Polylepis besseri Hieron.

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ROSACEAE (ROSA FAMILY)

P. crista-galli Bitter, *P. triacontandra* Bitter, *P. incana* H.B.K. ssp. *brachypoda* Bitter, ssp. *incarum* Bitter, ssp. *subtusalbida* Bitter, *P. racemosa* Ruíz & Pavón var. *lanata* Kuntze, and var. *tomentosa* Kuntze

Coloradito, keñua, keru, keshua, kewiña, q'ueñua, queñua, quenuina, queuñua, quewiña, quinhuar, quiñual, quiñuar, yagual

Distribution of the genus is restricted to the Andean corridor of South America from Venezuela, south to northern Argentina and Chile. *Polylepis besseri* forests most commonly occur in small (1 to several ha) isolated patches surrounded by high-elevation grasslands and agriculture. Characteristically forming open-structure, monotypic forests at high elevations in the Andes of South America, *P. besseri* is also found in association with *Buddleja* sp., *Escallonia* sp., and *Gynoxis* sp. (Fjeldsa and Krabbe 1990).

A slow-growing tree tolerant of wind, freezing temperatures, solar radiation, and moderate drought, *P. besseri* thrives in some of the harshest tropical environments. Depending on environmental factors, the species can vary from shrub to small tree and range in height from 3 to 10 m with an average of 7 m. Commonly occurring as a low, multibranched cup with a crown diameter of 4 m, *P. besseri* also grows in a more erect, cupped form with a single trunk reaching a maximum d.b.h. of 45 cm. Rusty colored, papery, flaking bark combines with the tree's contorted growth form to give a unique appearance. The tree prefers rocky, well-drained soils, usually on steep slopes of sandy loams, and tolerates moderate acidity and nutrient-poor soils. As a major primary source of organic matter, *P. besseri* is important in forming and protecting soils in climatic zones with characteristically sparse vegetation (Borter 1994). *Polylepis besseri* typically grows at elevations between 3000 to 4000 m in areas with rainfall ranging from 300 to 1200 mm (Borter 1994). These trees grow at higher elevations than any other tree in the world (Killeen and others 1993), surviving as high as 5200 m on the slopes of Nevado Sajama in Potosi, Bolivia. As an evergreen tree that does not resprout and has low fire tolerance, *P. besseri* is highly susceptible to the pressures of agricultural expansion and fuelwood consumption.

Frequent hybridizing within the *Polylepis* genus causes much confusion in species identification, the most common *P. besseri* crosses being with *P. tomentella* Wedd., *P. (aff.) australis* Bitter, and various subspecies (Killeen and others 1993).

Though often twisted and poorly formed, *P. besseri* wood has an attractive reddish color and is very strong and durable. The specific gravity of *P. besseri* wood is not found in the literature, but experience shows that it is a relatively dense wood and resistant to rot. In a study of all tree species in the highlands of Bolivia, *P. besseri* proved to be the most frequently and widely used based on a series of questions asked of subsistence farmers (Ledezma 1994). Traditional uses include: charcoal, home construction, tools, plows, firewood, cooking utensils, soil conservation and improvement, wind and frost protection, paddle wheels for water-powered mills, fenceposts, urban forestry, medicine for colds, musical instruments, and dyes for clothing (Arze and Weeda 1996, Borter 1994, Fossati 1996, Ledezma 1994).

Polylepis besseri can flower any time of the year with a peak flowering season March through May (Fossati 1996). Flowers are generally red and without petals, arranged in axillary racemes of 1 to 70 flowers. Each flower produces a single fruit 7 to 10 mm long. The fruit consists of 3 turbine-shaped wings running along the axis of the seedcoat and a single, ovular seed that is pointed at one end and 3 to 5 mm long (Killeen and others 1993). The fruits dry on the tree in 5 to 6 months, providing the greatest amount of ripe seed from August through November (Fossati 1996).

Ripe seeds from *P. besseri* must be collected after they are dry but before they fall to the ground, because of their very small size. Seeds are commonly collected from select branches cut as firewood; no special tools are needed since this species does not exceed 10 m in height and is easily scaled. Seeds average 80,000 to 120,000 per kg (Borter 1994). Seeds have a very

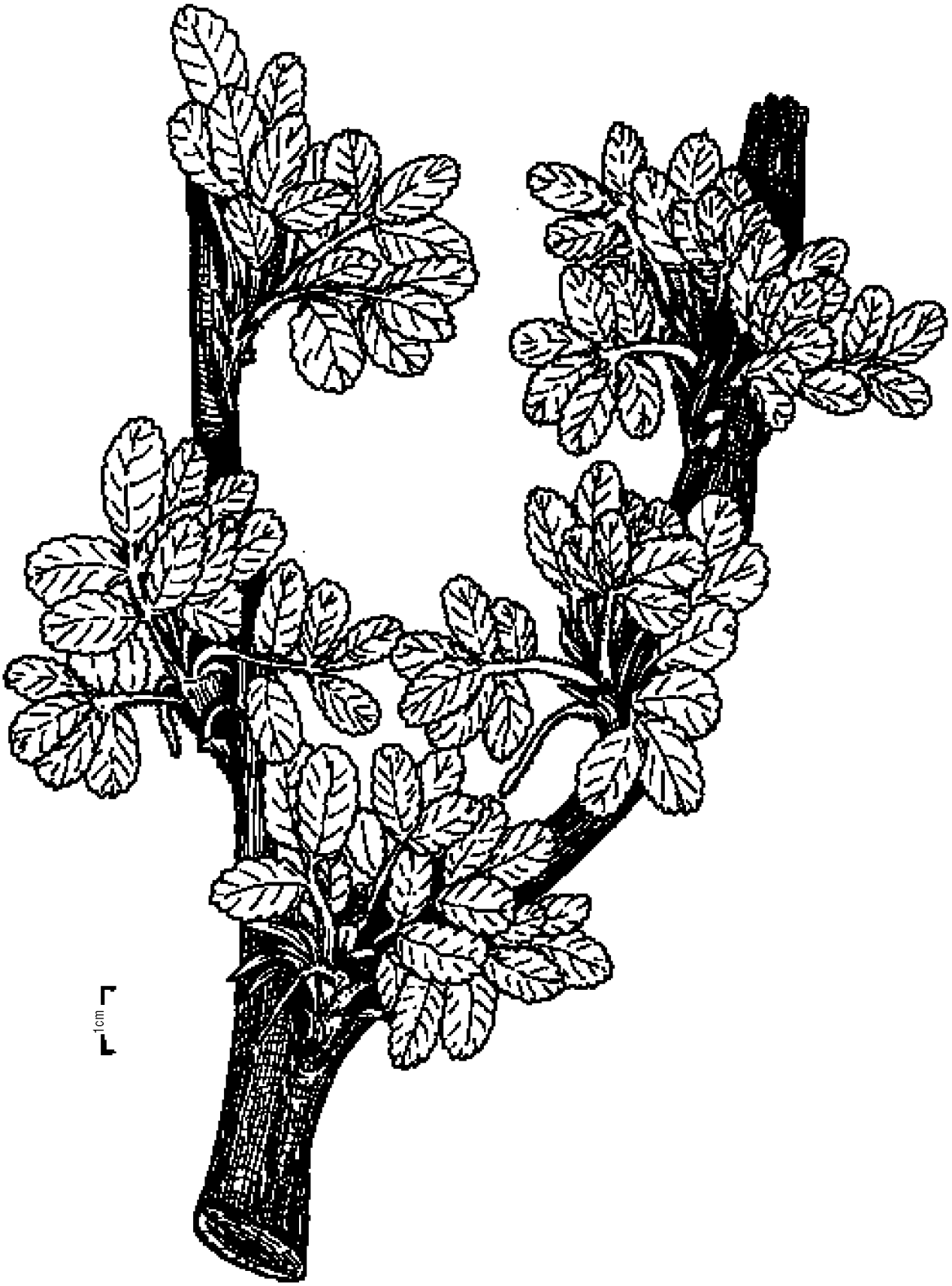
low germination rate (2 to 15 percent) with no satisfactory pregermination treatments known. Because the germination rate diminishes rapidly in storage, limited seedbed production can be achieved only through planting in substrates of high sand and organic matter content immediately after collection.

The preferred method of seedling production is possible when parent trees are available locally. The soils beneath the trees are cleared of all vegetation and loosened before the seeds drop. Naturally germinated seedlings can then be extracted and transported in small plastic bags sprinkled with water to a nearby nursery, where they can be transplanted to containers for future development (Fossati 1996). Seedlings in containers should be shaded at first, then grown in full sunlight after they have adapted to transplantation. Normally, seedlings develop in the nursery for 12 to 18 months. An alternative method involves cutting 1- to 2-year-old branches into 15- to 25-cm lengths at the start of the rainy season, soaking them for 24 hours in water or root-inducing hormone, and either planting the cuttings in a sandy soil mixture in nursery containers or directly planting them in the field (Mamani and Apaza 1995).

Although established *P. besseri* trees are extremely resistant to harsh climates, seedlings require protection from drought, wind, and grazing animals. Because growth is very slow, these trees need many years to establish, an obvious disadvantage to reforestation efforts. Given their adaptation to reproduction within the shelter of monotypic stands, the best *P. besseri* management strategy may be to prevent complete deforestation and manage for sustained natural reproduction within existing forests.

ADDITIONAL INFORMATION

The cause of the small size and isolated nature of *P. besseri* forests is the subject of some debate. One theory holds that *P. besseri* competes best in high-elevation microsites of rocky, well-drained, frost-free soils with microclimates of nightly mists and cold air drainage—in effect creating low-elevation microenvironments at high elevations (Simpson 1977). Alternatively, paleobotanical and historical evidence suggests that *P. besseri* forests were once much more extensive, and that burning, grazing, and other anthropic pressures have greatly reduced their area during the last 3,000 years, particularly over the last several hundred years (Fjeldsa and Kessler 1996, Fjeldsa and Krabbe 1990). Because of its unique position as the highest growing tree in the Andes, the genus *P. besseri* is extremely important both ecologically and as a human resource (Ledezma 1994, Ridgley and Tudor 1989). *Polylepis besseri* provides a rare source of high-elevation forest habitat, which several species of avifauna rely on exclusively (Fjeldsa and Krabbe 1990, Ridgley and Tudor 1989).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