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The genus *Polylepis* (Rosaceae) in Bolivia

MICHAEL KESSLER

RESUMEN

KESSLER, M. (1995). El género *Polylepis* (Rosaceae) en Bolivia. *Candollea* 50: 131-171. En inglés, resúmenes en español e inglés.

Se presenta una revisión de *Polylepis* en Bolivia. Se reconocen nueve especies y ocho subespecies. *P. neglecta*, *P. tomentella* subsp. *incanoides* y *P. tomentella* subsp. *nana* son descritas como nuevas para la ciencia. Se proponen dos nuevas combinaciones: *P. besseri* subsp. *subtusalbida*, *P. besseri* subsp. *incarum* y dos subespecies con status nuevo: *P. racemosa* subsp. *triacontandra*, *P. racemosa* subsp. *lanata*. Se presenta una clave de las especies y subespecies, descripciones adecuadas y listas completas del material estudiado. Siete táxones son ilustrados.

ABSTRACT

KESSLER, M. (1995). The genus *Polylepis* (Rosaceae) in Bolivia. *Candollea* 50: 131-171. In English, Spanish and English abstracts.

The genus *Polylepis* in Bolivia is revised to include nine species and eight subspecies. *P. neglecta*, *P. tomentella* subsp. *incanoides* and *P. tomentella* subsp. *nana* are described as new. Two new combinations are proposed: *P. besseri* subsp. *subtusalbida*, *P. besseri* subsp. *incarum*, and two subspecies receive new status: *P. racemosa* subsp. *triacontandra*, *P. racemosa* subsp. *lanata*. A key to the taxa, full descriptions of all taxa and full specimen citations are provided. Seven taxa are illustrated.

KEY-WORDS: *Polylepis* — ROSACEAE — Bolivia — Andes — Taxonomy.

Introduction

The genus *Polylepis* (Rosaceae: *Sanguisorbeae*) includes about 20 species of shrubs and small to medium-sized trees. It is of exclusively Andean distribution and occurs in montane and subalpine habitats. Frequently it forms the upper treeline, and on Nevado Sajama in Bolivia *P. tarapacana* forms the world's highest woody plant formation at 5100 m (JORDAN, 1980).

There has been no conflict about the delimitation of this unmistakable genus since its description by RUIZ & PAVON (1798), but the circumscription of species and infraspecific taxa has long caused a lot of confusion. The variability of taxa within and between populations, as well as frequent hybridization have lead to widely differing views concerning the number and delimitation of taxa. Thus, in the first treatment of the genus BITTER (1911) recognized 33 species, 10 subspecies and 22 varieties, while in the latest revision SIMPSON (1979) adopted a rather broad species concept and reduced the species number to 15 without recognizing infraspecific taxa. This latter concept seems to have been too restrictive, as in a later work SIMPSON separated *P. tarapacana* from *P. tomentella* and mentioned that *P. besseri* probably includes more than one biological species (SIMPSON, 1986). Lately, *P. microphylla* from Ecuador was also recognized as being a valid species (ROMOLEROUX, 1992).

The only previous treatment of the Bolivian *Polylepis* species is that of MIYAGAWA (1975) who only worked in a small geographic region and closely followed BITTER's (1911) taxonomic concept. SIMPSON (1986) lists six species as occurring in Bolivia. In the last decade extensive field-work, especially by S. Beck, I. Hensen and the author, has provided over 500 new collections of *Polylepis* from Bolivia. This is about three times the number of specimens previously collected in the country and allows in the present treatment a revision of all Bolivian *Polylepis* species, including the particularly difficult *P. besseri* group. This leads to the separation of *P. besseri* into three species, the recognition of three subspecies within *P. besseri* and the transfer of two populations to *P. racemosa*. Together with the description of a new species (*P. neglecta*) and two new subspecies within *P. tomentella*, I recognize nine *Polylepis* species for Bolivia, two of which have three subspecies each and one with two subspecies (Tab. 1).

Material and Methods

This study is based on field work conducted in July 1989, July to December 1991, and August 1993, and on herbarium material from the following herbaria: A, AAU, DAV, F, G, GH, GOET, HBG, LPB, MO, NY, P, QCA, QCNE, US, USM. 712 specimens from Bolivia and over 750 specimens from other countries were studied. Descriptions of morphological and anatomical features are provided by BITTER (1911), ANCIBOR (1975, 1984), MIYAGAWA (1975) and SIMPSON (1979, 1986). Classification of vestiture types follows SIMPSON (1979). Species descriptions, phenological and ecological data apply to Bolivian populations only. The term subspecies, as used here, implies not only morphological identity of a taxon, but also geographical identity.

Taxonomic treatment

Key to the species and subspecies of *Polylepis* in Bolivia

NOTE. — Identification is generally possible on sterile material. Vestiture should be studied on young, but fully developed leaves. Hybrids are frequently encountered and may only be recognizable after careful study of large collection series from one stand.

- | | | |
|----|--|-----------------------|
| 1a | Lower leaflet surface sericeous, sometimes almost glabrous; bark yellowish brown to orange | 2 |
| 1b | Lower leaflet surface glabrous, pannose, villous, lanose or with small matted glandular hairs; bark reddish brown to dark brown | 3 |
| 2a | Leaflets over 1.4 cm long; 2-7 pairs of leaflets; over 8 flowers per inflorescens; fruits with spines | 1. <i>P. sericea</i> |
| 2b | Leaflets to 1.2 cm long; 1-3 pairs of leaflets; up to 4 flowers per inflorescens; fruits with twisted knobs | 2. <i>P. pepeï</i> |
| 3a | Lower leaflet surface glabrous or with very short pannose hairs which are not recognizable as individual hairs without a hand-lens, hairs shorter than the height of the leaf veins; leaf veins glabrous or puberulous, easily visible | 4 |
| 3b | Lower leaflet surface pannose, pilose or villous, individual hairs recognizable without a hand-lens; leaf veins with similar hairs, often completely obscured by them | 9 |
| 4a | Leaflets membranaceous, sharply serrate; over 14 flowers per inflorescens; fruits with 2-3 thin wings | 4. <i>P. neglecta</i> |
| 4b | Leaflets coriaceous, entire to crenate; to 12 flowers per inflorescens; fruits with 3-5 hard, irregular ridges | 5 |

SIMPSON (1979)	BITTER (1911)	This study
<i>P. sericea</i>	<i>(P. ochreata)</i> <i>(P. stuebelii)</i> <i>(P. hypargyrea)</i> <i>P. sericea</i> <i>(P. albicans)</i> <i>(P. coriacea)</i>	<i>P. sericea</i>
<i>P. pepeii</i>	—	<i>P. pepeii</i>
—	—	<i>P. neglecta</i>
<i>P. hieronymi</i>	<i>P. hypoleuca</i> <i>P. hieronymi</i>	<i>P. hieronymi</i>
<i>P. besseri</i>	<i>P. triacontandra</i> <i>(P. subquinquefolia)</i>	<i>P. racemosa</i> subsp. <i>triacontandra</i>
	—	<i>P. racemosa</i> subsp. <i>lanata</i>
	<i>P. besseri</i> <i>P. besseri</i> var. <i>longipedicellata</i>	<i>P. besseri</i> subsp. <i>besseri</i>
	<i>P. besseri</i> subsp. <i>subtusalbida</i> <i>P. pallidistigma</i>	<i>P. besseri</i> subsp. <i>subtusalbida</i>
	<i>P. incana</i> subsp. <i>incarum</i> <i>P. incana</i> subsp. <i>brachypoda</i>	<i>P. besseri</i> subsp. <i>incarum</i>
	<i>P. crista-galli</i>	<i>P. crista-galli</i>
<i>P. tomentella</i>	<i>P. tomentella</i> subsp. <i>pentaphylla</i> <i>P. tomentella</i> subsp. <i>tetragona</i> <i>P. tomentella</i> subsp. <i>dentatialata</i>	<i>P. tomentella</i> subsp. <i>tomentella</i>
	—	<i>P. tomentella</i> subsp. <i>incanoides</i>
	—	<i>P. tomentella</i> subsp. <i>nana</i>
	<i>P. tarapacana</i>	<i>P. tarapacana</i>

Tab. 1. — Alignment of the *Polylepis* taxa occurring in Bolivia according to BITTER (1911), SIMPSON (1979), and the present study. Taxa in brackets are not found in Bolivia, but are synonymized with Bolivian taxa. *P. tarapacana* is recognized as a valid species in SIMPSON (1986).

- 5a Upper leaflet surface glabrous, covered by a yellow, glassy resin; leaflets to 1.3 cm long, entire to very slightly crenate; western cordillera **9. *P. tarapacana***
- 5b Upper leaflet surface without resin, glabrous to pilose; leaflets over 0.9 cm long, crenate; eastern highlands 6
- 6a Outer surface and upper margin of stipular sheaths pilose, villous, strigose and/or with glandular hairs 4
- 6b Outer surface of stipular sheaths glabrous or with scattered glandular hairs, upper sheath margin villous or strigose 7
- 7a Plant shrubby, to 1.5 m tall; leaflets to 1.2 cm long, with 5-6 teeth per side; inflorescences to 1.8 cm long, without glandular hairs; Prov. Arani, Cochabamba
8c. *P. tomentella* subsp. *nana*
- 7b Plant a shrub or tree, to 9 m tall; leaflets over 0.8 cm long, with 5-24 teeth per side; inflorescences over 1.2 cm long, with or without glandular hairs 8
- 8a Leaflets 0.8-1.9 cm long, with 5-10 teeth per side; leaflet apex slightly to strongly acute; lower leaflet surface always with yellow glandular hairs; upper leaflet surface glabrous to pilose; 2-6 flowers per inflorescences; Potosí, Oruro, Chuquisaca, Tarija
8a. *P. tomentella* subsp. *tomentella*
- 8b Leaflets 0.9-2.4 cm long, with 7-24 teeth per side; leaflet apex obtuse to slightly acute; lower leaflet surface with or without yellow glandular hairs; upper leaflet surface glabrous, rarely very slightly pilose; 4-8 flowers per inflorescences; Cochabamba
8b. *P. tomentella* subsp. *incanoides*
- 9a Vestiture of lower leaflet surface shaggy, long, lanose, restricted to leaf veins or much longer there than on the remaining surface; fruits with largest spine on the top of each ridge 10
- 9b Vestiture of lower leaflet surface homogeneously distributed, short to long, pannose to villous; fruits with several spines on each ridge 11
- 10a 1-2 pairs of leaflets; leaflet apex obtuse to acute, with 8-14 teeth per side; 8-18 flowers per inflorescences; inflorescences vestiture shaggy; La Paz
5a. *P. racemosa* subsp. *triacontandra*
- 10b 2-3 pairs of leaflets; leaflet apex obtuse to strongly emarginate, entire or with 4-8 teeth per side; 5-11 flowers per inflorescences; inflorescences vestiture loosely to densely villous; Cochabamba **5b. *P. racemosa* subsp. *lanata***
- 11a 2-4 pairs of leaflets; leaflets round, obovate or ovate; leaflet apex obtuse to emarginate; vestiture of lower leaflet surface dense, white, pannose; inflorescences, flowers and fruits with a dense, white pannose vestiture 12
- 11b 1-3 pairs of leaflets; leaflets oblong to elliptic; leaflet apex obtuse to acute; vestiture of lower leaflet surface white, yellowish or grayish, loosely to densely pannose; inflorescences, flowers and fruits loosely to densely villous 14
- 12a Leaflets 2.0-3.8 cm long, obovate, apex obtuse to strongly emarginate; flowers sessile; fruits with largest spine near the top of each ridge ... **5b. *P. racemosa* subsp. *lanata***
- 12b Leaflets 1.1-3.4 cm long, round to ovate, apex obtuse; flowers sessile or with up to 1.1 cm long stalks; fruits with irregular ridges or thin spines 13
- 13a Stipular sheaths villous to pannose; flowers sessile or with up to 0.2 cm long stalks; fruits with irregular ridges **6a. *P. besseri* subsp. *besseri***
- 13b Stipular sheaths strigose; flowers stalked 0.2-1.1 cm; fruits with long, thin spines
3. *P. hieronymi*

- | | | |
|-----|---|---|
| 14a | Leaflets lanceolate to obovate, 1.9-4.9 cm long; lower leaflet surface villous, shaggy, white; inflorescences unbranched or branched; 8-18 flowers per inflorescens | |
| | 5a. <i>P. racemosa</i> subsp. <i>triacontandra</i> | |
| 14b | Leaflets elliptic, ovate or obovate, 0.9-3.2 cm long; vestiture of lower leaflet surface pan-nose, short to long, white, yellowish or grayish; inflorescences unbranched; 3-12 flowers per inflorescens | 15 |
| 15a | Leaflets yellowish; from the vicinity of Lake Titicaca | 6c. <i>P. besseri</i> subsp. <i>incarum</i> |
| 15b | Leaflets green, grayish or bluish; Cochabamba, Potosí, Chuquisaca, Tarija | 16 |
| 16a | 1-2 pairs of leaflets; leaflets 1.3-3.2 cm long, obovate to rhombic; 4-12 flowers per in-florescens; fruits 0.6-1.6 cm wide and 0.9-1.3 cm long, with coarsely indented ridges, green, brown or red; SE Potosí, Chuquisaca, Tarija | 7. <i>P. crista-galli</i> |
| 16b | 1-3 pairs of leaflets; leaflets 0.9-2.9 cm long, elliptic, lanceolate, ovate or obovate; 3-7 flowers per inflorescens; fruits 0.3-0.7 cm wide and 0.3-0.7 cm long, with finely indented ridges, green or brown; Cochabamba, NW Potosí | 6b. <i>P. besseri</i> subsp. <i>subtusalbida</i> |

- 1. *Polylepis sericea*** Weddell, *Chloris Andina*: 238. 1861; Simpson, *Smithsonian Contr. Bot.* 43: fig. 16. 1979. **Type:** Venezuela, Mérida, Sierra Nevada, 11,000 ft, June 1847, Funck & Schlim 1546 (lectotype, P, selected in Simpson, *Smithsonian Contr. Bot.* 43: 28; isolectotype, G).
- = *Acaena ochreatea* Weddell, *Chloris Andina*: 240. 1861. **Type:** Ecuador, Pichincha, W slopes of Pichincha, 12,000 ft, May 1856, Jameson 73 (lectotype, P, selected in Simpson, *Smithsonian Contr. Bot.* 43: 28; isolectotypes, G, GH; Rockefeller photograph 27498, F, MO, US). = *Polylepis ochreatea* (Weddell) Bitter, *Bibliotheca Botanica* 74: 5. 1911.
- = *Polylepis stuebelii* Hieronymus, *Bot. Jahrb. Syst.* 21: 313. 1896. **Type:** Ecuador, Cotopaxi, W slope of Cerro Quilindaña near Bambasacha, 3700 m, Stübel 204 (type, destroyed in B; Rockefeller photograph 3395, MO, NY, US).
- = *Polylepis albicans* Pilger, *Bot. Jahrb. Syst.* 37: 535. 1906. **Type:** Perú, Ancash, Cordillera Blanca above Caraz, June 1903, Weberbauer 3229 (type, destroyed in B; Rockefeller photograph 3383, GH, NY).
- = *Polylepis ochreatea* var. *integra* Bitter, *Bot. Jahrb. Syst.* 45: 598, fig. 4. 1911. **Type:** Ecuador, Imbabura, Volcán Mojanda, 3000-4000 m, Sodiro s.n. (holotype, FI; possible isotype, W).
- = *Polylepis hypargyrea* Bitter, *Bot. Jahrb. Syst.* 45: 600, fig. 5. 1911. **Type:** Venezuela, Mérida, Sierra Nevada, Páramo de La Culata, Dec., Moritz 1120 (type, destroyed in B; Rockefeller photograph 17985, GH).
- = *Polylepis subintegra* Benoist, *Bull. Soc. Bot. France* 81: 326. 1934. **Type:** Ecuador, Pichincha, Taurichupa, 4000 m, 28. Nov. 1930, Benoist 3356 (lectotype, P, selected in Simpson, *Smithsonian Contr. Bot.* 43: 28).
- = *Polylepis quindiensis* Cuatrecasas, *Rev. Acad. Colomb. Cienc. Exact.* 4: 343. 1941. **Type:** Colombia, Caldas, Cordillera Central, ladera W del macizo del Quindio, Nevado del Ruiz, 3400-3500 m, 5 Mayo 1940, Cuatrecasas 9327 (holotype, US; isotype, US).

Evergreen tree, (2)5-15 m tall; bark of the trunk and larger branches yellowish brown to orange, flaking off in long stripes. Leaves slightly congested at the tips of the branches, imparipinnate with 2-7 pairs of leaflets, obtrullate in outline, 2-6 cm wide and 2.5-12 cm long; rachis slightly tomentose, point of leaflet attachment hispid with a ring of scattered reddish multicellular glandular trichomes and resinous exudate; stipular sheaths truncate or spurred (to 4 mm) at the apex, outer surface and top sericeous. Leaflets elliptic, lanceolate or ovate in outline, second pair from the terminal leaflet the largest, one of this pair 0.4-1.4 cm wide and 1.4-3.8 cm long; margins entire or slightly serrate; apex acute or obtuse; base unequally cordate; terminal leaflet with 2-8 mm long petiolule; upper surface glabrous or slightly sericeous, especially along the central vein; lower surface with an evenly distributed sparse to dense layer of white or grayish silky trichomes. Inflorescences pendant,

3-25 cm long, bearing 8-60 flowers; floral bracts to 12 mm long, green to orange; rachises rarely branched, tomentose. Flowers perfect, 0.5-1 cm in diameter; sepals 3-5, oval, green, outer surface sericeous; Stamens 6-16, purple or deep red brown, covered with long white trichomes; base of style with or without a tuft of long white hairs. Fruits irregularly shaped, more or less turbinate, pilose or hispid, with a variety of short to long, thin spines, 0.2-0.7 cm wide including protuberances, 0.2-0.8 cm long.

Specimens examined. — La Paz: Prov. Larecaja, between Sorata and Mapiri, Fola, Aug. 1933, Cárdenas 1102 (NY); Prov. Murillo, 8 km after Palca on road to Iquico, 4000 m, 10.11.1967, Vuillemier 342 (F, GH, MO, NY); Cochabamba: Prov. Chapare, Mayca Mayu, 3300 m, 28.7.1990, Hensen 849 (LPB), Hensen 852 (LPB); Prov. Chapare, Mayca Mayu, 3300 m, 2.4.1991, Hensen 2248 (LPB); Prov. Chapare, Maycamayu, ca. 60 km N Sacaba, 17°12'S/65°58'W, 3300 m, 11.8.1991, Kessler 2874 (GOET), Kessler 2875 (GOET), Kessler 2877 (GOET, LPB, USM), Kessler 2878 (AAU, GOET, LPB), Kessler 2879 (GOET, LPB), Kessler 2880 (GOET).

Distribution. — Eastern cordillera in La Paz and Cochabamba; Venezuela to Bolivia (Fig. 1).

Phenology. — Flowers: August, November; fruits: November.

Ecology. — In Bolivia this is an uncommon, localized species of the upper humid montane forestline between 3300 and 3700 m where it cooccurs with *P. racemosa*.

Remarks. — An unmistakable species, despite of its great variability. The sericeous leaflet undersurface distinguishes it from all other Bolivian species except *P. pepeii* which has much smaller leaflets, less flowers per inflorescens and very characteristic twisted fruits. The closely related *P. pauta* Hieronymus has been recorded in Cuzco, SE Peru, and might occur in montane forests in La Paz. It is distinguished from *P. sericea* by the vestiture of the leaflet undersurface which is restricted to the veins, more rounded leaflets, and strongly serrate leaflet margins.

2. ***Polylepis pepeii*** Simpson, Smithsonian Contr. Bot. 43: 32, fig. 20. 1979. **Type:** Bolivia, Cochabamba, Chapare, 77 km after Chapare on the road to Todos Santos, 4200 m, 4. Jan. 1968, Vuillemier 465 (holotype, US; isotypes, GH, P).

Evergreen shrub or tree, to 4 m tall; bark of the trunk and larger branches yellowish brown, flaking off in long stripes. Leaves strongly congested at the tips of the branches, imparipinnate with 1-3 pairs of leaflets, obtrullate in outline, 1-2.4 cm wide and 0.8-2.8 cm long; rachis glabrous or with short, straight, appressed trichomes, point of leaflet attachment with a ring of short, straight, single-celled trichomes; stipular sheaths truncate or with short, obtuse spurs at the apex, outer surface and top glabrescent to strigose. Leaflets oblong to obovate in outline, second pair from the terminal leaflet the largest if more than one pair is present, one of this pair 0.2-0.4 cm wide and 0.6-1.2 cm long; margins entire, ciliate; apex emarginate or tridentate due to a projection of the midvein; base unequally attenuate; terminal leaflet sessile or with 1-2 mm long petiolule; upper surface sparsely to densely strigose; lower surface minutely sericeous, the trichomes often most conspicuous on the veins and margins. Inflorescences upright or pendant, to 4 cm long, bearing 1-4 flowers; floral bracts lanceolate, to 6 mm long, outer surface strigose; rachises densely strigose. Flowers perfect, 0.4-1 cm in diameter; sepals 3-4, lanceolate to ovate, green, outer surface sparsely to densely strigose; Stamens (4?) 10-12, apex tomentose; base of style with or without tuft of long white hairs. Fruits irregularly shaped, fusiform, often slightly twisted, with an irregular number of blunt protuberances or short spines around the middle, pilose or hispid, 0.2-0.3 cm wide including protuberances, 0.3-0.7 cm long.

Specimens examined. — La Paz: Prov. Murillo, Cordillera Real, Mina Alaska, 13,700 ft (4200 m), 1.-4.3.1926, Tate s.n. (LPB, NY); Prov. Murillo, 14.8 km N of pass at head of Zongo Valley, 3850-4050 m, Brandbyge 584 (AAU, LPB); Prov. Murillo, Valle de Zongo, Cabecera del Río Manos, 3700 m, 7.8.1983, Octavio s.n. (LPB); Prov. Murillo, Zongo Valley, 15 km below pass, 16°13'S/68°07'W, 3950 m, 5.8.1991, Kessler 2795 (GOET, LPB, USM); Prov. Murillo, de la cumbre

bajando 16 km hacia Unduavi, 3600 m, Beck 11859 (LPB); Prov. Murillo, 16 km debajo de la cumbre en camino a Unduavi, valle lateral arriba de Laguna Viscachani, 3900-4000 m, Solomon 16172 (LPB, MO); Prov. Nor Yungas, Camino a Chuspipata, 16°15'S/67°41'W, 3600 m, 12.8.1991, Palacios 7521 (LPB, QCNE); Prov. Sud Yungas, debajo de Unduavi, subiendo el Valle de Cerromarca, 3450 m, 28.8.1988, Beck 14680 (LPB); Prov. Inquisivi, 15 km N Villa Victoria, ca. 15 km SW Quime, 17°06'S/67°14'W, 4050 m, 5.12.1991, Kessler 3385 (GOET, LPB), Kessler 3386 (AAU, GOET, LPB); Cochabamba: Prov. Tiraque, nahe Cerro Khomer Khasa, alte Strasse in den Chapare, 4000 m, 11.6.1993, Ibisch P.I.93.ROS.1 (GOET, LPB).

Distribution. — Eastern Cordillera in La Paz and Cochabamba; also in Cuzco and Puno, southeastern Peru (Fig. 1).

Phenology. — Flowers: December.

Ecology. — An uncommon and localized species, known from between 3450 and 4100 m at sites located a few kilometers westward from the outer eastern Andean ridges, i.e. not directly exposed to the convective cloud masses.

Remarks. — As opposed to SIMPSON's (1979) original description of the species, *P. pepeï* may well achieve tree form, and specimens with 35 cm dbh and a height of 4 m have been found in Cuzco, Peru (P. Driesch, pers. comm.).

3. *Polylepis hieronymi* Pilger, Bot. Jahrb. Syst. 37: 535. 1906; Simpson, Smithsonian Contr. Bot. 43: fig. 12. 1979. **Type:** Bolivia, Tarija, Salinas, Cuesta de Pollo, Valle del Tambo, Juni 1873, Lorentz & Hieronymus 938a (type, destroyed in B; isotypes, G, GOET, NY; Rockefeller photograph 3355, NY, G).
- = *Polylepis racemosa* β *hypoleuca* Weddell, Chloris Andina: 238. 1861. **Type:** Bolivia, Tarija, zwischen Tarija und San Luis, Juli-Aug. 1846, Weddell 4607 (lectotype, P, selected in Simpson, Smithsonian Contr. Bot. 43: 23). \equiv *Polylepis hypoleuca* (Weddell) Bitter, Bot. Jahrb. Syst. 45: 607. 1911.
 - = *Polylepis racemosa* var. *albotomentella* Kuntze, Revis. Gen. Plant. 3: 77. 1898. **Type:** Argentina, Córdoba, Sierra de Córdoba, Los Gigantes, Kurtz 6926 (type, NY). \equiv *Polylepis australis* var. *bijuga* Bitter, Bot. Jahrb. Syst. 45: 624. 1911. Nom. illeg.
 - \equiv *Polylepis hieronymi* var. *dolicholopha* Bitter, Bot. Jahrb. Syst. 45: 609. 1911. Nom. illeg.
 - = *Polylepis hieronymi* var. *saltensis* Bitter, Bot. Jahrb. Syst. 45: 609. 1911. **Type:** Argentina, Salta, near Pampa Granda, pass "El Alizar", 2400-2600 m, 1900, Nelson 12584 (holotype, S).

Evergreen tree, to 3 m tall; bark of the trunk and larger branches grayish brown, flaking off in stripes. Leaves strongly congested at the tips of the branches, imparipinnate with 3-4 pairs of leaflets, obtrullate in outline, 1.9-5.2 cm wide and 2.9-9.7 cm long; rachis densely lanose, point of leaflet attachment with a ring of small, dark-colored multicellular glandular trichomes, often hidden under lanose or hispid hairs; stipular sheaths truncate at the apex, but sometimes appearing spurred because of the projection of long sericeous hairs from the outer surface and top. Leaflets ovate in outline, the first pair from the terminal leaflet the largest, one of this pair 0.5-1.2 cm wide and 1.2-3.2 cm long; margins crenate; apex obtuse; base unequally cordate, the pairs of leaflets often subopposite; terminal leaflet with 2-6 mm long petiolule; upper surface rugose, often sparsely villous; lower surface densely lanose with long twisted trichomes. Inflorescences pendant, 5-22 cm long, bearing 8-25 flowers; floral bracts to 7 mm long, strigose on the outer surface; rachises usually branched, tomentose. Flowers perfect, 0.6-0.9 cm in diameter; sepals (3)-4, oval, outer surface sericeous; Stamens 8-18, orbicular, upper half with a tuft of long white or yellowish trichomes; base of style with a tuft of long white hairs. Fruits almost cylindrical, densely lanose, with long, thin, often hooked spines, 0.3-0.9 cm wide including protuberances, 0.5-1.0 cm long.

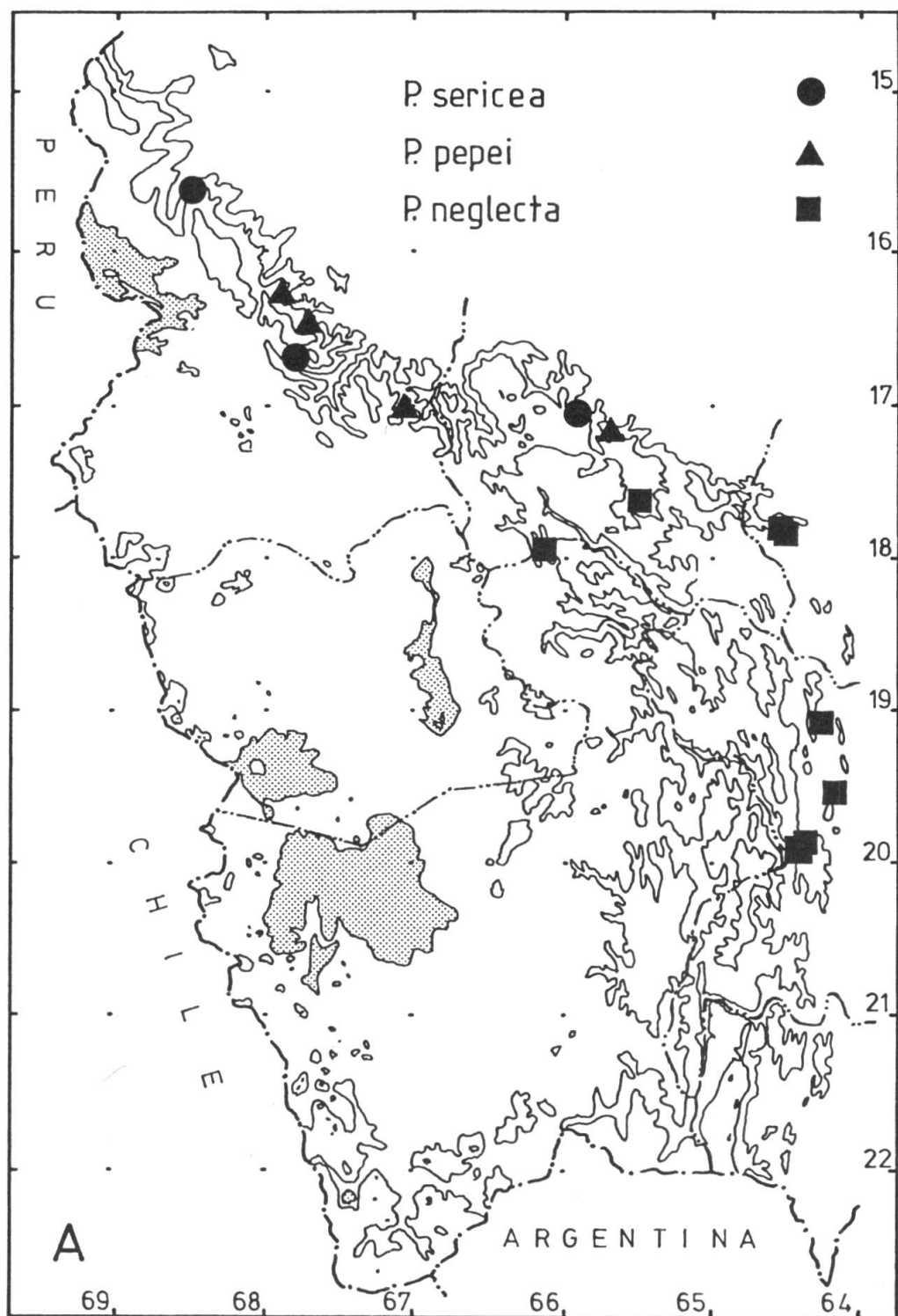
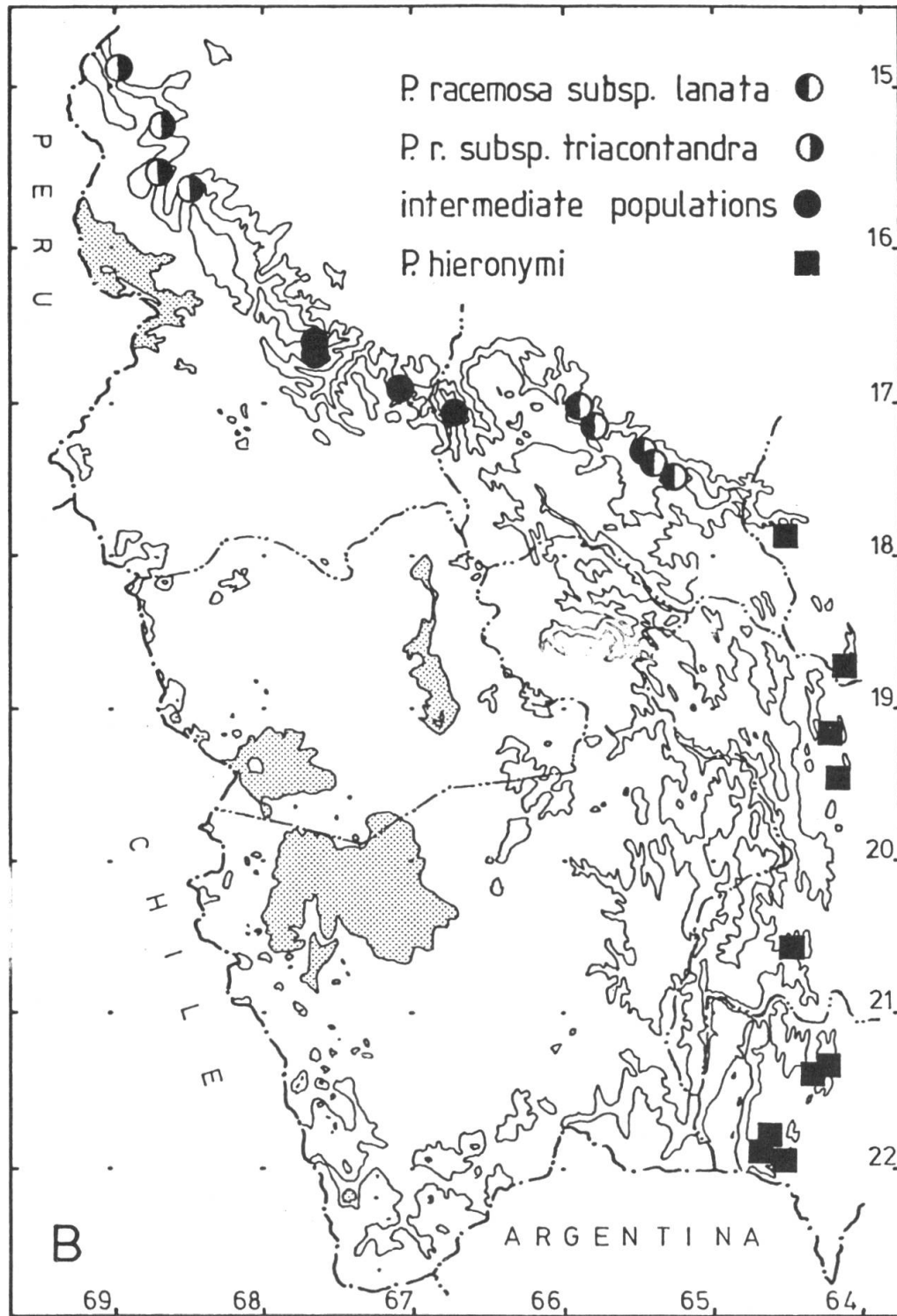


Fig. 1. — Bolivian distribution of *Polylepis sericea*, *P. pepeii*, *P. neglecta* (A), *P. racemosa* subsp. *lanata*, *P. racemosa* subsp. *triacontandra*, and *P. hieronymi* (B). Shaded areas are lakes and salt lakes; contour intervals are located at 2500, 3500, 4500, and 5500 m.



Specimens examined. — Santa Cruz: Prov. Florida, Gipfel des “Mesón” bei Samaipata, 2200 m, März 1911, Herzog 1786/a (GOET); Prov. Florida, 4 km N of center of Samaipata, 18°08'S/63°52'W, 2000-2100 m, Nee & Vargas 43429 (NY); Prov. Caballero, Loc. San Juan del Patrero, Yunguillas y Cabeceras del Río Zapallar, 17°52'S/64°25'W, 2300-2400 m, 12.-13.5.1992, Vargas et al. 1350 (NY); Prov. Valle Grande, between “Mataralcito” and “El Palmar” on road from Valle Grande to Tierras Nuevas, 17 km by air ESE of Valle Grande, 18°32'S/65°57'W, 2150 m, 29.12.1988, Nee et al. 37403 (NY); Chuquisaca: Prov. B. Boeto, próximo a Lagunillas, 2240 m, 24.1.1988, Murguía 128 (LPB); Prov. B. Boeto, 1 km S Nuevo Mundo on road to Padilla, 19°28'S/64°10'W, 2200 m, 7.10.1991, Kessler 3306 (GOET, LPB), Kessler 3307 (AAU, GOET), Kessler 3308 (AAU, GOET), Kessler 3309 (GOET, LPB); Prov. B. Boeto, 8 km SW Nuevo Mundo on road to Padilla, 2450 m, 19°25'S/64°11'W, 7.10.1991, Kessler 3317 (GOET), Kessler 3318 (GOET), Kessler 3321 (GOET, LPB); Prov. Tomina, Padilla 25 kms hacia Monteagudo, 2400 m, 1.10.1983, Beck & Liberman 9345 (GOET, LPB); Prov. Tomina, ca. 20 km SE Padilla on road to Monteagudo, 19°03'S/64°16'W, 2450 m, 7.10.1991, Kessler 3319 (AAU, GOET, LPB), Kessler 3320 (GOET, LPB); Prov. Sud Cinti, Cerro Cobre Khasa, between Culpina and El Palmar, 20°48'S/64°34'W, 3100 m, 21.9.1991, J.Fjeldsá s.n. (GOET); Prov. Sud Cinti, Cerro Campamentito, between Culpina and El Palmar, 20°48'S/64°26'W, 2500 m, 21.9.1991, J.Fjeldsá s.n. (GOET); Tarija: Prov. Arce, 39,9 km S of junction of road to Entre Rios on road to Padcaya, 2100-2200 m, Solomon 10218 (LPB, MO, NY); Prov. Arce, ca. 5 km W Padcaya, 21°54'S/64°46'W, 2200 m, 18.9.1991, Kessler 3113 (AAU, GOET, LPB), Kessler 3114 (AAU, GOET, LPB), Kessler 3115 (GOET, USM); Prov. O'Connor, 21,1 km on road to Entre Rios, 1900 m, Solomon 10918 (LPB, MO, NY); Prov. O'Connor, ca. 70 km on road from Tarija to Entre Rios, 21°26'S/64°19'W, 2200 m, 20.9.1991, Kessler 3123 (AAU, GOET), Kessler 3124 (AAU, GOET), Kessler 3125 (GOET, LPB), Kessler 3660 (AAU, GOET), Kessler 3661 (GOET).

Distribution. — Santa Cruz, Chuquisaca and Tarija; Bolivia south to Jujuy (Córdoba?), Argentina (Fig. 1).

Phenology. — Flowers: July, September, October; fruits: September, October.

Ecology. — A pioneer species which often colonizes landslides and roadsides between 1900 and 3300 m in the area of the Boliviano-Tucumanic forests (with *Podocarpus parlatorei*, *Alnus acuminata*, div. Myrtaceae, etc.).

Remarks. — In sterile condition this species can be distinguished from *P. besseri* subsp. *besseri* by the larger number of leaflets (3-4 pairs as opposed to 2-3), and the hispid vestiture of stipule sheaths and upper leaflet surfaces (lanose in *P. besseri* subsp. *besseri*). In contrast to SIMPSON's (1979, 1986) view *P. hieronymi* is here considered to be more closely to *P. besseri* and *P. racemosa* than to *P. sericea*.

4. *Polylepis neglecta* M. Kessler, spec. nov. (Fig. 2). **Type:** Bolivia, Dept. Potosí, Prov. Bilbao, 31 km SW Acacio on road to Sacaca and Uncia, 18°06'S/66°08'W, 3500 m, 22.8.1991, Kessler 3410 (holotype, LPB; isotypes, AAU, G, GOET, MO, NY, US, USM).

Differt a *P. australi* Bitter floribus inflorescentiae pluribus (14-27 versus 2-12), inflorescentia plerumque ramosa, foliolis plus numerosis et apicibus foliolorum semper acutis.

Evergreen tree, 5-12 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves clearly congested at the tips of the branches, imparipinnate with 2-4 pairs of leaflets, obtrullate in outline, 4-5.5 cm wide and 6-8.5 cm long; rachis glabrescent to hispid, point of leaflet attachment hispid with a tuft of long white trichomes; stipular sheaths truncate or spurred (to 2 mm) at the apex, outer surface glabrescent to slightly hispid, top with long, straight white hairs. Leaflets elliptic or lanceolate in outline, first (rarely second) pair from the terminal leaflet the largest, one of this pair 0.4-1.0 cm wide and 1.4-3.2 cm long; margins serrate with 10-17 teeth; apex acute; base unequally cordate; terminal leaflet with 2-7 mm long petiolule; upper surface

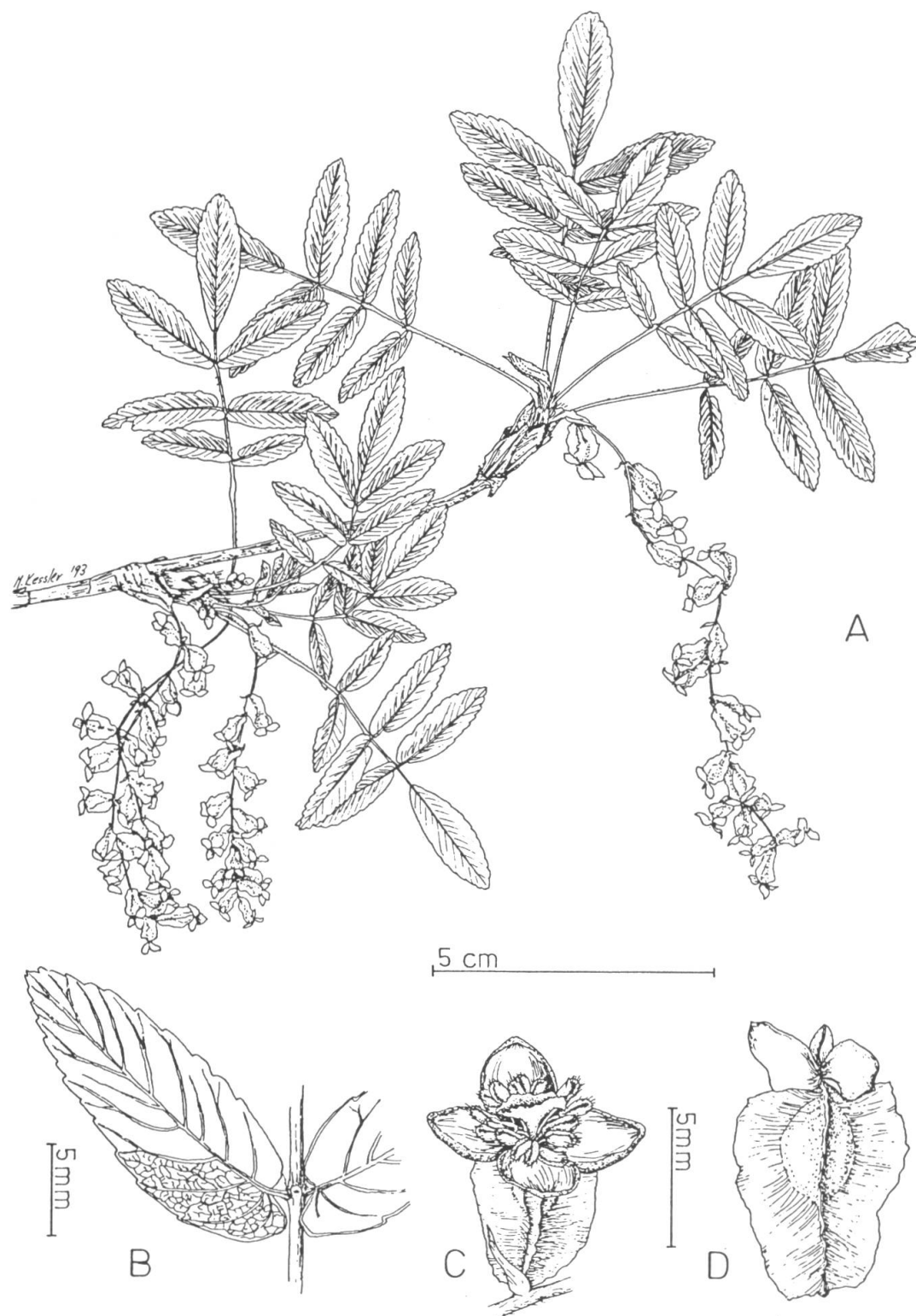


Fig. 2. — *Polylepis neglecta* M. Kessler
A, branchlet; **B**, leaflet and point of leaflet attachment; **C**, flower; **D**, fruit. **A-D**, Kessler 3410.

glabrous or slightly tomentose, especially along the central vein; lower surface with an evenly distributed sparse to dense layer of very short yellowish glandular trichomes, rarely with a few long hispid hairs, occasionally almost glabrous. Inflorescences pendant, 5-14 cm long, bearing 14-27 flowers; floral bracts lanceolate, 1-4 mm long, green to reddish brown, glabrous to sparsely hispid; rachises usually branched, glabrous. Flowers perfect, 0.4-0.8 cm in diameter; sepals 3-4, oval, green, outer surface sparsely hispid, tomentose or glandular; stamens 8-20, anthers with a tuft of long white trichomes at the apex; base of style with a tuft of long white hairs. Fruits turbinate, with 2-3(4) irregular and pronounced wings, green to red, glabrous to sparsely hispid or glandular, 0.4-0.6 cm wide including wings, 0.4-1.0 cm long.

Specimens examined. — Cochabamba: Prov. Carrasco, 10 km W Valle Hermoso on Cochabamba-Comarapa road, 17°44'S/64°56'W, 2900 m, 5.10.1991, Kessler 3298 (GOET, LPB); Prov. Mizque, Cañada Pucara Mayu, a 37 km de Rodeo a Mizque, entre Khewiña Khasa y Pucara Khasa, 17°49'S/65°26'W, 3200 m, 8.5.1987, Estenssoro 802 (LPB); Prov. Mizque, Pucara Mayu, camino secundario de Rodeo a Mizque, cerca a Khewiña Khasa, en las cabeceras del R. Pucara, 17°47'S/65°30'W, 3150 m, 8.5.1987, Estenssoro 680 (LPB); Santa Cruz: Prov. Caballero, about 25 km from Pojo, the road Cochabamba-Sta. Cruz about 215 km from Cochabamba, 17°50'S/64°40'W, 2950 m, 21.4.1987, Brandbyge 717 (AAU); Prov. Caballero, ca. 55 km W Comarapa on road to Cochabamba, 17°50'S/64°42'W, 2600 m, 6.10.1991, Kessler 3302 (AAU, GOET, LPB); Prov. Caballero, ca. 50 km W Comarapa on road to Cochabamba, 2800 m, 6.10.1991, Kessler 3303 (GOET); Potosí: Prov. Bilbao, antes de Sakani Khasa, 3400 m, 18.3.1993, Torrico 198 (LPB); Prov. Bilbao, 31 km SW Acacio on road to Sacaca and Uncia, 18°06'S/66°08'W, 3500 m, 22.8.1991, Kessler 3019 (AAU, GOET, LPB), Kessler 3411 (AAU, GOET), Kessler 3522-3552 (one each GOET); Chuquisaca: Prov. B. Boeto, 8 km SW Nuevo Mundo on road to Padilla, 19°25'S/64°11'W, 2500 m, 7.10.1991, Kessler 3316 (AAU, GOET, LPB); Prov. Azurduy, ca. 20 km NW Tarvita on road to Tarabuco, 19°54'S/64°34'W, 2900 m, 24.9.1991, Kessler 3434 (AAU, GOET), Kessler 3435 (GOET, LPB), Kessler 3436 (AAU, GOET), Kessler 3437 (AAU, GOET, LPB), Kessler 3625-3635 (one each GOET), Kessler 3663-3668 (one each GOET); Prov. Tomina, Padilla 26 kms hacia Monteagudo, 2600 m, 8.3.1981, Beck 6323 (GOET, LPB); Prov. Tomina, ca. 20 km SE Padilla on road to Monteagudo, 19°03'S/64°16'W, 2450 m, 7.10.1991, Kessler 3320 (GOET, LPB).

Etymology. — The species name *neglecta* refers to the fact that this species has long been overlooked by field botanists. For example, it is locally common directly along the frequently travelled road from Cochabamba to Santa Cruz, but it was only collected for the first time in 1987 and then not recognized as an undescribed species until 1991.

Distribution. — Endemic to central Bolivia; known from eight localities in Cochabamba, Santa Cruz, Potosí and Chuquisaca (Fig. 1).

Phenology. — Flowers: August — October; fruits: March, August — October.

Ecology. — Found between 2400 and 3500 m in areas with about 600 — 1200 mm mean annual precipitation. Rarely forms pure stands; usually associated with other *Polylepis* species (*P. hieronymi*, *P. besseri*) and with elements of the Bolivian-Tucumanic forests such as *Podocarpus parlatorei*, *Alnus acuminata*, *Juglans australis*, *Azara salicifolia*, *Fagara coco*, *Prunus tucumanensis* and *Eschallonia millegrana*.

Remarks. — *P. neglecta* is closely related to the allopatric *P. australis* Bitter from Argentina, but it differs in the larger number of flowers per inflorescence (14-27 as opposed to 2-12), the usually branched inflorescences which are often glabrous, the lack of glandular or hispid hairs on the stipular sheaths, the larger number of leaflet pairs (2-4 as opposed to 1-3), the always acute leaflet apices, and the always present tuft of hairs at the base of the style. The finely pinnate, light green leaves and the long pendant inflorescences which are often reddish when fruiting give this species a unique habit for a *Polylepis* species which is reminiscent of some *Salix* species.

Hybrids with *P. besseri* subsp. *subtusalbida* are known from Potosí. While these hybrids are morphologically clearly intermediate between their parent species, they are indistinguishable from *P. crista-galli* and can only be recognized as hybrids when the whole population is studied in the field.

5. *Polylepis racemosa* Ruiz & Pavón, Syst. Veget. Flora Peruviana et Chilensis: 139. 1798; Simpson, Smithsonian Contr. Bot. 43: fig. 36. **Type:** Caxamarquilla et Pillao, Perú, Ruiz s.n. (holotype, P; isotype, G).

- = *Polylepis villosa* Humboldt, Bonpland et Kunth, Voyage aux reg. equinoct. de Nouv. Cont. P. 6, Sect. 3, 6(26): 228. 1824. **Type:** Perú, Caxamarca, 8784 ft, Aug. 1802, Bonpland 3685 (holotype, P; isotype, P).
- = *Polylepis incana* subsp. *icosandra* Bitter, Bot. Jahrb. Syst. 45: 641. 1911. **Type:** Perú, Ancash, Cajatambo, zwischen Tallenga und Piscapaccha, Weberbauer 2886 (type, probably destroyed in B).
- = *Polylepis incana* subsp. *micranthera* Bitter, Bot. Jahrb. Syst. 45: 642. 1911. **Type:** Perú, Huánuco, Sierra, Caxamarquilla, without collector (holotype, W).
- = *Polylepis incana* var. *primovestita* Bitter, Bot. Jahrb. Syst. 45: 645. 1911. **Type:** Perú, Caxamarquilla et Pillao, Ruiz s.n. (holotype, P; isotype, G).
- = *Polylepis incana* var. *connectens* Bitter, Bot. Jahrb. Syst. 45: 654. 1911. **Type:** Perú, Berge bei Huánuco, Haenke s.n. (holotype, PR).

Evergreen tree, 3-15 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-3 pairs of leaflets, rhomboid to obtrullate in outline, 2.3-6.8 cm wide and 3.5-8.8 cm long; rachis densely villous or lanose, especially on the upper surface, sometimes mixed with scattered glandular trichomes; point of leaflet attachment with a tuft of long white lanose or strigose trichomes; stipular sheaths with a slight shoulder (to 1 mm) at the apex, outer surface glabrous or sparsely lanose or glandular; inner surface and top with long lanose or strigose trichomes protruding at the apex from the inner surface. Leaflets elliptic, obovate or almost oblong in outline, first or second pair from the terminal leaflet the largest, one of this pair 0.7-1.8 cm wide and 1.9-4.9 cm long; margins entire to clearly crenate with 4-14 teeth; apex acute, obtuse or slightly to deeply emarginate; base unequally attenuate, rounded or cordate; terminal leaflet with 2-12 mm long petiolule; upper surface smooth to slightly rugose, dark green, glabrous to slightly hispid or lanose, especially along the central vein; lower surface with long, shaggy white, yellowish or brown interwoven trichomes inserted on the veins but loosely covering the entire undersurface, these trichomes mixed with a variable amount of short, twisted, multicellular, often glandular trichomes which may also cover the surface between the veins. Inflorescences pendant, 3.5-18 cm long, bearing 3-18 flowers; floral bracts lanceolate, 2-10 mm long, occasionally with leaflet-like tips, sparsely lanose; rachises rarely branched, with scattered to dense lanose, and sometimes glandular, trichomes. Flowers perfect, 0.5-1.1 cm in diameter; sepals 3-4, ovate to almost rounded, outer surface villous and sparsely glandular, especially near the tips, inner surface pilose near the tip, often intermixed with several-celled glandular trichomes; stamens 10-22, anthers orbicular, with a dense tuft of straight white trichomes on the upper half; base of style with or without a tuft of long white hairs. Fruits turbinate with 2-5 irregular, flattened ridges projecting into a point at the top, body of fruit densely lanose mixed with scattered glandular trichomes, 0.2-0.9 cm wide including protuberances, 0.2-0.9 cm long.

Distribution. — La Paz and Cochabamba, Bolivia; Peru.

Remarks. — SIMPSON (1979) only treated the northern and central Peruvian populations as *P. racemosa*, and merged the populations from southern Peru and Bolivia with *P. besseri*. In the present study I recognize seven distinct taxa within "*P. besseri*" (sensu SIMPSON, 1979), two of which are treated as distinct species (*P. crista-galli* and *P. rugulosa* from Chile and Peru) and two of which are transferred to *P. racemosa* because some of their specimens are undistinguishable from typical Peruvian specimens of *P. racemosa*. Within *P. racemosa* four clearly distinct populations

(northern and central Peru; Apurimac and Cuzco, southern Peru; Puno, southern Peru, to La Paz; Cochabamba) are recognizable. Two of these occur in Bolivia and are here given subspecies status. They both differ from the nominate subspecies from central Peru which is not circumscribed here due to a lack of personal acquaintance with it. All four main populations intergrade with each other where they meet.

P. racemosa is distinguished from *P. bessi* s.str. by the shaggy lanose vestiture of the leaflet undersurface which is concentrated on the nerves, by the restriction of the tuft of hairs on the anthers to their upper half, and by the single main spine near the top of the fruit ridges. Hybrids between both species are not uncommon.

5a. *Polylepis racemosa* Ruiz & Pavón subsp. *triacontandra* (Bitter) M. Kessler, stat. nov. (Fig. 3, 4).

- = *Polylepis triacontandra* Bitter, Bot. Jahrb. Syst. 45: 630. 1911. **Type:** Bolivia, La Paz, Larecaja near Sorata, Cochipata, 3300 m, 9.10.1818, Mandon 674 (lectotype, G, selected in Simpson, Smithsonian Contr. Bot. 43: 42; isoelectotypes, GOET, NY, P, S, US).
- = *Polylepis subquinquefolia* Bitter, Bot. Jahrb. Syst. 45: 636. 1911. **Type:** Peru, Puno, Sandia above Coyoeno, 3600 m, Weberbauer 931 (type, destroyed in B; Rockefeller photograph 3391, GH, NY).

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-2 pairs of leaflets, obtrullate in outline, 2.9-6.8 cm wide and 3.5-6.7 cm long; rachis densely lanose, especially on the upper surface, mixed with scattered glandular trichomes; point of leaflet attachment with a tuft of long white lanose trichomes; stipular sheaths with a slight shoulder (to 1 mm) at the apex, outer surface sparsely lanose; inner surface and top with long lanose or strigose trichomes protruding at the apex from the inner surface. Leaflets elliptic or obovate in outline, first pair from the terminal leaflet the largest, one of this pair 0.8-1.6 cm wide and 1.9-4.9 cm long; margins revolute, clearly crenate with 8-14 teeth; apex acute, obtuse or very slightly emarginate; base unequally attenuate to rounded; terminal leaflet with 4-11 mm long petiolule; upper surface slightly rugose, dark green, glabrous to very sparsely lanose along the central vein; lower surface with long, shaggy white interwoven trichomes inserted on the veins but loosely covering the entire undersurface, surface between the veins with scattered similar trichomes mixed with a variable amount of short, twisted, multicellular, often glandular trichomes. Inflorescences pendant, 8-18 cm long, bearing 8-18 flowers; floral bracts lanceolate, 6-10 mm long, to 5 mm wide and occasionally with up to 12 mm long leaflet-like tips, sparsely lanose; rachises often branched, with scattered lanose and glandular trichomes. Flowers perfect, 0.7-1.1 cm in diameter; sepals 3-4, ovate to almost rounded, often red, outer surface villous and sparsely glandular, especially near the tips, inner surface pilose near the tip, often intermixed with several-celled glandular trichomes; stamens 16-20, anthers orbicular, with a dense tuft of straight white trichomes on the upper half; base of style with or without a tuft of long white hairs. Fruits turbinate with 2-4 irregular, flattened ridges projecting into a point at the top, body of fruit densely lanose often mixed with scattered glandular trichomes, 0.3-0.5 cm wide including protuberances, 0.5-0.9 cm long.

Specimens examined. — La Paz: Prov. Franz Tamayo, Pelechuco, 11,000 ft., 5.5.1902, Williams 2496 (NY); Prov. Franz Tamayo, pueblo de Calaya, 3720 m, 6.5.1982, Menhofer X-1218 (LPB); Prov. Franz Tamayo, Pelechuco, 3600 m, Jordan 29 (LPB); Prov. Franz Tamayo, 2 km S Pelechuco on road to Ulla Ulla, 3700 m, 28.8.1991, Kessler 3051 (AAU, GOET), Kessler 3052 (AAU, GOET, LPB), Kessler 3420 (AAU, GOET, LPB), Kessler 3421 (GOET, LPB), Kessler 3422 (AAU, GOET), Kessler 3423 (GOET), Kessler 3424 (AAU, GOET), Kessler 3425 (GOET), Kessler 3558-3587 (one each GOET); Prov. Saavedra, 2 kms arriba de Chajaya, 3740 m, 4.8.1985, Beck 11350 (LPB); Prov. Saavedra, Chajaya, a few kilometers from Charazani, 3500 m, 15°13'S/69°01'W, 30.3.1985, Solomon 13346 (LPB, MO); Prov. Camacho, Ambaná, Beck 4214 (LPB); Prov. Murillo, Calacoto (La Paz), 16°31'S/68°08'W, 3300 m, 15.8.1986, Solomon 15492 (LPB, MO, NY); Prov. Larecaja, Camino Sorata hacia Consata, Tacacoma, 3800 m, U. Fisel s.n. (LPB); Prov. Larecaja, Sorata 55 kms. hacia Consata, sobre camino de altura, 16.12.1981 Beck 4976 (GOET, LPB); Prov. Larecaja, La

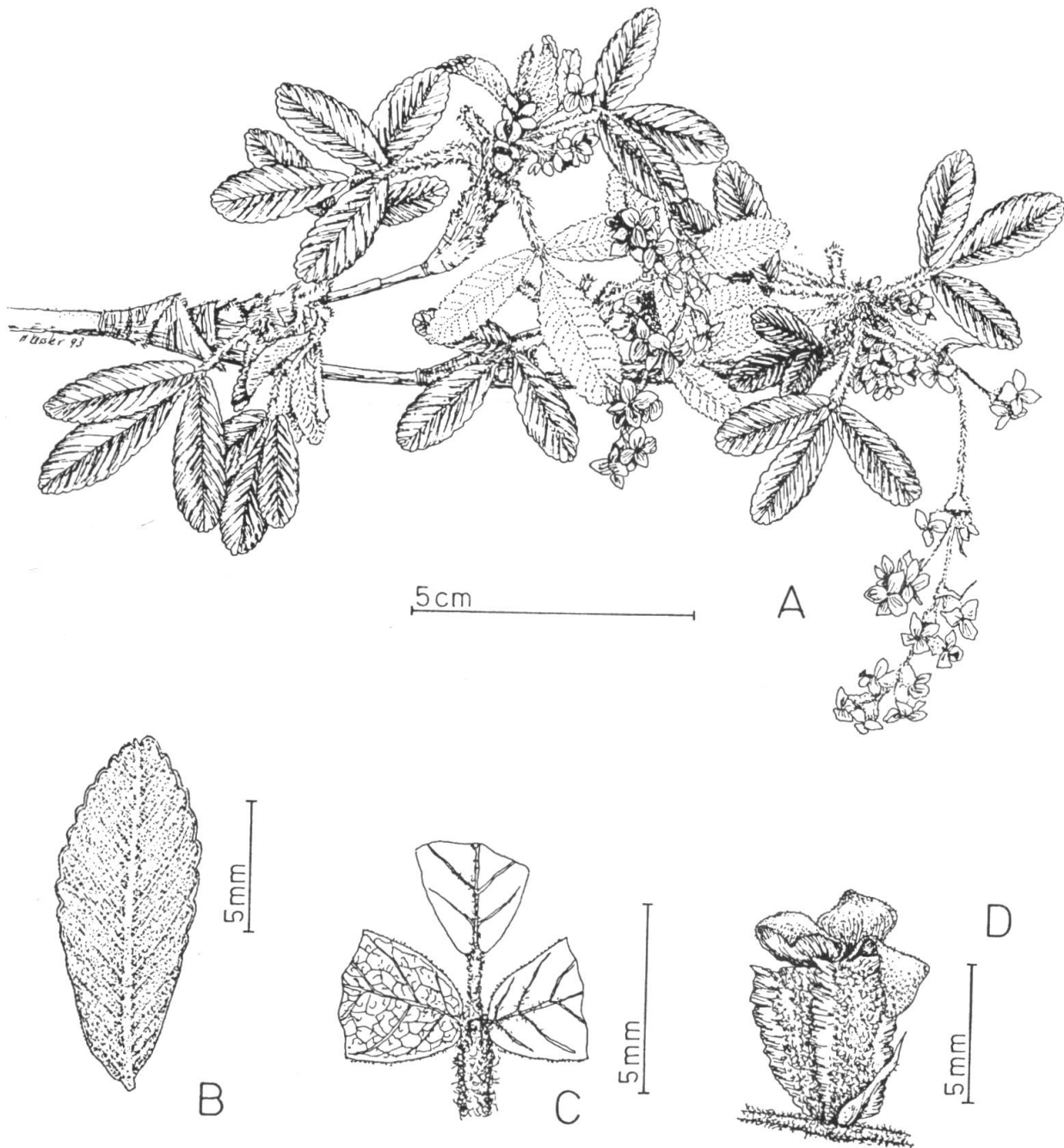


Fig. 3. — *Polylepis racemosa* Ruiz & Pavón subsp. *triacontandra* (Bitter) M. Kessler
A, branchlet; **B**, leaflet, underside; **C**, point of leaflet attachment, upper side, showing venation on left leaflet; **D**, fruit. **A-D**,
 Kessler 3423.

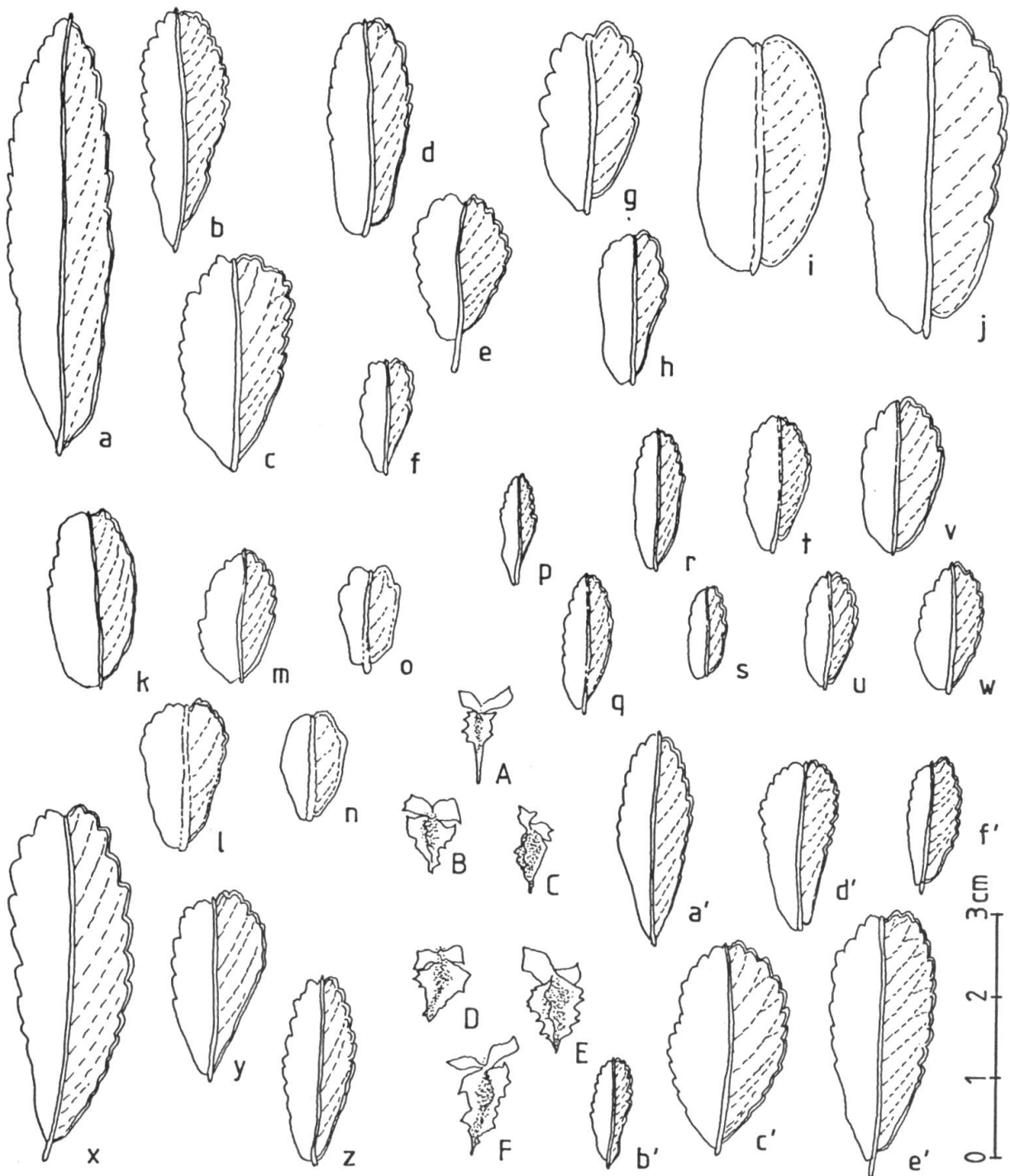


Fig. 4. — Uppermost right leaflets of *Polylepis racemosa* subsp. *triacontandra* (a-c), intermediate specimens between the Bolivian subspecies of *P. racemosa* (d-f), *P. racemosa* subsp. *lanata* (g-j), *P. besseri* subsp. *besseri* (k-o), *P. besseri* subsp. *subtusalbida* (p-w), *P. besseri* subsp. *incarum* (x-z) and *P. crista-galli* (a'-f'), and fruits of *P. besseri* subsp. *subtusalbida* (A-C) and *P. crista-galli* (D-F). a, Kessler 3051; b, Solomon & Beck 6640; c, Solomon 15492; d, Kessler 3029; e, Pentland 49; f, Kessler 3032; g, Kessler 2876; h, Kuntze s.n.; i, Balls 6244; j, Hensen 2280; k, Kessler 2985; l, Kessler 3212; m, Lewis s.n.; n, Murguía 147; o, Bang 769; p, Kessler 3415; q, Hensen 1264; r, Vuilleumier 468; s, Hensen 1509; t, Kessler 2981; u, Kessler & Kelschbach 216; v, Hensen 2400; w, Hensen 247; x, Boertman 138; y, Kessler 3636; z, Liberman 1164; a', Kessler 3170; b', Kessler 3174; c', Cárdenas 5724; d', Gerold 97; e', Kessler 3153; f', Beck 9641; A, Kessler 3415; B, Beck 7395; C, Hensen 1012; D, Kessler 3109; E, Kessler 3170; F, Cárdenas 5724.

Paz, 58,5 km N Sorata on road to Quiabaya, 15°36'S/68°41'W, 3600 m, 16.12.1981, Solomon & Beck 6640 (LPB, MO, NY); Prov. Saavedra, Kaata (Charazani), 3780 m, 3.1984, Richter 104 (LPB).

Distribution. — Cordillera Apolobamba and northern Cordillera Real in La Paz, Bolivia, and Puno, Peru (Fig. 1).

Phenology. — Flowers: April, August, October; fruits: April, May, August, December.

Ecology. — Found between 3600 and 4000 m on the eastern side of the Cordillera Apolobamba where it grows at the upper limit of the humid Yungas forests and in adjacent rainshadowed valleys. It is frequently planted around villages, e.g. near Lake Titicaca and in the city of La Paz.

Remarks. — The subspecies *triacontandra* is easily distinguishable from the subspecies *lanata* by the lower number of rounded to pointed leaflets with a dense lanose underleaflet vestiture, the higher number of flowers per inflorescens, only sparsely lanose inflorescens rachises and much longer and broader floral bracts which regularly have leaflet-like tips (Fig. 4).

When planted within the range of *P. besseri* subsp. *incarum*, *P. racemosa* subsp. *triacontandra* frequently hybridizes with it. Hybrids are recognizable by having intermediate leaflet length (19-29 mm), intermediate numbers of teeth on the leaflet margins (6-12) and flowers per inflorescens (7-14), whitish to yellowish densely lanose underleaflet vestiture and only occasionally branched inflorescences.

5b. *Polylepis racemosa* Ruiz & Pavón subsp. *lanata* (O. Kuntze) M. Kessler, stat. nov. (Fig. 4).

≡ *Polylepis racemosa* var. *lanata* O. Kuntze, Rev. Gen. Plant. 3: 77. 1898; Simpson, Smithsonian Contr. Bot. 43: fig. 28. 1979. **Type:** Bolivia, Cochabamba, Tunari, 3000-4000 m, Kuntze s.n. (holotype, destroyed in B; isotype NY).

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with 2-3 pairs of leaflets, obtrullate in outline, 2.6-6.8 cm wide and 3.8-7.8 cm long; rachis densely lanose, especially on the upper surface, mixed with glandular trichomes; point of leaflet attachment with a tuft of long white lanose trichomes; stipular sheaths truncate or with a very slight shoulder (to 0.5 mm) at the apex, outer surface sparsely lanose mixed with glandular trichomes; inner surface and top with long lanose trichomes protruding at the apex from the inner surface. Leaflets elliptic or obovate in outline, first pair from the terminal leaflet the largest, one of this pair 0.9-1.8 cm wide and 2.0-3.8 cm long; margins revolute, entire to clearly crenate with 4-8 teeth; apex slightly to strongly emarginate; base unequally rounded to cordate; terminal leaflet with 2-12 mm long petiolule; upper surface smooth to slightly rugose, dark green, with scattered weak twisted trichomes, especially along the central vein; lower surface with long, shaggy white to brown interwoven trichomes inserted on the veins but loosely covering the entire undersurface, surface between the veins rarely with scattered short, twisted, multicellular, often glandular trichomes. Inflorescences pendant, 3.5-18 cm long, bearing 5-11 flowers; floral bracts lanceolate, 4-6 mm long, sparsely lanose; rachises rarely branched, with scattered to dense lanose and glandular trichomes. Flowers perfect, 0.5-1.0 cm in diameter; sepals 3-4, ovate, outer surface villous and sparsely glandular, especially near the tips, inner surface pilose near the tip, often intermixed with several-celled glandular trichomes; stamens 12-22, anthers orbicular, with a dense tuft of straight white trichomes on the upper half; base of style without a tuft of long white hairs. Fruits turbinate with 2-4 irregular, flattened ridges projecting into a point at the top, body of fruit densely lanose often mixed with scattered glandular trichomes, 0.3-0.5 cm wide including protuberances, 0.4-0.9 cm long.

Specimens examined. — Cochabamba: Prov. Ayopaya, a 5 km de Independencia muy cerca a la comunidad de Kuri Barranca, 3500 m, 28.10.-5.11.1987, Merida 004 (LPB); Prov. Chapare, Abra de Colomi, 3450 m, 20.6.1929, Steinbach 9869 (F, G, GH, NY); Prov. Chapare, Quebrada de Colomi, 11,500 ft., 15.3.1939, Balls 6244 (US); Prov. Chapare, Colomi, 3600 m, Feb. 1947, Cárdenas 3906 (US), Cárdenas 3907 (US); Prov. Capare, Colomi, 3300 m, Jan. 1949, Cárdenas 4332 (GH,

US), Cárdenas 4333 (US); Prov. Chapare, Colomi, 12,200 ft., 8.1.1949, Brooke 5075 (F, NY); Prov. Chapare, Corani, 8.2.1985, Mostacedo s.n. (LPB); Prov. Chapare, 14,7 km N of Colomi (junction of the road to Candelaria) on the road to the Chapare, represa de Corani, 3300 m, 17°15'S/65°53'W, 19.10.1985, Solomon 14421 (AAU, LPB, MO); Prov. Chapare, Candelaria, 3300 m, 18.5.1989, Guillen 20 (LPB); Prov. Chapare, Cantón Colomi, 8 km al NW de Colomi, Candelaria Pie de Gallo, 3200 m, 23.4.1989, Beck et al. 18100 (GOET, LL, LPB, MO, SI, TEX); Prov. Chapare, Candelaria, 3300 m, 4.4.1991, Hensen 2280 (GOET, LPB); Prov. Chapare, Choro, 11,000 ft., 18.1.1950, Brooke 5984 (F, NY); Prov. Chapare, Rumpa Rancho, Candelaria, 3300 m, 17.5.1989, Crespo 24 (LPB); Prov. Chapare, Rumpa Rancho, Candelaria, 3400 m, 19.5.1989, Crespo 17 (LPB) Prov. Chapare, Pirhuata, 3800 m, 18.5.1989, Crespo 10 (LPB); Prov. Chapare, Mayca Mayu, 3300 m, 28.7.190, Hensen 850 (LPB); Prov. Chapare, Mayca Mayu, 3300 m, 2.4.1991, Hensen 2249 (LPB); Prov. Chapare, Maycamayu, ca. 60 km N Sacaba, 17°12'S/65°58'W, 3300 m, 11.8.1991, Kessler 2850 (AAU, GOET, LPB), Kessler 2851 (AAU, GOET, LPB), Kessler 2870 (GOET), Kessler 2871 (GOET), Kessler 2873 (GOET), Kessler 2876 (GOET, LPB), Kessler 3402 (AAU, GOET), Kessler 3483-3489 (one each GOET); Prov. Chapare, ca. 4 km N Maycamayu, ca. 65 km from Sacaba, 17°12'S/65°58'W, 3350 m, 13.8.1991, Kessler 2933 (AAU, GOET), Kessler 3490-3492 (one each GOET); Prov. Carrasco, Zapata Rancho, 3300 m, 19.3.1991, Hensen 1918 (LPB); Prov. Carrasco, Mojón, 3300 m, 19.3.1991, Hensen 1823 (LPB); Prov. Carrasco, surroundings of Monte Punco, 17°36'S/65°17'W, 2800 m, 14.8.1991, Kessler 2956 (GOET); Prov. Carrasco, ca. 3 km N Cocapata off Cochabamba-Santa Cruz road, 17°34'S/65°19'W, 3000 m, 15.8.1991, Kessler 2961 (AAU, GOET), Kessler 2962 (GOET, LPB, USM), Kessler 2963 (AAU, GOET, LPB), Kessler 2964 (GOET, LPB), Kessler 2965 (GOET), Kessler 3493 (GOET), Kessler 3494 (GOET); Prov. Carrasco, Comunidad Lachujmayu, 3200 m, 22.11.1991, Hensen 934 (GOET, LPB).

Distribution. — Known only from the Cordillera Tunari in Cochabamba (Fig. 1).

Phenology. — Flowers: January — April, June, August, October; fruits: January, March, April, June, August, November, December.

Ecology. — Found between 2800 and 3900 m on slopes which are not directly exposed to the convectional rains of the eastern Andean slopes but which are frequently shrouded in mist. Often occurs with a variety of other trees such as *P. sericea*, *Alnus acuminata*, *Vallea stipularis*, *Prumnopitys exigua*, *Podocarpus glomerata*, *Weinmannia fagaroides* or *Oreopanax* spp. The synecology and phytosociology was studied by HENSEN (1993).

Remarks. — Hybrids are known with both local subspecies of *P. besseri*. Hybrids with *P. besseri* ssp. *subtusalbida* have smaller leaflets with attenuated leaflet bases and apices, a higher number of teeth on the leaflet margins and generally shorter and denser vestiture. Some specimens of *P. racemosa* subsp. *lanata* show a clear transitions to *P. besseri* subsp. *besseri* even in areas where the latter is not currently found (e.g., Cárdenas 3906 and 4333, Steinbach 9869). Such specimens are recognized by the lanose hairs between the veins on the leaflet undersurface, smaller leaflets with rounded apices and the dense white vestiture of their inflorescences.

Intermediate populations. — In southern La Paz and western Cochabamba four localities are known where the Bolivian subspecies of *P. racemosa* intergrade. Intermediate specimens do not simply show intermediate characters (in leaflet shape, number of teeth on leaflets, length of floral bracts), but also have their own traits, tending to have smaller leaflets and a denser vestiture to the underside of the leaflets (Fig. 4).

Intermediate specimens examined. — BOLIVIA: La Paz: Prov. Murillo, Catagna, au pied S de l'Illimani, 16°45'S; 14,800 pies, Pentland 47 (GOET); Prov. Saavedra, 2 kms arriba de Chajaya, 3740 m, 4.8.1985, Beck 11350 (GOET, LPB); Prov. Inquisivi, 10 km W from Quime on road to Caxata, 3400 m, 17°00'S/67°12'W, 3400 m, Brandbyge 769 (AAU, LPB); Prov. Inquisivi, Quime 7 kms hacia Caxata, 3420 m, 19.2.1981, Beck 4378 (LPB); Prov. Inquisivi, 8 km W Quime on road to Caxata, 17°03'S/67°17'W, 3350 m, 24.8.1991, Kessler 3028 (GOET, LPB), Kessler 3029 (AAU, GOET), Kessler 3030 (AAU, GOET), Kessler 3031 (AAU, GOET, LPB), Kessler 3032 (AAU, GOET); Cochabamba: Prov. Ayopaya, 10 km al NW de Independencia, 3250 m, 10.5.1988, Beck & Seidel 14528 (GOET, LPB).

6. *Polylepis besseri* Hieronymus, Bot. Jahrb. Syst. 21: 312. 1896. **Type:** Bolivia, Capi, März 1890, Bang 769 (lectotype, G, selected in Simpson, Smithsonian Contr. Bot. 43: 42; isolectotypes, F, GH, MO, NY, US (2 sheets), W).

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-3 pairs of leaflets, rhombic or obtrullate in outline, 1.3-4.7 cm wide and 1.8-7.9 cm long; rachis densely white to yellowish lanose or pannose, usually with admixed glandular trichomes, point of leaflet attachment with a tuft of white or yellowish lanose trichomes; stipular sheaths truncate or slightly spurred (to 1 mm) at the apex, outer surface sparsely to densely covered in white to yellowish lanose or pannose trichomes, usually admixed with glandular trichomes, inner surface with long lanose trichomes. Leaflets almost rounded, ovate, obovate, elliptic, lanceolate or rhombic in outline, first pair from the terminal leaflet the largest, one of this pair 0.4-1.5 cm wide and 0.9-2.9 cm long; margins clearly to strongly revolute, entire to strongly serrate with 4-11 teeth; apex acute, obtuse or slightly emarginate; base unequally attenuate, rounded or cordate; terminal leaflet with 1-6 mm long petiole; upper surface smooth to slightly rugose, glabrous to lanose or pannose; lower surface with an evenly distributed dense layer of white or yellowish, short to long lanose or pannose trichomes, sometimes mixed with yellow multicellular glandular trichomes, occasionally with long lanose trichomes on the prominent veins. Inflorescences pendant, 1.7-11 cm long, bearing 3-8 flowers; floral bracts 3-8 mm long, sparsely lanose, pannose and/or glandular on the outer surface; rachises unbranched, glabrescent to very densely covered in lanose, pannose and/or glandular trichomes. Flowers perfect, 0.5-1 cm in diameter; sepals 3-5, ovate to almost rounded, green or red, outer surface and top of inner surface with variable amounts of pannose, lanose and glandular trichomes; stamens 12-24, anthers orbicular, covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, with a variable amount of lanose, pannose and/or glandular trichomes, with 2-5 flattened ridges with a series of spines, 0.3-0.8 cm wide including protuberances, 0.3-0.9 cm long.

Distribution. — Two allpopatric populations: one around Lake Titicaca in Puno, Peru, and La Paz, the other in Cochabamba, Potosí and Chuquisaca (Fig. 5).

Remarks. — In accordance with SIMPSON's (1986) observation that *P. besseri* as circumscribed by herself (SIMPSON, 1979) "will probably also be shown in the future to contain more than one biological species", I recognized seven distinct populations within "*P. besseri*" (sensu SIMPSON). Of these, two are placed with *P. racemosa* and two are given species status (*P. cristagalli*, and *P. rugulosa* Bitter). Only the remaining three populations are maintained within *P. besseri* and are given subspecific status. In spite of this restricted concept, *P. besseri* remains a very variable species whose identification is further complicated by its tendency to hybridize with other *Polylepis* species within its range.

P. besseri is differentiated from *P. racemosa* by the dense, evenly distributed underleaflet vestiture, smaller leaflets, unbranched inflorescences with fewer flowers, completely tomentose anthers, and fruits which have several spines of more or less equal size on each ridge (Fig. 4).

6a. *Polylepis besseri* Hieronymus subsp. *besseri* (Fig. 4, 6).

- = *Polylepis besseri* var. *longipedicellata* Bitter, Bot. Jahrb. Syst. 45: 629. 1911. **Type:** Bolivia, Cochabamba, Puna of Mizque, d'Orbigny s.n. (holotype, G; isotypes, NY, US).

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-3 pairs of leaflets, rhombic or obtrullate in outline, 1.5-4.2 cm wide and 1.9-7.9 cm long; rachis densely white pannose, usually with admixed glandular trichomes, occasionally lanose, point of leaflet attachment with a tuft of white lanose trichomes; stipular sheaths truncate or slightly spurred (to 1 mm) at the apex, outer surface densely covered in white lanose or pannose trichomes, usually admixed with glandular trichomes, inner surface and top with long lanose trichomes. Leaflets almost rounded to obovate in outline, first pair from the terminal leaflet the largest, one of this pair 0.4-1.3 cm wide and

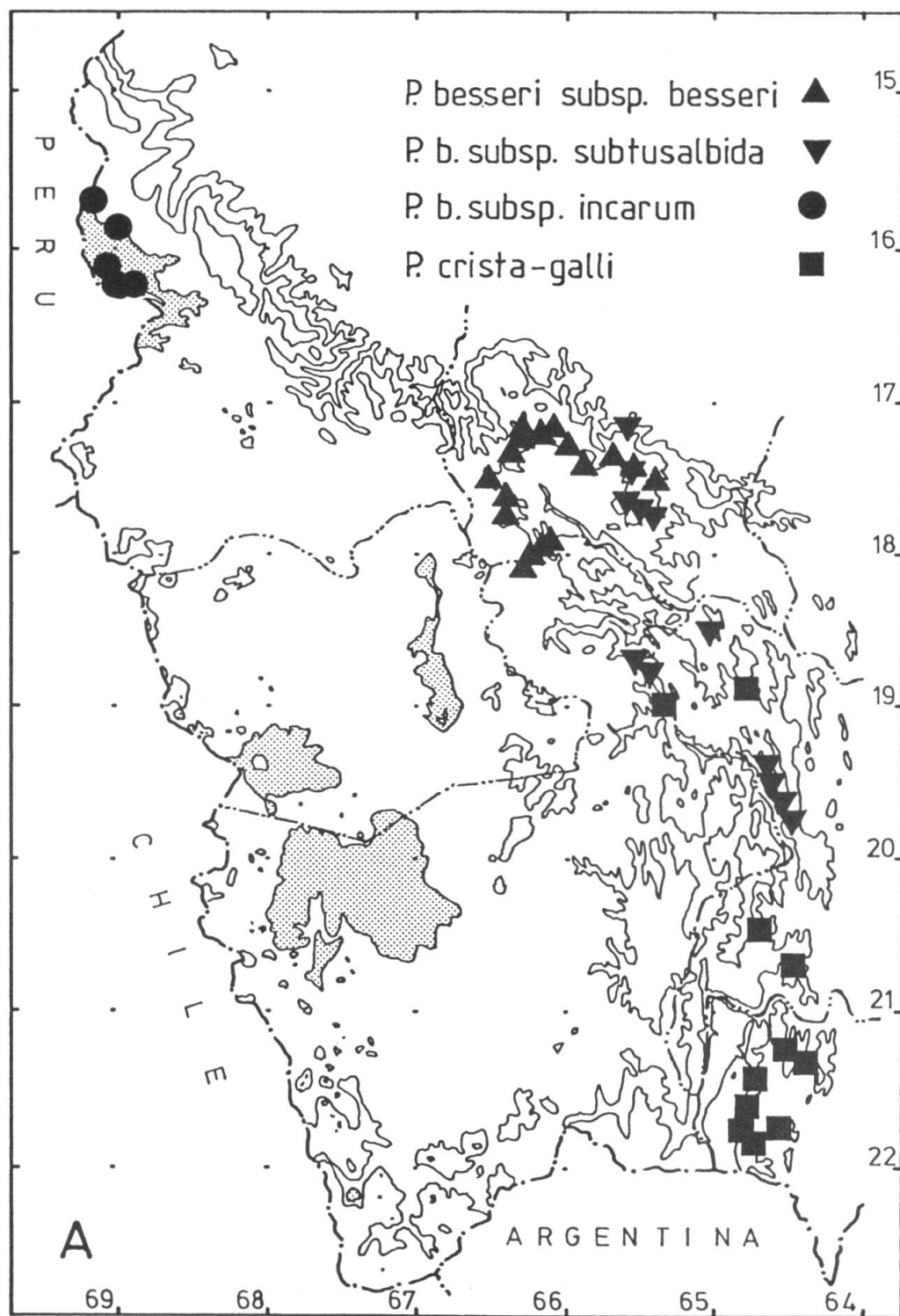
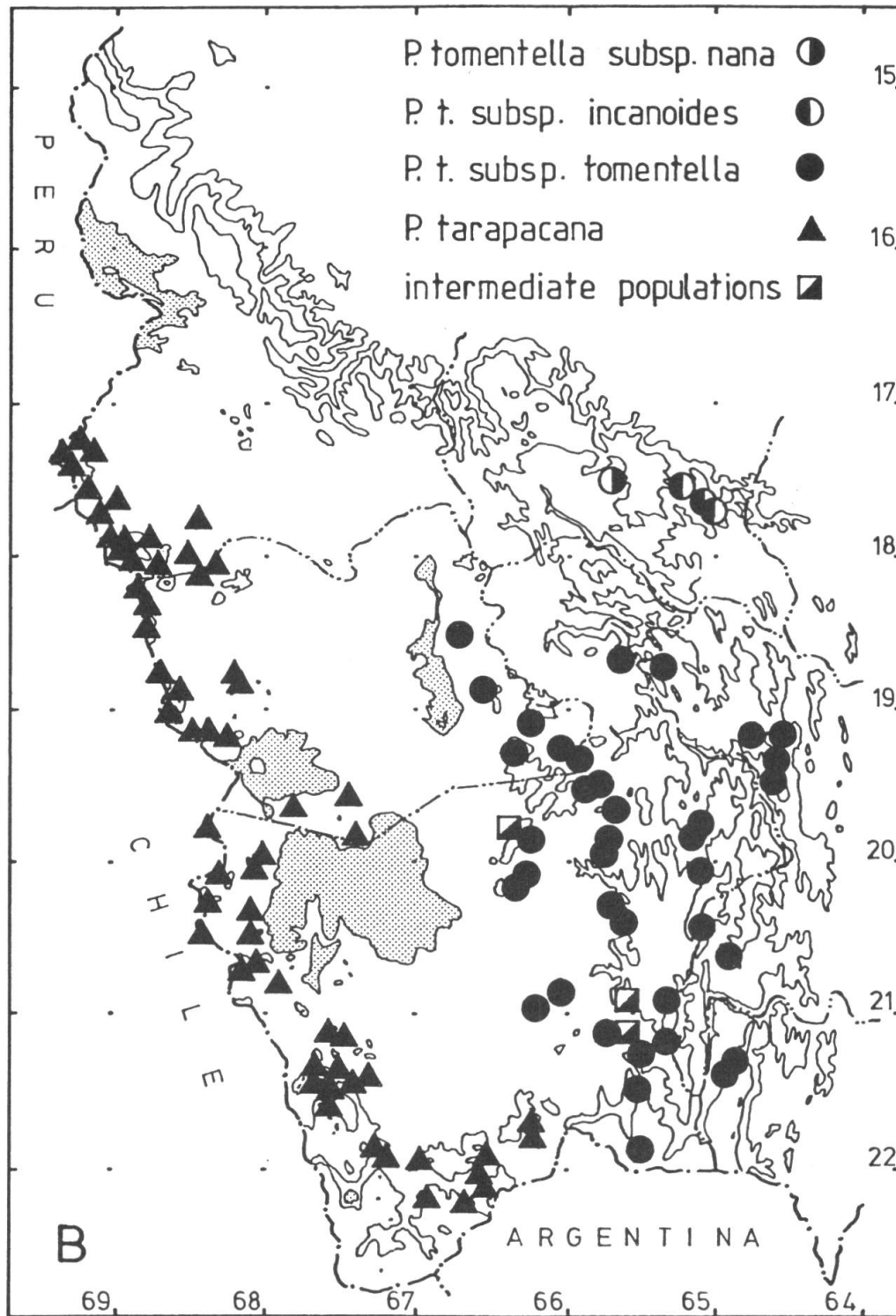


Fig. 5. — Bolivian distribution of *Polylepis besseri* subsp. *besseri*, *P. besseri* subsp. *subtusalbida*, *P. besseri* subsp. *incarum*, *P. crista-galli* (A), *P. tomentella* subsp. *nana*, *P. tomentella* subsp. *incanoides*, *P. tomentella* subsp. *tomentella*, and *P. tarapacana* (B). Shaded areas are lakes and salt lakes; contour intervals are located at 2500, 3500, 4500, and 5500 m.



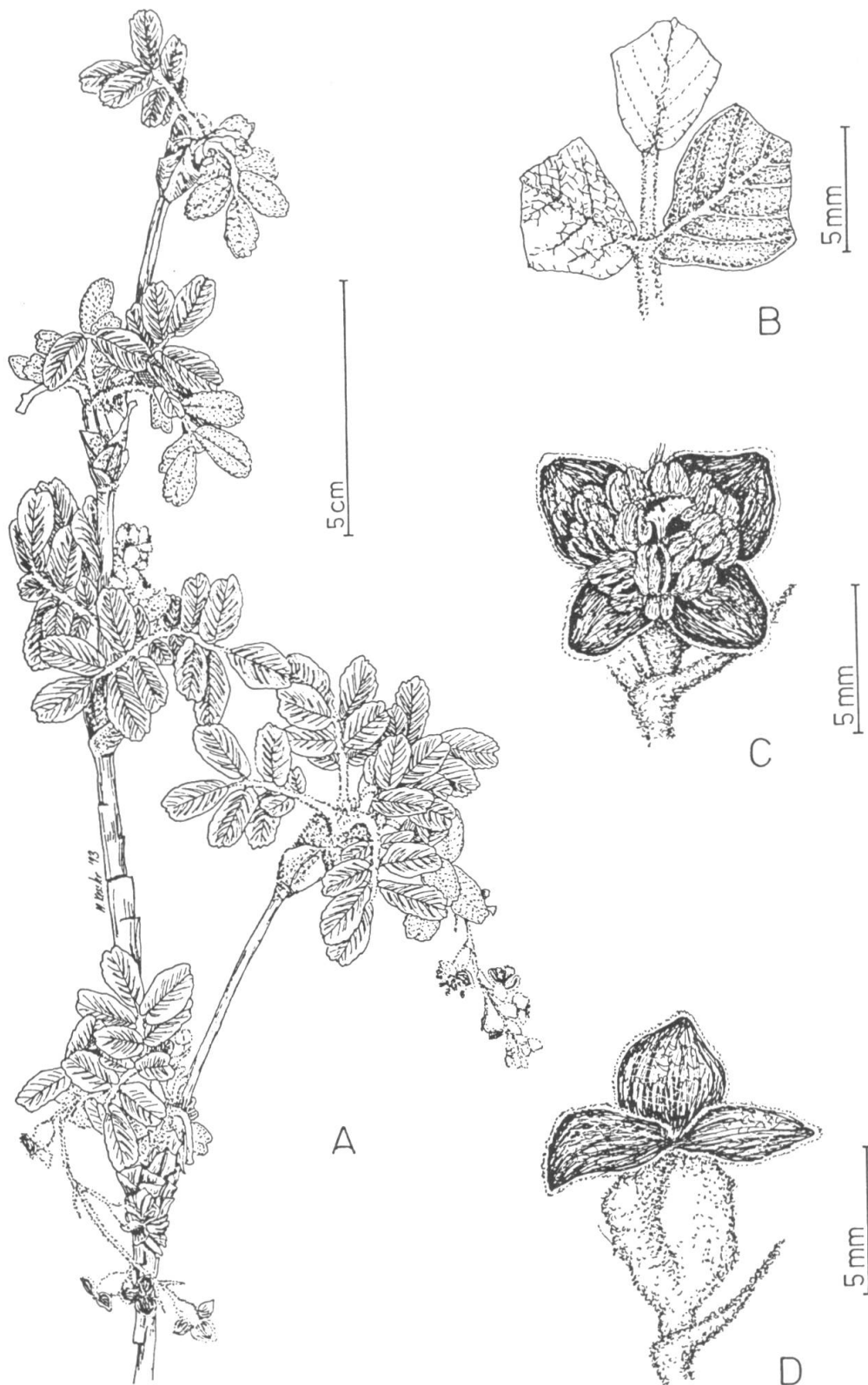


Fig. 6. — *Polylepis besseri* Hieronymus subsp. *besseri*
 A, branchlet; B, point of leaflet attachment, left leaflet showing upper side and venation, right leaflet showing underside and vestiture; C, flower; D, fruit. A-D, Kessler 3267.

1.1-2.3 cm long; margins clearly to strongly revolute, usually entire, occasionally slightly serrate with 4-8 teeth; apex obtuse or slightly emarginate; base unequally attenuate, rounded or cordate; terminal leaflet with 3-6 mm long petiolule; upper surface smooth to slightly rugose, dark green, glabrous to very slightly lanose or pannose; lower surface with an evenly distributed dense layer of long white lanose or pannose trichomes, occasionally with long lanose trichomes on the prominent veins. Inflorescences pendant, 3.5-11 cm long, bearing 5-8 flowers; floral bracts 4-7 mm long, sparsely lanose, pannose and/or glandular on the outer surface; rachises unbranched, glabrescent to very densely covered in lanose, pannose and/or glandular trichomes. Flowers perfect, 0.6-1 cm in diameter; sepals 3-5, ovate to almost rounded, often red, outer surface and top of inner surface with variable amounts of pannose, lanose and glandular trichomes; stamens 12-24, anthers orbicular, covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, with a dense cover of lanose, pannose and/or glandular trichomes, with 2-5 flattened ridges with a series of spines, 0.3-0.6 cm wide including protuberances, 0.4-0.9 cm long.

Specimens examined. — Cochabamba: Prov. Chapare, 'Yungas de Espíritu 1 (AES)', following the abandoned Chapare Road along the NW facing side of the Serranía de Callejas at the headwaters of the Río Espíritu Santo, ca. 50 km 25 N of W from Cochabamba, 17°12'S/65°42'W, 4000 m?, 1.12.1985, Marko Lewis s.n. (F, LPB, MO); Prov. Carrasco, 5 km al este del puente sobre el Río López Mendoza por el camino entre Cochabamba y Santa Cruz, 19° km al este de Epizana, 17°32'S/65°22'W, 2900 m, 11.2.1987, Solomon & Nee 16038 (LPB, MO, NY); Prov. Mizque, Cañada Pucara Mayu, a 37 km de Rodeo a Mizque, entre Kewiña-Khasa y Pucara Khasa, 17°49'S/65°26'W, 3200 m, 8.5.1987, Estenssoro 810 (GOET, LPB); Prov. Mizque, Somborreto, entre Markilla y Rodeo, 3630 m, 20.6.1987, Estenssoro 819 (LPB); Prov. Mizque, ca. 30 km NW Mizque on road to Arani, 17°45'S/65°29'W, 2950 m, 17.8.1991, Kessler 2985 (AAU, GOET, LPB), Kessler 2988 (AAU, GOET, LPB), Kessler 2989 (AAU, GOET), Kessler 2996 (GOET); Prov. Mizque, between Cerro Canto Monte and Mizque along Arani-Mizque road, 3600 m, 17.4.1987, Fjeldså s.n. (LPB); Prov. Campero, Pallamiani Khasa, camino entre Aiquile-Racaypampa, hacia Pallamiani-Khasa — Lenkho, 3200 m, 9.5.1987, Estenssoro 692 (GOET, LPB); Prov.?, 106,8 km E of Cochabamba on Carretera Fundamental 4, 9100 ft., 4.12.1975, Davidson 3743 (F, NY); Potosí: Prov. Linares, a 2 km de Lajas hacia Tambillo, Serranía de Mataka, 3930 m, 5.4.1993, Torrico 346 (LPB); Prov. Chayanta, Phajri Q'ucho, al norte de Ocurí, 3800-4050m, 12.3.1993, Torrico 119 (LPB); Chuquisaca: Prov. Oropesa, Carca, Río Ravelo, 3800 m, 15.6.1988, O. Murguía 145 (GOET, LPB); Prov. Oropesa, ca. 40 km W Sucre on road to Macha, 18°53'S/65°26'W, 3300 m, 26.9.1991, Kessler 3263 (GOET, LPB), Kessler 3264 (GOET), Kessler 3265 (GOET, LPB), Kessler 3266 (AAU, GOET), Kessler 3267 (AAU, GOET, LPB); Prov. Zudáñez, 25 km S Icla on Tarabuco-Azurduy road, 19°27'S/64°49'W, 3500 m, 24.9.1991, Kessler 3208 (GOET), Kessler 3210 (AAU, GOET, LPB), Kessler 3212 (AAU, GOET, LPB); Prov. Zudáñez, 40 km S Icla on Tarabuco-Azurduy road, 19°33'S/64°39'W, 3700 m, 24.9.1991, Kessler 3223 (AAU, GOET, LPB); without clear locality: Alturas de Chacatilla, 3500 m, 28.3.1980, R.E.B. (ERTS) 60 (GOET, LPB).

Distribution. — Only known from Cochabamba, Chuquisaca and adjacent Potosí, central Bolivia (Fig. 5).

Phenology. — Flowers: March, May, August, September, December; fruits: February, March, September, October, December.

Ecology. — Found between 3000 and 4100 m in regions with 700 to 1100 mm mean annual precipitation. Usually forms pure stands, but has been found together with *P. besseri* subsp. *subtusalbida*, *P. tomentella* and *P. racemosa* subsp. *lanata*, and, at its lower elevational limit, with elements of *Podocarpus-Alnus* forests.

Remarks. — *P. besseri* subsp. *besseri* often hybridizes with other *Polylepis* species. These hybrids are frequently only recognizable when the whole stand is carefully studied in the field. In such cases large collection series are necessary for unambiguous identification. This is especially the case in the area of sympatry of *P. besseri* subsp. *besseri* and *P. tomentella* subsp. *incanoides* in Arani, central Cochabamba, as their hybrids are frequently indistinguishable from *P. besseri*

subsp. *subtusalbida* which also occurs in this province. Hybrids with *P. tomentella* subsp. *tomentella* in Chuquisaca and Potosí are more easily recognized since *P. besseri* subsp. *subtusalbida* is absent from this area.

- 6b. *Polylepis besseri* Hieronymus subsp. *subtusalbida* (Bitter) M. Kessler, **comb. nov.** (Fig. 4, 7).**
 = *Polylepis incana* subsp. *subtusalbida* Bitter, Bot. Jahrb. Syst. 45: 640. 1911. **Type:** Bolivia, Cuesta de Duraznillos, 2400-2600 m, Dez. 1907, Hertzog 712 (holotype WRSB).
 = *Polylepis racemosa* var. *tomentosa* O. Kuntze, Rev. Gen. Plant. 3: 77. 1898. **Type:** Bolivia, Cochabamba, between Challa and Tapacari, 3600-4000 m, 18.3.1892, Lorentz & Hieronymus s.n. (type, destroyed in B; isotypes, NY, UC, US). = *Polylepis besseri* var. *abbreviata* Bitter, Bot. Jahrb. Syst. 45: 628. 1911. Nom. illeg.

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-3 pairs of leaflets, rhombic or obtrullate in outline, 1.4-4.7 cm wide and 1.8-6.9 cm long; rachis densely white lanose, usually with admixed glandular trichomes, rarely pannose, point of leaflet attachment with a tuft of white lanose trichomes; stipular sheaths truncate at the apex, outer surface sparsely to densely covered in white lanose trichomes, admixed with glandular trichomes, inner surface with long lanose trichomes. Leaflets ovate, obovate, elliptic or lanceolate in outline, first pair from the terminal leaflet the largest, one of this pair 0.4-1.5 cm wide and 0.9-2.9 cm long; margins clearly to strongly revolute, clearly to very strongly serrate with 4-11 teeth, rarely subentire; apex acute, obtuse or very slightly emarginate; base unequally attenuate or rounded; terminal leaflet with 1-5 mm long petiolule; upper surface smooth to slightly rugose, glabrous to lanose or pannose, usually along the central vein; lower surface with an evenly distributed dense layer short to moderately long, white to yellowish pannose trichomes, usually mixed with yellow multicellular glandular trichomes on the veins. Inflorescences pendant, 1.7-9 cm long, bearing 3-7 flowers; floral bracts 3-8 mm long, sparsely lanose and usually glandular on the outer surface; rachises unbranched, glabrescent to very densely covered in lanose, pannose and/or glandular trichomes. Flowers perfect, 0.5-1 cm in diameter; sepals 3-4, ovate to almost rounded, green or rarely red, outer surface and top of inner surface with variable amounts of pannose, lanose and glandular trichomes; stamens 12-24, anthers orbicular, covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, with a variable amount of lanose, pannose and/or glandular trichomes, with 2-5 flattened ridges with a series of spines, 0.3-0.7 cm wide including protuberances, 0.3-0.7 cm long.

Specimens examined. — Cochabamba: Prov. Tapacari, 74 km before Cochabamba on the road from Oruro, 3600 m, 7.1.1968, Vuilleminier 474 (G, GH, US 2 sheets); Prov. Tapacari, Cochabamba 68 kms hacia Oruro, 3450 m, 3.11.1982, Beck 9033 (LPB), Beck 9034 (LPB); Prov. Arque, 84 km W of Cochabamba on the paved road to La Paz, 17°40'S/66°45'W, 3800 m, 18.4.1987, Brandbyge 668 (AAU); Prov. Arque, km 68 on the road from Cochabamba to La Paz, 17°38'S/66°27'W, 3500 m, 25.10.1985, Solomon 14353 (LPB, MO); Prov. Arque, 72 km W Cochabamba on road to Oruro, 0.5 km down a small road (the old Cochabamba road), 3750 m, 18.4.1987, 17°40'S/66°40'W, Brandbyge 670 (AAU); Prov. Arque, km 68 on the road from Cochabamba to La Paz, 17°38'S/66°27'W, 3500 m, 25.10.1985, Solomon 14535 (LPB, MO); Prov. Arque, Quillacollo 59 kms hacia Oruro, 3580 m, 31.3.1979, Beck 933 (LPB); Prov. Arque, 79 km from Cochabamba on road to Oruro, 17°41'S/66°29'W, 3750 m, 20.8.1991, Kessler 2999 (GOET, USM), Kessler 3000 (GOET, LPB); Prov. Quillacollo, al borde del camino Tiquipaya-Apoye, 3500 m, 13.10.1988, Hensen 256 (GOET, LPB); Prov. Quillacollo, Lapia, camino Tiquipaya — Titiri, 3500 m, 6.12.1988, Hensen 290 (LPB); Prov. Quillacollo, camino Tiquipaya — Titiri, 3500 m, 9.3.1991, Hensen 1431 (LPB); Prov. Quillacollo, camino Sipe-Sipe — Lipichi, 3800 m, 30.3.1989, Hensen 318 (LPB); Prov. Quillacollo, entre San Miguel y Titiri, 3600 m, 16.3.1991, Hensen 1686 (GOET, LPB); Prov. Quillacollo, San Miguel, 3600 m, Hensen 2400 (GOET, LPB); Prov. Quillacollo, 40 km after Cochabamba on the road to Morochata, 3390 m, Vuilleminier 468 (GH, MO, US 2 sheets); Prov. Quillacollo, Cochabamba 24 kms hacia Morochata, 3180 m, 28.11.1981, Beck 7395 (GOET, LPB); Prov. Quillacollo, cerca a Wakaplaya, camino Sipe-Sipe — Kani, 3700 m, 13.10.1988, Hensen 247

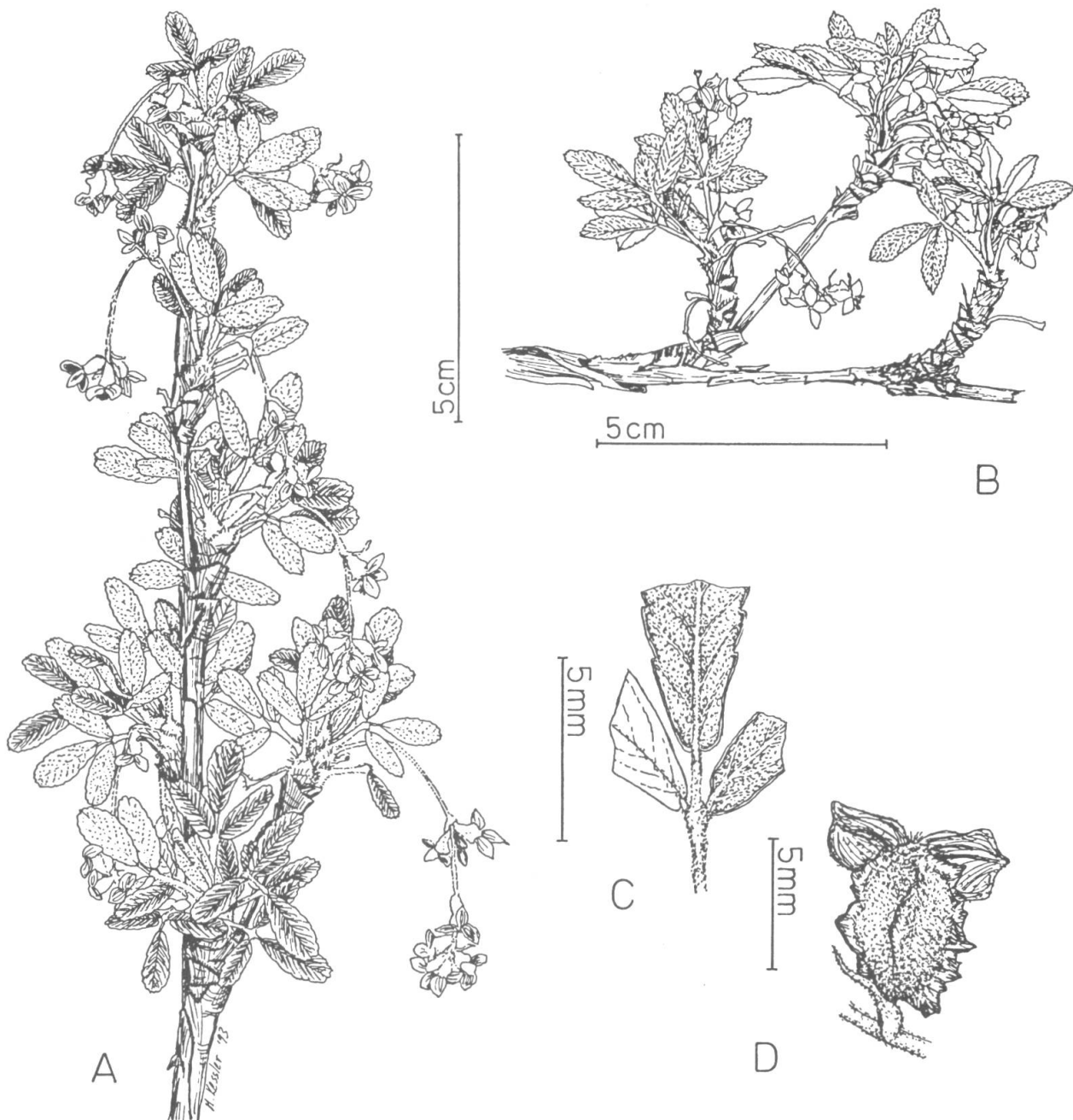


Fig. 7. — *Polylepis besseri* Hieronymus subsp. *subtusalbida* (Bitter) M. Kessler
A, branchlet of a specimen with rounded leaflets and pendant inflorescences; **B**, branchlet of a specimen with pointed leaflets and erect inflorescences; **C**, point of leaflet attachment, left leaflet showing upper side, right and upper leaflet showing under-side; **D**, fruit. **A**, *Pedrotti & al. s.n.*; **B-D**, *Kessler 3413*.

(GOET, LPB); Prov. Quillacollo, Lampaya, 3600 m, 5.3.1991, Hensen 1270 (LPB); Prov. Quillacollo, entre Lampaya y Llanke, 3700 m, 5.3.1991, Hensen 1315 (GOET, LPB); Prov. Quillacollo, San Miguel, camino a Independencia, 3300 m, 1.8.1990, Hensen 874 (GOET, LPB); Prov. Quillacollo, Wayra Lomaa, 3600 m, 1.4.1991, Hensen 2215 (LPB); Prov. Quillacollo, Palca Pampar, 3600 m, 1.4.1991, Hensen 2150 (LPB); Prov. Quillacollo, Lapia, 3700 m, 4.4.1991, Hensen 2300 (LPB); Prov. Ayopaya, Piusilla, 3300 m, 30.3.1991, Hensen 2134 (LPB); Prov. Cercado, Sapanani, 3600 m, 28.7.1990, Hensen 855 (LPB); Prov. Cercado, Sapanani Alto, 3800 m, 7.1.1991, Hensen 2332 (LPB), Hensen 2333 (GOET, LPB); Prov. Cercado, Parque Tunari, 3500 m, Pedrotti et al. s.n. (GOET, LPB); Prov. Cercado, Monte Tunari, 3650 m, Lourteig 2600 (P, US); Prov. Cercado, Parque Nacional Tunari, 3700 m, 23.7.1989, Kessler & Kelschbach 216 (AAU, GOET, LPB); Prov. Chapare, Parque Tunari, 3400 m, 2.8.1990, Hensen 874 (GOET, LPB), Hensen 875 (LPB), Hensen 878 (LPB); Prov. Chapare, 20 km above Sacaba on road to Palca, 17°19'S/66°02'W, 3750 m, 13.8.1991, Kessler 2940 (GOET); Prov. Arani, al borde de la carretera Cochabamba — Santa Cruz, 3400 m, 4.11.1988, Hensen 222 (LPB); Prov. Arani, Infiernillos, Cuenca A, 3800 m, 24.2.1991, Hensen 1012 (GOET, LPB); Prov. Arani, Alalay, 3700 m, 28.3.1991, Hensen 2063 (GOET, LPB); Prov. Arani, the road between Cochabamba and Santa Cruz, 107 km from Cochabamba, Gewiñapamba, 17°34'S/65°18'W, 3100 m, 21.4.1987, Brandbyge 711a (AAU); Prov. Arani, Mojón, 1 km N Cochabamba-Sta. Cruz road, 17°29'S/65°25'W, 3000 m, 14.8.1991, Kessler 2941 (AAU, GOET, LPB), Kessler 2942 (AAU, GOET, LPB); Prov. Punata, camino Melga-Punata, 3500 m, 3.3.1991, Hensen 1232 (LPB); Prov. Punata, entre Melga y Punata, 3500 m, 3.3.1991, Hensen 1264 (GOET, LPB); Prov. Punata, abajo del Cerro Tuti, 3800 m, 10.3.1991, Hensen 1509 (GOET, LPB); Prov. Carrasco, Rodeo Grande, at km 140 on road from Cochabamba to Santa Cruz, 9.2.1971, 3000 m, Hawkes et al. 4400 (MO); Prov. Carrasco, Zapata Rancho, 3300 m, 19.3.1991, Hensen 1918 (LPB); Prov. Carrasco, Incallajta ruins, 15 km S Monte Punco, 17°37'S/65°25'W, 3000 m, 15.8.1991, Kessler 2981 (GOET, LPB); Prov. Mizque, Totora 35 kms hacia Cochabamba, 3000 m, 28.3.1979, Beck 861 (LPB); Potosí: Prov. A. Ibáñez, Pichata, on Acacio-Uncia road, 18°06'S/66°13'W, 3950 m, 23.8.1991, Kessler 3023 (AAU, GOET); Prov. Bilbao, 22 km SW Acacio on road to Sacaba and Uncia, 18°06'S/66°08'W, 3400 m, 22.8.1991, Kessler 3021 (GOET); Prov. Bilbao, 31 km SW Acacio on road to Sacaba and Uncia, 18°06'S/66°08'W, 3500 m, 22.8.1991, Kessler 3019 (AAU, GOET, LPB), Kessler 3412 (GOET, LPB, USM), Kessler 3413 (AAU, GOET), Kessler 3414 (AAU, GOET, LPB), Kessler 3415 (GOET), Kessler 3416 (AAU, GOET), Kessler 3418 (AAU, GOET), Kessler 3419 (GOET, LPB), Kessler 3553 (GOET), Kessler 3554 (GOET), Kessler 3556 (GOET), Kessler 3557 (GOET), Kessler 3648-3651 (one each GOET).

Distribution. — Along the northern and western rim of the Cochabamba Basin in Cochabamba and adjacent Potosí (Fig. 5).

Phenology. — Flowers: April to January; fruits: throughout the year.

Ecology. — Found between 3000 and 4100 m in areas which are somewhat more arid than the range of *P. besseri* subsp. *besseri*. Autecology, synecology and phytosociology are treated in detail by HENSEN (1993).

Remarks. — A very variable taxon. Specimens from drier localities show a tendency to have smaller, more strongly serrate leaflets, shorter vestiture and shorter inflorescences with fewer flowers (Fig. 4). Probably at least two varieties could be recognized, but their differentiation becomes practically impossible in areas where *P. besseri* subsp. *subtusalbida* hybridizes with other *Polylepis* taxa.

P. besseri subsp. *subtusalbida* hybridizes with *P. tomentella* subsp. *incanoides* in Cochabamba. These hybrids have a very short and densely yellowish glandular vestiture on lower leaflet surfaces and slightly lanose stipule sheaths. Only detailed field observations and large collection series can assure positive identification of such hybrids. Hybrids are also known with *P. racemosa* subsp. *lanata* and *P. besseri* subsp. *besseri*.

6c. *Polylepis besseri* Hieronymus subsp. *incarum* (Bitter) M. Kessler, **comb. nov. (Fig. 4, 8).**

- = *Polylepis incana* subsp. *incarum* Bitter, Bot. Jahrb. Syst. 45: 643. 1911. **Type:** Bolivia, Lago Titicaca, Isla del Sol, near Challa, Seler 148 (holotype, B).
- = *Polylepis incana* subsp. *brachypoda* Bitter, Bot. Jahrb. Syst. 45: 644. 1911. **Type:** Bolivia, Lago Titicaca, Isla del Sol, near Challa, Seler 148a (type, probably destroyed in B).
- = *Polylepis pallidistigma* Bitter, Bot. Jahrb. Syst. 45: 645. 1911. **Type:** Peru, Puno, Azángaro, Munani, 3650 m, Weberbauer 1369 (type, destroyed in B; isotypes, GOET, WRAT).

Evergreen tree, to 8 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with 1-2 pairs of leaflets, rhombic or obtrullate in outline, 1.5-4.2 cm wide and 1.9-5.2 cm long; rachis densely white pannose, usually with admixed glandular trichomes, occasionally lanose, point of leaflet attachment with a tuft of white lanose trichomes; stipular sheaths truncate at the apex, outer surface densely covered in white or yellowish, lanose trichomes, admixed with yellowish glandular trichomes, inner surface and top with long lanose trichomes. Leaflets obovate, elliptic to rhombic in outline, first pair from the terminal leaflet the largest, one of this pair 0.4-1.0 cm wide and 1.0-2.8 cm long; margins revolute, serrate with 4-11 teeth; apex acute, obtuse or very slightly emarginate; base unequally attenuate, rarely rounded; terminal leaflet with 3-6 mm long petiolule; upper surface smooth to slightly rugose, dark green, glabrous to lanose, pannose and/or glandular; lower surface with an evenly distributed dense layer of very short to moderately long, white or yellowish pannose trichomes, usually with yellowish glandular trichomes along the veins, rarely glabrescent on veins. Inflorescences pendant, 3-10.5 cm long, bearing 6-8 flowers; floral bracts 3-7 mm long, occasionally with leaflet-like tips, sparsely lanose and glandular on the outer surface; rachises unbranched, sparsely to densely covered in white or yellowish lanose and glandular trichomes. Flowers perfect, 0.5-1 cm in diameter; sepals 3-4, ovate, green, outer surface and top of inner surface with variable amounts of pannose, lanose and glandular trichomes; stamens 14-20, anthers orbicular, covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, with a dense cover of lanose and glandular trichomes, with 2-5 flattened ridges with a series of spines, 0.3-0.8 cm wide including protuberances, 0.3-0.7 cm long.

Specimens examined. — La Paz: Prov. Camacho, entre Puerto Acosta y Escoma, 3830 m, 28.2.1979, Ceballos et al. Bo. 643 (G); Prov. Camacho, Puerto Acosta 6 kms hacia La Paz, 3950 m, 6.4.1982, Beck 7689 (GOET, LPB); Prov. Manco Kapac, Insel Coaty, (Mondinsel) im Titicacasee, 3840 m, März 1910, Buchtien 4243 (GH, GOET, NY, US); Prov. Manco Kapac, Cerro Kheñwani, 3900 m, 22.1.1986, Liberman 1164 (GOET, LPB); Prov. Manko Kapac, outskirts of Copacabana, 3850 m, 18.8.1989, Kessler & Kelschbach 389 (GOET); Prov. Manco Kapac, Isla del Sol, 3840 m, Huanca 58 (LPB); Prov. Manco Kapac, Chapampa, 1 km S Copacabana, 16°11'S/69°06'W, 3900 m, 31.7.1991, Kessler 2782 (AAU, GOET, LPB), Kessler 2783 (AAU, GOET), Kessler 2784 (AAU, GOET, LPB), Kessler 3438-3477 (GOET), Kessler 3645 (GOET); Prov. Manco Capac, Hacienda Challa, Isla del Sol, 3850 m, 1.8.1991, Kessler 3636-3640 (one each GOET); Prov. Murillo, La Paz, Cota Cota, Jardín de MNHN, 16°30'S/68°10'W, 3300 m, 22.11.1987, Moraes 912 (LPB).

Distribution. — Surroundings of Lake Titicaca in Puno, Peru, and La Paz. Planted as an ornamental tree in the city of la Paz.

Phenology. — Flowering and fruiting: throughout the year.

Ecology. — In Bolivia known only from the vicinity of villages where it is frequently planted. In Peru it forms large stands between 3810 and 4100 m (FJELDSÅ, 1987, YALLICO, 1992).

Remarks. — This is a very variable taxon which most closely resembles *P. besseri* subsp. *subtusalbida*, but sometimes also shares characters of other species, such as the very short underleaflet vestiture with *P. tomentella*, the long white lanose underleaflet vestiture with *P. racemosa* subsp. *triacotandra*, or the yellowish coloration and hispid vestiture with *P. subsericans* Macbride (Fig. 4). However, most specimens share a unique combination of characters, namely the broadly

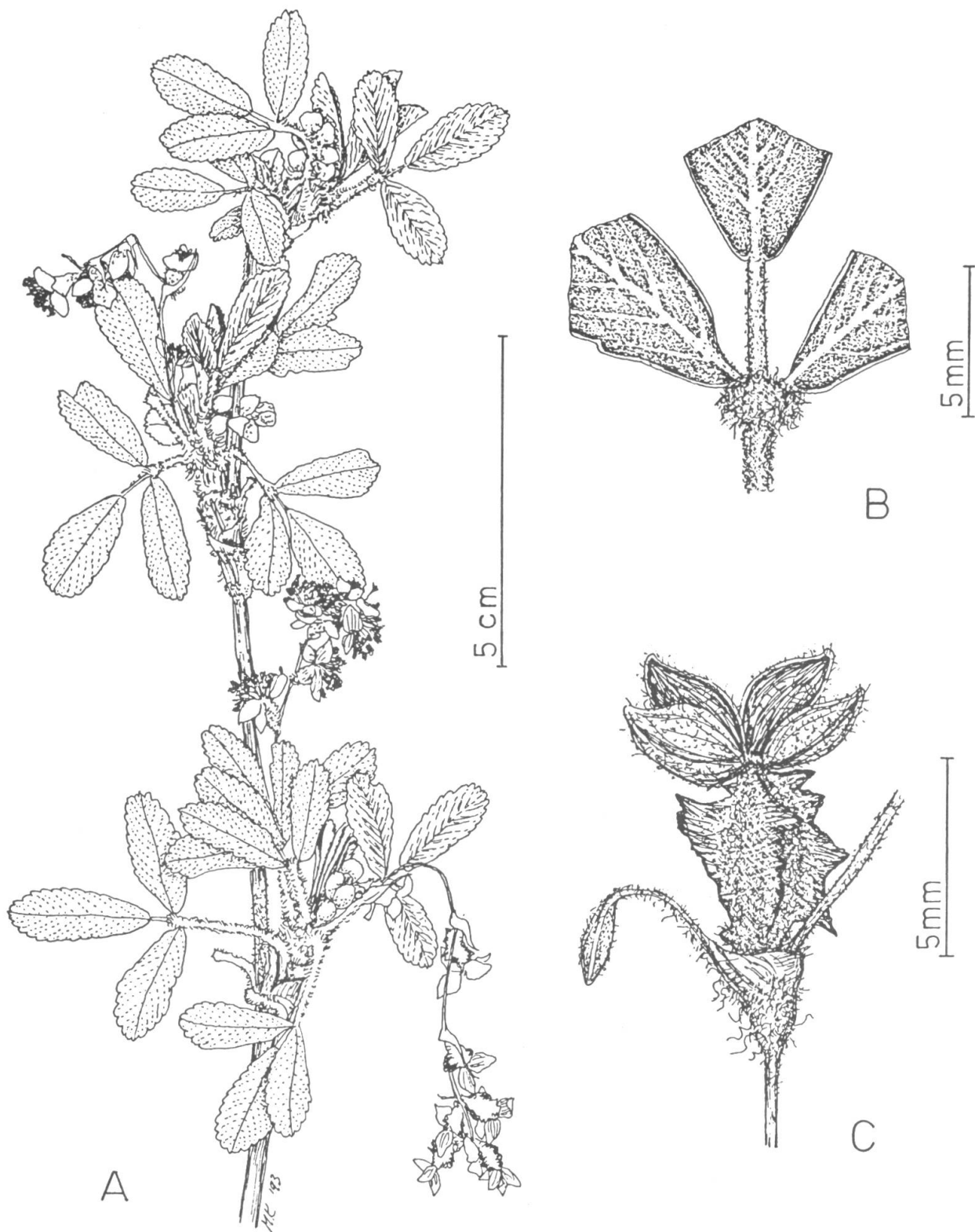


Fig. 8. — *Polylepis besserii* Hieronymus subsp. *incarum* (Bitter) M. Kessler
A, branchlet; B, point of leaflet attachment; C, fruit, note the leaflet like tip of the stipular sheath. A-C, Kessler 3462.

obovate leaflet shape, the short yellowish glandular vestiture of the lower leaflet surface, the densely glandular vestiture of the entire plant and the resulting yellowish coloration, justifying the recognition of a distinct subspecies. The variability may be the result of thousands of years of intensive human activities in the region, resulting in the fragmentation of populations and the introduction of alien species with which *P. besserii* subsp. *incarum* hybridizes.

7. *Polylepis crista-galli* Bitter, Bot. Jahrb. Syst. 45: 633. 1911. **Type:** Bolivia, Tarija, Tucumilla, 2500 m, Fiebrig 2020 (lectotype G, selected in Simpson, Smithsonian Contr. Bot. 43: 42; isolectotypes, A, P) (Fig. 4, 9).

= *Polylepis crista-galli* var. *longiracemosa* Bitter, Bot. Jahrb. Syst. 45: 634. 1911. **Type:** Bolivia, Tarija, Pinos, between Tarija and San Luis, 2500-2700 m, 1.3.1903, Fries 1296 (holotype, S).

Evergreen tree, to 10 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with 1-2 pairs of leaflets, rhombic or obovate in outline, 2.4-5.8 cm wide and 1.8-6.2 cm long; rachis densely white lanose, admixed with short multicellular glandular trichomes, point of leaflet attachment with a tuft of white lanose trichomes; stipular sheaths truncate or slightly spurred (to 1 mm) at the apex, outer surface sparsely to densely covered in white lanose or short multicellular glandular trichomes, inner surface and top with long lanose trichomes. Leaflets obovate or rhombic in outline, first pair from the terminal leaflet the largest, one of this pair 0.6-1.4 cm wide and 1.3-3.2 cm long; margins revolute, serrate with 7-12 teeth; apex obtuse or slightly emarginate; base unequally attenuate; terminal leaflet with 2-7 mm long petiolule; upper surface slightly rugose, often with a bluish sheen, glabrescent to densely covered in very short white pannose trichomes, sometimes with scattered lanose trichomes; lower surface with an evenly distributed dense layer of white, yellowish or grayish pannose trichomes. Inflorescences pendant, 5-8 cm long, bearing 4-12 flowers; floral bracts 4-6 mm long, lanose; rachises usually unbranched, with scattered lanose trichomes, sometimes also short multicellular glandular trichomes. Flowers perfect, 0.5-1 cm in diameter; sepals 3-4, ovate to almost rounded, green or red, outer surface and top of inner surface with variable amounts of pannose and glandular trichomes; stamens 10-16, anthers covered with long white trichomes; base of style with or without a tuft of long white hairs. Fruits turbinate, with a variable amount of pannose trichomes, with 2-4 wide flattened ridges with a series of spines, green, brown or often red, 0.6-1.6 cm wide including protuberances, 0.3-1.3 cm long.

Specimens examined. — Potosí: Prov. Linares, Serranía entre Lajas y Tambillo, 3900 m, 5.4.1993, Torrico 344 (LPB), Torrico 345 (LPB); Prov. Linares, a 2 km de Lajas hacia Tambillo, Serranía de Mataca, 3930 m, 5.4.1993, Torrico 348 (LPB); Prov. Chayanta, Ravelo 20 kms hacia Sucre, 3200 m, 30.9.1983, Beck & Liberman 9343 (GOET, LPB); Chuquisaca: Prov. B. Boeto, 1 km S Mendoza, 2830 m, 29.4.1987, O.Murguía R. 46 (GOET, LPB); Prov. Nor Cinti, ca. 40 km E Culpina on road to Chillajara, 20°37'S/64°46'W, 3000 m, 21.9.1991, Kessler 3169 (AAU, GOET, LPB), Kessler 3170 (GOET), Kessler 3171 (AAU, GOET, LPB), Kessler 3172 (GOET, LPB), Kessler 3174 (AAU, GOET); Prov. Sud Cinti, Cerro Kobre Khasa, between Culpina and El Palmar, 20°48'S/64°34'W, 3100 m, 21.9.1991, J.Fjeldsø s.n. (GOET); Prov. ?, Guerraloma, 2800 m, May 1959, Cárdenas 5724 (US); Tarija: Prov. Mendez, Strasse Carichi-Mayu — Leon Cancha, Passhöhe 2800 m, 1.2.1982, Gerold 97 (GOET, LPB); Prov. Mendez, above Tarija on road to Villazón, 21°29'S/64°55'W, 2900 m, 17.9.1991, Kessler 3109 (AAU, GOET, LPB); Prov. Mendez, 35 km W Tarija on road to Villazón, 21°29'S/64°55'W, 3000 m, 20.9.1991, Kessler 3165 (GOET); Prov. Mendez, 40 km W Tarija on road to Villazón, 21°29'S/64°55'W, 3300 m, 20.9.1991, Kessler 3166 (GOET); Prov. O'Connor, Tarija 53 kms hacia Entre Rios, 2360 m, 22.10.1983, Beck & Liberman 9641 (GOET, LPB); Prov. O'Connor, ca. 5 km W pass on Tarija-Villa Montes road, 21°27'S/64°22'W, 2500 m, 18.9.1991, Kessler 3110 (AAU, GOET, LPB); Prov. O'Connor, ca. 6 km E of pass on Tarija-Entre Rios road, 21°27'S/64°26'W, 2300 m, 20.9.1991, Kessler 3152 (GOET),

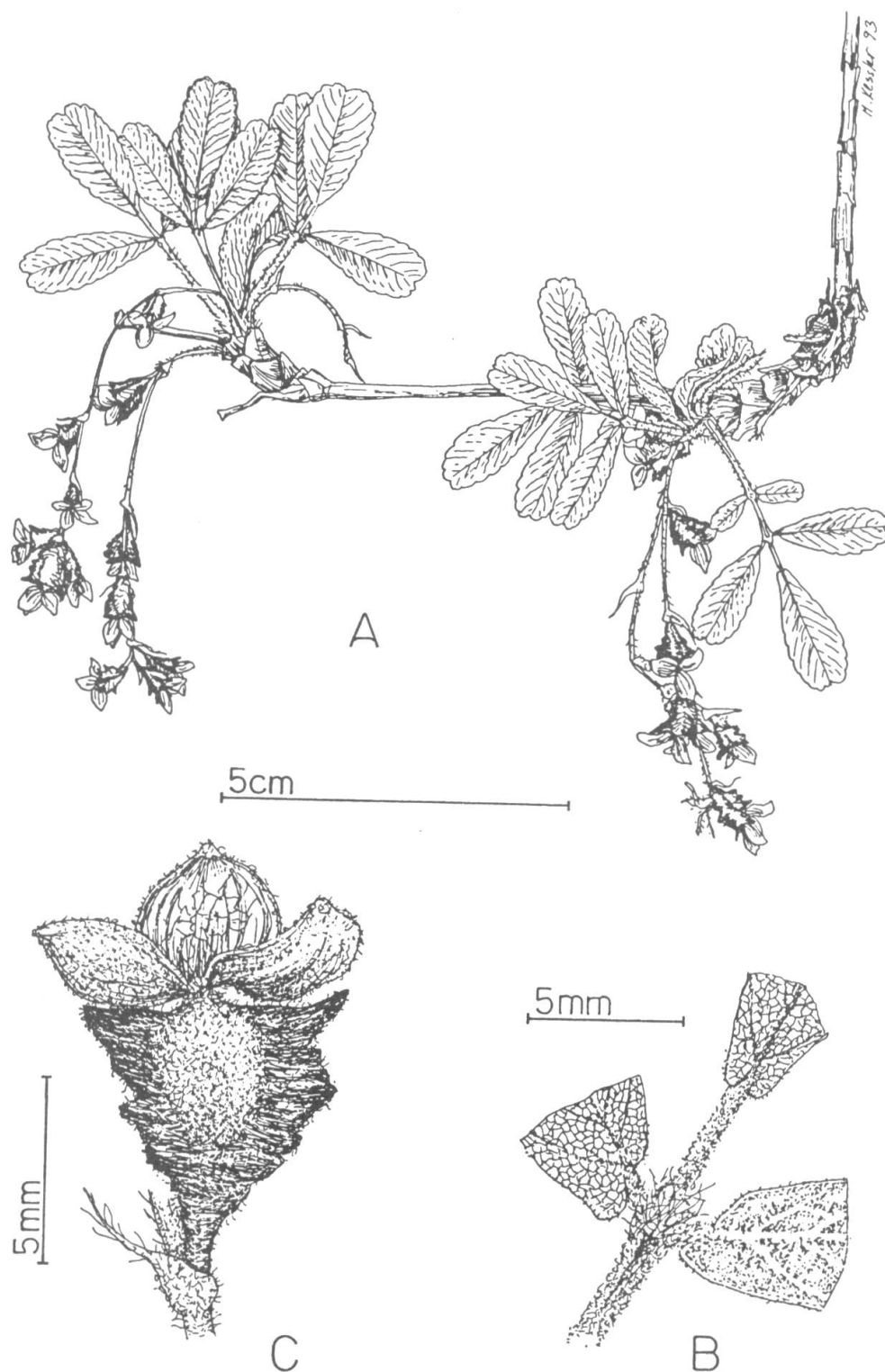


Fig. 9. — *Polylepis crista-galli* Bitter
 A, branchlet; B, point of leaflet attachment, left and upper leaflets showing upper side and nervature, right leaflet showing underside and vestiture; C, fruit. A-C, Kessler 3153.

Kessler 3153 (GOET, LPB), Kessler 3154 (AAU, GOET, LPB), Kessler 3155 (AAU, GOET, LPB), Kessler 3156 (GOET, LPB, USM), Kessler 3431 (GOET), Kessler 3432 (GOET); Prov. Arce, de Camacho hacia Rejera, 2600 m, 1.11.1987, Beck & Liberman 14309 (GOET, LL, LPB, MO, TEX); Prov. ?, Rincón de la Victoria, 2000 m, 7.11.1974, Züerpe et al. 5126 (NY).

Distribution. — Potosí, Chuquisaca and Tarija, Bolivia (Fig. 5).

Phenology. — Flowers: May, September; fruits: October — December.

Ecology. — Found between 2300 and 3200 (3500) m within the belt of the Boliviano-Tucumanic forests where it favours N-facing slopes, dry sites and exposed localities such as mountain ridges or steep rocky slopes. From (3200) 3500 to 3900 m it forms pure stands, occasionally admixed with *Alnus acuminata*.

Remarks. — This species was included by SIMPSON (1979) within *P. besseri*, but it is distinguished by its large, strongly winged and often red fruits, and its large leaflets which have an attenuate base, a short pannose cover of the underside and often a light grayish-blue sheen on the upper surface (Fig. 4). While some specimens of *P. besseri* subsp. *subtusalbida* also show some of these characters, they are recognized by their smaller leaflets with a clearly rounded base.

P. crista-galli is practically indistinguishable from presumed hybrids between *P. neglecta* and *P. besseri* subsp. *subtusalbida*. Especially striking is the similarity of the fruits and the presence of the light bluish sheen on the upper leaflet surface. No hybrids are known between *P. crista-galli* and other species.

8. *Polylepis tomentella* Weddell, Chloris Andina: 237, plate 78. 1861. **Type:** Bolivia, Chuquisaca, Cinti, Jan 1846, Weddell 3927 (lectotype, P, selected in Simpson, Smithsonian Contr. Bot. 43: 46; islectotype, P).

Evergreen tree or shrub, 1.5 to 9 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with 1-2 pairs of leaflets, trullate in outline, 1.0-4.0 cm wide and 1.2-2.7 cm long; rachis densely covered in yellowish multicellular glandular trichomes and short to long pannose or lanose trichomes, point of leaflet attachment with a tuft of lanose trichomes; stipular sheaths truncate or slightly spurred (to 0.5 mm) at the apex, outer surface glabrous to densely covered in short yellowish multicellular glandular trichomes, rarely with long lanose trichomes, top with long lanose trichomes. Leaflets ovate, obovate or lanceolate in outline, first pair from the terminal leaflet the largest, one of this pair 0.2-1.0 cm wide and 0.6-2.4 cm long; margins slightly to strongly revolute, serrate with 5-24 teeth; apex obtuse or acute; base unequally attenuate or cordate; terminal leaflet sessile or with 1-5 mm long petiolule; upper surface glabrous to densely covered in very short white pannose and/or yellowish multicellular glandular trichomes, occasionally admixed with scattered lanose trichomes; lower surface with a dense layer of white or yellowish pannose trichomes, usually admixed with short yellowish multicellular trichomes, especially along the veins. Inflorescences pendant or held upright by stipule sheaths, 1.3-7 cm long, bearing 2-9 flowers; floral bracts 3-5 mm long, lanose, rarely also with glandular trichomes; rachises unbranched, with lanose trichomes, sometimes also short multicellular glandular trichomes. Flowers perfect, 0.4-0.8 cm in diameter; sepals 3, ovate, outer surface glabrescent or covered in short pannose and/or glandular trichomes, rarely also with scattered lanose trichomes; stamens 6-24, anthers covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, slightly to densely covered in pannose and/or glandular trichomes, rarely with scattered lanose trichomes, with 3-4 ridges with a series of spines, 0.2-0.8 cm wide including protuberances, 0.3-0.9 cm long.

Distribution. — Eastern Andes from Cochabamba, Bolivia, to Jujuy, Argentina.

Remarks. — This is a confusing species which shows narrow zones of hybridization or introgression with the parapatric species *P. besseri* and *P. tarapacana*. In the present study two small isolated populations with distinctive traits are described as subspecies.

As some specimens of *P. tomentella* are indistinguishable from those of *P. incana* H.B.K. from Ecuador and Peru both species could be merged under the latter name. However, *P. incana* also contains a series of distinctive isolated populations which could be given species status. Genetic studies might clarify the status of these populations, but at the present state of knowledge it seems preferable to maintain the traditional concept of treating the Ecuadorian and Peruvian populations as *P. incana* and those from Bolivia and Argentina as *P. tomentella*.

8a. *Polylepis tomentella* Weddell subsp. *tomentella* (Fig. 10).

- = *Polylepis tomentella* subsp. *pentaphylla* Bitter, Bot. Jahrb. Syst. 45: 648. 1911. **Type:** Argentina, Jujuy, Laguna Tres Cruces, Dez. 1900 — Feb. 1901, Clarin 11688 (holotype, S).
- = *Polylepis tomentella* subsp. *tetragona* Bitter, Bot. Jahrb. Syst. 45: 649. 1911. **Type:** Argentina, Jujuy, Salina Grande nahe Jujuy, 3500 m, Hauthal 141 (type, probably destroyed in B; isotype, GOET).
- = *Polylepis tomentella* subsp. *dentatialata* Bitter, Bot. Jahrb. Syst. 45: 650. 1911. **Type:** Bolivia, Potosí, in valle inter Chorolque et Tacna (Quechisla-Kasni), 3600-3800 m, Hauthal 117 (type, probably destroyed in B; isotype, GOET).
- = *Polylepis tomentella* var. *pilosior* Bitter, Bot. Jahrb. Syst. 45: 647. 1911. **Type:** Bolivia, Chuquisaca, Cinti, Jan. 1846, Weddell 3947 p.p. (holotype, P).

Evergreen tree or shrub, 1.5 to 9 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with 1(-2) pairs of leaflets, trullate in outline, 1.2-3.8 cm wide and 2.2-2.5 cm long; rachis densely covered in yellowish multicellular glandular trichomes, often with admixed long lanose trichomes, point of leaflet attachment with a tuft of lanose trichomes; stipular sheaths truncate or slightly spurred (to 0.5 mm) at the apex, outer surface glabrous to densely covered in short yellowish multicellular glandular trichomes, rarely with long lanose trichomes, top with long lanose trichomes. Leaflets ovate, obovate or lanceolate in outline, first pair from the terminal leaflet the largest, one of this pair 0.3-0.6 cm wide and 0.8-1.8 cm long; margins slightly to strongly revolute, serrate with 5-9 teeth; apex more or less acute; base unequally attenuate or cordate; terminal leaflet sessile or with 1-4 mm long petiolule; upper surface glabrous to densely covered in yellowish multicellular glandular trichomes, occasionally admixed with scattered lanose trichomes; lower surface with a dense layer of white or yellowish pannose trichomes, always admixed with short yellowish multicellular trichomes, especially along the veins. Inflorescences pendant, 1.5-7 cm long, bearing 2-5 flowers; floral bracts 3-5 mm long, lanose, rarely also with glandular trichomes; rachises unbranched, with lanose trichomes, sometimes also with short multicellular glandular trichomes. Flowers perfect, 0.4-0.8 cm in diameter; sepals 3, ovate, outer surface glabrescent or covered in short pannose and/or glandular trichomes, rarely also with scattered lanose trichomes; stamens 6-24, anthers covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, slightly to densely covered in pannose and usually glandular trichomes, rarely with scattered lanose trichomes, with 3-4 ridges with a series of spines, 0.2-0.8 cm wide including protuberances, 0.3-0.9 cm long.

Specimens examined. — Oruro: Prov. Avaroa, Challapata, 4000 m, 1.4.1921, Asplund 6169 (US), Asplund 6170 (US); Prov. Avaroa, a pocos kms de Challapata, camino a Sevonuyo, 3790 m, 6.3.1991, Huanca & Vidaurre 31 (LPB); Prov. Avaroa, ca. 70 km W Potosí on road to Oruro, 19°14'S/66°04'W, 3800 m, 22.11.1991, Kessler 3366 (GOET, LPB), Kessler 3367 (GOET, LPB), Kessler 3368 (AAU, GOET, LPB), Kessler 3369 (AAU, GOET, LPB); Prov. Avaroa, 5 km S Challapata, 18°57'S/66°45'W, 3700 m, 22.11.1991, Kessler 3378 (AAU, GOET), Kessler 3379 (GOET, LPB), Kessler 3380 (GOET, LPB); Prov. Poopó, a 6 km de Challapata en dirección a Huari, 3750 m, 26.2.1991, Navarro 200 (LPB); Potosí: Prov. Frias, 39 km northwest of Potosí on the road to Challapata, 3680 m, 14.12.1967, Vuilleumier 450 (GH, US); Prov. Frias, Thunarumi, próximo a Paco Grande, 3650 m, 19.4.1991, Huanca & Vidaurre 98 (LPB), Huanca & Vidaurre 100 (LPB); Prov. T. Frias, Orocuro, bajando hacia Yocalla, 3850 m, 17.2.1979, Ceballos et al. Bo. 273 (G); Prov. T. Frias, Orocuro, cerca de Ventilla, 4030 m, 17.2.1979, Ceballos et al. Bo. 255 (G); Prov. T. Frias,

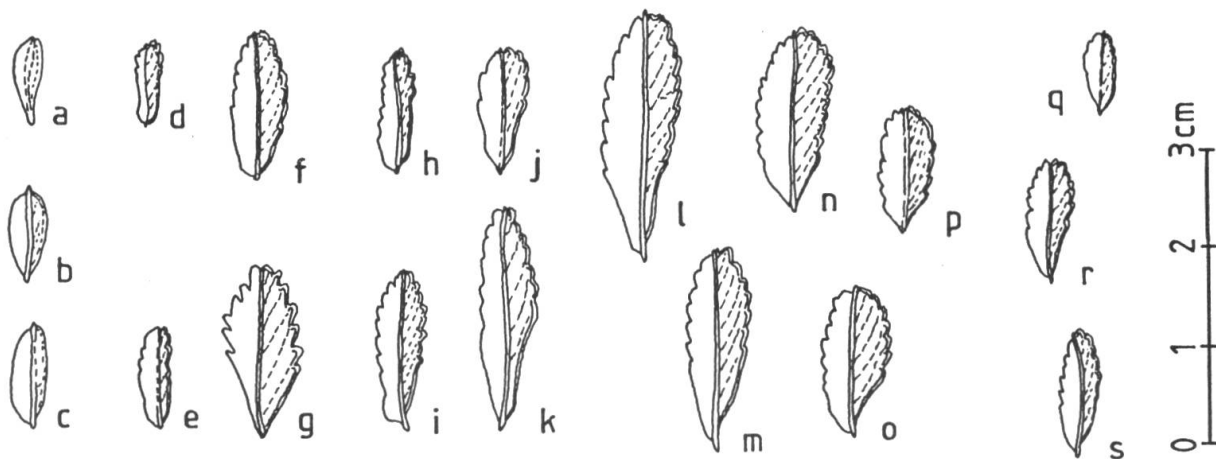


Fig. 10. — Uppermost right leaflets of *Polylepis tarapacana* (a-c), intermediate specimens between *P. tarapacana* and *P. tomentella* (d-e), *P. tomentella* subsp. *tomentella* (f-k), *P. tomentella* subsp. *incanoides* (l-p), and *P. tomentella* subsp. *nana* (q-s). The specimens i and k are abnormally large specimens from humid ravines in otherwise arid regions where specimens typically have much smaller leaflets (h, j). a, Kessler 3078; b, Kessler 3067; c, Liberman 171; d, Beck 9860; e, Vuillemier 450; f, Kessler 3097; g, Kessler 3085; h, Kessler 3278; i, Kessler 3283; j, Kessler 3185; k, Kessler 3187; l, Solomon & King 15922; m, Kessler 3293; n, Beck 7047; o, Kessler 2955; p, Kessler 3292; q, Kessler 2998; r, Kessler 3641; s, Kessler 3519.

27.7 km SW of Cruce Ventillas on road to Potosí, 4000 m, 12.5.1983, Solomon 10651 (LPB, MO); Prov. T. Frias, Potosí 36 kms. hacia Oruro, 3500 m, 30.10.1983, Beck & Liberman 9860 (GOET, LPB); Prov. T. Frias, Challapata 124 kms. hacia Potosí, 4080 m, Beck 674 (LPB); Prov. Quijarro, entre Kilpani y Candora, 3835 m, 25.3.1993, Torrico 222 (LPB), Torrico 223 (LPB); Prov. Quijarro, entre Cebadilla y Condoriri, 3860 m, 26.4.1993, Torrico 256 (LPB); Prov. Quijarro, Catasaya, 4000 m, 25.3.1993, Torrico 234 (LPB); Prov. Quijarro, 32 kms. de Potosí en camino a Uyuni, 4100 m, Liberman 229 (LPB); Prov. Chayanta, ca. 10 km N Ocurí on road to Guadalupe, 18°46'S/65°49'W, 3700 m, 27.9.1991, Kessler 3277 (AAU, GOET), Kessler 3278 (GOET), Kessler 3279 (AAU, GOET, LPB), Kessler 3280 (AAU, GOET), Kessler 3282 (AAU, GOET, LPB), Kessler 3283 (GOET, LPB); Prov. Chayanta, ca. 25 km E Ocurí on Sucre-Macha road, 18°45'S/65°41'W, 3600 m, 27.9.1991, Kessler 3274 (GOET, LPB); Prov. Chayanta, Entre Macha y Yocalla, 25.3.1993, Torrico 216 (LPB); Prov. Nor Chichas, near Quechisla on the road to Chorolque, 3600 m, Dec. 1931, Cárdenas 24 (GH); Prov. Nor Chichas, camino Lique entre Yurtuy, Cancha a la Laguna, 3800 m, 19.11.1987, Schulte 22 (GOET, LPB); Prov. Nor Chichas, near Sta. Barbara on the road from Quechisla, 4200 m, 22.2.1936, West 6110 (GH, MO, UC); Prov. Nor Chichas, cerca a Cotagaitilla, desde Cotagaita, al borde del río, 2800 m, 13.5.1993, Torrico 502 (LPB); Prov. Sud Chichas, Cerro Pabellón 3 km W Atocha, 20°59'S/66°16'W, 4000 m, 16.9.1991, Kessler 3085 (AAU, GOET, LPB), Kessler 3086 (GOET), Kessler 3087 (AAU, GOET), Kessler 3088 (AAU, GOET, LPB), Kessler 3089 (AAU, GOET, LPB), Kessler 3621 (ie., it includes Nos. 3622, 3623), 3624 (GOET); Prov. Sud Chichas, ca. 10 km N Salo on Atocha-Tupiza road, 21°15'S/65°50'W, 4000 m, 16.9.1991, Kessler 3107 (AAU, GOET, LPB); Prov. Sud Chichas, Vilquiza, a 13 km de Tupiza, 3320 m, 18.4.1993, Torrico 436 (LPB); Chuquisaca: Prov. Oropeza, Cajamarca ca. 30 kms. hacia Ravelo, 3300 m, 9.10.1984, Beck 8827 (GOET, LPB); Prov. Oropeza, ca. 35 km W Sucre on road to Macha, 18°53'S/65°25'W, 3300 m, 26.9.1991, Kessler 3258 (GOET), Kessler 3259 (AAU, GOET); Prov. Yamparaez, 5 km W Tarabuco on road to Sucre, 19°09'S/64°58'W, 3300 m, 23.9.1991, Kessler 3199 (GOET), Kessler 3200 (GOET, LPB), Kessler 3201 (AAU, GOET), Kessler 3202 (AAU, GOET); Prov. Zudáñez, 20 km S Icla on Tarabuco-Azurduy road, 19°25'S/64°59'W, 3300 m, 24.9.1991, Kessler 3207 (AAU, GOET); Prov. Zudáñez, 25 km S Icla on Tarabuco-Azurduy road, 19°27'S/64°49'W, 3500 m, 24.9.1991, Kessler 3213 (AAU, GOET, LPB); Prov. Tomina, pass on San Pedro-Keluya road, 19°55'S/65°11'W, 3450 m, 22.9.1991, Kessler 3189 (AAU, GOET), Kessler 3190 (AAU, GOET, LPB), Kessler 3191 (GOET, LPB), Kessler 3192 (GOET); Prov. Nor Cinti, along the road between Camargo and San Lucas, 3300 m, 10.12.1967, Vuillemier 427 (GH, US); Prov. Nor Cinti, Muyuquiri

6 kms hacia Camargo, 3510 m, Beck 686 (LPB); Prov. Nor Cinti, 30 km N Camargo on road to Potosí, 20°30'S/65°10'W, 3200 m, 22.9.1991, Kessler 3177 (GOET), Kessler 3178 (AAU, GOET, LPB), Kessler 3179 (AAU, GOET, LPB), Kessler 3184 (AAU, GOET, LPB), Kessler 3185 (GOET); Prov. Nor Cinti, 32 km N Camargo on road to Potosí, 20°30'S/65°10'W, 3200 m, 22.9.1991, Kessler 3186 (GOET, LPB), Kessler 3187 (AAU, GOET), Kessler 3188 (AAU, GOET, LPB); Tarija: Prov. Méndez, Iscayachi, 5 km S turnoff to Tarija from Villazón-Camargo road, 21°31'S/65°01'W, 3600 m, 17.9.1991, Kessler 3094 (AAU, GOET), Kessler 3095 (GOET, LPB), Kessler 3096 (AAU, GOET), Kessler 3097 (GOET, LPB, USM), Kessler 3098 (AAU, GOET, LPB).

Distribution. — Oruro, Potosí, Chuquisaca and Tarija, Bolivia; Jujuy, NW-Argentina (Fig. 5).

Phenology. — Flowers and fruits: February, September — December.

Ecology. — Found between 2800 and 4300 m in regions with 300 to 900 mm mean annual precipitation. Over wide areas of the eastern Bolivian Andes this is the only *Polylepis* taxon.

Remarks. — As treated here, this subspecies encompasses over 95% of the known populations of *P. tomentella*, including BITTER's (1911) subspecies *pentaphylla*, *tetragona* and *dentatolata* which at most could be considered varieties. There is a smooth clinal variation from north to south with a reduction of leaflet size, an increase in leaflet thickness, and a reduction of the number of flowers per inflorescens. Northern populations approach *P. tomentella* subsp. *incanoides*, those from the south *P. tarapacana*.

Individuals growing at azonally humid sites, e.g., near streams or along roads, frequently differ markedly from specimens on adjacent, but drier locations. Such specimens have large, coarsely serrate leaflets, often with two pairs of leaflets and a dark bluish sheen on the upper surface, long inflorescences with a larger number of flowers and occasionally lanose trichomes on the stipular sheaths. They therefore resemble hybrids of this species with *P. besseri* subsp. *subtusalbida*, but as the latter is frequently absent from localities where the abnormal specimens of *P. tomentella* are found, it seems unlikely that these are in fact hybrids. The differentiation of these specimens is only to be seen relative to the general population: typical specimens of a northern population can be larger than abnormal specimens of a southern population (Fig. 10). A systematic classification of the abnormal specimens as an ecotype or variety is therefore impractical.

P. tomentella subsp. *tomentella* hybridizes with *P. besseri* subsp. *besseri*.

8b. *Polylepis tomentella* Weddell subsp. *incanoides* M. Kessler, subsp. nov. (Fig. 10). **Type:** Bolivia, Cochabamba, Prov. Carrasco, surroundings of Monte Punco, 17°36'S/65°17'W, 2800 m, 14.8.1991, Kessler 2954 (holotype, LPB; isotypes, AAU, GOET). **Ill.:** Simpson, Smithsonian Contr. Bot. 43: fig. 32. 1979.

Differt a *P. tomentella* subsp. *tomentella* pinnis maioribus (9-24 mm versus 8-19 mm) cum apicibus multum rotundatis, numero maiore dentium foliolorum (7-24 versus 5-9) et floribus inflorescentiae pluribus (4-8 versus 2-5).

Evergreen tree or shrub, 1.5 to 5 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with one pair of leaflets, trullate in outline, 1.4-4.0 cm wide and 1.5-2.7 cm long; rachis densely covered in yellowish multicellular glandular and pannose trichomes, often with scattered lanose trichomes, point of leaflet attachment with a tuft of lanose trichomes; stipular sheaths truncate, outer surface usually glabrous, rarely with a sparse cover of short yellowish multicellular glandular trichomes. Leaflets ovate, obovate or lanceolate in outline, 0.3-1.0 cm wide and 0.9-2.4 cm long; margins slightly to strongly revolute, serrate with 7-24 teeth; apex obtuse or slightly acute; base unequally attenuate or cordate; terminal leaflet sessile or with 2-5 mm long petiolule; upper surface glabrous, very rarely with scattered very short white pannose and/or yellowish multicellular glandular trichomes; lower surface with a dense layer of very short white or yellowish pannose trichomes, rarely admixed with short yellowish multicellular trichomes along the veins. Inflorescences

pendant, 1.8-4.5 cm long, bearing 4-8 flowers; floral bracts 3-5 mm long, lanose, rarely also with pannose trichomes; rachises unbranched, with lanose trichomes, sometimes also short multicellular glandular trichomes. Flowers perfect, 0.4-0.8 cm in diameter; sepals 3, ovate, outer surface glabrescent or covered in short pannose and/or glandular trichomes, very rarely also with scattered lanose trichomes; stamens 6-24, anthers covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, slightly to densely covered in pannose and/or glandular trichomes, rarely with scattered lanose trichomes, with 3-4 ridges with a series of spines, 0.2-0.8 cm wide including protuberances, 0.3-0.9 cm long.

Specimens studied. — Cochabamba: Prov. Arani, cerca de Tiraque, al borde de la carretera Cochabamba-Sta. Cruz, 3400 m, 4.11.1988, Hensen 222 (GOET, LPB); Prov. Arani, Mojón, 1 km N Cochabamba-Sta. Cruz road, 17°29'S/65°25'W, 3000 m, 14.8.1991, Kessler 2943 (GOET, LPB); Prov. Carrasco, Montepunco, Canyon of Rio Huairamayú (R. Montepunco), 40 km n. of Totora, 22.8.47, 2800 m, Fosberg 28456 (NY); Prov. Carrasco, 2 km después de Totora, 2900 m, 20.2.1979, Ceballos et al. Bo. 407 (G); Prov. Carrasco, 6 km E Monte Punco on Cochabamba-Comarapa road, 17°30'S/65°23'W, 2850 m, 5.10.1991, Kessler 3288 (GOET, LPB), 3289 (GOET); Prov. Carrasco, surroundings of Monte Punco, 17°36'S/65°17'W, 2800 m, 14.8.1991, Kessler 2953 (GOET), Kessler 2955 (AAU, GOET, LPB); Prov. Carrasco, Llutu Pampa, 3100 m, 14.4.1991, Hensen 2416 (LPB), Hensen 2420 (LPB); Prov. Carrasco, Yana Qhara, 3100 m, 14.4.1991, Hensen 2450 (LPB), Hensen 2463 (LPB); Prov. Carrasco, Rodeo Chico, 3100 m, 14.4.1991, Hensen 2473 (LPB); Prov. Carrasco, Cochabamba 142 kms. hacia Sta. Cruz, 3050 m, 24.3.1981, Beck 6827 (GOET, LPB); Prov. Carrasco, Cochabamba 161 kms. hacia Sta. Cruz, 3100 m, 27.9.1981, Beck 7047 (GOET, LPB); Prov. Carrasco, Carretera Fundamental 4, 7 km E Epizana, 9700 ft., 5.12.1975, Davidson 3760 (F, NY); Prov. Carrasco, Cerros de Totora y Duraznillo, 2500 m, 20.12.1921, Steinbach 6031 (A, G); Prov. Carrasco, 8 km al este de Epizana por el camino entre Cochabamba y Santa Cruz, 17°40'S/65°09'W, 3200 m, 4.2.1987, Solomon & King 15922 (MO, NY); Prov. Carrasco, Epizana, 3000 m, Nov. 1954, Cárdenas 5221 (US); Prov. Carrasco 81 miles out of Cochabamba on road to Santa Cruz, 9400 ft., 13.11.1959, Maguire & Maguire 44482 (GH, NY, US); Prov. Carrasco, 3 km E Epizana on road to Comarapa, 3000 m, 5.10.1991, Kessler 3290 (GOET); Prov. Carrasco, 8 km E Epizana on Cochabamba-Comarapa road, 17°41'S/65°04'W, 3000 m, 5.10.1991, Kessler 3292 (GOET), Kessler 3293 (AAU, GOET); Prov. Carrasco, 10 km W Valle Hermoso on Cochabamba-Comarapa road, 17°44'S/64°56'W, 2900 m, 5.10.1991, Kessler 3298 (GOET, LPB); Prov. Mizque, Khuchu, 23 km E Vacas, 3500 m, 3.3.1991, Hensen 1924 (LPB); without precise locality: D'Orbigny 495 (F).

Etymology. — The name refers to the similarity of *Polylepis tomentella* and *P. incana* which is particularly conspicuous in this subspecies.

Distribution. — Endemic to the provinces of Arani, Carrasco and Mizque in Cochabamba, Bolivia (Fig. 5).

Phenology. — Flowers: February, March, August-December; fruits: February, September-December.

Ecology. — Recorded between 2500 and 3400 m in areas with about 600 to 1100 mm mean annual precipitation. Usually forms pure stands, but at its distributional limits mixes with *P. besseri*, elements of the Boliviano-Tucumán forests (*Podocarpus parlatorei*, *Alnus acuminata*, *Clethra* sp., *Weinmannia* sp.) or species of the semi-deciduous forests of the mesothermic inter-Andean valleys (*Schinopsis haenkeana*, *Aspidosperma quebracho-blanco*, etc.). The synecology and phytosociology was studied by HENSEN (1993).

Remarks. — There exists no single diagnostic character to differentiate *P. tomentella* subsp. *incanoides* from the subsp. *tomentella*, but many character combinations occur at different frequency in both taxa. For example, yellowish multicellular trichomes on the lower leaflet surface are present in all examined specimens of the subsp. *tomentella*, but only in about 13% of those of the subsp. *incanoides*. Other characters are the larger leaflet size of the subspecies *incanoides* (9-24 mm against 8-19 mm), its larger number of teeth on the leaflets (7-24 against 5-9), its generally

more rounded leaflet apices, its almost always glabrous upper leaflet surfaces and its larger number of flowers per inflorescences (4-8 against 2-5). Together with the allopatric distribution and a clear ecological differentiation, these differences warrant the description of a new subspecies.

P. tomentella subsp. *incanoides* hybridizes with *P. besseri* subsp. *besseri* and subsp. *subtusulbida* at their narrow zones of sympatry.

8c. *Polylepis tomentella* Weddell subsp. *nana* M. Kessler, subsp. nov. (Fig. 10, 11).

Type: Bolivia, Dept. Cochabamba, Prov. Arani, 2 km W turnoff to Vacas from Arani-Mizque road, 17°33'S/65°42'W, 3200 m, 18.8.1991, Kessler 3409 (holotype, LPB; isotypes, AAU, GOET).

Differt a *P. tomentella* subsp. *tomentella* et subsp. *incanoides* statura minore et habitu fruticosa.

Evergreen scrub, to 1.5 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves strongly congested at the tips of the branches, imparipinnate with one pair of leaflets, trullate in outline, 1.0-2.2 cm wide and 1.2-1.6 cm long; rachis on the abaxial side densely covered in yellowish multicellular glandular and short pannose trichomes, on the adaxial side with dense white lanose trichomes, point of leaflet attachment with a tuft of lanose trichomes; stipular sheaths truncate, outer surface glabrous to densely covered in short yellowish multicellular glandular trichomes, rarely with long lanose trichomes, top with long lanose trichomes. Leaflets obovate or unequally lanceolate in outline, 0.2-0.5 cm wide and 0.6-1.2 cm long; margins slightly to strongly revolute, serrate with 5-6 teeth; apex acute, upper tooth of one side projecting beyond the central vein; base unequally attenuate; terminal leaflet sessile or with 1-2 mm long petiolule; upper surface often with a dark bluish sheen, glabrous to densely covered in very short white pannose trichomes; lower surface with a dense layer of white or yellowish pannose trichomes, usually admixed with short yellowish multicellular trichomes along the veins. Inflorescences held upright by stipule sheaths or slightly pendant, 1.3-1.8 cm long, bearing 4 flowers; floral bracts 3-5 mm long, lanose, rarely also with glandular trichomes; rachises unbranched, with lanose trichomes. Flowers perfect, 0.4-0.7 cm in diameter; sepals 3, ovate, outer surface glabrescent or covered in short pannose and/or glandular trichomes, rarely also with scattered lanose trichomes; stamens 12-16, anthers covered with long white trichomes; base of style with a tuft of long white hairs. Fruits turbinate, slightly to densely covered in pannose and/or glandular trichomes, rarely with scattered lanose trichomes, with 3-4 ridges with a series of spines, 0.3 cm wide including protuberances, 0.3-0.5 cm long.

Specimens examined. — Cochabamba: Prov. Arani, between Arani and Cañadas on the road to Vacas, 17°34'S/65°40'W, 3100 m, Brandbyge 708 (AAU); Prov. Arani, camino a Vacas, 3170 m, 11.1.1990, Saravia & Guillén 17 (LPB); Prov. Arani, Kewiñal, 3300 m, 23.3.1991, Hensen 1924 (LPB); Prov. Arani, Kewiñal, 3300 m, 24.3.1991, Hensen 1949 (LPB), Hensen 2012 (LPB); Prov. Arani, 2 km W turnoff to Vacas from Arani-Mizque road, 17°33'S/65°42'W, 3200 m, 18.8.1991, Kessler 2998 (GOET, LPB), Kessler 3403 (GOET, LPB), Kessler 3404 (GOET, LPB), Kessler 3405 (GOET), Kessler 3406 (GOET, LPB), Kessler 3407 (GOET, LPB), Kessler 3408 (GOET, LPB, USM), Kessler 3495-3521 (one each GOET), Kessler 3641 (GOET), Kessler 3642 (GOET).

Etymology. — The name refers to the small size of this subspecies.

Distribution. — Known only from the type locality (Fig. 5).

Phenology. — Flowers and fruits: March, August.

Ecology. — Known only from a small number of stands between 3000 and 3500 m, totalling about 75 ha in area. The mean annual precipitation in the area is around 450-500 mm and seven months of the year are arid. The synecology and phytosociology have been treated by HENSEN (1993).

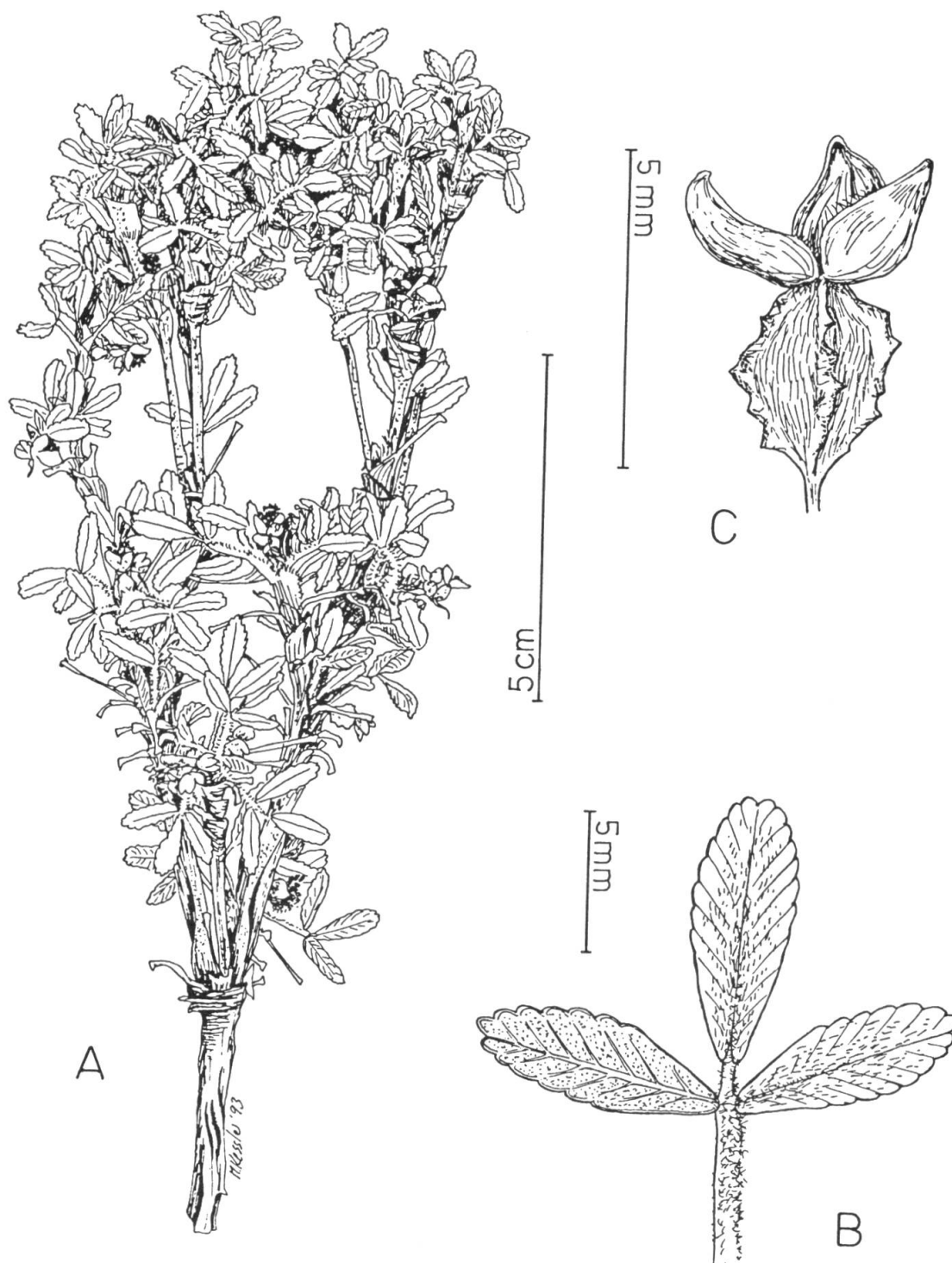


Fig. 11. — *Polylepis tomentella* Weddell subsp. *nana* M. Kessler
 A, branchlet; B, leaf, left leaflet showing underside, upper and right leaflets showing upper side and vestiture; C, fruit. A-C,
 Kessler 3518.

Remarks. — Besides its shrubby growth form, this subspecies has several additional characters that distinguish it from the other subspecies of *P. tomentella*. These are the small size of the leaflets, the frequently dense vestiture of the upper leaflet surface, the complete lack of shoulders on the stipular sheaths, the small size of the inflorescences and the total lack of glandular hairs on the inflorescences rachises (Fig. 10). These characters may also be found in some specimens of *P. tomentella* subsp. *tomentella* from southern Bolivia, but not in those geographically closest to the subsp. *nana*. *P. tomentella* subsp. *incanoides*, which grows only a few kilometers away, never shows any similarity to *nana*. Edaphic factors seem not to be responsible for the shrubby growth of *nana* since adjacent specimens of *Dodonaea viscosa*, *Senna aymara* and planted *Eucalyptus globulus* show their usual growth forms. This suggests that the shrubby growth form of *P. tomentella* subsp. *nana* is genetically fixed, warranting the description as a subspecies.

9. *Polylepis tarapacana* Philippi, Anales Mus. Nac. Chile 2 (secc. Bot.) 8: 21. 1891; Simpson, Smithsonian Contr. Bot. 43: fig. 31. 1979. (Fig. 10). **Type:** Chile, Tarapacá, nahe Caña, 3900 m, Philippi s.n. (lectotype, SGO, selected in Simpson, Smithsonian Contr. Bot. 43: 46; isolotypes, GH, SGO).

- = *Polylepis tarapacana* var. *multisquamata* Bitter, Bot. Jahrb. Syst. 45: 654. 1911. **Type:** Chile, Tarapacá, Philippi s.n. (type, destroyed in B). Probably an illegitimate name since it is possibly based on part of the type collection of *P. tarapacana*.
- = *Polylepis tarapacana* var. *sajamensis* Bitter, Bot. Jahrb. Syst. 45: 654. 1911. **Type:** Bolivia, Oruro, Sajama, 4500 m, Stübel 1 (type, probably destroyed in B).
- = *Polylepis tarapacana* var. *brevifilamentosa* Bitter, Bot. Jahrb. Syst. 45: 654. 1911. **Type:** Perú, Tacna, nahe der Provinz Oruro, Stübel 112 (type, probably destroyed in B).
- = *Polylepis tarapacana* var. *pynolopha* Bitter, Bot. Jahrb. Syst. 45: 654. 1911. **Type:** Bolivia, between La Paz and Tacna, 12.300-13.400 ft, 1838, Pentland s.n. (holotype, P).

Evergreen tree or shrub, 1 to 3 m tall; bark of the trunk and larger branches reddish brown, flaking off in large pieces. Leaves congested at the tips of the branches, imparipinnate with one pair of leaflets, trullate in outline, 0.8-3.0 cm wide and 1.9-2.1 cm long; rachis densely covered in yellowish multicellular glandular trichomes, these often covered in a reddish resinous exudate; stipular sheaths truncate or with a short shoulder (to 0.5 mm), basal part of the outer surface glabrous or with short glandular trichomes, distal half and margin densely covered in short glandular and long lanose, rarely strigose, trichomes, with long lanose and strigose hairs projecting from the inner surface over the margins. Leaflets ovate or obovate in outline, 0.3-0.5 cm wide and 0.7-1.3 cm long; relatively thick, margins revolute, entire or very slightly serrate; apex obtuse or acute; base unequally attenuate, sometimes somewhat cordate; terminal leaflet sessile, rarely with up to 2 mm long petiolule; upper surface rugose, glabrous, usually covered with a thick layer of clear, yellowish resinous exudate; lower surface with a dense layer of very short yellowish pannose and glandular trichomes, rarely admixed with a few projecting long lanose trichomes. Inflorescences barely projecting between the stipular sheaths, to 1.5 cm long, bearing 1-2 flowers; floral bracts 3-5 mm long, lanose; rachises unbranched, with lanose trichomes, often with short multicellular glandular trichomes and areas covered in orange resinous exudate. Flowers perfect, 0.5-1.0 cm in diameter; sepals 3, ovate, outer surface densely covered with short glandular and a few scattered lanose trichomes; stamens 6-14, anthers covered with long white trichomes on the tips; base of style with a tuft of long white hairs. Fruits turbinate, densely covered in lanose and glandular trichomes, rarely with scattered lanose trichomes, with 3-4 ridges with a series of spines, 0.2-0.4 cm wide including protuberances, 0.3-0.6 cm long.

Specimens examined. — La Paz: Prov. Pacajaes, Santiago de Machaca 27 kms. hacia Berenguela, 4130 m, 24.4.1982, Beck 9008 (GOET, LPB); Oruro: Prov. Sajama, around base of Volcano Sajama, 4350 m, 18.10.1967, Vuillemier 316 (GH, US); Prov. Sajama, 6 km NE Laguna, foothills of Ndo. Sajama, 4200 m, 5.12.1984, G. & D. Schmitt 173 (MO, NY); Prov. Sajama, 2 km south of the town of Sajama on the road to Tambo Quemado, 5.9.1986, Zeballos s.n. (MO); Prov. Sajama, localidad Mamaniri próxima a la población de Sajama, 4170 m, 2.4.1991, Huanca 69 (GOET, LPB);

Prov. Sajama, Volcán Sajama, 29.4.1987, Arctander s.n. (AAU); Prov. Sajama, al norte del pueblo Sajama, 4300 m, 31.5.1991, Beck 19897 (LPB); Prov. Sajama, Sajama, 4600 m, 1.6.1991, Hensen 2610 (LPB); Prov. Sajama, Tirata, 30 km W Curahuara de Carangas on road to Sajama, 17°52'S/68°32'W, 4100 m, 27.7.1991, Kessler 2777 (GOET, LPB), Kessler 2778 (AAU, LPB); Prov. Sajama, 2 km W Tambo Colorado on road to Chile, 18°17'S/69°02'W, 4500 m, 29.9.1991, Kessler 3284 (GOET), Kessler 3285 (AAU, GOET), Kessler 3286 (AAU, GOET, LPB); Prov. Sajama, de Turco 3 km hacia Curahuara de Carangas, 3880 m, 18.3.1992, Beck 21044 (LPB); Potosí: Prov. Sud Lípez, Cerro Tapachuillcha, 4600 m, 12.4.1980, Liberman 171 (GOET, LPB); Prov. E. Baldivieso, Cerro Chuhuila on Alota-Lag. Hedionda road, 21°29'S/67°50'W, 4500 m, 13.9.1991, Kessler 3073 (AAU, GOET), Kessler 3074 (AAU, GOET, LPB), Kessler 3075 (GOET, LPB), Kessler 3076 (GOET, LPB); Prov. E. Baldivieso, ca. 20 km W Alota on road to Lag. Hedionda, 21°23'S/67°43'W, 4050 m, 13.9.1991, Kessler 3078 (GOET); Prov. Sud Lípez, 32 km E Lag. Colorada on road to Peña Barrosa, 22°12'S/62°28'W, 4500 m, 14.9.1991, Kessler 3083 (AAU, GOET, LPB), Kessler 3084 (AAU, GOET, LPB), Kessler 3429 (GOET, USM), Kessler 3430 (GOET), Kessler 3595-3620 (GOET).

Distribution. — The volcanic western Andean cordillera from Puno and Tacna, southern Peru, to Potosí, southwestern Bolivia, and in adjacent Chile (Fig. 5).

Phenology. — Flowers: September, October, December; fruits: April, September, October, December.

Ecology. — Found mostly on volcanic slopes between 3900 and 5100 m, where it forms the highest woody plant formation on earth. Detailed observations on the distribution and ecology were made by JORDAN (1980, 1983) and LIBERMAN (1986).

Remarks. — The differentiation of *P. tarapacana* and *P. tomentella* has always been problematic. WEDDELL (1861) included specimens from Tacna (where only *tarapacana* occurs) within *P. tomentella*, but BITTER (1911) recognized PHILIPPI's (1891) species *tarapacana*. SIMPSON (1979) lumped both taxa by stating that "there is a gradual transition from west to east across the altiplano with no populations that appear as "hybrids" (op. cit., p. 49)", but later separated both species on the basis of a report from Chile where both taxa were found growing close to each other without showing any hybridization (SIMPSON, 1986). However, *P. tomentella* does not occur in Chile, and it is likely that this observation is based on a misidentification of *P. rugulosa* from the *besseri* group.

There exists an transition zone between both taxa along the southeastern edge of the Altiplano where populations are intermediate in character and do not show typical specimens of either species. As this zone is narrow (up to 30 km wide) relative to the total range of both taxa, and as both taxa maintain their typical characters when cultivated in La Paz (unpubl. data), they are here treated as separate species. The introgression zone follows approximately the line of 300 mm mean annual precipitation and marks the transition zone between the cold and arid Altiplano climate to the somewhat less harsh Valle climate (Fig. 5).

Intermediate specimens examined. — Potosí: Prov. Quijarro, near pass on Río Mulatos-Yura road, 19°43'S/66°28'W, 4300 m, 11.9.1991, Kessler 3065 (GOET, LPB), Kessler 3066 (GOET, LPB), Kessler 3067 (GOET, AAU), Kessler 3068 (GOET, LPB, AAU) (population more similar to *P. tarapacana*); Prov. Sud Chichas, Mina Isca Isca above the village of La Torre north of Tupiza, 3875-3880 m, 2.12.1967, Vuilleminier 402 (GH, US, G); Prov. Sud Chichas, 180 km SE of Uyuni on road to Tupiza, 21°00'S/65°45'W, 3900 m, 25.8.1987, Killeen 2682 (MO) (more similar to *P. tomentella*).

Hybrids

Hybridization is very common among *Polylepis* species. In Ecuador, even triple hybrids have been found (S.Laegaard, pers. comm.). Probably, all *Polylepis* species can hybridize if they occur

sympatrically. This makes the identification of many specimens very problematic, and in some cases a detailed examination of the whole population is indispensable to clarify the status of these individuals.

In the following list, hybrids are not given names, but are listed according to their parent taxa. Brief descriptions of the hybrids are given under the first-mentioned parent taxon in the main text.

Polylepis neglecta × *P. besseri* subsp. *subtusalbida*

Specimens examined. — Potosí: Prov. Bilbao, antes de Sakani Khasa, 3400 m, 18.3.1993, Torrico 199 (LPB); Prov. Bilbao, 31 km SW Acacio on road to Sacaca and Uncia, 18°06'S/66°08'W, 3500 m, 22.8.1991, Kessler 3417 (AAU, GOET, LPB, USM), Kessler 3555 (GOET).

Polylepis racemosa subsp. *triacontandra* × *P. besseri* subsp. *incarum*

Specimens examined. — La Paz: Prov. Camacho, Puerto Acosta, 3680 m, 5.4. 1982, Beck 7662 (GOET, LPB); Prov. Camacho, Puerto Acosta, Estancia Kerojani, 3900 m, 26.1.1980, Jordan 51 (LPB); Prov. Murillo, Palca 28,5 kms hacia Cohoni, 3440 m, 14.10.1990, Beck 17832 (GOET, LPB), Prov. Murillo, Río Minasa, 1,5 km arriba del viejo puente del ferrocarril (ca. 3 km arriba de Villa Fátima, La Paz), 16°27'S/68°07'W, 4000 m, 18.1.1987, Solomon 15783 (LPB, MO, NY).

Polylepis racemosa subsp. *lanata* × *P. besseri* subsp. *subtusalbida*

Specimens examined. — Cochabamba: Prov. Ayopaya, cerca a Morochata, 3300 m, 1.8.1991, Hensen 872 (LPB); Prov. Carrasco, Zapata Rancho, 3200 m, 22.11.1989, Hensen 945 (LPB); Prov. Carrasco, Mojón, 3300 m, 19.3.1991, Hensen 1765 (GOET, LPB).

Polylepis besseri subsp. *besseri* × *P. tomentella* subsp. *tomentella*

Specimens examined. — Chuquisaca: Prov. Zudáñez, 25 km S Icla on Tarabuco-Azurduy road, 19°27'S/64°49'W, 3500 m, 24.9.1991, Kessler 3209 (AAU, GOET, LPB), Kessler 3211 (GOET, LPB).

Polylepis besseri subsp. *besseri* × *P. tomentella* subsp. *incanoides*

Specimens examined. — Cochabamba: Prov. Arani, 49,3 km E of bridge over the Río Pucará (at Punata) on the road to Sta. Cruz, 3100 m-3300 m, 17°26'S/65°29'W, 20.10.1985, Solomon 14452 (NY, LPB); Prov. Arani, Vacas (village Rodeo W of Vacas?), 3650 m, 17.4.1987, Arctander s.n. (AAU).

Polylepis besseri subsp. *subtusalbida* × *P. tomentella* subsp. *incanoides*

Specimens examined. — Cochabamba: Prov. Arani, 5 km E Mojón on Cochabamba-Comarapa road, 17°30'S/65°24'W, 3000 m, 5.10.1991, Kessler 3287 (AAU, GOET, LPB); Prov. Carrasco, 6,6 km by road NW of López Mendoza, at km 198 from Cochabamba, Q. Majón, 3250 m, 15.5.1984, G. & D. Schmitt 108 (MO); Prov. Carrasco, Yana Qhara, 3300 m, 14.4.1991, Hensen 2463 (LPB); Prov. Carrasco, Llutu Pampa, 3390 m, 14.4.1991, Hensen 2489 (LPB); Prov. Carrasco, 8 km E Epizana on Cochabamba-Comarapa road, 17°41'S/65°04'W, 3000 m, 5.10.1991, Kessler 3291 (GOET); Prov. Carrasco, Rodeo Grande, at km 140 on road from Cochabamba to Santa Cruz, 3000 m, 9.2.1971, Hawkes et al. 4400 (MO); Cochabamba, a unos 97 km de la capital en dirección a Sta. Cruz, 3650 m, 25.12.1982, Casas 7746 (NY).

Excluded taxon

Polylepis australis Bitter. BASTIAN's (1986) citation of this species for Tarija was based on the misidentification of *P. hieronymi*.

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REFERENCES

- ANCIBOR, E. (1975). Estudio anatómico de la vegetación de la Puna de Jujuy. I. Anatomía de *Polylepis tomentella* Wedd. (Rosaceae). *Darwiniana* 19: 373-385.
- ANCIBOR, E. (1984). Estructura de la madera de *Polylepis tomentella* Wedd. (Rosaceae). *Physis (Buenos Aires)*, Secc. C, 42 (102): 23-28.
- BASTIAN, E. (1986). Grundzüge der Vegetationsdegradierung in Südost-Bolivien. In: BUCHHOLZ, H. J. (ed.), Bolivien: Beiträge zur physischen Geographie eines Andenstaates. *Jahrb. Geogr. Ges. Hannover* 1985: 23-67.
- BITTER, G. (1911). Revision der Gattung *Polylepis*. *Bot. Jahrb. Syst.* 45: 564-656.
- FJELDSÅ, J. (1987). *Birds of Relict Forests in the High Andes of Peru and Bolivia*. Zoological Museum, Copenhagen.
- HENSEN, I. (1993). *Vegetationskundliche Untersuchungen in Polylepis-Wäldern der Ostkordillere Boliviens*. Doctoral thesis, Univ. Göttingen, Germany.
- JORDAN, E. (1980). Das durch Wärmemangel und Trockenheit begrenzte Auftreten von *Polylepis* am Sajama Boliviens mit dem höchsten *Polylepis*-Gebüschvorkommen der Erde. 42. *Deutsch. Geographentag*: 303-305.
- JORDAN, E. (1983). Die Verbreitung von *Polylepis*-Beständen in der Westkordillere Boliviens. *Tuexenia* 3: 101-112.
- LIBERMAN C. M. (1986). Microclima y Distribución de *Polylepis tarapacana* en el Parque Nacional del Nevado Sajama, Bolivia. *Doc. Phytosociol.* X: 235-272.
- MIYAGAWA, M. (1975). *Untersuchungen zur Taxonomie und Anatomie der bolivianischen Polylepis-Arten (Familie: Rosaceae)*. Diploma thesis, Univ. Heidelberg, Germany.
- PHILIPPI, R. A. (1891). Catalogus praeivium plantarum in itinere at Tarapacá a Federico Philippi lectarum. *Anales Mus. Nac. Chile*, 2 (secc. Bot.) 8.
- ROMOLEROUX, K. (1992). Rosaceae in the páramos of Ecuador. In: BALSLEV, H. & J. L. LUTEYN (eds.), *Páramo. An Andean Ecosystem under Human Influence*: pp. 85-94. Academic Press, London.
- RUIZ, L. H. & J. A. PAVON (1798). *Systema Vegetabilium Flora Peruviana et Chilensis*. Sancha, Madrid.
- SIMPSON, B. B. (1979). A revision of the genus *Polylepis* (Rosaceae: Sanguisorbeae). *Smithsonian Contr. Bot.* 43.
- SIMPSON, B. B. (1986) Speciation and specialization of *Polylepis* in the Andes. In: VUILLEMIER, F. & M. MONASTERIO (eds.), *High Altitude Tropical Biogeography*: pp. 304-315. Oxford Univ. Press, New York.
- WEDDELL, H. A. (1861). *Chloris Andina*. Vol. 2. Bertrand, Paris.
- YALLICO, E. (1992). *Distribución de Polylepis en el Sur de Puno*. Proyecto Arbolandino, Pomata, Perú.

