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THE SYSTEMATICS OF THE AMERICAN SPECIES OF ALNUS (BETULACEAE)[1]

JOHN J. FURLOW

TAXONOMIC TREATMENT — CONTINUED

5. **Alnus jorullensis** Humboldt, Bonpland, & Kunth

Alnus jorullensis Humboldt, Bonpland, & Kunth, Nov. Gen. Sp. Pl. **2:** 20. 1817.

Spreading trees up to 20 m in height; trunk usually single, up to 1.8 m in diameter, the branches sometimes massive; bark gray to dark brown, smooth to corky, often broken by deep transverse constrictions which encircle the stem, the lenticels inconspicuous on smooth branches; young stems light to medium brown or dark red-brown, dull to slightly lustrous, not glaucous to heavily glaucous, without conspicuous resin-coating, not differentiated into long and short shoots, usually without conspicuous longitudinal ridges originating at the nodes; internodes glabrous, sparsely pubescent, or velutinous, moderately to densely glandular; nodes and branchlets bearing inflorescences very densely glandular; hairs yellowish to brown; glands medium to large, yellow to brown. Lenticels of twigs circular to elliptic, 0.5–1.5 mm long, 0.3–0.7 mm wide, whitish to yellowish or brownish, moderately prominent; leaf scars 1–2 mm high, 1.5–2.7 mm wide, with inconspicuous bundle scars. Buds ellipsoid, slightly rounded to rounded at the apex, moderately to heavily resin-coated; stalk 1–3 mm long, 1–2 mm in diameter, sparsely pubescent to moderately villous, densely glandular; body 2–7 mm long, 1.5–3 mm in diameter; scales 2, stipular, equal, valvate, glabrous to moderately pubescent, glandular; pubescence

[1]This continues and completes the article started in the January issue, Volume 81 (825), pp. 1–121.

and glands obscured by the resin coating. Leaves narrowly elliptic, elliptic, elliptic-oblong, oblong, or obovate (rarely ovate); apex acute, obtuse, or rounded; base attenuate, acute, or narrowly cuneate; blade (4–) 5–16 (–20) cm long, (2–) 3–7 (–9) cm wide, dark to very dark green and dull to very lustrous above, light to medium green, brown, or yellow-brown and dull below; coriaceous; margin flat to moderately revolute, unthickened, double-serrate or sinuate to shallow-lobed and serrate or serrulate, up to 50% entire from the base; major teeth or lobes (7–) 9–17 (–22) mm apart at mid-leaf, up to 3 mm deep, irregular; secondary teeth (1–) 3–5 (–8) per cm, 0.1–1.2 mm deep, irregular; adaxial surface glabrous to sparsely pubescent, moderately to densely glandular; abaxial surface and veinlets glabrous to sparsely pubescent or moderately villous, moderately to very densely glandular, slightly to moderately resin-coated; major veins and vein axils near the base glabrous to tomentose; pubescence yellowish to brownish; glands small to large, bright or pale yellow to brown. Lateral veins 7–17, (4–) 5–8 (–14) mm apart at mid-leaf, slightly to strongly ascending, sometimes branching once again, especially near the base, terminating in major teeth at the margin; cross veins between lateral veins poorly to well developed. Petioles (2–) 6–12 (–23) mm long, 1–1.5 (–3) mm in diameter, glabrous to sparsely pubescent, moderately to densely glandular. Stipules ovate to elliptic, the apex acute, ca. 5 mm long, ca. 1.5 mm wide, green to light brown, moderately villous to velutinous, the hairs yellowish, moderately glandular, the glands yellowish. Pistillate inflorescences borne in racemose groups of 3–5 on short non-divergent to strongly diverging branchlets, these generally subtended by leaves, produced during the previous growing season, erect, ovate to elliptic, at anthesis 2–3 (–4) mm long, ca. 2 mm in diameter, on peduncles 0.2–4 mm long, 1–1.5 mm in diameter; staminate catkins borne in one or more racemose clusters of (2–) 3–5 at the end of the main branch above the pistillate inflorescences, the lowermost usually subtended by small leaves, produced during the previous growing season, pendent before and during anthesis, at anthesis (3–) 3.5–11 cm long, 3–9 mm in diameter, on peduncles 1–7 mm long, 0.8–1.5 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers 3 per bract; perianth of 4 parts, these ovate, elliptic, or obovate, the apex acute to rounded, 1.3–1.5 mm long, 0.4–1.1 mm wide, the margin lined with minute to moderately large glands;

stamens 4, opposite and free of or basally adnate to the perianth parts, appearing equal to or longer than the perianth, the filaments 1.2–1.4 mm long, the anthers 1.1–1.6 mm long and 1.1–2 mm in diameter, the thecae separate for 35–65% of their length. Infructescences ovoid to ellipsoid, (11–) 13–25 (–29) mm long, (8–) 9–15 mm in diameter, on peduncles 0.2–5 mm long, 1.5–2 mm in diameter; scales 3.5–5 mm long, 3.5–5.5 mm wide at the apex, 1–1.8 mm wide at the base, the apex moderately to greatly thickened and flat, the terminal lobe-tip truncate and not extended to somewhat extended. Fruits narrowly winged or merely wing-margined, dark brown; bodies elliptic to obovate, 1.7–3.5 mm long, 1.2–3 mm in diameter; wings 1.5–3.5 mm long, 0.2–1 mm wide, firm; persistent styles 0.7–1.2 mm long.

Alnus jorullensis is more morphologically specialized than is *A. acuminata* and occurs in somewhat less mesic habitats. The leaves are often laterally expanded at the apex and narrowed near the base, the veins rising more abruptly near the tip than in most other species. The teeth at the apex are usually larger than those at mid-leaf, and the lower margin may appear entire for a considerable distance above the base. The tree is scrubby in appearance, although it becomes quite large and bears massive spreading limbs.

This species is closely related to *Alnus acuminata,* from which it was most likely derived. It shares with it such unique characteristics as the deep transverse constrictions in its bark and well-developed abaxial leaf glands. It is more specialized, however, in leaf shape, density of the glands, and habitat, and it is quite distinct as a species.

The name *"Alnus jorullensis"* is frequently misapplied to various Latin American alders. In recent years the concept of this species has become somewhat less confused, but it is still difficult to distinguish *A. jorullensis* from the other taxa using current keys. Standley (1920), in his key to the species of Mexico, separates *A. jorullensis* from all the other species in the first couplet, stating that its leaves are "densely covered beneath with yellow wax glands" while the other species have "leaves without glands beneath or the glands remote and inconspicuous." As explained above, this second lead really fits none of the Latin American taxa, even though the former may be applied to ssp. *lutea* of *A. jorullensis.*

In comparison with the usually ovate form of *A. acuminata,* the type of *Alnus jorullensis* (Figure 41) demonstrates the distinctively

Figure 41. Holotype of *Alnus jorullensis* Humboldt, Bonpland, & Kunth (photograph courtesy of John H. Beaman).

elliptic to obovate leaves of the species. Other characters of diagnostic value include the ascending lateral veins of the leaves, the scrubby habit of the trees, and (in ssp. *lutea*) the heavy accumulation of large, bright-yellow glands on the abaxial leaf surfaces.

In the current literature, *Alnus jorullensis* is usually seen as the densely glandular-leafed alder discussed above. Humboldt and Bonpland's specimen does not represent this glandular form, however, instead corresponding closely to Fernald's *A. firmifolia,* which is described by its author as "resembling large-leaved *A. jorullensis* HBK., but quite lacking the close covering of waxy or granular atoms which characterize the lower leaf-surface of that species." The types of both *A. jorullensis* and *A. firmifolia* have glands on the lower leaf surface, but these are relatively small, dark, and widely spaced.

Two forms of *Alnus jorullensis* do, in fact, exist. One of these has leaves bearing densely-arranged yellow glands on the lower surface, while the other has foliage as that described above. Individuals of the sparsely glandular form bear more irregularly and obovately shaped leaves which are usually more coarsely toothed, especially near the apex. The glandular form (ssp. *lutea*) occurs in relatively warmer habitats than any of the other Mexican taxa of *Alnus,* in the pine-oak zone, at elevations generally below 2,500 meters (described by Goldman, 1951, as the "arid lower tropical subzone"). The sparsely glandular form (ssp. *jorullensis*) is found at higher elevations in similar (though necessarily somewhat cooler and moister) habitats. Where the two occur together (usually at intermediate elevations), they interbreed freely, producing a wide variety of intermediate individuals. Both types occur throughout central and southern Mexico, but only ssp. *jorullensis* reaches south as far as Guatemala.

5.a **Alnus jorullensis** Humboldt, Bonpland, & Kunth ssp. **jorullensis**

Alnus jorullensis Humboldt, Bonpland, & Kunth, Nov. Gen. Sp. Pl. **2:** 20. 1817; *Alnus acuminata δ jorullensis* (Humboldt, Bonpland, & Kunth) Regel, Mem. Soc. Nat. Mosc. **13**(2): 149. 1861; *Alnus jorullensis α typica* Regel, Bull. Soc. Nat. Mosc. **38**(3): 425. 1865. TYPE: *Humboldt & Bonpland s.n.*, "crescit in aridis, arenosis montis ignivomi Mexicani, Volcan de Jorullo, altit. 630 hex." (HOLOTYPE, P; photograph of type, MSC!). Figure 41.

Alnus firmifolia Fernald, Proc. Amer. Acad. **43:** 61. 1907. TYPE: *Pringle 10040,* "Federal District, mountains about Cima Station, alt. 9800 ft., 30, August, 1905" (HOLOTYPE, GH!; ISOTYPES, DAO!, F!, MICH!, MSC!, NY!, PH!, UC!, US!, WIS!). Figure 42.

Figure 42. Holotype of *Alnus firmifolia* Fernald (= *Alnus jorullensis* Humboldt, Bonpland, & Kunth ssp. *jorullensis*).

Spreading trees up to 20 m in height; trunk up to 1.8 m in diameter; bark brown, smooth to corky; young stems light to dark red-brown, rarely glaucous; internodes mostly glabrous (occasionally sparsely pubescent), moderately glandular; nodes and stems bearing inflorescences densely glandular; glands small, brown to dark brown. Lenticels of twigs circular to elongate, 0.5–1 mm long, yellowish to brownish, somewhat prominent; leaf scars 1–1.8 mm high, 1.7–3.5 mm wide. Buds ellipsoid; stalk 1–2 mm long, 0.7–2 mm in diameter, more or less glabrous; body 3–4 mm long, 1.5–3 mm in diameter; scales glabrous. Leaves elliptic, elliptic-oblong, or obovate (rarely ovate), the apex usually obtuse or rounded (but occasionally acute), the base acute to broadly cuneate; blade (3.5–) 4.5–11 (–13) cm long, (2.5–) 3.5–5.5 (–7) cm wide, medium to dark green or brown below; margin flat, double-serrate, serrate, or serrulate, up to 25% entire from the base; major teeth (7–) 10–17 mm apart, up to 3 mm deep, very irregular; secondary teeth (3–) 5–8 per cm, 0.2–1.1 mm deep, slightly uneven to irregular; adaxial surface and veinlets moderately to rather densely glandular; leaf pubescence yellowish to brownish; leaf glands small to medium in size, yellowish, brownish, or dark brown. Lateral veins 7–10 (–15), (4–) 6–10 (–11) mm apart at mid-leaf, slightly to moderately ascending, sometimes branching once again near the base; cross veins between lateral veins usually well-developed. Petioles (4–) 10–15 (–18) mm long, 1–1.5 (–2) mm in diameter, glabrous or sparsely pubescent, moderately to densely glandular. Pistillate inflorescences borne on branchlets diverging strongly from the main axis, at anthesis ca. 4 mm long, ca. 2.5 mm in diameter, on peduncles 0.2–1.5 mm long, ca. 1 mm in diameter; staminate catkins borne in clusters of 2–4, at anthesis (3–) 5–6.5 cm long, 7–8 mm in diameter, on peduncles 3–5 mm long, 1–1.5 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers with 4 perianth parts, these elliptic to obovate, acute at the apex, 1.2–1.5 mm long, 0.4–0.8 mm wide, the margin lined with small to moderately large glands; stamens basally adnate to the perianth parts, appearing equal to or longer than the perianth, the filaments 0.6–0.9 mm long, the anthers 1.2–1.6 mm long, 1.3–1.7 mm in diameter, the thecae separate for 40–65% of their length. Infructescences 11–28 mm long, 8–13 mm in diameter, on peduncles 0.2–5 mm long, 1.5–2 mm in diameter; scales 3.5–5 mm long, 3.5–5 mm wide at the apex, 1–1.7 mm wide at the base, the apex moderately thickened and flat, the terminal lobe-tip truncate to

rounded and not extended to somewhat extended. Fruits narrowly wing-margined, dark brown; body 1.7–2.2 mm long, 1.2–1.7 mm in diameter; wings 1.5–2.5 mm long, 0.2–0.7 mm wide, firm; persistent styles 0.7–1 mm long. Figures 3B, 4C, 14B, 17B, 19F, and 42.

DISTRIBUTION AND HABITAT: Central Durango south and east to Jalisco, northern Michoacán, Mexico, and central Veracruz; central Oaxaca; southeastern Guatemala. Along rocky streams, intermittent streams, and slopes near streams or arroyos from elevations of 2,800 to 3,800 meters (occasionally as low as 2,200 meters). Usually associated with *Pinus, Quercus,* or *Abies* in open woodland associations. Figure 43.

COMMON NAMES: Aile, aliso.

REPRESENTATIVE SPECIMENS: **Guatemala.** Sierra de los Cuchumatanes, about 28 mi from Huehuetenango, *Hawkes et al. 1746* (F); cumbre de la Sierra de los Cuchumatanes, *Standley 81150* (F); vicinity of Tojquia, *Steyermark 50128* (F); summit of Sierra de los Cuchumatanes, *Steyermark 50148* (F). **Mexico.** CHIAPAS. Paraje of Matsab, Mun. of Tenejapa, *Ton 1961* (NY). DISTRITO FEDERAL. Mountains about Cima Station, *Pringle 10040* (DAO, F, MICH, MSC, NY, UC, US, WIS); parte occidental del Pedregal de San Angel cerca del Rio Eslava, *Rzedowski 2239* (ENCB). DURANGO. North slopes of Cerro Huehueto (Huehuento) S of Huachicheles, about 75 mi W of Cd. Durango, *Maysilles 7994* (MICH, NY). GUERRERO. Teotepec, Distr. Mina, *Hinton 14794* (MICH, NY). HIDALGO. Cerca de Tezuantla, *Espinosa 402* (ENCB); 2 km al E de El Guajolote, *Rzedowski 27417* (ENCB). JALISCO. Northeastern slopes of the Nevado de Colima, *McVaugh 12845* (MICH); La Joya, en la ladera E del Nevado de Colima, *Rzedowski 19361* (ENCB, MEXU). MÉXICO. Paraje Provincial, Mount Popocatépetl, *Balls B4168* (UC); 19 km E of Amecameca along the road to Popocatépetl, *Furlow 320* (MSC); Cerro Papayo, Río Frío, *Matuda 28227* (MEXU); on Nevado de Toluca, *Rose & Painter 7884* (US); Netzcualango, vertiente NW del Ixtaccíhuatl, *Rzedowski 21616* (ENCB, MSC). MICHOACÁN. Cerro Burro, 11.2 km S. of Opopeo, *Furlow 326* (MSC); ca. 18 mi S of Pátzcuaro, *King & Soderstrom 5218* (MEXU, MICH, NY, UC). MORELOS. Yautepec, *Gomez Murga 87* (ENCB); between Huitzilac and Tres Cumbres, *Hatheway 1184* (MO); Tres Marias Mts., *Pringle 15039* (F, DAO, MO, MSC, UC); Lagunas de Zempoala, *Straw & Gregory 1060* (MEXU, MICH). OAXACA. Mountains N of Ixlán de Juárez, lumber road along ridges of sierra, departing highway 13.5 mi N of Ixtlán, *Anderson & Anderson 5413* (ENCB, MICH); vicinity of Cerro Zempoaltepetl, *Hallberg 894* (MICH); vicinity of Cerro Zempoaltepetl, *Hallberg 909* (MICH); Sierra de San Felipe, *Pringle 10248* (DAO, ENCB, MICH, MSC, UC). PUEBLA. La Cumbre, Zacapoaxtla, *Vela G. 1087* (ENCB). VERACRUZ. P. Orizaba, *Miranda 319* (MEXU); 9 mi E of Perote, *Spetzman 1412* (MEXU).

The original specimen of *Alnus jorullensis* was reported by Humboldt, Bonpland, and Kunth (1817) to have been collected on Volcán de Jorullo, Michoacán. This locality does not seem a likely

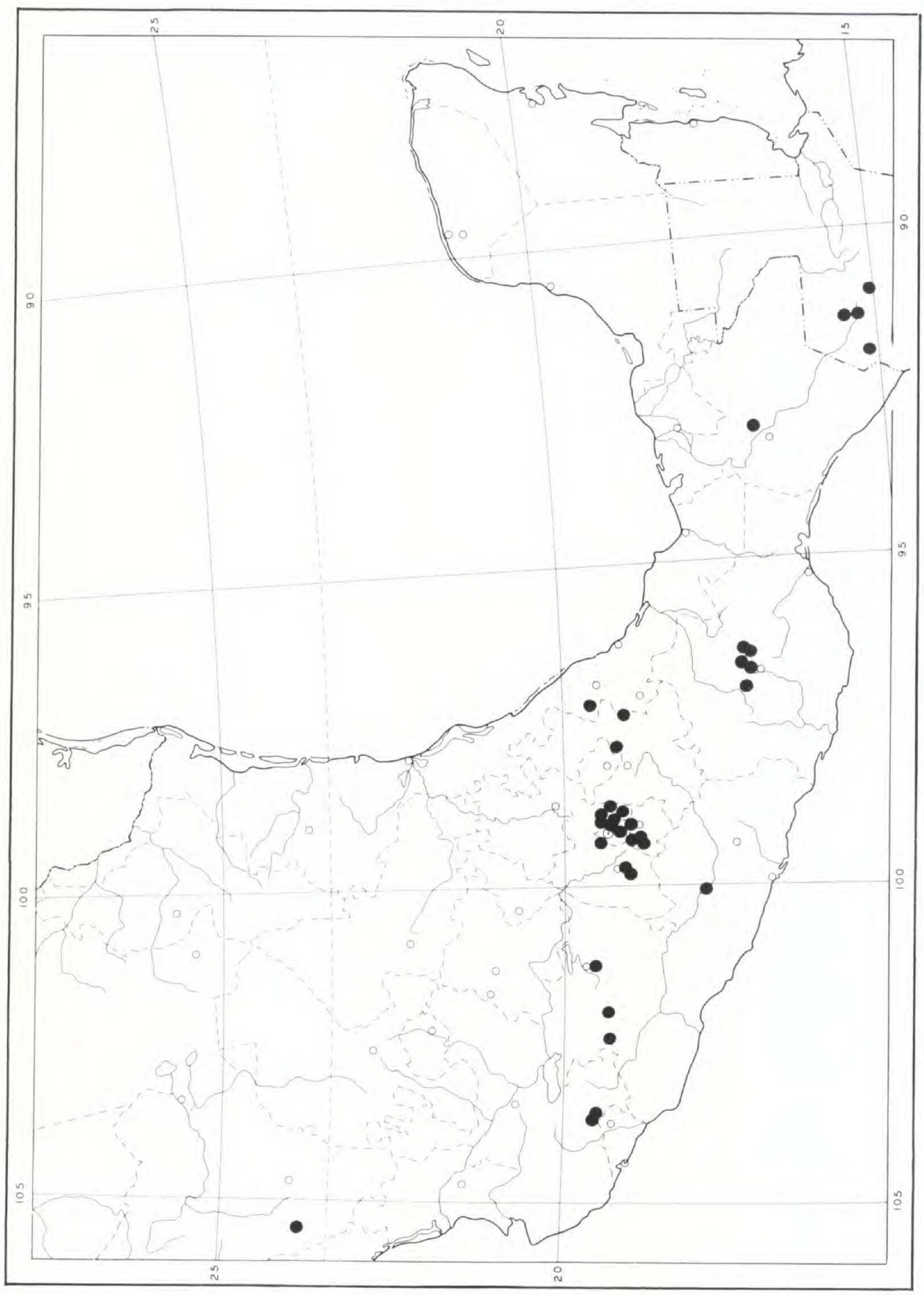

Figure 43. Distribution of *Alnus jorullensis* Humboldt, Bonpland, & Kunth ssp. *jorullensis*.

habitat for *Alnus,* however, having a maximum elevation of only 630 meters, a semi-arid climate, and vegetation including such plants as acacias and palms. On a trip to the site in 1971, I was unable to locate any alders, though I collected *A. jorullensis* (ssp. *lutea*) at nearby Pátzcuaro, in a forest of *Pinus* at an elevation of about 2,000 meters. Subspecies *jorullensis* is a frequent tree at several of the other sites visited by Humboldt and Bonpland in central Mexico (e.g., Nevado de Toluca), and it seems likely that the type actually came from one of those places.

Alnus jorullensis ssp. *jorullensis* is easily distinguished from the other Latin American taxa of *Alnus* by its large mature size and scrubby habit, and by its leathery obovate to elliptical leaves bearing small pale-yellowish to brown (often inconspicuous) glands on the lower surface. The leaves, when dry, are usually very dark green above and rather dark brown or dark greenish brown below. This taxon occurs as far south as Guatemala, though material was seen from only a single region of that country. It is the common alder of high elevations in its range, occurring at altitudes greater than those of any of the other taxa.

5b. **Alnus jorullensis** ssp. **lutea** Furlow

Alnus jorullensis ssp. *lutea* Furlow, Ann. Mo. Bot. Gard. **63:** 381. 1977. TYPE: *Furlow 330,* Michoacán: 8 kilometers north of Uruapan along the roadside; elevation 2,000 meters. Tree, 5 meters high; trunk 15 cm in diameter; bark smooth with transverse constrictions. Occasional. November 28, 1971 (HOLOTYPE, MSC!). Figure 44.

Alnus jorullensis var. *exigua* Fernald, Proc. Amer. Acad. **40:** 27. 1904. TYPE: *A. Dugés s.n.,* Guanajuato and vicinity, without date (reported in the protologue as from "mtns. of Santa Rosa, April 1901") (HOLOTYPE, GH!).

Spreading trees up to 15 (–20) m in height; trunk up to ca. 0.6 m in diameter; bark gray-brown to dark brown, usually corky; young stems medium brown to dark red-brown, not glaucous to heavily glaucous; internodes glabrous, sparsely pubescent, or velutinous, moderately to densely glandular; nodes and stems bearing inflorescences very densely glandular; hairs yellowish to brownish; glands medium to large in size, yellowish to brownish. Lenticels of twigs circular to elliptic, 0.5–1.5 mm long, whitish to yellowish, moderately prominent; leaf scars 1–2 mm high, 1.5–2.7 mm wide. Buds with stalks 1–3 mm long, 1–2 mm in diameter, sparsely pubescent to

moderately villous; bodies 2–7 mm long, 1.5–3 mm in diameter; scales sparsely to moderately pubescent, densely glandular. Leaves narrowly elliptic, oblong, or obovate (rarely ovate); apex acute, obtuse, or rounded; base attenuate, acute, or cuneate; blade (4–) 5–15 (–20) cm long, (2–) 3–7 (8.5) cm wide, light to medium brown or yellow-brown below; margin flat to moderately revolute, double-serrate or sinuate to shallow-lobed and serrate or serrulate, up to 50% entire from the base; major teeth or lobes 9–17 (–22) mm apart, up to 1.5 mm deep, irregular; secondary teeth (1–) 3–5 per cm, 0.1–0.5 mm deep, irregular; adaxial surface glabrous to sparsely pubescent; abaxial surface and veinlets glabrous to sparsely pubescent, densely to very densely glandular; pubescence yellowish to brownish; glands medium to large in size, crowded, bright yellow (occasionally brownish or pale yellow). Lateral veins 8–10, (4–) 5–8 (–14) mm apart at mid-leaf, moderately to strongly ascending, sometimes branching once again near the base; cross veins between lateral veins usually poorly developed. Petioles (2–) 6–12 (–23) mm long, 1–1.5 (–3) mm in diameter, glabrous to sparsely pubescent, moderately to densely glandular. Pistillate inflorescences borne on non-diverging branches, at anthesis 2–3 mm long, ca. 2 mm in diameter, on peduncles 0.2–4 mm long, 1.2–1.5 mm in diameter; staminate catkins borne in clusters of 3–5, at anthesis 3.5–11 cm long, 3–9 mm in diameter, on peduncles 1–7 mm long, 0.8–1.5 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers with 4 perianth parts, these usually obovate, rounded at the apex, 1.2–1.4 mm long, 0.6–0.9 mm wide, the margin lined with very minute glands; stamens free or basally adnate to the perianth parts, usually appearing longer than the perianth, the filaments 1.2–1.5 mm long, the anthers 1.1–1.6 mm long and 1.1–2 mm in diameter, the thecae separate for 35–45% of their length. Infructescences (11–) 13–25 mm long, 9–15 mm in diameter, on peduncles 0.2–2 mm long, 1.5–1.8 mm in diameter; scales 4.5–5 mm long, 4.5–5.5 mm wide at the apex, 1.5–1.7 mm wide at the base, the apex moderately to greatly thickened, the terminal lobe-tip truncate and not extended. Fruits narrowly winged or merely wing-margined; bodies 2.5–3.5 mm long, 1.7–2 mm in diameter; wings 3–3.5 mm long, 0.5–1 mm wide, firm; persistent styles 1–1.3 mm long. Figures 5F, 6A, 14C, 15E, 17C, 19G, 20C, and 44.

Figure 44. Holotype of *Alnus jorullensis* ssp. *lutea* Furlow.

DISTRIBUTION AND HABITAT: Central Sinaloa and Durango south and east to southern Jalisco, Michoacán, México, and central Veracruz; central Oaxaca. Rocky streambanks, intermittent streams, and moist to moderately dry slopes from elevations of about 1,000 to 2,500 (rarely to 3,000) meters. Usually associated with *Pinus, Quercus,* or *Abies.* Figure 45.

COMMON NAMES: Aile, aliso.

REPRESENTATIVE SPECIMENS: **Mexico.** DISTRITO FEDERAL. Bosque de Santa Rosa, *Matuda 20970* (MEXU); Pedregal de San Angel, *Rzedowski 514* (ENCB). DURANGO. Perfil de la Sierra Madre Occidental a lo largo de la carretera Durango-Mazatlán, *Martin et al. 315* (ENCB); from El Salto S along lumber road toward Pueblo Nuevo (about 60 air mi SW of Cd. Durango, *Maysilles 7807* (MICH); Laguna del Progreso, 34 road mi N of railroad at Coyotes, *Maysilles 8333* (NY). GUANAJUATO. Guanajuato and vicinity, *A. Dugés s.n.,* without date; 30 km al E de San Luís de Paz, *Rzedowski 9082* (ENCB). GUERRERO. Cerro Azul, Distr. Mina, *Hinton 14943* (NY, WTU); Petlacala, Distr. Mina, *Hinton 15406* (MICH, NY, UC, WTU). HIDALGO. San Vincinte, *Fisher s.n.,* Aug. 16, 1937 (F, NY, RM); Jacala, *Kenoyer 641* (MO); Omitlan-Huasca, *Miranda 4472* (MEXU); hills, Cuyamaloya, 8000 ft, *Pringle 10288* (F, MEXU, MSC, MO, NY, UC); ca. 3 mi S of Tepiji del Río, *Straw & Gregory 1166* (MEXU, MICH, UC). JALISCO. Nevado de Colima above the sawmill called Piedra Ancha and just E of the first great cañon W of the sawmill site, *McVaugh 11673* (MEXU, MICH); Real Alto, trail to Poso Hedionda, *Mexia 1717* (F, MICH, MO, NY, UC); camino de Atenquique al Nevado de Colima, *Rzedowski 19395* (ENCB, MEXU, MSC). MÉXICO. Pantoja, Distr. Temascaltepec, *Hinton 3545* (NY); Ixtaccíhuatl, *Purpus 1792* (F, NY, UC). MICHOACÁN. 13 km W of Pátzcuaro on a dry hillside with pines and oaks, *Furlow 328* (MSC); 8 km N of Uruapan along the roadside, *Furlow 330* (MSC); steep mountainside NW of Aquililla, ca. 5–7 km S of Aserradero Dos Aguas, *McVaugh 22683* (ENCB, MICH). MORELOS. 2½ mi S of Tres Cumbres on old hwy 95 to Cuernavaca, *Gibson 1035* (MEXU); 1 km al N de Cuajumulco, *Palacios Ch. s.n.,* Feb. 15, 1965 (ENCB, MSC). OAXACA. Cerro San Felipe, *Conzatti 4074* (MEXU); Loma del encino, El Carrizal, Yolox, *May Nah 788* (ENCB, MEXU); summit ridge, Sierra de San Felipe, 7000 ft, *Pringle 10249* (DAO, ENCB, MICH, MSC, UC). PUEBLA. 38 km W of the city of Orizaba on a steep hillside with pines, *Furlow 339* (MSC); Mt. Orizaba, *Purpus 3003* (NY, UC); ca. 4.5 km E Río Frío, Mun. Tlahuapan, *Weber 802* (ENCB). SINALOA. 7 mi W of Santa Rita along a side road E of the Los Hornos to Surutato road, *Breedlove 16518* (MICH); along road to Surutato, 3 mi SE of Los Ornos, *Breedlove & Thorne 18614* (MICH); El Batel, 70 km NE of Mazatlán, *Pitekla 293* (UC). ZACATECAS. Sheltered east-facing valley, steep mountainsides near summits ca. 20 km westward toward Tlaltenango from the road junction S of Jalpa, *McVaugh 25638* (MICH).

Alnus jorullensis ssp. *lutea* is readily distinguishable from all the other American taxa of the genus by the profusion of moderately to very bright yellow glands covering the lower leaf surfaces. These glands produce in the leaves a peculiar yellowish brown or yellowish

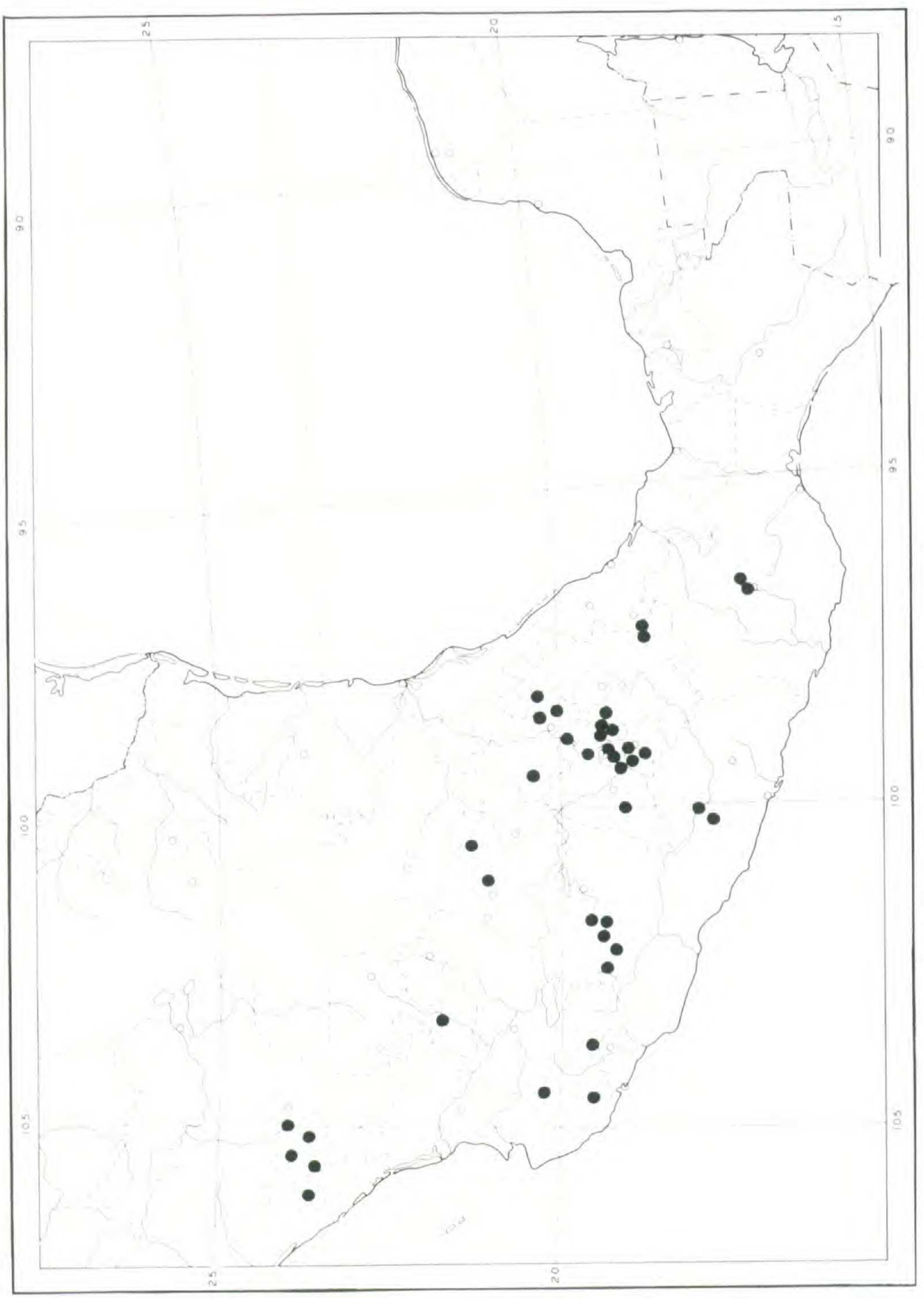

Figure 45. Distribution of *Alnus jorullensis* ssp. *lutea* Furlow.

green-brown color when viewed without magnification. The subspecies has therefore been given the epithet *"lutea"* in reference to this characteristic. Other diagnostic features, as already mentioned, include leaves which are narrower and more ovate in shape, bear more sharply-pointed apices, and have less coarsely-toothed margins than those of ssp. *jorullensis*.

This and the previous subspecies represent ecotypes, *Alnus jorullensis* ssp. *jorullensis* occurring at generally higher and ssp. *lutea* occurring at generally lower elevations throughout much of mountainous southern Mexico. Subspecies *lutea* does not reach Central America as does ssp. *jorullensis*.

6. **Alnus incana** (Linnaeus) Moench

Alnus incana (Linnaeus) Moench, Meth. Pl. p. 424. 1794; *Betula alnus* Linnaeus, Sp. Pl. **2:** 983. 1754, in part; *Betula alnus β incana* Linnaeus, Sp. Pl. **2:** 983. 1754; *Betula incana* (Linnaeus) Linnaeus f., Suppl. Pl. p. 417. 1781.

Trees or shrubs up to 25 m in height; trunks up to 3.5 dm in diameter, erect or ascending, bark light to dark gray, reddish, or purplish-brown, smooth or broken into plates (on old individuals); young stems light to dark red-brown, dull to slightly lustrous, slightly to heavily glaucous, usually without conspicuous resinous coating, not differentiated into long and short shoots, without longitudinal ridges originating at the nodes; internodes sparsely pubescent to velutinous or tomentose, moderately to densely glandular; nodes and stems bearing inflorescences very densely glandular; hairs yellowish to brownish to dark brown; glands small to medium in size, pale yellowish to brown; lenticels of twigs circular to elliptic, 0.2–1.2 mm long, 0.2–0.7 mm wide, whitish to yellowish, moderately prominent; leaf scars 1–2 mm high, 1.5–2.5 mm wide, the bundle scars inconspicuous to somewhat prominent. Buds ellipsoid, acute to slightly rounded at the apex, moderately to heavily resin-coated; stalk 2–4 mm long, 1–2 mm in diameter, sparsely pubescent to velutinous, densely glandular; body 3–7 mm long, 1.5–3 mm in diameter; scales 2 (–3), stipular, equal, valvate, moderately villous to velutinous, glandular; pubescence and glands usually obscured by the resin coating. Leaves ovate to oblong-ovate, elliptic, or nearly orbicular (rarely somewhat obovate), the apex acute to obtuse or rounded; base attenuate, broadly cuneate to acute, obtuse, or rounded, sometimes oblique; blade (2.5–) 4–9 (–11) cm long, (1–)

3–9 cm wide, medium to dark green and dull to moderately lustrous above, light to medium green and dull (sometimes slightly to heavily glaucous) below, membranaceous, chartaceous, or somewhat coriaceous; margin flat to slightly revolute, slightly to moderately thickened, double-serrate to nearly serrulate; major teeth (4–) 8–13 (–16) mm apart at mid-leaf, up to 7 mm deep, regular; secondary teeth 3–11 (–13) per cm, 0.3–1.2 mm deep, regular; adaxial surface glabrous, sparsely pubescent, or somewhat pilose, sparsely to moderately glandular; abaxial surface and veinlets glabrous to velutinous or tomentose, sparsely to moderately glandular, slightly to moderately resin-coated; major veins and vein axils near the base tomentose to wooly-pubescent; pubescence whitish to yellowish or brownish; glands small to medium, whitish, yellowish, or brownish. Lateral veins 7–14, (3–) 4–9 (–10) mm apart at mid-leaf, straight to slightly ascending, sometimes branching once again, especially near the base, terminating in major teeth at the margin; cross veins between lateral veins poorly to well developed. Petioles (4–) 8–17 (–25) mm long, (0.5–) 0.8–1.5 mm in diameter, moderately villous to tomentose, sparsely to moderately glandular. Stipules ovate, elliptic, or obovate, the apex acute to obtuse, 5–10 mm long, 2–3.5 mm wide, green, glabrous to velutinous, the hairs yellowish, moderately glandular, the glands yellowish. Pistillate inflorescences borne in racemose groups of (2–) 3–6 (–8) on short branchlets non-divergent to strongly divergent from the main axis, produced during the previous growing season, erect, ovate to elliptic, at anthesis 2–5 mm long, 1.2–3 mm in diameter, on peduncles 0.2–2 mm long, 0.8–2 mm in diameter; staminate catkins borne in one or more racemose clusters of 2–4 at the end of the main branch above the pistillate inflorescences, produced during the previous growing season, pendent during both dormancy and anthesis, at anthesis 3–7 (–10) cm long, 5–9 mm in diameter, on peduncles 1–18 mm long, 0.8–2.2 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers 3 per bract; perianth of 4 parts, these elliptic to obovate, the apex rounded, 1.2–1.9 mm long, 0.4–1.3 mm wide, the margin lined with small to medium or large glands; stamens 4, opposite and basally to nearly completely adnate to the perianth parts, usually appearing somewhat shorter than to equal in length to the perianth; filaments 0.4–1.2 mm long; anthers 0.8–1.4 mm long and 0.7–1.2 mm in diameter, the thecae separate for 30–55% of their length. Infructescences ovoid to ellipsoid, (6–)

10–17 (–22) mm long, (6–) 8–11 (–14) mm in diameter, on peduncles 0.2–6 (–8) mm long, (0.8–) 1–1.5 (–2) mm in diameter; scales 3–5.5 mm long, 3–5.5 mm wide at the apex, 0.8–1.5 mm wide at the base, the apex thin to moderately thickened and flat, the terminal lobe-tip acute and depressed to somewhat or very extended. Fruits narrowly winged or wing-margined, brown; body ovate, elliptic, or obovate, 2.5–3.5 mm long, 1.2–2.5 mm in diameter; wings 2.5–3.5 mm long, 0.4–0.8 (–1.2) mm wide, firm to coriaceous; persistent styles 0.5–1.2 mm long.

Alnus incana was one of two alders included by Linnaeus in *Species Plantarum* as varieties of his *Betula alnus*. It occurs in a circumpolar distribution, occupying habitats ranging from lowlands to nearly subalpine conditions. Among several morphologically and geographically well-marked segments of the species are subspecies *rugosa* of north-eastern North America and subspecies *tenuifolia* of western North America. Although the typical subspecies of Europe becomes a tree, *Alnus incana* in the New World seldom attains a stature greater than that of a large shrub. Fernald (1945b) emphasized this in arguing for separate specific status for the North American forms. There are too many affinities between New and Old World plants, however, to continue to separate them as different species.

Alnus incana, especially in Europe and Asia, is extremely variable (cf. Hultén, 1971), and this has led to the application of a profusion of species, variety, and form names to it. Leaf shape is usually ovate, but it ranges from this form to obovate or orbicular. Pubescence and glaucousness of the leaves are likewise quite variable, as are habit and bark characters. In spite of this diversity, however, there is usually little confusion in determining the species.

Best development, as with greatest variability, is in Europe, pointing to an origin there, although this species has been greatly affected by Pleistocene glaciation, complicating the tracing of its history.

6a. **Alnus incana** ssp. **rugosa** (DuRoi) Clausen

Alnus incana ssp. *rugosa* (DuRoi) Clausen, Mem. Cornell Univ. Agr. Expt. Sta. **291:** 8. 1949; *Betula alnus* (*rugosa*) DuRoi, Diss. Inaug. Obs. Bot. p. 32. 1771; *Betula rugosa* (DuRoi) Ehrhart, Beitr. Naturk. **3:** 21. 1788; *Alnus rugosa* (DuRoi) Sprengel, Syst. Veg. ed. 16, **3:** 848. 1826; *Alnus glutinosa δ serrulata* lusus c. *rugosa* (DuRoi) Regel, Mem. Soc. Nat. Mosc. **13**(2): 165. 1861; *Alnus*

Figure 46. Representative specimen of *Alnus incana* ssp. *rugosa* (DuRoi) Clausen

serrulata β rugosa (DuRoi) Regel, Bull. Soc. Nat. Mosc. **38**(3): 432. 1865; *Alnus rugosa* var. *α typica* Winkler, Pflanzenreich **19**(4.61): 119. 1904. TYPE LOCATION: "habitat in America septentrianali" (original material not seen).

Alnus glauca Michaux, Hist. Arb. For. Sept. **3:** 322. 1813; *Alnus incana* var. 3 *glauca* (Michaux) Laudon, Arboret. Fruticet. Brit. **3:** 1688. 1838; *Alnus incana α glauca* (Michaux) Regel, Mem. Soc. Nat. Mosc. **13**(2): 154. 1861. Original material not seen (P?).

Alnus glutinosa α serrulata (Aiton) Regel, Mem. Soc. Nat. Mosc. **13**(2): 165. 1861, in part.

Alnus incana β americana Regel, Mem. Soc. Nat. Mosc. **13**(2): 155. 1861; *Alnus incana* var. ι . *americana* (Regel) Winkler, Pflanzenreich **19**(4.61): 123. 1904; *Alnus rugosa* var. *americana* (Regel) Fernald, Rhodora **47:** 350. 1945; *Alnus americana* (Regel) Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Acad. Sci. U.R.S.S. **17:** 103. 1955, *non* Petzold & Kirchner, Arb. Musc. p. 597. 1864. TYPE: *Sartwell,* "Penn Yan in Nordamerika" (LE?, not seen).

Alnus argentea hort. ex Petzold & Kirchner, Arb. Musc., p. 600. 1864, *pro syn.*

Alnus canadensis hort. ex Winkler, Pflanzenreich **19**(4.61): 119. 1904, *pro syn.*

Alnus oblongata hort. ex Winkler, Pflanzenreich **19**(4.61): 119. 1904, *non* Willdenow, Sp. Pl. ed. 4, **4:** 335. 1805, *pro syn.*

Alnus incana var. *glauca* f. *tomophylla* Fernald, Rhodora **16:** 56. 1914; *Alnus incana* var. *tomophylla* (Fernald) Rehder, Man. Cult. Tr. Shrbs., p. 147. 1927, erroneously attributed to Fernald; *Alnus rugosa* var. *americana* f. *tomophylla* (Fernald) Fernald, Rhodora **47:** 353. 1945. TYPE: *Fernald & Wiegand 5303,* Newfoundland: border of a wet thicket, Norris Arm, Aug. 21, 1911 (HOLOTYPE, GH!). Figure 47.

Alnus rugosa var. *typica* f. *emersoniana* Fernald, Rhodora **47:** 347. 1945. TYPE: *Fernald & Bartlett 14,* Massachusetts: Round Pond, Tewksbury, Middlesex Co., Apr. 14 & Oct. 14, 1906 (HOLOTYPE, GH!).[1]

Alnus rugosa var. *americana* f. *hypomalaca* Fernald, Rhodora **47:** 353. 1945. TYPE: *Weatherby & Weatherby 7015,* New Brunswick: Seal Cove Brook, Grand Manan, Charlotte Co., July 24, 1941 (HOLOTYPE, GH!).

Spreading shrubs up to 10 (–17) m in height; trunks up to ca. 17 (–25) cm in diameter, the bark dark gray, reddish, or purplish-brown, with large, conspicuous whitish or grayish elliptic or elongate lenticels; young stems light to dark red-brown, dull; internodes sparsely pubescent to velutinous; lenticels of twigs 0.2–1.2 mm long, 0.2–0.7 mm wide, moderately prominent, whitish to yellowish; leaf scars 1–2 mm high, 1.5–2.5 mm wide, the bundle scars somewhat prominent. Buds acute (or sometimes slightly rounded) at the apex; stalk 2–4 mm long, 1–2 mm in diameter, sparsely pubescent to

[1] Another collection from the same locality (*Fernald & Bartlett 18*) was erroneously annotated "type number" by Fernald on sheets now at the following (and possibly other) herbaria: CAN, F, GH, NY, US (2 sheets), and WIS.

velutinous; body 3–7 mm long, 1.5–3 mm in diameter. Leaves ovate to elliptic (rarely obovate), the apex acute to obtuse; blade (2.5–) 4–9 (–11) cm long, (1.3–) 3–7.5 cm wide, medium to dark green and dull above, usually medium green and dull below, often slightly to heavily glaucous below, chartaceous; margin flat to slightly revolute, slightly to moderately thickened, double-serrate to nearly serrulate; major teeth (4–) 8–13 (–15) mm apart at mid-leaf, up to 4 mm deep, regular; secondary teeth 6–11 (–13) per cm, 0.3–1 mm deep, regular; adaxial surface glabrous to sparsely pubescent, sparsely to moderately glandular; abaxial surface and veinlets glabrous to velutinous, sparsely to moderately glandular; pubescence yellowish to brownish; glands small to medium in size, yellowish to brownish. Lateral veins 11–14, (3–) 4–9 (–10) mm apart at mid-leaf; cross veins between lateral veins well developed. Petioles (4–) 8–17 (–20) mm long, 0.5–1.5 mm in diameter, moderately villous to tomentose, sparsely to moderately glandular. Stipules 6–10 mm long, 2–3.5 mm wide. Pistillate inflorescences borne in groups of (2–) 3–6 on short branchlets non-divergent to strongly divergent from the main axis, at anthesis 2–5 mm long, 1.2–2 (–2.5) mm in diameter, on peduncles 0.2–2 mm long, 0.8–1 mm in diameter; staminate catkins borne in one or more clusters of 2–4, at anthesis 2–7 cm long, 5–8 mm in diameter, on peduncles 1–9 (–11) mm long, 0.8–2 (–2.2) mm in diameter. Staminate flowers with 4 perianth parts, these elliptic or obovate, the apex rounded, 1.4–1.9 mm long, 1.1–1.3 mm wide, the margin lined with medium to large glands; stamens basally adnate to the perianth parts, usually somewhat shorter than to equal in length to the perianth; filaments 0.4–0.9 mm long, anthers 0.9–1.2 mm long and 0.8–1.2 mm in diameter, the thecae separate for 30–45% of their length. Infructescences (6–) 10–17 mm long, (6–) 8–11 mm in diameter, on peduncles 0.2–6 (–8) mm long, 1–1.5 (–2) mm in diameter; scales 3.5–4.5 mm long, 3–4 mm wide at the apex, 0.8–1.5 mm wide at the base. Fruits narrowly winged or wing-margined; body elliptic to obovate, 2.5–3.5 mm long, 1.3–2.5 mm in diameter; wings 2.5–3.5 mm long, 0.4–0.8 (–1) mm wide, firm to coriaceous; persistent styles 0.5–1 (–1.3) mm long. Figures 2A, 4B, 7A, 9A, 16D, 22C, 46, and 47.

DISTRIBUTION AND HABITAT: North-central Manitoba east to southern Labrador, south to southeastern North Dakota, northeastern Iowa, northern Indiana, central Ohio, and southern Pennsylvania. Streambanks, lakeshores, borders of bogs, edges of

Figure 47. Specimen of *Alnus incana* ssp. *rugosa* (DuRoi) Clausen. Holotype of *Alnus incana* var. *glauca* f. *tomophylla* Fernald.

swamps, wet fields and swales, often forming fairly dense thickets. Found at elevations of nearly sea level along the north Atlantic coast to about 825 meters in the Appalachian highlands. Figure 48.

COMMON NAMES: Speckled alder, tag alder, swamp alder, hazel alder, hoary alder, aulne blanchatre (Quebec).

REPRESENTATIVE SPECIMENS: **Canada.** LABRADOR. Paradise River, Sandwich Bay, *Bishop 275* (A); platiere pres de la route de la riv. Hamilton, rive N du lac Gabbro, *Dutilly & Lepage 41117* (DAO); Goose Bay, *Schofield 781* (DAO). MANITOBA. Lac Du Bonnet, *Breitung 7473* (DAO); E end Singoosh Lake, Duck Mts., *Halliday 66-1933* (CAN); Lake Winnipeg, *Moyer s.n.*, Aug. 28, 1889 (NY). NEW BRUNSWICK. Charlotte Co.: Grand Manan, *Weatherby & Weatherby 7015* (CAN, GH, US). Restigouche Co.: Campbellton, low grounds, *Chalmers s.n.*, Aug. 8, 1877 (CAN). Sunbury Co.: Mill Settlement, Blissville Parish, *Christie 637* (DAO); Bass River, *Fowler s.n.*, May 1, 1835 and Sept. 23, 1875. NEWFOUNDLAND. SE of Tompkins, 1 mi N of St. Andrews, Codroy Village, *Basset 846* (DAO); valley of the Exploits River, Norris Arm, *Fernald & Weigand 5305* (CAN, GH, NY, US); Humber Arm, Bay of Islands, McIver's Cove, *Fernald et al. 1646* (GH, NY). NORTHWEST TERRITORIES. Keewatin District: Robinson Portage, *Peeble & Peeble 18* (US). NOVA SCOTIA. Antigonish Co.: Merland, *Smith et al. 13598* (CAN). Halifax Co.: Musquodobolt Harbour, *Rouseau 35623* (CAN). Lunenburg Co.: wet thickets and swales back of brackish shore of Lahave River, Bridgewater, *Fernald & Long 23779* (A, CAN, GH, MO). Yarmouth Co.: Sloan Lake, Pleasant Valley, *Fernald et al. 21015* (GH). ONTARIO. Algoma District: N shore of Lake Superior, 10 mi SE of White River, *Crow 1268* (MSC). Carleton Co.: Dow's Swamp, Ottawa, *Minshall 2707* (DAO). Kenora District: Moose Factory, *Dutilly & Lepage 13795* (A). Rainy River District: along C.N.R. ¾ mi W of Rainy R. Town, *Garton 8524* (DAO). Thunderbay District: 24 mi S of Nipigon along Rt. 17, *Furlow 312* (MSC). PRINCE EDWARD ISLAND. Prince Co.: woods just E of Wellington, *Smith 161* (DAO). Queens Co.: Mount Albion, *Erskine & Smith 1733* (DAO). QUEBEC. Abitibi Co.: Harricanaw River, *Bentley 58204* (CAN). Gaspe-Est Co.: York, *Collins et al. s.n.*, Aug. 25, 1904 (GH). Mantane Co.: Riviere Blanche, wet ground, *Forbes 69585* (CAN, DS). Nouveau Quebec Region: Fort George, *Baldwin et al. 565* (CAN). Portneuf Co.: Station Agionomique, *Cinq-Mars 64498* (DAO). Stanstead Co.: North Hatley, *Jack s.n.*, Sept. 26, 1914 (A). **United States.** CONNECTICUT. Litchfield Co.: Berkshire Mountains, *Barkley et al. 38162* (MEXU). Woodbury Co.: Woodbury, *Clark s.n.*, Aug. 25, 1908 (DAO). ILLINOIS. Winnebago Co.: shallow bog near Sugar River, Sec. 20, Shirland Twp., *Fell & Fell 49-382* (DAO). INDIANA. Legrange Co.: Pigeon River State Fish and Game Area, on the N shore of the marsh along the Pigeon River, *Furlow 243* (MSC); along streams, 3 mi SE of Mongo, *Palmer 40375* (NY). Lake Co.: valley of Deep River, below schoolhouse, N of Liverpool, about 2½ mi NW of Hobart, *Steyermark 63551* (F). Porter Co.: just E of Tremount, in the ditch beside the road, *Furlow 245* (MSC). IOWA. Allamakee Co.: margin of Yellow River near Old Stone House, 7 mi NE of Postville, *Thorne 12449* (F, NY). Fayette Co.: about 8 mi SW of Oelwein, *Pammel 475* (MO). MAINE. Hancock Co.: 3 mi E Franklin, *Friesner 6308* (RM, UC). Lincoln Co.: Ocean Point, *Fassett 15802* (F). Penobscot Co.: swamps,

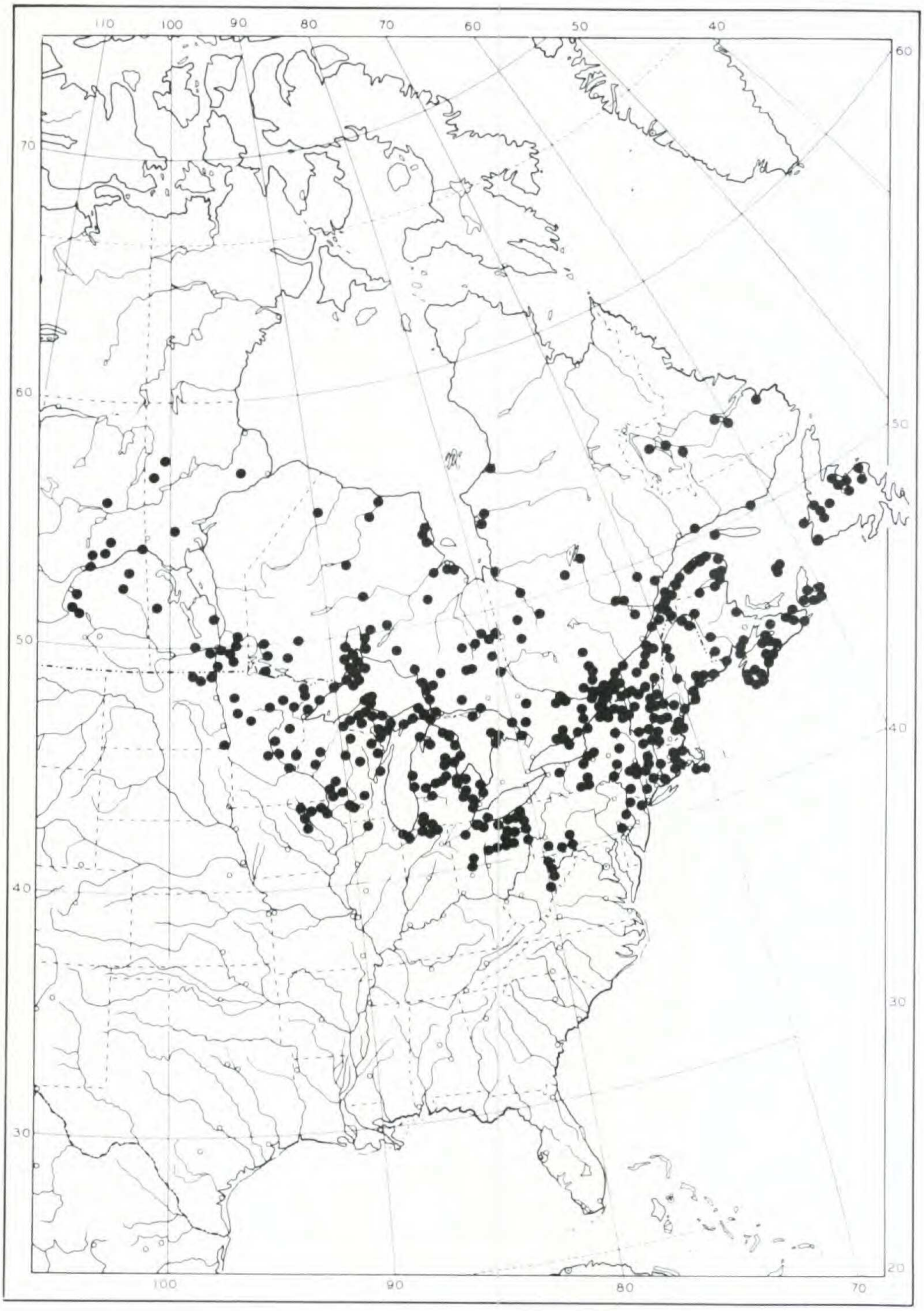

Figure 48. Distribution of *Alnus incana* ssp. *rugosa* (DuRoi) Clausen.

Bangor, *Knight s.n.*, Apr. 22, Oct. 8, 1905 (RM). York Co.: York and vicinity, York Harbor, *Bicknell 3445* (NY); Cape Heddick, *Jack 3388* (A, UC, US). MARYLAND. Mountain Lake Park, *Carter s.n.* Sept. 2, 190? (NY). MASSACHUSETTS. Berkshire Co.: Hoosac R., *Churchill s.n.*, July 26, 1915 (MO); E Mt. Williamstown, *Gilbert s.n.*, in 1883 (UC). Dukes Co.: Martha's Vineyard, head of cove, Great Pond, *Bicknell 3443* (NY). Middlesex Co.: swampy woods, Winchester, *Fernald & Bartlett 7* (GH, NY); clay-bottomed swamp, Winchester, *Fernald & Bartlett 10* (GH, NY); Round Pond, Tewksbury, *Fernald & Bartlett 14* (GH) & *Fernald & Bartlett 18* (CAN, F, GH, NEBC, NY, US). MICHIGAN. Alpena Co.: on the E shore of Long Lake, *Furlow 234* (MSC). Cass Co.: without location, *Pepoon 630* (MSC). Chippewa Co.: Whitefish Point, crest of foredune, *Gillis 2435* (MSC). Livingston Co.: low border of Douglas Lake near mouth of Maple River, *Deam 28814* (NY). Luce Co.: Dear Park, shore of Muskallonge Lake, *Gillis 5534* (MSC). Ontonagon Co.: 1.5 mi E of Silver City, edge of dunes on Lake Superior shore, *Beaman 1849* (MSC). St. Clair Co.: near Port Huron, *Dodge s.n.*, July 21, 1896 (RM). MINNESOTA. Anoka Co.: ¾ mi due N from Little Cook Lake, edge of Carlos Avery Game Refuge, S of Linwood, *Thieret 8462* (F). Clearwater Co.: Lake Itasca State Park, *Furlow 261* (MSC). Hubbard Co.: Benedict, *Bergman 3035* (NY). Louis Co.: border of bog, bay side, Duluth, *Lakela 1341* (NY). Marrison Co.: 12 mi W of Brainerd along US rt. 210, *Furlow 260* (MSC). NEW HAMPSHIRE. Coos Co.: shore of Lake Umbagog, Cambridge, *Pease 18150* (GH). Grafton Co.: along Batchelders Brook ½ mi from Baker River, *Churchill s.n.*, Aug. 6, 1936 (MSC). Sullivan Co.: along rocky streams near Acworth, *Palmer 42735* (A). NEW JERSEY. Sussex Co.: Cranberry Lake, *Mackenzie s.n.*, Aug. 19, 1906 (RM). NEW YORK. Cayuga Co.: on the W shore of Sterling Pond, Fair Haven Beach State Park, *Furlow 191* (MSC). Chemung Co.: without location, *Lucy 9673* (RM). Chenago Co.: without location, *Lucy 3235* (F, RM). St. Lawrence Co.: 3 mi NW of Canton on the floodplain of the Grasse River, *Furlow 194* (MSC). NORTH DAKOTA. Cavalier Co.: Walhalli, *Bergman 2025* (MO). Richland Co.: Leonard, *Stevens 1340* (UC). OHIO. Ashtabula Co.: springs along lower Ashtabula R., *Hicks s.n.*, June 18, 1932 (OS). Henry Co.: along the Maumee River about 3 mi NE of Napoleon, *Weishaupt s.n.*, July 1, 1956 (OS). Richland Co.: Mansfield, *Wilkinson 9673* (NY, OS). PENNSYLVANIA. Bedford Co.: 3/16 mi S of Woodvale, *Berkheimer 10591* (UC). Lehigh Co.: meadows S of trolley tracks just SW of Trexlertown, *Pretz 5917* (UC). Monroe Co.: ½ mi E of Tannersville, *Earle 1186* (DAO). RHODE ISLAND. Providence Co.: bank E of gate, Hauterive, East Providence, *Collins s.n.*, Oct. 17, 1906 (NY); North Providence, *Olney s.n.*, without date (NY). VERMONT. Bennington Co.: Manchester, *Day 163* (GH). Caledonia Co.: Peacham, very common near stream, *Blanchard s.n.*, May 1, 1884 (UC). Chittenden Co.: shore of Lake Champlain, near Buckington, *Rehder s.n.*, Aug. 4, 1902 (A). Rutland Co.: Twin Mountains, W. Rutland, *Eggleston 3210* (NY). Windsor Co.: 1 mi W of Bridgewater Corners along the Ottauguechee River, *Furlow 201* (MSC). WEST VIRGINIA. Preston Co.: Cranesville, *Davis & Davis 107* (NY). Tucker Co.: George Thompson Farm, Canaan Valley, *Core & Strausbaugh s.n.*, July 25, 1947 (DAO). WISCONSIN. Florence Co.: Tifler, *Haynie 28752* (F). Jackson Co.: 1 mi E of Black River Falls, *Furlow 256* (MSC). Marinette Co.: marsh near Green Bay at City of Marinette, *Grassl 3327* (NY). Sauk Co.: swampy ground near Kilburn, *Palmer 27679* (MO, UC).

This taxon was generally considered conspecific with *Alnus incana* of Europe until Fernald (1945b) argued in favor of its being given specific status and treated it so in the 8th edition of *Gray's Manual of Botany* (1950). In the former work, the author lists differences between the taxa of America and Eurasia, especially emphasizing the fact that the Old World taxon is usually a tree while that of the New World is a shrub. He concludes by stating: "surely no argument beyond the mere facts and the plates is needed to show that we have been far astray in calling our northern Swamp Alder the same as the Eurasian *A. incana.*" The differences cited by Fernald, however, all seem minor when compared with the striking similarities of the two taxa.

The original material of *Betula alnus rugosa* DuRoi was a cultivated shrub in the botanic garden of Harbke near Brunswick. The existence of the type is not known. Fernald (1945b) provides a photograph taken by Rehder at B (and presumed since destroyed) of a specimen of *"Betula rugosa"* distributed by Ehrhart and coming from the Harbke Garden[1].

Alnus incana ssp. *rugosa* is often indistinguishable from the typical subspecies on the basis of herbarium material. In northeastern North America the foliage is often moderately to heavily glaucous below (*A. rugosa* var. *americana* Fern., *A. incana* var. *glauca* Ait. f.), this trait gradually disappearing to the west and the south. As noted by Steele (1961), this character is consistent throughout the geographical range of the variety, but it is difficult to use since it doesn't appear until after the leaves are fully matured late in the summer.

A cut-leafed form of this subspecies, *Alnus rugosa* f. *tomophylla,* was described by Fernald (1914) from Newfoundland (Plate 34). Unlike the cut-leafed form of *A. rubra,* this taxon is represented by only a single collection. Cut-leafed variants of *Alnus incana* in Europe are numerous and have a very involved nomenclature (cf. Hylander, 1957).

Alnus incana ssp. *rugosa* is easily distinguished from the other species with which it occurs by its smooth, dark, conspicuously-lenticeled bark and by its acute-tipped, double-serrate leaves. It is

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[1]Termed a "topotype" by Fernald.

predominantly a lowland shrub, more common in swamps and bogs than along running streams like most of the other species of *Alnus*. The largest recorded specimen of *A. incana* ssp. *rugosa*, occurring at Holland, Michigan, has a height of 17 meters, a trunk circumference of 80 centimeters, and a spread of 8 meters (Pomeroy & Dixon, 1966).

The exact western limit of the geographical range is difficult to establish since this subspecies intergrades gradually into subspecies *tenuifolia* in northern Saskatchewan and Manitoba. To the south and east its range overlaps that of *Alnus serrulata*, and in this region occurs a putative hybrid swarm of intermediate forms. Such specimens seem to be especially common in material from Massachusetts. In both areas of overlap with other taxa, *Alnus incana* ssp. *rugosa* may be difficult to determine. No attempt has been made to resolve this problem in the present key.

6b. **Alnus incana** ssp. **tenuifolia** (Nuttall) Breitung

Alnus incana ssp. *tenuifolia* (Nuttall) Breitung, Amer. Midl. Natr. **58:** 25. 1957; *Alnus tenuifolia* Nuttall, North Amer. Sylva **1:** 48. 1842. TYPE: *Nuttall s.n.*, "on the borders of small streams within the range of the Rocky Mountains, and afterward in the valleys of the Blue Mountains of Oregon (HOLOTYPE, BM?; ISOTYPE, GH!). Figure 49.

Alnus incana var. *virescens* Watson, Bot. Calif. **2:** 81. 1880, *non* Wahlenberg, Fl. Lapponica, p. 250. 1812; *Alnus glutinosa* var. *virescens* (Watson) Kuntze, Rev. Gen. Pl. **2:** 638. 1891; *Alnus tenuifolia* var. a. *virescens* (Watson) Callier *in* Schneider, Ill. Handb. Laubh. **1:** 133. 1904. TYPE: *Watson 1090*, Parley's Park, Utah, June, 1869, alt. 7000 ft. (LECTOTYPE, GH!).[1]

Alnus communis Desfont. ex Kuntze, Rev. Gen. Pl. **2:** 638. 1891, *pro syn.*

Alnus occidentalis Dippel, Handb. Laubh. **2:** 158. 1892; *Alnus tenuifolia* var. b. *occidentalis* (Dippel) Callier *in* Schneider, Ill. Handb. Laubh. **1:** 133. 1904; *Alnus incana* ssp. *rugosa* var. *occidentalis* (Dippel) Hitchcock *in* Hitchcock et al., Vasc. Plts. Pac. Northwest **2:** 73. 1964. TYPE: *Diecks, Purpus*, "in Nordwest-Amerika heimische" (not seen).

Alnus densiflora Muller, Madroño **5:** 152. 1940. TYPE: *Allen 514*, Nevada, Storey Co.: southwest of Virginia City on the Jumbo Canyon Road, September 3, 1937 (HOLOTYPE, US!).

Spreading shrubs or trees up to 9 (–15) m in height; trunks usually several, ascending, up to 30 cm in diameter; bark light gray to dark brown, smooth, speckled with moderately-prominent to inconspicuous round to elliptic lenticels; young stems often moderately to

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[1]Another Watson specimen from the King Expedition, also labeled "No. 1090," but from Carson City, Nevada, is at US.

heavily glaucous; lenticels of twigs 0.2–0.7 mm long, usually inconspicuous; leaf scars 1–2 mm high, 1.8–2.5 mm wide, with moderately-prominent bundle scars. Buds ellipsoid to obovoid, usually somewhat rounded at the apex, lightly to moderately resin-coated; stalk 1–3 mm long, 1–2 mm in diameter, glabrous to velutinous; body 4–7 mm long, 1.5–3 mm in diameter. Leaves ovate to elliptic; apex acuminate, acute, or obtuse; base usually broadly cuneate to rounded; blade (3–) 4–8.5 (–9.5) cm long, 2.5–8 cm wide, usually medium to dark green and dull to moderately lustrous above, light to medium green or brownish and dull below, membranaceous to chartaceous; margin flat, not thickened, double-serrate; the major teeth often more or less rounded, (5–) 7–10 (–16) mm apart at mid-leaf, (2–) 4–7 mm deep, regular; secondary teeth (3–) 4–9 per cm, 0.5–1.2 mm deep, regular; adaxial surface glabrous to sparsely pubescent, abaxial surface and veinlets glabrous to sparsely pubescent, slightly or not at all resin-coated. Lateral veins 8–13, (3–) 5–7 (–9) mm apart at mid leaf, usually branching once again, especially near the base; cross veins between lateral veins poorly to well developed. Petioles (4–) 7–18 (–25) mm long, 0.8–1.5 mm in diameter, glabrous to moderately villous or velutinous, moderately to densely glandular. Stipules elliptic to obovate, the apex rounded, 5–7 mm long, 2–3 mm wide, green to light brown, glabrous to moderately villous. Pistillate inflorescences borne in groups of (2–) 3–5, at anthesis 2.5–4 mm long, 1.5–2.8 mm in diameter, on peduncles 0.2–1 mm long, 0.8–2 mm in diameter; staminate catkins borne in groups of 3–5 at the end of the main branch above the pistillate inflorescences, this branch moderately to strongly divergent from the main axis, at anthesis 4–10 cm long, 7–9 mm in diameter, on peduncles 2–18 mm long, 1–1.5 mm in diameter. Staminate flowers with 4 perianth parts, these obovate, 1.6–2 mm long, 1.2–1.6 mm wide, the margin lined with very minute glands; stamens almost completely adnate to the perianth parts, usually appearing shorter than the perianth, the filaments 0.4–1.1 mm long, the anthers 0.8–1.1 mm long and 0.8–1.1 mm in diameter, the thecae separate for 45–55% of their length. Infructescences 9–18 (–20) mm long, (5–) 8–13 mm in diameter, on peduncles 0.2–3 (–6) mm long, 0.8–1.5 mm in diameter; scales 4–5.2 mm long, 3.7–5 mm wide at the apex, (0.8–) 1.2–1.5 mm wide at the base, the apex moderately thickened, the terminal lobe-tip acute to rounded and somewhat extended. Fruits narrowly winged or merely wing-margined, brown;

Figure 49. Lower left: isotype of *Alnus tenuifolia* Nuttall (= *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung). Upper right: specimen of *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung.

body mostly elliptic or obovate, 2.5–3.5 mm long, 1.2–2.5 mm in diameter; wings 3–3.5 mm long, 0.5–1.2 mm wide, firm to coriaceous; persistent styles 0.5–1.2 mm wide, firm to coriaceous; persistent styles 0.5–1.2 mm long. Figures 9B, 17A, and 49.

DISTRIBUTION AND HABITAT: Southern Alaska east to Mackenzie District (as far north as the Mackenzie Delta), south to south-central California, southern Arizona, and central New Mexico. Streambanks, lake shores, wet fields and meadows, bog and muskeg margins, and moist slopes at elevations from about 100 meters in Alaska to over 3,000 meters in Colorado and Arizona. Occurring singly or forming fairly dense thickets. Often associated with *Populus, Salix, Abies, Pinus,* or *Pseudotsuga.* Figure 50.

COMMON NAMES: Thinleaf (or thin-leafed) alder, mountain alder, alder, river alder.

REPRESENTATIVE SPECIMENS: **Canada.** ALBERTA. Cold Lake, French Bay E of peninsula along the Alberta-Saskatchewan border, *Dumais & Rankin 1233* (CAN); about 20 mi SE of Smith, *Furlow 262* (MSC); Jasper National Park, about 7 mi SW of the N park entrance, *Furlow 270* (MSC); river valley adjacent to Fort Saskatchewan, *Turner 4784* (DAO). BRITISH COLUMBIA. Dawson Creek, *Breitung 1823* (DAO); 4 mi NNE of Nelson, *Calder & Saville 9395* (DAO, UC); Merritt, bank above Nocola River, *McCabe 4438* (UC); 25 mi S of Ft. St. James, *McCabe 7589* (UC, WTU); Queen Charlotte Isl., *Newcombe s.n.,* Apr. 25, 1901 (F); N slopes of Peace R. valley, vicinity of Hudson Hope, *Raup & Abbe 3699* (CAN, NY). NORTHWEST TERRITORIES. Mackenzie District: near Basworth Creek, Norman Wells, *Cody & Gutteridge 7385* (DAO, F); Mackenzie River 4 mi E of Trout River, *Cody & Spicer 11371* (DAO, UC); Liard River, 2 mi above Blue Bill Creek, 42 mi N of Fort Liard, *Cody & Spicer 11910* (DAO, UC); flat alluvial island in delta at junction of Mackenzie E Channel with Kugwallet Bay of Arctic Ocean, *Lindsey 706* (CAN). SASKATCHEWAN. South shore of Lake Athabaska, E of William River, vicinity of Little Gull Lake, shore of small lake to the E, *Argus 319–62* (DAO); Meadow Lake Forest Reserve, 20 mi S of Meadow Lake, *Breitung 8203* (DAO); Lazy Edward Bay, Cree Lake, *Maini 150* (DAO, RM). YUKON TERRITORY. Whitehorse, *Anderson 9610* (CAN); Bear Creek area about 8 mi E of Dawson, *Calder & Billard 3220* (DAO, RM, UC); Dawson, *Eastwood 17 & Eastwood 20* (CAN); Rampart House on the Alaska-Yukon border, *Loan 359* (DAO). **United States.** ALASKA. Fairbanks, *Anderson 1579* (NY); floodplain of the Chena River at mi 3.2 on Chena Pump Road, *Anderson s.n.,* Sept. 6, 1971 (MSC); Kenai River near mouth of Cooper Creek, Kenai Peninsula, *Calder 5122* (DAO); foot of Chugash Mts., Anchorage, *Dutilly et al. 21669* (DAO, US); bank of Naknek River, King Salmon, *Schofield 2295* (DAO, WTU). ARIZONA. Apache Co.: Greer, *Fulton 8216* (ARIZ); 3 mi N of Alpine, *Furlow 350* (MSC); bottom of Canyon de Chelly, ¼ mi above Monument Canyon, *Goodman & Payson 3253* (WTU). Graham Co.: Riggs Flat, Graham Mts., *Shreve 5251* (ARIZ). Pima Co.: Rincon Mts., Manning Trail, *Blumer 3420* (ARIZ, UC). CALIFORNIA. El Dorado Co.: ca. 2 mi S of Meyers, Upper Truckee River Basin,

Crampton 6690 (UC); about 1 mi E of Pyramid Ranger Station, *Robbins 1699* (UC). Glen Co.: Plaskett Meadows, *Baker 9896* (UC). Humboldt Co.: Croghan Hole on Trinity Summit, *Tracy 19286* (UC, WTU). Placer Co.: 4 mi S of Truckee on Truckee-Tahoe Road, *Mason 5463* (UC). Siskiyou Co.: shore of Castle Lake, *Bacigalupi 6800* (JEPS). COLORADO. Boulder Co.: Boulder, *Moseley s.n.*, in 1896 (RM); Lower Boulder Cañon, *Osterhout 2404* (NY, RM); Allan's Park, *Ramaley 902* (RM); along streams at mouth of Gregory Canyon W of Boulder, *Robbins 346* (UC). Eagle Co.: near Walcott, *Palmer 38127* (NY). Gunnison Co.: Crested Butte, 8 mi NE of Gothic, *Booth 49c334* (WTU). Larimer Co.: 2 mi below Bear Lake, Rocky Mountain National Park, *Furlow 308* (MSC). Ouray Co.: Red Mountain road S of Ouray, *Underwood & Selby 280* (NY). IDAHO. Bonneville Co.: 17 mi SW of Victor, Targhee National Forest, *Furlow 277* (MSC). Elmore Co.: Sawtooth Primitive Area, along stream 7 mi S of Spangle Lakes, *Hitchcock & Muhlick 10171* (NY, WTU). Idaho Co.: 6 mi SW of Lolo Pass, Clearwater National Forest, *Furlow 285* (MSC). Lewis Co.: Cottonwood Canyon, *Mulford s.n.*, June 14, 1892 (NY). MONTANA. Flathead Co.: along Logan Creek 10 mi NE of Lake McDonald, Glacier National Park, *Furlow 274* (MSC); Columbia Falls, *Williams 405* (MSC, NY). Missoula Co.: Missoula, *Elrod 2* (NY). Park Co.: Livingston, along Yellowstone River, *Mason 3506* (UC). NEVADA. Douglas Co.: Edgewood, Lake Tahoe, at California line, *Keck 5526* (UC). Lyon Co.: Carson Creek Cañon, *Brandegee s.n.*, without date (UC); Carson City, *Watson 1090* (US). Storey Co.: 2–3½ mi SW of Virginia City, *Allen 514* (A, NY). Washoe Co.: 8 mi W of Reno Hot Springs, *Archer 5474* (DAO); Hunter Creek Canyon, *Kennedy s.n.*, Apr. 5, 1901 (UC). NEW MEXICO. Catron Co.: upper Willow Creek drainage, Mogollon Range, 60 mi NW of Silver City, 18 mi E of Mogollon, *Band 256* (WTU). San Juan Co.: 7 mi NW of Washington Pass near E base of Chuska Mts., *Watson s.n.*, Aug. 27, 1958 (ARIZ). San Miguel Co.: low woods along Pecos River, Pecos, *Drouet & Richards 3312* (F). Crook Co.: Strawberry Range, Blue Mountains, between Mitchell and Prineville, *Mason 3550* (UC). Harney Co.: opposite Tumtum Lake, 7.6 mi S of Fields, *Ferris 12851* (UC). R. & Blue Mts., *Nuttall s.n.*, without date (GH). UTAH. Salt Lake Co.: Murray, *Jones s.n.*, Apr. 11, 1917 (UC). Sevier Co.: head of Salina Canyon, *Jones 3429* (MSC, NY, UC). Wasatch Co.: along bank of small stream W of Strawberry Res., *Foster 268* (NY). WASHINGTON. Chelan Co.: lower end of Lake Chelan, *Sudworth s.n.*, Oct. 2, 1904 (US). Spokane Co.: base of Mt. Carleton (Mt. Spokane), *Kreager 226* (NY, UC, WTU). Stevens Co.: 28 mi E of Colville on hillside above Little Pend Oreille Lake, *Beattie 11682* (NY). Yakima Co.: Surveyor's Creek, Toppenish, *Heidenreich 26* (WTU). WYOMING. Albany Co.: Medicine Bow National Forest, W of Eagle Rock, *Holliday 34* (RM). Park Co.: Yellowstone National Park, Soda Butte Creek, *Nelson & Nelson 5868* (NY, RM, WTU). Teton Co.: Two Ocean Lake, *Churchill s.n.*, July 20, 1958 (MSC).

This taxon differs from ssp. *rugosa* mainly in the coarser teeth of its leaves, its larger, more tree-like habit, its lighter bark with less-conspicuous lenticels, and its montane riparian habitat. Although variable, it is not as much so as ssp. *rugosa*. In the North it occurs nearly at sea level, but it is found primarily in the mountains throughout most of its range.

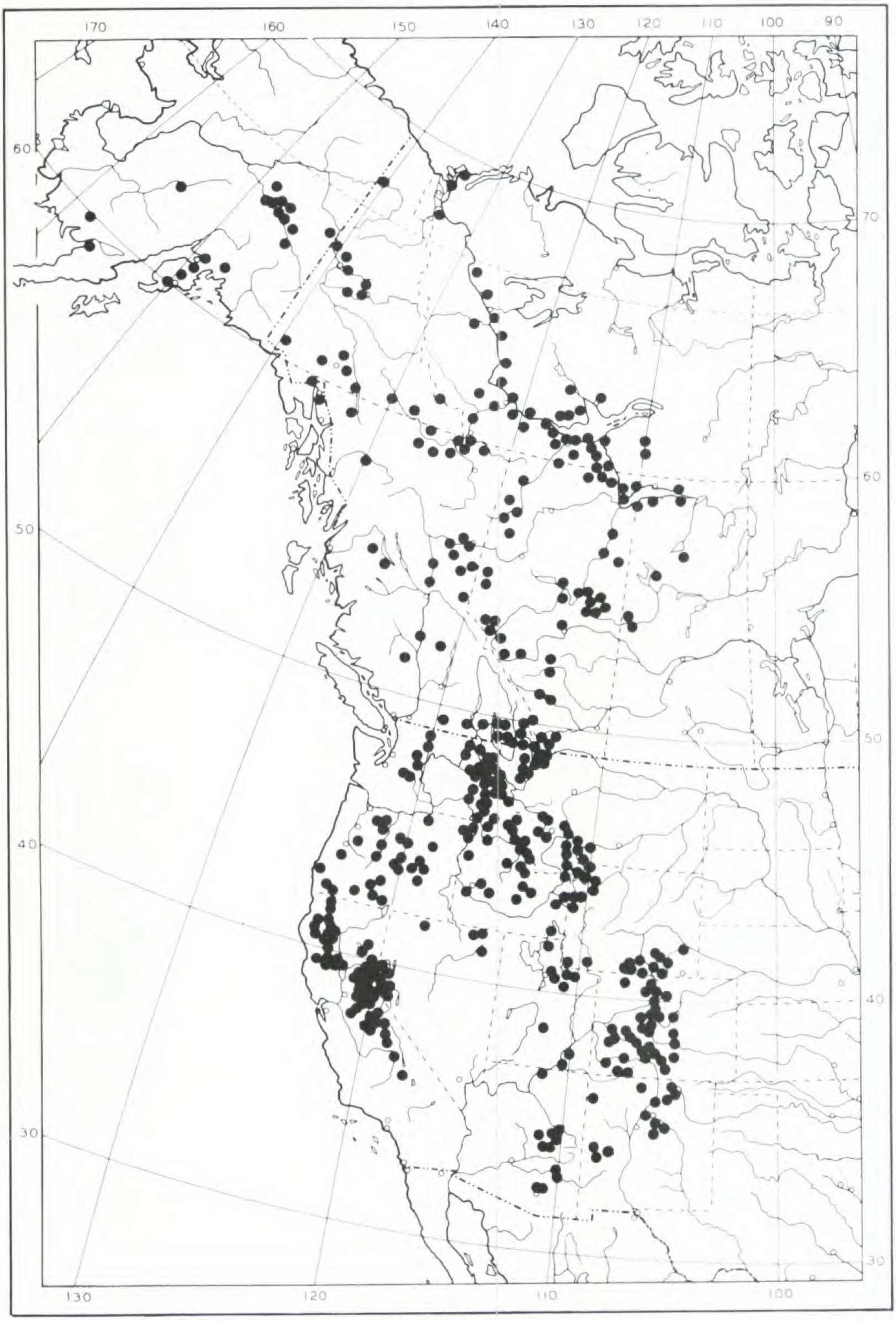

Figure 50. Distribution of *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung in North America.

In 1940, Muller described what he thought to be a new species of *Alnus, A. densiflora,* based on a specimen collected in the Sierra Nevada Mountains of Nevada, noting that the staminate flowers were borne in very "compact" inflorescences. The type of this species (*Allen 514*) is a specimen of typical *A. incana* ssp. *tenuifolia,* the crowded staminate inflorescences being merely the unexpanded catkins of the following season, although it is clear from Muller's description that he thought them to be in anthesis (in September).

Hitchcock, in his recent treatment of this taxon (Hitchcock *et al.*, 1964), views all of *Alnus incana* in North America as belonging to one subspecies and the European material to another, the eastern and western North American segments being treated as varieties. From the degree of divergence among these taxa, however, especially between the eastern and western New World forms, it seems better to consider them all of the same rank (cf. Hultén, 1967, 1971).

The only other taxa with which *Alnus incana* ssp. *tenuifolia* could be confused in its normal range are *Alnus rhombifolia* and *A. oblongifolia,* with which it sometimes occurs sympatrically. In leafless material, these species can usually be distinguished from *A. incana* by the buds, which are more rounded at the apex and more completely covered by the bud scales in *A. incana.* Flowering material can be determined by the number of stamens and by the fact that the stamens are shorter than the perianth only in *A. incana* ssp. *tenuifolia.*

Several floras (including Gleason, 1963, and Gleason & Cronquist, 1963) state that the range of *Alnus incana* ssp. *tenuifolia* extends east to Minnesota and North Dakota. No material was seen from that area, however, that could be referred to this subspecies (all being *A. incana* ssp. *rugosa*). Although no material of *A. incana* ssp. *tenuifolia* was seen from Mexico, it might be expected to occur there in the area adjacent to its range in Arizona and New Mexico. Gleason (1963) and Gleason and Cronquist (1963) state that this taxon exists in Baja California.

7. **Alnus serrulata** (Aiton) Willdenow

Alnus serrulata (Aiton) Willdenow, Sp. Pl. ed. 4, **4**(1): 336. 1805; *Betula serrulata* Aiton, Hort. Kew, **3:** 338. 1789; *Betula alnus serrulata* (Aiton) Michaux, Fl. Bor. Amer. **2:** 181. 1803; *Alnus serrulata—α: vulgaris* Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841; *Alnus glutinosa δ serrulata* (Aiton) Regel, Mem. Soc. Nat. Mosc.

13(2): 164. 1861, in part; *Alnus glutinosa δ serrulata* lusus a. *genuina* Regel, Mem. Soc. Nat. Mosc. **13**(2): 164. 1861; *Alnus serrulata α genuina* Regel, Bull. Soc. Nat. Mosc. **38**(3): 432. 1865; *Alnus rugosa* var. *β. serrulata* (Aiton) Winkler, Pflanzenreich **19**(4.61): 120. 1904; *Alnus serrulata* var. *vulgaris* Fernald, Rhodora **47:** 358. 1945; *Alnus incana* var. *serrulata* (Aiton) Boivin, Le Nat. Canad. **94:** 651. 1967. TYPE: "nat. of Pennsylvania. Cult. 1769 by Peter Collinson, Esq." (BM?, not seen).

Alnus carpinifolia Desfontaines ex Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841, *pro syn.*

Alnus maritima hort. ex Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841, *pro syn.*

Alnus rubra Desfontaines ex Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841, *non* Bongard, Mem. Akad. Sci. St. Petersb. ser. 6, **2:** 162. 1833, *pro syn.*

Alnus serrulata—β : macrophylla Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841; *Alnus macrophylla* Desfontaines ex Spach, Ann. Sci. Nat. ser. 2, **15:** 206. 1841, *pro syn.*

Alnus rubra Tuckerman, Amer. Jour. Sci. ser. 2, **45:** 32. 1843, *non* Bongard, Mem. Akad. Sci. St. Petersb. ser. 6, **2:** 162. 1833.

Alnus latifolia Desfontaines ex Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 336. 1851, *pro syn.*

Alnus glutinosa δ serrulata lusus b. *obtusifolia* Regel, Mem. Soc. Nat. Mosc.**13**(2): 165. 1861; *Alnus serrulata δ obtusifolia* (Regel) Regel, Bull. Soc. Nat. Mosc. **38**(3): 433. 1865; *Alnus rugosa* var. *obtusifolia* (Regel) Winkler, Pflanzenreich **19**(4.61): 120. 1904. TYPE: "gesehen vom Ohio und in kultivirten Exemplaren" (not seen).

Alnus americana hort. ex Petzold & Kirchner, Arb. Musc., p. 597. 1864, *non* Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 337. 1851.

Alnus obtusifolia Mertens ex Regel, Mem. Soc. Nat. Mosc. **13**(2): 165. 1861, *pro syn.*

Alnus noveboracensis Britton, Torreya **4:** 124. 1904; *Alnus serrulata* var. *vulgaris* f. *noveboracensis* (Britton) Fernald, Rhodora **47:** 358. 1945. TYPE: *Britton s.n.*, New York, Grant City, Staten Island (HOLOTYPE, NY!).

Alnus undulata hort. ex Winkler, Pflanzenreich **19**(4.61): 119. 1904, *pro syn.*

Alnus serrulata var. *subelliptica* Fernald, Rhodora **47:** 358. 1945. TYPE: *Fernald & Bartlett 16*, "Massachusetts: sandy swamp, Tewksbury, April 14 and Oct. 14, 1906" (HOLOTYPE, GH!; ISOTYPES, CAN!, F!, NY!, US!, WIS!). Figure 51.

Alnus serrulata var. *subelliptica* f. *emarginata* Fernald, Rhodora **47:** 359. 1945. TYPE: *Bissell & Weatherby* (*Weatherby 2031*), "Connecticut: open, rather sphagnous swamp, Rainbow, Windsor, Hartford Co., Sept. 16, 1906 and April 6, 1907" (HOLOTYPE, GH!).

Alnus serrulata var. *subelliptica* f. *mollescens* Fernald, Rhodora **47:** 359. 1945. TYPE: *St. John 2681*, "New York: wet hollow. Riverbed, Southampton. Suffolk Co., July 25-Aug. 3, 1920" (HOLOTYPE, GH!).

Alnus serrulata var. *subelliptica* f. *nanella* Fernald, Rhodora **47:** 360. 1945. TYPE: *Fernald & Lewis 14596*, "Virginia: Ram Hole Swamp, Seward Forest, near Triplett, Brunswick Co., June 22 and Sept. 13, 1944" (HOLOTYPE, GH!; ISOTYPES, PH!, US!).

Compact shrubs up to 10 (–14) m in height; trunks up to 16 cm in diameter, ascending; bark light gray, smooth to slightly rough, the lenticels inconspicuous; young stems light brown to dark red-brown, dull, often slightly to moderately glaucous, without noticeable resinous coating, not differentiated into long and short shoots, without longitudinal ridges; internodes glabrous to velutinous, moderately to densely glandular; nodes and branchlets bearing inflorescences very densely glandular; hairs whitish to yellowish or brownish; glands small to medium in size, yellowish to dark brown; lenticels of twigs circular to elliptic, 0.3–0.6 mm long, 0.2–0.4 mm wide, yellowish, inconspicuous; leaf scars 0.7–3 mm high, 1.5–2.5 mm wide, the bundle scars moderately prominent. Buds ellipsoid to obovoid, slightly rounded to rounded at the apex, moderately to heavily resin-coated; stalk 1.5–3 mm long, 1–1.5 mm in diameter, sparsely to moderately pubescent, densely glandular; body 3–6 mm long, 2–3 mm in diameter; bud scales 2, stipular, equal, valvate, moderately pubescent, glandular; pubescence and glands usually obscured by the resin coat. Leaves usually elliptic or obovate (rarely ovate); apex obtuse to rounded (rarely acute); base broadly cuneate (sometimes rounded); blade (4–) 5–9 (–14.5) cm long, (2–) 3.5–6.5 (–7.5) cm wide, medium to dark green and dull to moderately lustrous above, light to medium green or green-brown and dull below, chartaceous to somewhat coriaceous; margin flat to slightly revolute, slightly to moderately thickened, serrulate to somewhat double-serrate; major teeth (when present) (5–) 7–18 (–22) mm apart at mid-leaf, less than 2 mm deep, irregular; secondary teeth (5–) 7–11 (–15) per cm, 0.1–0.8 (–1) mm deep, regular to slightly uneven; adaxial surface glabrous to sparsely pubescent, moderately to densely glandular; abaxial surface and veinlets glabrous to moderately villous, moderately to densely glandular, slightly to moderately resin-coated; major veins and vein axils near the base tomentose to wooly-pubescent; pubescence whitish to yellowish; glands small to medium in size, whitish to yellowish or brownish. Lateral veins 8–11, (3–) 4–8 (–10) mm apart at mid-leaf, straight or slightly ascending, sometimes branching once again, especially near the base, terminating in teeth at the margin; cross veins between lateral veins poorly (to rarely well) developed. Petioles (2–) 6–15 (–22) mm long, 0.5–1.5 (–2) mm in diameter, glabrous, moderately villous, or tomentose, sparsely to moderately glandular. Stipules elliptic to

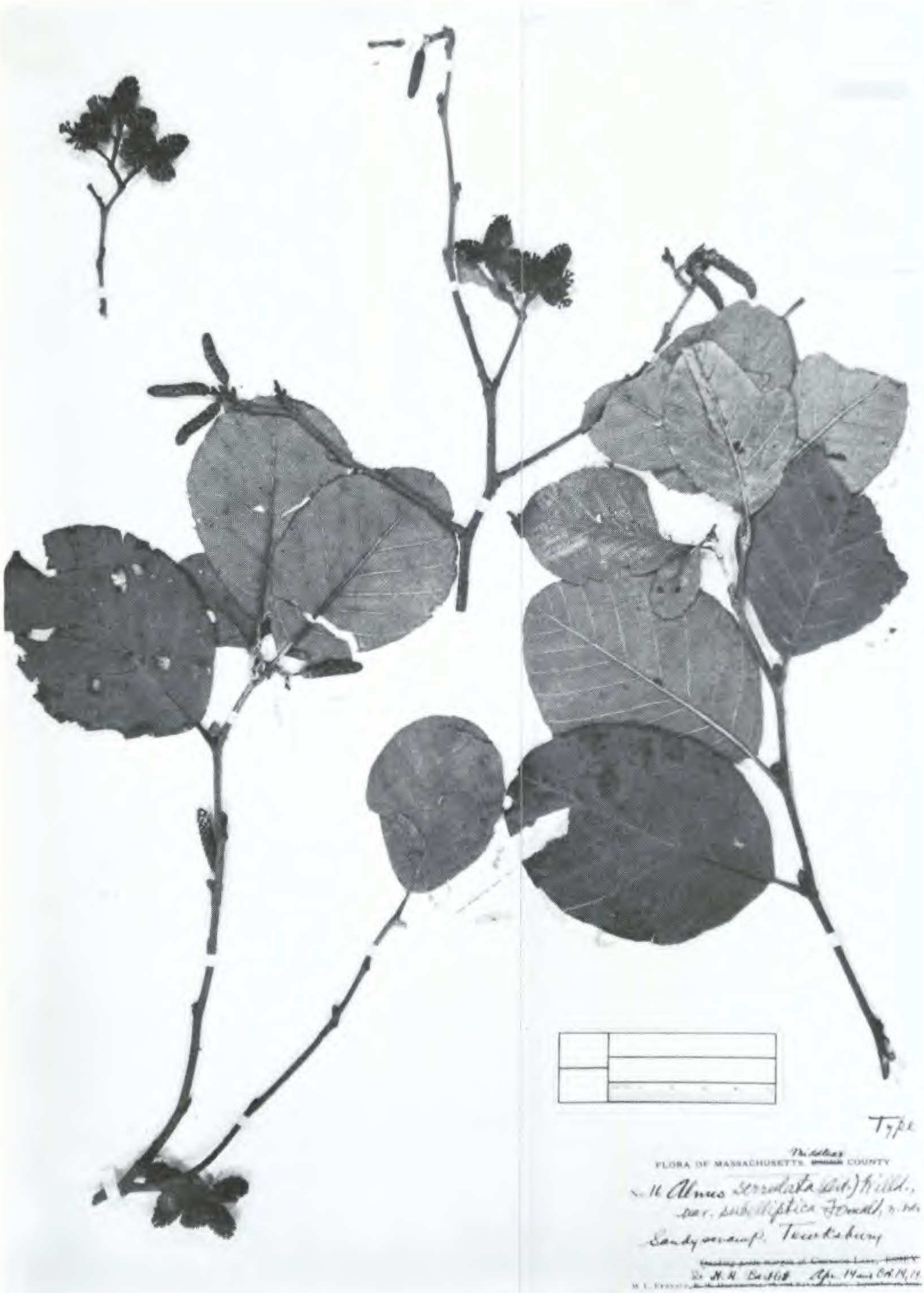

Figure 51. Specimen of *Alnus serrulata* (Aiton) Willdenow. Holotype of *Alnus serrulata* var. *subelliptica* Fernald.

Figure 52. Representative specimen of *Alnus serrulata* (Aiton) Willdenow.

obovate, the apex obtuse to rounded, 2.5–5.5 mm long, 1.6–3 mm wide, green to light brown, glabrous to moderately villous, the hairs yellowish, moderately glandular, the glands pale yellow. Pistillate inflorescences borne in racemose clusters of (2–) 3–5 on short non-strongly-divergent branchlets, produced during the previous growing season, erect, ovate to elliptic, at anthesis 3–6 mm long, 1.5–2.5 mm in diameter, on peduncles 0.5–2 (–3) mm long, 0.8–1 mm in diameter; staminate catkins borne in one or more racemose clusters of 3–5 at the end of the main branch above the pistillate inflorescences, this branch usually strongly divergent, bending sharply away from the main axis, produced during the previous growing season, pendent during dormancy and anthesis, at anthesis 3–8.5 cm long, 4–10 mm in diameter, on peduncles 1.5–8 mm long, 0.5–1.2 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers 3 per bract; perianth of 4 parts, these elliptic to obovate, the apex obtuse to rounded, 0.7–1.1 mm long, 0.3–1.1 mm wide, the margin lined with minute glands; stamens 4, opposite and basally adnate to the perianth parts, usually appearing much longer than the perianth, the filaments 0.6–0.9 mm long, the anthers 0.8–1.1 mm long and 0.8–1 mm in diameter, the thecae separate for 15–40% of their length. Infructescences ovoid to ellipsoid, 10–17 (–22) mm long, (6–) 8–11 mm in diameter; on peduncles 0.2–5 (–8) mm long, 0.8–1.2 mm in diameter; scales 3–4.5 mm long, 3–4 mm wide at the apex, 0.8–1 mm wide at the base, the apex moderately thickened, flat, the terminal lobe-tip acute and somewhat to very extended. Fruits narrowly winged or wing-margined, brown; body obovate, 2.2–3.3 mm long, 1.2–2 mm in diameter; wings 2–2.5 mm long, 0.2–0.5 mm wide, firm to coriaceous; persistent styles 0.7–1.4 mm long. Figures 2C, 4D, 8D, 18C, 22 E, 23A, 51, and 52.

DISTRIBUTION AND HABITAT: South-central Quebec east to southern Nova Scotia, southwest to northern Ohio and Indiana, central Missouri and eastern Oklahoma, south to the Gulf of Mexico and northern Florida. Streambanks, edges of sloughs, swampy fields, margins of bogs, and lake shores from near sea level to elevations of about 750 meters in the Appalachian and Ozark highlands. Figure 53.

COMMON NAMES: Smooth alder, common alder, hazel alder (erroneously), tag alder, red alder.

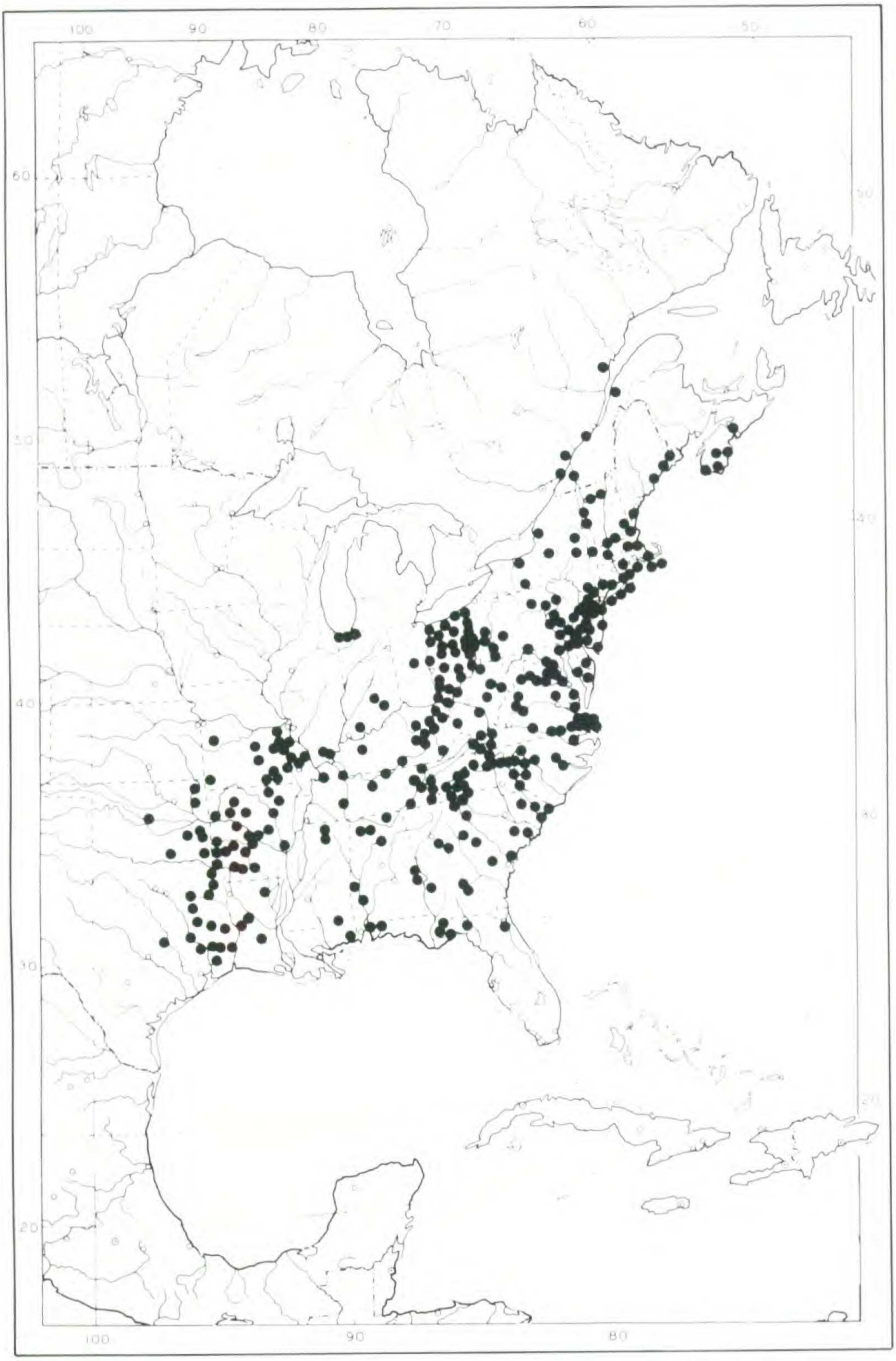

Figure 53. Distribution of *Alnus serrulata* (Aiton) Willdenow.

REPRESENTATIVE SPECIMENS: **Canada.** NOVA SCOTIA. Lunenburg Co.: outlet of Wallace Lake near Italy Cross, *Donly 876* (DAO). Queens Co.: Ponhook Lake, *Smith et al. 10323* (DAO). Yarmouth Co.: Butler's Lake, Gavelton, *Fernald et al. 21021* (GH). QUEBEC. Chambly Co.: Chambly, *Cleonique 5001* (DAO). Lotbiniere Co.: Lotbiniere, rivages du Saint-Laurrent, *Marie-Victorin et al. 56117* (CAN). Temiscouata Co.: Lac Naud, *Blouin et al. 7006* (DAO). **United States.** ALABAMA. Baldwin Co.: E shore of Mobile Bay at Battles Warf, *Brinker 338* (MO). Franklin Co.: vicinity of Russellville, *James 46* (MO). Russell Co.: 11 mi W of Phoenix City, *Furlow 346* (MSC). ARKANSAS. Hot Springs Co.: Magnet Cove, *Demaree 16650* (NY). Pike Co.: banks of Little Mo. River, New Hope, *Demaree 9749* (NY). Pulaski Co.: Little Rock, *Hasse s.n.*, Apr. 20, 1860, Aug., 1860 (NY); along Broadie Creek, near Little Rock, *Merrill 1465* (MO). Yell Co.: Ola, creek bottoms, *Demaree 18227* (MO). CONNECTICUT. New Haven Co.: Waterbury, Cooke St., *Lucian W. 4* (NY). New London Co.: Norwich, *Setchell s.n.*, Mar. 19, 1883, Aug. 22, 1883 (UC). DELAWARE. New Castle Co.: region about Newark, *Tidestrom 3104* (MICH). Sussex Co.: moist thicket near Georgetown, *Britton 13* (NY); 4 mi S of Milford, near the W shore of Hudson's Pond, *Furlow 247* (MSC). DISTRICT OF COLUMBIA. At edge of natural woods in U.S. Nat. Arboretum, *Mazzeo 1170* (WTU); common at Terra Cotta, *Tidestrom 4337* (NY). FLORIDA. Gadsden Co.: along a very small stream 19 mi W of Tallahassee, *Godfrey 52793* (GH, NY). Jefferson Co.: 1 mi E of Lloyd, *Godfrey 55316* (NY). Wakulla Co.: near the Sopchoppy River, about 5 mi N of Sopchoppy, *Godfrey 55213* (GH, WTU). GEORGIA. Clark Co.: just S of Athens, *Duncan 3877* (RM, UC). Randolph Co.: banks of small creek S of Cuthbert, *Harper 1782* (A, F, GH, MO, NY). Wilcox Co.: 11.5 mi S of Abbeville on US rt. 129, *Furlow 345* (MSC). ILLINOIS. Johnson Co.: Tunnel Hill, *Palmer 15176* (MO). Pope Co.: creekbank, Belle Smith Spring, SE of McCormick, *Evers 51637* (WIS). INDIANA. Brown Co.: on the N bank of Salt Creek just E of Belmont, *Furlow 315* (MSC). DuBois Co.: 1 mi N of Bretzville along Ind. rt. 64, *Furlow 316* (MSC). Jackson Co.: in the wet woods about ¼ mi S of Chestnut at the intersection of US rt. 202 and Interstate rt. 89, *Furlow 202* (MSC). NEW JERSEY. Cape May Co.: NE branch of Pond Creek near Ray Road, *Stone s.n.*, Aug. 9, 1918 (MO). Ocean Co.: Barnegat, *Long 22066* (UC). Salem Co.: along Delaware River, N of Penns Grove, *Adams & Adams 1889* (UC). NEW YORK. Oneida Co.: E end of Oneida Lake, *House 27158* (NY, UC, WTU). Richmond Co.: Grant City, Staten Id., *Britton s.n.*, Aug. 3, 1894 (NY). Warren Co.: island in Lake George, *Engelmann s.n.*, Aug. 24, 1856 (MO). NORTH CAROLINA. Buncombe Co.: bordering the Swannanoa River, *Biltmore 1240* (F, NY, RM). Mitchell Co.: Roan Mountain and vicinity, *Meehan et al. s.n.*, July, 1880 (NY). Rowan Co.: China Grove, *Eggleston 4607* (NY); on Dunn's Mountain, *Small s.n.*, Aug. 10–27, 1884 (NY). Wilkes Co.: Blue Ridge Parkway, just S of the intersection with NC rt. 18, *Furlow 210* (MSC). OHIO. Athens Co.: between rt. 124 and the River, 1¾ mi SW of the Washington Co. line, *Herrick s.n.*, July 3, 1956 (OS). Columbiana Co.: rt. 164, 4 mi N of rt. 39, *Herick s.n.*, July 2, 1954 (OS). Hocking Co.: Neotoma, *Wolfe et al. s.n.*, May 26, 1940 (OS). Wooster Co.: in low ground, Wooster, *Duvel 488* (OS). OKLAHOMA. Delaware Co.: open creek bank on Flint Creek, Flint, *Wallis 1945* (OKL). Johnston Co.: along Pennington Creek, NW of Tishomingo, *Goodman 5445* (UC). McCurtain Co.: Broken Bow, along Yanubbee Creek, *Furlow 348* (MSC). PENNSYLVANIA. Dauphin Co.: Harrisburg, *Small s.n.*, Apr. 16, 1888 (F). Lancaster Co.: in the vicinity of Conewago, *Small s.n.*, Sept., 1892 (NY). Lehigh Co.: meadows along Trout Creek E of 12th Ward, Allentown, *Pretz 6107* (UC). Philadelphia Co.: along head of

Cresheim Creek, Mermaid, *Adams & Thebes 1191* (UC). RHODE ISLAND. Newport Co.: N outlet of Middle Quarry Pond, *Collins s.n.*, Oct. 19, 1906 (NY). Providence Co.: Limerock, Lincoln, *Collins 15006* (F). SOUTH CAROLINA. Dorchester Co.: Charleston, *Sargent s.n.*, Feb. 12, 1880 (A). Georgetown Co.: river swamp 14 mi NW of Georgetown, *Godfrey & Tryon 788* (NY, UC). Jasper Co.: 1 mi NW of Gillesonville, *Bell 1672* (UC). TENNESSEE. Campbell Co.: in shallow water, Cove Lake, *Isely 3351* (MSC). Knox Co.: Knoxville, *Kearney s.n.*, Feb. 25, 1893 (F, NY). Lumnen Co.: along brooks W Mitchelville, *Eggert s.n.*, Aug. 17, 1897 (MO). Roane Co.: Harriman, *McMorine s.n.*, Apr. 17, 1893 (DAO). TEXAS. Cherokee Co.: Larissa, *Palmer 8628* (MO). Newton Co.: near Newton, *Nogle s.n.*, Oct., 1961 (F). Polk Co.: Livingston, *Palmer 6766* (MO). VERMONT. Addison Co.: shore of Lake Dunmore, *Dutton s.n.*, Aug. 23, 1908 (MO). Caledonia Co.: Lyndon, *Bartlett 30* (NY). VIRGINIA. Amherst Co.: along Otter Creek, Blue Ridge Parkway, *Freer 2475* (US). Brunswick Co.: Seward Forest, near Triplett, *Fernald & Lewis 14596* (GH, PH, US). Isle of Wight Co.: dry sandy woods S of Zuni, *Fernald et al. 6582* (GH, MO). Prince William Co.: half way between Beverly Mill and Hopewell Gap, E slope of Bull Run Mountains, *Allard 3911* (F, GH, NY). Princess Anne Co.: on the banks of the Dismal Swamp Canal about 7 mi N of the North Carolina state line, *Furlow 207* (MSC). Southampton Co.: Franklin, *Eggleston 4916* (NY). WEST VIRGINIA. Fayette Co.: Gauley Bridge, *Eggleston 5522* (MO, NY). Mingo Co.: near mouth of Little Huff Creek, *Berkley 1042* (MO). Upshur Co.: without location, *Pollock s.n.*, Apr. 13, 1896 (MICH).

The name *Alnus rugosa* has been widely and erroneously used for this species since about the beginning of the nineteenth century, most recently by Ball (1964) in *Flora Europaea*. Since Fernald's (1945b) review of this problem, however, most of the confusion between these two species has been resolved.

The leaves of *Alnus serrulata* are easily recognized by their serrulate margins and elliptic to obovate shape. In other respects, however, herbarium specimens may be difficult to distinguish from *A. incana* ssp. *rugosa,* with which it is sympatric in the northern part of its range. The problem of identification is most difficult when the leaves are absent. A useful feature (employed by Fernald, 1945b, 1950) to distinguish these species is the form of the branchlet bearing the staminate inflorescences. In *A. serrulata* this stem bends abruptly away from the main axis at the point of attachment, while this is not the case in *A. incana* ssp. *rugosa* (Figure 23). However the character is not absolutely reliable and should be used in combination with other distinctive features, including the more globose or rounder-tipped winter buds and lighter-colored bark with less-prominent lenticels. The largest known individual, as noted by Pomeroy and Dixon (1966), occurs near Shreve, Ohio and has a trunk circumference of 50 cm, a height of 14 m, and a spread of 7 m.

When *Alnus serrulata* and *A. incana* ssp. *rugosa* overlap in distribution, they apparently hybridize (cf. Steele, 1961), although an artificial hybrid between these species has not been reported. *Alnus serrulata* var. *subelliptica* Fern. occurs in the region of overlap and may represent part of the putative hybrid swarm found there. Fernald's forms of this variety vary in leaf shape, size, and pubescence.

Alnus serrulata is primarily coastal in distribution, although it also occurs over a considerable portion of non-coastal southeastern North America and at moderate elevations in the Appalachian and Ozark Mountains. Like a number of other species of the Atlantic Coastal Plain, *A. serrulata* occurs disjunctly in the sand dunes of the southern end of Lake Michigan. A gap in its distribution occurs in the Mississippi River delta region (Figure 53). Comparable gaps occur in the distributions of several other southeastern American taxa, including *Toxicodendron toxicarium* (cf. Gillis, 1971) and *Lyonia ligustrina* var. *foliosiflora* (cf. Judd, 1978).

The closest relative of *Alnus serrulata* in North America is *A. incana,* though these species are quite distinct morphologically. *Alnus serrulata* is regarded here as more highly specialized than *A. incana* in its shrubbier habit, obovate leaf form, and serrulate leaf margin. Both species occur in rather similar lowland habitats in eastern North America, though *A. serrulata* is more often found along flowing streams than is *A. incana* and generally occurs in a warmer climate.

8. **Alnus glutinosa** (Linnaeus) Gaertner

Alnus glutinosa (Linnaeus) Gaertner, Fruct. Sem. **2:** 54. 1790; *Betula alnus* α *glutinosa* Linnaeus, Sp. Pl. **2:** 983. 1753; *Betula glutinosa* (Linnaeus) Linnaeus, Syst. Nat. ed. 10, **2:** 1265. 1759; *Alnus glutinosa* (*vulgaris*) Persoon, Syn. Pl. **2:** 550. 1807; *Alnus glutinosa* — α*: vulgaris* Spach, Ann. Sci. Nat. ser. 2, **15:** 207. 1841.

Betula alnus Linnaeus, Sp. Pl. **2:** 983. 1753, in part.

Alnus vulgaris Hill, Brit. Herb., p. 510. 1757, *nom. illeg.*

Broadly pyramidal trees up to 20 (–35) m in height; trunks usually one to several, up to about 0.5 or 0.7 m in diameter; bark dark brown, smooth when young, fissured or broken into shallow plates when older, lenticels moderately conspicuous on smooth stems; young stems green to light reddish-brown, moderately lustrous, usually not glaucous, with a moderately heavy to very heavy

resinous coating, not differentiated into long and short shoots, sometimes with slightly noticeable longitudinal ridges originating at the nodes; internodes glabrous to sparsely pubescent, moderately to densely glandular; nodes and branchlets bearing inflorescences glabrous to sparsely pubescent, very densely glandular; hairs whitish to light brownish; glands usually medium in size, yellowish; lenticels of twigs elliptic to circular, 0.7–1.2 mm long, 0.2–0.5 mm wide, yellowish or whitish, more or less inconspicuous; leaf scars ca. 1.5 mm high, ca. 2.5 mm wide, the bundle scars not prominent. Buds ellipsoid to obovoid, obtuse to rounded at the apex, usually heavily resin-coated; stalk 2–5 mm long, 1.5–2.5 mm in diameter, glabrous to sparsely pubescent, densely glandular; body 6–10 mm long, 2.5–5 mm in diameter; bud scales 2 (–3), stipular, equal, valvate, more or less glabrous, moderately to densely glandular; pubescence and glands usually obscured by the resin coat. Leaves obovate to suborbicular; apex retuse to obcordate (sometimes merely rounded); base obtuse to broadly cuneate (rarely rounded); blade (3–) 4–7.5 (–9) cm long, (2.5–) 3–7 (–8) cm wide, dark green and moderately to very lustrous above, medium green and dull below, chartaceous to coriaceous; margin flat, usually not thickened, double-serrate to denticulate (sometimes deeply lobed in cut-leafed forms); major teeth (5–) 9–15 (–20) mm apart at mid-leaf, 1.5–7 mm deep, regular to irregular; secondary teeth 3–8 per cm, 0.5–1 mm deep, regular to irregular; adaxial surface glabrous to sparsely pubescent, sparsely glandular; abaxial surface and veinlets glabrous to sparsely pubescent, moderately glandular, moderately to heavily resin-coated; major veins and vein axils near the base pilose to densely tomentose; pubescence whitish to brownish; glands small, medium, or large in size, whitish to brownish. Lateral veins (5–) 7–9 (–10), 4–12 mm apart at mid-leaf, usually slightly ascending, sometimes branching once again, especially near the apex, terminating in teeth at the margin; cross veins between lateral veins poorly to well developed. Petioles 7–27 mm long, 1–1.5 mm in diameter, usually sparsely pubescent, moderately to densely glandular. Stipules elliptic to obovate, rounded to obtuse at the apex, 6–9.5 mm long, 3–5 mm wide, medium green, glabrous to sparsely pubescent, the hairs whitish, sparsely to moderately glandular, the glands yellowish to brownish. Pistillate inflorescences borne in racemose groups of 2–4 (–5) on short non-strongly-divergent branchlets, produced during

FLANTS OF OHIO

Alnus glutinosa (L.) Gaertner

FRANKLIN CO.: steep rocky embankment along the east side of Alum Creek just south of the Main St. bridge, Columbus. Others forming a grove on the floodplain downstream. Tree, 30 ft. tall.

John J. Furlow May 25, 1976
No. 491

Beal-Darlington Herbarium
MICHIGAN STATE UNIVERSITY

Figure 54. Representative specimen of *Alnus glutinosa* (Linnaeus) Gaertner.

the previous growing season, erect, ovoid to ellipsoid, at anthesis (3–) 4–5 (–6) mm long, 2–3 mm in diameter, on peduncles 1–6 mm long, 1–1.5 mm in diameter; staminate catkins borne in one or more racemose clusters of 2–5 at the end of the main branch above the pistillate inflorescences, produced during the previous growing season, pendent during dormancy and anthesis, at anthesis 4–12.5 cm long, 4.5–12 mm in diameter, on peduncles 2–11 mm long, 0.7–1.5 mm in diameter; floral bracts 1.5–2.5 mm high, 2–3 mm wide. Staminate flowers 3 per bract, perianth of 4 parts, these generally obovate, the apex rounded, ca. 1.5 mm long, ca. 1.3 mm wide, the margin lined with glands of moderate size; stamens 4, opposite and basally adnate to the perianth parts, usually appearing shorter than to equal in length to the perianth, the filaments 0.5–0.8 mm long, the anthers 1.2–1.6 mm long, 0.8–1.3 mm in diameter, the thecae separate for 30–50% of their length. Infructescences ovoid to ellipsoid, (12–) 16–22 mm long, 10–13 mm in diameter; peduncles 1–22 mm long, 0.5–1.5 mm in diameter; scales 4–5.5 mm long, 4–6 mm wide at the apex, 1.5–2.5 mm wide at the base, the apex moderately thickened, flat to slightly reflexed, the terminal lobe-tip acute to rounded, not usually extended. Fruits narrowly bordered, brown; body obovate, 2.5–3.5 mm long, 2–2.7 mm wide; wing-borders 2.5–3.5 mm long, 0.2–0.5 mm wide; persistent styles 0.5–1.2 mm long. Figure 54.

DISTRIBUTION AND HABITAT: In Europe from central Scandinavia south to southern Spain, Italy, and Asia Minor; in America escaped from cultivation and naturalized from Massachusetts and southern New York, southern Ontario, southern Michigan, and northern Illinois south to southern New Jersey, southern Ohio, and central Illinois. Riverbanks, lake shores, and wet areas. Figure 55.

COMMON NAMES: Black alder, common alder, European alder.

SPECIMENS EXAMINED: **Canada.** ONTARIO. Elgin Co.: Port Burwell, sandy beach, *James 1670* (DAO); shore of Lk. Erie near St. Williams, *James 2148* (DAO). Oxford Co.: along edge of stream, about 3 mi N of Conning, *Soper & Shields 4770* (CAN). **United States.** CONNECTICUT. Hartford Co.: open, rather sphagnous swamp, Windsor, *Weatherby 2031* (US). ILLINOIS. Cook Co.: low ground near Stony Island, Chicago, *Johnson 1474* (US). Piatt Co.: Monticello, *Jones 34385* (UC). INDIANA. Marion Co.: bank of Williams Creek S of the Indiana School for the Blind, Indianapolis, *Furlow 480* (MSC). MASSACHUSETTS. Barnstable Co.: Cape Cod, just E of Brewster, *Furlow 204* (MSC). Norfolk Co.: wet ground, Brookline, *Forbes 17130*

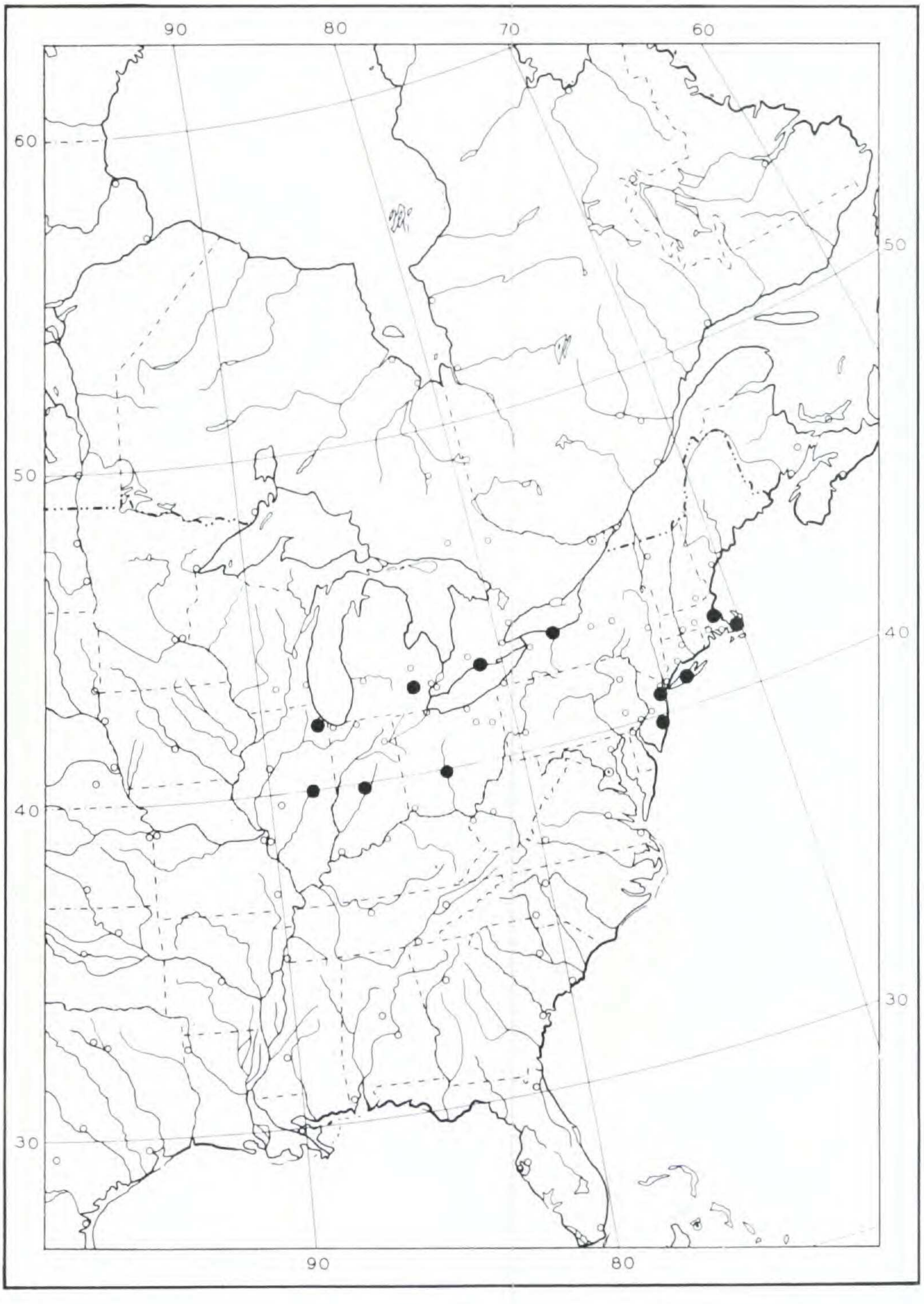

Figure 55. Distribution of *Alnus glutinosa* (Linnaeus) Gaertner in North America.

(WIS); brackish marsh, Brookline, *Forbes s.n.*, Mar. 25, 1904 (MSC); swamp, Beacon St., Brookline, *Forbes s.n.*, Mar. 29 & Sept. 7, 1903 (RM, UC). MICHIGAN. Washtenaw Co.: Dexter-Huron Drive, shoreline of Huron River, *Denton 980* (MSC). NEW JERSEY. Ocean Co.: S tip on the W side of Island Beach, growing in a *Phragmites* swamp, *Bio-Ecology Class* (*Rutgers University*) *s.n.*, Oct. 2, 1955 (DAO). NEW YORK. Monroe Co.: banks of Genesee River, Plymouth Ave., Rochester, *Matthews 4436* (NY); low places along Lake Ontario on Edgemere Dr., *Matthews 4749* (DAO, MSC, RM, UC, WIS). Queens Co.: W side of track to Flushing, L.I., *Schrenk s.n.*, Apr. 5, 1878 (NY). Richmond Co.: Todt Hill, Staten Island, *Britton s.n.*, Sept. 20, 1891 (NY); near Egbertville, Staten Island, *Britton s.n.*, July 18, 1894 (NY). OHIO. Franklin Co.: along Alum Creek near the Main Street Bridge, Columbus, *Furlow 355* (MSC). PENNSYLVANIA. Philadelphia Co.: West Philadelphia, in swamps on Indian Run, *MacElwee 2141* (NY).

Alnus glutinosa is the common alder throughout much of western Europe. In the eastern United States and Canada it is the most frequently cultivated species, and it often escapes and becomes naturalized in that region. The most useful characters for distinguishing this species from the native American taxa include the arborescent habit and the obovate to orbicular leaves with notched tips. *Alnus glutinosa* is the lectotype species of the genus *Alnus*.

Alnus subg. **Alnobetula** (Ehrhart) Petermann

Alnus subg. *Alnobetula* (Ehrhart) Petermann, Deutschl. Fl., p. 516. 1849 (based on *Betula alnobetula* Ehrhart, Bietr. Naturk. **2:** 72. 1788); *Alnus* sect. I. *Alnobetula* (Ehrhart) W.D.J. Koch, Syn. Fl. Germ. Helvet., p. 663. 1837; *Alnobetula* (Ehrhart) Schur, Vehr. Sieb. Ver. Naturw. **4:** 68. 1853; *Alnus* subg. a. *Alnobetula* (Ehrhart) Callier *in* Schneider, Ill. Handb. Laubh. **1:** 120. 1904; *Alnaster* sect. *Alnobetula* (Ehrhart) Murai, Bull. Gov. For. Expt. Sta. Jap. **154:** 62. 1963, not validly published; *Alnus* subg. *Alnaster* sect. *Alnobetula* (Ehrhart) Murai, Bull. Gov. For. Expt. Sta. Jap. **154:** 62. 1963, *pro syn.*; *Alnus* subg. *Alnaster* sect. *Alnobetula* (Ehrhart) Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 32. 1964, not validly published. TYPE: *Alnus viridis* (Villars) Lamarck & De Candolle.

Duschekia Opiz, Oekon. Neuigk. Verhandl. **1839:** 524. 1839. TYPE: *Betula ovata* Schrank (= *Alnus viridis* (Villars) Lamarck & De Candolle).

Alnaster Spach, Ann. Sci. Nat. ser. 2, **15:** 183. 1841; *Alnus* a. *Alnaster* (Spach) Endlicher, Gen. Pl. suppl. **2,** p. 28. 1842; *Alnus* sect. I. *Alnaster* (Spach) Regel, Mem. Soc. Nat. Mosc. **13**(2): 134. 1861; *Alnus* subg. *Alnaster* (Spach) Regel, Bull. Soc. Nat. Mosc. **38**(3): 421. 1865. TYPE: *Alnaster viridis* (Villars) Spach (= *Alnus viridis* (Villars) Lamarck & De Candolle).

Semidopsis Zumaglini, Fl. Pedemont. **1:** 249. 1849. TYPE: *Semidopsis viridis* (Villars) Zumaglini (= *Alnus viridis* (Villars) Lamarck & De Candolle).

Alnus subg. *Alnaster* ser. a. *Virides* Schneider *in* Sargent, Pl. Wilson. **2**(3): 491. 1916; *Alnaster* sect. *Virides* (Schneider) Czerepanov, Notul. Syst. Herb. Inst.

Bot. Kom. Acad. Sci. U.R.S.S. **17:** 94. 1955. TYPE: *Alnus viridis* (Villars) Lamarck & De Candolle.

Alnaster sect. *Virides* ser. *Fruticosi* Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Acad. Sci. U.R.S.S. **17:** 96. 1955. TYPE: *Alnaster fruticosa* (Ruprecht) Ledebour (= *Alnus viridis* ssp. *crispa* (Aiton) Turrill).

Alnaster sect. *Virides* ser. *Sinuati* Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Acad. Sci. U.R.S.S. **17:** 96. 1955. TYPE: *Alnaster sinuata* (Regel) Czerepanov (= *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve).

Small to large spreading shrubs with ascending branches; twigs and young branches differentiated into long stems and short spur shoots; buds sub-sessile, covered with ca. 5 or 6 unequal, imbricate scales. Leaves double-serrate; venation craspedodromous. Pistillate inflorescences borne on long, slender peduncles, each subtended by a leaf (often reduced), in racemose clusters on short shoots along a major branch, the latter bearing the staminate catkins in a racemose arrangement at the apex, the lowermost sometimes subtended by leaves; pistillate inflorescences produced along with new growth at the beginning of the season; staminate inflorescences produced during the previous season and exposed during the dormant season, more or less erect during dormancy, anthesis occurring in spring (at the beginning of new growth), fruit maturation occurring at the end of the current growing season; staminate flowers with 4, or occasionally 5 or 6 stamens. Fruits with 2 large lateral membranaceous wings.

The citation "*Alnus* subgen. *Alnaster* (Spach) Endlicher" is sometimes used for this taxon (cf. Murai, 1964). Endlicher, however, did not specify a rank when he published this name, and the first author to subsequently assign a rank was Regel (1861), who used "*sectio,*" thus establishing Endlicher's name as a section, not a subgenus (cf. Article 35, *International Code of Botanical Nomenclature,* Stafleu et al., 1972). The name *Alnus* subg. *Alnaster* was first published in 1865 by Regel, while *Alnus* subg. *Alnobetula* (with the same type and circumscription) was published earlier, in 1849, by Petermann, making the latter the correct subgeneric name.

9. **Alnus viridis** (Villars) Lamarck & De Candolle

Alnus viridis (Villars) Lamarck & De Candolle, Fl. Fr. ed. 2, **3:** 304. 1805; *Betula viridis* Villars, Hist. Pl. Dauph. **3**(1): 789. 1789; *Alnaster viridis* (Villars) Spach, Ann. Sci. Nat. ser. 2, **15:** 201. 1841; *Semidopsis viridis* (Villars) Zumaglini, Fl. Pedemont. **1:** 250. 1849; *Duschekia viridis* (Villars) Opiz, Seznam Rostl. Kvet.

Ceske, p. 38. 1852; *Alnobetula viridis* (Villars) Schur, Vehr. Sieb. Ver. Naturw. **4:** 68. 1853. TYPE LOCALITY: "en Valgaudemar, en l'Oysans, le Champsaur, &c." (original material not seen).

Alnus alpina Villars, Hist. Pl. Dauph. **1:** 295. 1786, *nom nud.; Betula alpina* (Villars) Borkhausen, Theor.-prakt. Handb. Forstbot. **1:** 477. 1800. TYPE: "la maotagne de Sept-Laux" (original material not seen).

Betula alnobetula Ehrhart, Beitr. Naturk. **2:** 72. 1788; *Alnus alnobetula* (Ehrhart) Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 372, 1851, *pro syn; Alnus alnobetula* (Ehrhart) K. Koch, Dendrol. ed. 2, **2**(1): 265. 1873; *Alnaster alnobetula* (Ehrhart) Schweinfurth ex Ascherson, Fl. Prov. Brandenb. **1:** 622. 1864. TYPE: *Herrenhaufen,* June 1782 (GOET?, not seen).

Betula ovata Schrank, Baiersche Fl. **1:** 419. 1793; *Alnus ovata* (Schrank) Loddiges, Bot. Cab. **12:** no. 1141. 1826; *Duschekia ovata* (Schrank) Winkler Pflanzenreich **19**(4.61): 105. 1904, *pro syn.,* erroneously attributed to Opiz. TYPE LOCALITY: Bavaria (original material not seen).

Spreading shrubs up to ca. 12 m in height; trunks up to 20 cm in diameter, ascending to prostrate, bark light gray to reddish-brown, smooth, covered with prominent whitish or grayish lenticels; young stems medium to dark red-brown, slightly to moderately (or sometimes very) lustrous, not glaucous to highly glaucous, moderately to heavily resin-coated, differentiated into long and short shoots, sometimes with longitudinal ridges originating at the nodes; internodes glabrous to velutinous, sparsely to densely glandular; nodes and stems bearing inflorescences very densely glandular; pubescence whitish to yellowish; glands yellowish to light brown; lenticels of twigs circular to elliptic, 0.2–1.2 mm long, 0.2–1 mm wide, whitish to yellowish, usually very prominent; leaf scars 1–2 mm high, 1.5–3.5 mm wide, the bundle scars inconspicuous to moderately prominent. Buds short-stalked and often appearing sessile, ovoid, acuminate or acute at the apex, moderately to heavily resin-coated; stalk 0.2–2 mm long, 1.5–2 mm in diameter, glabrous to velutinous, densely glandular; body 5–11 mm long, 2–6 mm in diameter; scales ca. 5, unequal in size, glabrous to velutinous, glandular; pubescence and glands usually obscured by the resin coat. Leaves narrowly to broadly ovate or elliptic; apex acuminate, acute, obtuse, or (sometimes) rounded; base acute, obtuse, rounded, or cordate; blade 2–16 cm long, 1.3–13 cm wide, light yellowish green to dark green and dull to lustrous (usually very lustrous when young) above, light to medium green and dull to lustrous below, membranaceous to coriaceous, usually very glutinous; margin non-revolute, often somewhat puckered, slightly to much thickened,

serrulate to coarsely double-serrate; major teeth 3–25 mm apart at mid-leaf, up to 6 mm deep, slightly uneven to regular or irregular; secondary teeth 5–18 per cm, 0.3–3 mm deep, slightly uneven to irregular; adaxial surface glabrous to sparsely pubescent, sparsely to moderately (or rarely densely) glandular; abaxial surface and veinlets glabrous to velutinous, moderately to densely glandular, lightly to moderately resin-coated; major veins and vein axils near the base tomentose to wooly-pubescent; pubescence whitish to yellowish or brownish. Lateral veins 5–12, 2–13 mm apart at mid-leaf, straight or slightly ascending, often branching once or twice again, especially near the base, terminating in major teeth at the margin; cross veins between lateral veins absent or poorly developed. Petioles 3–26 mm long, 0.7–2.5 mm in diameter, glabrous to moderately villous or velutinous, sparsely to densely glandular. Stipules ovate, ovate-oblong, or elliptic; apex acute, obtuse, or rounded; 3–9 mm long, 2–5 mm wide, green or light brown, glabrous to sparsely pubescent, moderately glandular; pubescence whitish to yellowish; glands yellowish. Pistillate inflorescences borne in racemose clusters of 2–10 at the apices of short shoots, the lowermost often appearing somewhat separate from the group and subtended by reduced leaves, produced with new growth in the spring, more or less erect, ovate to cylindric, at anthesis 5–8 mm long, 1.5–2.5 mm in diameter, on peduncles 2–18 mm long, 0.2–0.8 mm in diameter; staminate catkins borne in a single racemose cluster of 2–4 at the end of the main branch above the pistillate inflorescences, produced during the previous growing season, erect during dormancy, pendent at anthesis, at anthesis 2.5–14 cm long, 5–12 mm in diameter, on peduncles 0.2–2 mm long, 0.5–2 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers (2–) 3 per bract; perianth of 4 (–5) parts, these elliptic to obovate, rounded at the apex, 1.1–1.4 mm long, 0.7–1.2 mm wide, with conspicuous medium to large glands along the margin; stamens 4 (or rarely 5), opposite, separate from, and usually appearing much longer than the perianth parts; filaments 0.7–1.7 mm long; anthers 1–1.7 mm long and 0.7–1.3 mm in diameter, the thecae separate for 40–80% of their length. Infructescences ovoid to ellipsoid or cylindric, 8–23 mm long, 4–16 mm in diameter, on peduncles 3–20 mm long, 0.5–1.2 mm in diameter; scales 3–6 mm long, 2.7–4.5 (–6) mm wide at the apex, 0.7–1.7 mm wide at the base, the apex thin to moderately thickened, flat, the terminal lobe-tip

acute and somewhat extended. Fruits winged, light yellowish brown; body elliptic to obovate, 1.7–3.2 mm long, 1.2–2 mm in diameter; wings obovate, extending beyond the apex of the body, 2.5–4 mm long, 0.7–2 mm wide at the widest point, membranaceous; persistent styles 0.3–0.8 mm long.

Alnus viridis has a circumpolar distribution with a gap in northern Europe. Subspecies *crispa* and *sinuata* in northern and northwestern North America, respectively, occur as well in adjacent northeastern Asia, being replaced there to the south by subspecies *maximowiczii* (Callier) Löve & Löve, and to the west by subspecies *viridis*.

This species is perhaps the easiest of our taxa to identify because of its distinctive sub-sessile, multi-scaled buds and long, thin infructescence peduncles. Although most present keys and descriptions state that the winter buds of *Alnus viridis* are sessile, they are, in fact, always at least somewhat short-stipitate. The inflorescences are generally subtended by leaves or leafty bracts, these being narrower, more rounded at the tip, more obovate, and more cuneate at the base than the normal vegetative leaves. This is by far the most glutinous and fragrant-leafed of the American species of the genus.

9a. **Alnus viridis** ssp. **crispa** (Aiton) Turrill

Alnus viridis ssp. *crispa* (Aiton) Turrill, Curtis' Bot. Mag. **173:** tab. 382. 1962; *Betula crispa* Aiton, Hort. Kew. **3:** 339. 1789; *Betula alnus crispa* (Aiton) Michaux, Fl. Bor. Amer. **2:** 181. 1803; *Alnus crispa* (Aiton) Pursh, Fl. Amer. Sept., p. 623. 1814; *Alnus alnobetula* var. ζ. *crispa* (Aiton) Winkler, Pflanzenreich **19**(4.61): 107. 1904; *Alnus viridis* var. *crispa* (Aiton) House, Bull. N.Y. St. Mus. **254:** 271. 1924; *Alnaster crispus* (Aiton) Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Akad. Sci. U.R.S.S. **17:** 96. 1955. *Duschekia crispa* Pouzar, Preslia **36:** 339. 1964. TYPE: "nat. of Newfoundland and Hudson's Bay" (HOLOTYPE, BM).

Alnus undulata Willdenow, Sp. Pl. ed. 4, **4**(1): 336. 1805. TYPE: "habitat in Canada" (B?, not seen).

Alnus viridis α Hooker, Fl. Bor.-Amer. **1:** 157. 1838, *nom. illeg.*

Alnus repens Wormskjold ex Hornemann, Fors. Dansk. Oecon. Pl. ed. 3, **1:** 957. 1821; *Alnus ovata* var. *repens* (Hornemann) Wormskjold ex Lange, Fl. Dan. **16**(46): 12, tab. 2738. 1871; *Alnus ovata* f. *repens* (Hornemann) Kjellman *in* Nördenskjold, Vege. Exp. Vet. Aktt. **2:** 52. 1883; *Alnus alnobetula* var. ε. *repens* (Hornemann) Winkler, Pflanzenreich **19**(4.61): 107. 1904; *Alnus alnobetula* var. a. *typica* f. *repens* (Hornemann) Callier *in* Schneider, Ill. Handb. Laubh. **1:** 121. 1904; *Alnus viridis* var. *repens* (Hornemann) Callier, Fedde Rep. Sp. Nov. **10:** 225. 1911; *Alnus viridis* var. *repens* f. *typica* Callier, Fedde Rep. Sp. Nov. **10:**

225. 1911; *Alnus viridis* I. *typica* d. *repens* (Hornemann) Ascherson & Graebner, Syn. Mitteleur. Fl., p. 415. 1911. TYPE: "Leutenant Wormskiold har fundet den i det sudlige og Prof. Gieseke i det nordlige Gronland" (not seen).

Alnus orbiculata Lopylaie ex Spach, Ann. Sci. Nat. ser. 2, **15:** 201. 1841, *pro syn.*

Alnus mitchelliana Curtis ex A. Gray, Amer. Jour. Sci. **42:** 42. 1842. TYPE: *Gray & Carey s.n.*, in monte Roan dicto, Carolina Septentrionalis, July, 1841 (LECTOTYPE, GH!; ISOLECTOTYPES, MO!, NY!).

Alnus(*Alnobetula*) *fruticosa* Ruprecht, Beitr. Pfl. Russ. Reich. **2:** 53. 1845; *Alnaster fruticosus* (Ruprecht) Ledebour, Fl. Ross. **3**(2): 655. 1850; *Alnus viridis* * *A. fruticosa* (Ruprecht) Nyman, Conspect. Fl. Europ., p. 672. 1881; *Alnus alnobetula* var. *β . fruticosa* (Ruprecht) Winkler, Pflanzenreich **19**(4.61): 106. 1904; *Alnus fruticosa* var. a. *typica* Callier *in* Schneider, Ill. Handb. Laubh. **1:** 121. 1904; *Alnus fruticosa* var. *typica* f. *normalis* Callier, Fedde Rep. Sp. Nov. **10:** 227. 1911; *Alnus fruticosa* var. *typica* forma *vulgaris* Callier, Fedde Rep. Sp. Nov. **10:** 226. 1911; *Duschekia fruticosa* (Ruprecht) Pouzar, Preslia **36:** 339. 1964. TYPE: "in sylvis ad fl. Mesen fere ubique, hic terminus maxime occidentalis videtur fruticis per Siberiam facile totam (v.g. Ircutzk! Baical!) ad Kamtschatkam ins Karaginsk! Unalaschkam! et Sitcham! usque diffusi" (LE?, not seen).

Alnus viridis β sibirica Regel, Mem. Soc. Nat. Mosc. **13**(2): 137. 1861, in part; *Alnus viridis* var. *sibirica* (Regel) Callier, Mitt. Deutsch. Dendr. Ges. **27:** 49. 1918, erroneously attributed to Regel, in part.

Alnus viridis β sibirica lusus a. *communis* Regel, Mem. Soc. Nat. Mosc. **13**(2): 138. 1861, in part.

Alnus viridis β sibirica lusus c. *subglabra* Regel, Mem. Soc. Nat. Mosc. **13**(2): 138. 1861. TYPE LOCALITY: "aus Dahurien, vom Kotzebouesund, aus Kamtschatka, Sitka, Grönland und Labrador" (original material not seen).

Alnus tristis Wormskjold ex Regel, Mem. Soc. Nat. Mosc. **13**(2): 138. 1861, *pro syn.*

Alnus viridis β. parvifolia Regel *in* De Candolle, Prodromus **16**(2): 183. 1868, in part; *Alnus alnobetula* a. *parvifolia* (Regel) Dippel, Handb. Laubh. **2:** 146. 1892, in part; *Alnus alnobetula* var. *θ. parvifolia* (Regel) Winkler, Pflanzenreich **19**(4.61): 107. 1904, excl. American element; *Alnus viridis* var. *parvifolia* Sauter ex Winkler, Pflanzenreich **19**(4.61): 107. 1904, *pro syn.* TYPE LOCALITY: "in alpibus altioribus Helvetiae australis, in alpibus tyrolensibus et in Labrador" (original material not seen).

Alnus ovata var. *repens* f. *macrophylla* Lange, Med. om Gronl. **3:** 280. 1887. TYPE: *Majuola,* Greenland (HOLOTYPE, S).

Alnus fruticosa var. *typica* f. *macrophylla* Callier, Fedde Rep. Sp. Nov. **10:** 226. 1911. Original material not seen.

Alnus mollis Fernald, Rhodora **6:** 162. 1904; *Alnus crispa* var. *mollis* (Fernald) Fernald, Rhodora **15:** 44. 1913; *Alnaster crispa* f. *mollis* (Fernald) Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 36. 1964, *pro syn; Alnus crispa* f. *mollis* (Fernald) Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 36. 1964, *pro syn.* TYPE: *Fernald, s.n.*, Maine, rocky river bank, Orono, May & Aug. 1890 (LECTOTYPE, GH!). Figure 56.

Alnus fruticosa var. *typica* f. *grandifolia* Callier, Fedde Rep. Sp. Nov. **10:** 227. 1911. Original material not seen.

Alnus viridis var. d) *repens* f. 1. *groenlandica* Callier, Mitt. Deutsch. Dendr. Ges. **27:** 48. 1918. TYPE LOCALITY: Grönland, Labrador (original material not seen).

Alnus viridis var. *sibirica* lus. c. *glabra* Callier, Mitt. Deutsch. Dendr. Ges. **27:** 49. 1918, erroneously attributed to Regel (probably intended to refer to *Alnus viridis β sibirica* lusus *subglabra* Regel), *nom. illeg.*

Alnus viridis var. *fernaldii* House, Bull. New York St. Mus. **254:** 271. 1924. Original material not seen.

Alnus crispa var. *elongata* Raup, Jour. Arn. Arb. **17:** 243. 1936. TYPE: *Raup & Abbe 4665,* Alberta, sandy beach on the north shore of Lake Athabasca a few miles west of Sand Point, Sept. 9, 1932 (HOLOTYPE, GH!; ISOTYPES, CAN!, F!, MO!, US!).

Alnus crispa f. *stragula* Fernald, Rhodora **47:** 144. 1945. TYPE: *Pease & Smith 25707,* Quebec, Matane Co., Mt. Logan, July 13, 1923 (HOLOTYPE, GH!).

Alnus crispa var. *harricanensis* Lepage, Le Natr. Canad. **77:** 44. 1950. TYPE: *Dutilly & Lepage 15164,* Quebec, riviere Harricana, sur une ile granitique a environ trois milles en bos de l'embouchure de la riviere Samson, 2 juillet 1946 (HOLOTYPE, CAN!; ISOTYPE, GH!).

Spreading shrubs up to 6 (–9) m in height; trunks ascending to decumbent where the climate is severe, up to ca. 10 cm in diameter; bark light gray, smooth; young stems usually strongly differentiated into long and short shoots, often with prominent longitudinal ridges originating at the nodes; internodes glabrous to velutinous, densely glandular; lenticels of twigs 0.5–1 mm long, 0.3–0.7 mm wide, whitish, often quite conspicuous; leaf scars 1–2 mm high, 1.7–3.5 mm wide, the bundle scars inconspicuous. Leaves broadly to narrowly ovate or elliptic; apex usually obtuse (sometimes acute or rounded); base acute, obtuse, or rounded, sometimes cordate; blade (2–) 3.5–8.5 (–15.5) cm long, (1.3–) 3–6 (–12.8) cm wide, medium to dark green and dull (lustrous when young) above, light to medium green and dull to moderately lustrous below, coriaceous; margin slightly to much thickened, finely double-serrate or serrulate; major teeth (3–) 5–11 (–25) mm apart at mid-leaf, up to 4 mm deep, irregular; secondary teeth (5–) 8–15 (–18) per cm, 0.5–2.5 mm deep, irregular; adaxial surface glabrous to sparsely pubescent, sparsely to moderately glandular; abaxial surface and veinlets glabrous to velutinous, moderately to densely glandular, moderately to heavily resin-coated; pubescence whitish to yellowish or brownish; glands small to medium in size, yellowish to brownish. Lateral veins 7–12, 3–9 (–11) mm apart at mid-leaf. Petioles (3–) 5–15 (–24) mm long, 0.7–1.5 (–2.5) mm in diameter, glabrous to moderately villous or velutinous, sparsely to densely glandular. Stipules ovate, ovate-oblong, or elliptic, the apex obtuse to rounded, 7–9 mm long, 2–5

Figure 56. Specimen of *Alnus viridis* ssp. *crispa* (Aiton) Turrill. Lectotype of *Alnus mollis* Fernald.

Figure 57. Specimen of *Alnus viridis* ssp. *crispa* (Aiton) Turrill.

mm wide. Pistillate inflorescences at anthesis 5–8 mm long, 1.5–2.5 mm in diameter, on peduncles 2–7 mm long, 0.4–0.8 mm in diameter; staminate catkins at anthesis 2.5–9 (–12) cm long, 5–10 mm in diameter, on peduncles 0.2–1 mm long, 0.5–1 (–2) mm in diameter. Filaments of stamens 0.7–1 mm long; anthers 1–1.5 mm long, 0.7–1.3 mm in diameter, the thecae separate for 50–80% of their length. Infructescences 11–15 (–20) mm long, 0.5–1.2 mm in diameter; scales 4–6 mm long, 2.7–4.5 (–6) mm wide at the apex, 0.7–1.2 mm wide at the base, the apex moderately thickened. Fruits winged, light brown; body elliptic to obovate, (2–) 2.5–3.2 mm long, (1.2–) 1.5–2 mm in diameter; wings 2.5–5 mm long, (0.7–) 1–2 mm wide at the widest point; persistent styles (0.3–) 0.6–1 mm long. Figures 2D, 7D, 9D, 13A, 56, and 57.

DISTRIBUTION AND HABITAT: Alaska and adjacent Siberia east to northern Labradór and the southwestern coast of Greenland, south to northern California, south-central Alberta and Manitoba, northern Minnesota, Wisconsin, and Michigan, southern Ontario, central New York, and northern Massachusetts; disjunct populations in south-central Pennsylvania and west-central North Carolina (on the border with Tennessee). Occurring singly or forming dense thickets along streams, lakeshores, coasts, and bog or muskeg margins, or on sandy or gravelly slopes or flats from near sea level in the North to about 2,000 meters in New Hampshire (1,900 meters in North Carolina). Often growing with *Picea, Pinus, Populus, Salix,* or *Betula,* usually in sandy, gravelly, or rocky soil. Figure 58.

COMMON NAMES: Green alder, mountain alder, alder, aulne vert (Quebec).

REPRESENTATIVE SPECIMENS: **Canada.** ALBERTA. 6 mi SSE of Ellscott, *Dumais & Rankin 1002* (CAN); about 1 mi SW of Smith, *Furlow 267* (MSC); Saskatchewan Mountains, SE of Jasper, *Malte 10* (CAN); Saskatoon Mountains near Beaverlodge, Peace River District, *Raup 1941* (DAO); on N shore of L Athabasca just W of Sand Point, *Raup & Abbe 4665* (CAN, F, GH, MO, US); 1 mi N of Kootenay Crossing, *Taylor & Ferguson 2555* (DAO). BRITISH COLUMBIA. Quarantine Lake, about 20 mi W of Victoria, Vancouver Island, *McCabe 5551* (UC); Muncho Lake, Alaska Highway, *Szczawinski s.n.,* July 27, 1962 (DAO). LABRADOR. Flint Island, near Port Manvers, *Bryant 103* (GH); Goose Bay, *Gillett & Findlay 5541* (NY, RM, UC, US, WTU). MANITOBA. 7 mi SW of Lac Du Bonnet, *Breitung 7777* (DAO); Clear Lake, *Heimburger s.n.,* July 27, 1939 (CAN); Whiteshell Forest Reserve, E of Winnipeg, *Scoggan 10606* (CAN). NEW BRUNSWICK. Gloucester Co.: bank along Tete-a-Gouche River, Bathurst, *Blake 5474*

(GH, NY, US). King's Co.: Springfield, *Roberts & Bateman 64–401* (DAO). York Co.: McAdam, *Dore 9839* (DAO). NEWFOUNDLAND. SE of Tompkins, 1 mi N of St. Andrews, Codroy Valley, *Bassett 840* (DAO); Burchy Cove (Curling), *Fernald & Wiegand 3275* (A, CAN, GH, NY); St. John's, *Robinson & Schrenk 24* (CAN, GH, MO, NY). NORTHWEST TERRITORIES. Keewatin District: NW extremity of Nuettin Lake, Little River, 1 mi above mouth, *Harper 2225* (CAN); McConnell R., 7 mi inland from mouth, *MacInnis 42* (DAO); Beralzon Lake, *Scoggan & Baldwin 8366* (CAN). Mackenzie District: Great Bear Lake, Gunbarrel Inlet, *Cody 2852* (DAO); Aklavik, Mackenzie River Delta, *Cody & Ferguson 9680* (DAO); valley of Caribou Hills behind Reindeer Station, *Cody & Ferguson 10442* (DAO); S shore of Mackenzie River 2 mi E of Trout River, *Cody & Matte 8631* (DAO); Yellowknife, N end of Kam Lake, *Cody & McCanse 2166* (DAO); Louise Falls on Hay River, *Lewis 387* (DAO); Moraine Point, Great Slave Lake, *Lewis 469* (DAO); NW shore of Thelon River, ca. 20 mi SW of Hornby Pt., *Rossbach 6435* (CAN). NOVA SCOTIA. Annapolis Co.: Roadside, Lily Lake, North Mountain, *Smith et al. 10521* (CAN). Digby Co.: Centreville, common alder at edge of Midway Lake, *Smith et al. 15450* (DAO). Kings Co.: Newtonville, *Cunningham s.n.*, July 30, 1957 (DAO). Pictou Co.: without location, *Robinson 577* (NY); roadside thickets near Pictou, *Smith et al. 13572* (DAO). Yarmouth Co.: dry fields and clearings near St. John (Wilson's) Lake, *Fernald et al. 23776* (GH). ONTARIO. Algoma District: 12 mi S of Wawa, Lake Superior Prov. Park, *Furlow 309* (MSC). Kenora District: Kenora, *Dudley s.n.*, July 8, 1939 (DAO); Kenora, *Young s.n.*, May 21, 1940 (DAO). Thunder Bay District: Terrace Bay, *Crow 1293* (MSC); 1 mi S of Fort William, *Garton 2492* (DAO). PRINCE EDWARD ISLAND. Prince Co.: O'Leary, borders of second growth woods, *Erskine 1950* (DAO). Queens Co.: Wood Islands, cleared edge of swampy ground, *Erskine 1313* (DAO, NY). QUEBEC. Baie James Co.: Beaver River, islands in, *Baldwin et al. 559* (CAN); Harricanaw Riv., James Bay, *Dutilly & Lepage 15164* (CAN, DAO). Gaspe Co.: Riviere a Claude, *Chrysler s.n.*, Aug. 4, 1935 (US); SW side of Mt. St. Pierre, *Clausen & Trapido 2905* (UC); sea-cliffs, Cap Blanc, Pruce, *Collins et al. s.n.*, Aug. 17, 1904 (GH); rocky baut, Gaspe Bay, *Collins et al. s.n.*, Aug. 25, 1904 (GH); on bank of St. Lawrence River near Ruisseau, Castor, *Cooley & Pease 6727* (GH); on terraces and bluffs, Ste. Anne des Monts, *Fernald & Collins 534* (A, CAN, GH); Allen's Ravine, N slope of Mt. Albert, *Fernald & Collins 585* (GH). Isles de la Madeleine Co.: Amherst, *Johansen s.n.*, July, 1917 (CAN). Kamouraska Co.: Lac Disparu, Ste-Anne-de-la-Pocatiere, *Hamel 573* (DAO). Matane Co.: Razorback Ridge, Mt. Logan, *Pease & Smith 25707* (GH). Mistassini Co.: Riviere Takwa, dans un bois tourbeus le long du premier portage, *Rosseau & Rouleau 940* (GH). Nouveau-Quebec: Baie d'Hudson, *Brisson & Forest 20784* (UC). Riviere-du-Loup Co.: Riviere-du-Loup, 3 mi N de la ville, *Hamel & Payette 837* (DAO); Saint-Epiphane, *Lemieux 7411* (DAO). SASKATCHEWAN. S shore of Lake Athabasca, E of William River, *Argus 446–62* (DAO); Cree Lake, *Maini 201* (DAO, RM); Archibald R., vicinity of Wolverine Pt., L. Athabasca, *Raup 6740* (CAN, NY); 2 mi S of Reserve, *Rowe 234* (DAO). YUKON TERRITORY. Dawson, *Anderson 1578* (NY); Rampart House, *Loan 669* (DAO, UC); Mackenzie River Delta, Aklavik, *Porsild & Porsild 1864* (CAN). **Greenland.** Sydvestgrönland, *Dahl s.n.*, Sept. 17, 1937 (CAN); Groenl. Occid., ca. Neria 61°33′ N lat. bor., *Eugenius s.n.*, June 30, 1928 (CAN); Groenl. Occid., ca. Neria 61°33′ N lat. bor., *Eugenius s.n.*, June 26, 1930 (F, MO, US); Björnedalen v. Ivigtut., *Grontved 736* (CAN, DAO); Torssukatak, *Hansen et al. 1890*

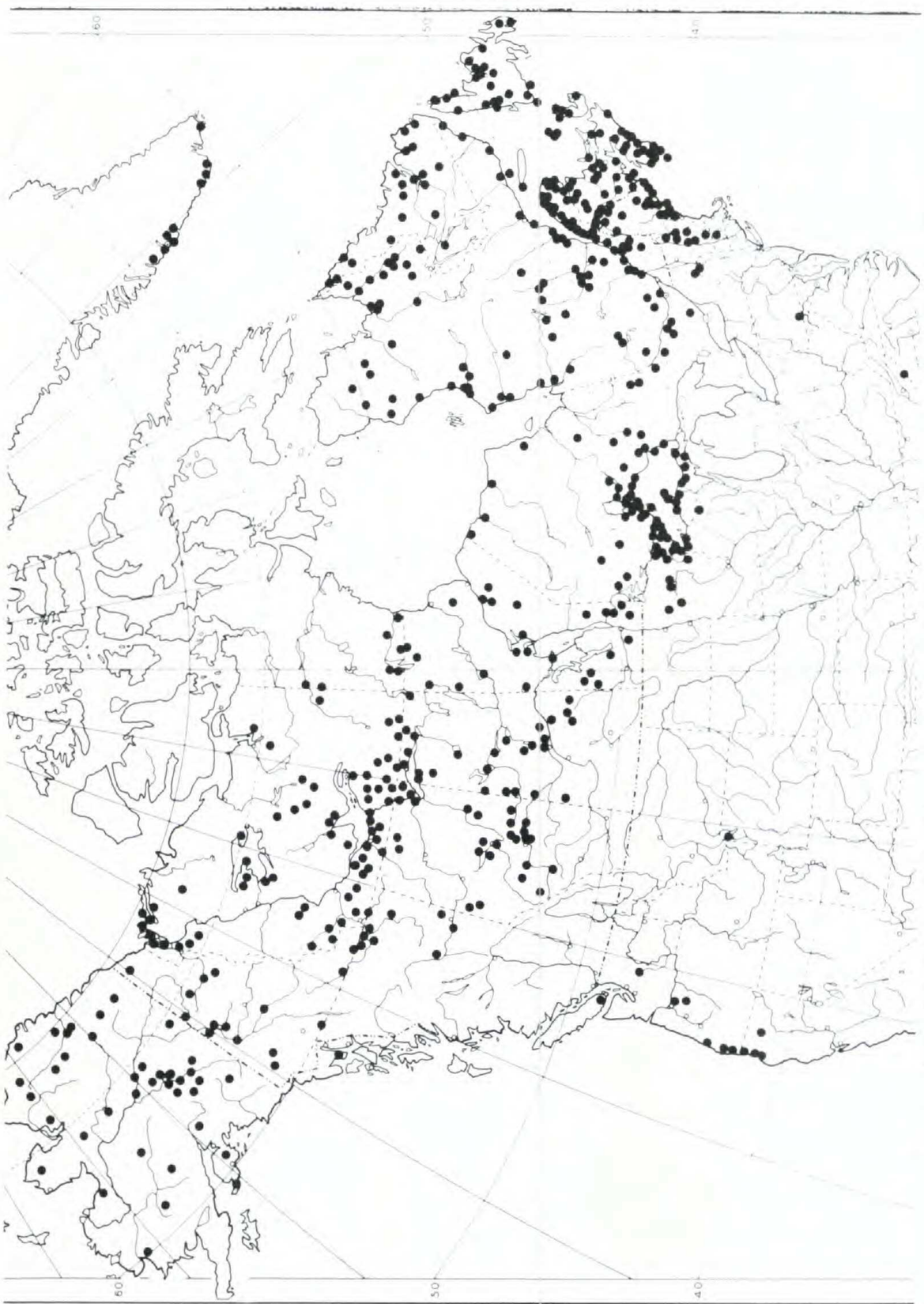

Figure 58. Distribution of *Alnus viridis* ssp. *crispa* (Aiton) Turrill in North America.

(CAN); 64° 12′N Lat., *Lyngl. sn.*, Sept. 6, 1927 (CAN, MO, RM); FREDERIKSHAAB DISTR., *Porsild 7975* (CAN); SYD.-GRONL., Bjornedal. Arsuk-Fjord, *Porsild & Porsild s.n.*, July 13, 1925 (CAN, GH, NY). **United States.** ALASKA. Talkeetna, *Anderson 7620* (CAN); College, University of Alaska Campus, *Anderson s.n.*, Sept. 6, 1971 (MSC); Killik R. valley, *Cantlon 4799* (MSC); Big Delta Camp area, Richardson Highway, *Cody 6254* (DAO); 6 mi E of Delta Junction, *Cody & Webster 4890* (DAO); between Circle and Central Road House, *Cody & Webster 5362* (DAO); Rampart, *Hollich s.n.*, July 10, 1903 (NY); Anchorage area, *York 361* (F). CALIFORNIA. Del Norte Co.: near coast meadows, Crescent City, *Dudley s.n.*, July 1, 1899 (DS); Coopers Flat, Smith River, *Parks & Parks 24152* (DS, NY, RM, UC, WTU); adjacent to S end of Elk Valley, *Tracy 19180* (UC); 1 mi S of Crescent City, *Wolf 9097* (DS, NY). Siskiyou Co.: Spirit Lake, Marble Mts., *Howell 14956* (DS). MAINE. Androscoggin Co.: Norway, *Smith s.n.*, May 1, 1865 (NY). Aroostook Co.: gravelly shores, St. Francis, *Fernald 98* (MSC, NY, RM, UC). Penobscot Co.: rocky river bank, Orono, *Fernald s.n.*, May and Aug., 1890 (GH). MASSACHUSETTS. Franklin Co.: Charlemont, *Churchill & Woodward s.n.*, May 15, 1915 (UC); Shelburne, banks of Deerfield River, *Forbes s.n.*, May 11, 1912 (UC). MICHIGAN. Alger Co.: Pictured Rocks, Lake Superior, *Wheeler s.n.*, Aug. 28, 1900 (MSC). Baraga Co.: tip of Point Abbaye, on maple woods border near lake shore, *Beaman 1829* (MSC). Houghton Co.: edge of pond in Jacobsville Quarry, *Richards 3622* (DAO). Keewenaw Co.: rocky shore of Lake Superior, 3 mi NW of Copper Harbor, *Bennett 33* (F). Schoolcraft Co.: thickets on E bank of Manistique River, 5 mi NW of Blaney Park, *Voss 9935* (MSC). MINNESOTA. Clearwater Co.: Itasca Park, Douglas Lodge, *Grant 3125* (F, MO, NY, UC). Cook Co.: on the Lake Superior shore 1½ mi N of Cascade River, *Furlow 314* (MSC). St. Louis Co.: 18th St. on Minnesota Ave., Duluth, *Lakela 1681* (F, NY, US). NEW HAMPSHIRE. Coos Co.: Mt. Washington at 5500 ft. altitude among rocks at the base of the summit cone and Bigelow's lawn, *Churchill s.n.*, July 10, 1937 (MSC); Tuckerman's Ravine Trail, Mt. Washington, *Eggleston & Eggleston 22353* (NY); upper wall of Tuckerman's Ravine, *Kennedy s.n.*, July 10, 1891 (RM). Grafton Co.: White Mountains, *Chickering s.n.*, July 15, 1877 (F). NEW YORK. Essex Co.: Whiteface Mountain, Adirondacks, *Dore 14274* (DAO); shore of Elk Lake, North Hudson, *House 25957* (UC). NORTH CAROLINA. Mitchell Co.: Roan Mtn., *Alexander s.n.*, June 23, 1939 (NY); Roan Mountain, near the lower edge of the spruce forest zone, *Furlow 251* (MSC); in monte Roan dicto Carolina Septentrionalis, *Gray & Cary s.n.*, July, 1841 (GH, MO, NY); summit Roan, *Gray et al. s.n.*, in 1879 (A); Roan Mountain, *Rydberg 8269* (NY). OREGON. Clackamas Co.: Government Camp Meadow, vicinity of Mt. Hood, *Abrams 11373* (DS). Coos Co.: cliffs at Bandon Beach, *Abrams & Benson 10620* (DS, RM). Curry Co.: in coastal scrub, about 600 ft. back from the ocean, about 7 mi S of Ophir, *Bacigalupi 8976* (JEPS); Cape Blanco, *Ferris & Lorrains 10629* (DS, UC); Brookings, *Kildale 8498* (DS). PENNSYLVANIA. Bedford Co.: ⅜ mi ENE of Martin Hill Fire Tower, *Berkheimer 9883* (UC). TENNESSEE. Carter Co.: Roan Mountain, *Hernandez et al. 11739* (DAO, DS, MSC, NY). VERMONT. Chittenden Co.: Mt. Mansfield, *Pringle s.n.*, June 5 and 6, Aug. 10, 1877 (F, US). Washington Co.: Plainfield, *Eggleston s.n.*, May 20, 1894 (NY). WASHINGTON. Snohomish Co.: Stevens Pass Region, Cascade Mountains, *Grant s.n.*, May, Aug. 1929 (UC). WISCONSIN. Bayfield Co.: along Lake Superior Shore at tip of Bayfield Peninsula, *Voss 10030* (MICH). Douglas Co.: Sauntry Lake, *Wilson 1755* (RM). Vitas Co.: highest ground E of Diamond L., *Fassett 13778* (MO). WYOMING.

Park Co.: S shore of Yellowstone Lake, *Adams s.n.*, Aug. 9, 1871 (US); timber reserve, Crandall Creek, *Rose 287* (US).

This subspecies is often difficult to distinguish from ssp. *viridis* of mountainous central Europe on the basis of herbarium material. However, as noted by Turrill (1962), it possesses a significant number of differences, including taller growth, larger leaves, finer and more regular leaf serrations, longer and more slender petioles, and larger cones. Populations in northeastern Asia (frequently called *Alnus fruticosa*) are continuous with the American members, both in distribution and morphology (cf. Porsild, 1939), and are considered here as belonging to ssp. *crispa*.

In both Europe and America, the names *Alnus alnobetula* and *A. viridis* have been extensively used for this species, but in recent years segregating the New World form as a separate species, *A. crispa,* has been the most common treatment. The unity of *A. viridis* in Europe, America, and Asia seems to be gaining renewed recognition in the literature, however, and the results of the present studies support this view.

The leaves of *Alnus viridis* ssp. *crispa* occurring in Quebec, Ontario, Michigan, and adjacent areas are usually more or less pubescent below (*A. crispa* var. *mollis* Fernald). To the west and south this form passes gradually into the generally glabrous typical form. Other character differences do not correlate with the pubescent extreme, and the variety is therefore not recognized here. To the west, through northern Canada, the leaves become gradually narrower and the habit somewhat taller.

In northwestern North America the ranges of *Alnus viridis* ssp. *crispa* and ssp. *sinuata* overlap, and in this region is found an extremely variable apparent hybrid swarm (cf. Hultén, 1944). Where allopatric, the subspecies are easily distinguished by leaf texture and serration, although vigorous shoots of ssp. *crispa* often have very coarsely-toothed leaves, appearing much like those of ssp. *sinuata*.

Subspecies *crispa* has not heretofore been recognized as occurring in western North America south of northern British Columbia and central Alberta. Actually, it reaches the northern counties of California along the Pacific coast and, farther inland, northwestern Wyoming. Although no specimens from Montana or Idaho could be assigned to this subspecies, many appeared to be intermediate

between it and ssp. *sinuata,* as frequently did specimens from Oregon, Washington, and southern British Columbia, suggesting that the putative hybrid swarm extends much further to the south than previously realized.

Throughout its normal range, *Alnus viridis* ssp. *crispa* occurs either along streams and in other damp places or in somewhat drier habitats. It is often found in rocky or sandy and acid soil, and occurs from low to subalpine elevations, depending on latitude and other ecological conditions. The subspecies occurs disjunctly on the summit of Roan Mountain on the North Carolina-Tennessee border in a population that has long interested American botanists (cf. Gray, 1842; Clarkson, 1960). Recently a second and intermediate disjunct population, lying in southern Pennsylvania, has been noted (Wherry, 1960). The habitat on the summit of Roan Mountain is described in detail by Brown (1941), who gives an account of the climate, soil, vegetational history, etc., together with an analysis of each of the various communities found there. *Alnus viridis* ssp. *crispa* occurs on Roan Mountain on "balds" in the spruce-fir forest occupied also by *Rhododendron* and grasses. The summit is often shrouded by clouds, and it is therefore very humid, a factor which may be important in the maintenance of this relict population so far south of the normal southern limit of its range.

9b. **Alnus viridis** ssp. **sinuata** (Regel) Löve & Löve

Alnus viridis ssp. *sinuata* (Regel) Löve & Löve, Univ. Colo. Stds. ser. Biol. **17:** 20. 1965; *Alnus viridis δ sinuata* Regel, Bull. Soc. Nat. Mosc. **38**(3): 422. 1865; *Alnus sinuata* (Regel) Rydberg, Bull. Torr. Bot. Club **24:** 190. 1897; *Alnus sinuata* var. a. *typica* Callier *in* Schneider, Ill. Handb. Laubh. **2:** 888. 1912; *Alnus fruticosa* var. *sinuata* (Regel) Hultén, Fl. Aleut. Isls., p. 153. 1937; *Alnus crispa* ssp. *sinuata* (Regel) Hultén, Fl. Alaska Yukon, p. 587. 1944; *Alnaster sinuatus* (Regel) Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Acad. Sci. U.R.S.S. **17:** 97. 1955; *Alnus crispa* var. *sinuata* (Regel) Breitung, Canad. Fld.-Natrl. **71:** 51. 1957; *Duschekin sinuata* (Regel) Pouzar, Preslia **36:** 339. 1964; *Alnaster crispa* ssp. *sinuata* (Regel) Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 35. 1964, *pro syn.* TYPE: "in Kamtschatka und dem nordwestlichem Amerika" (LE?, not seen).

Alnus viridis β Hooker, Fl. Bor.-Amer. **1:** 157. 1838, *nom. illeg.*

Alnus viridis β sibirica Regel, Mem. Soc. Nat. Mosc. **13**(2): 137. 1861, in part.

Alnus viridis β sibirica lusus b. *sitchensis* Regel, Mem. Soc. Nat. Mosc. **13**(2): 138. 1861; *Alnus sitchensis* (Regel) Sargent, Silva of N. Amer. **14:** 61. 1902; *Alnus sitchensis* var. a. *typica* Callier *in* Schneider, Ill. Handb. Laubh. **1:** 123. 1904. TYPE: *Mertens* ?, "nur aus Sitka" (LE?, not seen).

Alnus viridis β sibirica lusus d. *kamtschatica* Regel, Mem. Soc. Nat. Mosc. **13**(2): 139. 1861; *Alnus kamtschatica* (Regel) Kudo ex Masamune, Jour. Jap. Bot. **10:** 498. 1934. TYPE: "nur aus Kamtschatka gesehen" (LE?, not seen).

Alnus glandulosa Sargent, Silva of N. Amer. **14:** 62. 1902, *pro syn,* erroneously attributed to J. Richardson *in* J. Franklin, Narr. Journ. Pol. Sea. 1823 (probably mistakenly referring to *A. glutinosa* in that account).

Alnus sitchensis var. b. *kamtschatica* Callier *in* Schneider, Ill. Handb. Laubh. **1:** 123. 1904; *Alnus sinuata* var. *kamtschatica* (Callier) Callier *in* Schneider, Ill. Handb. Laubh. **2:** 888. 1912; *Alnus fruticosa* var. *kamtschatica* (Callier) Komorov, Fl. Peinis. Kamtsch. **1:** 47. 1927; *Alnus kamtschatica* Komorov, Fl. S.S.S.R. **5:** 310. 1936, *non* Kudo ex Masamune, Jour. Jap. Bot. **10:** 498. 1934; *Alnaster kamtschaticus* Czerepanov, Notul. Syst. Herb. Inst. Bot. Kom. Acad. Sci. U.R.S.S. **17:** 96. 1955. TYPE LOCALITY: "nur Kamtschatka" (original material not seen).

Alnus alnobetula var. *η stenophylla* Winkler, Pflanzenreich **19**(4.61): 107. 1904; *Alnus sinuata* var. *stenophylla* Callier, Fedde Rep. Sp. Nov. **10:** 227. 1911. TYPE: *Elmer 365,* Clarkia, Kootenai Co., Idaho (SYNTYPE, B?; ISOSYNTYPE, NY!); *Elmer 887,* Cedar Mts., Latah Co., Idaho (SYNTYPE, B?; ISOSYNTYPE, NY!); *Rydberg & Bessey 3933,* Emigrant Gulch, Mont. (SYNTYPE, B?; ISOSYNTYPES, NY!, RM!); *Sandberg, MacDougal, & Heller 427,* Cedar Mountain, Latah Co., Idaho (SYNTYPE, B?; ISOSYNTYPES, DS!, NY!, US!).

Alnus crispa ssp. *sinuata* var. *laciniata* Hultén, Fl. Alaska Yukon, p. 598. 1944. TYPE: *Hutchison 595,* Kodiak, Pillar Mtn., July 2, 1936 (HOLOTYPE, H).

Spreading shrubs up to 10 m in height; trunks up to 13 cm in diameter, bark light gray to reddish-brown, smooth; young stems usually strongly differentiated into long and short shoots, the spur shoots usually much shorter than those of ssp. *crispa,* without pronounced longitudinal ridges; lenticels of twigs 0.3–1.2 mm long, 0.2–1 mm wide, yellowish; leaf scars 1–2 mm wide, with moderately prominent bundle scars; internodes glabrous (rarely sparsely pubescent), sparsely to moderately glandular. Leaves narrowly to broadly ovate (or sometimes almost elliptic); apex acuminate, acute or obtuse; base rounded to cordate, often oblique; blade (3–) 4–9 (–14) cm long, (2–) 3–7 (–10) cm wide, light (usually yellowish) to medium green and dull to moderately lustrous above, light to medium yellowish green and moderately to very lustrous below, membranaceous to chartaceous; margin slightly thickened, double-serrate; major teeth (6–) 8–13 (–22) mm apart at mid-leaf, up to 6 mm deep, slightly uneven to regular; secondary teeth 6–14 per cm, 0.3–3 mm deep, slightly uneven to irregular; adaxial surface glabrous to sparsely pubescent, sparsely to moderately glandular; abaxial surface and veinlets glabrous to sparsely pubescent, lightly resin-coated; pubescence whitish to yellowish; glands small to medium,

yellowish to brownish. Lateral veins 7–11, (3–) 5–7 (–13) mm apart at mid-leaf. Petioles (4–) 8–16 (–26) mm long, 0.8–1.8 mm in diameter, glabrous to sparsely pubescent, moderately to densely glandular. Stipules ovate, the apex acute, 3–3.5 mm long, 2.3–3 mm wide. Pistillate inflorescences at anthesis 6–8 mm long, 2–2.5 mm in diameter, on peduncles 2–18 mm long, 0.4–0.8 mm in diameter; staminate catkins at anthesis 2.5–13.5 cm long, 5–12 mm in diameter, on peduncles 0.2–2 mm long, 1.2–2 mm in diameter. Stamens with filaments 1.2–1.7 mm long; anthers 1–1.6 mm long, 0.8–1.2 mm in diameter, the thecae separate for 40–50% of their length. Infructescences (10–) 14–20 (–23) mm long, (6–) 8–13 mm in diameter, on peduncles 4–19 mm long, 0.7–1.2 mm in diameter; scales 3–5 mm long, 3.5–4.5 mm wide at the apex, 1–1.8 mm wide at the base, the apex thin to moderately thickened. Fruits light yellowish brown; body elliptic to obovate, 1.7–2.5 mm long, 1.2–2 mm in diameter; wings 2.7–4 mm long, 0.9–1.5 mm wide at the widest point; persistent styles 0.5–0.7 mm long. Figures 3D, 14D, 18D, 22F, and 59.

DISTRIBUTION AND HABITAT: Alaska and adjacent Siberia east to western Yukon Territory, south to northern California, southern Idaho, and northwestern Wyoming. Occurring singly or in open to dense thickets along gravelly or rocky streambanks, lakeshores, and coasts; on moist rocky slopes, outcrops, and avalanche trails; and in open coniferous woodlands from near sea level along the Pacific coast from Alaska to northern California, to the subalpine zone at elevations over 2,500 meters in Montana and Idaho. Often associated with *Picea, Pinus, Salix,* or *Populus.* Figure 60.

COMMON NAMES: Sitka alder, mountain alder, alder.

REPRESENTATIVE SPECIMENS: **Canada.** ALBERTA. The Whistlers, Jasper, *Comte 1658* (MO); Cavell Creek, *Macoun s.n.,* Aug. 17, 1917 (F, NY); Lake Louise, *McCabe 5236* (UC); Banff National Park, 2 mi SW of Eisenhower Junction, *Mosquin & Seaborn 7161* (DAO); Banff, Stony Squaw Mt., *Sanson 1630* (DAO). BRITISH COLUMBIA. A few mi N of Lower Post Alaska Highway, *Calder & Gillett 24470* (DAO, US, WTU); upper Victoria Lake, near S end of Moresby Island, *Calder & Taylor 35789* (DAO); 10 mi NW of Houston on road between Smithers and Burns Lake, *Calder et al. 12863* (UC, WTU); trail to summit of Mt. Arrowsmith, Vancouver Island, *Calder et al. 16421* (DAO); rocky point N of Fraser River, Mission, *Ledingham 49–508* (DAO); Cowichan Lake, *Spreadborough s.n.,* May 24, 1911 (CAN). NORTHWEST TERRITORIES.

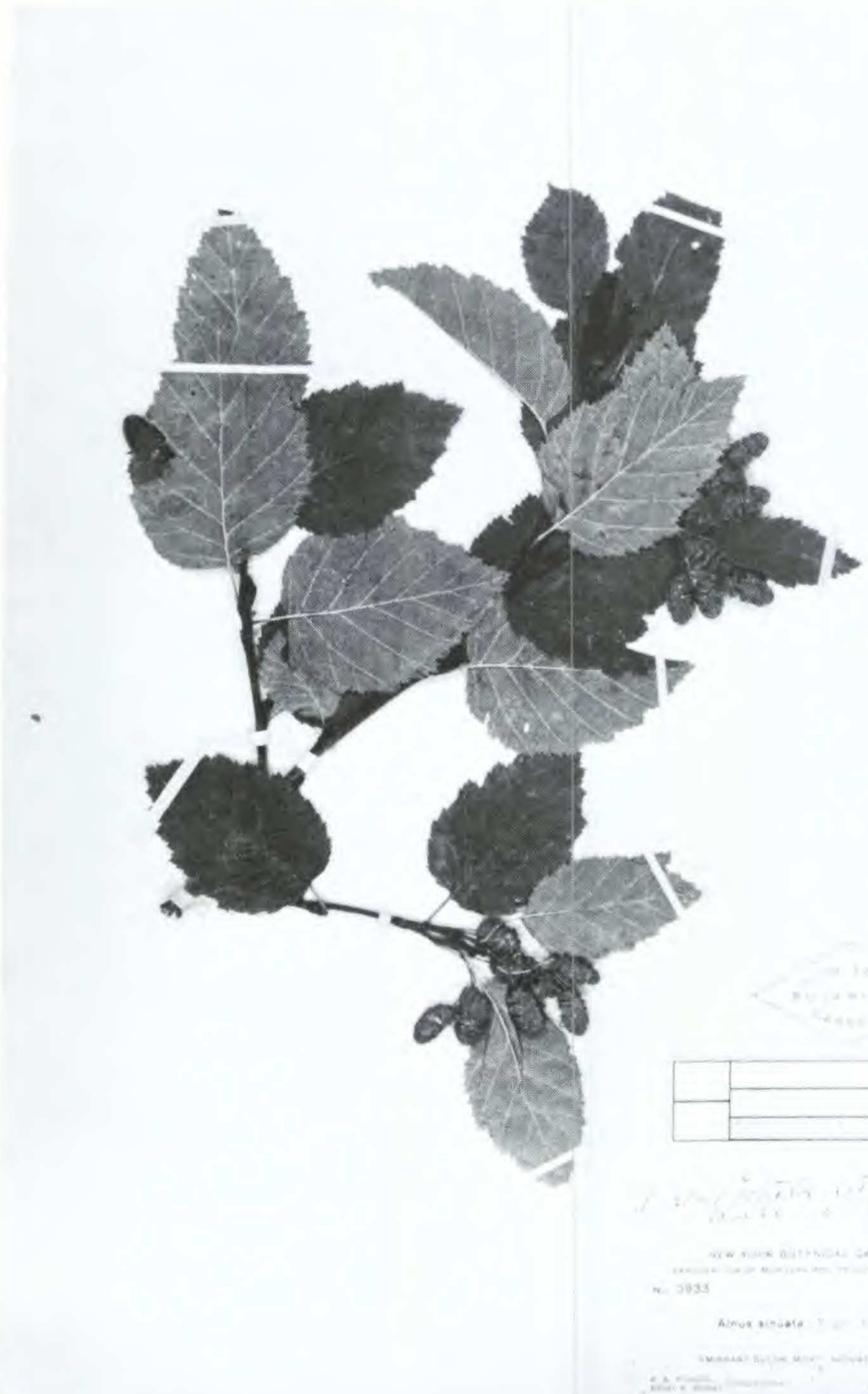

Figure 59. Representative specimen of *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve.

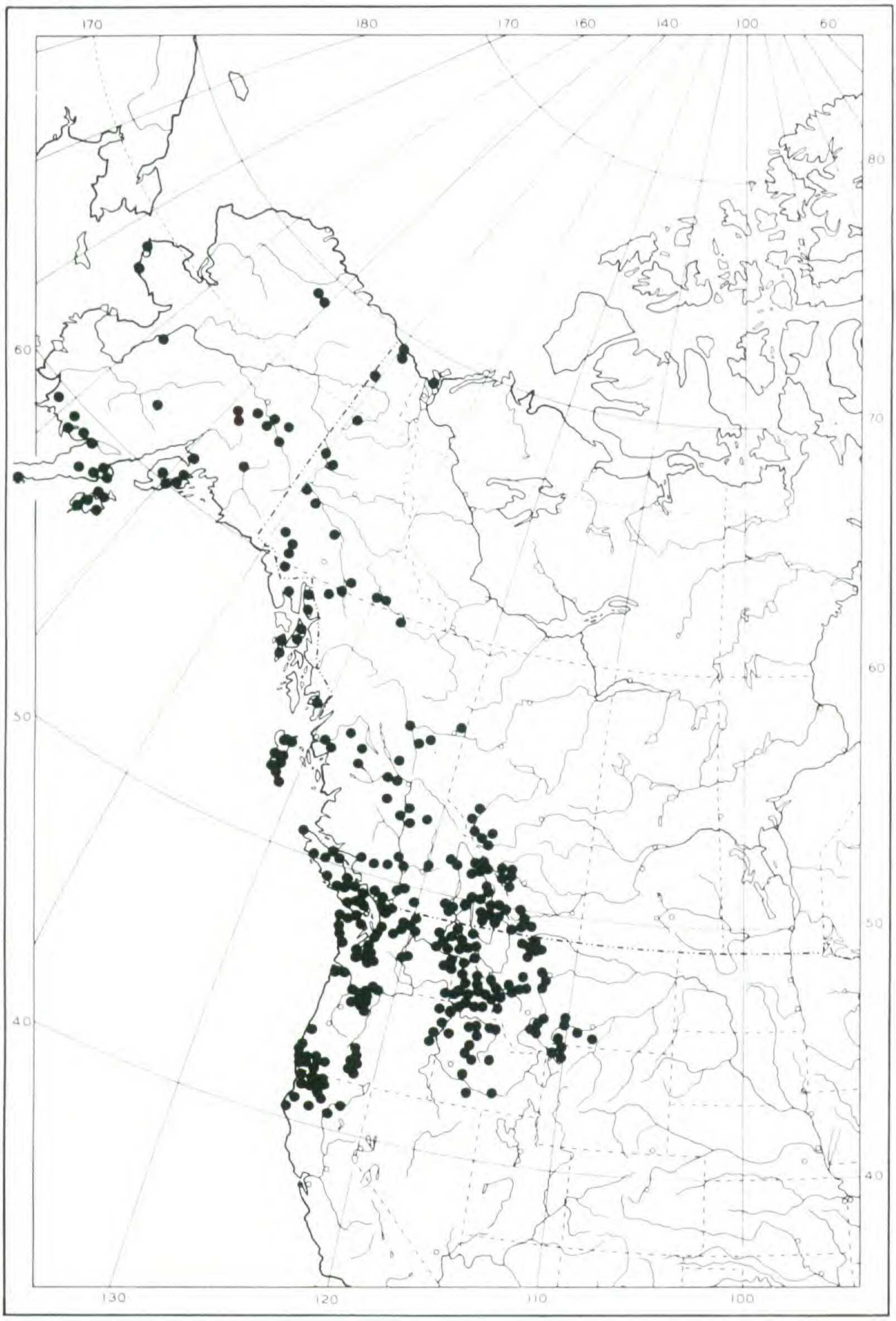

Figure 60. Distribution of *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve in North America.

Mackenzie District: Mackenzie Delta, *Sowan 35* (DAO). YUKON TERRITORY. Moosehide Mtn., Dawson, *Calder & Billard 2879* (DAO); vicinity of Carcross, *Porsild 18460* (CAN). **United States.** ALASKA. Moose Pass, *Anderson 6479* (RM); Fairbanks Quadrangle, end of Ballaine Road at crest of hill, *Argus 435* (DAO, RM); junction of Ukak and Savanoski Rivers, *Cahalane 164* (US); about 1 mi on road to Kenai from Soldatna, Kenai Peninsula, *Calder 4995* (DAO); road from Palmer to Willow, bank of Little Susitna River, *Dutilly et al. 21868* (DAO, US); Washington Bay, Kuiu Island, along seashore, *Eyerdam 8167* (DAO, F); Kodiak Island, Kodiak, *Kincaid s.n.,* July 30, 1899 (CAN); Palmer Creek Road, S of Hope, Kenai Penninsula, *Langenheim 4255* (UC, WTU); between Fire Lake and Eklutna, *Lepage 23048* (DAO); Hyder, river flats, *McCabe 8459* (UC, WTU); Ketchikan Lakes, Revillagigedo Island, *McCabe 8612* (NY, UC); about Anchorage, *Nelson & Nelson 3506* (RM); Petersburg, *Palmer 681* (DAO). CALIFORNIA. Del Norte Co.: 2 mi N of Crescent City, *Abrams & Benson 10727* (US); coastal plain, Crescent City, *Parks 4290* (DS, F, NY, RM, UC); low flats E of Crescent City, *Tracy 13519* (UC, WTU). Humboldt Co.: Trinity Summit, near Box Camp, *Tracy 17913* (DS, UC). Salmon Mountain Range, along Sugar Creek, *Parker s.n.,* May 26, 1949 (UC). IDAHO. Bonner Co.: roadside, Priest River Exptl. Forest, *Daubenmire 44487* (WTU); Rock Creek, Upper Priest River, *Epling 7646* (F). Idaho Co.: 6 mi SW of Lolo Pass, Clearwater National Forest, *Furlow 284* (MSC). Latah Co.: Cedar Mountains, *Sandberg et al. 427* (DS, NY, US); W slope of Moscow Mountains, *Sharesmith 3561* (RM, UC, WTU). MONTANA. Flathead Co.: mountainside near Swan River E of Big Fork, *Butler 233* (NY). Glacier Co.: 3 mi E of Logan Pass, Glacier National Park, *Furlow 272* (MSC). Mineral Co.: near Taft, 5 mi SE of state boundary, *Bartlett & Grayson 1038* (NY). Missoula Co.: Silver Butte-Fisher Road, *Schmautz 367* (DAO). Park Co.: Emigrant Gulch, *Rydberg & Bessey 3933* (NY, RM); Kersey Lake, about 5 mi E of Cooke City, *Witt 1699* (MO, UC, WTU). Powell Co.: Garnet, *Scheuber s.n.,* June 1, 1901 (NY, UC). Ravalli Co.: 3 mi N of Lost Trail Pass, Bitterroot National Forest, *Furlow 282* (MSC). OREGON. Curry Co.: Brookings, *Abrams & Benson 10711* (DS, RM); just back of seashore, 3 mi N of Brookings, *Bacigalupi 2323* (DS, NY, US). Josephine Co.: head of Bolan Creek, Siskiyou Mountains, *Bacigalupi et al. 3469* (JEPS, UC). Multnomah Co.: Corbett, *Matthews 54* (UC). WASHINGTON. Gray's Harbor Co.: rocky talus slopes by trail to Mt. Colonel Bob, Olympic Mts., *Thompson 7319* (WTU). King Co.: Seattle, *Piper s.n.,* June 26, 1889 (UC). Kittitas Co.: wooded slopes along Boulder Creek, *Thompson 10701* (WTU). Pierce Co.: Chinook Pass, Mount Rainier National Park, *Furlow 288* (MSC). Snohomish Co.: by alpine stream along Perry Creek Trail, Cascade Mts., *Thompson 14539* (NY, UC, WTU). Stevens Co.: along the E side of Columbia River near Canadian boundary, *Rogers 412* (DS, NY, UC, WTU). Whatcom Co.: boulder glacier moraine, Mt. Baker, *Eaton s.n.,* July 28, 1908 (WTU). WYOMING. Park Co.: S of Camp 14, *Rose 356* (US).

Alnus viridis ssp. *sinuata* is usually considered a separate species, *Alnus sinuata,* in current manuals, although Hultén (1944) treats it as a subspecies of *Alnus crispa.* In northeastern Asia (as far south as Japan) this subspecies is usually known as *A. kamtschatica.* Although this name is usually credited to Komorov, his combination is

a later homonym of that of Kudo. The relationship of *A. kamtschatica* to *A. viridis* ssp. *sinuata* has not been studied in detail, but from the specimens seen, it appears that the two taxa are identical. In the area of Japan, ssp. *sinuata* apparently hybridizes with ssp. *maximowiczii* where the ranges of these taxa come together, just as it does with ssp. *crispa* in Alaska and adjacent regions (cf. Hultén, 1944).

Subspecies *sinuata* is often difficult to distinguish from ssp. *crispa* in herbarium material except on the basis of leaf morphology. Its foliage is usually much thinner, lighter (and more yellowish) green, and much more coarsely toothed, sometimes even approaching a triply-serrate condition. The largest known member of this taxon grows in Saddle Mountain State Park, Oregon and has a trunk circumference of about 40 cm (Dixon, 1961).

Alnus subg. **Clethropsis** (Spach) Regel

Alnus subg. *Clethropsis* (Spach) Regel, Bull. Soc. Nat. Mosc. **38**(3): 421. 1865; *Clethropsis* Spach, Ann. Sci. Nat. ser. 2, **15:** 183. 1841; *Alnus* b. *Clethropsis* (Spach) Endlicher, Gen. Pl. suppl. **2,** p. 28. 1842; *Alnus* sect. *Clethropsis* (Spach) Sargent, Silva of N. Amer. **9:** 68. 1896; *Alnus* subg. *Gymnothyrsus* sect. *Clethropsis* (Spach) Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 40. 1964. TYPE SPECIES: *Alnus nepalensis* D. Don (lectotype).

Trees or large shrubs with several erect trunks; twigs and young branches not differentiated into a system of long and short shoots; buds stalked, covered with 2 equal, stipular, valvate scales. Leaves single-toothed; venation semicraspedodromous to eucamptodromous. Pistillate inflorescences solitary or in racemose clusters in leaf axils along the branch on short, stout peduncles, the staminate catkins forming one or more racemose clusters at the apex of this branch, the lowest several usually subtended by leaves; inflorescences produced during the current growing season, anthesis occurring in late summer or early autumn (near the end of the growing season), fruit maturation occurring the following spring (beginning of the next growing season); staminate flowers with 4 stamens. Fruits lacking wings.

Alnus subg. *Clethropsis* occurs only in eastern Asia and eastern North America. It is distinct from the other segments of the genus, especially in its autumn-flowering habit and unique leaf venation. As discussed above, fossil leaves closely matching those of modern

representatives of this subgenus have been found in parts of the world not now within the ranges of these modern species, including western North America.

Spach, in creating the genus *Clethropsis,* named two species, *C. nepalensis* and *C. nitida.* The following year, 1842, Endlicher placed this taxon in the genus *Alnus* and established *Alnus nepalensis* as the type (the only species mentioned). Endlicher did not specify the rank of his infrageneric taxon, the first author to do so being Regel in 1865.

Strangely, most treatments recognizing this subdivision of the genus have not included *Alnus maritima* in spite of its distinct affinities with the southern Asian species, placing it instead in subgenus or section *Gymnothyrsus* (= subgen. *Alnus*). Murai (1964) finally placed this species with its true relatives, but he considered the group only a section of the large subgenus *Gymnothyrsus.* Subgenus *Clethropsis* is probably derived from ancestors similar to present species of subg. *Alnus,* but it is distinct in the same fundamental ways as subg. *Alnobetula* and deserves subgeneric status.

10. **Alnus maritima** Muhlenberg ex Nuttall

Alnus maritima Muhlenberg ex Nuttall, North Amer. Sylva **1:** 50. 1842; *Alnus maritima* Muhlenberg, Obs. Bot. Pl. Amer. Sept. **1:** 193. 1807, unpublished manuscript; *Alnus maritima α typica* Regel, Bull. Soc. Nat. Mosc. **38**(3): 428. TYPE: *Muhlenberg specimen 477* (collected by Bartram?) without location or date (LECTOTYPE OF FURLOW, 1977, PH!).

Betula-alnus maritima Marshall, Arbust. Am., p. 20. 1785; *Alnus metoporina* Furlow, Ann. Mo. Bot. Gard. **63:** 381. 1977. TYPE: *Furlow 205,* Delaware, Sussex Co.: 4 mi. south of Milford, on the west shore of Hudson's Pond, September 14, 1970 (NEOTYPE, MSC!). Figure 61.

Narrow-crowned shrubs or trees up to 10 (–26) m in height; trunks usually several, erect, up to 15 (–35) cm in diameter; bark light gray, turning reddish-brown or brown in age, smooth or slightly rough, the lenticels obscured; young stems light red-brown to greenish-brown or brown, slightly to moderately lustrous, slightly to moderately glaucous, lightly to moderately resin-coated, not differentiated into long and short shoots, often with longitudinal ridges originating at the nodes; internodes glabrous to sparsely pubescent and sparsely to densely glandular; nodes very densely glandular; pubescence yellowish to brown; glands brownish to dark brown; lenticels of twigs circular to elliptic, 0.1–0.3 mm long and

wide, whitish, usually inconspicuous; leaf scars 0.7–2 mm high, 1.5–2.5 mm wide, bundle scars inconspicuous. Buds obovoid to ellipsoid, slightly rounded to rounded at the apex, without resinous coating to heavily resin-coated; stalk 1–2 mm long, 1–1.5 mm in diameter, sparsely pubescent to velutinous, very densely glandular; body 2.5–5 mm long, 1.5–2 mm in diameter; scales 2 (sometimes apparently absent from apical buds), stipular, equal, valvate, often incompletely covering the underlying organs, glabrous to moderately villous, glandular, the pubescence and glands usually obscured by the resin coating. Leaves elliptic, oblong, or obovate; apex acute, obtuse, or rounded; base acute to cuneate; blade (3–) 4.5–8 (–9) cm long, (1.8–) 2–4 (–5) cm wide, dark to very dark green and dull above, light brown or green-brown and dull to moderately lustrous below, moderately coriaceous, somewhat sticky when young; margin flat, slightly to moderately thickened, bearing low, single, relatively distant ascending teeth, each enlarged below at the tip into a single gland, 3–5 per cm, 0.2–1 mm deep, regular; adaxial surface glabrous or sparsely pubescent, moderately to densely glandular; abaxial surface and veinlets glabrous, moderately to densely glandular, slightly to moderately resin-coated; major veins and vein axils near the base moderately to densely villous; pubescence whitish, yellowish, or brownish; glands small to medium, yellowish or brownish. Lateral veins (6–) 7–11 (–13), 4–10 mm apart at mid-leaf, moderately to strongly ascending, sometimes branching once again, especially near the base, terminating in peripheral veins or, less frequently, in teeth at the margin; cross veins between the lateral veins poorly developed. Petioles (5–) 10–17 (–20) mm long, 0.6–1.5 mm in diameter, glabrous, moderately to densely glandular. Stipules oblong-elliptic or obovate, the apex acute to obtuse, 3–4 mm long, 0.5–1.2 mm wide, green, brown, or red-brown, glabrous to sparsely pubescent, the hairs yellowish, moderately glandular, the glands yellowish. Pistillate inflorescences solitary in leaf axils (2 to 4 per branch), produced during the current growing season, erect, ovate, at anthesis 3.5–4.5 mm long, 1.5–3 mm in diameter, on peduncles 5–7 mm long, 1–1.5 mm in diameter; staminate catkins borne in a single racemose cluster at the end of the branch bearing the pistillate inflorescences, the lowermost subtended by leaves, produced during the current growing season, pendent, at anthesis 2–6 cm long, 5–7 mm in diameter, on peduncles 2–16 mm long,

Figure 61. Representative specimen of *Alnus maritima* Muhlenberg ex Nuttall. Neotype of *Betula-alnus maritima* Marshall.

0.4–1 mm in diameter; floral bracts 1–2 (–3) mm high, (1.5–) 2–3 (–3.5) mm wide. Staminate flowers 3 per bract; perianth of 4 parts, these ovate to elliptic, the apex obtuse to rounded, ca. 1 mm long, 0.4–0.8 mm wide, the margin lined with small to medium-sized glands; stamens 4, opposite, separate from, and usually appearing much longer than the perianth, the filaments 0.2–0.7 mm long, the anthers 1.1–1.4 mm long and 0.9–1.1 mm in diameter, the thecae separate for 30–40% of their length. Infructescences ovoid (rarely ellipsoid), (12–) 17–24 (–28) mm long, 11–18 (–22) mm in diameter, on peduncles (3–) 7–10 mm long, 1.2–2.5 mm in diameter; scales 5.5–7 mm long, 6–7 mm wide at the apex, 1.5–2.2 mm wide at the base, the apex greatly thickened and reflexed, the terminal lobe-tip truncate to rounded, not extended. Fruits unwinged or narrowly wing-margined, dark brown, elliptic, 4–4.2 mm long, 2.5–2.7 mm in diameter; wing-margin 3–4 mm long, 0–0.2 mm wide; persistent styles 0.4–1 mm long. Figures 7B, 8B, 13C, 15F, 17D, and 61.

DISTRIBUTION AND HABITAT: Delaware and adjacent Maryland on the Delaware Peninsula; disjunct population in south-central Oklahoma. Found along the edges of ponds and small streams, often standing in water. Near sea level in Delaware and Maryland to about 175 meters in Oklahoma. Figure 62.

COMMON NAMES: Seaside alder, brook alder, Oklahoma alder.

REPRESENTATIVE SPECIMENS: **United States.** DELAWARE. Kent Co.: near mill ponds, Milford, *Canby s.n.*, in 1874 (NY). Sussex Co.: edge of mill pond near Georgetown, *Britton 16* (NY); on the shore of Record Pond off rt. 13 about 4 mi S of town, *Churchill s.n.*, Aug. 12, 1967 (MSC); 4 mi S of Milford on the W shore of Hudson's Pond, *Furlow 205* (MSC); Trap Pond State Park, along a small stream entering the E end of Trap Pond, *Furlow 248* (MSC); just S of Laurel on the N shore of Record's Pond, *Furlow 249* (MSC); along the muddy shore of Burton's Pond, Angola, *Proctor 3623* (DAO, MSC, NY, UC); 10 mi NW of Rehobeth, *Smith s.n.*, Sept. 2, 1935 (F, NY, RM, UC). MARYLAND. Wicomico Co.: Salisbury, *Canby 1956* (MSC); Quantico, near Salisbury, *Tidestrom 7398* (US). OKLAHOMA. Johnston Co.: 10 mi N of Tishomingo, *Furlow 349* (MSC); Pennington Creek, about 3 mi NE of Reagan, *Goodman 5980* (DAO, UC); along Pennington Creek at Devil's Den, *Nelson & Nelson 5863* (OKL, RM); along margins of Pennington Creek, *Palmer 39417* (F, NY, UC); Devil's Den, Pennington Creek, *Robbins 3265* (NY, UC, WTU); moist rocky banks of Blue River, 12 mi W of Wapanucka, *Waterfall 9258* (OKL). Pontotoc Co.: Sheep Creek, 1.5–2 mi SW of Hardin City, *Robbins 2795* (DAO, NY, WTU). Banks of Red River, Indian Territory, *Elihu Hall 612* (F, NY).

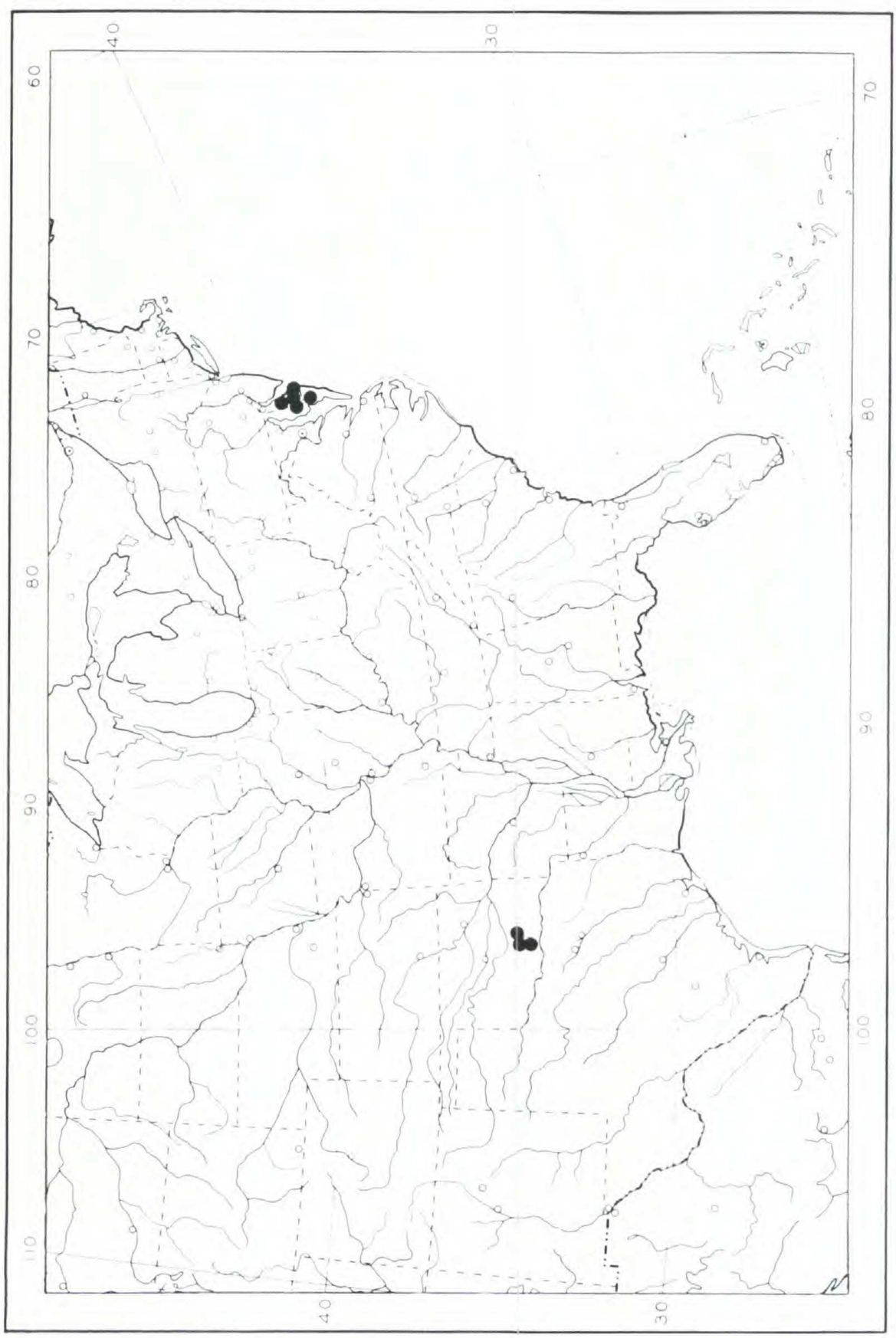

Figure 62. Distribution of *Alnus maritima* Muhlenberg ex Nuttall.

Humpfrey Marshall is usually cited as the original author of the epithet in Nuttall's combination, *Alnus maritima.* However neither Nuttall's protologue nor the unpublished manuscript of Muhlenberg, from which Nuttall obtained the name in the first place, makes reference to Marshall's binomial *Betula-alnus maritima.* There is no evidence that Marshall's and Nuttall's names were not derived independently for the same species and represent taxonomic, not nomenclatural, synonyms. In an earlier paper (Furlow, 1976), it was reported that Nuttall's combination, *Alnus maritima,* was illegitimate and had to be rejected, and a new name, *Alnus metoporina,* based on *Betula-alnus maritima* Marshall, was created to take its place. However this change was, in fact, not necessary according to the *International Code of Botanical Nomenclature* (Stafleu et al., 1972) and the new name has therefore been reduced to synonymy in the present treatment.

The type of *Alnus maritima* is the specimen labeled "477" in the Muhlenberg herbarium at the Academy of Natural Sciences of Philadelphia (Furlow, 1976). The actual collector of this specimen is not known. Muhlenberg (1807) begins the section of his manuscript dealing with the genus *Alnus* (which lists several species, including *Alnus maritima*) with the words *"Alnus bei Bartram",* which may indicate that the specimen itself was collected by Bartram, or it could mean something entirely different. Only a handful of authentic Bartram specimens are known with certainty to exist in the Muhlenberg herbarium (James A. Mears, personal communication).

In describing *Alnus maritima,* Nuttall (1842) made use of both the specimen just discussed and another collected by Charles Pickering along the eastern shore of Maryland (also at PH). Though the Pickering specimen has been somewhat better preserved, both demonstrate the essential diagnostic characteristics of *A. maritima* and are cited by Nuttall in his protologue. The former was selected as the lectotype because it is the original material upon which the name *Alnus maritima* was based by Muhlenberg.

Alnus maritima is easily distinguished from the other American species by its autumnal flowering (all of the others blooming in the spring), the color of its foliage (which is much darker than that of any of the others), the smoothness of the adaxial surface of the leaf blade, the more distantly serrulate leaf margin, the unique venation pattern of the leaves, and the larger infructescences (at least with

respect to the taxa occurring north of Mexico). It occurs sympatrically with *A. serrulata* in both Delaware and Oklahoma, sometimes with individuals of the two species growing on the same pond shore or stream bank. Where they do occur together, however, *A. maritima* is usually found in much wetter stiuations, often actually standing in several inches of water, while *A. serrulata* is found higher on the bank.

Alnus maritima has the most restricted geographical range of all the North American species. The presence of related fossil species in the western United States and Canada shows that the subgenus was once much more widespread over the continent, but today it is found only in two small and widely-separated populations of this single species. For many years botanists have speculated about the origin of the very small population in southern Oklahoma. This question has not been totally resolved by the present work, but in light of the formerly more widespread range of the subgenus as a whole, the earliness of the first collections of the species in Oklahoma, and the significant morphological and chemical differences between the members of the two populations noted here, it seems probable that the southern populations represent an actual relict and were not introduced by humans.

Alnus maritima is the most specialized of the New World species in terms of vegetative and floral characters, as discussed above. The solitary and axillary pistillate inflorescences are interpreted as having originated from racemose clusters, as seen in the other species, by reduction. Other species of subg. *Clethropsis* do, in fact, have clusters of inflorescences rather than solitary ones. The autumn-blooming habit appears to have been derived from the spring-blooming habit seen in the subgenera *Alnus* and *Alnobetula,* as well as in most other broad-leafed, wind-pollinated tree taxa of the northern part of North America. It is proposed that this may have originated from the early anthesis of the flowers produced during the current growing season but which would otherwise not bloom until growth resumes the following season following dormancy.

The largest specimen of *Alnus maritima* known to exist is a cultivated tree in Rock Creek Park, Washington, D.C. This individual has a trunk circumference of about 1.2 m, a height of 26 m, and a crown spread of nearly 17 m (Dixon, 1961).

NAMED HYBRIDS

Alnus crispa (Aiton) Pursh × subsp. *hulteni* Murai *in* Trappe *et al.*, Biology of Alder, p. 35. 1968, not validly published (= *Alnus viridis* subsp. *sinuata* (Regel) Löve & Löve × *A. viridis* subsp. *crispa* (Aiton) Turrill).

Alnus × *fallacina* Callier, Fedde Repert. Sp. Nov. **10:** 232. 1911. (= *Alnus incana* subsp. *rugosa* (DuRoi) Clausen × *A. serrulata* (Aiton) Willdenow). TYPE LOCALITY: "Hab. Amer. Septentrion." (original material not seen).

Alnus × *ljungeri* Murai, Bull. Gov. For. Expt. Sta. Jap. **171:** 60. 1964, not validly published. (= *Alnus glutinosa* (Linnaeus) Gaertner × *A. rubra* Bongard).

UNCERTAIN AND EXCLUDED NAMES

Alnus americana hort. ex Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 337. 1851, not validly published. Possibly = *Alnus rubra* Bongard.

Alnus arguta β *benthami* Regel, Mem. Soc. Nat. Mosc. **13**(2): 151. 1861. *Nom. nud.*

Alnus arguta γ *ovata* Regel, Mem. Soc. Nat. Mosc. **13**(2): 152. 1861, *nom. subnud.* From the description and type locality ("Naulingo, Acatlan, Chiconquiaco, und Tabina in Peru") probably = *Alnus acuminata* Humboldt, Bonpland, & Kunth subsp. *acuminata* in part and subsp. *arguta* (Schlechtendal) Furlow in part.

Alnus × *aschersoniana* Callier, Jahresb. Schles. Ges. Vaterl. Kult. **64:** 82. 1891. This taxon is identified by Callier as equivalent to *Alnus autumnalis* × *incana* Schweinfurth ex Ascherson. The identity of *A. autumnalis* in the latter name is uncertain.

Alnus autumnalis hort. ex Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 337. 1851, not validly published. Possibly = *Alnus serrulata* (Aiton) Willdenow.

Alnus autumnalis hort. ex Petzold & Kirchner, Arb. Musc., p. 599. 1864, *pro syn.* Possibly = *Alnus maritima* Muhlenberg ex Nuttall.

Alnus auctumnalis × *incana* ex Schweinfurth ex Ascherson, Fl. Prov. Brandenb. **1:** 623. 1864. See *Alnus* × *aschersoniana* Callier, above.

Alnus × *fiekii* Callier, Jahresb. Schles. Ges. Vater. Cult. **64:** 83. 1891. See *Alnus* × *silesiaca* Fiek, below.

Alnus × *fiekii* var. *dressleri* Callier, Jahresb. Schles. Ges. Vater. Cult. **64:** 84. 1891. See *Alnus* × *silesiaca* Fiek, below.

Alnus × *fiekii* var. *silesiaca* Callier, Jahresb. Schles. Ges. Vater. Cult. **64:** 84. 1891. See *Alnus* × *silesiaca* Fiek, below.

Alnus glutinosa var. *autumnalis* Kuntze, Rev. Gen. Pl. **2:** 638. 1891. Possibly = *Alnus serrulata* (Aiton) Willdenow.

Alnus glutinosa var. *quercifolia* hort. ex Hartig, Vollst. Naturgesh. Forstl. Kulturpfl., p. 337, not validly published. Possibly = *Alnus rubra* Bongard.

Alnus hybrida Neumann ex Reichardt, Vehr. Zool.-Bot. Ges. Wein **4**(2): 267. 1854, *non* A. Braun *in* Reichenbach, Icon. Fl. Germ. **12:** 3. 1850. This plant is reported to be a hybrid between *A. glutinosa* and *A. rugosa*, however the latter does not occur naturally in Europe where this putative hybridization supposedly took place.

Alnus incana α Hooker, Fl. Bor. Amer. **1:** 157. 1838. Possibly = *Alnus incana* subsp. *rugosa* (DuRoi) Clausen.

Alnus incana β Hooker, Fl. Bor. Amer. **1:** 157. 1838. Possibly = *Alnus serrulata* (Aiton) Willdenow.

Alnus incana 2. *autumnalis* hort. ex Petzold & Kirchner, Arb. Musc., p. 599. 1864. Possibly = *Alnus maritima* Muhlenberg ex Nuttall.

Alnus incana α. *glauca* (Aiton) Aiton f., Hort. Kew. ed. 2, **5:** 259. 1813. See *Betula incana* α *glauca* Aiton.

Alnus jorullensis var. η *acuminata* f. *angustifolia* Winkler, Pflanzenreich **19**(4.61): 127. 1904.

Alnus jorullensis var. η. *acuminata* f. *macrocarpa* Winkler, Pflanzenreich **19**(4.61): 127. 1904.

Alnus jorullensis var. *liebmanni* Callier, Mitt. Deutsch. Dendr. Ges. **27:** 165. 1918. Possibly = *A. jorullensis* subsp. *lutea* Furlow.

Alnus latifolia Desfontaines, Cat. Pl. Hort. Par. ed. 3, p. 352. 1829. *Nom. nud.*

Alnus oblongata Willdenow, Sp. Pl. ed. 4, **4**(1): 335. 1805. See *Betula oblongata* Aiton, below.

Alnus oblongata α *genuina* Regel, Mem. Soc. Nat. Mosc. **13**(2): 174. 1861. Possibly = *Alnus serrulata* (Aiton) Willdenow.

Alnus oblongata β *oblonga* Regel, Mem. Soc. Nat. Mosc. **13**(2): 174. 1861. Possibly = *Alnus maritima* Muhlenberg ex Nuttall.

Alnus × *purpusi* Callier *in* Schneider, Ill. Handb. Laubh. **1:** 132. 1904. This hybrid supposedly is between *A. rugosa* and *A. tenuifolia*. The type (*Purpus 1887*) is from British Columbia, however, where *A. incana* subsp. *rugosa* does not occur.

Alnus rugosa × *incana* Callier *in* Schneider, Ill. Handb. Laubh. **1:** 132. 1904. The identity of "*Alnus rugosa*" in this hybrid is uncertain. Callier equates it with *A. autumnalis*, and the hybrid with *A. auctumnalis* × *incana* Schweinfurth ex Ascherson (see above).

Alnus serrulata pumila Demcker, Mitt. Deutsch. Dendr. Ges. **18:** 326. 1909, *nom. nud.* Possibly = *Alnus acuminata* subsp. *acuminata*.

Alnus × *silesiaca* Fiek *in* Fiek & Pax, Jahresb. Schles. Ges. Vater. Cult. **66:** 178. 1888. Supposedly = *Alnus serrulata* × *glutinosa*, but originally collected in Europe where *A. serrulata* does not occur naturally.

Alnus tomentosa Durand ex Kellogg *in* Peirce, Rept. Supt. U.S. Coast Surv., p. 324. 1869, *nom. nud.* Durand's specimen (no. 199) was not seen; the collecting site is listed as Sitka, so the species may be either *Alnus rubra* Bongard or *Alnus viridis* subsp. *sinuata* (Regel) Löve & Löve.

Alnus viridis var. *glabra* Chamisso, Linnaea **6:** 538. 1831. Possibly = *Alnus viridis* subsp. *sinuata* (Regel) Löve & Löve.

Alnus viridis var. *microphylla* Chamisso, Linnaea **6:** 538. 1831. Possibly = *Alnus viridis* subsp. *sinuata* (Regel) Löve & Löve.

Betula alnus var. *americana* Ludwig, Neuere Wilde Baumz., p. 8. 1783, *nom. nud.* The only description provided is "dwarf american alder" and "die amerikanische Eller mit glatten Blattern." Possibly = *Alnus incana* subsp. *rugosa* (DuRoi) Clausen.

Betula alnus var. *glutinosa* Ludwig, Neuere Wilde Baumz., P. 8. 1783, *nom. nud.* From the common name provided ("round-leaved A."), probably = *Alnus glutinosa* (Linnaeus) Gaertner.

Betula alnus var. *incana* Ludwig, Neuere Wilde Baumz., p. 8. 1783, *nom. nud.* Probably = *Alnus incana* (Linnaeus) Moench.

Betula alnus var. *rugosa* Ludwig, Neuere Wilde Baumz., p. 8. 1783, *nom. nud.* Probably = *Alnus incana* subsp. *rugosa* (DuRoi) Clausen.

Betula incana α *glauca* Aiton, Hort. Kew. **3:** 339. 1789. May = either *Alnus incana* subsp. *incana* or subsp. *rugosa*. This taxon is *not* cited by Michaux as the basis for his *Alnus glauca*, as is sometimes indicated by other authors.

Betula oblongata Aiton, Hort. Kew. **3:** 338. 1789. May = *Alnus glutinosa* (Linnaeus) Gaertner, *A. serrulata* (Aiton) Willdenow, or *A. maritima* Nuttall (*vide* the discussion of Regel, 1861, pp. 171–172).

Betula-alnus 6. *crispa* Weston, Bot. Univers. Hortul. **1:** 323. 1770, *nom. subnud.* Possibly = *Alnus viridis* subsp. *crispa* (Aiton) Turrill.

Betula-alnus glauca Marshall, Arbust. Am., p. 20. 1785, *nom. nud.* Probably = *Alnus incana* subsp. *rugosa* (DuRoi) Clausen.

Betula-alnus 1. *glutinosa* Weston, Bot. Univers. Hortul. **1:** 323. 1770, *nom. subnud.* Probably = *Alnus glutinosa* (Linnaeus) Gaertner.

Betula-alnus 4. *incana* Weston, Bot. Univers. Hortul. **1:** 323. 1770, *nom. subnud.* Probably = *Alnus incana* (Linnaeus) Moench.

Betula-alnus rubra Marshall, Arbust. Am., p. 20. 1785, *nom. nud.* This name probably refers to *Alnus serrulata* (Aiton) Willdenow. It was used as the basis of *Alnus rubra* Tuckerman, *non* Bongard, as a name for *A. serrulata.*

Betula-alnus 3. *rubra* Weston, Bot. Univers. Hortul. **1:** 323. 1770, *nom. subnud.* Possibly = *Alnus serrulata* (Aiton) Willdenow.

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DEPARTMENT OF BIOLOGY
CAPITAL UNIVERSITY
COLUMBUS, OHIO 43209

INDEX TO NAMES OF SPECIES AND INFRASPECIFIC TAXA

Alnus alnobetula (Ehrhart) Hartig = *Alnus viridis* (Villars) Lamarck & DeCandolle
Alnus alnobetula (Ehrhart) K. Koch = *Alnus viridis* (Villars) Lamarck & DeCandolle
Alnus alnobetula var. ζ. *crispa* (Aiton) Winkler = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus alnobetula var. β. *fruticosa* (Ruprecht) Winkler = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus alnobetula a. *parvifolia* (Regel) Dippel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill, in part
Alnus alnobetula var. θ. *parvifolia* (Regel) Winkler — see *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus alnobetula var. ϵ. *repens* (Hornemann) Winkler = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus alnobetula var. η. *stenophylla* Winkler = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus alnobetula var. a. *typica* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill, in part
Alnus alnobetula var. *typica* f. *repens* (Hornemann) Winkler = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus alnus (Linnaeus) Britton = *Alnus glutinosa* (Linnaeus) Gaertner
Alnus alpina Villars = *Alnus viridis* (Villars) Lamarck and DeCandolle
Alnus americana (Regel) Czerepanov = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus americana hort. ex Hartig — see Excluded Names
Alnus americana hort. ex Petzold & Kirchner = *Alnus serrulata* (Aiton) Willdenow
Alnus argentea hort. ex Petzold & Kirchner = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus arguta (Schlechtendal) Spach = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus arguta β *benthami* Regel — see Excluded Names
Alnus arguta var. *cuprea* Bartlett = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus arguta α *genuina* Regel = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus arguta γ *ovata* Regel — see Excluded Names
Alnus arguta δ *punctata* Regel = *Alnus acuminata* H.B.K. ssp. *acuminata*
Alnus arguta var. *subsericea* Bartlett = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus × *aschersoniana* Callier — see Excluded Names
Alnus autumnalis hort. ex Hartig — see Excluded Names
Alnus autumnalis hort. ex Petzold & Kirchner — see Excluded Names
Alnus californica hort. ex Winkler = *Alnus rhombifolia* Nuttall
Alnus canadensis hort. ex Winkler = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus carpinifolia Desfontaines ex Spach = *Alnus serrulata* (Aiton) Willdenow
Alnus castaneifolia Douglas ex Hooker = *Alnus rubra* Bongard
Alnus castaneifolia Mirbel = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus communis Desfontaines ex Kuntze = *Alnus incana* ssp. *tenuifolia* (Nuttall) Bretung
Alnus crispa (Aiton) Pursh = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus crispa var. *elongata* Raup = *Alnus viridis* ssp. *crispa* (Aiton) Turrill

Alnus crispa var. *harricanensis* Lepage = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus crispa × ssp. *hulteni* Murai — see Named Hybrids
Alnus crispa var. *mollis* (Fernald) Fernald = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus crispa f. *mollis* (Fernald) Murai = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus crispa ssp. *sinuata* (Regel) Hultén = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus crispa ssp. *sinuata* var. *laciniata* Hulten = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus crispa var. *sinuata* (Regel) Breitung = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus crispa f. *stragula* Fernald = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus densiflora Muller = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus × *fallacina* Callier — see Named Hybrids
Alnus ferruginea Humboldt, Bonpland, & Kunth = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus ferruginea var. *aliso* Lorenz & Hieronymus ex Winkler = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus ferruginea var. *obtusifolia* Callier = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus ferruginea var. a. *typica* Callier = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata* (in part), *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow (in part)
Alnus × *fiekii* Callier — see Excluded Names
Alnus × *fiekii* var. *dressleri* Callier — see Excluded Names
Alnus × *fiekii* var. *silesiaca* Callier — see Excluded Names
Alnus firmifolia Fernald = *Alnus jorullensis* Humboldt, Bonpland, & Kunth ssp. *jorullensis*
Alnus fruticosa Ruprecht = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus fruticosa var. *kamtschatica* (Callier) Komorov = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus fruticosa var. a. *typica* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus fruticosa var. *typica* f. *grandifolia* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus fruticosa var. *typica* f. *macrophylla* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus fruticosa var. *typica* f. *normalis* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus fruticosa var. *typica* f. *vulgaris* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus glabrata Fernald = *Alnus acuminata* ssp. *glabrata* (Fernald) Furlow
Alnus glabrata var. *durangensis* Bartlett = *Alnus acuminata* ssp. *glabrata* (Fernald) Furlow
Alnus glandulosa Sargent = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus glauca Michaux = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus glutinosa (Linnaeus) Gaertner
Alnus glutinosa var. *autumnalis* Kuntze — see Excluded Names

Alnus glutinosa var. *quercifolia* hort. ex Hartig — see Excluded Names
Alnus glutinosa δ *serrulata* (Aiton) Regel = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen (in part), *Alnus rhombifolia* Nuttall (in part), *Alnus serrulata* (Aiton) Willdenow (in part)
Alnus glutinosa δ *serrulata* lusus d. *californica* Regel = *Alnus rhombifolia* Nuttall
Alnus glutinosa δ *serrulata* lusus a. *genuina* Regel = *Alnus serrulata* (Aiton) Willdenow
Alnus glutinosa δ *serrulata* lusus b. *obtusifolia* Regel = *Alnus serrulata* (Aiton) Willdenow
Alnus glutinosa δ *serrulata* lusus c. *rugosa* (DuRoi) Regel = *Alnus incana* ssp *rugosa* (DuRoi) Clausen
Alnus glutinosa var. *virescens* (Watson) Kuntze = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus glutinosa (*vulgaris*) Persoon = *Alnus glutinosa* (Linnaeus) Gaertner
Alnus glutinosa — α: *vulgaris* Spach = *Alnus glutinosa* (Linnaeus) Gaertner
Alnus guatemalensis Gandoger = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus hybrida Neumann ex Reichardt — see Excluded Names
Alnus incana (Linnaeus) Moench
Alnus incana α Hooker — see Excluded Names
Alnus incana β Hooker — see Excluded Names
Alnus incana β *americana* Regel = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana var. ι. *americana* (Regel) Winkler = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana 2. *autumnalis* hort. ex Petzold & Kirchner — see Excluded Names
Alnus incana α *glauca* (Aiton) Aiton f. — see Excluded Names
Alnus incana α *glauca* (Michaux) Regel = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana var. 3 *glauca* (Michaux) Loudon = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana var. *glauca* f. *tomphylla* Fernald = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana η *rubra* (Bongard) Regel = *Alnus rubra* Bongard
Alnus incana ssp. *rugosa* (DuRoi) Clausen
Alnus incana ssp. *rugosa* var. *occidentalis* (Dippel) Hitchcock = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus incana var. *serrulata* (Aiton) Boivin = *Alnus serrulata* (Aiton) Willdenow
Alnus incana ssp. *tenuifolia* (Nuttall) Breitung
Alnus incana var. *tomophylla* (Fernald) Rehder = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus incana var. *virescens* Watson = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus jorullensis Humboldt, Bonpland, & Kunth = *Alnus jorullensis* Humboldt, Bonpland, & Kunth ssp. *jorullensis*
Alnus jorullensis var. *acuminata* (Humboldt, Bonpland, & Kunth) Kuntze = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus jorullensis var. *acuminata* f. *angustifolia* Winkler — see Excluded Names
Alnus jorullensis var. *acuminata* f. *macrocarpa* Winkler — see Excluded Names

Alnus jorullensis var. *acuminata* f. *media* Winkler = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata* (in part), *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow (in part), *Alnus acuminata* ssp. *glabrata* (Fernald) Furlow in part)

Alnus jorullensis ζ. *acutissima* Winkler = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus jorullensis β *castaneifolia* (Mirbel) Regel = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus jorullensis var. *exigua* Fernald = *Alnus jorullensis* ssp. *lutea* Furlow

Alnus jorullensis var. *ferruginea* (Humboldt, Bonpland, & Kunth) Kuntze = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus jorullensis var. *liebmanni* Callier — see Excluded Names

Alnus jorullensis ssp. *lutea* Furlow

Alnus jorullensis var. ε. *mirbelii* (Spach) Winkler = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus jorullensis α *typica* Regel = *Alnus jorullensis* Humboldt, Bonpland, & Kunth ssp. *jorullensis*

Alnus kamtschatica (Callier) Komorov = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve

Alnus kamtschatica (Regel) Kudo ex Masamune = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve

Alnus lanceolata Philippi = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus latifolia Desfontaines — see Excluded Names

Alnus latifolia Desfontaines ex Hartig = *Alnus serrulata* (Aiton) Willdenow

Alnus lindeni Regel = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus × *ljungeri* Murai — see Named Hybrids

Alnus macrophylla Desfontaines ex Spach = *Alnus serrulata* (Aiton) Willdenow

Alnus maritima Muhlenberg ex Nuttall

Alnus maritima hort. ex Spach = *Alnus serrulata* (Aiton) Willdenow

Alnus maritima hort. ex Wetzel = *Alnus rubra* Bongard

Alnus maritima α *typica* Regel = *Alnus maritima* Muhlenberg ex Nuttall

Alnus metoporina Furlow = *Alnus maritima* Muhlenberg ex Nuttall

Alnus mirbelii Spach = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus mirbelii var. *acutissima* (Winkler) Callier = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*

Alnus mitchelliana Curtis ex Gray = *Alnus viridis* ssp. *crispa* (Aiton) Turrill

Alnus mollis Fernald = *Alnus viridis* ssp. *crispa* (Aiton) Turrill

Alnus noveboracensis Britton = *Alnus serrulata* (Aiton) Willdenow

Alnus oblongata (Aiton) Willdenow — see Excluded Names

Alnus oblongata hort. ex Winkler = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen

Alnus oblongata α *genuina* Regel — see Excluded Names

Alnus oblongata β *oblonga* Regel — see Excluded Names

Alnus oblongifolia Torrey

Alnus obtusifolia Mertens ex Regel = *Alnus serrulata* (Aiton) Willdenow

Alnus occidentalis Dippel = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus orbiculata Lopylaie ex Spach = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus oregona Nuttall = *Alnus rubra* Bongard
Alnus ovalifolia Bartlett = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus ovata (Schrank) Loddiges = *Alnus viridis* (Villars) Lamarck & DeCandolle
Alnus ovata var. *repens* (Hornemann) Lange = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus ovata var. *repens* f. *macrophylla* Lange = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus ovata f. *repens* (Hornemann) Kjellman = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus pringlei Fernald = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Alnus × *purpusi* Callier — see Excluded Names
Alnus repens Wormskjold ex Hornemann = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus rhombifolia Nuttall
Alnus rhombifolia var. *bernardina* Munz & Johnston = *Alnus rhombifolia* Nuttall
Alnus rhombifolia var. *ovalis* Winkler = *Alnus rhombifolia* Nuttall
Alnus rhombifolia var. *typica* Callier = *Alnus rhombifolia* Nuttall
Alnus rubra Bongard
Alnus rubra Desfontaines ex Spach = *Alnus serrulata* (Aiton) Willdenow
Alnus rubra Tuckerman = *Alnus serrulata* (Aiton) Willdenow
Alnus rubra var. *pinnatisecta* Starker = *Alnus rubra* Bongard
Alnus rubra f. *pinnatisecta* (Starker) Rehder = *Alnus rubra* Bongard
Alnus rufescens Liebmann ex Hemsley = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata* (in part), *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow (in part)
Alnus rugosa (DuRoi) Sprengle = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus rugosa var. *americana* (Regel) Fernald = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus rugosa var. *americana* f. *hypomalaca* Fernald = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus rugosa var. *americana* f. *tomophylla* Fernald = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus rugosa var. γ. *obtusifolia* (Regel) Winkler = *Alnus serrulata* (Aiton) Willdenow
Alnus rugosa var. β. *serrulata* (Aiton) Winkler = *Alnus serrulata* (Aiton) Willdenow
Alnus rugosa var. α. *typica* Winkler = *Alnus serrulata* (Aiton) Willdenow
Alnus rugosa var. *typica* f. *emersoniana* Fernald = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Alnus serrulata (Aiton) Willdenow
Alnus serrulata α *genuina* Regel = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata — β: *macrophylla* Spach = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata γ *oblongifolia* (Torrey) Regel = *Alnus oblongifolia* Torrey
Alnus serrulata δ *obtusifolia* Regel = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata pumila Demcker — see Excluded Names
Alnus serrulata β *rugosa* (DuRoi) Regel = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen

Alnus serrulata var. *subelliptica* Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata var. *subelliptica* f. *emarginata* Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata var. *subelliptica* f. *mollescens* Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata var. *subelliptica* f. *nanella* Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata — α: *vulgaris* Spach = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata var. *vulgaris* Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus serrulata var. *vulgaris* f. *noveboracensis* (Britton) Fernald = *Alnus serrulata* (Aiton) Willdenow
Alnus × *silesiaca* Fiek — see Excluded Names
Alnus sinuata (Regel) Rydberg = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sinuata var. b. *kamtschatica* (Callier) Callier = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sinuata var. *stenophylla* (Winkler) Callier = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sinuata var. a. *typica* Callier = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sitchensis (Regel) Sargent = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sitchensis var. b. *kamtschatica* Callier = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus sitchensis var. a. *typica* Callier = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus spachii (Regel) Callier = *Alnus acuminata* Humboldt, Bonpland, & Kunth ssp. *acuminata*
Alnus tenuifolia Nuttall = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus tenuifolia var. b. *occidentalis* (Dippel) Callier = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus tenuifolia var. a. *virescens* (Watson) Callier = *Alnus incana* ssp. *tenuifolia* (Nuttall) Breitung
Alnus tomentosa Durand ex Kellogg — see Excluded Names
Alnus tristis Wormskjold ex Regel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus undulata Willdenow = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus undulata hort. ex Winkler = *Alnus serrulata* (Aiton) Willdenow
Alnus viridis (Villars) Lamarck & DeCandolle
Alnus viridis α Hooker = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis β Hooker = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus viridis var. *crispa* (Aiton) House = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *fernaldii* House = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis ssp. *fruticosa* (Ruprecht) Nyman = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *glabra* Chamisso — see Excluded Names
Alnus viridis var. *microphylla* Chamisso — see Excluded Names
Alnus viridis β, *parvifolia* Regel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill, in part
Alnus viridis var. *parvifolia* Sauter ex Winkler — see *Alnus viridis* ssp. *crispa* (Aiton) Turrill

Alnus viridis var. *repens* (Hornemann) Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *repens* f. 1 *groenlandica* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *repens* f. *typica* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis β *sibirica* Regel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill, in part; = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve, in part
Alnus viridis β *sibirica* lusus a. *communis* Regel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill, in part
Alnus viridis β *sibirica* lusus d. *kamtschatica* Regel = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus viridis β *sibirica* lusus b. *sitchensis* Regel = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus viridis β *sibirica* lusus c. *subglabra* Regel = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *sibirica* (Regel) Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis var. *sibirica* lusus c. *glabra* Callier = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus viridis δ *sinuata* Regel = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Alnus viridis ssp. *sinuata* (Regel) Löve & Löve
Alnus viridis I. *typica* d. *repens* (Hornemann) Ascherson & Graebner = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Alnus vulgaris Hill = *Alnus glutinosa* (Linnaeus) Gaertner
Alnus washingtonia hort. ex Wetzel = *Alnus rubra* Bongard
Betula alnobetula Ehrhart = *Alnus viridis* (Villars) Lamarck & DeCandolle
Betula alnus Linnaeus = *Alnus glutinosa* (Linnaeus) Gaertner, in part; = *Alnus incana* (Linnaeus) Moench, in part
Betula alnus var. *americana* Ludwig — see Excluded Names
Betula alnus crispa (Aiton) Michaux = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Betula alnus α *glutinosa* Linnaeus = *Alnus glutinosa* (Linnaeus) Turrill
Betula alnus var. *glutinosa* Ludwig — see Excluded Names
Betula alnus β *incana* Linnaeus = *Alnus incana* (Linnaeus) Moench
Betula alnus var. *incana* Ludwig — see Excluded Names
Betula alnus (*rugosa*) DuRoi = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Betula alnus var. *rugosa* Ludwig — see Excluded Names
Betula alnus serrulata (Aiton) Michaux = *Alnus serrulata* (Aiton) Willdenow
Betula alpina (Villars) Borkhausen = *Alnus viridis* (Villars) Lamarck & DeCandolle
Betula arguta Schlechtendal = *Alnus acuminata* ssp. *arguta* (Schlechtendal) Furlow
Betula crispa Aiton = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Betula glutinosa (Linnaeus) Linnaeus = *Alnus glutinosa* (Linnaeus) Gaertner
Betula incana (Linnaeus) Linnaeus f. = *Alnus incana* (Linnaeus) Moench
Betula incana α *glauca* Aiton — see Excluded Names
Betula oblongata Aiton — see Excluded Names
Betula ovata Schrank = *Alnus viridis* (Villars) Lamarck & DeCandolle
Betula rugosa (DuRoi) Ehrhart = *Alnus incana* ssp. *rugosa* (DuRoi) Clausen
Betula serrulata Aiton = *Alnus serrulata* (Aiton) Willdenow
Betula viridis Villars = *Alnus viridis* (Villars) Lamarck & DeCandolle

Betula-alnus 6. *crispa* Weston — see Excluded Names
Betula-alnus glauca Marshall — see Excluded Names
Betula-alnus glutinosa Weston — see Excluded Names
Betula-alnus incana Weston — see Excluded Names
Betula-alnus maritima Marshall = *Alnus maritima* Muhlenberg ex Nuttall
Betula-alnus rubra Marshall — see Excluded Names
Betula-alnus rubra Weston — see Excluded Names
Duschekia crispa (Aiton) Pouzar = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Duschekia fruticosa (Ruprecht) Pouzar = *Alnus viridis* ssp. *crispa* (Aiton) Turrill
Duschekia ovata (Schrank) Winkler = *Alnus viridis* (Villars) Lamarck & DeCandolle
Duschekia sinuata (Regel) Pouzar = *Alnus viridis* ssp. *sinuata* (Regel) Löve & Löve
Duschekia viridis (Villars) Opiz = *Alnus viridis* (Villars) Lamarck & DeCandolle
Semidopsis viridis (Villars) Zumaglini = *Alnus viridis* (Villars) Lamarck & DeCandolle