously shaped, often over 1 cm wide, often less than 3 times as long as wide.
- 9a. Leaves mainly oblong to narrowly elliptic, 2.3–10 cm long, the margin often with 10 or more teeth per side.
- 10a. Leaves lustrous below; marginal and secondary veins slightly raised above; margins coarsely serrate (rarely entire) with 6–16 spine-tipped teeth per side; peduncle plus rachis 2–8 cm long; endemic near Concepción, Chile, at elevations of ca. 300 m *B. negeriana*
- 10b. Leaves dull below; marginal and secondary veins slightly impressed above; margins usually serrate with 10–32 spine-tipped teeth per side; peduncle plus rachis 0.5–1.5 cm long; from Arauco to Aisén, Chile, and Río Negro, Argentina, usually at elevations above 1000 m *B. serratodentata*
- 9b. Leaves variously shaped, often all less than 5 cm long, the margins entire or with fewer than 10 teeth per side.
- 11a. Inflorescence a raceme; style on fruit 1–3 mm long; continental species.
- 12a. Young twigs densely pubescent; spines pubescent, mainly with 5 arms 2–7 mm long, the arms \pm ascending (Fig. 3C) *B. darwinii*
- 12b. Young twigs glabrous or papillate-puberulent; spines not pubescent, with 3 (rarely more) arms 4–38 mm long, the laterals often perpendicular to the central.
- 13a. Flowers 5–10 mm long, 3–7 per inflorescence; leaves with impressed marginal and secondary veins above, usually lustrous above, the margins minutely papillate; year-old twigs with distinct longitudinal ridges and grooves *B. ilicifolia*
- 13b. Flowers up to ca. 5 mm long, 6–30 per inflorescence; leaves with flat or slightly raised marginal and secondary veins above, lustrous or not above, the margins not papillate; year-old twigs \pm terete.
- 14a. Leaf apex obtuse to broadly rounded; small veins between secondary veins usually clearly visible below; pedicels 6–15 mm long; spines 0.5–2.3 cm long; inflorescence with up to ca. 20 orange flowers; ovules 5–6; Región II *B. litoralis*
- 14b. Leaf apex usually acute; small veins between the secondary veins indistinct below; pedicels 3–10 mm long; spines 1–3.8 cm long; inflorescence with up to ca. 30 yellow flowers; ovules 1–4; Regions IV–X.
- 15a. Leaf margin commonly entire; midvein impressed above; leaves commonly over 5 cm long and 2.5 cm wide, not glaucous below; tree or shrub of forest habitats *B. valdiviana*
- 15b. Leaf margin rarely entire; midvein not impressed above; leaves rarely over 5 cm long and 2.5 cm wide, usually glaucous below; shrub of sclerophyllous scrub *B. chilensis*
- 11b. Inflorescence an umbel or solitary flower; style on fruit in continental species less than 1 mm long or up to 2 or 3 mm long in *B. montana* and *B. comberi*; style on fruits of Juan Fernández Island species ca. 1 mm long.
- 16a. Leaf margins generally entire; leaves mostly oblanceolate to obovate; spines insignificant or if present those near the tips of twigs often simple (i.e., without lateral arms); flowers mainly over 3 mm long.
- 17a. Spines absent or insignificant; Juan Fernández Archipelago.
- 18a. Inflorescence multiflorous; leaves often over 1.5 cm wide; Más a Tierra Island *B. corymbosa*
- 18b. Inflorescence probably of solitary flowers or few-flowered sessile umbels; leaves rarely over 1.5 cm wide; Más Afuera Island *B. masafuerana*
- 17b. Spines normally present; continental species.
- 19a. Mature leaves submembranous; apex rarely mucronate; style 1–2 mm long; usually near the upper limit of woody vegetation; from Cerro Caqui near Valparaíso (Región V) to Volcán Osorno (Región X) *B. montana*
- 19b. Mature leaves coriaceous; apex usually mucronate; style less than 0.5 mm long; from near sea level to the upper limit of woody vegetation;

- from the Andes of Curicó (Región VI) to the Strait of Magellan (Región XII) *B. microphylla*
- 16b. Leaf margins generally spinescent-toothed; leaves variously shaped; spines normally present (except in *B. comberi*), those near the tips of twigs with 3–5 subequal arms; flowers mainly under 3 mm long.
- 20a. Mature seeds fused into a mass; style 0.5–3 mm long; leaves mostly over 1 cm wide; Mendoza and deserts of Neuquén, Argentina.
- 21a. Plants spineless; style ca. 3 mm long; Neuquén and Mendoza up to ca. 1100 m *B. comberi*
- 21b. Plants with 3-parted spines up to 4.5 cm long; style ca. 0.5 mm long; Mendoza at about 2000 m *B. grevilleana*
- 20b. Matures seeds free from each other; style 0–0.5 mm long; leaves mainly less than 1 cm wide; Chile and lake district of Neuquén, Argentina, and farther south.
- 22a. Leaves up to ca. 2 cm long, angularly obovate to oblanceolate to rhomboid, usually arcuate; margin usually with 1–2 spine-tipped teeth per side; Coquimbo *B. glomerata*
- 22b. Leaves usually over 2 cm long, variously shaped, usually about flat; margins often with more than 2 spine-tipped teeth per side.
- 23a. Leaf blades mostly not more than 2 times as long as wide; leaf margin often with more than 3 teeth per side, these usually ascending or radiating; inflorescence often with a noticeable peduncle and/or rachis *B. actinacantha*
- 23b. Leaf blades 2–7 times as long as wide; teeth of leaf margin often less than 3 per side, usually perpendicular; inflorescence a solitary flower or a sessile umbel.
- 24a. Flower solitary or in pairs, 4–5 mm long; spine arms normally over 5 mm long *B. microphylla*
- 24b. Flowers in umbels of 7–11, ca. 3 mm long; spine arms 1–4 mm long *B. actinacantha*

1. *Berberis actinacantha* Mart., in Schult. & J. H. Schult., Syst. veg. 7: 12. 1829. TYPE: Chile. "Baths of Collina," *Macrae s.n.* (holotype, BR!, = ASU photo!; isotype, G!).

Berberis crispa Gay, Fl. chil. 1: 86. 1845. *Berberis actinacantha* var. *crispa* (Gay) Reiche, Anales Univ. Chile 88: 95. 1894. TYPE: Chile. Santiago, Valparaíso, San Fernando, *Gay s.n.* (lectotype, designated here, P["TYPE"]!, = ASU photo!; isolectotype, P!).

Berberis florida Phil., Linnaea 33: 5. 1864. TYPE: Chile. Andes of Colchagua, ca. 6000 ft., *Landbeck s.n.* (lectotype, designated here pro parte [non *B. valdiviana* at right], SGO-063345!, = ASU photo!).

Berberis congestiflora var. *hakeoides* Hook. f., Bot. Mag. t. 6770. 1884. *Berberis hakeoides* (Hook. f.) C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 146. 1905. TYPE: cultivated in England, seeds from "Arguihue," Chile (holotype, K!, = ASU photo!).

Berberis brachyacantha Phil. ex Reiche, Anales Univ. Chile 88: 96. 1894. TYPE: Chile. Constitución, *Philippi s.n.* (lectotype, designated here, SGO-063352!, = ASU photo!; isolectotype, SGO!, = ASU photo!).

Berberis variiflora C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 147. 1905. TYPE: Chile. Villarrica, *Neger s.n.* (lectotype, designated here, M [Schneider's hand]!, isolectotype, M!).

Berberis coquimbensis Muñoz, Agric. Técn. (Chile) 8: 79. 1948. TYPE: Chile. Coquimbo, Fray Jorge, *Jiles s.n.* (holotype, SGO-57575!, = ASU photo!; isotype, CONC-27637 not seen).

Shrub ca. 1 m high, glabrous or with young twigs, leaf bases, bracts, and/or petioles puberulent; young twigs green to light gray or reddish brown, glabrous

or puberulent, the older twigs with longitudinal cracks and ridges, often covered with numerous small black dots; spines foliaceous or star-like, the blade (the central portion) 1–3 mm long in star-like spines and 1–6 mm long in foliaceous spines, the arms 3–18, 1–24 mm long, often with two grooves below; bracts ovate to lanceolate, 1.5–4 mm long. Leaves suborbicular, reniform, elliptic, ovate, obovate, or oblanceolate, the blade 1.3–5.5 cm long, 0.4–4.5 cm wide, 0.7–2.5(–5) times as long as wide, coriaceous, drying gray-green to light brown, sometimes glaucous below, the margin with (0–)2–20 spinescent teeth per side; apex round to acute or truncate, usually with a spinescent tip; base truncate, cordate, cuneate, or acuminate; petiole 0–5 cm long, 0.5–1 mm thick, puberulent to glabrous; venation predominantly reticulate-actinodromous, the tertiary veins forming a distinct to obscure reticulate pattern between the larger veins. Inflorescence a sessile, or less often a pedunculate, umbel or raceme, with (1–)2–14 flowers, the peduncle plus rachis up to 3 cm long; pedicels 3–20 mm long; flowers 2–3(–5) mm long; tepals usually 14, the 6 innermost elliptic to obovate, clasping the stamens, somewhat smaller than the next 3; stamens 1.5–2.5(–3) mm long, with 2 minute tooth-like lateral appendages below the anther, the anther $\frac{1}{3}$ to $\frac{1}{2}$ the length of the stamen; pistil barrel-shaped to urceolate, 1.5–2.5 mm long, the stigma 0.5–1 mm wide, essentially sessile; ovules

(2-)5(-7), basal. Fruit subglobose, 5-6 mm long; seeds (1-)4-5, 3-5 mm long. Figures 2A, 3A & B, 6A, 9A & B. [Figs. 6-13 pp. 823-830.]

Distinguishing features. Stigma essentially sessile; stamens with tooth-like appendages; spines star-like or foliaceous; inflorescence a several-flowered umbel; leaves with toothed margins, smooth below, usually not glaucous below.

Phenology. Flowering mainly from August to November. Fruiting mainly from November to December.

Distribution and habitat. Endemic to Chile, from near Paposo (Región II) to Temuco (Región IX); from ca. 100 to 1900 m. A shrub of the sclerophyllous scrub vegetation of central Chile; locally common; apparently thriving with limited disturbance.

Common name. Michay (Gay, 1845; Navas, 1976).

Selected specimens. CHILE. **Región II:** Antofagasta, Cachinales, 39 km S of Paposo (25°09'S, 70°26'W), ca. 600 m, 16 Sep. 1991 (fl), *Landrum* 7493 (ASU). **Región IV:** Coquimbo, Illapel, Monte Redondo (31°03'S, 71°35'W), 400 m, 17 Nov. 1947 (st), *Jiles* 481 (CONC-103493); Coquimbo, Parque Nacional Fray Jorge, along "sendero" in forest (ca. 30°45'S, 71°45'W), high hills next to coast, 22 Sep. 1991 (st), *Landrum* 7547 (ASU); Coquimbo, Pichidangui, Cerro Silla del Gobernador (32°08'S, 71°30'W), 530 m, 12 Aug. 1961 (fl), *Schlegel* 3796 (CONC-47208). **Región V:** Isla Negra, road to Totoral, ca. 5.5 km from coast, ca. 0.5 km before junction with road to Huellilemu (33°21'S, 71°40'W), ca. 300 m, 28 Sep. 1993 (fl), *Landrum* 7885 (ASU); Cuesta La Dormida between Limache and Tiltill, at high point of road and ca. 1.4 km towards N on side road to *Nothofagus* forest, ca. 1400 m, 29 Sep. 1993, *Landrum* 7895 (ASU); El Tabo, Quebrada de Córdoba, 30 Dec. 1980 (fr), *Meza & Villagrán* 878 (SGO); near Quilpué, Hacienda Las Palmas, 17 June 1973 (fl), *Zöllner* 6726 (NA). **Región Metropolitana:** Rancagua, prope La Leona, 1828 (fl), *Bertero* s.n. (SGO); región montañosa de Aculeo, Nov. 1968 (fl), *Castillo G.* s.n. (CONC-108097); Santiago, Los Dominicos, Camino El Alba, Quebrada San Ramón, between "La Cascada" and ca. 1 km W (ca. 33°25'S, 70°30'W), ca. 1200 m, 3 Oct. 1991 (st), *Landrum* 7562 (ASU); Santiago, Rinconada de Lo Cerda, Quebrada de La Plata, al final de la Quebrada Los Maquis (33°39'S, 70°56'W), 800 m, 25 Sep. 1960 (fl), *Schlegel* 2947 (CONC-42129). **Región VI:** Colchagua, Pichilemu (34°23'S, 72°00'W), Sep. 1929 (fr), *Montero* 1526 (CONC-84027). **Región VII:** Constitución, montañas Placilla, 28 Sep. 1939 (fl), *Alberti* s.n. (SGO-133541); Linares, Llancaño, a orillas del Ancoa (35°5'S, 71°31'W), 6 Sep. 1953 (fl), *Ansoleaga* s.n. (CONC-14215); Linares, Parral, Termas de Catillo (36°17'S, 71°38'W), 320 m, 5 Jan. 1961 (st), *Montero* 6278 (CONC-84098); Linares, La Mina, camino al Melado, 1500 m, 17 Dec. 1953 (fr), *Ricardi* 2781 (CONC-14609). **Región VIII:** Arauco, at the N limit of Cañete along highway to Concepción (ca. 37°47'S, 73°25'W), < 200 m, 23 Oct. 1993 (fl), *Landrum* 7970 (ASU); Arauco, camino de Curanilahue a Cañete, entre río Curanilahue y

estero Paso Hondo (37°28'S, 73°23'W), 200 m, 6 Jan. 1977 (fr), *Marticorena* 1145 (CONC-88866); Arauco, Cordillera de Nahuelbuta, orillas del río Caramávida (37°41'S, 73°11'W), 850 m, 19 Dec. 1978 (fr), *Marticorena et al.* 1621 (CONC-88847); Ñuble, Atacalco, faldas del Caracol (36°53'S, 71°38'W), 700 m, 19 Sep. 1944 (fl), *Pfister* 6323 (CONC-6323). **Región IX:** Cautín, Cunco, 200 m, Sep. 1943 (fl), *Gunckel* 72950 (CONC-108066); Cautín, Padre Las Casas, 250 m, Dec. 1948 (fl), *Gunckel* 72960 (CONC-108040); Malleco, ca. 1.5 km W of Purén on road to Contulmo (ca. 38°3'S, 73°7'W), ca. 100 m, 24 Oct. 1993 (fl), *Landrum* 7978 (ASU); Cautín, Temuco, Cerro Ñielol, ca. 150 m, 27 Nov. 1947 (fr), *Sparre* 3237 (SGO).

Three varieties may be suggested within this variable species: a typical one in the area of Santiago and Valparaíso with mainly star-like spines (Fig. 3B); a second from the coastal region from Concón north to Paposo with leafy spines and relatively small leaves (Fig. 3A); and a third from Arauco to Cautín with leafy spines and relatively large leaves (Fig. 2A). Although these characters generally hold up for the areas mentioned, so many specimens do not conform that varietal names cannot consistently be assigned to these entities.

Some forms of this species and *B. microphylla* can be confused in their area of overlap (Curicó to Temuco). *Berberis actinacantha* is best distinguished from *B. microphylla* by having several-flowered inflorescences, in contrast to *B. microphylla* with only one or two (rarely three) flowers per inflorescence. *Berberis actinacantha* generally grows at lower elevations than *B. microphylla*. *Berberis actinacantha* is also similar to *B. congestiflora* (see lead 4 in key).

In the protologue of *Berberis variiflora* Schneider stated, "im Herb. München mit echter *congestiflora* gemischt" [in the Munich herbarium mixed with true *congestiflora*]. Of two possible specimens at M, the one selected as lectotype is an unmixed sheet: each piece is marked with "b" and the sheet has a long note by Schneider attached.

2. *Berberis chilensis* Gillies ex Hook., Bot. Misc. 3: 135. 1833. TYPE: Chile. Talca, *Gillies* s.n. (syntype, E-GL not seen; = SGO photo!); Valparaíso, *Bridges* s.n. (syntype, E-GL? not seen).

Shrub up to 2 m high, glabrous; young twigs smooth, reddish brown, often glaucous, the older twigs gray, with ± fibrous bark; spines (1-)3-parted, the arms (0.5-)1-4(-5.5) cm long, about equal in length, or central somewhat longer, the laterals perpendicular to the central; bracts ± triangular, gray-brown, ca. 1-2 mm long. Leaves elliptic to oblanceolate, either arched along the midvein with

the margins turned upward (Fig. 2C), or nearly flat with margins revolute (Fig. 2G), 0.5–5 cm long, 0.7–2.5 cm wide, 1.2–4.7 times as long as wide, the lower surface strongly glaucous or less often gray-green, the upper surface usually lustrous, gray-green, the margins usually with 1–5 coarse spine-tipped teeth per side; apex acute, spine-tipped; base cuneate, usually blending into petiole or the petiole distinct and up to 8 mm long; venation mixed craspedodromous, the midvein nearly flat above, moderately prominent below, the secondary veins up to ca. 5 pairs faint to distinct, the tertiary veins faint to distinct; blades stiffly coriaceous. Inflorescence a raceme (sometimes with minor side branches) ca. 1–5 cm long, with 10–30 flowers; pedicels 3–5 mm long, subtended by narrowly triangular, boat-shaped bracts 2–3 mm long; flowers lemon-yellow, 3–5 mm long; tepals (11–)12(–14), the inner six obovate, 2.5–5 mm long; stamens 2–3 mm long, without lateral appendages, the anther ca. $\frac{1}{3}$ the length; pistil 2–4 mm long, the style ca. $\frac{1}{2}$ the length; ovules (2–)3(–4), basal. Fruit subglobose, 5–7 mm long, terminating in a persistent style ca. 1–2 mm long; seeds 1–3, 4–5 mm long.

Distinguishing features. Style long; stamens without tooth-like appendages; spines 3-armed, usually large; inflorescence a several-flowered raceme; leaves with toothed margins, acute apices, flat midvein above, and often glaucous.

Common names. Michay (Navas, 1976), richa, palo amarillo (Hoffmann, 1978), espino maulino (Muñoz, 1966).

Berberis chilensis is most likely to be confused with *B. valdiviana* (see lead 15 in key).

KEY TO VARIETIES OF *BERBERIS*

- 1a. Leaves recurved, the margins directed upward (Fig. 2C); marginal teeth 2–7 mm long; pre-cordillera of the Andes *B. chilensis* var. *chilensis*
 1b. Leaves nearly flat, not recurved, the margins not directed upward (Fig. 2G); marginal teeth 1–2 mm long; coastal cordillera and coast
 *B. chilensis* var. *brachybotria*

2a. *Berberis chilensis* var. *chilensis*

Berberis ferox Gay, Fl. chil. 1: 80. 1845. TYPE: Chile. Santiago, Gay s.n. (lectotype, designated here, P!, = F-34519!; isolectotype, P!).

Berberis diffusa Gay, Fl. chil. 1: 80. 1845. *Berberis chilensis* var. *diffusa* (Gay) Reiche, Anales Univ. Chile 88: 92. 1894. TYPE: Chile. Santiago, Gay s.n. (holotype, P!, = F-34516!).

Berberis fragrans Phil. ex Reiche, Anales Univ. Chile 88: 92. 1894. TYPE: Chile. Curicó, Vichuquén, *Philippi?* s.n. (holotype, SGO-063348!, = ASU photo!).

Leaves recurved with the margins directed upward, gray-green below; margins not revolute; marginal teeth 2–7 mm long; spines 1–5(–5.5) cm long. Figures 2C, 6B, 9C.

Phenology. Flowering mainly in September and October. Fruiting mainly from November to March.

Distribution and habitat. Endemic to Chile, from Coquimbo (Región IV) to Malleco (Región IX), mainly in the pre-cordillera of the Andes. A shrub of sclerophyllous scrub vegetation, usually in fairly open habitats, from 370 to 1600 m.

Selected specimens. CHILE. **Región IV:** Coquimbo, Ovalle, Las Palmas (32°03'S, 71°25'W), 600 m, 6 May 1967 (fl), *Jiles 5029* (M); Coquimbo, Combarbalá, sector La Fragueta (31°07'S, 70°34'W), 1100 m, 10 Jan. 1978 (fr), *Jiles 6352* (CONC-108048). **Región Metropolitana:** Barnechea in Las Condes, hills near Nido de Aguilas (ca. 33°30'S, 70°30'W), ca. 550 m, 21 Jan. 1978 (fr), *Landrum 3074* (ASU); Los Domínicos, Camino El Alba, Quebrada San Ramón, between "La Cascada" and ca. 1 km W (33°25'S, 70°30'W), ca. 1200 m, 3 Oct. 1991 (fl), *Landrum 7558* (ASU); Cajón de Maipo, El Melocotón, near school on river terrace, ca. 1000 m, Oct. 1993 (st), *Landrum 8215* (ASU); Quebrada de la Plata (33°29'S, 70°54'W), 620 m, 30 Aug. 1956 (fl), *Schlegel 1135* (CONC-47209). **Región V:** Aconcagua, Los Andes, camino a Portillo, km 13 (32°51'S, 70°28'W), 1200 m, 15 Nov. 1970 (fr), *Martcorena & Weldt 551* (CONC-34740, OS); Aconcagua, Los Andes, Río Colorado (32°52'S, 70°15'W), 1000 m, 24 Apr. 1943 (st), *Schlegel 36* (CONC-47211); Aconcagua, Resguardo Los Patos near Putaendo, 1000 m, 5 Oct. 1975 (fl), *Zöllner 7323* (NA); Valle del Colliguay (33°12'S, 71°15'W), Jan. 1918 (st), *Jaffuel s.n.* (CONC-47445). **Región VI:** Cachapoal, La Leona, 1830 (fl), *Bertero 93* (F, G); Colchagua, San Fernando, Cerro Centinela, 460 m, 30 Sep. 1927 (fl), *Montero 190* (F); Rancagua, Termas de Cauquenes, ca. 1 km beyond Termas on road to CONAF reserve (ca. 34°15'S, 70°30'W), ca. 800 m, 26 Sep. 1993 (st), *Landrum 7880* (ASU); Rancagua, Coya, ca. 7 km E of bridge at Coya on road to Sierra Nevada (ca. 34°14'S, 70°31'W), ca. 800 m, 6 Oct. 1993 (yfr), *Landrum 7907* (ASU). **Región VII:** Talca, Sep. 1926 (fl), *Claude-Joseph 4328* (US); Linares, El Colo, altos de los Rabones (35°50'S, 71°24'W), 300 m, 14 Mar. 1988 (fr), *Rodríguez & Baeza 2301* (CONC-113069); Talca, road to Vilches, at turn off of main road to Laguna del Maule, ca. 800 m, 12 Jan. 1988 (fr), *Bricker 195* (ASU); Talca, Espinal de Los Llanos (35°20'S, 71°17'W), 300 m, 27 Nov. 1990 (fr), *Matthei & Quezada 1175* (CONC-110703). **Región VIII:** Bío Bío, Millantú (37°24'S, 72°36'W), 2 Oct. 1955 (fl), *Junge s.n.* (CONC-18838); Bío Bío, San Rosendo, cerros, 23 Dec. 1957 (st), *Montero 5554* (CONC-84083); Bío Bío, Arenales de Canteras (37°22'S, 71°53'W), 370 m, 6 Dec. 1977 (fr), *Oehrens s.n.* (CONC-47614). **Región IX:** Malleco, Angol, cerros, 13 Oct. 1957 (fl), *Montero 5279* (CONC-84088); Malleco, Mininco, 187 m, 8 Jan. 1967 (st), *Montero 7833* (CONC-84094); Malleco, Deuco, lado sur, camino a Angol (37°52'S, 72°45'W), 6 Nov. 1977 (st), *Montero 10690* (CONC-84085).

2b. *Berberis chilensis* var. *brachybotria* (Gay)
Landrum, comb. nov. Basionym: *Berberis brachybotria* [*brachybodria*] Gay, Fl. Chil. 1: 81. 1845. TYPE: Chile. Valparaíso, *Gaudichaud* (212) (lectotype, designated here, P["TYPE"]!, = ASU photo!; isolectotype, P!, = F-34508!, = ASU photo!).

Berberis brachybotria var. *brevispina* Reiche, Anales Univ. Chile 88: 92. 1894. TYPE: Chile. Cuesta de Zapata, entre Santiago y Valparaíso, *Philippi?* (holotype, SGO-063367!, = ASU photo!).

Leaves nearly flat, not recurved, gray-green or yellow-green below; margins slightly revolute; marginal teeth ca. 1–2 mm long; spines 1–2.5 cm long. Figures 2G, 6C, 9D.

Phenology. Flowering mainly in August and September. Fruiting mainly from October to January.

Distribution and habitat. Endemic to Chile, from Coquimbo (Región IV) to Colchagua (Región VI) in the coastal cordillera and on the coast. A shrub of sclerophyllous, sometimes dense, scrub.

Selected specimens. **Región IV:** Coquimbo, Illapel, parte S de la cuesta Los Hornos, 1500 m, 22 Sep. 1960 (fl), *Jiles* 3740 (CONC-41671); Coquimbo, Combarbalá, El Churque (30°26'S, 70°50'W), 11 Oct. 1971 (fl), *Jiles* 5725 (CONC-108047). **Región V:** Algarrobo, 3–4 km de la costa por el camino a Casablanca, 19 Aug. 1978 (fl), *Cassels* 142 (SGO); Colliguay (33°10'S, 71°09'W), 470 m, 9 Sep. 1956 (fl), *Garaventa* 6624 (CONC-70275, OS); Marga Marga, Estero de las Piedras (33°11'S, 71°17'W), Jan. 1932 (fr), *Jaffuel* 3255 (CONC-47446); Isla Negra, road to Totoral, ca. 6 km E of Isla Negra, at junction with road to Huellilemu (33°25'S, 71°40'W), ca. 300 m, 28 Sep. 1993 (fl), *Landrum* 7893 (ASU). **Región VI:** Colchagua, Hacienda Mallermo, 2 Dec. 1924 (fr), *Fuentes s.n.* (G); O'Higgins, Cachapoal, Palmas de Cocalán (34°11'S, 71°14'W), 450 m, 27 Nov. 1970 (fr), *Oehrens* 933 (CONC-41823); Rancagua, Loncha, ca. 23 km W of entrance to Codelco property, ca. 400 m, Oct. 1993 (st), *Landrum* 8212 (ASU).

The name *Berberis gayi* K. Koch (Hort. Dendr. 19, number 66. 1853) is apparently a new (superfluous) name for *Berberis brachybotria*.

3. *Berberis comberi* Sprague & Sandwith, Kew Bull. 1927: 175. 1927. TYPE: Argentina. Neuquén: Cerro Lotena, 3000 ft., 24 Sep. 1925, *Comber* 49 (holotype, K not seen, = K photo-13717 at SGO!).

Shrub to ca. 1 m high; young twigs yellowish brown, the mature twigs gray, obscurely striate, gradually tapering from point of attachment to tip without branching for up to ca. 18 cm; spines none; bracts broadly ovate, 0.8–2 mm long. Leaves rhombic, oblong-elliptic, or subpalmate, 2–4.5 cm long,

1.7–4.6 cm wide, 0.9–1.4 times as long as wide, solitary or in clusters of 2 or 3 on short shoots; blade stiffly coriaceous, drying yellow-brown, slightly lustrous above and below, or dull below; margin with 1–2 subtriangular spinescent teeth per side; base narrowly acute to acuminate, or hastate to truncate; apex acute to acuminate, spinescent; petiole none or up to ca. 2 mm long, blending with base; venation reticulate-actinodromous to mixed craspedodromous, not impressed, generally faint to indistinguishable. Inflorescence uniflorous or an umbel of 2 or 3 flowers; pedicels 2–4 mm long; flowers ca. 1 cm long, yellow-orange; tepals probably about 12–14, the innermost 7–9 mm long; stamens 4.5–5 mm long, the anther ca. ½ the length; pistil vase-shaped, ca. 8 mm long; style ca. 3 mm long, the stigma ca. 1 mm diam.; ovules 8–10, basal. Fruit subglobose, ca. 1–1.3 mm long, the persistent style ca. 3 mm long, the peltate stigma 1.5–2 mm diam., the fruit wall papery when dry; seeds 4–11, fused into a stone-like mass ca. 10 mm long at maturity. Figures 2I & J, 6B, 10A.

Distinguishing features. Style long; stamens without tooth-like appendages; spines none; inflorescence a solitary flower or 2–3-flowered umbel; leaves stiff, the margins spiny; twigs spur-like; mature seeds fused in a mass.

Phenology. Flowering probably in September and October. Fruiting in November and December.

Distribution and habitat. Endemic to central western Argentina, found only in Mendoza and Neuquén provinces. A shrub of desert scrub in the rain shadow of the Andes.

Selected specimens. ARGENTINA. **Mendoza:** Depto. Malalhue, Ranquil de Lirkai, 1100 m, 9 Dec. 1960 (fr), *Ruiz Leal* 21446 (ASU, MERL). **Neuquén:** 38 km N of Zapala on ruta 40 (ca. 38°40'S, 70°W), ca. 865 m, 9 Dec. 1994 (st), *Landrum* 8352 (ASU, MERL); near ruta 40 and Río Picun Leufu, 2 km along road to Bajada Los Molles from ruta (ca. 39°15'S, 70°W), ca. 750 m, 11 Dec. 1994 (fr), *Landrum* 8377 (ASU, MERL); más o menos 2 km antes de la bifurcación del camino de Huitrin y Chosmalal, 13 Jan. 1963, *Roig et al.* 4423 (MERL); 20 km al N de Zapala, 25 Feb. 1993, *Roig et al.* 14716 (MERL).

Berberis comberi is an extraordinary species. It is known only from a few localities in the Patagonian deserts of Neuquén and Mendoza, Argentina, that have dramatic seasonal changes. It forms dense shrubs with stiff, spur-like branches up to ca. 18 cm long. The leaves are stiffly coriaceous and spinose, but the twigs lack spines. The flowers were reported to be 5-merous (Sandwith, 1927), which would be quite unusual in *Berberis*: I have seen no flowering specimens to verify this. The floral characters in this description are based on reports of

Sprague and Sandwith (1927) and Job (1942), all of whom had only the flowering type specimen to examine. Ruiz Leal (1965) was first to describe fruiting specimens. The seeds agglutinate together to form a "stone-like" mass.

Berberis comberi is not clearly closely related to any other species of *Berberis* in southern South America except perhaps *B. grevilleana*. They share the unusual characteristic of having seeds that fuse together in a mass in the mature fruit.

4. *Berberis congestiflora* Gay, Fl. chil. 1: 75, t. 3. of Atlas. 1845. TYPE: Chile. Valdivia, Gay *s.n.* (lectotype, designated here, P["TYPE"]!, = ASU photo!; 2 isoelectotypes, P!, = ASU photos!; isoelectotype, G!, = F-27406!).

Shrub to 3 m high, glabrous or the young petioles, bracts, and twigs minutely puberulent; young twigs light gray, often shiny, becoming dull, the bark sometimes fibrous with age; spines star-like to broadly foliaceous, the arms 5–12(–15), 2–5 mm long, the central blade portion about as long as or longer than the arms, the margin revolute; bracts ovate, 1–3 mm long. Leaves elliptic, ovate, or suborbicular, the blade 0.9–3.5 cm long, 0.6–2.5 cm wide, 1–1.7(–2.4) times as long as wide, subcoriaceous, glaucous below, the margin entire or with up to 7 spinescent teeth per side; apex acute to rounded; base cordate, truncate, or rounded; petiole 0–1.5 cm long, normally much shorter than the blade; venation predominantly reticulate-actinodromous, weak to prominent. Inflorescence an umbel or raceme with up to 25 flowers, the rachis, if present, up to 2 cm long, the peduncle plus rachis 2–5 cm long; pedicels 2–4 mm long, subtended by triangular bracts 1–2 mm long. Flowers ca. 2.5–3 mm long; tepals 14, the six innermost elliptic to obovate, 2–2.5 mm long, clasping the stamens, somewhat smaller than the next three; stamens 1.5–2 mm long, with two minute, tooth-like lateral appendages below the anther, the anther ca. ½ the length of the stamen; pistil barrel-shaped to urceolate, ca. 1.5 mm long, the stigma ca. 0.8 mm wide, essentially sessile; ovules (4–)5, basal. Fruit subglobose, ca. 6 mm long; seeds 4–5, ca. 4 mm long, lustrous. Figures 4F–H, 6C, 10B.

Distinguishing features. Style short; stamens with tooth-like appendages; spines star-like or foliaceous; inflorescence a several-flowered umbel or raceme; leaves subcoriaceous, usually glaucous below, the margins often entire.

Phenology. Flowering mainly from October to December. Fruiting mainly in January.

Distribution and habitat. Endemic to the Cen-

tral Valley of Chile, Regions IX and X, at elevations of less than 500 m. This species seems to thrive (especially along fences) in open areas of the Central Valley that are now largely converted to agriculture. Gay stated that it grows in "prados naturales . . . entre Villarica y Guanegue," which now must be quite rare or nonexistent.

Common name. Michai (Rodríguez et al., 1995).

Selected specimens. CHILE. **Región IX:** Cautín, Vilcún (38°40'S, 72°13'W), 200 m, 24 Nov. 1920 (fl), *Hollermayer 329* (CONC-108103); Malleco, road from Traiguén to Victoria, ca. 9 km W of Highway 5 (ca. 38°15'S, 72°25'W), < 200 m, 24 Oct. 1993 (fl), *Landrum 7983* (ASU, SGO); Cautín, ca. 9 km E of highway 5 on road to Vilcún, ca. 200 m E of road to El Natre (ca. 38°40'S, 72°22'W), ca. 250 m, 29 Oct. 1993 (fl), *Landrum 8050* (ASU); Cautín, Lautaro, camino entre Lautaro y Curacautín, km 15, 1 km antes de Santa Ana (38°29'S, 72°17'W), 270 m, 19 Jan. 1976 (fr), *Martcorena et al. 700* (CONC-45000). **Región X:** Valdivia, La Unión, Catamutún, 150 m, 26 Oct. 1928 (fl), *Behn 23299* (CONC-23299); Valdivia, Cordillera de Ranco, summis cacum, Dec. 1854 (fl), *Lechler 2990* (CONC-73583); Valdivia, río Traiguén, entre La Unión y río Bueno, 9 Feb. 1931 (fl), *Rudolph 26* (SGO); Valdivia, Fundo San Antonio, 5 km S de La Unión, río Lollehue, 3 Jan. 1967 (fr), *Zollitsch 156* (M).

Berberis congestiflora is similar to *B. actinacantha*, overlapping with it in Malleco and Cautín (see lead 4 in key). Field studies of these species would be useful to see whether they hybridize and if they show some habitat and phenology differences.

I found one hybrid between *B. congestiflora* and *B. darwinii* (*Landrum 8012*) near Victoria.

5. *Berberis corymbosa* Hook. & Arn., Bot. Misc. 3: 135. 1833. TYPE: Chile. Juan Fernández [Archipelago, Más a Tierra Island], *Graham s.n.*, *Douglas s.n.*, and *Cuming 1338* (syntypes, not seen, = SGO photo [*Cuming 1338, E-GL*]!).

Berberis paniculata Phil., Anal. Univ. Santiago 1872: 664. 1872. TYPE: Chile. Juan Fernández [Archipelago, Más a Tierra Island], *Philippi s.n.* (holotype, SGO!, = ASU photo!; isotype, CONC!, = ASU photo!).

Shrub or tree to ca. 5 m high, glabrous; young twigs reddish brown to yellowish brown, smooth, ± terete, becoming gray to light brown, slightly rough; spines usually few or lacking, 3-parted, weak, the arms 2–5 mm long, the laterals ascending slightly; bracts ovate, ca. 2 mm long. Leaves elliptic, oblanceolate, obovate, or orbicular, the blade 2–4.2 cm long, 0.8–4 cm wide, 1–3 times as long as wide, submembranous, the margin entire, rarely with a few spinescent teeth; apex obtuse, rounded, or acute, rarely apiculate; base attenuate; petiole 3–

22 mm long, the persistent base after leaf fall usually slightly flattened, usually truncate, ca. 2 mm long; venation prominent to weak, basal, reticulate, actinodromous. Inflorescence a panicle or umbel with up to ca. 10 flowers, the main axis and peduncle 1.5–7 cm long; pedicels (2–)10–20 mm long; flowers ca. 5–6 mm long; tepals ca. 14, those of the innermost whorl ca. 4.5 mm long, shorter than the immediately adjacent outer whorls; stamens ca. 3.5 mm long, the anther less than $\frac{1}{2}$ the length; pistil urceolate, ca. 3.5 mm long, the style ca. $\frac{1}{3}$ the length, the stigma ca. 1 mm wide; ovules ca. 4, basal. Fruit subglobose, ca. 9 mm long, the persistent style ca. 1 mm long, the stigma 1.5–2 mm wide; seeds few, ca. 5–6 mm long. Figure 6A.

Distinguishing features. Style and stigma prominent; stamens without tooth-like appendages; spines none or insignificant; inflorescence a panicle or umbel; leaves usually submembranous, the margins usually entire.

Phenology. Flowering in November and December. Fruiting in January and February.

Distribution and habitat. Endemic to Más a Tierra Island of the Juan Fernández Archipelago (Región V), Chile. Apparently a relatively rare species of humid forest or scrub.

Selected specimens. CHILE. **Región V:** Juan Fernández Archipelago, Más a Tierra Island, Cerro Pascua, Quebrada Michay, 300 m, 8 Feb. 1980 (fr), *Martcorena et al.* 9157 (CONC-52650, M, NA); near Selkirk tablet on Quebrada Villagra side of Portezuelo, 1800 ft., 9 Dec. 1965 (fl, yfr), *Meyer* 9486 (CONC-122685, MO, NA, RSA); on ridge between La Vaquería and Valle Inglés, 480 m, 5 Feb. 1990 (fr), *Stuessy & López* 11394 (CONC-116590); path to Salpuedes, 350 m, 15 Jan. 1991 (st), *Stuessy et al.* 11734 (CONC-121541).

Berberis corymbosa, endemic to Más a Tierra Island, is the only species of the genus growing there and thus should not be confused with any other. Its true affinities are not clear. The leaves are similar to *B. microphylla*, *B. masafuerana*, and *B. rotundifolia* of Chile, and the inflorescence and style are similar to *B. jobii* Orsi and *B. jujuyensis* Job, both of northwestern Argentina. More detailed studies would be useful.

6. *Berberis darwinii* Hook., Icon. Pl. 7, t. 672. 1844. TYPE: Chile. Valdivia and Osorno, *Bridges* 585 (lectotype, designated by Porter (1986), K not seen); *Bridges* 582 (syntype, K not seen); & Chiloé, *Darwin s.n.* (syntypes, CGE not seen, K not seen).

Berberis costulata Gand., Bull. Soc. Bot. Fr. 59: 705. 1913. TYPE: Chile. Chiloé, Quellón, *Skottsberg* 310 (holotype, LY!, = ASU photo!).

Shrub up to ca. 1.5 m high, glabrous except for pubescent twigs and spines; twigs initially reddish brown, densely pubescent, the hairs reddish brown to whitish, to ca. 0.5 mm long, the bark of older twigs gray, longitudinally cracked; spines \pm palmate, not foliaceous, with 5(–7) arms 2–7 mm long, pubescent; bracts ovate to lanceolate, 2–4 mm long. Leaves obovate, oblanceolate, or elliptic, 1.4–3 cm long, 0.5–1.4 cm wide, 1.2–4 times as long as wide, glabrous, the margin somewhat revolute, with 1–4(–6) pairs of spines; apex acute to subtruncate, terminating in a spine ca. 1 mm long; base acute, cuneate, or obtuse; petiole 0.5–1 mm long, 1–2 mm wide, glabrous; venation mixed craspedodromous, the midvein usually impressed above and prominent below, the secondary veins 2–4 pairs; blades coriaceous, lustrous above, dull beneath. Inflorescence a raceme 2–5 cm long with ca. 10 flowers; pedicels 5–12 mm long, 0.3–0.5 mm wide; flowers 4.5–7 mm long, orange; tepals 10–16, the smallest ovate, 2–3 mm long, the largest obovate, 4–6.5 mm long; stamens 2.5–5 mm long, without lateral appendages, the anther 1–1.5 mm long; pistil urceolate, 3–5.5 mm long, the style about $\frac{1}{2}$ the length; ovules 4–8, attached laterally to sublaterally near base of ovary. Fruit subglobose, 7–8 mm long, dark blue, terminating in a persistent style 1.5–3 mm long; seeds 3–6 per fruit, 3–4 mm long. Figures 2D, 3C, 4A–E, 6D, 10C.

Distinguishing features. Styles long; stamens without tooth-like appendages; spines small, palmate, pubescent; inflorescence, a several-flowered raceme; leaves with toothed margins, relatively small; twigs pubescent; flowers orange.

Phenology. Flowering in two peaks, from September to November and from February to March. Fruiting mainly from December to March.

Distribution and habitat. Endemic to southwestern South America. Found in Chile from the pre-cordillera of Curicó (Región VII) to near Lago Carrera (Región XI) and in Argentina in western Río Negro and Neuquén, Argentina. A species of disturbed forest habitats, it is now a common roadside shrub in south-central Chile and adjacent Argentina, much appreciated for its attractive flowers, and sometimes cultivated in California, New Zealand, and England.

Common names. Michai, quelung (Rodríguez et al., 1995).

Selected specimens. CHILE. **Región VII:** Curicó, Potrero Grande, Fundo El Pangal, río de las Islas, 700 m, 31 Oct. 1954 (fl), *Kausel* 4048 (F); Curicó, Upeo, 1000 m, 7 Dec. 1975 (yfr), *Zöllner* 8977 (MO, NA). **Región VIII:** Cordillera de Nahuelbuta bei Pino Huacho, ca. 800 m, 5 Nov. 1981 (fl), *Bayer & Rodríguez* 175 (M); 22 km

SE of Mulchen, Fundo Fresia, 1500 ft., 29 Oct. 1961 (yfr), *Greer 22* (OS); Antuco, El Toro, río Polcura, above recinto of Endesa (ca. 37°15'S, 71°28'W), ca. 900 m, 19 Oct. 1993 (fl), *Landrum 7956* (ASU); Arauco, camino de Quídico a Relún, cerca de Paillaco (38°16'S, 73°22'W), 450 m, 6 Jan. 1977 (fr), *Martcorena et al. 1177* (CONC-45650). **Región IX:** Temuco, road to Cunco, ca. 40 km E of Temuco, ca. 2.2 km E of Faja 18 road (ca. 38°55'S, 72°10'W), ca. 300 m, 25 Oct. 1993 (fl), *Landrum 7992* (ASU, SGO); road from Lautaro to Curacautín, ca. 17 km E of Lautaro, ca. 2 km W of Puente Peu Peu (ca. 38°28'S, 72°15'W), ca. 300 m, 28 Oct. 1993 (yfr), *Landrum 8029* (ASU); camino entre Curacautín y laguna Conguillío, a orillas del estero Quinchillama (38°31'S, 71°48'W), 600 m, 19 Jan. 1976 (fr), *Martcorena et al. 708* (CONC-44173); Volcán Llaima, ca. 1000 m, Feb. 1927 (fr), *Werdermann 1216* (CAS, F, G, K, M, MO, NY). **Región X:** Parque Nacional Puyehue, road to Antillanca, ca. 8 km above Administration at Aguas Calientes (ca. 40°45'S, 72°20'W), ca. 650 m, 9 Nov. 1993 (fl), *Landrum 8054* (ASU, SGO); Chiloé, Isla Talcán, Las Cuevas (42°46'S, 72°56'W), 22 Feb. 1961 (fl), *Martcorena 1734* (CONC-26391); Panguipulli, camino entre Coñaripe y Liquiñe, km 16, a orilla del río Llancahue (39°36'S, 71°54'W), 400 m, 16 Jan. 1976 (fr), *Martcorena et al. 476* (CONC-44347); camino El Mirador–Las Trancas, Cordillera Pelada (40°10'S, 73°29'W), 1000–1300 m, 2 Feb. 1961 (fr), *Ricardi 5283* (CONC-26515). **Región XI:** Aisén, Isla Carmen (43°02'S, 72°48'W), 17 Oct. 1947 (fl), *Behn 11* (CONC-8241); Aisén, carretera austral, Villa Santa Lucía, km 339, 150 m, 9 Feb. 1985 (fr), *Billiet 3854* (BR); Cerro Divisadero SE of Coihaique, road to centro de ski El Fraile, ca. 4.2 km from beginning of road, 16 Oct. 1993 (fl), *Landrum 8109* (ASU); Carretera Austral, ca. 20 km S of Puerto Tranquilo (ca. 72°35'W, 46°40'S), 19 Oct. 1993 (yfr), *Landrum 8152* (ASU). **ARGENTINA. Neuquén:** Lago Trapil, 21 Mar. 1939 (fl), *Cabrera 5085* (CAS); al NW del Lago Falkner, Feb. 1975 (fr), *Cassels s.n.* (SGO); Lago Mascardi, Mar. 1959 (fl), *Dawson 3282* (CONC-37568); Depto. Lacar (Parque Lanín), Lago Lacar, Pucará, 9 Nov. 1956 (fl), *Roig 1960* (MERL). **Río Negro:** región del Lago Nahuel Huapi, Lago Correntoso, 10 Jan. 1953 (fr), *Cabrera & Job 222* (NY); Alrededores de Bariloche, 13/21 Oct. 1975 (fl), *Roig & E. Méndez 8797* (MERL).

Berberis darwinii is most similar to *B. ilicifolia*, which differs in having glabrous spines with usually 3 arms and thicker, larger leaves. *Berberis darwinii* has been observed to hybridize with *B. trigona*, *B. valdiviana*, and *B. congestiflora*.

Although I have not seen the type of *Berberis darwinii*, the description and the illustration leave no doubt as to its identity.

The type of *Berberis knightii* (Lindl.) K. Koch (see excluded taxa), a plant cultivated in England in the mid-19th century, has not been located. Lindley's description indicates that the plant might have been *B. darwinii*.

7. *Berberis empetrifolia* Lam., Tabl. encycl., 2: 391, t. 253, fig. 4. 1792. TYPE: Detroit de Magellan, *Commerson s.n.* (holotype, P not seen, = F-34517!; isotypes, P!, CONC!, G!, W!).

Berberis mutabilis Phil., Anal. Univ. Santiago, 1872: 665. 1872. TYPE: Chile. Cordillera de Aculeo, collector? *s.n.* (lectotype, designated here, SGO-049024!; isolectotypes, BM!, SGO-063353!, = ASU photo!, W!).

Berberis empetrifolia var. *magellanica* C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 140. 1905. TYPE: Chile. Sandy point, [*Lechler*] *Hohenacker 1065* (lectotype, designated here, W! ["Acqu. 1889 No.8378"], = ASU photo!; isolectotypes, BR!, G!, M!, NY!, W!); Feuerland, Magellan, *Commerson s.n.* (syntypes, G!, W!).

Berberis wawrana C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 140. 1905. TYPE: Chile. Without locality, *Seibold-Wawra n. 3039* (lectotype, designated here, W!, = F-30140!, = ASU photo!); Cordillera de Colchagua, *Philippi s.n.* (syntype, W!).

Low-spreading shrub up to ca. 0.5 m high; twigs at first angular, yellowish to reddish, often glaucous, becoming terete, gray, the older bark slightly flaky; spines 3-armed (less often simple), the central arm 3–18 mm long, the laterals ascending slightly or perpendicular to the central, equaling it or somewhat shorter, the dilated spine base to ca. 3 mm long; bracts ovate, 1–2 mm long, light brown to reddish, often glaucous. Leaves subacicular, often falcate, the blade 5–18 mm long, 1–1.2 mm wide, in cross section rounded above, with a deep groove below, the margin strongly revolute; apex acute, often apiculate; base acute, sometimes glaucous; petiole 1–2.5 mm long, often glaucous, persisting as a peg-like structure after blade falls; venation indistinct, the midvein visible only as a faint impressed line above. Inflorescence a solitary flower; pedicels 2–14 mm long; flowers 3–5 mm long; tepals 12–17, the outermost oblong, the central ones obovate, the innermost obovate, 2–3 mm long, somewhat shorter than the adjacent outer tepals; stamens 2–2.5 mm long, with 2 minute tooth-like lateral appendages below the anther, the anther ca. ½ the length; pistil ca. 1.5 mm long, ± barrel-shaped, the stigma sessile; ovules 3–10, basal; fruit subglobose, 4–7 mm long, the stigma sessile; seeds (1–)3–7(–9), 3–4 mm long. Figures 2E, 7A, 10D.

Distinguishing features. Leaves subacicular, short; flowers solitary; style short; stamens with tooth-like appendages.

Phenology. Flowering mainly from November to January. Fruiting mainly from December to March.

Distribution and habitat. Endemic to southwestern South America. Found in Chile from the Andes of Coquimbo (Región IV) and in Argentina from the Andes of Mendoza at elevations around 3000 m to Tierra del Fuego in both countries at about sea level. This is a species well adapted to harsh, cold habitats, e.g., rocky slopes in the high

Andes, wind-blown pampa in Aisén, and sandy beaches along the Strait of Magellan.

Common names. Zarcilla, monte negro (Rodríguez et al., 1995), uva de la cordillera (Hoffmann, 1980).

Selected specimens. CHILE. **Región IV:** Ovalle, Cordillera del río Hurtado, 3000 m, Jan. 1933 (fl), *Iribarren s.n.* (G); Cordillera de Ovalle, río Torca (31°08'S, 70°43'W), 3000 m, 12 Feb. 1961 (fr), *Jiles 3772* (CONC-102224); Cordillera de Combarbalá, Potrero Grande (31°18'S, 70°50'W), 3000 m, 18 Feb. 1968 (fr), *Jiles 4533* (M); Illapel, Quebrada La Vega Escondida, 3 hours by horse due E of Cuncumén, 2700 m, 18 Nov. 1938 (fl), *Worth & Morrison 16553* (G, MO, NA). **Región V:** Los Andes, Laguna del Inca, Portillo (32°49'S, 70°11'W), 2900–3150 m, 12 Jan. 1981 (fl), *Arroyo 81242* (CONC-53335); ca. 3 km SW of Caracoles along road from Portillos, 3000 m, 11 Dec. 1951 (fl), *Hutchinson 155* (F, G, US); Estación Portillo, 2800 m, 14–16 Apr. 1933 (st), *Looser s.n.* (G); Aconcagua, camino Internacional entre Caracoles y Cristo Redentor, 3500 m, 15 Jan. 1964 (fl), *Martcorena & Matthei 565* (CONC-30501, OS). **Región Metropolitana:** Cajón de Maipo, ca. 22 km above San Gabriel, ca. 1 km below Embalse del Yeso, ca. 3000 m, 14 Dec. 1993 (fr), *Landrum 8224* (ASU, SGO); Valle del río Volcán, Refugio Lo Valdés, 1950 m, Feb.–Mar. 1944 (fl), *Looser s.n.* (G); San Ramón, cumbre Pirámide (33°30'S, 70°28'W), 3000 m, 5 Apr. 1959 (fr), *Schlegel 2489* (CONC-46716); Perez Caldera (33°12'S, 70°14'W), 2800 m, 27 Jan. 1954 (fr), *Sparre 10619* (CONC-17550, OS). **Región VI:** Sewell, río Coya, 2100–2600 m, 10 Feb. 1942 (fl), *Jiles s.n.* (G); Termas del Flaco (34°56'S, 70°25'W), 1900 m, 3 Feb. 1989 (st), *Niemeyer & Fernández 8904* (CONC-100031); junta del río Tinguiririca y río del Azufre (34°49'S, 70°34'W), 1220 m, 9 Mar. 1979 (fl), *Villagrán & Arroyo 55920* (CONC-55920). **Región VII:** alrededores de la Laguna del Teno (35°10'S, 70°33'W), 2560 m, 29 Mar. 1973 (fl), *Martcorena 20* (CONC-39325); Laguna del Maule (36°0'S, 70°30'W), 2200 m, 3 Apr. 1975 (fr), *Parra & Rodríguez 198* (CONC-43613). **Región VIII:** Laguna del Laja (37°27'S, 71°27'W), ca. 1300 m, 29 Nov. 1959 (fl), *Montero 6132* (CONC-83988); camino a Termas de Chillán, pasado Puente Torrealba (36°54'S, 71°27'W), 1250 m, 18 Nov. 1976 (fl), *Oehrens s.n.* (CONC-45393); Volcán Antuco, 2.9 km al SE del Refugio (37°22'S, 71°19'W), 1380 m, 19 Feb. 1988 (fr), *Stuessy & Baeza 11045* (CONC-110419); Baños de Chillán, Aguas Calientes, 2200 m, Mar. 1927 (fr), *Werdermann 1301* (BM, CAS, CONC-64750, F, G, K, M, MO). **Región IX:** 20.7 km W of Paso Pino Hachado, 3800 ft., 9 Mar. 1962 (st), *Greer 1380* (OS); pasado la confluencia de los ríos Lolco y Lancú (38°16'S, 71°28'W), 1050 m, 9 Jan. 1977 (fl), *Martcorena et al. 1369* (CONC-45760); Termas del río Blanco, Piedra El Sapo (38°35'S, 71°37'W), 1900 m, 31 Jan. 1938 (st), *Montero 3386* (CONC-83993, OS); Volcán Llaima, refugio, 1800 m, 10 Dec. 1939 (st), *Montero 3820* (OS). **Región XI:** Aisén, Balmaceda, along road to Portezuelo, 13.6 km W of junction with road to Coihaique (ca. 45°50'S, 71°40'W), ca. 500 m, 17 Oct. 1993 (fl), *Landrum 8133* (ASU); Aisén, Coihaique, Puente Pedregoso, ca. 4.5 km W of Coihaique Alto (ca. 45°25'S, 71°35'W), 20 Nov. 1993 (fl), *Landrum 8204* (ASU); Chile Chico, Ventisquero Soler (46°52'S, 73°08'W), 150 m, 24 Mar. 1967 (st), *Seki 577* (CONC-37238); La Tapera, just W of village, 650 m, 20 Mar. 1985

(fr), *Stuessy 7547* (OS). **Región XII:** NW face of Mt. Aymond, route 255-N (52°9–10'S, 69°25–29'W), 9 Oct. 1971 (st), *Dudley et al. 114* (NA); Puerto Williams, Isla Navarino, 8 Feb. 1959 (fr), *Godley 1172* (K); Parque Nacional Torres del Paine, ca. 11 km beyond Posada río Serrano on road to Lago Grey (ca. 51°10'S, 73°5'W), ca. 150 m, 24 Dec. 1994 (fl), *Landrum 8411* (ASU); Punta Steinman, ca. 35 km along road to Punta Canelo from main highway (ca. 53°10'S, 71°25'W), ca. 3 m, 31 Dec. 1994 (fr), *Landrum 8452* (ASU). ARGENTINA. **Chubut:** Esquel, La Hoya, 1000 m, 18 Jan. 1972 (fl), *Cabrera 21958* (CONC-37604); 21.3 km W of río Pico on road to Lago Vinter, 1000 m, 7 Dec. 1984 (fl), *Stuessy 6883* (OS); ca. 3 km E of Lago Vinter on road to río Pico, 930 m, 7 Dec. 1984 (st), *Stuessy et al. 6891* (OS). **Mendoza:** Malargue, Las Leñas (35°07'S, 70°06'W), 14 Jan. 1987 (fr), *Del Vitto 1435* (MERL); Santa Rosa de los Andes to Uspallata Pass, *Moseley s.n.* (BM); Luján, Agua de la Pampa, en la Pampa de la Polcura, 28 Jan. 1962 (st), *Roig 4208* (MERL); Las Heras, alto de los Manantiales, 3000 m, 19 Feb. 1965 (fr), *Roig 5283* (MERL). **Neuquén:** Aluminé, 16 Nov. 1967 (fl), *Cabrera 18699* (CONC-37594); Moquehue, 1230 m, 5 Jan. 1968 (fr), *Ruiz Leal 25798* (MERL); Copahue, 14 Jan. 1963 (fl, fr), *Ruiz Leal & F. A. Roig 22482* (MERL). **Santa Cruz:** a 4 km al E del Lago Burmeister, 1000 m, 8 Dec. 1980 (fl, fr), *Cei & S. S. de Cei s.n.* (MERL); a 14 km de Puente Blanco, 60 m, 20 Jan. 1970 (fr), *Ruiz Leal 27076* (MERL). **Tierra del Fuego:** Ushuaia en la península a 6–8 km de la población, 9 Jan. 1950 (fr), *Ruiz Leal & Carretero 12955* (MERL).

Berberis empetrifolia seems to hybridize with at least *B. montana* and *B. grevilleana*. Population samples of hybrid populations would be useful.

Lamarck did not mention a locality or collector for *Berberis empetrifolia*, but the specimen that has been taken as the holotype was collected by Comerson in the area of the Strait of Magellan.

The type specimens of *Berberis mutabilis* seem to represent a hybrid population of *B. empetrifolia* and some other species, perhaps *B. montana*. A specimen most similar to *B. empetrifolia* has been selected as the lectotype.

The original material of *Berberis wawrana* probably represents *B. empetrifolia* hybridized with another uncertain species.

8. *Berberis glomerata* Hook. & Arn., Bot. Beech. Voy. 5. 1830. TYPE: Chile. Coquimbo, *Macrae s.n.* (holotype, not seen, E-GL?, K?; isotype, G not seen; = F-27409!).

Berberis zahlbruckneriana C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 145. 1905. *Berberis glomerata* var. *zahlbruckneriana* (C. K. Schneid.) Ahrendt, J. Linn. Soc., Bot. 57: 232. 1961. TYPE: Chile. Coquimbo, Illapel, *Philippi s.n.* (lectotype, designated here, W!, = F-30129!, = ASU photo!; isolectotype, W!, = ASU photo!).

Shrub up to ca. 2 m high, the stems often erect, wand-like, with few lateral branches; young twigs dark reddish brown, becoming gray with age, mi-

nutely puberulent-papillate; spines with 3 nearly equal arms (central arm perpendicular to laterals) or palmate with ca. 5 arms, the arms 3–11 mm long; bracts broadly ovate, less than 1 mm long. Leaves angularly obovate, oblanceolate to rhomboid, usually arcuate, the blade 8–20 mm long, 2–10 mm wide, 1.5–4 times as long as wide, stiffly coriaceous, drying gray-green to olive-green, nearly concolorous, sometimes slightly lustrous, the margin with 0–2 spine-tipped teeth per side, the marginal spines ca. 1 mm long, the tooth plus spine often wing-like and directed upward, contrasting with the downwardly directed apex; apex acute, tipped by a spine ca. 1 mm long; base cuneate, often narrowly so; petiole less than 0.5 mm long; venation mixed craspedodromous, the midvein flat above, moderately prominent below, up to ca. 3 pairs of secondary veins visible. Inflorescence an umbel or raceme with the rachis scarcely elongate with 3–8 flowers, the peduncle plus rachis about 1–2 cm long; pedicels 3–7 mm long, the subtending bracts 1.5–2 mm long; flowers probably yellow, ca. 2.5 mm long; tepals 11, the innermost suborbicular to obovate, 1.5–3 mm long; stamens ca. 2 mm long, with two tooth-like lateral appendages below the anther, the anther about half the stamen's length; pistil subglobose, 1.5–2 mm long, the stigma sessile, ca. 1 mm wide; ovules 2–5, basal. Fruit globose, purple, 6–7 mm long; seeds ca. 4 mm long. Figures 7B, 11A.

Distinguishing features. Style short; stamens with tooth-like appendages; spines small, with 3–5 arms; inflorescence an umbel or short raceme of up to 8 flowers; leaves small, angular, with wing-like marginal teeth, smooth below, not glaucous.

Phenology. Flowering from July to September. Fruiting from September to November.

Distribution and habitat. Endemic to Región IV of Chile. A species of sparse to dense sclerophyllous scrub.

Selected specimens. CHILE. **Región IV:** Ovalle, entre El Toro y Cuesta Punitaqui (30°52'S, 71°12'W), 28 Oct. 1950 (fr), *Jiles 1929* (CONC-32283, M); Coquimbo, Combarbalá, Manquehue (30°57'S, 71°11'W), 620 m, 21 Aug. 1951 (fl), *Jiles 2010* (CONC-32210, M); road to Andacollo, 17.8 km SE of La Serena–Ovalle highway (30°15'S, 71°05'W), ca. 600 m, 22 Sep. 1991 (st), *Landrum 7544* (ASU, SGO); Coquimbo, Pichasca, ca. 750 m, 2 May 1980 (st), *Troncoso A. s.n.* (SGO).

Berberis glomerata is probably most closely related to *B. actinacantha*, sharing with that species a short style, stamens with tooth-like appendages, and a generally umbellate inflorescence.

9. *Berberis grevilleana* Gillies ex Hook. & Arn., Bot. Misc. 3: 136. 1833. *Berberis actinacantha* var. *grevilleana* (Gillies ex Hook.) C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 145. 1905. TYPE: Argentina. Andes of Mendoza, *Gillies s.n.* (holotype, E-GL!, = ASU photo!; isotype, K not seen, = SGO photo!).

Shrub to ca. 2 m high, glabrous or minutely papillose on young growth; young twigs smooth to minutely papillose, gray-green to light yellow-brown, the older twigs gray, with longitudinal cracks, with numerous black dots, the bark eventually somewhat stringy; spines with 3(–4) arms, the arms 1.2–4.5 cm long, ca. 2–3 mm wide, each with 2 parallel grooves beneath (rarely somewhat foliaceous); bracts broadly ovate, ca. 1.5 mm long. Leaves elliptic, oblanceolate, rhombic, obovate, or suborbicular, 1.5–3 cm long, 0.5–2.6 cm wide, 1.1–3 times as long as wide, the blade coriaceous, drying gray-green; margin entire or with 1–3(–4) teeth per side; base acuminate; apex acute with a spinescent tip up to 1.5 mm long; petiole ca. 0.5 mm long, blending with base; venation mixed craspedodromous to reticulate-actinodromous, the midvein prominent, the tertiary veins forming an elongate reticulate pattern between the larger veins, or obscure. Inflorescence an umbel with 1–5 flowers; pedicels 0.4–0.7(–1.1) cm long; flowers ca. 5 mm long; tepals ca. 14, the innermost obovate to elliptic, slightly fleshy, somewhat smaller than the next 3; stamens 2.5–3 mm long, usually with 2 minute tooth-like lateral appendages below the anther, the anther ca. ½ the length of the stamen; pistil ovoid to urceolate, 2.5–3 mm long, the stigma 1–1.2 mm wide, elevated on a short style; ovules 3–5, basal. Fruit ca. 1 cm long, the style ca. 0.5 mm long, the stigma ca. 1.5 mm wide; seeds 3–4 mm long, fused together in a stone-like mass at maturity. Figures 2H, 3F, 7B, 11B.

Distinguishing features. Style short, but evident; stamens usually with tooth-like appendages; spines large, usually 3-parted; inflorescence a few-flowered umbel; leaves with toothed margins, coriaceous, gray-green; mature seeds fused in a mass.

Phenology. Flowering mainly in October and November. Fruiting mainly in January and February.

Distribution and habitat. Endemic to central western Argentina: most abundant in Mendoza from 1800 to 2800 m, but also rarely found in the provinces of San Juan and Córdoba (Orsi, 1976). Rocky slopes in shrubby desert vegetation.

Common name. Crucero.

Selected specimens. ARGENTINA. **Mendoza:** San

Carlos, Refugio General Alvarado, 2400 m, 27 Jan. 1950 (fr), *Cuezzo & Barkley s.n.* (TEX); road from Termas Villavicencio to Uspallata, ca. 6 km beyond the Termas (ca. 69°W, 32°30'S), ca. 2000 m, 4 Dec. 1994 (yfr), *Landrum 8329* (ASU, MERL); Potrerillos, Las Vegas, 5 km beyond road to Vallecitos (ca. 69°5'W, 33°S), ca. 2000 m, 4 Dec. 1994 (yfr), *Landrum 8347* (ASU, MERL); Las Heras, Quebrada de la Casa de Piedra, en laderas de los cerros, 16 Jan. 1938 (fr), *Ruiz Leal 4781* (MERL).

Berberis grevilleana is superficially similar to both *B. chilensis* and *B. actinacantha*, but it lacks the racemose inflorescence of *B. chilensis* and has large 3-parted spines unlike those of *B. actinacantha*. It is separated geographically from both of them by the Andes. It hybridizes with *B. empetrifolia*. It is perhaps most closely related to *B. comberi*, because both share the unusual character of seeds that are tightly fused together in the mature fruit.

Lechler (1857) and subsequent authors have reported *B. grevilleana* in Chile. In Lechler's time this was probably due to travelers crossing the Andes between Mendoza and Santiago not clearly specifying where specimens were collected. In later years there seems to have been a confusion with *B. chilensis*.

10. *Berberis horrida* Gay, Fl. chil. 1: 84. 1845. *Berberis actinacantha* var. *horrida* (Gay) Reiche, Anales Univ. Chile 88: 96. 1894. TYPE: Chile. Provincias centrales, *Gay s.n.* (lectotype, designated here, P! [sheet a mixed collection, lefthand portion lectotype; righthand portion *B. actinacantha*, excluded], = ASU photo!; isolectotype, P! [mixed collection, as in previous, lefthand portion isolectotype], = F-34526!).

Berberis actinacantha var. *mollis* Reiche, Anales Univ. Chile 88: 96. 1894. TYPE: Chile. Rancagua, San Fernando (holotype, SGO not seen).

Berberis pilosifolia Ahrendt, J. Linn. Soc., Bot. 57: 235. 1961. TYPE: Chile. [Termas de?] Cauquenes, 3000–4000 ft., Dec. 1927, *Clarence Elliott 114* (holotype, K!, = ASU photo!).

Shrub up to ca. 2 m high; young twigs yellowish to glaucous gray or reddish gray, glabrous to minutely hirsute (but not densely so), sometimes with numerous black dots, the older twigs with somewhat stringy, gray bark; spines foliaceous or star-like, the blade (central portion) 2–6 mm long, the arms 2–7 mm long; bracts ovate, 1–3 mm long, the apex obtuse to sharply acuminate. Leaves elliptic to orbicular, sometimes palmately lobed, the blade 1–4 cm long, 0.5–2.2 cm wide, 1–3.3 times as long as wide, stiffly coriaceous, drying light gray-green to brown, the upper surface smooth or nearly so,

dull or lustrous, the lower surface prominently reticulate, shortly hirsute-papillose, the margin with 2–4 spinescent teeth per side, or in broader leaves the teeth becoming lobes; apex acuminate, spine-tipped; base cuneate to rounded; petiole 1–20 mm long; venation reticulate-actinodromous, the midvein prominent, the secondary and tertiary veins forming a raised pattern below. Inflorescence a sessile umbel (rarely a panicle), with 3–10 flowers; pedicels 5–10 mm long; flowers yellow, 3–5 mm long; tepals usually 14, the six innermost elliptic, ca. 3 mm long, clasping the stamens, somewhat smaller than the next three; stamens ca. 2 mm, with 2 tooth-like lateral appendages below the anther, the anther ½ the length of the stamen; pistil barrel-shaped, ca. 2 mm long, the stigma ca. 1 mm wide, essentially sessile; ovules 3–9, basal. Fruit 4–6 mm long; seeds 2–3, 3–4 mm long. Figures 7C, 11C.

Distinguishing features. Style short; stamens with tooth-like appendages; spines star-like or foliaceous; inflorescence an umbel of up to ca. 10 flowers; leaves with toothed margins, reticulate, hirsute-papillose below.

Phenology. Flowering mainly in September and October. Fruiting mainly in December and January.

Distribution and habitat. Endemic to central Chile from Cerro La Campana (Región V) to the cordillera of San Fernando (Región VI). I have found this species growing in sclerophyllous scrub along rocky river terraces in the pre-cordillera of the Andes at about 800 to 1000 m. These habitats have often been converted to agriculture, and the species is now rather rare.

Common name. Michai (Gay, 1845; Navas, 1976).

Selected specimens. CHILE. **Región Metropolitana:** Cerro Manquehue, 25 Oct. 1891 (fl), *collector unknown s.n.* (SGO); Huinganes, 50 mi. SE of Santiago, 16 Nov. 1901 (fr), *Hastings 369* (US). **Región V:** Cerro de La Campana, Nov. 1979 (st), *Martínez s.n.* (CONC-108042). **Región VI:** San Fernando, road to Termas del Flaco, 6.4 km E of La Rufina Hostería, 10.4 km beyond road to Bellavista, ca. 800 m, 7 Oct. 1993 (fl), *Landrum 7915* (ASU); Rancagua, road from Coya to Mina La Juanita, ca. 7–8 km above Coya (34°14'S, 70°31'W), ca. 900 m, 18 Jan. 1995 (fr), *Landrum 8491* (ASU, SGO); Baños de Cauquenes, May 1956 (st), *Richter s.n.* (CONC-108011).

Berberis horrida is one of the rarest species of *Berberis* in Chile. It is probably most closely related to *B. actinacantha*. They share all the features mentioned above under "distinguishing features" except the reticulate, hirsute-papillose lower leaf surface of *B. horrida*.

11. *Berberis ilicifolia* L. f., Suppl. pl. 210. 1782. TYPE: *Sparrmann s.n.* (holotype, LINN not seen).

Berberis lagenaria Poir., Encycl. Meth. 8: 619. 1808. TYPE: Detroit de Magellan, *Comerson s.n.* (holotype, P not seen; isotype, P!, = ASU photo!).

Berberis subantarctica Gand., Bull. Soc. Bot. Fr. 59: 705. 1913. TYPE: Argentina. Patagonia, Pt. Grappler, *Skottsberg 293* (holotype, LY!, = ASU photo!).

Shrub 1–4 m high; young twigs dark reddish brown, longitudinally ridged, minutely papillate-puberulent, with age becoming more nearly terete, gray to yellowish, the leaf scars persisting as semi-circular, often corky, protuberances; spines normally 3-parted, smooth or minutely papillate, the arms ca. 0.4–1.2 cm long, often slightly curved, the lateral arms perpendicular or forming an acute angle with the central arm; bracts narrowly triangular, to ca. 10 mm long. Leaves obovate, oblong-lanceolate, elliptic, oblanceolate, the blade 2–5 cm long, 1.2–2.2 cm wide, 1.6–2.8 times as long as wide, stiffly coriaceous, drying lustrous or dull gray-green to brownish above, usually lighter below, the upper surface minutely papillate along the margin, the margin with (0–)1–6 spine-tipped teeth, the marginal spines 1–4 mm long; apex acute to subtruncate, spine-tipped; base acute to rounded, blending with petiole or petiole distinct and up to 4 mm long; venation mixed craspedodromous, the midvein impressed above, prominent below, the secondary veins 3–5 pairs, impressed or nearly flat above, about flat below, the tertiary veins impressed to flat above, indistinct or faint below. Inflorescence a raceme with 3–7 flowers, the peduncle plus rachis 0.7–2(–3.5) cm long, usually shorter than the pedicels; pedicels 0.7–2 cm long; flowers orange, 0.5–1 cm long; tepals ca. 14, the innermost suborbicular to obovate; stamens ca. 3 mm long, without lateral appendages, the anther slightly over half the length; pistil nearly cylindrical at anthesis, 3–7 mm long; stigma ca. 1.5 mm across; ovules (4?)5–6, basal. Fruit subglobose, to ca. 10 mm long, with a persistent style ca. 2–3 mm long; seeds 4–6, 5–6 mm long. Figures 7C, 11D.

Distinguishing features. Style long; stamens without tooth-like appendages; spines usually 3-parted; inflorescence a raceme of 3–7 flowers; leaves with toothed margins, with impressed veins above, often lustrous; young twigs longitudinally ridged.

Phenology. Flowering mainly from August to December. Fruiting mainly from November to March.

Distribution and habitat. Endemic to south-

western South America. Found in Chile from the Cordillera Pelada and Puyehue (Región X) to Cabo de Hornos (Región XII) and in Argentina from Chubut, Santa Cruz, and Tierra del Fuego (Orsi, 1976). An understory shrub in *Nothofagus* forests.

Common name. Chelia (C. Muñoz, 1966).

Selected specimens. CHILE. **Región X:** Valdivia, Monumento Natural Alerce Costero (40°11'S, 73°31'W), 1000 m, 12 Feb. 1988 (fr), *Gardner & Knees 4171* (K); Chiloé, Cordillera San Pedro, 8 Oct. 1958 (fl), *Godley 416* (BM); Osorno, Parque Nacional Puyehue, road to Antillanca, ca. 8 km above Administration at Aguas Calientes (ca. 40°45'S, 72°20'W), ca. 650 m, 9 Nov. 1993 (fl), *Landrum 8058* (ASU); Chiloé, Cordillera de Pichihué, Feb. 1983 (fr), *Villagrán 4916* (SGO). **Región XI:** Aisén, Carretera Austral, 58 km S and W of Villa Castillo towards Puerto Murta, near Lago Cofré (ca. 46°15'S, 72°30'W), 18 Oct. 1993 (fl), *Landrum 8150* (ASU); Aisén, Carretera Austral, ca. 177.9 km S of Coihaique, a few km N of entrance to Puerto Murta (ca. 72°45'W, 46°25'S), 19 Oct. 1993 (st), *Landrum 8169* (ASU). **Región XII:** Fiordo Contralmirante Martínez Brazo S-E (54°33'S, 70°36'W), 19 Mar. 1991 (fr), *Henríquez & Palma 63* (HIP); Fuerte Bulnes ca. 50 km S of Punta Arenas, ca. 3.7 km E of main road to Punta Arenas (ca. 53°40'S, 70°55'W), ca. 100 m, 22 Dec. 1994 (fl), *Landrum 8399* (ASU); ca. 30 km SW of Punta Arenas, ca. 1.5 km E of Laguna Parrillar (ca. 53°30'S, 71°15'W), ca. 320 m, 22 Dec. 1994 (yfr), *Landrum 8400* (ASU); Isla Noir, Tierra del Fuego (54°29'S, 73°05'W), 26 Dec. 1983 (fr), *Venegas s.n.* (HIP). ARGENTINA. **Tierra del Fuego:** Ushuaia, 22 Dec. 1949 (fr), *Ruiz Leal 12838* (MERL); Estancia Figue, a orillas del río Olivia, 16 Feb. 1953 (fr), *Ruiz Leal & Roig 14995* (MERL).

The ranges of *Berberis ilicifolia* and *B. serratodentata* overlap from Región XI (near Coihaique) to Región X (at Puyehue and the Cordillera Pelada). In this large area of overlap, which is still poorly collected, the lines between these two species are sometimes not clear. *Berberis ilicifolia* extends farther south to the tip of South America, and *B. serratodentata* grows as far north as the Cordillera de Nahuelbuta. Beyond the region of overlap, the species are quite distinct; the differences are summarized in the key below.

KEY TO *BERBERIS ILICIFOLIA* AND *B. SERRATODENTATA*

- 1a. Leaves about 1.5–2.5× as long as wide; leaf margins usually with 1–4 teeth per side; lower leaf surface smooth; margins of upper leaf surface papillate; spines common *B. ilicifolia*
1b. Leaves about 2.5–4× as long as wide; leaf margins usually with 10 or more teeth per side; lower leaf surface papillate; margins of upper leaf surface smooth; spines uncommon *B. serratodentata*

In the area of overlap I have not found any specimens that match typical *B. ilicifolia* from farther south, but I do find plants representative of typical *B. serratodentata*. This suggests that *B. ilicifolia*

from Aisén northward is introgressed with *B. serratodentata*. Most of these plants I have identified as *B. ilicifolia*, realizing that they are not quite pure.

In 1914, Skottsberg described *Berberis pseudoilicifolia* from the area of overlap and proposed that it might be a hybrid between *B. ilicifolia* and *B. serratodentata*. I concur with his opinion (see excluded taxa).

Berberis ilicifolia is also similar to *B. darwinii*; the differences are discussed under the latter.

12. *Berberis litoralis* Phil., Fl. atacam., 7. 1860.

TYPE: Chile. Quebrada Miguel Diaz, coast of Atacama Desert, *Philippi s.n.* (holotype, SGO-063351!, = ASU photo!; isotype, W!; isotype, B lost, = F-14298!).

Shrub up to ca. 5 m high, glabrous; young twigs dark reddish brown, soon becoming gray and longitudinally ridged; spines usually 3-parted, the arms about equal in length, 0.5–1.4(–2.3) cm long, the laterals perpendicular to the central; bracts ovate-triangular to lanceolate-triangular, 1.5–8 mm long, ca. 1.5 mm wide, gray to dark brown. Leaves elliptic to obovate, the blade (2–)3.3–5.8 cm long, (0.8–)1.5–3.2 cm wide, 1.5–2.2 times as long as wide, coriaceous, drying dull to slightly lustrous, gray-green, darker above than below, the margin slightly revolute, usually spinescent-serrate (rarely entire), the teeth 1–10 per side, 1–2 mm long; apex usually broadly rounded to obtuse, spine-tipped; base acuminate to acute, merging with petiole or the petiole distinct and up to ca. 3 mm long; venation mixed craspedodromous, the midvein impressed slightly above, prominent below, the secondary veins about 4–7 pairs, the tertiary veins forming a usually distinct reticulate pattern within the larger veins. Inflorescence a raceme 2–5 cm long, with 6–17 flowers, sometimes terminating leafy branchlets; pedicels 6–15 mm long, subtended by narrowly triangular, keeled bracts ca. 3 mm long; flowers ca. 5 mm long, orange; tepals 14, the innermost suborbicular to obovate, 5–6 mm long; stamens ca. 4 mm long, without lateral appendages, the anther ca. 1.5 mm long; pistil ca. 5 mm long, the style ca. ½ the length or less; stigma ca. 2 mm wide; ovules 5–6, basal; fruit subglobose, ca. 7 mm long, terminating in a style ca. 1 mm long; seeds ca. 5, ca. 5 mm long. Figures 7C, 12A.

Distinguishing features. Style long; stamens without tooth-like appendages; spines 3-parted; inflorescence a raceme of 6–17 flowers; leaves usually serrate, usually with a rounded apex.

Phenology. Flowering mainly in September and October.

Distribution and habitat. Endemic to the coast of northern Chile: restricted to coastal hills near Paposo (Región II) at elevations of 500 to 1000 m. A species of local foggy habitats that support some of the northernmost patches of sclerophyllous vegetation in Chile.

Selected specimens. CHILE. **Región II:** Paposo, Quebrada de Miguel Díaz, 550 m, 4–5 Sep. 1989 (fl), *Flores et al. s.n.* (SGO-109958); 10.5 km N of Paposo, La Rinconada (ca. 24°54'S, 70°30'W), ca. 850 m, 15 Sep. 1991 (fl), *Landrum & Gutiérrez 7460* (ASU); 39 km S of Paposo, Cachinales (ca. 25°09'S, 70°26'W), ca. 600 m, 16 Sep. 1991 (fl), *Landrum & Morales 7492* (ASU); Quebrada Sepultura (24°55'S, 70°30'W), 840 m, 3 Oct. 1991 (fl), *Quezada & Ruiz 171* (CONC-121406).

Berberis litoralis is most similar to *B. valdiviana*, and they are in fact sometimes difficult to distinguish based solely on morphology. They share racemose inflorescences, pronounced styles, large trifid spines, and relatively large, mainly elliptic leaves. Fortunately, they have widely disjunct distributions: *Berberis litoralis* is restricted to a few coastal populations near Paposo in the Atacama Desert at ca. 25°S latitude, and *B. valdiviana* is found no farther north than ca. 35°S latitude. The most consistent characters distinguishing these species are found in lead 14 of the key.

13. *Berberis masafuerana* Skottsberg, Nat. Hist. Juan Fernández 2: 125, species no. 57, fig. 9 a–b. 1921. TYPE: Chile. Más Afuera, Quebrada de las Casas, Quebrada de la Lobería, *Skottsberg s.n.* (holotype, S? not seen).

Shrub or small tree to 2 m high, glabrous or the young growth sometimes minutely puberulent; twigs smooth, subterete, light or dark reddish brown when young, becoming gray, slightly rough with age; spines lacking, insignificant or weak, awl-shaped to 3–5-armed, the arms unequal to equal, to 4 mm long; bracts ovate, 1.5–2 mm long. Leaves obovate, oblanceolate, elliptic, or rarely suborbicular, the blade 1.6–3 cm long, 0.5–1.5 cm wide, (1.2–)2–3.6 times as long as wide, drying gray-green to brownish green, darker above than below, subcoriaceous to submembranous; apex rounded, often mucronate; base acute to cuneate; petiole 2–3 mm long, ca. 0.5 mm wide, the persistent base ca. 1–3 mm long; venation reticulate-actinodromous, the midvein raised slightly to impressed proximally above, moderately prominent below, the secondary veins usually 1–2 pairs. Inflorescence a solitary flower or perhaps a few-flowered umbel;

flowers unknown; fruit 6–8 mm diam., the persistent style ca. 0.5 mm long. Figure 6A.

Distinguishing features. Style short; spines lacking or insignificant; leaves usually obovate or oblanceolate, with entire margins.

Phenology. Probably flowering mainly from September to November and fruiting mainly from December to January. Fertile specimens practically unknown.

Distribution and habitat. Endemic to Más Afuera of the Juan Fernández Islands (Región V), Chile. Skottsberg reported that the species grows on inaccessible canyon walls. Perhaps it grew in other habitats before goats were introduced to Más Afuera.

Selected specimens. CHILE. **Región V:** Juan Fernández Islands, Más Afuera: Quebrada del Tongo, 280–320 m, 14 Feb. 1986 (st), *Landero & Gaete 8479* (CONC-112201, RSA); Cuchillo de Imán, N side of island, down from Cerro Verde, 880 m, 20 Jan. 1986 (st), *Landero & Gaete 9148* (CONC-111574); Quebrada Guatón on W side of island, 1100 m, 26 Jan. 1986 (st), *Landero & Ruiz 9313* (CONC-112172, RSA); Quebrada Larga, 550 m, 5 Feb. 1986 (st), *Ruiz et al. 8299* (CONC-111819).

Berberis masafuerana is a poorly known and rather uniform entity endemic to Más Afuera. It is similar to *Berberis microphylla* and *B. montana*, but differs from them in having weak spines that are occasionally 5-armed. The style of *B. masafuerana* is about 0.5 mm long on the mature fruit, shorter than in *B. montana* and longer than in *B. microphylla*. It is also possible that *B. masafuerana* is related to *B. corymbosa* of Más a Tierra Island. When more collections have been made the situation should be evaluated again.

14. *Berberis microphylla* G. Forst., *Commentat. Soc. Regiae Sci. Gott.* 9: 29. 1787. TYPE: Chile or Argentina. Tierra del Fuego, *Forster s.n.* (holotype, BM? not seen; isotype, W!, = ASU photo!).

Berberis buxifolia Lam., *Tabl. encycl.*, 2: 391, t. 253, fig. 3. 1792. TYPE: Chile or Argentina. Strait of Magellan, *Commerson s.n.* (holotype, P not seen, = F-34509!; isotypes [4 sheets] P!, = ASU photos!).

Berberis inermis Pers., *Syn. pl.* 387. 1805. TYPE: Chile or Argentina. Strait of Magellan, *Commerson s.n.* (apparent holotype, P not seen, = F-34527!; isotypes [2 sheets], P!, = ASU photos!).

Berberis heterophylla Juss. ex Poir., *Encycl.* 8: 622. 1809. TYPE: Chile or Argentina. Strait of Magellan, *Commerson s.n.* (holotype, P not seen, = F-34525!; isotype, G not seen, = F-27413!).

Berberis cuneata DC., *Syst. nat.*, 2: 16. 1821. TYPE: Argentina. Puerto Deseado (holotype, BM? not seen).

Berberis dulcis Sweet, *Brit. fl. gard.* 4, plate 100. 1831.

TYPE: England. Cultivated, from Strait of Magellan (holotype, not seen, CGE?, MW?).

Berberis marginata Gay, *Fl. chil.* 1: 88. 1845. TYPE: Chile. Lago Llanquihue, *Gay s.n.* (holotype, P!, = F-34528!).

Berberis buxifolia var. *spinosissima* Reiche, *Fl. Chile* 1: 39. 1895. *Berberis spinosissima* (Reiche) Ahrendt, *J. Linn. Soc., Bot.* 57: 241. 1961. TYPE: Chile. Cordillera de Chillán, Collector unknown, s.n. (holotype, SGO-049057!, = ASU photo!).

?*Berberis heterophylla* var. *pluriflora* Reiche, *Anales Univ. Chile* 88: 97. 1894. TYPE: Chile. Cordillera de Cauquenes (holotype, SGO not seen).

Berberis buxifolia Lam. var. *gracilior* Albov, *Revista Mus. La Plata* 7: 361. 1896. TYPE: Argentina. Ushuaia, *Albov 1896–83* (holotype, LP? not seen; isotype, SI not seen, = ASU photocopy!).

Berberis buxifolia var. *papillosa* C. K. Schneid., *Ill. Handb. Laubh.* 1: 302. 1904. TYPE: Chile. Villarrica, *Neger s.n.* (apparent holotype, M!, = ASU photo!).

Berberis buxifolia var. *nuda* C. K. Schneid., *Bull. Herb. Boissier*, ser. 2, 5: 142. 1905. TYPE: Chile. Villarrica, *Neger s.n.* (holotype, M! [excluding "a"], = ASU photo!).

Berberis buxifolia var. *antarctica* C. K. Schneid., *Bull. Herb. Boissier*, ser. 2, 5: 142. 1905. TYPE: Chile. Cape Horn, *Hooker 1098* (lectotype, designated here, M!, = ASU photo!; isolectotypes, B lost, G not seen, W!, = ASU photo!).

Berberis antucoana C. K. Schneid., *Bull. Herb. Boissier*, ser. (2), 5: 144. 1905. *Berberis buxifolia* var. *antucoana* (C. K. Schneid.) Orsi, in Correa, *Flora Patagónica pt. IVa*: 331. 1984. TYPE: Chile. Cordillera de Antuco, *Poeppig s.n.* (syntype, W not seen; isosyntype, M!, = F-19121!; Sierra Velludo, *Philippi s.n.* (syntype, W not seen).

Berberis parodii Job, *Darwiniana* 5: 184, fig. 1. 1941. TYPE: Argentina. Cerro Otto, San Carlos de Bariloche, *Cabrera & Job LP 127* (holotype, LP-26389!).

Berberis michay Job, *Revista Mus. La Plata, Secc. Bot.* 5: 55. 1942. TYPE: Argentina. Santa Cruz: Dpto. Lago Argentino, Arroyo del Bote, Mar. 1914, *Comis, Iter Patagonicum 354* (holotype, SI not seen, = ASU photocopy!; isotype, SI not seen, = ASU photocopy!).

Berberis barilocheensis Job, *Revista Mus. La Plata, Secc. Bot.* 5: 50. 1942. TYPE: Argentina. Río Negro: San Carlos de Bariloche, 5 Jan. 1935, *Cabrera & Job 33* (holotype, LP-26118!, = ASU photo!).

Shrub up to 3 m high, glabrous or the twigs and young growth pubescent to puberulent; twigs reddish brown, light brown, yellowish, or gray, with longitudinal ridges, often with numerous black spots, the bark smooth, with age slightly fibrous or flaky; spines 3-parted, the arms (3–)5–45 mm long, about equal in length or the lateral arms shorter or absent (especially near the branch tips); bracts ovate to suborbicular, 1–2 mm long, light green to reddish brown, becoming gray with age. Leaves usually obovate to oblanceolate, less often elliptic to nearly linear, the blade 6–40 mm long, 2–14 mm wide, 1.4–7 times as long as wide, coriaceous to subcoriaceous, drying olive-green, dull to slightly lustrous above, the margin entire or with 1–2 per-

pendicular spinescent teeth per side; apex acute to obtuse, often with a terminal spine-like apiculum to ca. 1–1.5 mm long; base cuneate to acute; petiole to 1.5(–5) mm long, often persisting as a peg-like structure after the blade falls, with a broadened base; venation reticulate-actinodromous, the mid-vein weak to prominent below, weak to indistinct above, the secondary veins prominent to indistinct, usually 2–3 pairs. Inflorescence a solitary flower (rarely an umbel of 2 or 3); pedicels 5–24 mm long; flowers 4–5 mm long, yellow; tepals about 12–15, those of the innermost whorl 2.5–4 mm long, shorter than the immediately adjacent outer whorls; stamens 2.5–3 mm long, with or without two tooth-like lateral appendages below the anther, the anther ca. ½ or less the length; pistil ca. 3 mm long, ovoid to barrel-shaped, the style insignificant, the stigma 1–1.5 mm wide; ovules usually ca. 7, basal. Fruit subglobose, 7–11 mm diam., the style essentially none; seeds (1–)6–10, ca. 4–6 mm long, dark black to brown. Figures 2B, 3E, 7B, 12B.

Distinguishing features. Style short; stamens with or without tooth-like appendages; spines 3-parted or simple; inflorescence usually a solitary flower; leaves obovate to oblanceolate, usually with entire margins; flowers yellow.

Phenology. Flowering from August to March, with the peak being from October to January. Fruiting mainly from December to March.

Distribution and habitat. Endemic to southwestern South America from the Andes of Curicó (Región VI) in central Chile at 2500 m to sea level in Tierra del Fuego in both Chile and Argentina. A shrub of disturbed habitats, doing especially well in pastures and along roads.

Common names. Michai, mulun, calafate (Gay, 1845; Rodriguez et al., 1995).

Selected specimens. CHILE. **Región VI:** orillas de la Laguna de Teno (35°10'S, 70°35'W), 2500 m, 10 Mar. 1967 (fl), *Martcorena & Matthei 916* (CONC-70278, OS); interior of valley Teno, 2000 m, 30 Dec. 1971 (fl), *Zöllner 5095* (NA); Laguna Planchón, 2500 m, 30 Dec. 1971 (fl), *Zöllner 6347* (CONC-108020, NA). **Región VII:** Altos de Vilches (35°36'S, 71°12'W), 25 Nov. 1970 (fr), *Oehrens 925* (CONC-41821); Cajón de los Helados (34°50'S, 70°33'W), 7 Jan. 1951 (fr), *Ricardi s.n.* (CONC-10172); Laguna Dial (36°25'S, 70°55'W), 1520 m, 26 Jan. 1961 (fr), *Schlegel 3683* (CONC-88848). **Región VIII:** Reducción Pitracuicui (37°47'S, 73°30'W), 110 m, 8 Aug. 1979 (fl), *Cuevas 8* (CONC-88745); Refugio Garganta del Diablo (36°54'S, 71°24'W), 1800 m, 31 Dec. 1964 (fl), *Gleisner 168* (CONC-88852); road between Pemuco and Yungay, ca. 8 km N of Yungay (ca. 37°5'S, 71°55'W), ca. 200 m, 18 Oct. 1993 (st), *Landrum 7954* (ASU); Lago Lanalhue, road on W side of lago to Hostería, ca. 2 km from main highway (37°53'S, 73°20'W), 23 Oct. 1993 (fl), *Landrum 7972* (ASU). **Región IX:** 9.4 km al oeste del Paso Pino

Hachado, Mar. 1962 (fl), *Greer 26* (CONC-27391); Volcán Lonquimay, near gate and house of guardaparque (ca. 38°25'S, 71°30'W), ca. 1500 m, 26 Oct. 1993 (fl), *Landrum 8001* (ASU, SGO); Licanray, 210 m, 18 Sep. 1974 (fl), *Montero O. 9336* (CONC-84025); 6 km S de Curacautín, 23 Mar. 1954 (st), *Sparre & Constance 10857* (CONC-17566). **Región X:** Parque Nacional Puyehue, road to Antillanca, ca. 8 km above Administration at Aguas Calientes (ca. 40°45'S, 72°20'W), ca. 650 m, 9 Nov. 1993 (fl), *Landrum 8059* (ASU, SGO); Chiloé, camino de Chacao a Ancud, 1 km antes de la entrada del camino a Caulin (41°51'S, 73°37'W), 45 m, 10 Jan. 1975 (fr), *Martcorena et al. 4* (CONC-42826); Niebla, Playa Grande, 27 Sep. 1975 (fl), *Montero 9739* (CONC-84024); Isla Gran Guaiteca, Puerto Low in Bahía Low (43°51'S, 73°55'W), 7–15 Jan. 1984 (fr), *Patterson s.n.* (F, NY). **Región XI:** Puerto San Andrés, N side, Taitao Península (46°33'S, 75°26'W), 23 May 1973 (st), *Goodall 47* (NA); Cerro Divisadero SE of Coihaique, road to centro de ski El Fraile (ca. 45°37'S, 70°00'W), 16 Nov. 1993 (fr), *Landrum 8108* (ASU); río Exploradores, entre río Verde y río Teresa, Parque Nacional Laguna San Rafael, Sector Hotel (46°37'S, 73°33'W), 25 Jan. 1988 (fr), *Pisano V. 6201* (CONC-104598); junta del río Soler y río Romero (47°00'S, 73°05'W), 700 m, 29 Mar. 1962 (st), *Seki 608* (CONC-88750). **Región XII:** Puerto Inútil, Isla Navarino (54°59'S, 67°50'W), below 50 ft., 6 Dec. 1968 (st), *Barret & Norris 58-10* (NA); Puerto Hambre ca. 50 km S of Punta Arenas (ca. 53°40'S, 70°55'W), 0–10 m, 22 Dec. 1994 (fr), *Landrum 8393* (ASU); Punta Steinman, ca. 35 km along road to Punta Canelo from main highway (ca. 53°10'S, 71°25'W), ca. 3 m, 31 Dec. 1994 (fr), *Landrum 8462* (ASU); Fiordo Peel, río Murtillar (50°27'S, 73°37'W), 17 Nov. 1985 (fl, yfr), *Pisano V. 5912* (CONC-73141). ARGENTINA. **Chubut:** proximo del desvío de Ruta 40 a Alto río Senguer, 720 m, 13 Jan. 1978 (fr), *Ambrosetti & Méndez 27523* (MERL); Tehuelches, cerca río Pico, 7–26 Feb. 1993 (fr), *Roig 14300* (MERL); entre río Mayo y Alto Seuguer (ruta 40), 560 m, 11–12 Dec. 1986 (fr), *Roig Junent 12903* (MERL); 35 km E of Esquel on route 25 (2.9 km SE of the junction of routes 40 and 25), 670 m, 4 Dec. 1984 (fr), *Stuessy et al. 6828* (OS). **Neuquén:** Lacar, Lago Lacar (Parque Lanín), Pucará, 9 Nov. 1956 (fr), *Roig 1950* (MERL); al NW del Lago Falkner, Feb. 1975 (fr), *Cassels s.n.* (SGO); entre Zapala y Laguna Miranda, 1180 m, 7 Dec. 1990 (fr), *Roig et al. 12967* (MERL). **Río Negro:** Dep. Bariloche, Cerro Catedral, 13 Nov. 1968 (yfr), *Cabrera et al. 19496* (CONC-42805); Valle El Bolsón, 10 Feb. 1983 (fr), *Roig 13342* (MERL); Meseta de Somuncura, Laguna Raimunda, 1440 m, 20 Feb. 1967 (fr), *Ruiz Leal 25575* (MERL); 3.3 km S of Foyel on route 258, 750 m, 3 Dec. 1984 (fr), *Stuessy et al. 6792* (OS). **Santa Cruz:** valle superior del río Turbio, 23 Jan. 1978 (st), *Ambrosetti & Méndez s.n.* (MERL); 4 m al E del Lago Burmeister, 1000 m, 8 Dec. 1980 (fl), *Cei & de Cei s.n.* (MERL); Güer Aike cerca de La Esperanza, 14 Feb. 1993 (fr), *Roig et al. 14378* (MERL); río Chico, cerca de Riera, 20 Feb. 1993 (fr), *Roig et al. 14597* (MERL). **Tierra del Fuego:** Lapataia National Park above Ushuaia, 16 Feb. 1976 (fr), *Barclay s.n.* (US); Ushuaia, 6–8 km de la población, margen derecha río Olivia, 22 Dec. 1949 (fl, fr), *Ruiz Leal & Carretero 12815* (MERL); Valle de Tierra Mayor, 24 Feb. 1956 (fr), *Ruiz Leal & Roig 15081* (MERL).

The name *Berberis buxifolia* has long been the name most commonly used for this species, but an

older, less frequently used name, *B. microphylla*, exists and should be used in accordance with the rules of nomenclature.

This is a variable and widespread species that has benefitted from human disturbance. Other authors have subdivided it into numerous entities, but after field and herbarium studies I find that I cannot erect any satisfactory subspecific division.

Leaf shape variation in *B. microphylla* is illustrated in Figure 5. Plants of wetter habitats are near the top, whereas those of drier habitats are near the bottom of this figure.

In more humid areas leaves tend to be broader and entire and the spines shorter; in drier areas the leaves tend to be narrower and are often toothed and the spines longer. The plants of the Patagonian steppe that have long been called *B. heterophylla* combine relatively narrow leaves, long spines, and leaves with toothed margins, but where I have seen these growing the characters are not consistent within local populations, so recognizing even a variety at this point seems unwarranted. If extensive populations can be found that are uniform in a particular set of character states, then a Patagonian variety might be accepted. It would be better not to use the epithet *heterophylla* because the type of *B. heterophylla* does not have exceptionally narrow leaves or long spines, nor are the leaf margins especially toothed.

Berberis microphylla is most likely to be confused with *B. montana*. They are contrasted directly in lead 19 of the key. It perhaps hybridizes with *B. valdiviana* (Landrum 8032) and *B. trigona* (Landrum 8018).

Berberis dulcis Sweet was described and illustrated from a cultivated plant, so perhaps no specimens exist. The illustration and origin clearly indicate its identity.

Some authors have taken Paxton's description of *Berberis dulcis* (Paxton's Mag. Bot. 10: 171. 1843) as a new species description. I do not believe that was Paxton's intention because he mentioned that the plant had been growing in England for about 13 years, or about the number of years since it was described by Sweet. In any case, it would be an illegitimate later homonym.

Usteri (Mitt. Deutsch. Dendrol. Ges. 8: 94. 1899) introduced three names into the *Berberis* literature: *Berberis buxifolia* var. *nana* Hort. ex A. Usteri, *Berberis buxifolia* var. *pygmaea* Hort. ex A. Usteri, and *Berberis buxifolia* var. *macrantha* Phil. ex A. Usteri. There was only incidental mention of these taxa in a key, and it was probably not the intention of the author to establish new names. Thus, I believe these were not validly published.

The type of *Berberis brevifolia* Phil. ex. Reiche (see excluded taxa) is sterile but appears to be *B. microphylla*, although it comes from outside the known range of that species. It might also be a form of *B. actinacantha*.

15. *Berberis montana* Gay, Fl. chil. 1: 90. 1845.
TYPE: Chile. Montañas de Cauquenes y de Talcalegue, Gay s.n. (holotype, P!, = F-34529!).

Berberis coletioides Lechler, Berberid. Amer. austral., 38. 1857. *Berberis montana* var. *coletioides* (Lechler) C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 395. 1905. TYPE: Chile. Cordillera de Santiago, Philippi s.n. (syntypes, SGO not seen, Lechler hb. 3135 [at MB?] not seen).

Berberis polypetala Phil., Anal. Univ. Santiago 1872: 666. 1872. TYPE: Chile. Volcán Calbuco, Juliet s.n. (holotype, SGO-063370!, = ASU photo!).

Berberis montana var. *gracilis* C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 395. 1905. *Berberis coletioides* var. *gracilis* (C. K. Schneid.) Ahrendt, J. Linn. Soc., Bot. 57: 247. 1961. TYPE: Chile. Villarrica, Neger s.n. (holotype, M not seen; isotype, G!).

Berberis montana var. *chillanensis* C. K. Schneid., Bull. Herb. Boissier, ser. 2, 5: 395. 1905. *Berberis chillanensis* (C. K. Schneid.) Sprague, Kew Bull. 9: 455. 1932. TYPE: Chile. Cordillera de Chillán, Germain s.n. (lectotype, designated here, W!, = ASU photo!; isolectotypes, CONC!, F!, G!); Philippi s.n., 1855 (syntype, W!).

Berberis chillanensis var. *hirsutipes* Sprague, Kew Bull. 9: 456. 1932. TYPE: Argentina. Suangulo, 1950 m, 16 Jan. 1926 (fl), Comber 479 (holotype, K!, = ASU photo!).

Berberis cabreræ Job, Revista Mus. La Plata, Secc. Bot. 5: 60. 1942. TYPE: Argentina. Río Negro: Bariloche, Cerro López, 1500 m, 15 Jan. 1935, Cabrera & Job 325 (holotype, LP-26065 not seen; isotype, LP-24657!, = ASU photo!).

Shrub up to ca. 2 m high, glabrous or the twigs and young growth pubescent to minutely papillate-puberulent; twigs reddish brown, tan, or gray, with longitudinal ridges, the bark smooth, with age slightly fibrous; spines 3-parted, the arms 3–12(–15) mm long, or often the lateral arms absent or insignificant, especially near the branch tips; bracts ovate to broadly rounded, 1–2 mm long, membranous to submembranous, reddish brown to yellowish tan. Leaves obovate, oblanceolate, or oblong, the blade 5–18 mm long, 1.5–9 mm wide, 2–3.3(–4.7) times as long as wide, membranous to submembranous, drying gray-green, dull to slightly lustrous above, the margin normally entire; apex acute to rounded, usually without an apiculum; base acute to acuminate; petiole in living leaves usually insignificant, but often present as persistent leaf bases, these 2–3 mm long, with a broad clasping base and narrow neck-like apex, borne in the

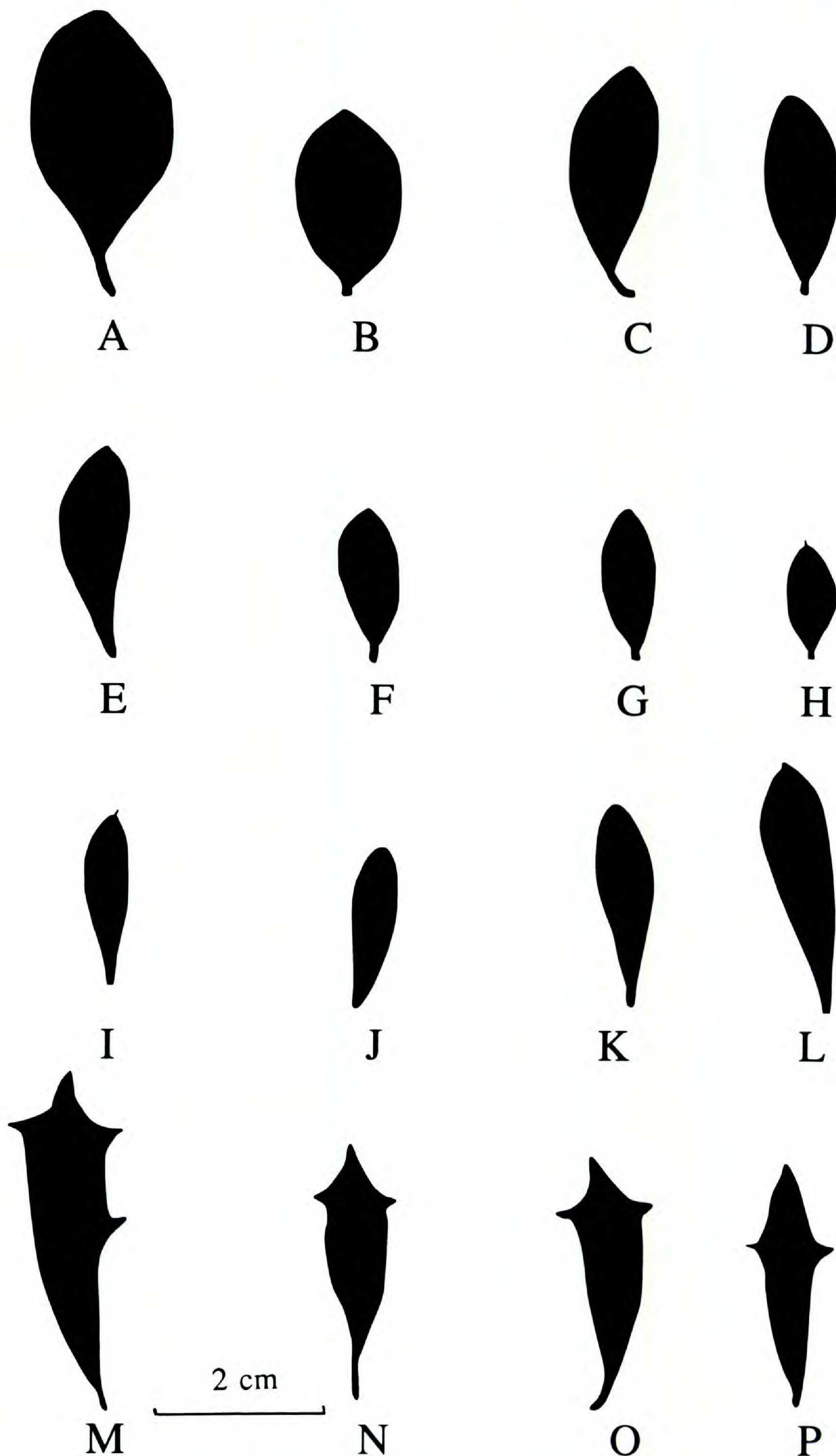


Figure 5. Leaf variation in *Berberis microphylla*. In general, the leaves at the top come from wetter localities and those at the bottom come from drier localities. Each leaf is from a separate collection, each made by the author. General locality and Region are indicated for each collection. —A. 8059, Puyehue (X). —B. 8067, Puyehue (X). —C. 8000, road to Volcán Lonquimay (IX). —D. 7972, Lanalhue (VIII). —E. 7607, Volcán Villarrica (IX). —F. 7945, Termas de Chillan (VIII). —G. 7592, Valdivia (X). —H. 7613, Huerquehue (IX). —I. 8434, Cullen (XII). —J. 7941, Recinto (VIII). —K. 8418, Cerro Guido (XII). —L. 8146g, Puerto Ibañez (XI). —M. 8141, Puerto Ibanez (XI). —N. 8425, San Gregorio (XII). —O. 8146h, Puerto Ibañez (XI). —P. 8406, Lago Sarmiento (XII).

axils of spines and subtending leaf clusters; venation reticulate-actinodromous, the midvein weak to prominent below, the veins otherwise weak to indistinct. Inflorescence a solitary flower or a sessile umbel-like cluster of 2–3; pedicels 0.6–1.2 cm long; flowers 3.5–6 mm long; tepals about 15, the innermost 6, 2–4 mm long, darker yellow-orange than the other tepals, shorter than the immediately adjacent outer whorls; stamens 3–3.5 mm long, with very small appendages just below the anther, the anther ca. $\frac{1}{2}$ the length; pistil 3–4 mm long, elongate urceolate, the style ca. $\frac{1}{2}$ the length; ovules 4–7, basal. Fruit subglobose, ca. 8 mm diam., the style 1–2 mm long; seeds up to about 7, ca. 4 mm long. Figures 7D, 12C.

Distinguishing features. Style long; stamens with tooth-like appendages; spines 3-parted or simple; inflorescence a solitary flower or 2–3-flowered umbel; leaves mostly obovate to oblanceolate, with entire margins; flowers yellow-orange, the innermost 6 tepals darker than others.

Phenology. Flowering mainly from November to January. Fruiting mainly from January to March.

Distribution and habitat. Endemic to southwestern South America. Found in Chile from Cerro Caqui (Región V) to Volcán Osorno (Región X) and in Argentina only in the vicinity of Lago Nahuelhuapi and probably near Baños de Copahue. A shrub of forests and open areas, usually near the upper limit of woody vegetation.

Common name. Palo amarillo (Gay, 1845).

Selected specimens. CHILE. **Región V:** Valparaíso, La Calera, Cerro Caqui (32°43'S, 71°03'W), 1800 m, 12 Oct. 1966 (fl), *Zöllner 1650* (CONC-108058). **Región Metropolitana:** San Gabriel (33°26'S, 70°14'W), ca. 2500 m, Dec. 1951 (fr), *Gunckel 21744* (CONC-108062); Quebrada Jorquera, cerca del Refugio de Farellones, 2200 m, 9–12 Feb. 1957 (fr), *Looser 5707* (G); Melipilla, Las Vizcachas, ca. 10 km from La Dormida, 1860 m, 8 Dec. 1938 (fl), *Morrison 16811* (G, MO, NA); Cerro San Ramón, Paso del Inca (33°28'S, 70°25'W), 2700 m, 21 Nov. 1955 (fl), *Schlegel 938* (CONC-88844). **Región VI:** Colchagua, San Fernando, Vegas del Flaco (34°56'S, 70°25'W), 1800 m, 7 Feb. 1955 (fr), *Ricardi 3155* (CONC-18846). **Región VII:** Talca, El Picazo (35°32'S, 71°00'W), 28 Dec. 1936 (fl), *Barros 320* (CONC-108094); Linares, Valle Botacura (36°05'S, 70°40'W), 2000 m, 21 Jan. 1961 (fr), *Schlegel 3570* (CONC-88867). **Región VIII:** Chillán, Termas de Chillán, ca. 1 km below Puente Aserradero (ca. 36°55'S, 71°27'W), ca. 1300 m, 17 Oct. 1993 (fl), *Landrum 7943* (ASU); Bío Bío, alrededores de Termas de Copahue, Feb. 1942, *Muñoz & Montandón 3016* (SGO); Bío Bío, Las Cuevas, Laguna del Laja (37°28'S, 71°19'W), 1300 m, 2 Nov. 1952 (fl), *Ricardi 2343* (CONC-13183, OS). **Región IX:** P. N. Nahuelbuta, Piedra del Aguila (37°49'S, 72°59'W), 1350 m, 24 Nov. 1987 (fl), *Baeza 5* (CONC-110170); road from Curacautín to Lonquimay, ca. 1.5 km before turnoff to road to Volcán Lonquimay (ca. 38°25'S, 71°30'W), ca. 1300 m, 26 Oct. 1993 (fl), *Landrum 7997*

(ASU); Temuco, camino desde la Laguna Conguillío, 2 km antes de la Laguna Captrén (38°39'S, 71°40'W), 1300 m, 20 Jan. 1976 (fl), *Martcorena et al. 820* (CONC-44201); Los Pinos, 6 km antes de Paso Pino Hachado (38°39'S, 70°56'W), 1600 m, 10 Jan. 1977 (fr), *Martcorena et al. 1382* (CONC-88851). **Región X:** Volcán Osorno, La Picada, El Lomón (41°05'S, 72°25'W), 950–1500 m, 28–30 Nov. 1939 (fl), *Gunckel 9365* (CONC-108105); Parque Nacional Puyehue, road to Antillanca, ca. 14.4 km above Park Administration (ca. 40°45'S, 72°20'W), ca. 800 m, 10 Nov. 1993 (fl), *Landrum 8066* (ASU, SGO); Lago Pihueico (39°54'S, 71°52'W), 1060 m, 7 Dec. 1976 (fl), *Veblen 507* (CONC-88863); río Pilmaiquén, La Poza (40°33'S, 72°50'W), 110 m, Mar. 1967 (fl), *Zollitsch 99* (CONC-41835). ARGENTINA. **Neuquén:** Cerro Chapelco, 1400 m, 12 Jan. 1972 (fl), *Cabrera 21913* (CONC-37550); Neuquén, Pino Hachado, 18 Nov. 1969, *Ruiz Leal 26757* (MERL).

Sprague's new combination and variety (*Berberis chillanensis* (Schneider) Sprague var. *hirsutipes* Sprague) published in 1932 were also reported informally by Bean in the same year in *New Flora and Silva* 5: 49–51. It was clearly the intention of Bean to report on the activities of Sprague as they were being published in the *Kew Bulletin*, so I assume Sprague's publication was first to appear.

Berberis montana is most likely to be confused with *B. microphylla*; the two are compared directly in lead 19 of the key.

Berberis montana probably hybridizes with *B. empetrifolia*. Both grow at high elevations, and the harsh habitat of exposed volcanic soils and cold winds may have locally favored hybrids.

Cortella and Orsi (1986) found that *B. copahuensis* Job (see excluded taxa), which they considered to be a species, intergrades with *B. empetrifolia*. I hypothesize that *B. copahuensis* is a hybrid between *B. empetrifolia* and *B. montana* and that it is back-crossing with *B. empetrifolia* in the population they studied.

16. *Berberis negeriana* Tischler, Bot. Jahrb. Syst. 31: 640. 1902. TYPE: Chile. Concepción, *Neger s.n.* (holotype, M!, = ASU photo!, = F neg. 19123!).

Shrub up to ca. 1 m high; young twigs light brown to gray, minutely papillate, the older bark gray, with longitudinal cracks and ridges; spines absent; bracts triangular to narrowly triangular, up to 9 mm long. Leaves oblong-elliptic, the blade 4.8–10 cm long, 1.3–4.2 cm wide, 2.3–3.7 times as long as wide, coriaceous, drying dark green to brown, somewhat lighter below than above, lustrous on both surfaces, the margin coarsely serrate (rarely entire), with 6–16 spine-tipped teeth, the marginal spines 1–3 mm long, the teeth (not including spine) 0.5–3 mm long, sometimes every other tooth di-

rected downward; apex acute; base acuminate to broadly cuneate; petiole 0–3 mm long; venation mixed craspedodromous, the midvein impressed slightly to nearly flat above, prominent below, the secondary veins distinct, raised above and below, 7–13 pairs, the tertiary veins distinct. Inflorescence a raceme with the peduncle plus rachis 2–8 cm long, with few to ca. 12 flowers; pedicels 10–16 mm long, the subtending bracts 2–3 mm long; flowers yellow, ca. 5–8 mm long; tepals 14, the innermost elliptic to obovate, ca. 6 mm long; stamens ca. 5 mm long, without lateral appendages, the anther ca. ½ the length; pistil ca. 6 mm long, the style ca. 2 mm long, elongating to ca. 4 mm long soon after anthesis; ovules 2–3, basal. Fruit (perhaps only seen immature) oblong, ca. 7 mm long by ca. 4 mm wide, the persistent style ca. 3 mm long. Figures 7D, 12D.

Distinguishing features. Style long; stamens without tooth-like appendages; spines none; inflorescence a raceme of up to ca. 12 flowers; leaves oblong-elliptic with serrate margins, the lower surface lustrous.

Phenology. Flowering from September to November. Fruiting in December and January.

Distribution and habitat. Endemic to the area just east of Concepción (Región VIII), Chile. Reports of specimens from Villarrica seem to be based on confused labels. An understory shrub of *Nothofagus* forest.

Selected specimens. CHILE. **Región VIII:** Concepción, Bosque Fisco at Nonguén, SE of Concepción (36°50'S, 73°2'W), ca. 200–300 m above houses, 4 Sep. 1991 (fl), Landrum & Ruiz 7434 (ASU); Concepción, Chiguayante, hills N of town following a path beginning at San Pablo and San Marcos streets, climbing ca. 1 hour, 30 Nov. 1993 (st), Landrum & Ruiz 8210 (ASU); Concepción, Chiguayante, Cerro Manquimávida (36°55'S, 73°01'W), Oct. 1936 (fl), Pfister s.n. (CONC-7724, OS).

Orsi (1976) placed *Berberis negeriana* in synonymy under *B. serratodentata*, but they differ in various ways outlined in lead 10 of the key. It may also be confused with *B. valdiviana*; the differences are discussed under that species.

This is the rarest and most endangered species of *Berberis* in Chile. Only a few individuals are known, growing in a remnant *Nothofagus* forest, vulnerable to being completely destroyed.

17. *Berberis rotundifolia* Poepp. & Endl., Nov. gen. sp. pl. 2: 63. 1838. TYPE: Chile. Pico de Pilque, *Poeppig* s.n. (holotype, W not seen, = F-30137!; isotypes, G!, M!, = ASU photo!, W!, = ASU photo!).

Berberis polymorpha Phil., *Linnaea* 28: 664. 1856. TYPE:

Chile. Cordillera near Chillán, *Germain* s.n. (lectotype, designated here, SGO-063364! [lower left portion only, the right and upper portions excluded], = ASU photo!; isolectotype B, lost, = F-14307!).

Berberis umbellata Phil., *Anal. Univ. Santiago* 663. 1872. *Berberis philippii* Ahrendt, *J. Linn. Soc., Bot.* 57: 232. 1961, = *B. umbellata* Phil. 1872, non Wall. ex G. Don, *Gen. hist.* 1: 116. 1831. TYPE: Chile. Río Bueno, Valdivia, *Krause* s.n. (holotype, SGO-063372!, = ASU photo!).

Shrub to ca. 1.5 m high, glabrous; young twigs smooth, light reddish brown to yellowish, becoming gray; spines star-like, the arms (3–)5–7, 2–15 mm long, the central blade portion about as long as or shorter than the arms, the margin revolute; bracts broadly ovate, ca. 2 mm long. Leaves suborbicular, elliptic, ovate, or obovate, the blade 1.5–5 cm long, 0.6–4 cm wide, 0.9–2(–2.7) times as long as wide, submembranous, drying light brown to gray-green, darker above than below, sometimes glaucous below, the margin entire or with a few weak teeth, especially near the base; apex acute to rounded; base acuminate to rounded or truncate; petiole 0–4.5 cm long, ca. 0.5 mm wide; venation reticulate-actinodromous, the midvein narrow, ca. 0.1–0.2 mm wide, the tertiary veins distinct. Inflorescence an umbel or raceme with 7–12 flowers, the rachis if present short, the peduncle plus rachis 1–4 cm long; pedicels 4–12 mm long, subtended by triangular bracts 1–2 mm long. Flowers ca. 4 mm long; tepals 11–14, the innermost elliptic to obovate; stamens 2–2.5 mm long, with two minute, tooth-like lateral appendages below the anther, the anther ca. ½ the length; pistil barrel-shaped, ca. 2 mm long, the stigma sessile, ca. 1 mm wide; ovules (3–)5, basal. Fruit subglobose, 6–7 mm long, blue-purple; seeds usually 5, ca. 4 mm long, dark, shiny. Figures 3D, 8A, 13A.

Distinguishing features. Style short; stamens with tooth-like appendages; spines star-like or foliaceous; inflorescence a several-flowered, pedunculate umbel or short raceme; leaves submembranous, mostly with entire margins.

Phenology. Flowering from November to January. Fruiting from January to March.

Distribution and habitat. Endemic to central and southern Chile, from Curicó (Región VII) to at least Temuco (Región IX), and perhaps to río Bueno (Región X) where the type of *B. umbellata* is reported to have been collected. A shrub of *Nothofagus* forest understory and regeneration.

Selected specimens. CHILE. **Región VII:** Cordillera de Talca, El Picazo (35°32'S, 71°00'W), 2320 m, 28 Dec. 1936 (yfr), *Barros* 318 (CONC-103559); Curicó, Los Queñes (35°05'S, 70°30'W), 1500 m, Jan. 1933 (st), *Grandjot* s.n. (CONC-23279); Curicó, Molina, Area de Protección,

Radal Siete Tazas, Parque Inglés, Cajón de los Bueyes, 28 Dec. 1989 (fl, fr), *Muñoz S. 2508* (SGO). **Región VIII:** Pemehue, 1370 m, 19 Jan. 1946 (st), *Kuschel s.n.* (SGO); Termas de Chillán, ca. 200 m above Puente Aserradero (ca. 36°55'S, 71°27'W), ca. 1300 m, 17 Oct. 1993 (fl), *Landrum 7951* (ASU); Termas de Chillán, camino de bajada por la lavandería, 1700 m, 9 Jan. 1945 (fl), *Pfister 964* (CONC-6322, OS); cordillera del río Manso, 1000–1200 m, Feb. 1896, *Reiche s.n.* (SGO). **Región IX:** 11.3 km W of Lonquimay, 5200 ft., 20 Dec. 1960 (st), *Greer 1126* (OS); 10 km WNW of Lonquimay, 5100 ft., 4 Feb. 1962 (st), *Greer 1215* (OS); Toltén, Jan. 1917 (fr), *Gusinde 633* (W); Temuco, road to Cunco, ca. 40 km E of Temuco, ca. 2.2 km E of Faja 18 road (ca. 38°55'S, 72°10'W), ca. 300 m, 25 Oct. 1993 (fl), *Landrum 7995* (ASU, SGO).

Berberis rotundifolia is part of a complex of species related to *B. actinacantha* and is distinguished from them in leads 2 and 3 of the key. Some forms of *B. corymbosa* of Más a Tierra Island are similar in leaf shape and texture to *B. rotundifolia*, and the possibility of a relationship must be considered.

18. *Berberis serratodentata* Lechler, *Berberid. Amer. austral.*, 16. 1857. TYPE: Chile. Cordillera de Valdivia, tierra de los Pehuenches, *Lechler 2985* (holotype, MB? not seen; isotype, P!, = F-34538!).

Berberis pearcei Phil., *Linnaea* 33: 4. 1864. TYPE: Chile. Boquete de Ranco, Andes de Valdivia, *Pearce s.n.* (holotype, SGO!, = ASU photo!).

Shrub to ca. 1.5 m high, glabrous; young twigs smooth (sometimes shiny), yellow-brown, the older bark becoming gray, fibrous; spines usually absent or less often a few present, 3-parted to palmate with the arms to ca. 4 mm long; bracts oblong-truncate, ovate-triangular to narrowly acuminate-triangular, 3–12 mm long. Leaves oblong, elliptic, narrowly elliptic, ovate, lanceolate, or oblanceolate, the blade 2.3–9.3 cm long, 1.1–2.4 cm wide, 2–4.3 times as long as wide, coriaceous, drying gray-green to yellow-green, dull to lustrous above, dull, papillate below, the margin often revolute, usually serrate with 10–32 spine-tipped teeth per side, the marginal spines 1–2.5 mm long, the teeth (not including spine) to ca. 1 mm long; apex acute to rounded; base acuminate, acute, decurrent along the petiole, the petiole to ca. 7 mm long; venation mixed craspedodromous, the midvein impressed above, prominent below, the secondary veins faint to prominent, impressed slightly to flat above, 7–12 pairs, the tertiary veins faint to indistinct. Inflorescence a raceme, with 8–15 flowers, the peduncle plus rachis 0.5–1.5 cm long; pedicels 6–13 mm long; flowers orange, 5–7 mm long; tepals 14, the innermost obovate; stamens 4–5 mm long, without lateral appendages, the anther ½ or less the length;

pistil ca. 5 mm long; stigma ca. 1.5 mm across; ovules 4–6, basal. Fruit subglobose, ca. 7 mm long, the style ca. 2 mm long; seeds 4–6, ca. 5 mm long. Figures 2F, 8B, 13B.

Distinguishing features. Style long; stamens without tooth-like appendages; spines usually none; inflorescence a raceme of 8–15 flowers; leaves mainly oblong, with serrate margins, the lower surface dull, papillate.

Phenology. Flowering in November and December. Fruiting from January to March.

Distribution and habitat. Endemic to southwestern South America. Found in Chile from the Cordillera of Nahuelbuta (Región VIII) to Coihaique (Región XI) and in Argentina in western Río Negro, Neuquén, and Santa Cruz (Orsi, 1984). An understory shrub of *Nothofagus* and *Araucaria* forests.

Common name. Saloll (Muñoz, 1966).

Selected specimens. CHILE. **Región IX:** road from Curacautín to Lonquimay over mountain, ca. 5 km after turnoff to road to Volcán Lonquimay (ca. 38°25'S, 71°30'W), ca. 1600 m, 26 Oct. 1993 (st), *Landrum 8015* (ASU); Melipeuco, China Muerta (38°42'S, 71°31'W), ca. 1800 m, 23 Jan. 1958 (st), *Montero 5805* (CONC-84040, OS); Volcán Mocho (39°56'S, 72°04'W), 1300 m, 19 Feb. 1956 (st), *Montero 4996a* (CONC-84092); Angol, Parque Nacional de Nahuelbuta, Piedra de Aguila (37°49'S, 72°59'W), 1350 m, 9 Jan. 1968 (fr), *Ricardi et al. 1971* (CONC-41833, F). **Región X:** Chiloé, Piruquina (42°24'S, 73°48'W), 400 m, 20 Feb. 1932 (st), *Junge 325* (CONC-2225); Llanquihue, Cerro Vichadero, Casa Pangué (41°04'S, 71°51'W), 1200 m, 14 Jan. 1953 (fr), *Pfister s.n.* (CONC-13561); Parque Nacional Puyehue, road to Antillanca, ca. 15.5 km above Park administration (40°45'S, 72°20'W), 1100 m, 10 Nov. 1993 (fl), *Landrum 8070* (CONC-47918). **Región XI:** Cerro Divisadero SE of Coihaique, road to centro de ski El Fraile, ca. 12.2 km from beginning of road (ca. 45°37'S, 70°00'W), 16 Oct. 1993 (fl), *Landrum 8118* (ASU). ARGENTINA. **Río Negro:** ca. 2 km down from top of Cerro Otto towards San Carlos de Bariloche, ca. 1250 m, 2 Dec. 1984 (fl), *Stuessy et al. 6758* (OS).

Berberis serratodentata is similar to *B. negeriana*; the two are contrasted in lead 10 of the key. *Berberis serratodentata* hybridizes with *B. ilicifolia*, and this problem is discussed under that species.

19. *Berberis trigona* Kunze ex Poepp. & Endl., *Nov. gen. sp. pl.* 2: 63, t. 187. 1838. TYPE: Chile. Antuco, *Poeppig s.n.* (holotype, W not seen; isotype, M!).

Berberis linearifolia Phil., *Linnaea* 28: 663. 1857. TYPE: Chile. Strait of Magellan [probable error], *Lechler s.n.* (lectotype, designated here, SGO-049022!, = ASU photo!); Volcán Osorno, *Philippi s.n.* (SGO not seen). *Berberis grisebachii* Lechler, *Berberid. Amer. Austral.* 34. 1857. TYPE: Chile. Laguna de Ranco, *Lechler 823*

(holotype, MA? not seen; isotypes, BR!, G!, = F-27415!, M not seen, = F-19122!, W!).

Berberis trigona var. *longifolia* Reiche, Fl. Chile 1: 36. 1895. *Berberis linearifolia* var. *longifolia* (Reiche) Ahrendt, J. Linn. Soc., Bot. 57: 256. 1961. TYPE: Chile. Valle del estero de Chillán, Collector unknown, s.n. (holotype, SGO!, = ASU photo!).

Shrub up to 2 m high, glabrous; twigs usually light gray to tan (rarely dark reddish brown), with longitudinal ridges, the bark of older twigs becoming fibrous; spines 3-parted, not foliaceous, the arms nearly equal, 3–18 mm long, curved slightly downward; bracts ovate to ovate-oblong, dark brown, ca. 3 mm long. Leaves elliptic, narrowly elliptic, oblanceolate, or linear, the blade 1.7–5.4 cm long, 0.4–1(–1.5) cm wide, (2–)2.6–8 times as long as wide, stiffly coriaceous, drying olive-green, lustrous above, dull below, the margins revolute; apex acute to rounded, ending in a sharp spine up to 2 mm long; base acute to acuminate; petiole 0.5–1.5 mm long and thick; venation mixed craspedodromous, the midvein impressed above, prominent below, the other veins indistinct. Inflorescence an umbel-like cluster of 2–4 flowers; pedicels 1–2.7 cm long, 0.3–0.5 mm wide; flowers orange to reddish orange, ca. 9 mm long; tepals 15–21, the smallest linear to oblong, ca. 3 mm long, the largest obovate to elliptic, 7–10 mm long; stamens ca. 5 mm long, without lateral appendages, the anther less than ½ the length; pistil 4.5–7 mm long; style 1.5–3 mm long; stigma peltate, ca. 1.5 mm wide; ovules 4–9. Fruit subglobose, 7–10 mm long, terminating in a persistent style ca. 3–4 mm long; seeds 5–9, 3.5–4 mm long. Figures 2K, 3G, 8C, 13C.

Distinguishing features. Style long; stamens without tooth-like appendages; spines 3-parted, up to 18 mm long, slightly recurved; inflorescence an umbel-like cluster of 2–4 flowers; leaves mostly over 3 times as long as wide, the margins entire; flowers orange to reddish orange.

Phenology. Flowering mainly from November to February. Fruiting mainly in January and February.

Distribution and habitat. Endemic to southwestern South America. Found in Chile from Antuco (Región VIII) to Volcán Osorno (Región X) and in Argentina only in western Neuquén and Río Negro. An understory shrub of *Nothofagus* forests.

Common names. Calafate (Rodríguez et al., 1995), michai (M. Muñoz et al., 1981).

Selected specimens. CHILE. **Región VIII:** Bío-Bío, Los Angeles, Antuco, El Canelo (37°20'S, 71°41'W), 650 m, 15 Jan. 1982, *Montero 12178* (CONC-84006). **Región IX:** Malleco, road from Curacautín to Lonquimay over mountain, ca. 3 km after turnoff to road to Volcán Lon-

quimay (ca. 38°25'S, 71°30'W), ca. 1500 m, 26 Oct. 1993 (fl), *Landrum 8004* (ASU, SGO); road from Victoria to Curacautín, at Puente Collihuanqui, ca. 38 km E of Victoria (ca. 38°22'S, 71°57'W), ca. 800 m, 26 Oct. 1993 (fr), *Landrum 8020* (ASU); Melipeuco, China Muerta (38°42'S, 71°31'W), ca. 1800 m, 23 Jan. 1958 (fl), *Montero 5793* (CONC-84001); Termas de Tolhuaca, 950–1180 m, 12 Mar. 1939 (fl), *Morrison & Wagenknecht 17487* (G, MO, NA). **Región X:** San Juan de la Costa, 500–600 m, 6 Feb. 1958 (fr), *Eyerdam 10610* (F, NY, US); Parque Nacional Puyehue, road to Antillanca, ca. 13.7 km above Park Administration (ca. 40°45'S, 72°20'W), ca. 800 m, 10 Nov. 1993 (fl), *Landrum 8064* (ASU, SGO); Cordillera Pelada, camino a Hueicolla (40°10'S, 73°29'W), 1100 m, 21 Jan. 1964 (st), *Montero 6733* (CONC-84007); Llanca-cura, Alerzal de Huenchucona (40°18'S, 73°24'W), 10 Jan. 1963 (fr), *Schlegel 4527* (CONC-46742). ARGENTINA. **Neuquén:** al NW del Lago Falkner, cerca del camino, Feb. 1975 (fl), *Cassels s.n.* (SGO); San Carlos de Bariloche, Cerro Tronador, ca. 900 m, 29 Oct. 1983 (fl), *Charpin 18483* (G); Lago Lacar, Pucará, 9 Nov. 1956 (yfr), *Roig & A. Ruiz Leal 1968* (MERL). **Río Negro:** Laguna Frías, 29 Jan. 1975, *Ambrosetti 2331* (MERL-47027); Lago Nahuel Huapi, Puerto Meyer, 8 June 1939 (fr), *Cabrera & Job 207* (NY); camino del Lago Mascardi a Lago Hess, 28 Nov. 1946 (fl), *Teague s.n.* (K); arriba del río Guillermo, 28 Nov. 1946 (fl), *Teague s.n.* (K).

Berberis trigona has more commonly been called *B. linearifolia*, but the first is the older name. It hybridizes with at least *B. darwinii* (*Landrum 8041* and *8046* from near Vilcún) and, perhaps, also with *B. microphylla*.

Berberis lologensis is a hybrid between *B. trigona* and *B. darwinii* (see excluded taxa). I have not seen a type of *B. bidentata* (see excluded taxa), but it seems to be a hybrid between the same species.

20. *Berberis valdiviana* Phil., *Linnaea* 28: 609. 1856. TYPE: Chile. Dagli pulli, Valdivia, *Philippi s.n.* (holotype, SGO-063359!, = ASU photo!).

Berberis valdiviana var. *gracilifolia* Ahrendt, J. Linn. Soc., Bot. 57: 261. 1961. TYPE: Chile. Valdivia, Malalhue, 650 ft., Sep. 1924 (fl), Jan. 1925 (fr), *Holler-mayer (Werdermann) 682* (holotype, K not seen; isotypes, BM!, G!, M!, MO!, = ASU photo!, NY!).

Shrub to ca. 3 m high, glabrous; young twigs reddish brown, soon becoming gray and eventually longitudinally ridged; spines 3-parted, the arms about equal in length, or the central somewhat longer, 1–3.8 cm long, the laterals perpendicular to the central; bracts ovate to lanceolate, 2 to 6 mm long, gray to brown. Leaves elliptic, oblanceolate or less often ovate, occasionally a few trilobed leaves present (leaf-spine intermediates), the blade 1.8–8 cm long, 1–3.4 cm wide, 1.6–4.6 times as long as wide, stiffly coriaceous, drying gray-green to yellow-brown, usually lustrous above, somewhat lighter and not as lustrous below, the margin flat to

slightly revolute, entire or with up to 8 small, spine-tipped teeth per side, the teeth 1–2(–4) mm long; apex acute to obtuse, spine-tipped; base acuminate to rounded, gradually merging with petiole or the petiole distinct and up to 7 mm long; venation mixed craspedodromous, the midvein impressed above, prominent below, the secondary veins 4–6 pairs, connected by an equally strong marginal vein 2–3 mm within the margin (a weaker exterior marginal vein sometimes present), the tertiary veins faint to distinct. Inflorescence a raceme 3.5–9 cm long, with 10–30 flowers; pedicels 4–6 mm long, subtended by narrowly triangular, keeled bracts 2–3 mm long; flowers 3–5 mm long, yellow; tepals 14, the innermost obovate, 3–4 mm long; stamens 2–3 mm long, without lateral appendages, the anther ca. 1 mm long; pistil 2–3 mm long, the stigma 1.2–1.5 mm wide; style about half the length; ovules 1–4, basal. Fruit subglobose, ca. 6 mm long, terminating in a style ca. 1 mm long; seeds 1–2(–4?), ca. 4 mm long. Figures 8D, 13D.

Distinguishing features. Style long; stamens without tooth-like appendages; spines 3-parted; inflorescence a many-flowered raceme; leaves mostly elliptic, lustrous above and below, the margins usually entire; flowers yellow.

Phenology. Flowering mainly from September to November. Fruiting mainly from November to January.

Distribution and habitat. Endemic to southern central Chile, from Colchagua (Región VI) to La Unión (Región X). An understory shrub or small tree of *Nothofagus* forests. Often regenerating along roads and in pastures, probably from root sprouts.

Common names. Clen (Rodríguez et al., 1995); espina en cruz (pers. obs.)

Selected specimens. CHILE. **Región VI:** Colchagua, Tanumé (34°12'S, 71°57'W), Nov. 1920 (fl), *Aspillaga s.n.* (CONC-46447); Colchagua, Lolol, Cerro Robles, 650 m, 19 Feb. 1946 (st), *Kausel 1898* (SGO-059728). **Región VII:** Parral, cerca Estación Quella del ramal a Cauquenes en lugar Titinivilo, 3 Nov. 1964 (fr), *Aravena 50L* (SGO). **Región VIII:** Atacalco, la subida del Cerro Castillo (36°53'S, 71°38'W), 960 m, Oct. 1944 (fl), *Heck 6319* (OS); road from Florida to Penco ca. 4 km NW of Florida (ca. 36°47'S, 72°37'W), ca. 230 m, 16 Oct. 1993 (yfr), *Landrum 7936* (ASU); Concepción, Agua de la Gloria (36°49'S, 72°52'W), Sep. 1933 (fl), *Pfister s.n.* (CONC-654); camino de Concepción a Cabrero, Fundo El Queule (36°53'S, 72°56'W), 340 m, 8 Oct. 1986 (fl), *Rodríguez 2156* (CONC-125990). **Región IX:** entre los ríos Toltén y Allipén (39°01'S, 72°29'W), 22 Sep. 1935 (st), *Junge s.n.* (CONC-3821); road from Victoria to Curacautín, ca. 30 km E of Victoria, ca. 5 km E of easternmost road to Selva Oscura (ca. 38°20'S, 72°5'W), ca. 800 m, 26 Oct. 1993 (fl), *Landrum 8010* (ASU, SGO); road from Lautaro to Curacautín, ca. 8–9 km E of Lautaro, vicinity of Estero Ñirca (ca. 38°30'S, 71°29'W), ca. 250 m, 28 Oct. 1993

(yfr), *Landrum 8028* (ASU); Temuco, Cerro Ñielol, ca. 175 m, 3 Oct. 1935 (fl), *Montero 2463* (CONC-84042, OS). **Región X:** Valdivia (fl), *Philippi 534* (G); Malalhue, 1925 (fl), *Werdermann 682* (BM, CAS, G, M, NY); La Unión, Fundo San Antonio, río Lollehue (40°16'S, 73°04'W), 60 m, Mar. 1967 (fr), *Zollitsch 150* (CONC-38510, M).

Berberis valdiviana is most likely to be confused with *B. chilensis* (see lead 15 of the key for distinguishing characteristics) and *B. litoralis* (see discussion under that species). When specimens lack spines and the leaves have serrate margins, which is common in stump sprouts, *B. valdiviana* can look very similar to *B. negeriana*. However, in *B. valdiviana* the leaves tend to be smaller, and less lustrous beneath, and there are many more flowers in the inflorescence. To date, I have only found specimens of *B. negeriana* near Concepción, whereas *B. valdiviana* occurs from Colchagua to La Unión.

Berberis valdiviana forms a vigorous and attractive hybrid with *Berberis darwinii* (*Landrum 8009* from near Victoria).

EXCLUDED OR UNCERTAIN TAXA

Berberis bidentata Lechler, *Berberid. Amer. austral.* 11. 1857. TYPE: Chile. Laguna de Maihue, Cordillera de Ranco, *Lechler 3133* (holotype, MA? not seen). A probable hybrid between *B. trigona* and *B. darwinii*. See discussion under *B. trigona*.

Berberis brevifolia Phil. ex Reiche, *Anales Univ. Chile* 88: 96. 1894. TYPE: Chile. Colchagua, Cahuil (holotype, SGO!, = ASU photo!). See discussion under *B. microphylla*.

Berberis buxifolia Lam. var. *gracilis* Albov, *Revista Mus. La Plata* 7: 300. 1896. [Orthographic variant of *gracilior*.]

Berberis copahuensis Job, *Notas Prelim. Mus. La Plata, Bot.* 16: 146. 1953. TYPE: Argentina. Baños de Copahue, *Kurtz s.n.* (holotype, CORD not seen, = ASU photo!). Hybrid between *B. empetrifolia* and *B. montana*; see discussion under *B. montana*.

Berberis knightii (Lindl.) K. Koch, *Dendrologie* 1: 413. 1869. *Mahonia knightii* Hort. ex Lindl., *J. Hort. Soc. London* 5: 20. 1850. TYPE: Unknown. See discussion under *B. darwinii*.

Berberis lologensis Sandwith, *Kew Bull.* 3: 108. 1928. TYPE: Argentina. Neuquén: Lago Lolog, 20 Feb. 1927 (fr), *Comber 1061* (holotype, K!, = ASU photo!). Hybrid between *B. trigona* and *B. darwinii*; see discussion under *B. trigona*.

Berberis morenonis Kuntze, *Rev. Gen. Plant.* 3(2): 3. 1898. TYPE: Argentina. Patagonia, 50°–

[Continued on page 831]

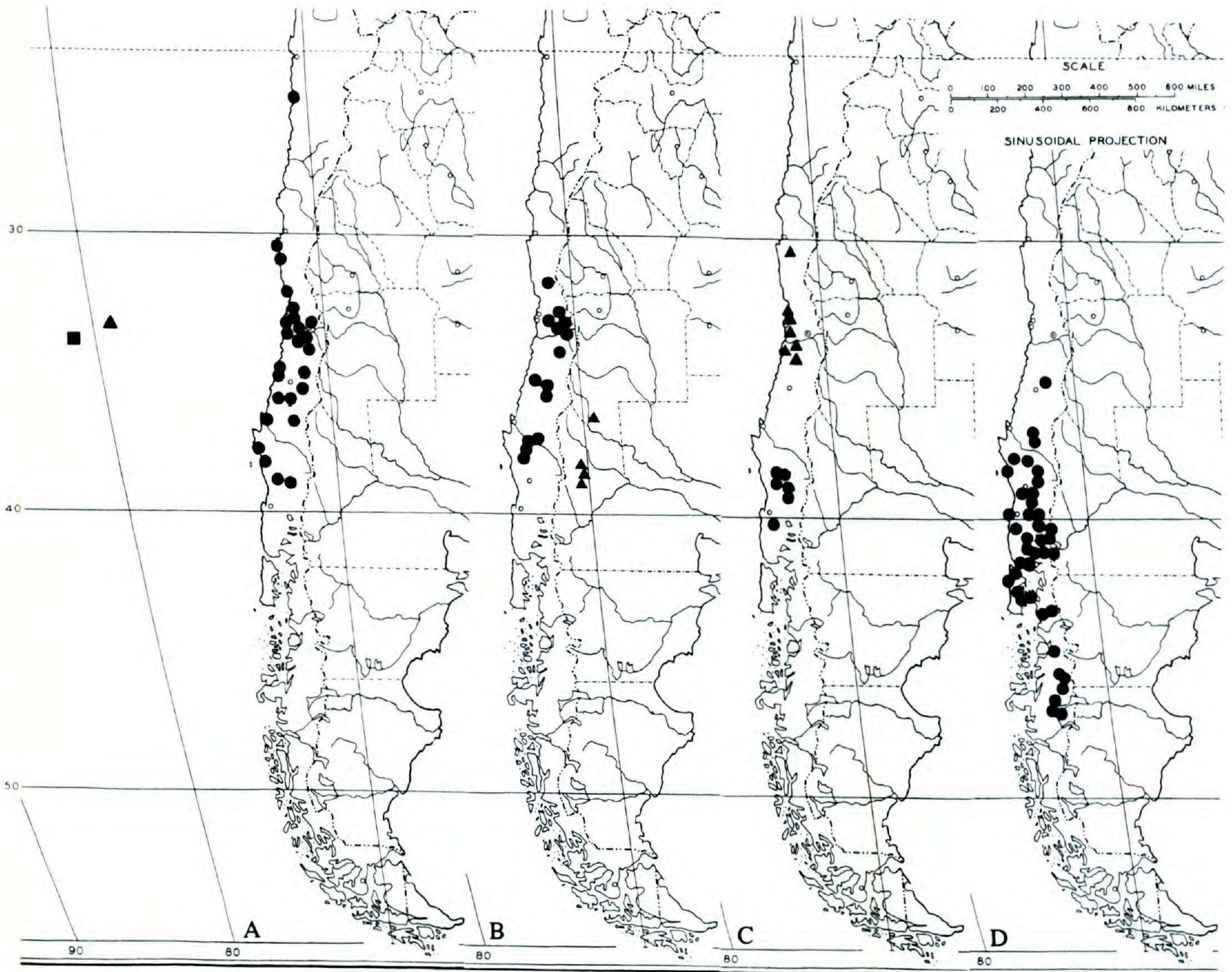


Figure 6. Distribution of selected species of *Berberis*. —A. *B. actinacantha* (dots), *B. corymbosa* (triangle), and *B. masafuerana* (square). —B. *B. chilensis* var. *chilensis* (dots) and *B. comberi* (triangles). —C. *B. chilensis* var. *brachybotria* (triangles) and *B. congestiflora* (dots). —D. *B. darwinii*.

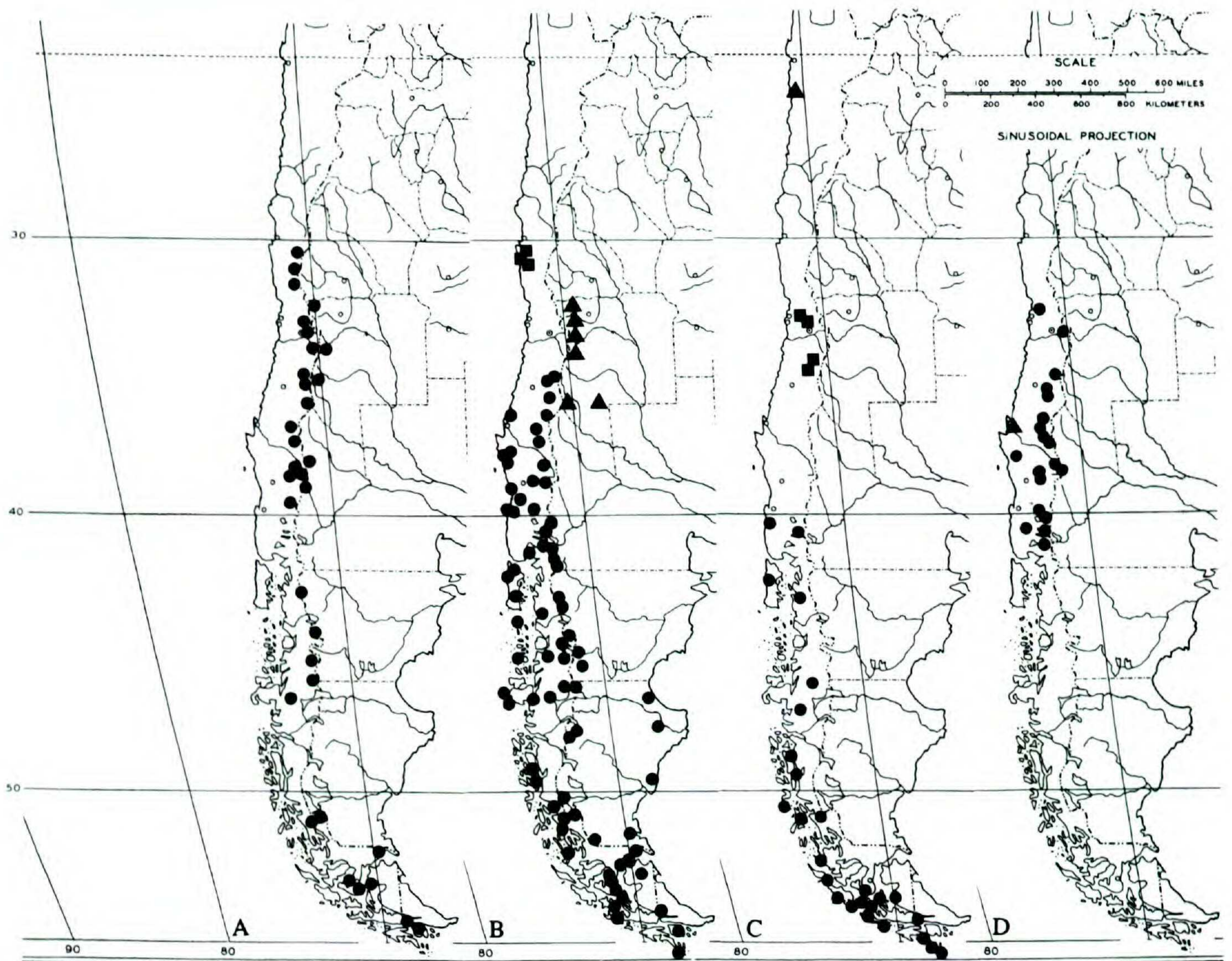


Figure 7. Distribution of selected species of *Berberis*. —A. *B. empetrifolia*.—B. *B. glomerata* (squares), *B. grevilleana* (triangles), and *B. microphylla* (dots). —C. *B. horrida* (squares), *B. ilicifolia* (dots), and *B. litoralis* (triangle). —D. *B. montana* (dots), and *B. negeriana* (triangle).

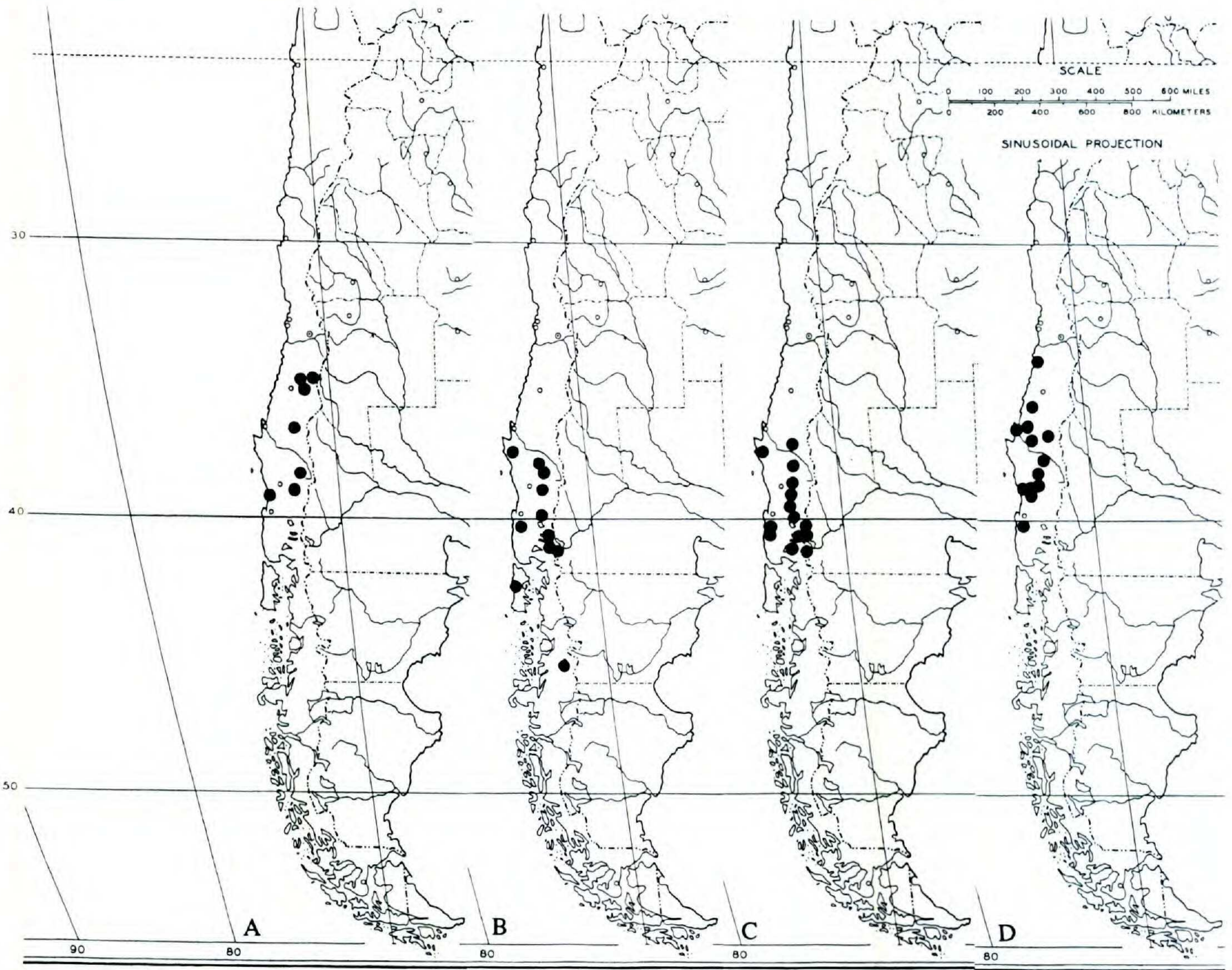


Figure 8. Distribution of selected species of *Berberis*. —A. *B. rotundifolia*. —B. *B. serratodentata*. —C. *B. trigona*. —D. *B. valdiviana*.

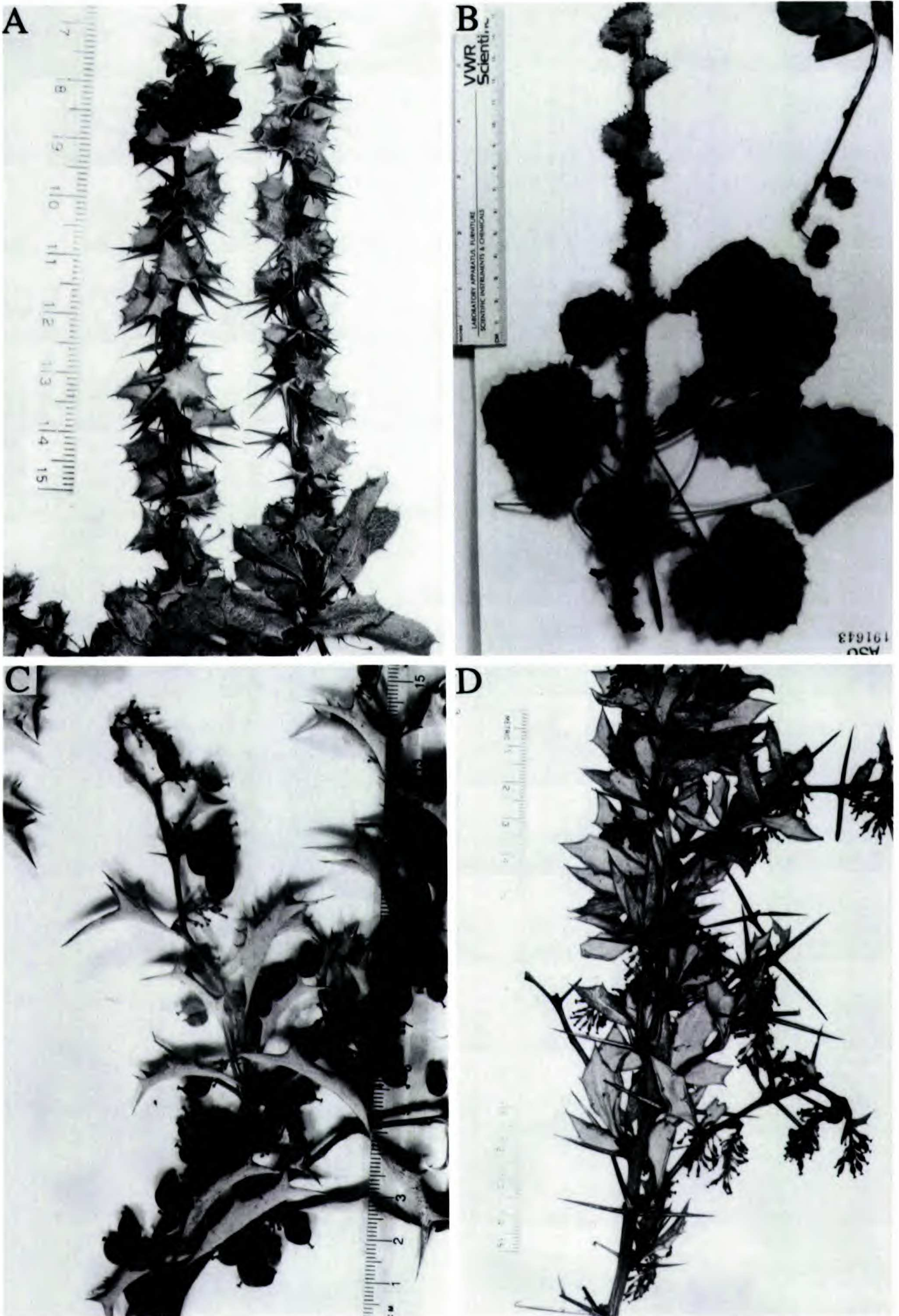


Figure 9. Photos of selected specimens of *Berberis* collected by the author. —A. *B. actinacantha* from northern part of range (7885). —B. *B. actinacantha* from southern part of range (7952). —C. *B. chilensis* var. *chilensis* (8492). —D. *B. chilensis* var. *brachybotria* with immature fruits (7894).

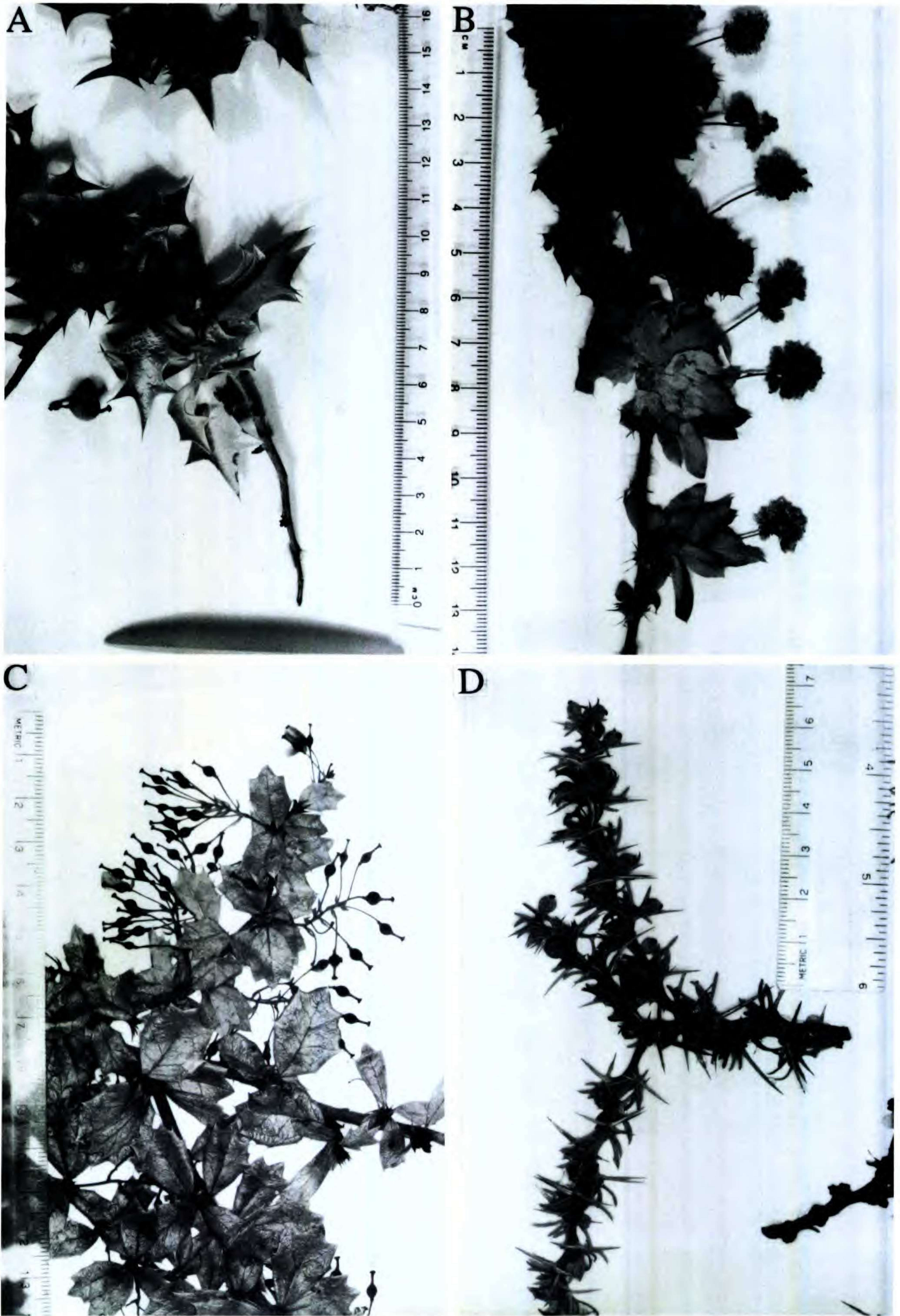


Figure 10. Photos of selected specimens of *Berberis* collected by the author. —A. *B. comberi* (8379). —B. *B. congestiflora* (7988). —C. *B. darwinii* with immature fruits (8148). —D. *B. empetrifolia* (8344).

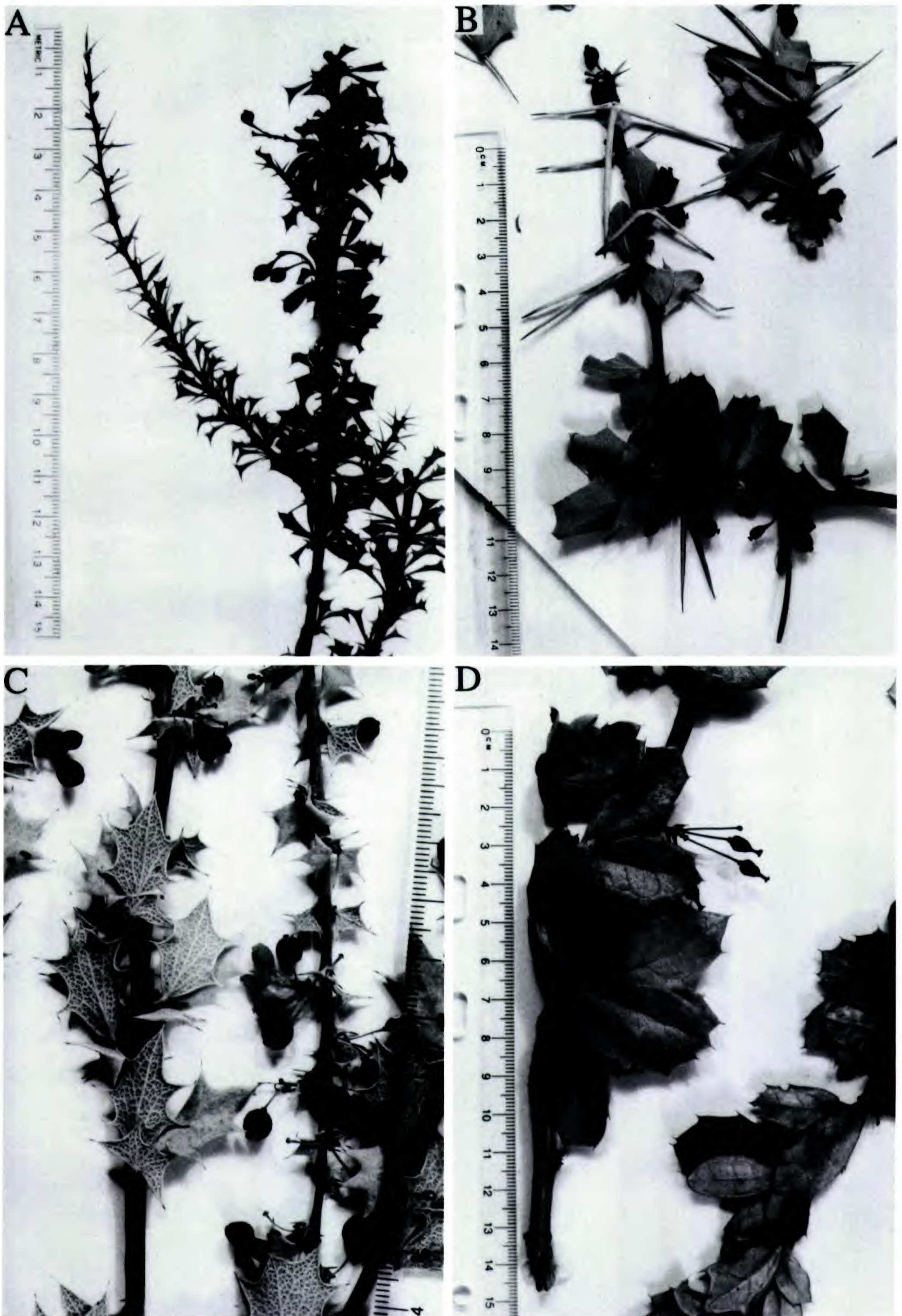


Figure 11. Photos of selected specimens of *Berberis* collected by the author. —A. *B. glomerata* (7525). —B. *B. grevilleana* (8332). —C. *B. horrida* (7903). —D. *B. ilicifolia* with immature fruits (8394).

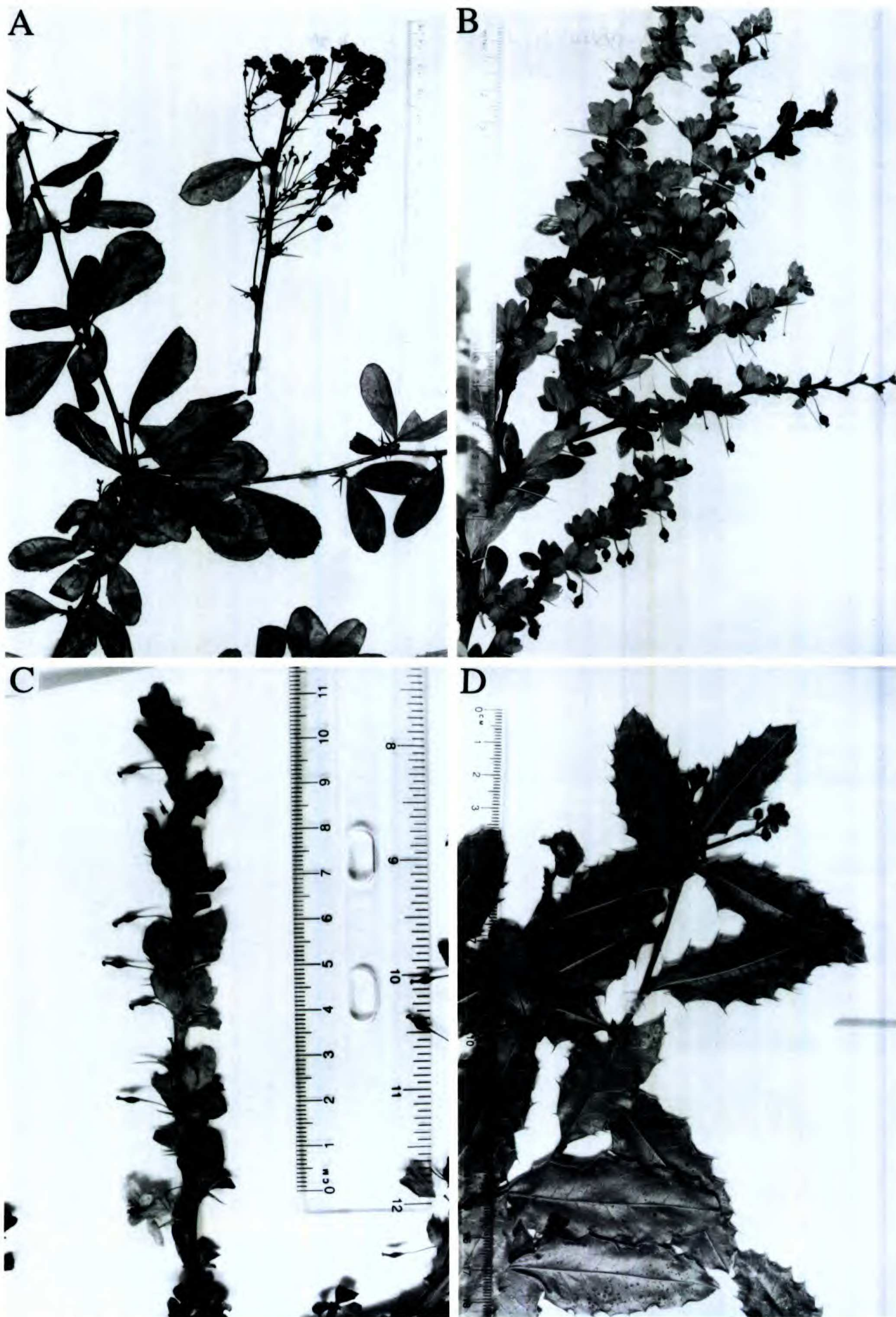


Figure 12. Photos of selected specimens of *Berberis* collected by the author or C. M. Taylor. —A. *B. littoralis* (Landrum 7492). —B. *B. microphylla* (Landrum 7607). —C. *B. montana* with immature fruits (Taylor 10313). —D. *B. negeriana* with buds (Landrum 7436).

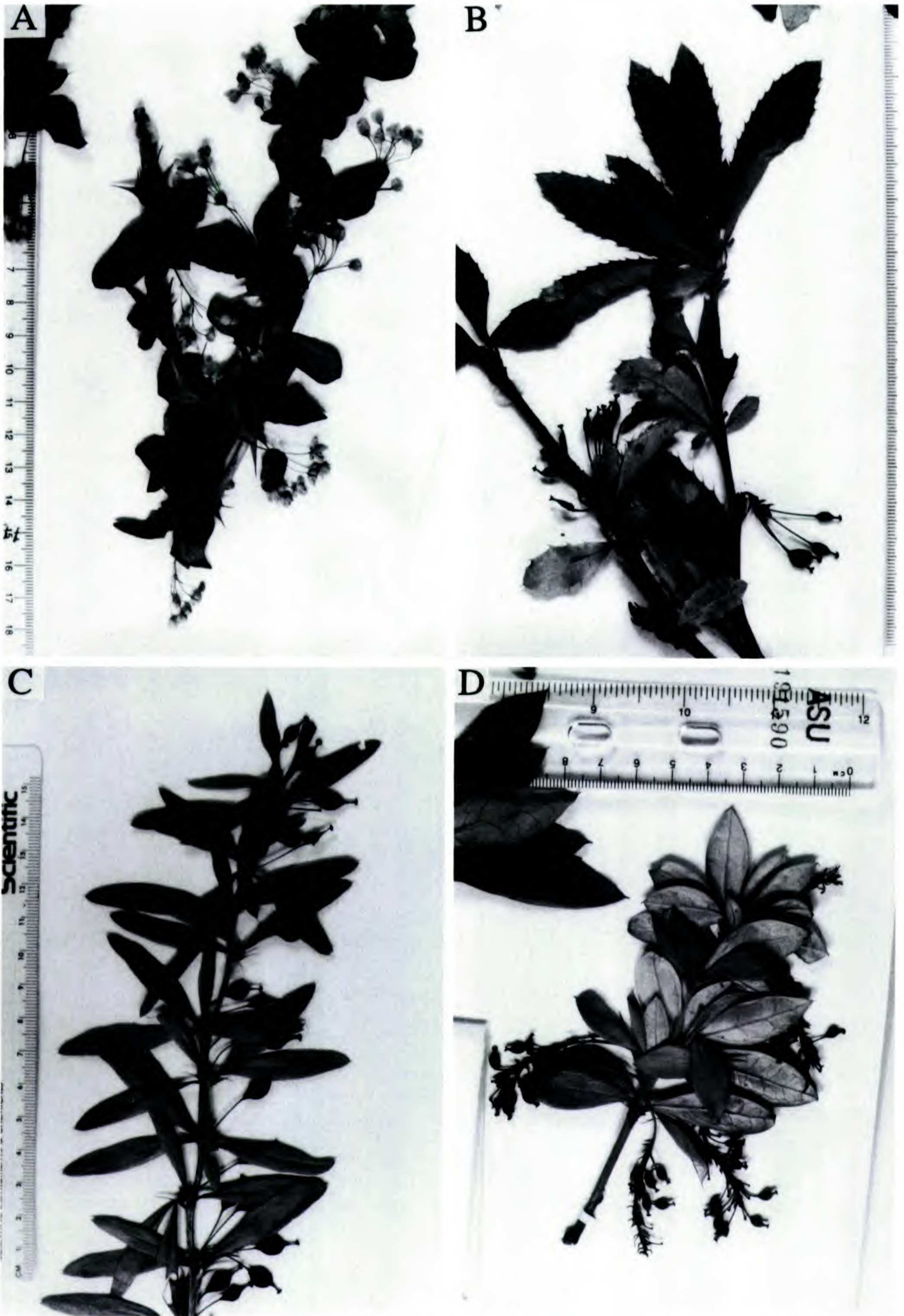


Figure 13. Photos of selected specimens of *Berberis* collected by the author. —A. *B. rotundifolia* (7951). —B. *B. serratodentata* (8111). —C. *B. trigona* (8020). —D. *B. valdiviana* (7931).

53°, *Moreno* 768. Possible type, LP!, = ASU photo! [seedlings only].

Berberis pseudoilicifolia Skottsb., Kongl. Svenska Vetenskapsakad. Handl. 56(5): 226. 1914. TYPE: Chile. Cordillera Pelada, *Philippi s.n.* (syntype, B lost; possible isosyntypes, G!, = ASU photo!, SGO-039418!, SGO-063349!); Volcán Osorno, *Reiche s.n.* (syntype, B lost). Hybrid between *B. ilicifolia* and *B. serratodentata*; see discussion under *B. ilicifolia*.

Berberis setigrifolia Ahrendt, J. Linn. Soc., Bot. 57: 237. 1961. TYPE: Chile [probably in error]. *Pearce s.n.* (holotype, K!, = ASU photo!). [Apparently a species of Peru or Bolivia.]

Literature Cited

- Ahrendt, L. 1961. *Berberis* and *Mahonia*, a taxonomic revision. J. Linn. Soc., Bot. 57: 1–410.
- Berry, E. W. 1938. Tertiary Flora from Río Pichileufú, Argentina. Special Pap. Geol. Soc. Amer. 12: 1–149.
- Britton, N. L. & A. Brown. 1913. An Illustrated Flora of the Northern United States and Canada, ed. 2. 3 vols. C. Scribner's Sons, New York.
- Cabrera, A. 1971. Fitogeografía de la República Argentina. Bol. Soc. Argent. Bot. 14: 1–42.
- Cortella de Castells, A. R. & M. C. Orsi de Herrero Ducoux. 1986. Morfología foliar en poblaciones simpátricas de *Berberis empetrifolia*, *B. copahuensis* (Berberidaceae) y un posible híbrido. Bol. Soc. Argent. Bot. 24(3–4): 305–318.
- Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia Univ. Press, New York.
- Cunningham, W. D., I. W. D. Dalziel, T.-Y. Lee & L. A. Lawver. 1995. Southernmost South America-Antarctic Peninsula relative plate motions since 84 Ma: Implications for the tectonic evolution of the Scotia Arc region. J. Geophys. Res. 100: 8257–8266.
- Digilio, A. P. L. & P. R. Legname. 1966. Los árboles indígenas de la Provincia de Tucumán. Opera Lilloana XV.
- Fajardo, V. 1992. Alcaloides en especies del género *Berberis* de Chile. Pp. 215–240 in O. Muñoz M. (editor), Química de la Flora de Chile. Universidad de Chile, Santiago.
- Fergulio, E. 1949. Descripción geológica de la Patagonia, Tomo II: 274–315. Dirección General de Yacimientos Petrolíferos Fiscales [Argentina], Buenos Aires.
- Galli-Olivier, C. 1967. Piediplain in northern Chile and the Andean uplift. Science 158: 653–655.
- Gay, C. 1845. Berberidaceae. In Flora chilena 1: 73–94.
- Goldblatt, P. 1993. Biological relationships between Africa and South America: An overview. Pp. 3–14 in P. Goldblatt (editor), Biological Relationships Between Africa and South America. Yale Univ. Press, New Haven.
- Hoffmann J., A. 1980. Flora Silvestre de Chile, Zona Central. Fundación Claudio Gay, Santiago.
- Job, M. M. 1942. Los *Berberis* de la región de Nahuel Huapí. Revista Mus. La Plata, Secc. Bot. 5: 21–72.
- Landrum, L. R. 1981. The phylogeny and geography of *Myrceugenia* (Myrtaceae). Brittonia 33: 105–129.
- Lechler, W. 1857. Berberides Americae Australis, Stuttgart.
- Marshall, L. G. & T. Sempere. 1993. Evolution of the Neotropical Cenozoic land mammal fauna in its geochronologic, stratigraphic, and tectonic context. Pp. 329–392 in P. Goldblatt (editor), Biological Relationships between Africa and South America. Yale Univ. Press, New Haven.
- Meacham, C. A. 1980. Phylogeny of the Berberidaceae with an evaluation of classifications. Syst. Bot. 5: 149–172.
- Muñoz P., C. 1966. Sinopsis de la Flora Chilena, 2nd ed. Universidad de Chile, Santiago.
- Muñoz S., M., E. Barrera M. & I. Meza P. 1981. El uso medicinal y alimenticio de plantas nativas y naturalizadas en Chile. Publicación Ocasional 33, Museo Nacional de Historia Natural, Santiago, Chile.
- Navas, L. E. 1976. Flora de la Cuenca de Santiago de Chile, vol. 2. Universidad de Chile, Santiago.
- Orsi, M. C. 1976. Sinopsis de las especies Argentinas del género *Berberis* (Berberidaceae). Bol. Soc. Argent. Bot. 17: 127–149.
- . 1984. Berberidaceae. In M. N. Correa (editor), Flora Patagónica. pt. IVa. Instituto Nacional de Tecnología Agropecuaria, Buenos Aires.
- Patterson, B. & R. Pascual. 1972. The fossil mammal fauna of South America. Pp. 247–309 in A. Keast, F. C. Erk & B. Glass (editors), Evolution, Mammals and Southern Continents. State Univ. New York Press, Albany.
- Pitman, W. C., S. Cande, J. LaBrecque & J. Pindell. 1993. Fragmentation of Gondwana: The separation of Africa from South America. Pp. 15–36 in P. Goldblatt (editor), Biological Relationships between Africa and South America. Yale Univ. Press, New Haven.
- Porter, D. M. 1986. Charles Darwin's vascular plant specimens from the voyage of the HMS Beagle. J. Linn. Soc., Bot. 93: 1–172.
- Raven, P. H. & D. I. Axelrod. 1974. Angiosperm biogeography and past continental movements. Ann. Missouri Bot. Gard. 61: 539–673.
- Rodríguez, G., R. Rodríguez & H. L. Barrales. 1995. Plantas Ornamentales Chilenas, Chilean Ornamental Plants. Universidad de Concepción, Concepción.
- Ruiz Leal, A. 1965. Notas Fanerogámicas Mendocinas. II. Revista Fac. Ci. Agrar. Univ. Nac. Cuyo 12(2): 181–200.
- Sandwith, N. Y. 1927. New species from the Andes of Argentina. Kew Bull. 1927: 174–177.
- Schneider, C. K. 1905. Die Gattung *Berberis* (*Euberberis*). Vorarbeiten für eine Monographie. Bull. Herb. Boissier, Ser. 2, 5 (1): 33–48; (2): 133–148; (4): 391–403; (5): 449–464; (7): 655–670; (8): 800–812; (9): 813–831.
- . 1908. Weitere Beiträge zur Kenntnis der Gattung *Berberis* (*Euberberis*). Bull. Herb. Boissier, Ser. 2, 8: 192–204, 258–266.
- Sempere, T., G. Hérail, J. Oller & M. G. Bonhomme. 1990. Late Oligocene-early Miocene major tectonic crisis and related basins in Bolivia. Geology 18: 946–949.
- Shackleton, N. J. & J. K. Kennett. 1975. Paleotemperature history of the Cenozoic and the initiation of Antarctic glaciation: Oxygen and carbon isotope analyses in DSDP sites 277, 279, and 281. Pp. 743–756 in P. R. Supko & Perch-Nielson et al. (editors), Initial Reports of the Deep Sea Drilling Project 29. U.S. Printing Office, Washington, D.C.
- Skottsberg, C. 1914. Die Vegetationsverhältnisse längs der Cordillera de los Andes s. von 41° S. Br. Ein Beitrag zur Kenntnis der Vegetation in Chiloé, Westpatagonien

dem andien Patagonien und Feuerland. Kongl. Svenska Vetensk. Acad. Handl. 56(5): 1–366.

Stuessy, T. F. & C. Taylor. 1995. Evolución de la Flora Chilena. Pp. 85–118 in C. Marticorena & R. Rodríguez (editors), Flora de Chile, vol. 1. Universidad de Concepción, Concepción, Chile.

Tanai, T. 1986. Phytogeographic and phylogenetic history of the genus *Nothofagus* Bl. (Fagaceae) in the Southern Hemisphere. J. Fac. Sci., Hokkaido Univ., Ser. IV, 21(4): 505–582.

LIST OF RECOGNIZED TAXA

1. *B. actinacantha* Mart.
2. *B. chilensis* Gillies ex Hook.
 - 2a. *B. chilensis* var. *chilensis*
 - 2b. *B. chilensis* var. *brachybotria* (Gay) Landrum
3. *B. comberi* Sprague & Sandwith
4. *B. congestiflora* Gay
5. *B. corymbosa* Hook. & Arn.
6. *B. darwinii* Hook.
7. *B. empetrifolia* Lam.
8. *B. glomerata* Hook. & Arn.
9. *B. grevilleana* Gillies ex Hook. & Arn.
10. *B. horrida* Gay
11. *B. ilicifolia* L. f.
12. *B. litoralis* Phil.
13. *B. masafuerana* Skottsb.
14. *B. microphylla* G. Forst.
15. *B. montana* Gay
16. *B. negeriana* Tischler
17. *B. rotundifolia* Poepp. & Endl.
18. *B. serratodentata* Lechler
19. *B. trigona* Kunze ex Poepp. & Endl.
20. *B. valdiviana* Phil.

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- al. 83 (14), 86 (15), 132 (15), 2041 (15). Roig, F. A. 193 (9), 614 (9), 1433 (14), 1950 (14), 1960 (6), 2495 (6), 2665 (9), 3063 (6), 4208 (7), 5283 (7), 7125 (9), 8793 (14), 9331 (11), 12954 (14), 12955 (6), 13342 (14), 14300 (14), 15897 (9). Roig, F. A. & Ruiz Leal, A. 1968 (19). Roig, F. A. & Mendez, E. 8797 (6). Roig, F. A. et al. 4423 (3), 11895 (11), 12967 (14), 14378 (14), 14379 (14), 14399 (14), 14458 (14), 14595 (14), 14597 (14), 14665 (14), 14716 (3), 44151 (11). Roig Junent 12903 (14). Rudolph 26 (4). Ruiz Leal, A. 5 (7), 1314 (7), 1743 (9), 1845 (7), 1858 (7), 1942 (7), 1960 (7), 2219 (9), 2328 (9), 3114 (9 × 7), 3637 (7), 4091 (9), 4781 (9), 5328 (9), 6175 (7), 6176 (9), 6225 (9), 6288 (9), 6510 (7), 7122 (9), 7426 (9), 7795 (9), 7819 (9), 12838 (11), 14716 (14), 16807 (7), 18173 (14), 21446 (3), 21919 (3), 24519 (9), 24542 (7), 24552 (7), 25575 (14), 25667 (14), 25683 (14), 25798 (7), 25918 (9), 26757 (15), 26970 (14), 27076 (7). Ruiz Leal, A. & Roig, F. 1436 (11), 14995 (11). Ruiz Leal, A. & Carretero 12815 (14), 12955 (7). Ruiz Leal & F. A. Roig, A. 15081 (14), 15587 (7), 15616 (7), 18510 (9), 18777 (9), 22399 (3), 22482 (7). Ruiz, E. et al. 8299 (13), 8306 (13).
- San Martin, J. 1362 (1). Sandeman, C. 366 (4), 371 (7), 373 (14), C. 388 (19). Santesson, R. 1051 (6). Schlegel, F. 216 (1), 720 (1), 805 (1), 922 (7), 938 (15), 1133 (1), 1135 (2a), 1572 (6), 1700 (2a), 2023 (14), 2203 (6), 2489 (7), 2516 (7), 2947 (1), 3535 (7), 3570 (15), 3683 (14), 3796 (1), 4432 (2a), 4527 (19), 5865 (15), 6152 (7), 6939 (15), 6940 (18 × 11). Schlegel, H. 36 (2a). Schmid, R. 1980–25 (6). Schwabe, H. 60 (6), 102 (6). Seibold-Wawra (see also Wawra), 2977 (7), 3038 (15), 3039 (7). Seki, T. 57 (6), 330 (14), 577 (7), 608 (14). Simon, J. P. 250 (8), 352 (14). Skottsberg, C. 293 (11), 310 (6), 813 (1), 1011 (2a). Sleumer, H. 463 (7), 506 (9). Smith & Sparre 140 (19). Sobel, G. & Strudwick, J. 2549 (14), 2551 (11). Soloman, J. & A. 4237 (7), 4252 (7). Sparre, B. 2667 (8), 3237 (1), 3271 (4), 10619 (7). Sparre, B. & Constance, L. 10770 (14), 10828 (14), 10857 (14), 10860 (20), 10869 (14). Sparre, B. & Smith 20 (7), 126 (6), 138 (18), 140 (19), 142 (15), 214 (7), 215 (14), 234 (15), 235 (19), 246 (6), 321 (14), 340 (15), 348 (15), 10944 (1). Stuessy, T. 6883 (7), 7547 (7). Stuessy, T. & Baeza, M. 11045 (7). Stuessy et al., T. 6752 (14), 6758 (18), 6773 (14), 6774 (6), 6792 (14), 6828 (14), 6891 (7), 7160 (11), 7217 (6), 7429 (6), 7484 (14), 7507 (14).
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- Wagenknecht, R. 77 (1), 589 (19). Wallace, B. J. 76 (7). Wawra 3127 (11), 3148 (11). Weldt, E. 179 (14), 184 (7), 206 (1), 242 (7), 283 (6), 858 (15), 880 (6), 902 (19). Weldt, E. & Rodríguez 978 (14). Werdermann, E. 52 (6), 60 (14), 682 (20), 1075 (19), 1216 (6), 1272 (7), 1275 (19), 1277 (15), 1301 (7), 1316 (14). West, J. 3997 (1), 4681 (6), 4905 (7). Worth, C. & Morrison, J. 16553 (7).
- Zeki, T. 634 (6). Zollitsch, L. 88 (6), 150 (20), 156 (4), 173 (14), 225 (6), 277 (15). Zollner, O. 1650 (15), 5095 (14), 5244 (2b), 6347 (14), 6626 (15), 6726 (1), 6812 (1), 7323 (2a), 7680 (17), 7700 (19), 8093 (1), 8159 (6), 8183 (14), 8323 (2a), 8351 (1), 8601 (7), 8914 (15), 8977 (6), 9541 (1), 9637 (19), 9678 (15), 10404 (2b), 11299 (2a), 11414 (15), 11499 (6), 11601 (7), 12383 (17), 12869 (6), 12919 (1), 12932 (6), 12942 (15), 15554 (17), 15673 (1).