

Revision of *Pearcea*
(Gesneriaceae)

Lars Peter Kvist
and Laurence E. Skog



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ABSTRACT

Kvist, Lars Peter, and Laurence E. Skog. Revision of *Pearcea* (Gesneriaceae). *Smithsonian Contributions to Botany*, number 84, 47 pages, 22 figures, 1 table, 1996.—Seventeen species of *Pearcea* (Gesneriaceae) are recognized, nine of which are new: *Pearcea bella*, *P. bilabiata*, *P. cordata*, *P. fuscicalyx*, *P. glabrata*, *P. gracilis*, *P. grandifolia*, *P. intermedia*, and *P. strigosa*. Of the remaining eight species, two were originally described in *Pearcea*, one is transferred herein from *Kohleria*, and five come from *Parakohleria*, a genus placed in synonymy herein. *Pearcea* occurs mainly on the eastern Andean slopes of Colombia (5 species), Ecuador (12 species), Peru (6 species), and Bolivia (1 species), and one species also occurs on the western Andean slopes in Ecuador. The largest number of species appears to occur in Ecuador, although additional species may occur in less explored parts of Peru. *Pearcea* differs from related and similar genera in the Gloxinieae by having fleshy capsules dehiscing by two valves and exposing a sticky seed mass. All species are herbs, usually with bright red flowers, and are usually found in the shady, humid forest understory, often near small streams. Hybridization, local speciation, and polymorphic variation may complicate the species delimitation. The variable *Pearcea sprucei* occurs throughout nearly the entire range of the genus (and includes the only accepted variety, var. *parviflora*), but most species are rare and local.

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Introduction

During our research in preparation of the revision of *Kohleria* Regel (Kvist and Skog, 1992), we began to study a group of species that until recently was placed in *Kohleria*. We concluded that these plants did not belong in that genus and postponed our revision of them until we had finished the study of *Kohleria*. The result of this revision is presented herein. We expand the genus *Pearcea* Regel from only two species to 17 species, including the ones previously referred to *Kohleria* (and to *Parakohleria* by Wiehler in 1978).

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of the American Gloxinia and Gesneriad Society and the Research Opportunity Fund of the National Museum of Natural History, Smithsonian Institution, which provided travel funds to visit herbaria and to undertake field work in South America.

Finally, we appreciate the comments of the outside reviewers, Susanne Renner and James F. Smith, which added immeasurably to the paper; however, the responsibility for the opinions expressed and any errors remain with the authors.

MATERIALS AND METHODS.—The revision is based on studies of herbarium material (451 collections from the following herbaria: A, AAU, AMAZ, BH, BM, BUS, C, CGE, CM, COL, DAV, E, ECON, F, FI, FI-W, G, GB, GH, HBG, IBE, K, L, LAM, M, MA, MANCH, MO, MOL, MPU, NA, NY, P, PH, QCA, QCNE, S, SEL, TRT, TULV, U, UC, US, USM, VEN, W, WAG, WU, WIS) and living plants collected from the wild and grown in the greenhouses of the Department of Botany, National Museum of Natural History, Smithsonian Institution. In addition, the following nine species were studied in their natural habitats in Colombia, Ecuador, and Peru: *Pearcea abunda*, *P. bella*, *P. hispidissima*, *P. intermedia*, *P. purpurea*, *P. reticulata*, *P. schimpffii*, *P. sprucei*, and *P. strigosa*.

Taxonomic History

Pearcea was established by Regel (1867) based on *P. hypocyrtiflora*, described earlier the same year as *Gloxinia hypocyrtiflora* by J.D. Hooker. Regel named the genus in honor of Richard William Pearce (–1835–1868), who collected plants in South America for the horticultural firm of James Veitch and Sons. The Veitch company supplied plants to the Royal Botanic Gardens, Kew, from which the drawing and description of the original species were made. It was not until 1936 that a second species, *P. schimpffii*, was added to the genus by Mansfeld. Both of these species from Ecuador have peculiar basally inflated corollas with a narrowed throat. This urceolate corolla shape was considered by earlier authors as the main character distinguishing *Pearcea* from other genera in the tribe Gloxinieae Fritsch. *Pearcea bella*, which is newly described in

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this work, also has an urceolate corolla. In addition, we herein expand *Pearcea* with 14 other species having funnellform, ventricose, and bilabiate corollas, and we propose the main uniting and distinguishing character for the genus to be the unusual fruit dehiscence. The rest of this section deals with the taxonomic history of these 14 species and with the rationale for referring them to *Pearcea*. We initially studied this material, and became increasingly aware of its affinities with *Pearcea*, during our revision of *Kohleria* (Kvist and Skog, 1992).

The funnellform-flowered *Pearcea* species formerly were members of other genera. The first two of these species were described from Peru as *Rhytidophyllum purpureum* and *R. melastoma* (both now *Pearcea purpurea*) by Poeppig in 1840. Later Hanstein (1865) and Bentham (1876) transferred them to *Moussonia* Regel and *Isoloma* (Bentham) Decaisne, respectively. The next two of the funnellform-flowered species were described from Bolivia in 1896 as *Isoloma sprucei* (now *Pearcea sprucei*) by Britton and *Isoloma parviflorum* (now *P. sprucei* var. *parviflora*) by Rusby. Three more species were added to *Isoloma* by Kuntze (1898) and Rusby (1900), but these now are all synonyms of *P. sprucei* var. *parviflora*.

Isoloma (Bentham) Decaisne (1848, not *Isoloma* J. Smith (1841)) is a synonym of *Kohleria* that was mainly used by British workers in the 19th Century. Several other synonyms of *Kohleria* were in common use, and the Central American genus *Moussonia* (Regel, 1847, 1848) also was confused with *Kohleria*. Numerous species were added to all of these genera, but from near the turn of the century (e.g., Fritsch, 1893–1894), the whole group usually was treated as *Kohleria* sensu lato, which then included nearly 100 species names and several sectional names. New (*Pearcea*) species were referred to *Kohleria* (and a few to *Diastema* Bentham), but they were not recognized as a subgroup in *Kohleria* s.l. In 1913 Fritsch described *Kohleria reticulata* and *K. jamesoniana* from Ecuador (now *Pearcea reticulata* and *P. sprucei*, respectively), *Kohleria weberbaueri* from Peru (now *Pearcea purpurea*), and *Diastema galeopsis* from Bolivia (now *Pearcea sprucei* var. *parviflora*). In 1935 Cuatrecasas added three Ecuadorian species to *Kohleria* (all now synonyms of *Pearcea sprucei*) as well as *Diastema rhodotrichum* (now *Pearcea rhodotricha*).

The complex and confusing taxonomic history of *Kohleria* s.l. has already been discussed (Kvist and Skog, 1992). Here it is sufficient to repeat that Wiehler (1975) realized that *Kohleria* s.l. consisted of three natural groups: *Moussonia*, restricted to Mexico and Central America, *Kohleria* sensu stricto, which ranges from Mexico to Peru and the Guianas with Colombia being the country having the highest number of taxa (Kvist and Skog, 1992), and a third group ranging along the eastern Andean slopes of Ecuador and Peru. In 1978 Wiehler described this third group as the new genus *Parakohleria*, with 14 species. Three species were new, and the others were transferred from *Kohleria* (6), *Moussonia* (2), *Diastema* (2), and *Pearcea* (1). It is remarkable that Wiehler transferred *Pearcea schimpfii*, described by Mansfeld (1936), to *Par-*

akohleria in spite of the urceolate corollas that supposedly characterize *Pearcea*. We find no major floral differences between the two "old" *Pearcea* species, *P. hypocyrtiflora* (J.D. Hooker) Regel and *P. schimpfii*, although they can be separated from each other by leaves of different shapes and patterns of coloration and venation.

In a later publication, Wiehler (1983) gave some characters delimiting the monotypic genus *Pearcea* from *Parakohleria* and including but not mentioning *Pearcea schimpfii*. He argued that *Pearcea* (i.e., *P. hypocyrtiflora*) differs by having (1) epedunculate 1–2 flowered inflorescences, (2) bilobed stigmas, and (3) an inability to hybridize with *Parakohleria*. The first argument does not hold because two of our new species, the urceolate-flowered *Pearcea bella* and the funnellform-flowered *P. fuscicalyx*, always have epedunculate inflorescences. Some specimens of the variable *P. sprucei* are, as well, epedunculate, and plants of *P. hypocyrtiflora* occasionally have up to 5 mm long peduncles. The second argument is doubtful because the stigmas are only weakly bilobed in *P. hypocyrtiflora* (also the case in *P. schimpfii*) and are more similar to the usual capitate stigmas of *Parakohleria* than to the bilobed stigmas of *Kohleria*. The third argument is not documented with hybridization data available to us. It is not known if anyone has tried to cross *Pearcea schimpfii* with any other species. We concluded therefore (Kvist and Skog, 1992) that the species with strongly inflated corollas heretofore placed in *Parakohleria* and *Pearcea* belong to *Pearcea*, and then we took a closer look at the funnellform-flowered species placed in *Parakohleria*.

Wiehler (1978, 1983) segregated *Parakohleria* from *Kohleria* based on the following characters: a capitate rather than a bilobed stigma, the usual absence of scaly rhizomes, the basally more strongly bent corolla tube, a more congested inflorescence, and the five free floral nectary glands. Only the stigma seemed to afford a clear distinction, but while doing field work we discovered that the fruits also are distinctive. *Kohleria* species have either dry capsules with wind-dispersed seeds that split from the apex with two valves (Figure 1c) or fleshy capsules that split with one slit from the apex to the base (Figure 1d,e). *Parakohleria* (= *Pearcea*) species have fleshy capsules that split with two valves from the apex to the base (Figure 1a). We concluded that the segregation of *Parakohleria* from *Kohleria* was justified, but we became aware that the funnellform-flowered *Parakohleria* species were not well delimited from the *Pearcea* species with urceolate flowers.

The discovery of *Pearcea intermedia* strengthened the affinity of *Parakohleria* with *Pearcea*. This species has the funnellform corollas (Figure 20g) typical of *Parakohleria* and has upper leaf surfaces with a characteristic pattern of green blotches surrounded by yellow green areas along the primary, secondary, and reticulate tertiary veins. The urceolate-flowered *Pearcea schimpfii* (Figure 20) has leaves with a pattern so similar that it is impossible to distinguish the two species vegetatively, but their leaves set them apart from all other

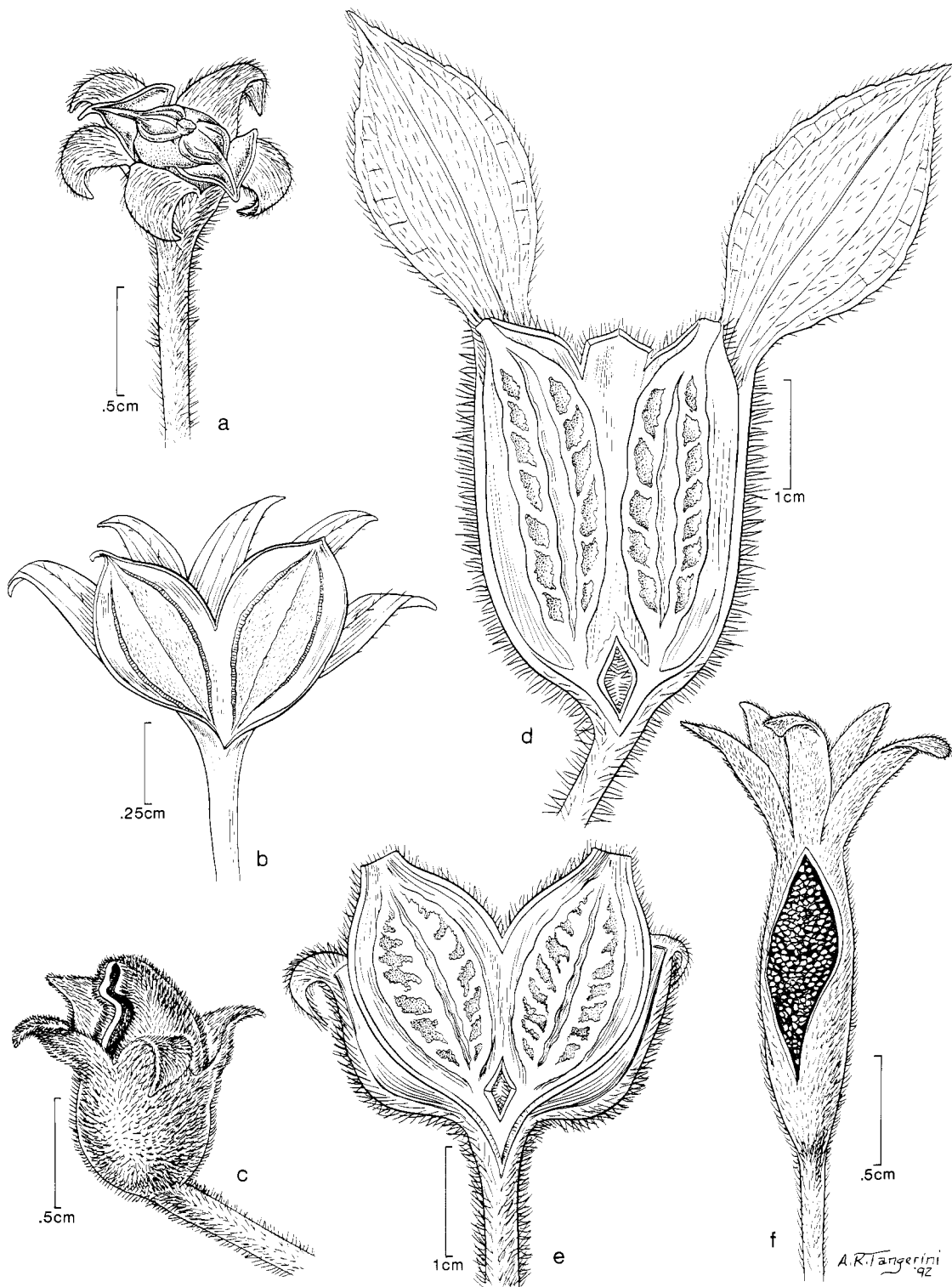


FIGURE 1.—Capsule dehiscence in *Pearcea* and in some other genera in tribe Gloxinieae: *a*, *Pearcea abunda*, 2 fleshy valves that split from apex to base and reflex completely; *b*, *Diastema racemiferum* Benthams, 2 apical valves with 1 of 2 slits continuing to base; *c*, *Kohleria allenii* Standley & L.O. Williams, 2 apical valves; *d*, *Kohleria longicalyx* L.P. Kvist & L.E. Skog, 1 longitudinal slit from apex to base; *e*, *Kohleria inaequalis* (Benthams) Wiehler, 1 longitudinal slit from apex to base; *f*, *Monopyle macrocarpa* Benthams, 1 longitudinal slit from middle of capsule toward apex and base. *a* from Kvist 60451 (AAU); *b* from Steyermark & Rabe 97441 (US); *c* from Liesner 2106 (US); *d* from Londoño & Kvist 153 (AAU); *e* from Londoño & Kvist 190 (AAU); *f* from Churchill et al. 4735 (US).

species. The trichomes of both species also consist of unusually large, flattened, yellow green cells (Figure 20b). Similar trichomes, although with smaller cells, cover the two other urceolate-flowered species, *P. hypocyrtiflora* and *P. bella* (Figure 13), and the funnellform-flowered *P. fuscicalyx* (Figure 15), *P. glabrata* (Figure 16), and *P. rhodotricha*.

The affinity also is strengthened by the fact that two other species have intermediate corollas. *Pearcea bella* (Figure 13) has urceolate corollas, but they are not as inflated as in the two original *Pearcea* species, *P. hypocyrtiflora* and *P. schimpffii* (Figure 20), and they are not strikingly different from the ventricose corollas of *P. abunda* (see photo in Kvist, 1991:22). In addition, the same range of corolla variation can be found in the distantly related New World Gesneriaceae genera *Gasteranthus* Bentham, *Drymonia* Martius, and *Alloplectus* Martius (Kvist, 1991). As a result, the merger of *Parakohleria* with *Pearcea* does not result in an unusually variable genus.

Pearcea apparently differs from *Kohleria* by having 11 rather than 13 haploid chromosomes. Wiehler (1978) wrote that the haploid numbers of *Kohleria* and *Parakohleria* both are 13 whereas $n = 11$ in *Moussonia*, but no documentation for counts on *Parakohleria* was provided. During the past few years, Royce Oliver, cytologist in the Department of Botany, Smithsonian Institution, repeatedly tried to count the chromosomes of *P. abunda*. It proved exceedingly difficult because the chromosomes are small. Twice he succeeded and found 11 chromosome pairs. This is interesting because this number can set *Pearcea* apart from *Kohleria* and *Diastema* (Table 1), and it is unexpected because all other South American genera of the Gloxinieae that have been examined have a haploid number of 13 (except for a few tetraploids with 26). Smaller numbers (10–12) have been reported only from Central American/Mexican genera (Skog, 1984). Additional counts from *Pearcea* are needed to substantiate or refute the base number of 11 for the genus.

Distinguishing Characters

In Table 1 some features of *Pearcea* are compared with those of nine other genera in the Gloxinieae in order to discuss their differences and affinities. Gloxinieae currently includes 23 genera (excluding *Parakohleria*) and approximately 200 species.

The following suite of characters distinguishes *Pearcea* from related and similar genera. The plants are terrestrial herbs, usually with a conspicuous indumentum, occasionally with stolons but usually without scaly rhizomes. The flowering shoots have frondose subtending leaves supporting congested cymes that are usually pedunculate, but some are epedunculate and some have only one or two flowers (Figure 2a,d-f). The corollas are bent downward at the base, usually red (sometimes orange or yellow but never white), and 0.9–2.7 cm long. The nectariferous disc consists of five (or rarely four) free glands. The stigma is capitate, stomatomorphic, or only weakly

bilobed, and the fruit is a fleshy capsule, up to 8 mm long, dehiscent apically with two reflexing valves disclosing the seed mass.

The urceolate-flowered *Pearcea* species cannot be confused with species of the other genera in the Gloxinieae, although the funnellform-flowered species occasionally may be confused with *Kohleria* and *Diastema* (Table 1). In the absence of fruits, the conspicuously bilobed stigma sets species of *Kohleria* apart, and most species of *Kohleria* also have considerably longer tubular corollas. *Diastema* species mostly have white or whitish flowers, which are never found in *Pearcea* (Table 1), and the plants are low-growing herbs.

The inflorescences of *Pearcea* also distinguish the genus from *Diastema*, as well as from some small-flowered *Kohleria* species. The inflorescence morphology of *Kohleria* and related genera was discussed by Kvist and Skog (1992) (Figure 2). *Diastema* has flowering shoots with single flowers (probably much reduced cymes) supported by subtending leaves reduced to bracts (Figure 2c), whereas the subtending leaves that support the cymes of *Pearcea* are never reduced to bracts (Figure 2a). Two small-flowered *Kohleria* species (*K. spicata* (Kunth) Oersted and *K. stuebeliana* Fritsch) that are sympatric with *Pearcea* in Ecuador and possibly in Colombia have flowering shoots in which the subtending leaves gradually reduce to bracts toward the apex (Figure 2b, frondose-bracteose following Troll, 1964). A similar inflorescence with small red flowers is found in *Gloxinia sylvatica* (Kunth) Wiehler, which is sympatric with *Pearcea* species in Peru and Bolivia.

The cymes of *Pearcea* are similar to those described by Weber (e.g., 1973) as "pair flowered cymes," in which regular flowers are accompanied by an additional bractless flower in frontal-median position, and are similar to those found in many *Kohleria* species (Kvist and Skog, 1992) (Figure 2d-f). The cymes of *Kohleria*, however, never develop more than 10 flowers (Figure 2f, seven regular flowers and three bractless flowers), whereas no fixed maximum seems to exist for *Pearcea*. The highest numbers that have been counted are around 20 in *P. reticulata* (Figure 19). Only two species, *P. bella* (Figure 13) and *P. fuscicalyx* (Figure 15), apparently always have epedunculate inflorescences, and only the first consistently has solitary flowers in the leaf axils.

Ecology

Many terrestrial New World Gesneriaceae grow in fairly bright and open places, such as tree-fall gaps or along trails and in other disturbed places. Most disappear when the forest is cut completely, but some, e.g., many species of *Kohleria* (Kvist and Skog, 1992), *Heppiella* Regel (Kvist, 1990), and *Gloxinia* L'Héritier (pers. obs.), appear to thrive in deforested, degraded areas. Species of *Pearcea* are forest plants that can grow in fairly well-lit places, but many also are found in deep shade, e.g., in ravines along small streams. They share these dim, humid, moss-covered slopes with other genera of Gesneriaceae,

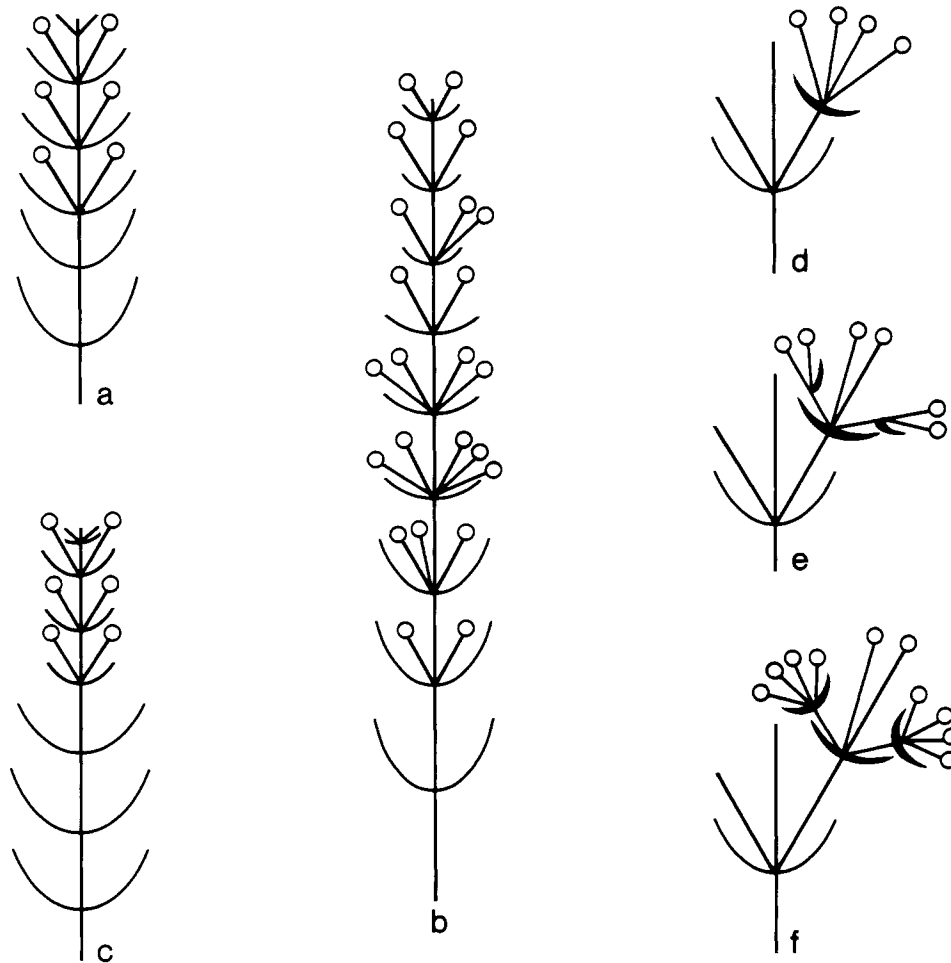


FIGURE 2.—Inflorescences of *Pearcea*, *Kohleria*, and *Diastema*: a, flowering shoot with single flowers supported by frondose subtending leaves; b, flowering shoot with single flowers supported by frondose-bracteose subtending leaves gradually reduced to bracts (some species of *Kohleria*); c, flowering shoot with single flowers supported by bracteose subtending leaves reduced to bracts (*Diastema*); d, cyme with 3 regular flowers and 1 front-flower; e, cyme with 5 regular flowers and 1 front-flower; f, cyme with 7 regular flowers and 3 front-flowers. (a,d-f found in both *Pearcea* and *Kohleria*.)

such as *Gasteranthus*, *Napeanthus* Gardner, *Diastema*, *Monopyle* Moritz ex Benthams, and even a few species of *Kohleria* (Kvist and Skog, 1992), but with few other flowering plants (Kvist, 1991). There are occasional reports on herbarium labels that specimens of *Pearcea* were epiphytic. None of the species, however, seem to be true epiphytes, but they may grow in moss cushions covering tree trunks in montane forests.

Nearly all exposed-habitat New World Gesneriaceae belong to the same tribe as *Pearcea*, the Gloxinieae. Plants of the genera in the Gloxinieae mostly possess scaly rhizomes (Kvist and Skog, 1992, fig. 9) or less commonly tubers (*Sinningia* spp.), enabling them to survive seasonal dry periods to resprout from the rhizomes or tubers when conditions improve. Considering that species of *Pearcea* usually grow in permanently humid places, it is no surprise that scaly rhizomes are

absent. We have never seen them on plants in their native habitats, but occasionally *Pearcea abunda* and *P. rhodotricha* develop small scaly rhizomes in cultivation. Many or all species develop stolons in their natural habitats and thereby often grow in small clonal groups.

The most weedy of the *Pearcea* species seems to be *P. reticulata*, which grows to 1.5 m tall and is common in the Río Pastaza valley of Ecuador. There the species generally grows in disturbed, secondary shrub forests but not in areas that are completely exposed. Some smaller plants also may grow in shade. *Pearcea reticulata* lacks scaly rhizomes, but on many of its underground stems we found red, round "bulbs" up to 2 cm in diameter. Dissection indicated these to be galls.

Pearcea species, like many other New World Gesneriaceae, are probably hummingbird pollinated, because the conspicuous

TABLE 1.—Comparison between *Pearcea* and nine other genera in the Gloxinieae. The frequency of characters is indicated as follows: +++++ = Always; ++++ = Mostly; ++ = Frequently; + = Occasionally; (+) = Rarely; ? = Possibly or unknown; - = Never.

Character	<i>Pearcea</i>	<i>Achimenes</i>	<i>Capanea</i>	<i>Diastema</i>	<i>Gloxinia</i>	<i>Heppiella</i>	<i>Koellikeria</i>	<i>Kohleria</i>	<i>Monopyle</i>	<i>Moussonia</i>
Life-form										
Terrestrial	++++	++++	+	++++	++++	+++	++++	++++	++++	++++
Epiphytic	?	-	+++	-	-	+	-	-	-	-
Climbing	-	-	+++	-	-	++	-	-	-	?
Habitat										
Understory	+++	+	(+)	+++	++	-	?	++	+++	?
Exposed	+	+++	+++	(+)	++	++++	+++	+++	(+)	+++
Scaly rhizomes										
Absent	++++	-	++++	?	?	++	?	++	?	++++
Present	-	++++	-	++++	++++	+++	++++	+++	++++	-
Flowering shoots										
Frondose	++++	++++	++++	-	+++	++++	-	+++	-	++++
Bracteose	-	-	-	++++	+	-	++++	+	++++	-
Flowers in cymes										
Maximum > 2	+++	-	++++	-	-	+++	-	+++	+++	++++
Maximum 1-2	+	++++	-	++++	++++	+	++++	+	++	?
Corolla color										
Red	+++	?	(+)	(+)	++	++++	-	++++	-	++++
White	-	?	-	+++	++	-	++++	-	++	-
Different	(+)	+++	+++	-	+++	-	-	-	+++	-
Filaments/anthers										
Coiling/coherent	++++	++++	++++	++++	++++	-	++++	++++	++++	++++
Not coiling/free	-	-	-	-	-	++++	-	-	-	-
Anthers/stigma										
Included	++++	++++	-	++++	++++	++	++++	++++	++++	++++
Excluded	(+)	-	++++	-	-	+++	-	-	-	-
Nectary										
4-5 free glands	++++	-	++++	++++	-	-	-	+++	-	-
Annular	-	++++	-	-	+++	++++	++++	+	-	++++
Absent	-	-	-	-	++	-	-	-	++++	-
Stigma										
Capitate	+++	++	++++	-	++++	++++	++++	-	++++	++++
Weakly bilobed	+	+++	-	++++	-	-	-	-	-	-
Bilobed	-	+	-	-	-	-	-	++++	-	-
Capsule										
Fleshy, 2-valved	++++	-	-	-	-	-	-	-	-	-
Fleshy-dry, 1 slit	-	-	-	++++	+	-	-	++	++++	-
Dry, 2-valved	-	++++	-	-	+++	+++	++++	+++	-	++++
Dry, 4-valved	-	-	++++	-	-	++	-	-	-	-
Seeds										
Globose	+++	-	-	++++	+	-	-	++	++++	?
Ellipsoid	+	++++	++++	-	+++	++++	++++	+++	-	+++
Chromosome number										
<i>n</i> = 11	++++	++++	-	-	-	-	-	-	-	++++
<i>n</i> = 13	?	-	++++	++++	++++	++++	++++	++++	++++	-
Number of species	17	22	2	~5	~12	4	1	17	~5	~10

and usually red flowers conform to the hummingbird pollination-syndrome (e.g., see Howe and Westley, 1988:110-114). Unfortunately, no reports of successful observations of pollination have been found. Populations of *Pearcea sprucei*

were observed in southern Ecuador, but although hummingbirds visited neighboring plants of other Gesneriaceae, such as species of *Besleria* Linnaeus and *Drymonia*, they were never seen to visit *Pearcea*.

The flowers are protandrous and, after pollen is shed, the filaments coil and drag the decaying stamens back into the flower while the style elongates (see photo of *Pearcea reticulata* in Kvist, 1991:16). The same phenomenon occurs in flowers of *Kohleria* but not in *Heppiella* (Table 1). Another similarity with *Kohleria*, and difference from *Heppiella*, is the presence of tiny glandular trichomes on the limb, usually in the throat (particularly where the anthers are located while they shed the pollen), and often on the filaments and style. The function of the glandular trichomes is unknown, but according to Steiner (1985), similar trichomes in *Drymonia serrulata* (Jacquin) Martius exude substances that help the pollen to adhere to bees visiting the flowers. The trichomes in the corollas of *Pearcea*, however, probably serve a different but as yet unknown function.

Apart from the species with urceolate (3), ventricose (2), and bilabiate (1) corollas, the species of *Pearcea* have fairly similar flowers; the color patterns and indumentum may vary, but the sizes and shapes are not that different. The corollas are probably not adapted to different specialized pollinators; if the primary pollinators are hummingbirds, the same birds can be expected to visit flowers of various *Pearcea* species because they are attracted by colors and shapes rather than by scents.

Until recently it was believed that *Pearcea* had capsules with wind-dispersed seeds as are found in exposed-habitat species of *Kohleria*, *Heppiella*, *Gloxinia*, *Sinningia*, and others. These capsules dehisce only from the apex into two valves (Figure 1c) and persist in this stage during few to several weeks or months while they dry out and the seeds are blown away. But as wind dispersal of seeds does not work well in the calm forest understory, we suspect there may be some other dispersal mechanism operating in *Pearcea*. In fact, field studies showed that *Pearcea* fruits instead split from the apex all the way to the base, with two fleshy valves reflexing to expose a glutinous seed mass (Figure 1a), which is quite different from the exposed-habitat species of the Gloxinieae. No seed dispersers were observed during daylight hours, but the glutinous seed masses disappeared overnight (perhaps eaten by nocturnal invertebrates). Within a day the degrading capsules hang slack below the inflorescences (*P. abunda*, *P. sprucei*, and *P. reticulata*, see photo of the latter in Kvist, 1991:19). Considering that the length of the ovoid capsules rarely exceeds 7 mm, it is no surprise that this dehiscence was neither detected from herbarium sheets nor reported earlier in the literature. Even the similarly opening but longer (to several cm) fleshy capsules of the distantly related genera *Alloplectus* and *Drymonia* were long overlooked.

Seeds of *Pearcea* (Figure 3a-c; see Beaufort-Murphy, 1983, pl. 51b,c) are subglobose or irregular. The understory species of *Kohleria* with unilaterally splitting capsules have similar seeds, whereas the exposed-habitat wind-dispersed *Kohleria* species have narrowly ellipsoid seeds with longitudinal, transverse, rather regular striations (Figure 3d; see Kvist and Skog, 1992,

figs. 5, 6). There seems to be a general correlation in the Gloxinieae between irregularly subglobose seeds and understory habitats (e.g., in plants of *Diastema* and *Monopyle*) and between regularly ellipsoid seeds, exposed habitats, and wind dispersal (Table 1; Kvist, 1991; Kvist and Skog, 1992).

From a field trip in 1987, we brought material of at least seven *Pearcea* species into cultivation. They were not difficult to keep alive; small cuttings planted in wet sphagnum moss maintained in plastic bags survived but often hardly grew for months or years, and in their native habitats plants probably also survive until conditions improve. *Pearcea abunda*, *P. bella*, and *P. sprucei* eventually flowered in cultivation but none developed fruits, and this may indicate that they, like *Kohleria*, require cross-pollination. *Pearcea* will probably continue in cultivation as a specialty for growers with a particular interest in unusual Gesneriaceae. Plants of *Pearcea* are attractive pot-plants, but sunny windows are too different from dark rainforest ravines; the plants will not thrive unless they are protected from strong light and dry air. The most hardy of the species in cultivation seem to be *P. abunda* and *P. rhodotricha*.

Pearcea also seems to have been ignored in its native range. No vernacular names have been recorded, whereas *Kohleria* is well known to the rural population (Kvist, 1987), and only one folk use of *Pearcea* has been recorded. The Cofán Amerindians in the Amazon basin of Ecuador use *Pearcea abunda* for medicinal purposes (see that species).

Geographical and Altitudinal Distribution

The range of the entire genus (Figures 4, 5) is nearly identical to the range of the commonest species, *Pearcea sprucei*, which is found on the eastern Andean slopes and adjacent lowlands from the Colombian department of Caquetá in the north through Ecuador and Peru to the department of Cochabamba in northwestern Bolivia (Figure 6). *Pearcea sprucei* also is the only representative of the genus on the western slopes in Ecuador and very locally in the upper Río Magdalena watershed in the Colombian department of Huila. All other *Pearcea* species are much more local in distribution: *P. abunda* (Figure 11) is distributed from southern Colombia to northern Peru, *P. hispidissima* (Figure 9) and *P. reticulata* (Figure 10) occur in Colombia and Ecuador, and 13 species are endemic to a single country (Figures 7-12).

The numbers of species known from Ecuador, Peru, Colombia, and Bolivia are twelve, six, five, and one, respectively. Figure 5 shows how many species are known from departments or provinces of these countries. The largest number of species is found in the northern and central Ecuadorian Amazon region, particularly the Upano-Zamora valley (with 8 species). In addition, there seems to be a second speciose center in the Río Huallaga valley of central Peru (with

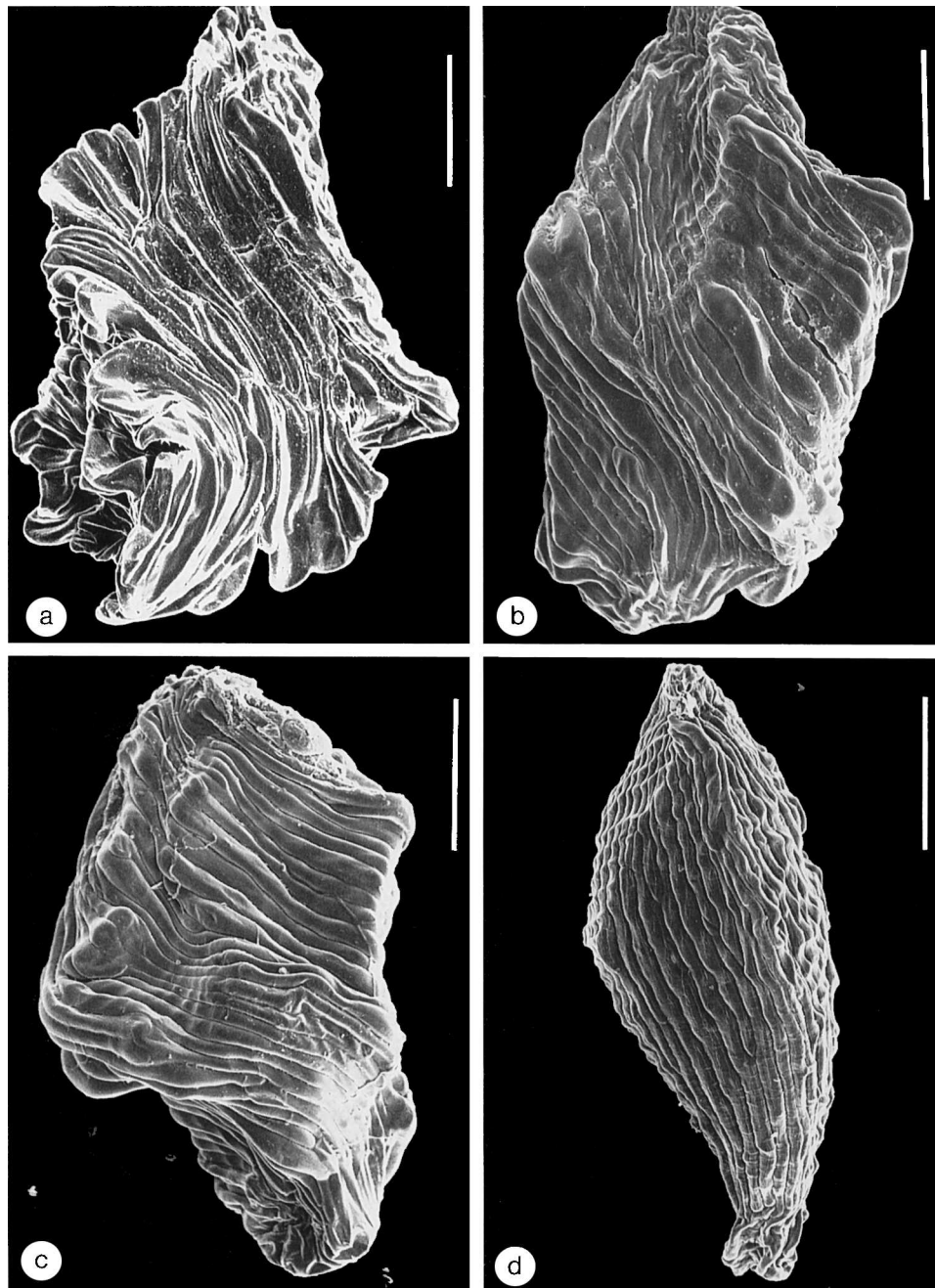


FIGURE 3.—Seeds of *Pearcea* and *Kohleria* (scale length = 100 μm): a, *Pearcea hispidissima*; b, *Pearcea fuscicalyx*; c, *Pearcea rhodotricha*; d, *Kohleria allenii*. Micrograph a of Lugo 3931 (GB); b of Schunke 10366 (MO); c of Lugo 5402 (US); d of Liesner 2106 (US).

6 species). *Pearcea* is apparently rare between these areas, but this may reflect lower collecting activity in southern Ecuador and northern Peru. Most Peruvian collections have come from fairly few areas, e.g., close to Tingo María in the department of Huánuco, particularly from along the road east to Pucallpa.

Extensive areas on the eastern Andean slopes in Peru have not been botanically explored, and current collecting activity is low due to political problems. It is therefore likely that additional species occur in Peru. At the present time, however, the morphological variation of *Pearcea* seems largest in Ecuador,

for example, the broadest range in corolla shapes occurs there.

We define the altitudinal vegetation zones as lowland rainforest (below 700 m), lower montane forest (700–1500 m),

montane forest (1500–2500 m), and cloud forest (above 2500 m). These zones proved to be helpful in describing the altitudinal distribution of *Columnnea* Linnaeus (Kvist and Skog,

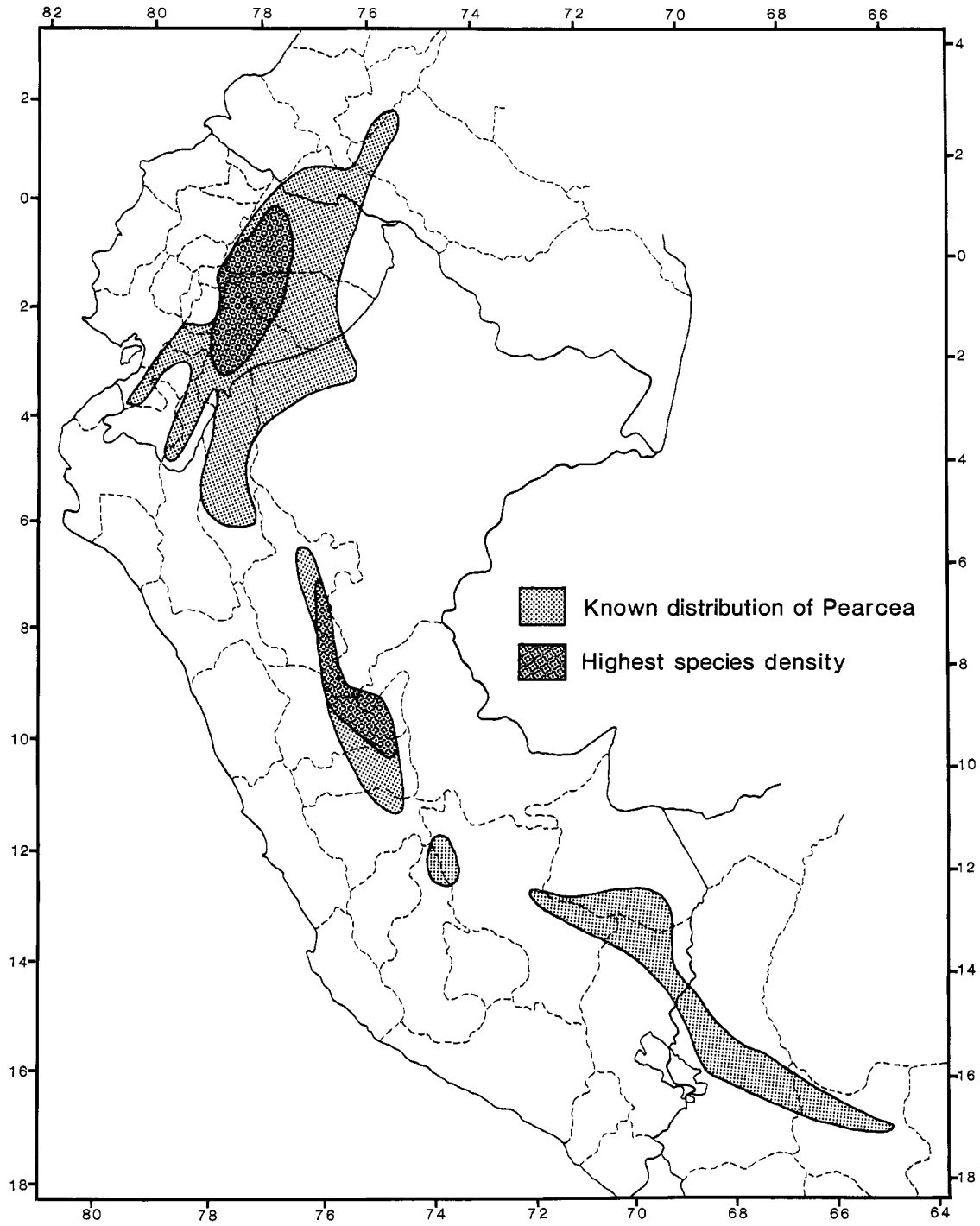


FIGURE 4.—Distribution of *Pearcea* in Colombia, Ecuador, Peru, and Bolivia, and areas where species are most common.

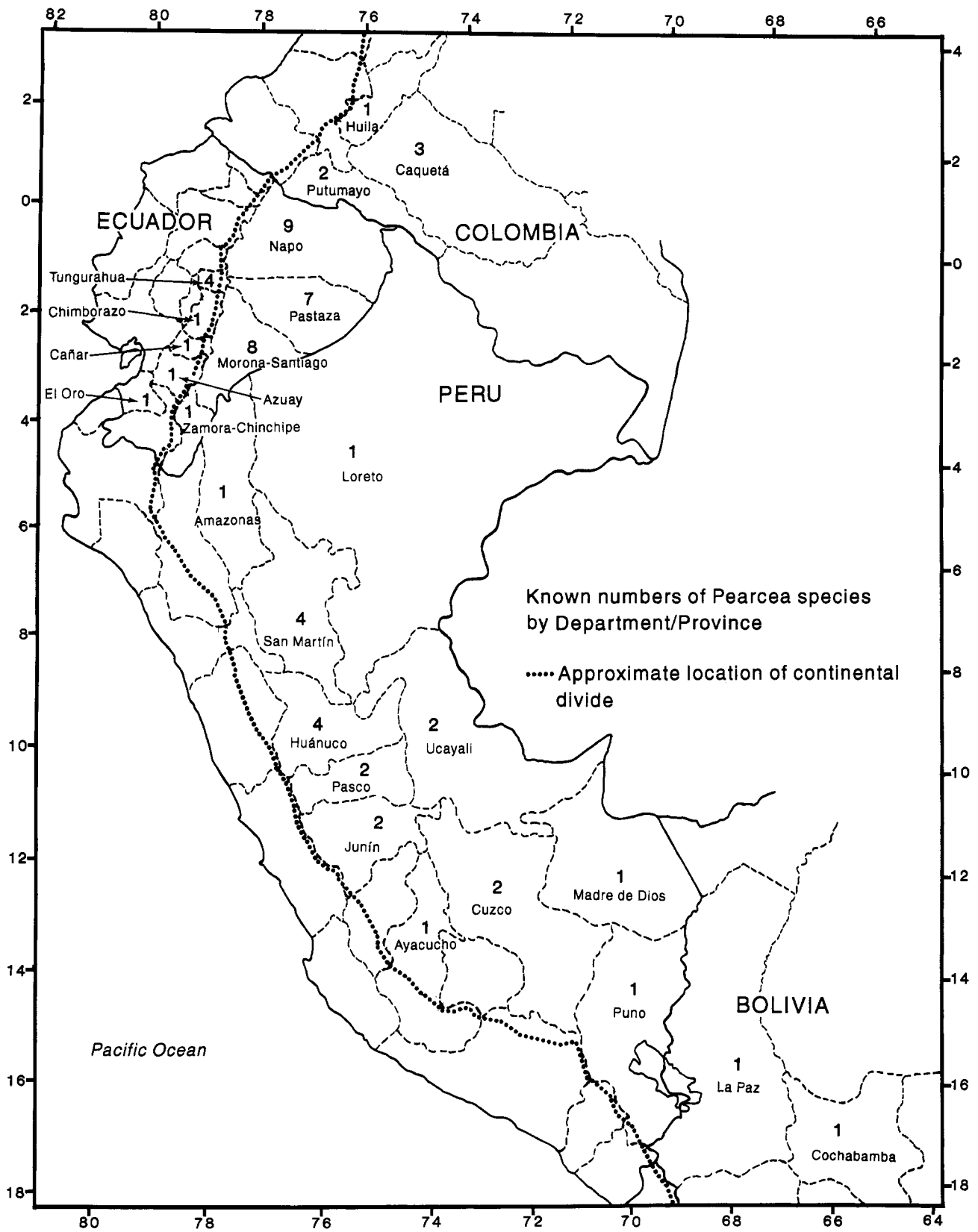


FIGURE 5.—Departments/provinces in Colombia, Ecuador, Peru, and Bolivia in which species of *Pearcea* have been collected, and number of species occurring in each department/province.

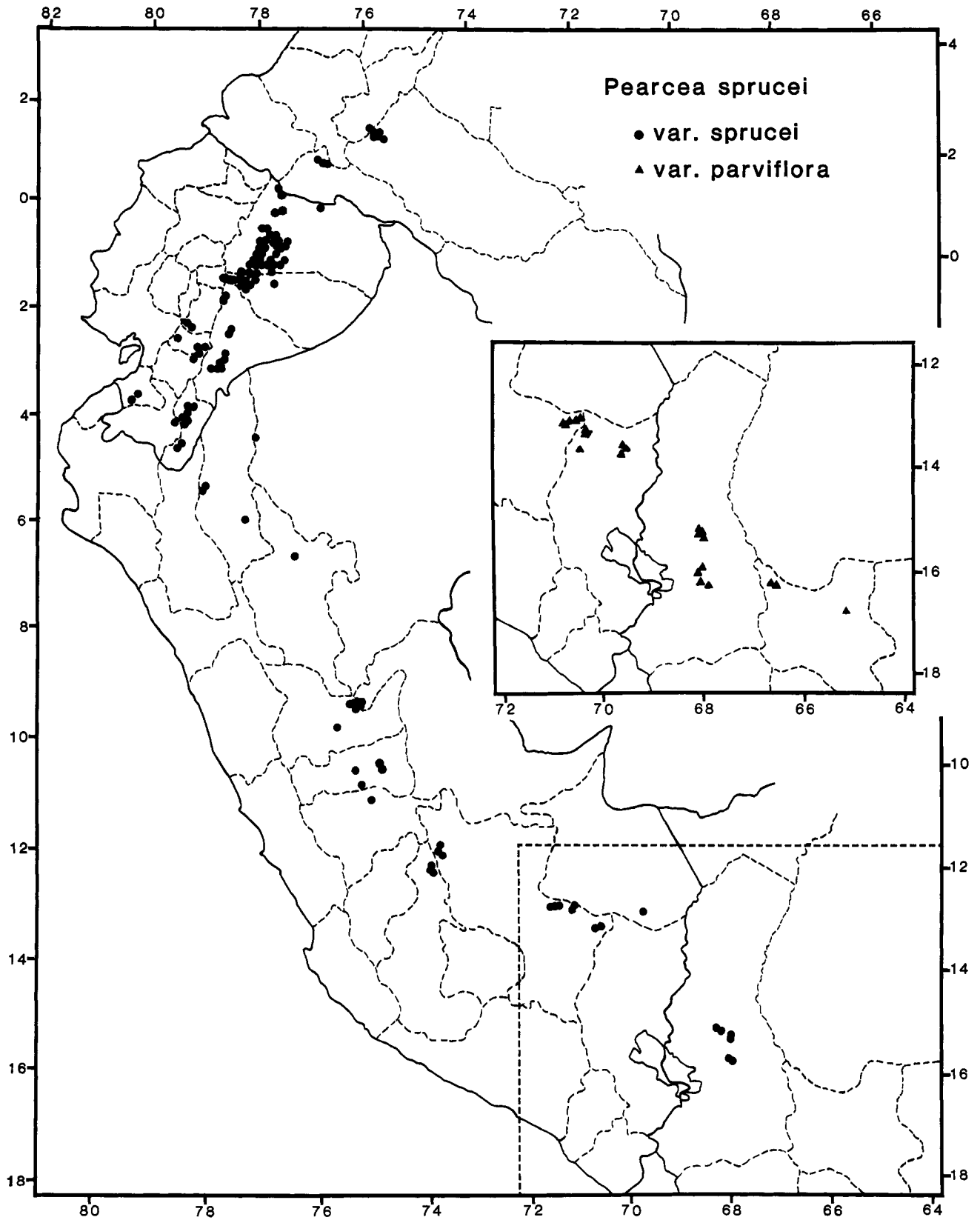


FIGURE 6.—Distribution of *Pearcea sprucei* var. *sprucei* and var. *parviflora* (inset) in Colombia, Ecuador, Peru, and Bolivia.

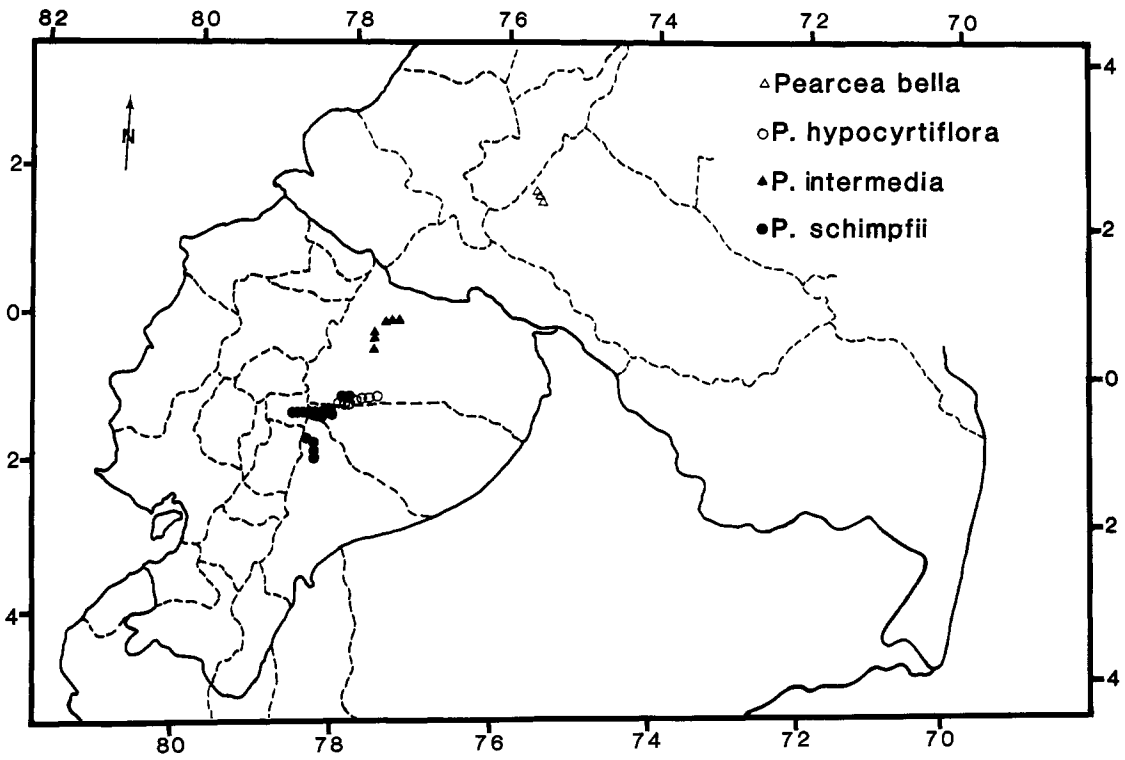


FIGURE 7.—Distribution of *Pearcea bella*, *P. hypocyrtiflora*, *P. intermedia*, and *P. schimpfii* in Colombia and Ecuador.

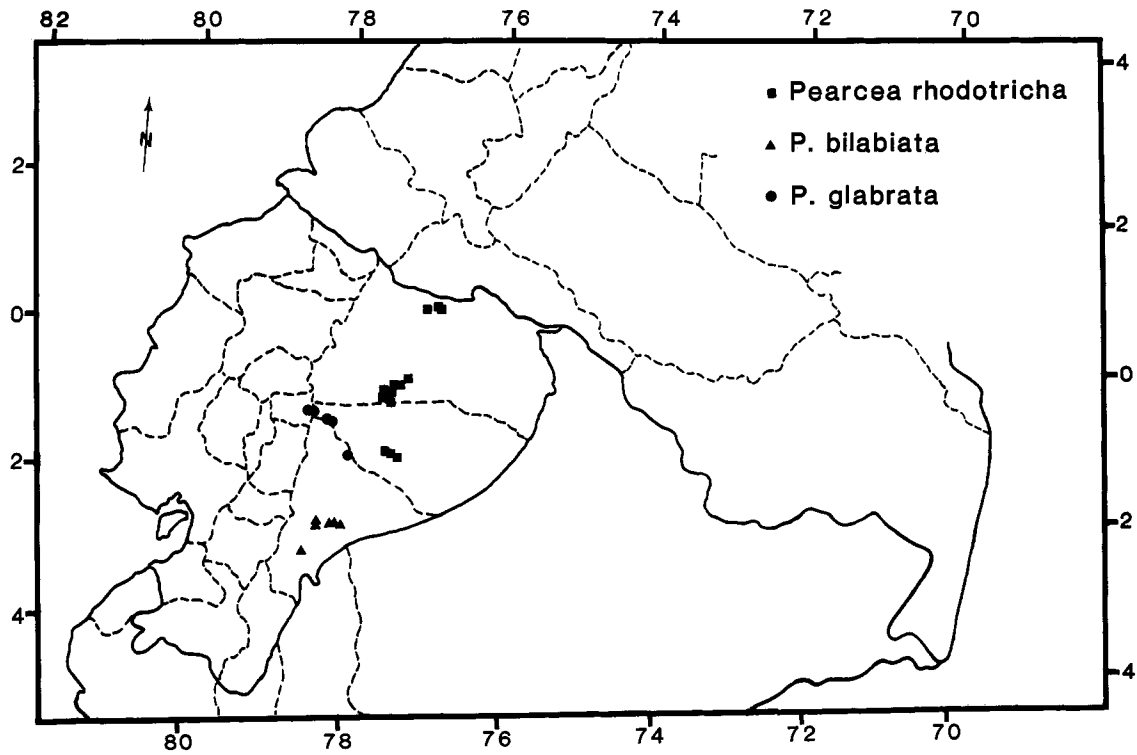


FIGURE 8.—Distribution of *Pearcea bilabiata*, *P. glabrata*, and *P. rhodotricha* in Ecuador.

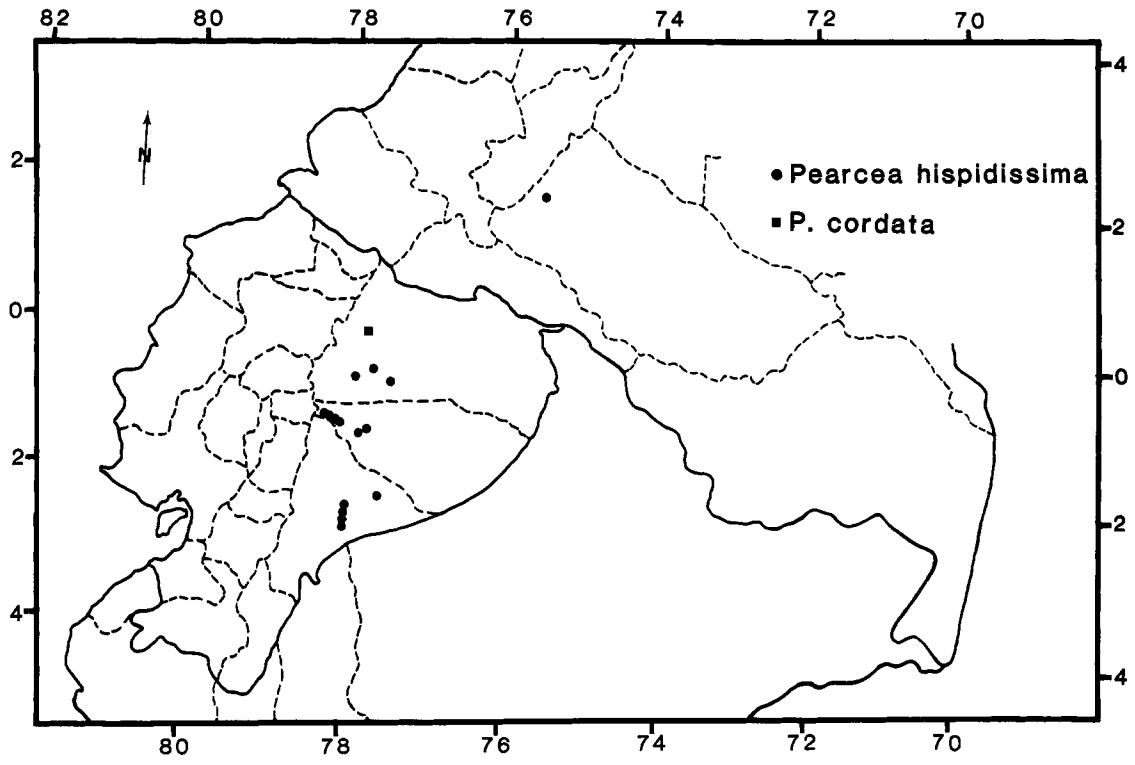


FIGURE 9.—Distribution of *Pearcea cordata* and *P. hispiddissima* in Colombia and Ecuador.

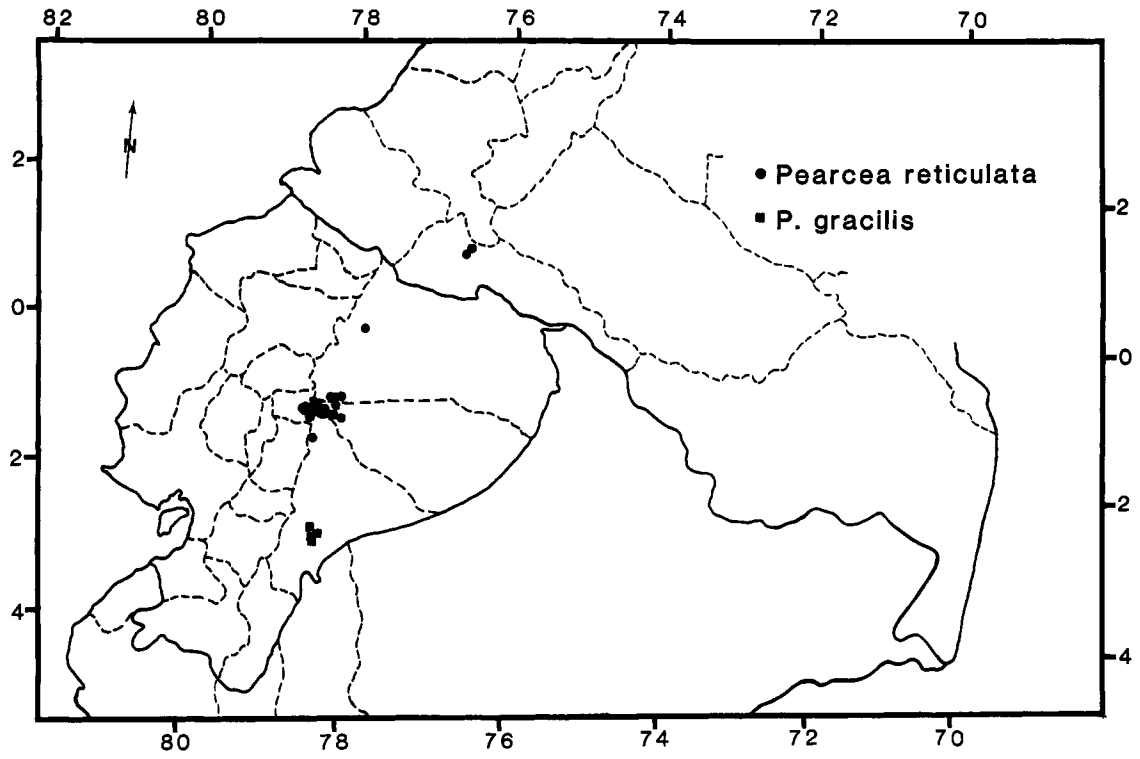


FIGURE 10.—Distribution of *Pearcea gracilis* and *P. reticulata* in Colombia and Ecuador.

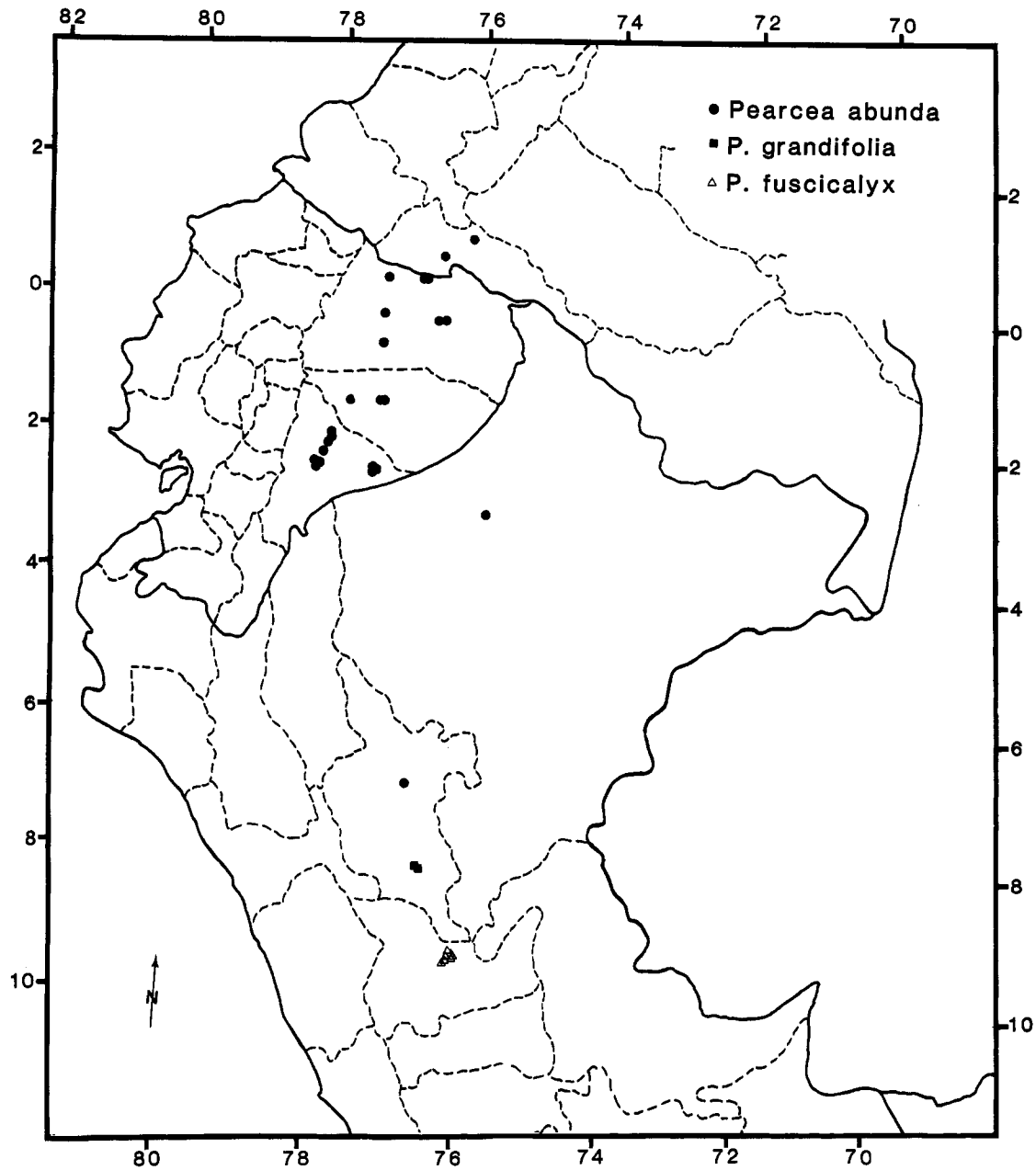


FIGURE 11.—Distribution of *Pearcea abunda*, *P. fuscicalyx*, and *P. grandifolia* in Colombia, Ecuador, and Peru.

1993) and also are useful for *Pearcea*. The lower montane forest is the zone richest in Gesneriaceae in the Andes, and *Pearcea* also is concentrated here, in numbers of both species and specimens.

Twelve species of *Pearcea* are found mainly or only in lower montane forest, two (*Pearcea hypocyrtiflora* and *P. rhodotricha*) are known only from lowland rainforest, and three (*P. cordata*, *P. gracilis*, and *P. intermedia*) are known from

montane forest. Cloud forest is penetrated only by the common *P. sprucei*, which ranges from 300 m to 2800 m elevation, but it is rare (or rarely collected) above 2000 m; most *P. sprucei* collections come from lower montane forest. In the lowland rainforest, *P. sprucei* is restricted to the most humid areas up to the base of the mountains (Figure 6). *Pearcea abunda* has been collected much more distantly from the Andes in the Peruvian department of Loreto (Figure 11).

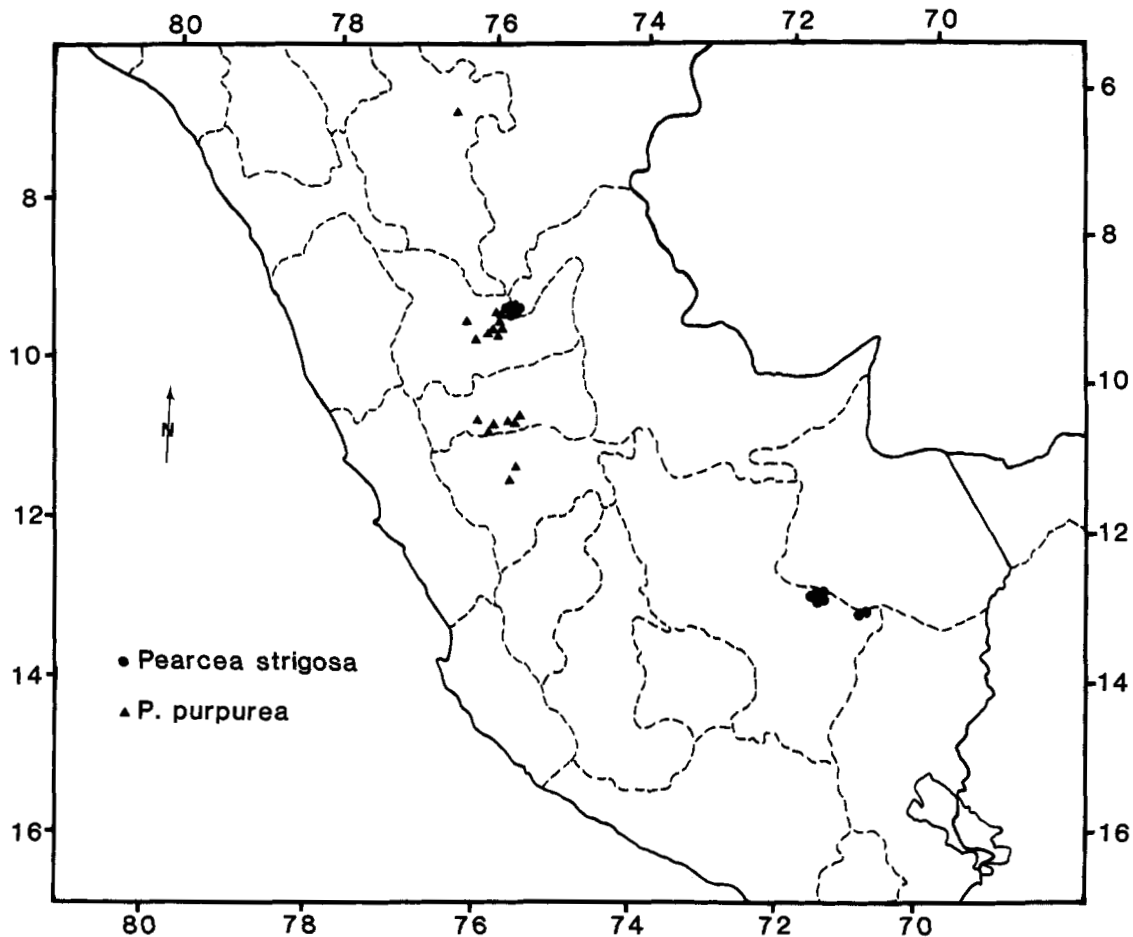


FIGURE 12.—Distribution of *Pearcea purpurea* and *P. strigosa* in Peru.

Variation

Pearcea (including *Parakohleria*) is probably the least known and understood genus among the 23 genera now referred to the Gloxinieae (Wiehler, 1983), partly because its members occur in relatively inaccessible areas and habitats, and partly because species delimitation in the group is very problematic. In analyzing the intraspecific variation in *Pearcea*, it became clear to us that the species of *Pearcea* are polymorphic, may hybridize, and rapidly diverge morphologically in isolation. This causes taxonomic problems because one can either merge the more common and widespread entities or segregate numerous narrowly distributed endemics based on very few specimens. We have chosen to preserve some entities as separate taxa despite some intermediate specimens, and we accepted rare species only if they were represented by a sufficient number of specimens with stable characters. *Pearcea cordata* and *P. grandifolia* are known from only one and two specimens, respectively, but both are clearly set apart by

features otherwise unknown in the genus and are not likely to be hybrids or extreme variations.

It should be noted that we rarely find any apparent first-generation hybrids. In spite of that, hybridization seems evolutionarily important because the morphological variation of several species is best explained by backcrossing and introgression with other species. As in *Kohleria* (Kvist and Skog, 1992), hybridization seems to weaken the species limits, although none of the 17 accepted *Pearcea* species seems to have evolved by interspecific hybridization. It should also be noted that the term "population" is used below, although we mostly discuss morphological characters of herbarium specimens. Thus, herbarium collections of individual species from particular regions and altitudes represent the populations. The same applies to sympatric species.

Examples of variation patterns that may reflect the polymorphic variation, introgression, and local speciation are briefly described below, but variation within individual species is described in more detail in the section on taxonomy.

POLYMORPHIC VARIATION.—Within populations of a species, individuals may differ strongly in certain features but be consistent in most others, as can be seen in the following examples:

Pearcea purpurea. In the center of the range of the species in the Peruvian department of Huánuco, most specimens have ovate-lanceolate leaves, but a few (e.g., *Poeppig 1632*, *Matthews 150*) have longer, narrowly lanceolate leaves.

Pearcea rhodotricha. Typical specimens from the province of Napo, Ecuador, have ovate leaves and red corollas with a black apex, but two collections (*Lugo S. 3503, 3562*) have lanceolate leaves and entirely red flowers.

Pearcea sprucei. In Ecuador the majority of the specimens have rugose leaves, whereas this feature is otherwise uncommon except in the departments of Huánuco and nearby Ucayali (Figure 21c) in central Peru. Purplish leaves also are common in Ecuadorian populations and in some parts of Peru (Figure 21d), but reflexed calyx lobes are found only in Ecuador, where nearly one-half of the specimens exhibit this character. Reflexed calyx lobes also occur in the variety *parviflora* from Bolivia and southern Peru. Nearly glabrous upper leaf surfaces in this species are known only from the Peruvian department of Pasco (e.g., *Gentry & Smith 35851*), whereas a villous, rather than sericeous, leaf indumentum is found in Ecuador (and in the variety *parviflora*).

INTROGRESSION.—Plants from the region(s) where a particular species seems to be common are, for the most part, fairly stable and distinct, whereas plants from the periphery of a species' range may show features of abundant sympatric species. Three examples follow:

Pearcea reticulata. From the north in the Río Pastaza valley (provinces of Tungurahua and Pastaza) of Ecuador, where the species is common, through the province of Napo and to the department of Putumayo in adjacent Colombia, the average size of the flowers is reduced and is more similar to the smaller flowers of the sympatric *P. sprucei*. To the south, one of the two collections from the province of Morona-Santiago (*Steyermark 53639*) resembles *P. sprucei* even more closely in having smaller flowers and shorter peduncles.

Pearcea purpurea. This species is fairly common in the department of Huánuco, Peru, the apparent geographic center of the species' range. Here it is distinguished by having long peduncles, ovate and mostly reflexed calyx lobes, and a villous, purple indumentum. To the south in the departments of Pasco (a few collections) and Junín (two collections) and to the north in San Martín (one collection), the calyx lobes are erect and usually lanceolate, similar to those of *P. sprucei*, and the peduncle length is reduced from an approximate average of 8 cm to 3 cm, but it still exceeds the pedicel in length. This in combination with the villous indumentum typical for *P. purpurea* sets these plants apart from sympatric *P. sprucei* populations.

Pearcea strigosa. Typical collections come from the Peruvian departments of Huánuco and adjacent Ucayali.

Collections from Cuzco also have the strigose indumentum and subulate calyx lobes usual for the species, but they lack the sericeous corolla trichomes extending beyond the limb and have lanceolate leaves, similar to *P. sprucei*, rather than narrowly lanceolate leaves as are usually found in *P. strigosa*.

SPECIATION.—Peripheral and isolated populations sometimes evolve distinct characteristics, diverging both from plants from the area(s) where the species is more common and from sympatric species. Examples can be found in *Pearcea abunda* and *P. sprucei*.

Pearcea abunda. The southernmost collection of this species, from the department of San Martín in Peru (*Klug 4216*), differs by having considerably larger flowers (1.9 cm long rather than maximally 1.5 cm long) and a sparser indumentum than is typical for the species. It might even represent a separate species.

Pearcea sprucei. The northernmost populations of this species, in the department of Caquetá, Colombia, differ by having peduncles usually several times longer than the pedicels and by having smaller flowers than more southern plants do, but the transition to populations in northern Ecuador is gradual (Figure 21a). A similar transition is seen in the southern part of the species' range, from long-pedunculate populations in Puno, Peru, and Bolivia, to short peduncles in northern Cuzco, Peru (Figure 21a). In addition, the former plants also have unusually large and long leaves with a sparse indumentum. Between the ranges of the two long-pedunculate *P. sprucei* populations in Colombia, Bolivia, and nearby Peru, there occur three other species with peduncles longer than 5 cm: *P. reticulata* in Ecuador, *P. grandifolia* in northern Peru, and *P. purpurea* in central Peru. Consequently, throughout nearly the entire range of *Pearcea* from southern Colombia to Bolivia, there are no sympatric long-pedunculate species. These species are probably close relatives (apart from the rare *P. grandifolia*), and the greatest taxonomic problem has been this complex.

A further complication in Bolivia and southern Peru is that in addition to the long-pedunculate *Pearcea sprucei* plants, there sympatrically grow plants with short peduncles, to only 2 cm long (Figure 21a), that also differ from the long-pedunculate specimens by having ovate leaves (Figure 21b), a villous indumentum (Figure 21g), and mostly reflexed calyx lobes (Figure 21e). These plants are placed in the variety *parviflora* of *P. sprucei* because var. *sprucei* and var. *parviflora* appear to be distinct in Bolivia and southern Peru (Figure 21a,b,d,e,g), the characters that separate the varieties appear to coalesce in more northern collections from the department of Cuzco in Peru, and some *P. sprucei* var. *sprucei* collections from high elevations in southern Ecuador are similar to var. *parviflora* (see further discussion under *P. sprucei*, below).

Evolution

Pearcea belongs to the tribe Gloxinieae, which consists of ~18 genera that are found mostly in open habitats and that have

bivalved capsules (Figure 1c) and wind-dispersed seeds, as well as some five genera found in the calm, humid forest understory that have evolved fleshy capsules adapted to animal dispersal. These latter genera are *Pearcea* (Figure 1a), fruits of which split into two fleshy valves from the apex to the base, *Diastema* (Figure 1b), which also has fruits splitting with two apical slits, only one of which continues to the base, *Kohleria*, in which six of 17 species (Figure 1d,e) split with one slit from capsule apex to base, and *Monopyle* (Figure 1f) and *Solenophora* Benthham, which split from the middle of the capsule rather than from the apex. In *Monopyle*, but apparently not in *Solenophora*, the slit continues to the apex. Most genera of the Gloxinieae are thus adapted to exposed habitats predominantly in areas with a seasonal climate. In such areas occur members of the tribe that, according to Kvist and Skog (1992), may be more primitive, such as *Achimenes* Persoon, *Eucodonia* Hanstein, and most species of *Gloxinia*. Later, a few groups, including *Pearcea*, apparently adapted independently to the forest understory, each switching to animal dispersal but developing different types of capsules. *Pearcea* and the other understory genera therefore seem to be advanced in the Gloxinieae (Kvist, 1991), although further studies are needed if one is to conclude that all the understory genera are, in fact, advanced.

In the Gloxinieae the delimitation of species seems particularly difficult in the forest understory genera. In *Kohleria* (Kvist and Skog, 1992) the most common understory species, *K. inaequalis*, was as difficult to circumscribe as the most widespread and common species of *Pearcea*, *P. sprucei*, whereas the open-habitat species of *Kohleria* were more easily circumscribed. The species of the understory genera *Diastema* and *Monopyle* also are difficult to delimit. This may indicate that local speciation is particularly rapid in the understory groups, possibly due to the relatively narrow dispersal of animal-dispersed seeds in the understory habitat. In the wind-dispersed species, long-distance dispersal of the tiny seeds may counteract local speciation, e.g., *Kohleria spicata* has probably wind-dispersed to Isla del Coco 500 km southwest of the Costa Rican coast, and this very common species shows little variation throughout its range from Mexico to Peru. The plants on Isla del Coco, however, belong to a salt-influenced ecotype growing on rocks and otherwise found on islands along the Pacific coast of Panama and Costa Rica (Kvist and Skog, 1992).

Hybridization followed by backcrossing and introgression seems to complicate taxonomic and phylogenetic studies in many genera of Gesneriaceae in northwestern South America. Other examples are *Creemosperma* Benthham, *Reldia* Wiehler, *Kohleria*, *Columnea* (Kvist and Skog, 1988, 1989, 1992, 1993), and *Pearcea*. There are good indications, particularly from *Kohleria*, that this reflects extensive introgression or even reticulate evolution.

Pearcea Regel

Pearcea Regel, 1867:388. [Type: *P. hypocyrtiflora* (J.D. Hooker) Regel (*Gloxinia hypocyrtiflora* J.D. Hooker).]
Parakohleria Wiehler, 1978:5. [Type: *P. abunda* Wiehler = *Pearcea abunda* (Wiehler) L.P. Kvist & L.E. Skog.]

Terrestrial herbs, rarely epilithic or appearing epiphytic, stems decumbent to erect, usually terete in live material but becoming bisulcate or subquadrangular when dry, (5-)25-100 (-150) cm long, diameter 1-5(-10) mm basally, branched or unbranched, stolons occasional, scaly rhizomes rare, but adventitious roots often present, basally often glabrescent or pilose to sericeous or villous apically. Leaves opposite, equal, subequal, or rarely unequal in each pair, blades usually lanceolate or ovate-lanceolate, less commonly ovate-elliptic, obovate, or oblanceolate, (3-)5-18(-25) × (1-)2-8(-10) cm, base oblique, cuneate, attenuate, or obtuse, apex acute or acuminate, margin serrulate, less commonly serrate or nearly entire, above green or less commonly purplish, occasionally rugose, often pilose or hirsute, less commonly velutinous, strigose, or glabrous, below lighter green or purple, velutinous, pilose, or sericeous; lateral veins (5-)7-10(-12) per side, often conspicuous and light green to yellow contrasting with darker green or purple areas between veins; petioles (0.2-)1-3(-6) cm long. Inflorescences of congested cymes of 1-12(-20) flowers in upper leaf axils, often purplish, sericeous, villous, or hispid; usually with peduncles to 2 cm long, less commonly epedunculate or with peduncles to 20 cm long; bracts mostly 2, but occasionally with up to 4 additional smaller bracts, each bract sessile, 2-25 mm long, ovate, lanceolate, or subulate; pedicels 0.2-5 cm long. Flowers protandrous; floral tube (combined bases of perianth and androecium) conic, green, yellow green, or purple, usually villous; calyx 3-13 mm long, the 5 lobes basally connate for 1-4 mm, mostly erect, less commonly reflexed, equal, triangular, ovate, lanceolate, or subulate with margin entire, both sides often sericeous or villous. Corolla bent downward at base, narrowly to broadly funnelform, subventricose, or ventricose, less commonly urceolate, rarely bilabiate, 0.9-2.7 cm long, base occasionally saccate, glabrous and yellow, tube red, often yellow basally and ventrally, rarely entirely yellow, outside villous, sericeous, or pilose, occasionally glandular-puberulent, rarely only puberulent, inside lighter red, cream, or yellow, often with darker dots, frequently puberulent and/or glandular-puberulent, throat often constricted, limb subregular, rarely bilateral, of 5 (rarely 4) ovate to rotund lobes, outside red, inside red or yellow, often with darker dots, usually glandular-puberulent at least along margin; stamens 4, didynamous, included, subincluded, or rarely exserted, filaments 5-25 mm long, coiling in later female flowering stage to pull anthers deeper into flower, mostly glabrous, less commonly puberulent, rarely glandular-puberulent, cream or yellowish, anthers cream or yellowish, oblong, 1.2-2 × 1-1.5 mm, coherent at apices and sides, thecae distinct, dehiscing by longitudinal slits; 1 dorsal staminode,

1–4 mm long, usually present; nectariferous disc fleshy, yellow, and glabrous, usually of 5 free glands, each 0.5–1 mm tall and 0.5–1.5 mm wide at base, rarely with 2 glands placed closely together, with 4 glands, and/or with 1–2 of glands bilobed; ovary $1/2$ – $3/4$ inferior, pilose to sericeous, style 7–25 mm long, cream or yellow white, mostly puberulent-pilose, especially basally, and glandular-puberulent, especially apically, stigma included or subincluded, rarely exserted, stomato-

morphic, rarely capitate or weakly bilobed. Fruit a fleshy capsule, globose-ovoid, 4–7(–10) mm long, diameter 3–6(–8) mm, dehiscent apically and loculicidally into 2 valves, both slits apparently always continuing to base, valves reflexing completely and exposing sticky seed mass; seeds very numerous, irregularly subglobose or rarely ellipsoid, 0.2–0.4 mm long, shape and size varying considerably even in a single capsule, surface irregularly striate, tawny, brown, or black.

Key to the Species and Varieties of *Pearcea* Regel

1. Leaves cordate; inflorescences and stems with trichomes to 8 mm long and retrorse; corolla yellow [plants from Ecuador] 4. *P. cordata*, new species
1. Leaves rarely cordate and only in combination with urceolate corollas; inflorescences and stems with trichomes only to 5 mm long and never retrorse; corolla red or orange [plants from throughout range of genus].
 2. Leaves to 27 × 15 cm; peduncles 13–20 cm long, villous-lanate [plants from Peru] 8. *P. grandifolia*, new species
 2. Leaves never exceeding 22 × 10 cm; peduncles rarely exceeding 8 cm, if longer then sericeous.
 3. Corolla obviously bilabiate (upper lobes 7–9 mm) [plants from Ecuador] 3. *P. bilabiata*, new species
 3. Corolla urceolate, ventricose, or funnellform, rarely shortly bilabiate (upper lobes to 3 mm).
 4. Corolla urceolate; peduncles often absent, if present then shorter than pedicels; inflorescences with 1–3(–5) flowers.
 5. Corolla 11–13 mm long; upper leaf surface dark green along primary and secondary veins [plants from Colombia] 2. *P. bella*, new species
 5. Corolla 15–25 mm long; upper leaf surface light green to yellow along veins [plants from Ecuador].
 6. Leaves ovate, seldom cordate or oblong, both surfaces pilose, often purplish with yellow veins; calyx lobes 1–2 mm long 10. *P. hypocyrtiflora*
 6. Leaves elliptic to lanceolate, upper surface glabrous, green with lighter areas along primary, secondary, and tertiary veins surrounding darker blotches, lower surface veins with conspicuous trichomes of up to 10 large, flat cells; calyx lobes 3–8 mm long 15. *P. schimpfii*
 4. Corolla funnellform or ventricose; peduncles rarely absent and frequently longer than pedicels; inflorescences with 1–12(–20) flowers.
 7. Leaves unequal or equal in each pair, upper surface usually glabrous (if sparsely pilose then with unequal leaves), lower surface with conspicuous villous or sericeous indumentum at primary, secondary, and tertiary veins, or lower surface pilose (then with unequal leaves); peduncles usually absent, if present then shorter than pedicels; floral tube with dense indumentum often contrasting with nearly glabrous calyx lobes.
 8. Leaves unequal in each pair, lower surface pilose; stems and inflorescences with densely hispid or villous 3–5 mm long trichomes; bracts and calyx lobes subulate [plants from Colombia and Ecuador] 9. *P. hispidissima*, new combination
 8. Leaves equal or subequal in each pair, lower surface glabrous except on veins; stems and inflorescences usually with appressed trichomes; bracts and calyx lobes ovate or lanceolate.
 9. Leaves mostly ovate or elliptic, serrate, surface below green, above green with darker blotches surrounded by yellow green areas along primary, secondary, and tertiary veins [plants from Ecuador] 11. *P. intermedia*, new species
 9. Leaves mostly lanceolate, serrulate, or subentire, usually purplish, particularly below between conspicuous yellow green veins.

10. Calyx lobes glabrous; inflorescences usually pedunculate, pedicels 1–1.5 cm long [plants from Ecuador] 6. *P. glabrata*, new species
10. Calyx lobes hispid; inflorescences epedunculate, pedicels 1.5–4.5 cm long [plants from Peru] 5. *P. fuscicalyx*, new species
7. Leaves subequal or equal in each pair, not glabrous; peduncles usually longer than pedicels; floral tube and calyx lobes usually with similar indumentum.
11. Margin of leaves ciliate with 3–5 mm long trichomes; stems and inflorescences with 3–5 mm long purple trichomes; apical 5 mm of corolla, including limb, usually black, rarely entirely red [plants from Ecuador] 14. *P. rhodotricha*, new combination
11. Margin of leaves not ciliate or with trichomes only to 2 mm long; stems and inflorescences rarely with dark villous indumentum, trichomes not exceeding 3 mm long; corolla never black apically.
12. Upper leaf surface strigose; calyx lobes lanceolate-subulate, strigose; corolla either minutely puberulent or sericeous with trichomes extending ~2 mm beyond limb.
13. Peduncles longer than pedicels; calyx lobes 3–5 mm long; corolla glabrous except for minute puberulence [plants from Ecuador] 7. *P. gracilis*, new species
13. Peduncles shorter than pedicels; calyx lobes 5–12 mm long; corolla sericeous with trichomes extending ~2 mm beyond limb [plants from Peru] 17. *P. strigosa*, new species
12. Upper leaf surface velutinous, puberulent, pilose, or hirsute; calyx lobes ovate or lanceolate, pilose, villous, or sericeous; corolla pilose, villous, or sericeous with trichomes not extending beyond limb.
14. Peduncles (if present) shorter than pedicels; corolla funnelform, limb not entirely red, diameter of throat ≥ 4 mm; calyx lobes lanceolate and about twice as long as wide at base (16. *P. sprucei*, new combination).
15. Leaves usually ovate, never conspicuously rugose; stems, inflorescences, and veins usually with whitish villous indumentum [plants from Bolivia and Peru] 16a. *P. sprucei* var. *parviflora*, new status
15. Leaves usually lanceolate, often rugose; stems, inflorescences, and veins usually sericeous with yellow green or purplish indumentum [plants from throughout range of genus] 16b. *P. sprucei* var. *sprucei*
14. Peduncles at least as long as pedicels (occasionally shorter at flowering onset but elongate to exceed pedicels); corolla funnelform or ventricose, limb entirely red or with darker dots or markings, diameter of throat 3–11 mm; calyx lobes lanceolate and about twice as long as wide at base or mostly ovate and about as long as wide at base.
16. Limb red, rarely yellow, without markings, corolla ventricose, 9–15 mm long and 3–4 mm wide in throat (to 19 mm long, 7 mm wide in specimens from San Martín Department, Peru) [plants from Colombia, Ecuador, and Peru] 1. *P. abunda*, new combination
16. Limb yellow or red with darker markings, corolla funnelform to ventricose, (12–)15–25 mm long and (3–)5–11 mm wide in throat.
17. Calyx lobes lanceolate and about twice as long as wide at base, never reflexed in central Peru but occasionally so in Ecuador and northern Peru; inflorescences and calyces sericeous with green to purplish indumentum [plants from throughout range of genus] 16b. *P. sprucei* var. *sprucei*
17. Calyx lobes mostly ovate and about as long as wide at base, often reflexed; inflorescences and calyces sericeous with yellow green indumentum or villous with grayish green or purple brown indumentum.
18. Stems, inflorescences, and calyces with grayish or purple brown villous indumentum; 2 upper lobes of limb red, 3 basal lobes yellow with darker spots or markings centrally or along margin; peduncle 3–7 cm long [plants from Peru] 12. *P. purpurea*, new combination
18. Stems, inflorescences, and calyces sericeous with yellow green indumentum; entire limb yellow with darker dots; peduncle 4–15 cm long [plants from Colombia and Ecuador] 13. *P. reticulata*, new combination

1. *Pearcea abunda* (Wiehler) L.P. Kvist & L.E. Skog,
new combination

FIGURES 1a, 11

Parakohleria abunda Wiehler, 1978:5, 7, pl. 1A. [Type: plants cultivated at the Marie Selby Botanical Gardens, Sarasota, FL, originally collected by Madison et al. (3194) from Ecuador, prov. Morona-Santiago, *Wiehler 77129* (SEL, holotype).]

Stems to 100(-150) cm long, occasionally branched, yellow green and villous to lanate apically. Leaves subequal in each pair, blades ovate-lanceolate, 7-15(-22) × 2.5-7(-10) cm, rarely purplish, above hirsute, below pilose with villous-sericeous veins, margin serrulate. Inflorescences with 3-12 flowers, yellow green to purple, villous; peduncles 2.5-5 cm long; bracts lanceolate, 4-10 mm long; pedicels 0.5-1.5 cm long. Floral tube villous-lanate; calyx lobes often reflexed, 3-4 mm long, ovate; corolla 0.9-1.5(-1.9) cm long, tube ventricose, diameter 5-9(-12) mm medially and 3-4(-7) mm in throat, bright red, less commonly intense yellow, outside sericeous, inside usually glandular-puberulent, lobes 1-2 mm long, red, rarely with darker purple lower lobes; filaments occasionally sparsely puberulent, style puberulent and/or glandular-puberulent. Capsule subglobose, 3-5 mm long, diameter 3-5 mm; seeds broadly ellipsoid, ~0.4 mm long, brown, striate. Chromosome number $n = 11$ (counted by Royce Oliver, Department of Botany, Smithsonian Institution, from *Kvist 60451* (vouchers in AAU, QCA, and US).

DISTRIBUTION.—*Pearcea abunda* occurs in the Ecuadorian Amazon lowland and adjacent areas of Colombia and Peru (Figure 11). The species is locally common in Ecuador, but only the cited specimens have been seen from Peru and Colombia. The Peruvian collection from Loreto is farther from the Andean slopes than any other collection of *Pearcea* (Figure 11). *Pearcea abunda* mostly occurs below 500 m elevation but reaches elevations up to 1000 m in the Ecuadorian province of Morona-Santiago.

REPRESENTATIVE COLLECTIONS.—COLOMBIA. *Putumayo*: Towards Puerto Asis, between Río Chipayacu and Finca Pedrogoso, *Ewan 16734* (US); Umbria, *Klug 1659* (BM, F, GH, MO, NY, US).

ECUADOR. *Morona-Santiago*: Taisha, Río Pangui, 10 km S-SE of military camp, *Brandbyge & Asanza 32112* (AAU, QCA, US); Mendez, 600-800 m, *Camp 902E* (NY, S, US); Macas, *Kvist 60451* (AAU, QCA, US); *60452* (AAU, QCA, QCNE, US). *Napo*: Añangu along Río Napo, *Besse et al. 1601* (SEL), *1602* (SEL); Río Aguatico, Dureño, *Cerón 344* (NY). *Pastaza*: 10 km E of Puerto Sarayacu, Sarayaquillo, *Lugo S. 4018* (GB, SEL), *5443* (GB, US).

PERU. *Loreto*: Río Huallaga, *Lewis et al. 11309* (USM); Valencia, Río Corrientes near Platanoyacu, *McDaniel & Marcos 11139* (US). *San Martín*: Upper Río Huallaga, Juan Jui, *Klug 4216* (A, BH, BM, F, K, MO, NY, S, U, UC, US, USM). Total of 27 wild collections seen.

DISTINGUISHING FEATURES.—The combination of hirsute leaves, villous inflorescences with peduncles longer than

pedicels, ovate and mostly reflexed calyx lobes, ventricose and red (rarely yellow) corollas with a narrow throat (see illustration in Kvist, 1991:22), and an entirely red/purple limb without darker spots or markings sets *Pearcea abunda* apart from all other species in the genus.

VARIATION.—The sole collection from the Peruvian department of San Martín (*Klug 4216*) differs by having considerably larger flowers (corolla 1.9 cm long, diameter 1.2 mm medially and to 0.7 mm in the throat) and by having longer (to 22 cm), relatively narrower leaves. It may represent a new species closely related to *P. abunda*, but additional collections are necessary before this can be determined.

NOTES.—In northwestern Ecuadorian Amazonia, the Cofán Amerindians crush and boil the leaves of *Pearcea abunda* and drink the decoction for colds. They also burn the leaves and apply the ash to sores in the mouth, according to *Cerón 344*.

2. *Pearcea bella* L.P. Kvist & L.E. Skog, new species

FIGURES 7, 13

Pearceae hypocyrtiflorae (J.D. Hooker) Regel affinis, sed corollis 11-13 mm longis urceolatis, floribus in foliorum axillis solitariis, foliis in paginis superioribus secus vena atro-viridibus differt.

Erect stems 10-20 cm long, basal diameter 2-3 mm, unbranched but with elongated rhizomes and adventitious roots, villous with yellow brown trichomes, shoots somewhat dorsiventral; internodes 0.5-2 cm long. Leaves subequal to unequal in each pair, blades oblique, ovate, 3-7 × 1.5-3.5 cm, base attenuate-cuneate, apex acute-acuminate, margin serrulate, above with dark green areas along primary and secondary veins, weakly rugose, appressed pilose, below lighter green, pilose, villous along veins, lateral veins 5-6 per side; petiole 1-3 cm long. Inflorescences of solitary flowers in upper leaf axils, villous with yellow green trichomes; epedunculate and ebracteate; pedicels 3-5 cm long. Floral tube conic, 1.0-1.5 mm long, villous; calyx 3-4 mm long, villous, lobes erect, triangular, 1-1.5 mm long and 1.5-2 mm wide at base, apex acute; corolla 11-13 mm long, tube urceolate, 9-12 mm long, diameter 7-9 mm medially and 1.5-2.5 mm in throat, outside red, ventrally and basally yellow red, villous, inside yellow, puberulent, limb with lobes subequal, rotund, 1-1.5 mm long and 1.5-2 mm wide at base, red, inside puberulent, with acute-obtuse apex; stamens included, filaments 5-6 mm long, puberulent, anthers ~1.2 × 1 mm; staminode 5-6 mm long; nectariferous disc of 5 glands, all ~0.5 mm high and 0.5 mm wide at base; ovary ²/₃ inferior, sericeous, 2-2.5 mm long, diameter 1-1.5 mm, style included, 7-9 mm long, puberulent and sparsely glandular-puberulent apically, stigma stomatomorphic. Fruit and seeds not seen.

TYPE.—COLOMBIA. *Caquetá*: Eastern slopes of the Andes along the road to Florencia, Quebrada Delicias, 750 m, 9 Feb 1987, *Londoño & Kvist 136* (COL, holotype; AAU, TULV, US, isotypes).

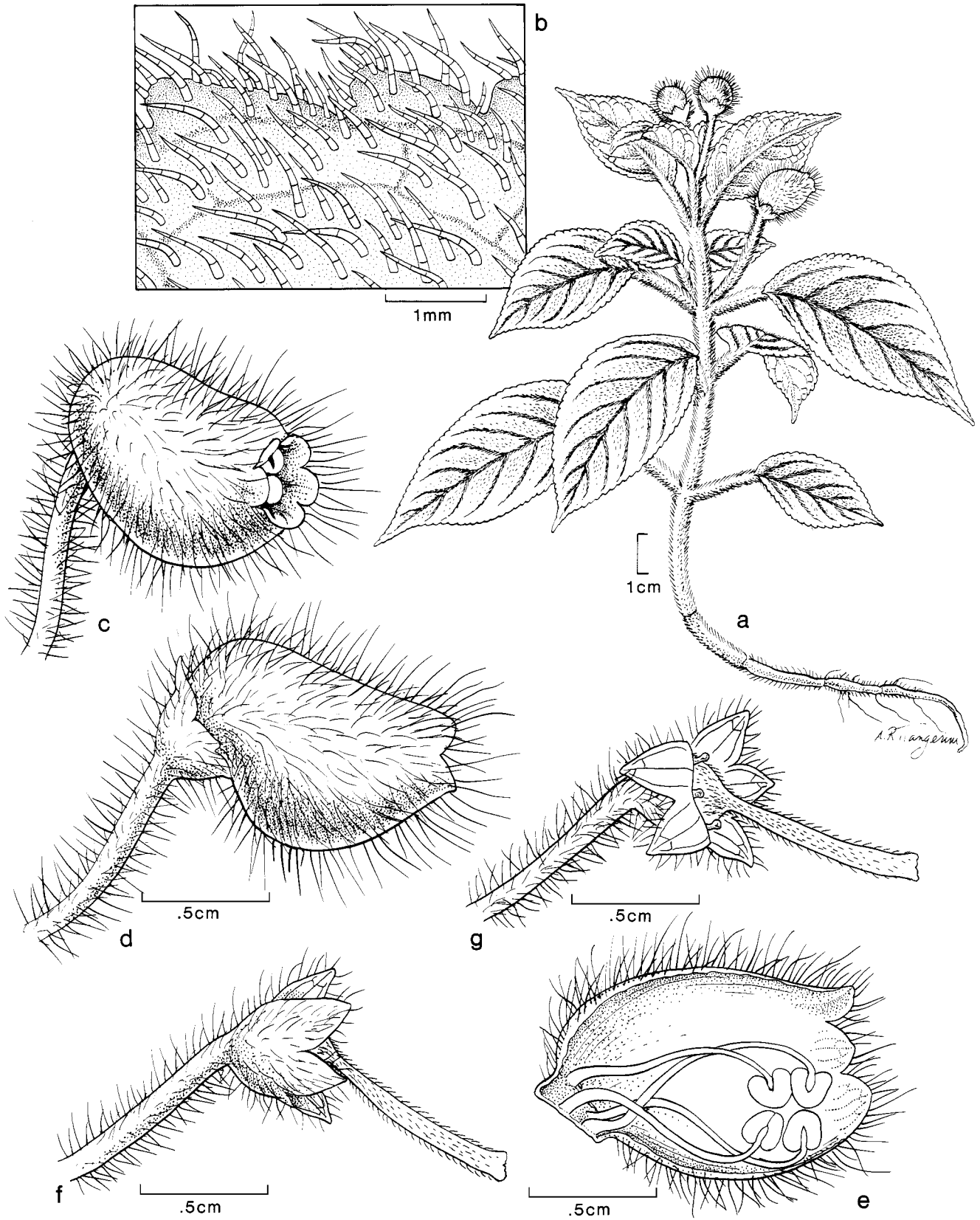


FIGURE 13.—*Pearcea bella*: a, habit and inflorescences; b, indument of upper leaf surface; c, flower showing corolla mouth and anthers; d, lateral view of flower; e, laterally opened corolla showing androecium; f, lateral view of flower with corolla removed; g, calyx, nectary, and gynoecium. All from *Cuatrecasas 9161* (F).

ETYMOLOGY.—The specific epithet, *bella*, comes from the Latin *bellus*, meaning pretty.

DISTRIBUTION.—The species is known only from the eastern slopes of the Andes in the Colombian department of Caquetá between 600 m and 1500 m elevation (Figure 7). Dense populations arising from creeping rhizomes were observed on shaded banks and slopes near small streams (Londoño & Kvist 136, 141).

OTHER COLLECTIONS.—COLOMBIA. *Caquetá*: Sucre, banks of Río Hacha, *Cuatrecasas 9161* (COL, F, US); road to Florencia, *Londoño & Kvist 141* (AAU, US). Total of three collections seen.

DISTINGUISHING FEATURES.—The approximately 1 cm long, urceolate corollas easily identify *Pearcea bella*. In addition, this species is unique in the genus by having solitary flowers in the leaf axils. *Pearcea bella* is not spectacular, but the pattern of lighter and darker green on the upper leaf surfaces and the small, urceolate, red corollas make populations of this species attractive.

3. *Pearcea bilabiata* L.P. Kvist & L.E. Skog, new species

FIGURES 8, 15f

Species insignis limbo corollae valde bilabiato, lobis superioribus 7–9 mm longis, a speciebus cogniti notis bene distincta.

Stems 20–100 cm long, basal diameter to 5 mm, frequently branched, glabrescent basally to sericeous apically; internodes 1–5 cm long. Leaves equal or subequal in each pair, blades mostly oblique, ovate to lanceolate, 4–10(–15) × 1.5–4(–6) cm, base attenuate-cuneate, apex acute-acuminate, margin serrate-serrulate, above dark, dull green, glabrous or sparsely appressed pilose particularly along veins, rarely rugose, below lighter green, velutinous, lateral veins 6–9 per side; petioles 0.5–2 cm long. Inflorescences of 2–7 flowers in upper leaf axils, yellow green or purple, sericeous or villous; peduncles 0.5–2(–4) cm long; bracts 2, lanceolate-subulate, 5–12 × 1–2 mm; pedicels 1.5–4.5 cm. Floral tube conic, 2–4 mm long, green or purple, villous; calyx 6–11 mm long, villous, lobes erect, lanceolate, 5–9 mm long and 1–2 mm wide at base, apex acute-acuminate; corolla 16–24 mm long, tube 9–15 mm long, diameter 3–7 mm, outside red, sericeous, inside yellow, glabrous, limb bilabiate, red outside, yellow and glandular-puberulent inside, lobes rotund, lower 3 with dark dots, upper lobe (= 2 dorsal connate lobes) 4–7 mm long (to base of lateral lobes and 7–9 mm long to base of basal lobe), lateral lobes 1–2.5 mm long, basal lobe 2–3.5 mm long and reflexed; stamens exserted, filaments 17–25 mm long, glabrous, anthers ~1.8 × 1.5 mm; staminode 2–4 mm long; nectariferous disc of 5 glands, all ~1 mm high and ~1 mm wide at base; ovary ²/₃ inferior, 3–4 mm long, diameter 3–4 mm, sericeous, style exserted, 17–25 mm long, sparsely glandular-puberulent or glabrous, stigma stomatomorphic. Capsule globose, 4–5 mm

long, diameter 4–5 mm; seeds subglobose-ellipsoid, 0.25–0.35 mm long, brown black, irregularly striate.

TYPE.—ECUADOR. *Morona-Santiago*: Road from Sigisig to Gualaquiza, between Oroyaco and El Portón, 22 Jul 1948, *Scolnik 1490* (US, holotype).

ETYMOLOGY.—The specific epithet refers to the bilabiate form of the corolla.

DISTRIBUTION.—Apparently a rare endemic, *Pearcea bilabiata* is restricted to the Ecuadorian province of Morona-Santiago (Figure 8). The species occurs at 800–1500 m elevation in the Upano-Zamora valley between the Andean slopes to the west and the Cordilleras de Cónдор and Cutucú to the east. In the Upano-Zamora valley at least seven *Pearcea* species occur, including *P. bilabiata*; the others are *P. abunda*, *P. glabrata*, *P. gracilis*, *P. hispidissima*, *P. sprucei*, and *P. reticulata*.

OTHER COLLECTIONS.—ECUADOR. *Morona-Santiago*: Cordillera de Cutucú, Mendez-Morona road, km 19, *Dorr & Valdespino 6297A* (US); Indanza-Limón (General Plaza), *Harling & Andersson 12755* (GB); new road from Mendez to Morona, *Hirtz et al. 7130* (MO); 20 km S of San Juan Bosco, *Madison et al. 7553* (SEL); Río Calagras, *Luer et al. 11870* (US); Cordillera de Cutucú, Mendez-Morona road, *van der Werff & Palacios 10408* (US). Total of seven collections seen.

DISTINGUISHING FEATURES.—The bilabiate corollas set *Pearcea bilabiata* apart from all other species in the genus, although the species is difficult to distinguish vegetatively.

4. *Pearcea cordata* L.P. Kvist & L.E. Skog, new species

FIGURES 9, 14

Species insignis foliis cordatis, inflorescentiis et caulis trichomatibus ad 8 mm longis hispidis retrorsis, corollasque flavis, a speciebus cognitis notis bene distincta.

Stems ~50 cm tall, 5 mm or more in diameter, unbranched, with the petioles, inflorescences, and flowers all with conspicuous, 5–8 mm long, yellow brown, hispid, retrorse trichomes, each consisting of ~10 cells; internodes ~5 cm long. Leaves subequal in each pair, blades cordate, 7–12 × 6–8 cm, margin serrate, above dull green, somewhat rugose, hirsute, below lighter yellow green, pilose, lateral veins 6–8 per side; petiole 3–7 cm long. Inflorescences of ~5 flowers; peduncles ~2 cm long; bracts 2, ovate-lanceolate, 8–15 × 3–5 mm; pedicels 0.8–1.5 cm long. Floral tube conic, ~3 mm long; calyx ~8 mm long, lobes lanceolate, ~6 mm long, apex acute; corolla ~15 mm long, tube funnelform, diameter to 6 mm in throat, outside yellow, inside, particularly limb, puberulent and glandular-puberulent, lobes subequal, rotund, 2–3 mm long and 2–3 mm wide at base, inside glandular-puberulent; stamens included, filaments ~12 mm long, puberulent and glandular-puberulent, anthers ~2 × 1 mm; nectariferous disc of 5 glands, ~0.8 mm high; ovary ~²/₃ inferior, ~4 mm long, diameter ~2 mm, pilose,

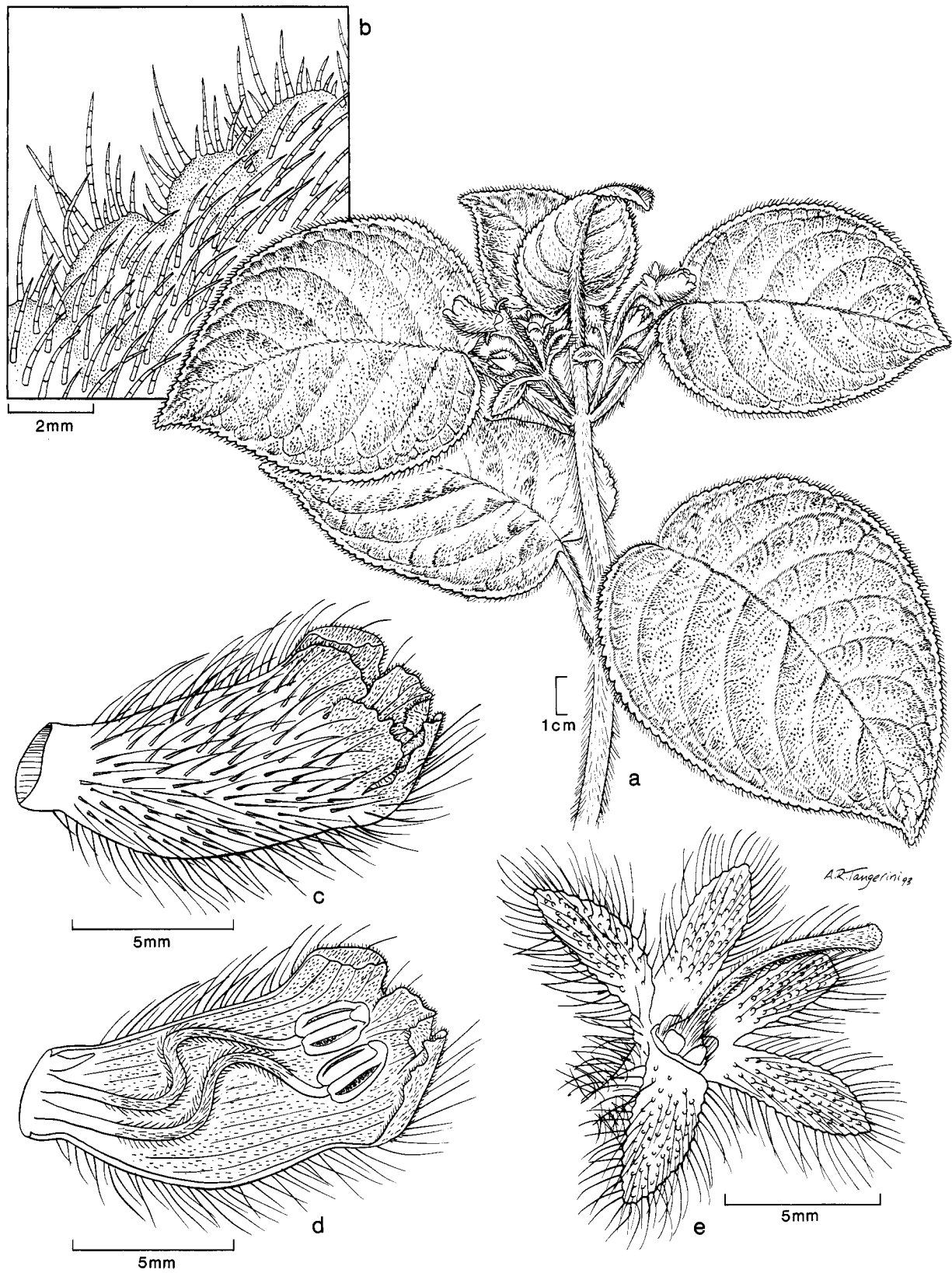


FIGURE 14.—*Pearcea cordata*: a, habit and inflorescences; b, indument of upper leaf surface; c, lateral view of flower; d, laterally opened corolla showing androecium; e, calyx, nectary, and gynoecium. All from *Holm-Nielsen et al.* 26512 (AAU).

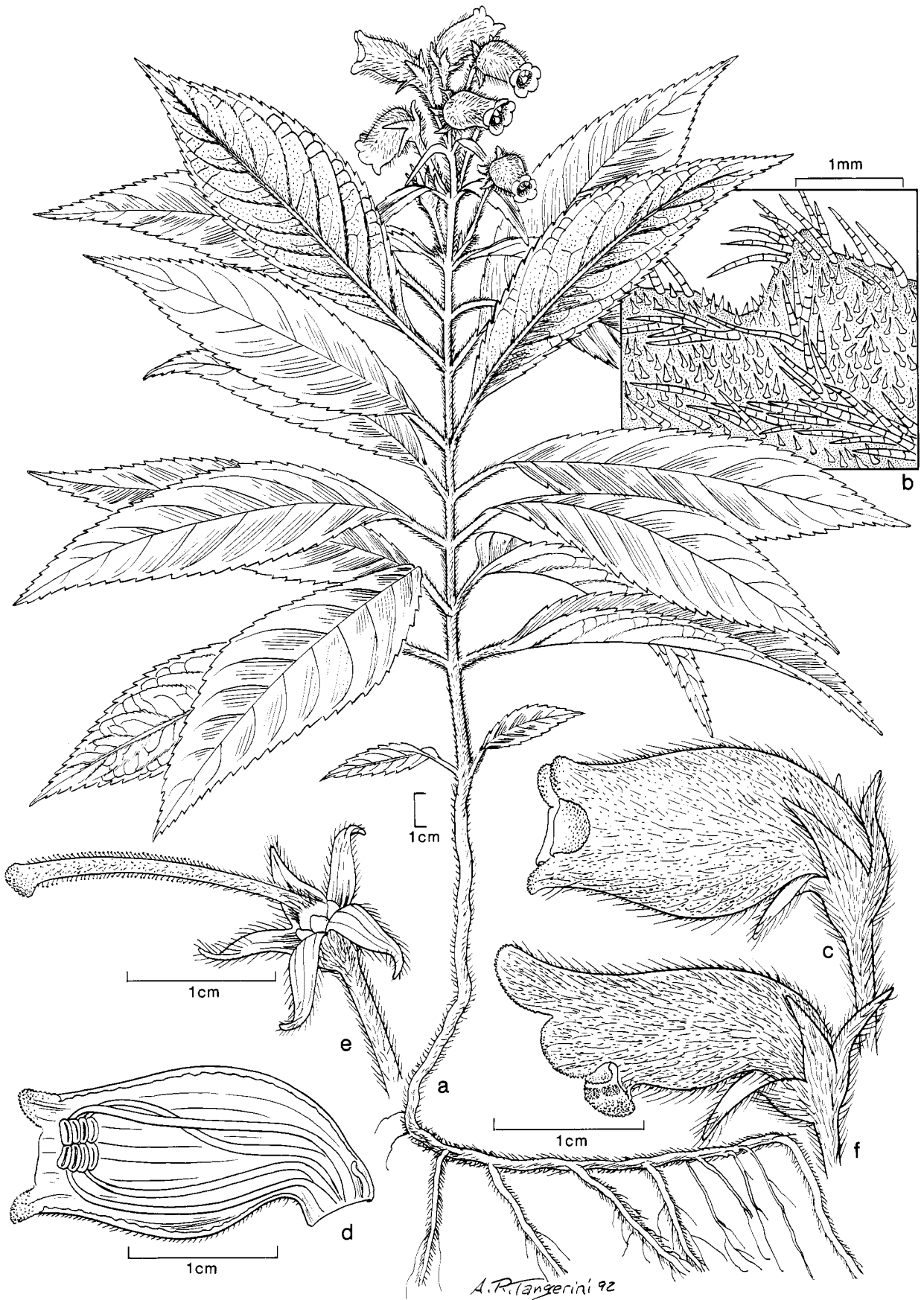


FIGURE 15 (opposite page).—*Pearcea fuscicalyx*: a, habit and inflorescences; b, indument of lower leaf surface; c, lateral view of flower; d, laterally opened corolla showing androecium; e, calyx, nectary, and gynoecium. *Pearcea bilabiata*: f, lateral view of flower. a, b from Schunke 5116 (US); c–e from Schunke 3111 (US); f from Scolnik 1490 (US).

style included, ~10 mm long, basally pilose and glandular-puberulent apically, stigma stomatomorphic. Fruits and seeds not seen.

TYPE.—ECUADOR. *Napo*: Río Borja, 1740 m, 21 Sep 1980, Holm-Nielsen et al. 26512 (AAU, holotype).

ETYMOLOGY.—The specific epithet refers to the cordate leaf bases.

DISTRIBUTION.—Montane forest in the Ecuadorian province of Napo (Figure 9). According to the label (of the single collection), *Pearcea cordata* was growing in a swamp forest at 1740 m elevation.

DISTINGUISHING FEATURES.—*Pearcea cordata* is the only species with cordate leaves and a hispid, retrorse indumentum (the latter character probably also distinguishes *P. cordata* from all other Ecuadorian Gesneriaceae). For these reasons, we have described *Pearcea cordata* despite the fact that only one poor collection (with two flowers) has been seen. It is also very unusual for a *Pearcea* species to have yellow rather than red or orange red flowers, but yellow flowers occasionally occur in *P. abunda* and *P. sprucei*.

5. *Pearcea fuscicalyx* L.P. Kvist & L.E. Skog, new species

FIGURES 3b, 11, 15a–e

Differt a *Pearceae glabratae* L.P. Kvist & L.E. Skog lobis calycum hispidis, inflorescentiis epedunculatis, pedicellis 1.5–4.5 cm longis.

Stems often decumbent, 20–50 cm long, basal diameter to 3 mm, usually unbranched, frequently with stolons and adventitious roots, often purplish, sericeous; internodes 1–3(–5) cm long. Leaves equal in each pair, blades weakly oblique, lanceolate, 6–15 × 1–3 cm, base cuneate, apex acute-acuminate, margin serrulate, above dark green with lighter veins, glabrous, below purplish at least centrally on both sides of primary vein, glabrous apart from sericeous veins, lateral veins 8–9 per side; petiole 1–3 cm long. Inflorescences of 1–3 flowers, violet or purple, hispid; epedunculate; bracts 2, lanceolate-subulate, 6–12 × 1–2 mm; pedicels 1.5–4.5 cm long. Floral tube conic, 1.0–1.5 mm long, dark purple, hispid; calyx 6–8 mm long, hispid, lobes erect, lanceolate, 4–6 mm long and 1–2 mm wide at base, apex acute-acuminate; corolla 18–24 mm long, tube funnellform, subventricose, 16–20 mm

long, diameter 8–12 mm medially and 6–9 mm in throat, outside red, pilose, inside glabrous or sparsely glandular-puberulent, limb with lobes subequal, rotund, 2–3 mm long and 3–4 mm wide at base, apex obtuse-truncate, outside red, densely glandular-puberulent, inside lighter red, sparsely glandular-puberulent; stamens subincluded, filaments 15–18 mm long, glabrous, anthers ~1.8 × 1.2 mm; staminode 3–4 mm long; nectariferous disc of 5 glands, all ~0.7 mm high and 1.0 mm wide at base; ovary ³/₄ inferior, 4–5 mm long, diameter 3–4 mm, sericeous, style subincluded, 15–18 mm long, glandular-puberulent and puberulent, stigma stomatomorphic. Capsule globose, 5–6 mm long, diameter 5–7 mm; seeds ellipsoid, 0.25 × 0.35 mm long, brown, striate.

TYPE.—PERU. *Huánuco*: Leoncio Prado, Jacintillo on left bank of Río Monzón, 170 m, 3 Nov 1977, Schunke V. 5116 (US, holotype; COL, F, G (2), GH, IBE, K, NY, P, USM, isotypes).

ETYMOLOGY.—The specific epithet refers to the purple-hispid floral tube and calyx.

DISTRIBUTION.—*Pearcea fuscicalyx* is so far known only from near Tingo María in the department of Huánuco in the Río Huallaga valley of Peru (Figure 11). All collections come from elevations around 700 m. Three other species of *Pearcea*, *P. purpurea*, *P. sprucei*, and *P. strigosa*, occur in the same area (Figures 6, 12). The first two occur at the same elevations as *P. fuscicalyx*, whereas the latter is found only at considerably higher elevations (in Huánuco).

OTHER COLLECTIONS.—PERU. *Huánuco*: Tingo María, Allard 20838 (US), 21856 (US), 22233 (US), 22287 (BH, US); junction of Río Monzón and Río Huallaga, Asplund 12684 (S); trail along Río Monzón near Río Huallaga at Tingo María, Croat 21261 (MO); across Río Huallaga from Tingo María, Gentry et al. 15941 (F, MO, US); SW of Tingo María, road to Jacintillo, Schunke V. 3111 (F, US); left bank of Río Monzón, Jacintillo, Schunke V. 10366 (MO, US). Total of 10 collections seen.

DISTINGUISHING FEATURES.—The combination of narrowly lanceolate, glabrous (apart from some hairs on the veins below) leaves with a purple lower surface, epedunculate inflorescences with up to three flowers, pedicels approximately 3 cm long, and purple-hispid floral tubes sets *Pearcea fuscicalyx* apart from all other species of *Pearcea*.

6. *Pearcea glabrata* L.P. Kvist & L.E. Skog, new species

FIGURES 8, 16

Species insignis laminis foliorum glabris lanceolatis paginis inferioribus purpureis, marginibus subintegris, tubis floralibus sericeis, lobis calycum reflexis a speciebus cognitis notis bene distincta.

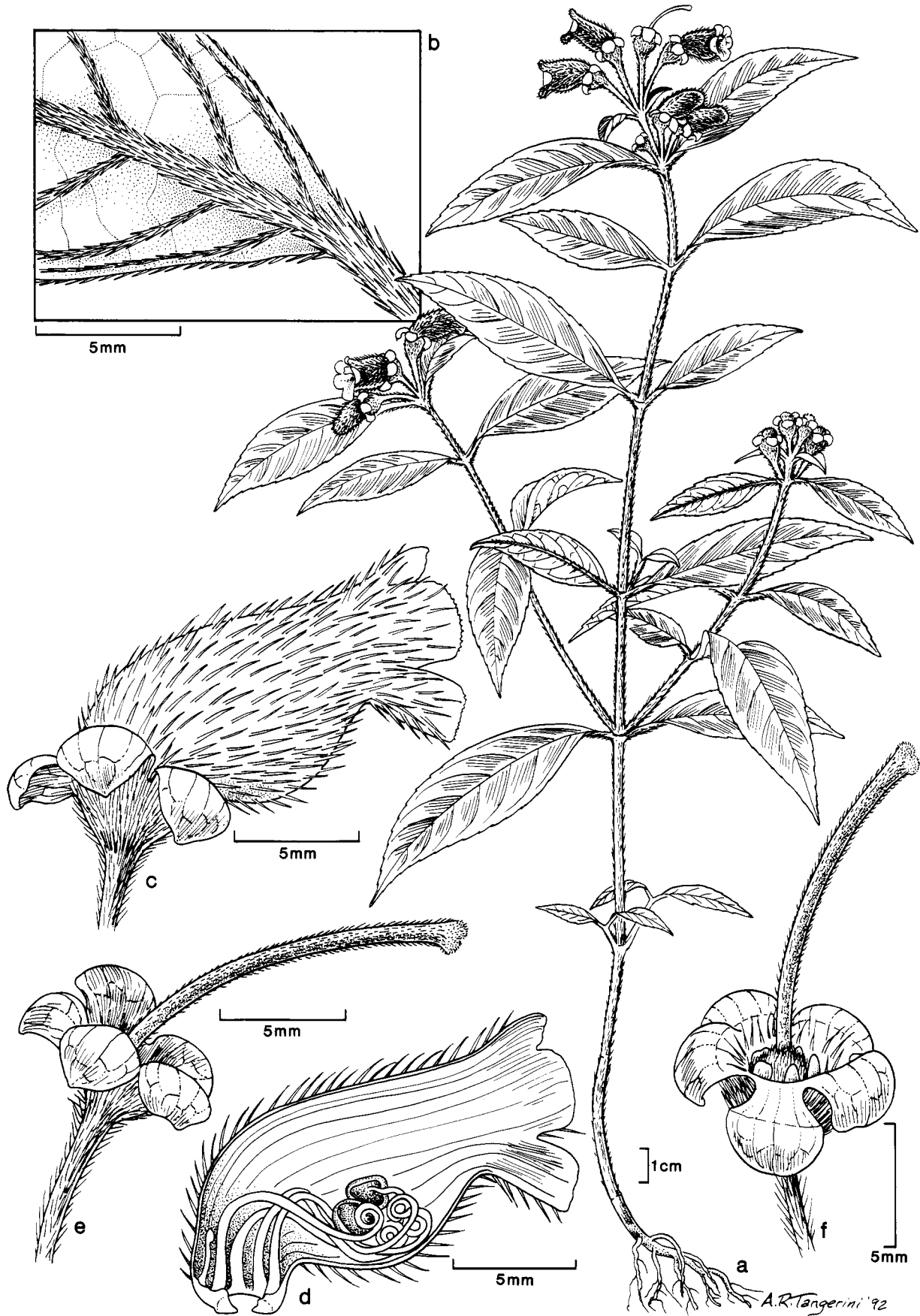


FIGURE 16 (opposite page).—*Pearcea glabrata*: a, habit and inflorescences; b, indument of lower leaf surface; c, lateral view of flower; d, laterally opened corolla showing androecium; e, flower with corolla removed; f, calyx, nectary, and gynoecium. All from *Harling 3756* (s).

Stems to 1 m long, basal diameter to 3 mm, frequently branched, yellow green, sericeous; internodes 1–6(–10) cm long. Leaves subequal in each pair, blades oblique, lanceolate, less commonly elliptic, (2–)4–10 × 1–3 cm, base cuneate, apex acute-acuminate, margin subentire, above dull green, glabrous, below usually purplish, glabrous apart from the strigose veins, lateral veins 7–9 per side; petioles 0.2–2 cm long. Inflorescences of 1–3(–5) flowers, yellow green, sericeous; peduncles 0.2–1.5 cm long; bracts 2, lanceolate-subulate, 4–8 × 1–2 mm; pedicels 1–1.5 cm long. Floral tube conic, 1.0–1.5 mm long, yellow green, sericeous; calyx 4–6 mm long, basally sericeous, lobes reflexed, ovate, 2–4 mm long and 1.5–3 mm wide at base, glabrous, apex acute; corolla 15–20 mm long, tube funnellform, subventricose, 12–18 mm long, diameter 5–9 mm medially and 4–8 mm in throat, outside red, pilose, inside glabrous, limb with lobes subequal, reflexed, rotund, 2–3 mm long and 2–3 mm wide at base, red, margin frequently glandular-puberulent, apex obtuse-truncate; stamens subincluded, filaments 10–18 mm long, glabrous, anthers ~1.5 × 1.0 mm; staminode ~3 mm long; nectariferous disk of 5 or rarely 4 glands, all ~0.6 mm high and 0.8 mm wide at base; ovary ³/₄ inferior, 4–5 mm long, diameter 3–4 mm, sericeous, style subincluded to exerted, 15–20 mm long, puberulent, stigma stomatomorphic. Fruit and seeds not seen.

TYPE.—ECUADOR. *Morona-Santiago*: Arapicos, 850 m, 2 Apr 1987, *Lugo S. 5923* (US, holotype; GB, isotype).

ETYMOLOGY.—The specific epithet refers to the glabrous upper leaf surface.

DISTRIBUTION.—Apparently *Pearcea glabrata* is a locally endemic inhabitant of the central eastern Andean slopes of Ecuador (Figure 8), where it has been collected between 1000 m and 1500 m elevation.

OTHER COLLECTIONS.—ECUADOR. *Pastaza*: Mera, *Harling 3756* (s); Mera-Shell Mera road, km 5, *Øllgaard et al. 35583* (AAU). *Tungurahua*: Colonia Regina, 5 km W of Río Verde, *Lugo S. 1894* (GB, SEL); Baños-Mera, km 35, along Río Cashaurco, *Øllgaard & Balslev 9268* (AAU, NY). *Province Unknown*: *Pearce s.n.* (K). Total of six collections seen.

DISTINGUISHING FEATURES.—The glabrous (apart from the veins below), lanceolate leaves, usually with a purple lower surface, and nearly entire margin distinguish *Pearcea glabrata*. The contrast between the sericeous floral tube and the glabrous, reflexed calyx lobes also characterizes the species.

NOTES.—According to the label of one of the specimens, (*Øllgaard et al. 35583*) the species occasionally grows as an epiphyte.

7. *Pearcea gracilis* L.P. Kvist & L.E. Skog, new species

FIGURES 10, 17

Foliis lanceolatis, hirsutis, viridibus, marginibus subintegris, inflorescentiarum pedunculis quam pedicellis plus quam duplo longioribus, bracteis et lobis calycum subulatis, corollis subglabris.

Stems to 120 cm long, basal diameter to 3 mm, frequently branched, yellow green, sericeous; internodes 2–5 cm long. Leaves equal or subequal in each pair, blades weakly oblique, lanceolate, 4–10 × 1–2.5 cm, base cuneate, apex acute-acuminate, margin subentire, above green, strigose, below paler green, hirsute with sericeous veins, lateral veins 6–8 per side; petiole 0.3–1.2 cm long. Inflorescences of 2–4(–7) flowers, yellow green, sericeous; peduncles 1.5–4.5 cm long; bracts 2, subulate, 2–10 × 0.5–1.5 mm; pedicels 0.3–1.5 cm long. Floral tube conic, 1.0–1.5 mm long, yellow green, sericeous; calyx 4–6 mm long, strigose, lobes erect, lanceolate-subulate, 3–5 mm long and 1–1.5 mm wide at base, apex acuminate; corolla 13–18 mm long, tube funnellform, subventricose, 12–16 mm long, diameter 4–6 mm medially and 3–6 mm in throat, outside red, with only tiny puberulent and frequently also glandular-puberulent trichomes, inside glabrous, limb with lobes subequal, rotund, 1–2.5 mm long and 2–3.5 mm wide at base, red, outside densely glandular-puberulent, inside glabrous, apex obtuse-truncate; stamens included, filaments 5–15 mm long, glabrous, anthers ~2 × 1.5 mm; staminode 3–4 mm long; nectariferous disc of 5 or rarely 4 glands, all ~0.5 mm high and 0.8 mm wide at base; ovary ²/₃ inferior, 3–4 mm long, diameter 2–3 mm, sericeous, style subincluded, 12–18 mm long, glabrous, stigma stomatomorphic. Capsule globose, 6–8 mm long, diameter 5–7 mm, dehiscent by 2 valves; seeds subglobose-ellipsoid, 0.2–0.3 mm long, brown black, irregularly striate.

TYPE.—ECUADOR. *Morona-Santiago*: 10 km S of San Juan Bosco, 1570 m, 27 Jan 1987, *Gentry et al. 30865* (QA, holotype; K, MO, SEL, isotypes).

ETYMOLOGY.—The specific epithet refers to the slender stems of this species.

DISTRIBUTION.—*Pearcea gracilis* is known from the eastern Andean slopes of Ecuador between 1500 m and 2000 m elevation (Figure 10).

OTHER COLLECTIONS.—ECUADOR. *Morona-Santiago*: Trail from Sevilla de Oro to Mendez, Tambo Pilas, *Camp 761E* (US); road Limón (General Plaza)-Gualaceo, *Harling & Andersson 12685* (GB, SEL); 8 km S of San Juan Bosco, *Madison & Besse 7534* (SEL). Total of four collections seen.

DISTINGUISHING FEATURES.—The combination of lanceolate, hirsute, green leaves with nearly entire margins, inflorescences with peduncles at least twice as long as the pedicels, subulate bracts and calyx lobes, and glabrous corollas (apart from tiny puberulent trichomes) distinguishes *Pearcea gracilis*.

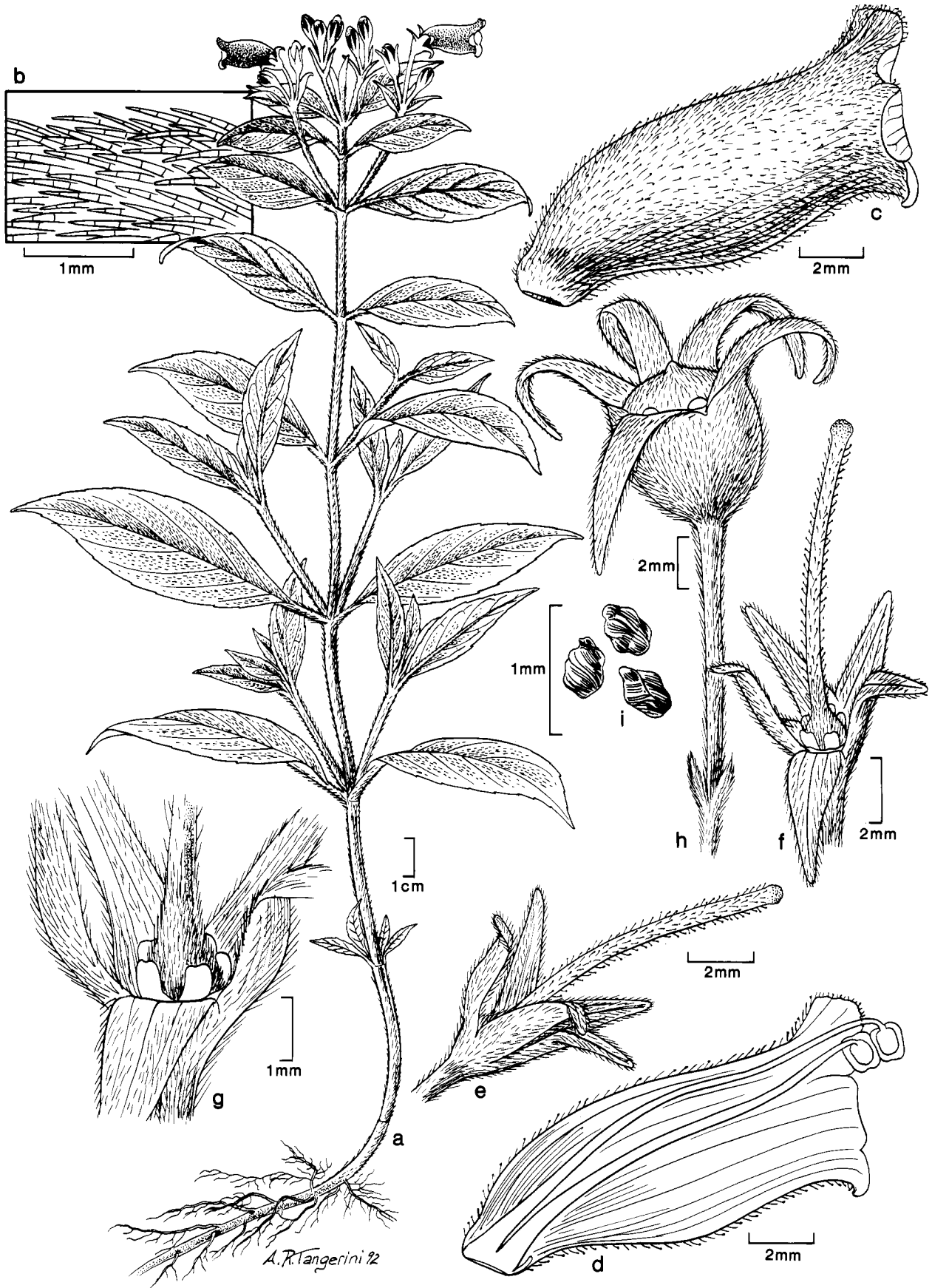


FIGURE 17 (opposite page).—*Pearcea gracilis*: a, habit and inflorescences; b, indument of upper leaf surface; c, lateral view of corolla; d, laterally opened corolla showing androecium; e, flower with corolla and androecium removed; f, calyx, nectary, and gynoecium; g, enlargement of calyx, nectary, and ovary; h, capsule; i, seeds. a,b from *Harling & Andersson 12685* (GB); c-i from *Madison et al. 7534* (SEL).

8. *Pearcea grandifolia* L.P. Kvist & L.E. Skog, new species

FIGURES 11, 18

Foliis magnis 27 × 15 cm, indumento caulium inflorescentiarumque villosolano, pedunculis 13–20 cm longis, sed lobis calycum longioribus quam latioribus aequantibus.

Stems rising 30–50 cm tall, basal diameter to 1 cm, unbranched, yellow green or reddish, villous basally to lanate apically; internodes 3–4 cm long. Leaves equal in each pair, blades weakly oblique, ovate-obovate, 13–27 × 8–15 cm, base attenuate to obtuse, apex acute-acuminate, margin serrate, above green, pilose with villous veins, below lighter green, pilose, lateral veins 10–12 per side; petiole 2–6 cm long. Inflorescences cymes of 6–15 flowers, villous-lanate; peduncles 13–20 cm long (but shorter at beginning of flowering); bracts 2–4, lowest 2 ovate-elliptic, 12–25 × 6–10 mm, other bracts smaller and lanceolate-subulate; pedicels 1–4 cm long. Floral tube conic, ~5 mm long, villous; calyx 8–12 mm long, villous-pilose, lobes erect, ovate, 7–10 mm long and 4–7 mm wide at base, apex acute; corolla 23–27 mm long, tube funnelliform, diameter to 15 mm in throat, outside red with villous white indumentum, inside glandular-puberulent, limb with rotund lobes, 2–3 mm long and 4–6 mm wide at base, glandular-puberulent inside; stamens included, filaments ~20 mm long, glandular-puberulent, anthers ~2 × 1.5 mm; nectariferous disc of 5 glands, each ~1.5 mm high and 1 mm wide; ovary ²/₃ inferior, ~5 mm long and 3 mm wide, villous, style included, ~12 mm long, pilose, glandular-puberulent apically, stigma stomatomorphic. Capsule globose, ~10 mm long, diameter ~8 mm; seeds several hundreds, ~0.3 × 0.2 mm, ellipsoid, obliquely striate, brown.

TYPE.—PERU. *San Martín*: Prov. Mariscal Cáceres, Quebrada de Santa Rosa de Cachiyacu (road to Progreso), 600 m, 19 Jul 1974, *Schunke V. 7558* (US, holotype; MO, isotype).

ETYMOLOGY.—The specific epithet refers to the large leaves.

DISTRIBUTION.—Known only from lower montane forest (500–1000 m) in the Peruvian department of San Martín (Figure 11).

OTHER COLLECTION.—PERU. *San Martín*: Prov. Mariscal Cáceres, District Campanilla, “Carretera marginal de la selva,” 7 km N of Pulcache, *Plowman & Schunke V. 11611* (K). Total of two collections seen.

DISTINGUISHING FEATURES.—The very large leaves easily distinguish *Pearcea grandifolia* even vegetatively. The lanate

indumentum of the stems and inflorescences also is distinctive, and only *P. reticulata* may have equally long peduncles (but that species does not have calyx lobes that are longer than the width at base). We have described *P. grandifolia* despite the limited material because the species is so unusual that we believe it cannot be a hybrid or a variant of some other species.

9. *Pearcea hispidissima* (Wiehler) L.P. Kvist & L.E. Skog, new combination

FIGURES 3a, 9

Parakohleria hispidissima Wiehler, 1978:6, 7, pl. 1B. [Type: Ecuador, Pastaza, Puyo-Veracruz road, km 4, *Wiehler 7176* (SEL, holotype).]

Stems to 100 cm long, 3–8 mm in diameter, occasionally branched, densely hispid with yellowish or purplish 3–5 mm long trichomes. Leaves unequal in each pair, rarely subequal, larger blade of pair ovate-elliptic, 8–18 × 3–9 cm, margin entire to serrulate, above dull green, glabrous, below lighter green, pilose; smaller blade of pair ovate-rotund, 0.8–3(–7) × 0.5–1.5(–5) cm. Inflorescences of 1–4(–6) flowers, yellow green, villous; peduncles to 2.5 cm long, occasionally absent; bracts subulate, 6–8 mm long; pedicels 1.5–4 cm long. Floral tube yellow green, villous; calyx lobes subulate, 5–8 cm long, villous; corolla funnelliform, subventricose, 16–21 mm long, tube diameter 7–11 mm medially and 5–9 mm in throat, red, outside pilose-villous, inside glabrous, lobes 1–1.5 mm long, red; filaments glabrous; style glandular-puberulent and/or puberulent. Capsule globose, 5–7 mm long, 5–6 mm wide; seeds ellipsoid, 0.8 × 0.4 mm, brown, striate.

DISTRIBUTION.—*Pearcea hispidissima* has been collected at 600–1200 m elevation on the eastern Andean slopes in Ecuador, and most collections come from the region of Río Bobonaza east of Puyo, the provincial capital of Napo (Figure 9). The single Colombian collection comes from very humid montane forest at 1900 m elevation close to a steep cliff.

REPRESENTATIVE COLLECTIONS.—COLOMBIA. *Caquetá*: Florencia-Guadalupe road, *Londoño & Kvist 158* (AAU, COL, TULV, US).

ECUADOR. *Morona-Santiago*: 9 km N–NW of Taisha, *Brandbyge & Asanza 31943* (AAU). *Napo*: Hollín-Loreto road, km 17, *Hurtado & Shiguango 1656* (MO). *Pastaza*: Veracruz, Indillama, *Lugo S. 28* (GB, SEL), *1083* (GB, SEL); Baños-Mera road, km 35, *Øllgaard et al. 9270* (AAU). Total of 20 collections seen.

DISTINGUISHING FEATURES.—The strongly anisophyllous leaves and the dorsiventral shoots distinguish *Pearcea hispidissima*. In addition, the species is characterized by having mostly ovate leaves with glabrous upper surfaces and nearly entire margins, villous inflorescences, and subulate calyx lobes.

VARIATION.—One specimen (*Asplund 9523*) is unusual in having nearly equal leaf pairs. The single collection from the department of Caquetá in Colombia is similar to the Ecuadorian specimens. This similarity is unusual in *Pearcea* because plants

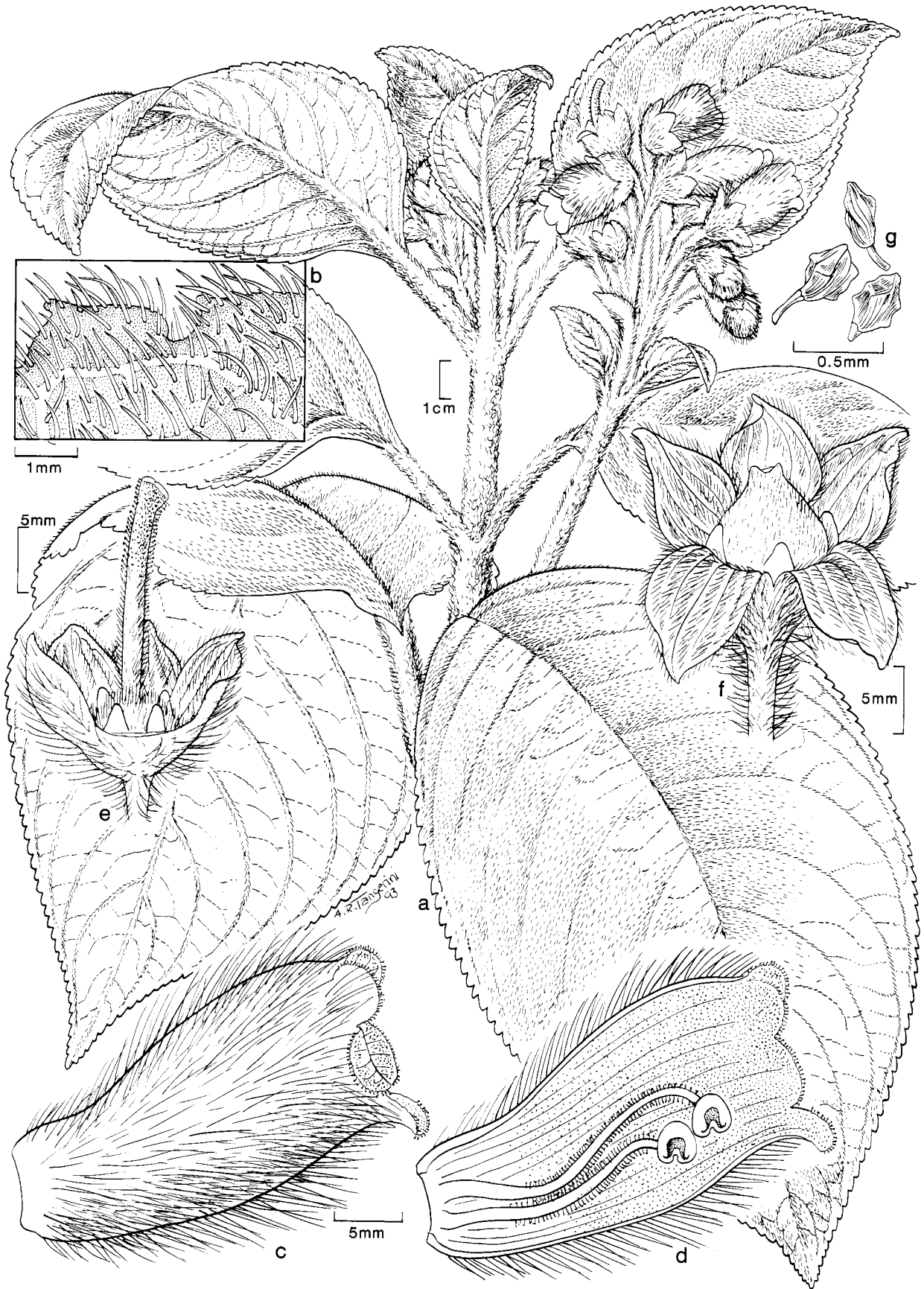


FIGURE 18 (opposite page).—*Pearcea grandifolia*: a, habit and inflorescences; b, indument of lower leaf surface; c, lateral view of corolla; d, laterally opened corolla showing androecium; e, calyx, nectary, and gynoecium (front calyx lobe removed); f, calyx, nectary, and young capsule; g, seeds. All from Schunke 7558 (US).

from the periphery of a species' range usually have some distinct features (see "Variation" preceding key, above).

TYPIFICATION.—According to Wiehler (1978), isotypes are located in K, NY, SEL, and US, but we could not find them and possibly they were never distributed.

10. *Pearcea hypocyrtiflora* (J.D. Hooker) Regel

FIGURE 7

Pearcea hypocyrtiflora (J.D. Hooker) Regel, 1867:388. *Gloxinia hypocyrtiflora* J.D. Hooker, 1867, pl. 5655. *Isoloma hypocyrtiflorum* (J.D. Hooker) Benthams, 1876:1002 ("hypocyrtiflora").—Hoehne, 1970:323, pl. 161. [Type: Based on cultivated material, originally collected by Jameson in eastern Ecuador, Prov. Napo, Archidona, Jameson 786 (K, lectotype selected herein; BM, E, MPU, isolectotypes).]

Erect stems 5–20 cm long, unbranched, but with long rhizomes and adventitious roots, yellow brown, villous. Leaves subequal to unequal in each pair, blades ovate, less commonly cordate or oblong, 2.5–17 × 2–10 cm, rugose, above and below appressed pilose, often purplish, primary and secondary veins often yellowish and contrasting with darker green or purplish areas between veins. Inflorescences of 1–2 flowers, villous, yellow green to purple; peduncles 0–0.5 cm long; bracts ovate, sometimes to 5 mm long but usually absent or caducous; pedicels 4–7 cm long. Floral tube villous; calyx lobes erect, rotund-ovate, 1–2 mm long; corolla tube urceolate (see photograph by Dunn in Anonymous, 1991:15), 16–23 mm long, diameter 8–15 mm medially and 2–3 mm in throat, outside red, villous, inside puberulent or glandular-puberulent, lobes 1–2 mm long, red; filaments puberulent; style puberulent or glandular-puberulent, stigma weakly bilobed. Capsule and seeds not seen.

DISTRIBUTION.—*Pearcea hypocyrtiflora* is currently known from an area ~50 km long near the Napo river, below 700 m elevation in the Ecuadorian province of Napo (Figure 7).

REPRESENTATIVE COLLECTIONS.—ECUADOR. *Napo*: Tena-Puyo, Besse et al. 1671 (SEL); Shingupino, 8 km SE of Tena, Grubb et al. 1503 (K); Ahuano at Río Napo 25 km E of Puerto Napo, Lugo S. 235 (GB, SEL); 8 km downstream from Puerto Misahualli, Palacios et al. 484 (AAU, US); Santa Rosa along Río Napo, Prance 26587P (SEL). *Province Unknown*: *Spruce s.n.* (K). Total of 18 collections seen.

DISTINGUISHING FEATURES.—*Pearcea hypocyrtiflora* shares urceolate corollas only with *P. bella* and *P. schimpffii*. *Pearcea bella* differs by having corollas ~1 cm rather than ~2 cm long and by having leaves with darker areas along the lateral veins on the upper leaf surfaces rather than between them. *Pearcea schimpffii* differs by having glabrous rather than

appressed pilose and rugose upper leaf surfaces and elliptic rather than ovate leaves. Vegetatively, however, the often large, ovate, purplish, and yellow-veined leaves distinguish *P. hypocyrtiflora* from all other species (see illustrations in Batcheller, 1992:19; Boggan, 1990:9; Striepens, 1991:16).

TYPIFICATION.—No specimen labeled as holotype has been seen. Possibly there were no specimens of the species preserved while it was under cultivation at the Royal Botanic Gardens, Kew, where it was drawn by W. Fitch and described by J.D. Hooker. The Kew plants came from Messrs. Veitch who grew them from a specimen collected in Ecuador by Richard Pearce. Hooker (1867) cites a Jameson collection, which he also annotated with the figure number from *Curtis's Botanical Magazine*. Daniel Oliver, keeper at Kew at the time, also noted on the same sheet that the Jameson collection was the "same or (very close ally) sent by Messrs. Veitch 4/67. [He] called it *Hypocyrtia brevicalyx* & sent it to Mr. Fitch to figure." Oliver later added to his note: "This name [i.e., *Hypocyrtia brevicalyx*] gives place to *Gloxinia hypocyrtiflora*, Bot. Mag." The name *Hypocyrtia brevicalyx* was used by Henry James Veitch in the plant list in *Gardener's Chronicle* of 4 May 1867 for a plant exhibited at the Royal Horticultural Show in April 1867 (Veitch, 1867). This name was mentioned by Regel when he transferred *Gloxinia hypocyrtiflora* to his new genus *Pearcea*, but by the typography in the Regel paper, it appears that Regel did not consider *Hypocyrtia brevicalyx* to be a name that had any standing. The name does appear, however, in *Index Kewensis* (Jackson, 1895) where it was relegated to being a synonym of *Pearcea hypocyrtiflora*. We believe, as Regel did, that the name *Hypocyrtia brevicalyx* has no standing beyond referring to a horticultural novelty.

11. *Pearcea intermedia* L.P. Kvist & L.E. Skog, new species

FIGURES 7, 20g

Differt a *P. sprucei* (Rusby) L.P. Kvist & L.E. Skog foliis ovatis glabris pagina superioribus flavi-viridibus reticulatis ordinatis, a *P. schimpffii* Mansfeld corollis subventricosis differt.

Stems frequently decumbent, to 50 cm long, basal diameter to 4 mm, apparently unbranched but with adventitious roots, basally glabrescent to apically villous (apart from glabrous, violet nodes), trichomes yellow brown with ~10 large, flat cells; internodes 2–5 cm long. Leaves equal in each pair, blades oblique, ovate-elliptic-obovate, 4–10 × 2–5 cm, base obtuse-attenuate-cuneate, apex acute, margin serrate, above with regular pattern of green blotches surrounded by yellow green areas along primary, secondary, and, particularly, reticulate tertiary veins, glabrous, below grayish green, glabrous apart from villous yellow-green veins, lateral veins 8–10 per side; petiole 2.5–4 cm long. Inflorescences of 1–4 flowers, yellow brown, villous; peduncles 0.3–0.8 cm; bracts 2, lanceolate, 15–25 × 3–6 mm; pedicels 2–4 cm long. Floral tube conic,

1.0–1.5 mm long, yellow brown, villous; calyx 7–10 mm long, villous, lobes erect, lanceolate, 5–8 mm long and 2–3 mm wide at base, apex acute-acuminate; corolla 16–20 mm long, tube funnellform, subventricose, 16–18 mm long, diameter 7–12 mm medially and 5–10 mm in throat, outside red, sericeous, inside yellow, occasionally glandular-puberulent, limb with lobes subequal, rotund, 1–2 mm long and 2–4 mm wide at base, inside glandular-puberulent and with darker dots, apex obtuse-truncate; stamens subincluded, filaments 13–18 mm long, glabrous basally to pubescent medially and glandular-puberulent apically, anthers $\sim 2 \times 1.5$ mm; staminode 1–3 mm long; nectariferous disk of 5 glands, all ~ 0.8 mm high and 0.8 mm wide at base; ovary $\sim 3/4$ inferior, 3–4 mm long, diameter 2–3 mm, sericeous, style subincluded, 14–18 mm long, glandular-puberulent, stigma stomatomorphic. Fruits and seeds not seen.

TYPE.—ECUADOR. *Napo*: Baeza-Tena road, km 40, 1900 m, 29 Mar 1979, *Løjtnant & Molau 11494* (AAU, holotype; GB, isotype).

ETYMOLOGY.—The specific epithet refers to this species' leaves being similar to those of the urceolate-flowered *P. schimpfii* but having funnellform corollas similar to those found in the majority of *Pearcea* species.

DISTRIBUTION.—*Pearcea intermedia* is known from the region near Baeza on the northeastern Ecuadorian Andean slopes, between 1700 m and 1900 m elevation (Figure 7).

OTHER COLLECTIONS.—ECUADOR. *Napo*: Baeza-Tena road, S slope of Cordillera de Guacamayos above Jondachi, *Harling & Andersson 16357* (GB, US); Baeza-Tena, *Holm-Nielsen et al. 16277* (AAU); *Napo-Lago Agrio* road, *Kvist 60386* (AAU, QCA, US); Baeza-Lago Agrio road, km 16, Santa Rosa, *MacBryde 720* (US); road to Tena, km 45 from N, *Webster 23238* (DAV, US); Baeza-Lago Agrio road, km 46, *Wiehler & Masterson 79300* (SEL). Total of seven collections seen.

DISTINGUISHING FEATURES.—The subventricose corollas of *Pearcea intermedia* are similar to those of several other *Pearcea* species, e.g., the common *P. sprucei*. Vegetatively, the species is strikingly similar to *P. schimpfii*, which, however, differs by having urceolate rather than subventricose corollas. Both species have ovate, glabrous leaves with a reticulate yellow green pattern surrounding green blotches on the upper surface, and the trichomes of the stem apex and inflorescences in both consist of unusually large, flat cells. *Pearcea schimpfii* has also been collected in the province of Napo, but in different parts of that province (Figure 7) and at different altitudes.

12. *Pearcea purpurea* (Poeppig) L.P. Kvist & L.E. Skog, new combination

FIGURE 12

Rhytidophyllum purpureum Poeppig, 1840:6, pl. 206 ["Rytidophyllum"]. *Moussonia purpurea* (Poeppig) Hanstein, 1865:289. *Isoloma purpureum* (Poeppig) Benthham, 1876:1002. *Parakohleria purpurea* (Poeppig) Wiehler, 1978:8. [Type: Peru, Huánuco, Cuchero, *Poeppig 1632* (w, holotype; BM, F, G, P, W (3), isotypes).]

Rhytidophyllum melastoma Poeppig, 1840:7 ["Rytidophyllum"]. *Moussonia melastoma* (Poeppig) Hanstein, 1865:288. *Kohleria melastoma* (Poeppig) Cuatrecasas, 1935:258 [reprint p. 55]. *Parakohleria melastoma* (Poeppig) Wiehler, 1978:8. [Type: Peru, Huánuco, Pampayaco, *Poeppig 1239* (w, holotype)].

Kohleria weberbaueri Fritsch, 1913:430. *Parakohleria weberbaueri* (Fritsch) Wiehler, 1978:10. [Type: Peru, Junín, Tarma, E of Huacapistana, *Weberbauer 2109* (B, holotype, no longer extant; MOL, lectotype, selected herein).]

Stems 40–100 cm long, occasionally branched, grayish villous. Leaves nearly equal in each pair, blades ovate, less commonly lanceolate, 4–15(–22) \times 2–8 cm, margin serrulate, above dull green, velutinous, less commonly hirsute, below grayish green, velutinous, veins pilose-villous below. Inflorescences with (2–)5–12(–16) flowers, grayish green to purplish, villous; peduncles 3–10 cm long; bracts 2–4(–6), lanceolate, 2 lowest 0.5–1.5 cm long, others smaller; pedicels 0.5–2.5 cm. Floral tube grayish green, villous; calyx lobes usually reflexed, ovate, rarely erect, lanceolate, 2–6 mm long; corolla 15–22 mm long, tube funnellform, subventricose, diameter 7–12 mm medially and 3–9 mm in throat, red, outside pilose-sericeous, inside glandular-puberulent, lobes 2–3 mm long, 2 upper lobes red, 3 lower lobes yellow with brown area near margin or brown dots centrally; filaments glabrous; style glandular-puberulent and/or puberulent. Capsule subglobose, 4–6 mm long, diameter 4–5 mm; seeds ovoid, ~ 0.5 mm long, brown black, striate.

DISTRIBUTION.—*Pearcea purpurea* occurs in central Peru, where most collections come from the department of Huánuco, fewer from Pasco, two from Junín and one from San Martín (Figure 12). It has been found at 600–2400 m elevation.

REPRESENTATIVE COLLECTIONS.—PERU. *Junín*: Tarma-Chanchamayo border, 45 km S of San Ramón, Río Tulumayo drainage, Rundayacu, *Foster & Smith 9161* (F, MO, US). *Huánuco*: Tingo María, *Asplund 12073* (S); 5 km S of Tingo María, *Schunke V. 3262* (COL, F, G, US, USM); Tingo María-Huánuco road, km 8, *Skog et al. 5147* (US, USM). *Pasco*: 30 km SW of Oxapampa, Río Paucartambo, *Madison 955* (F, GH); SW of Oxapampa on road to Maria Teresa and Llaupi, *Foster 7602* (F, MO, US, USM); Oxapampa-Villa Rica road, km 7 SE from Miraflores crest, *Foster 9112* (F, MO, US). *San Martín*: *Infantes 5524* (HBG). *Department Unknown*: *Matthews 150* (FI-W, G, P (2)), *2012* (BM, CGE, E, K (2)). Total of 33 collections seen.

DISTINGUISHING FEATURES.—*Pearcea purpurea* is most similar to *P. reticulata* and to some populations of *P. sprucei* that also have inflorescences with peduncles several times longer than the pedicels. Both differ from *P. purpurea* by having a sericeous rather than a villous indumentum on the inflorescences as well as on the veins of the lower leaf surfaces. Although some populations of *P. sprucei* have a villous indumentum, these have peduncles only to 2 cm long (see "Variation," in *P. sprucei*). The corollas of *Pearcea purpurea* are notable for their contrasting upper red lobes and the three lower yellow lobes with brown areas either near the margin or centrally.

VARIATION.—The type collection of *Pearcea purpurea* has lanceolate leaves instead of the ovate leaves usually found in this species, but the type is otherwise similar to the specimens of the bulk of the collections. Only the collections of Matthews have similar lanceolate leaves.

Specimens from the department of Pasco (e.g., *Foster 9112*) often have lanceolate calyx lobes similar to those of *P. sprucei* but have villous stems and inflorescences as in other specimens of *P. purpurea*, as well as the brown area on the three lower corolla lobes. This variation probably reflects introgression between *P. purpurea* and *P. sprucei* (see "Variation," preceding key).

NOMENCLATURE AND TYPIFICATION.—Wiehler (1978) selected a neotype for *Kohleria weberbaueri* because, at that time, no additional specimens of the type, *Weberbauer 2109*, had been found to lectotypify the species. Recently, a duplicate of the type was discovered at MOL. This specimen of *Weberbauer 2109* is selected as lectotype and supersedes the neotypification.

13. *Pearcea reticulata* (Fritsch) L.P. Kvist & L.E. Skog, new combination

FIGURES 10, 19

Kohleria reticulata Fritsch, 1913:428. [Type: Ecuador, Tungurahua, Baños, *Spruce 5841* (w, holotype; BM, CGE, E, G, K, NY, P, WAG, isotypes).]

Stems to 150 cm long, frequently branched, yellow green, apically sericeous-lanate. Leaves nearly equal in each pair, blades ovate-lanceolate, 9–19 × 4–7 cm, margin serrulate, above dull green, hirsute, below lighter green, pilose, primary, secondary, as well as tertiary veins sericeous and distinctly yellowish. Inflorescences with 5–12(–20) flowers, yellow green, sericeous-lanate; peduncles 4–15 cm long; bracts usually 6, ovate-lanceolate, 2 lowest 0.5–2.5 cm long, others smaller; pedicels 0.5–2.5 cm long. Floral tube yellow green, villous; calyx lobes ovate, 3–4(–6) mm long and 3–4 mm wide, sericeous; corolla (17–)20–25 mm long, tube funnelform, subventricose, diameter (7–)12–17 mm medially and 5–11 mm in throat, red, outside villous, inside glandular-puberulent, lobes 2–3 mm long, yellow with darker dots (see photograph in Kvist, 1991:16); filaments glabrous; style puberulent. Capsule broadly globose, 3–5 mm long, diameter 4–6 mm; seeds broadly ellipsoid, ~0.5 mm long, black, striate.

DISTRIBUTION.—*Pearcea reticulata* occurs on the eastern Andean slopes of Ecuador and in the adjacent Colombian department of Putumayo (Figure 10). The species is common in the Río Pastaza valley of Ecuador, where it often grows in secondary vegetation (pers. obs.), but it appears to be much rarer both to the south and to the north. Only the two cited collections are known from Colombia. *Pearcea reticulata* has been collected at 500–1600 m elevation but is usually found at 900–1400 m.

REPRESENTATIVE COLLECTIONS.—COLOMBIA. *Putumayo*: Between Mocoa and Sachamates, *Cuatrecasas 11402* (COL, F,

US); Mocoa, *Schultes & Smith 2054* (COL, F, GH, US).

ECUADOR. *Morona-Santiago*: Sangai National Park, km 17 N of Macas, *Bohlin et al. 1485* (GB). *Napo*: Baeza-Lago Agrio, km 49, *Balslev & Madsen 10284* (AAU, F, MO, NY, SEL (2)). *Pastaza*: Mera, *Lugo S. 1125* (GB, SEL); Baños-Mera trail, *Mexía 6824* (F, UC, US). *Tungurahua*: Trail between Machay and Río Mapoto, *Penland & Summers 112* (F, GH, US); Río Negro, *Harling & Andersson 17238* (GB, US); *Pastaza* valley, *Kvist 60315* (AAU, COL, GB, MO, NY, QCA, QCNE, US). Total of 53 collections seen.

DISTINGUISHING FEATURES.—The long peduncles distinguish *Pearcea reticulata* from all other species except *P. grandifolia* from northern Peru, *P. purpurea* from central Peru, and populations of *P. sprucei* found in southern Peru and Bolivia and in the department of Caquetá in Colombia. *Pearcea grandifolia* (Figure 18) differs from *P. reticulata* (Figure 19) by having much larger leaves, *P. purpurea* differs by having smaller flowers and having generally a grayish green rather than a yellow green indumentum, and *P. sprucei* differs by having lanceolate calyx lobes rather than ovate lobes. Plants of *P. reticulata* are usually taller and stouter than any other sympatric species, and its size combined with the conspicuous yellow green indumentum distinguishes the species even vegetatively.

VARIATION.—*Pearcea reticulata* specimens from the Río Pastaza valley in Ecuador cannot be confused with any other species of *Pearcea*. To the north and to the south, however, the specimens of *P. reticulata* gradually become more similar to *P. sprucei* and have smaller flowers, shorter peduncles, and a sparser, but yellow green, indumentum. These specimens are nevertheless distinct from *P. sprucei* (see "Variation," preceding key).

Acosta-Solís 7432 is a remarkable collection with inflorescences and calyces typical for *Pearcea reticulata* but with flowers 3–3.5 cm long, similar to those found in *Kohleria hirsuta* (Kunth) Regel. The plant appears to be an intergeneric hybrid between those two species. In Ecuador *K. hirsuta* has so far been collected only a few times in the province of Morona-Santiago (Kvist and Skog, 1992). The exact provenance of *Acosta-Solís 7432* is unclear, but the specimen comes either from Morona-Santiago or from Zamora-Chinchipe further to the south.

Wiehler (1976) reported that he hybridized *Kohleria reticulata* with *Kohleria hirsuta*. We have not seen material of the collection he used for this cross, but it came from the Río Pastaza valley near Baños where *Pearcea reticulata* is very common, and it is consequently very likely that it actually was this species that he crossed with *Kohleria hirsuta*. He reported zero percent pollen stainability, indicating the hybrid was completely sterile (he also reported zero percent pollen stainability for a hybrid between *Parakohleria weberbaueri* (apparently *Pearcea sprucei* var. *parviflora*) and *Kohleria spicata*). Later (Wiehler, 1983) he established a generic name, × *Paleria*, for hybrids between *Parakohleria* and *Kohleria*.

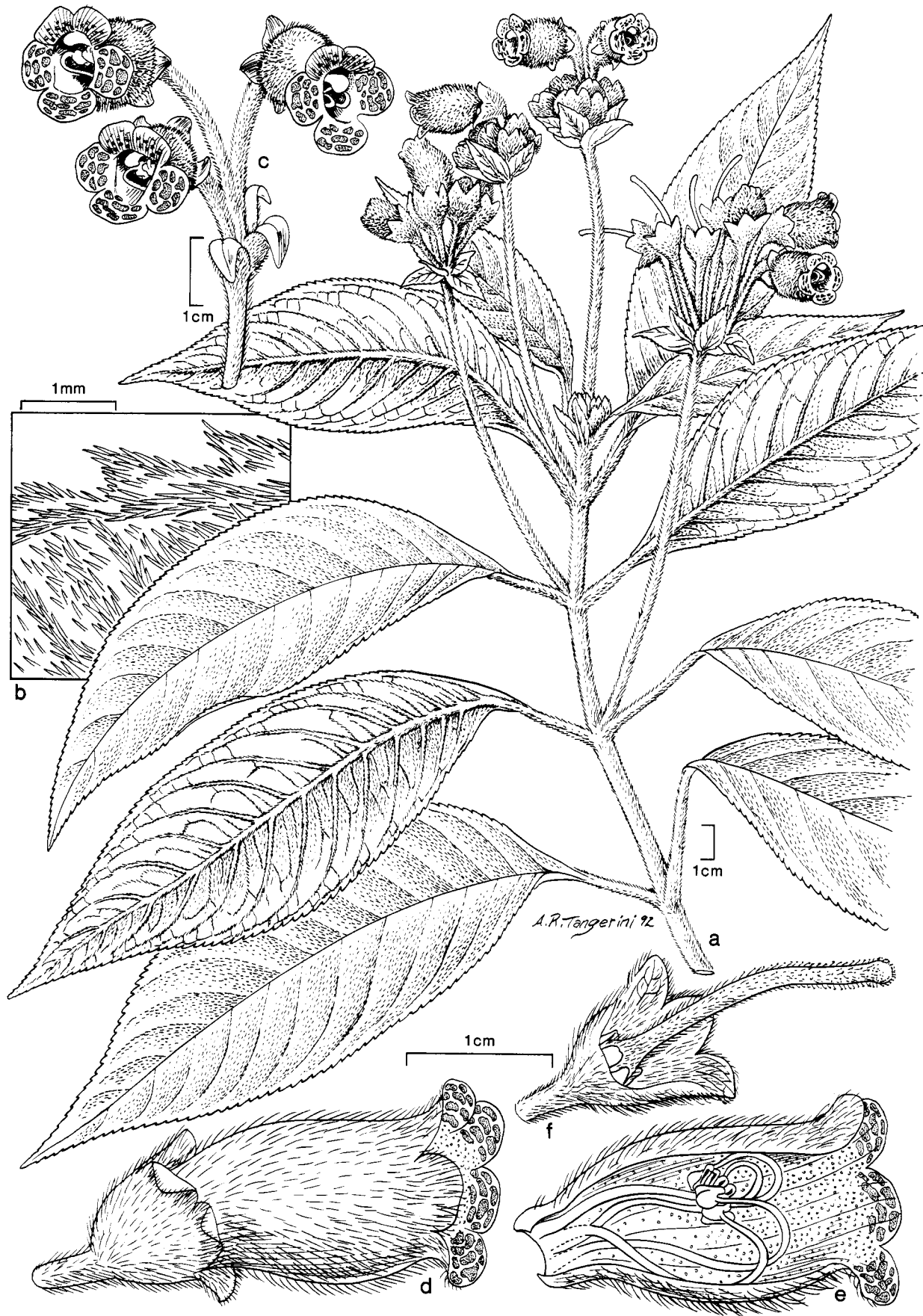


FIGURE 19 (opposite page).—*Pearcea reticulata*: a, habit and inflorescences; b, indument of lower leaf surface; c, inflorescence; d, lateral view of flower; e, laterally opened corolla showing androecium; f, calyx, nectary, and gynoecium (front calyx lobes removed). a, b from Harling 3197 (S); c–f from Dodson & Thien 1926 (WIS).

14. *Pearcea rhodotricha* (Cuatrecasas) L.P. Kvist & L.E. Skog, new combination

FIGURES 3c, 8

Diastema rhodotrichum Cuatrecasas, 1935:252 [reprint p. 49], pl. 20. *Parakohleria rhodotricha* (Cuatrecasas) Wiehler, 1978:7, 8, pl. 1C. [Type: Ecuador, Napo, E Santa Rosa ad Cotapino, Isern 496 (MA, lectotype).]

Stems to 50 cm long, unbranched, villous with 3–5 mm long brown red trichomes. Leaves frequently subequal to unequal in pairs, blades ovate, rarely lanceolate, 6–12(–18) × 2–6(–8) cm, margin serrate, with conspicuous 3–5 mm long trichomes, above dull green, appressed pilose, below yellow green to purple, pilose. Inflorescences of (1–)4–8(–12) flowers, purple-villous; peduncles 0.5–3 cm long, occasionally absent; bracts lanceolate, less commonly ovate, 5–8(–12) mm long; pedicels 1.5–2.5 cm. Calyx purple, villous, lobes lanceolate, 3–7 mm long; corolla 11–15 mm long, tube funnelliform, subventricose to ventricose, diameter 5–6 mm medially and 3–4 mm in throat, red and usually black on the upper ~5 mm including limb, rarely entirely red, outside villous, inside sparsely to densely glandular-puberulent, lobes 1–1.5 mm long, usually black; filaments 8–10 mm long, puberulent, rarely nearly glabrous; style 8–11 mm long, puberulent and glandular-puberulent. Capsule globose, ~3 mm long, diameter ~3 mm; seeds subglobose, ~0.3 mm long, black, striate.

DISTRIBUTION.—*Pearcea rhodotricha* is known from areas below 600 m elevation in the Ecuadorian Amazon region. Most of the collections have been made near the Napo and Bobonaza rivers (Figure 8).

REPRESENTATIVE COLLECTIONS.—ECUADOR. *Napo*: Puerto Misahualli, Besse et al. 68 (QCA, SEL); San José, Isern 596 (MA); Lago Agrio, Lugo S. 3147 (GB, SEL); Lago Agrio-El Chaco road, Lugo S. 3503 (GB, SEL); Lago Agrio-Baeza road, km 16, Santa Cecilia, Lugo S. 3562 (GB, SEL); new road toward Río Arajuno, Neill 6556 (US). *Pastaza*: Río Bobonaza, 8 km NW of Sarayacu, Lugo S. 5327 (GB, US); Río Bobonaza, Spruce 4962 (BM, K (2), W). Total of 24 collections seen.

DISTINGUISHING FEATURES.—*Pearcea rhodotricha* is easily distinguished from all other *Pearcea* species by having leaf margins with conspicuous trichomes to 5 mm long. Other characteristic features are the ovate, serrate leaves, the purple-villous indumentum of stems and inflorescences, and the red and apically black corollas (see illustration in Ertelt, 1991:21).

VARIATION.—Two collections (Lugo S. 3503, 3562) from Napo Province differ from other specimens of *Pearcea rhodotricha* by having lanceolate instead of ovate leaves and by

having red rather than red/black corollas. A third collection (Lugo S. 3147) has ovate leaves and entirely red corollas. These plants, however, are considered as variants of *Pearcea rhodotricha* because they are similar in other aspects, e.g., by having conspicuous trichomes on the leaf margins.

A collection (Hirtz et al. 3116) from the province of Morona-Santiago in southern Ecuador has characters intermediate between *Pearcea rhodotricha* (e.g., similar although shorter trichomes and a similar leaf shape and inflorescence) and *P. sprucei* (e.g., rugose leaves and flowers without a black apex). Because this intermediate collection was made 200 km south of the southernmost previously known occurrence of *P. rhodotricha* and at 1500 m elevation, whereas *P. rhodotricha* has so far never been collected above 700 m, this collection may represent a new species.

15. *Pearcea schimpffii* Mansfeld

FIGURES 7, 20a–f

Pearcea schimpffii Mansfeld, 1936:149. *Parakohleria schimpffii* (Mansfeld) Wiehler, 1978:9. [Type: Ecuador, Pastaza, W of Mera, Schimpff 704 (B, holotype, no longer extant; GH, lectotype selected by Wiehler (1978); G. M. MO. TRT, isolectotypes).]

Terrestrial or epilithic stems to 70(–100) cm long, glabrous to pilose near apex, trichomes yellow brown, of ~10 large, flat cells. Leaves usually nearly equal in each pair, blades elliptic, less commonly lanceolate, 4–12 × 2–6 cm, margin serrate, upper surface often with conspicuous, regular pattern of green blotches surrounded by reticulate yellow green areas, glabrous. Inflorescences of 1–3(–5) flowers, yellow brown to purple, villous; peduncles 0–2 cm long; bracts lanceolate, 7–15 mm long; pedicels 1–2.5 cm. Floral tube yellow brown, villous; calyx lobes erect, ovate, 3–8 mm long; corolla urceolate, 15–22 mm long, tube diameter 8–17 mm medially and 2–3 mm in throat, red to orange red, outside sericeous-villous, inside densely puberulent and often glandular-puberulent, lobes 1.5–2.0 mm long, red; stamens included, filaments 9–18 mm long, puberulent and often glandular-puberulent; style included, 8–12 mm long, densely puberulent and glandular-puberulent, stigma weakly bilobed. Capsule subglobose, ~4 mm long, diameter ~5 mm; seeds not seen.

DISTRIBUTION.—*Pearcea schimpffii* is known only from a small area between 1100 m and 1500 m elevation on the eastern Andean slopes in Ecuador (Figure 7). Most collections come from the Río Pastaza valley, where the species was observed growing on shady, humid cliffs along streams in forest-covered ravines (Kvist 60319).

REPRESENTATIVE COLLECTIONS.—ECUADOR. *Morona-Santiago*: 27 km SE of San Juan Bosco, Gentry et al. 30921 (MO, SEL). *Napo*: Hollín-Loreto road, km 17, Hurtado & Shiguango 1638 (US), 1751 (MO). *Pastaza*: Mera, sandy shore of Río Mangayacu, Asplund 18673 (S); Colonia Játiva, 7 km N of Mera, Harling & Andersson 16916 (GB, US). *Tungurahua*: Pastaza valley between Baños and Cashuroc, Hitchcock

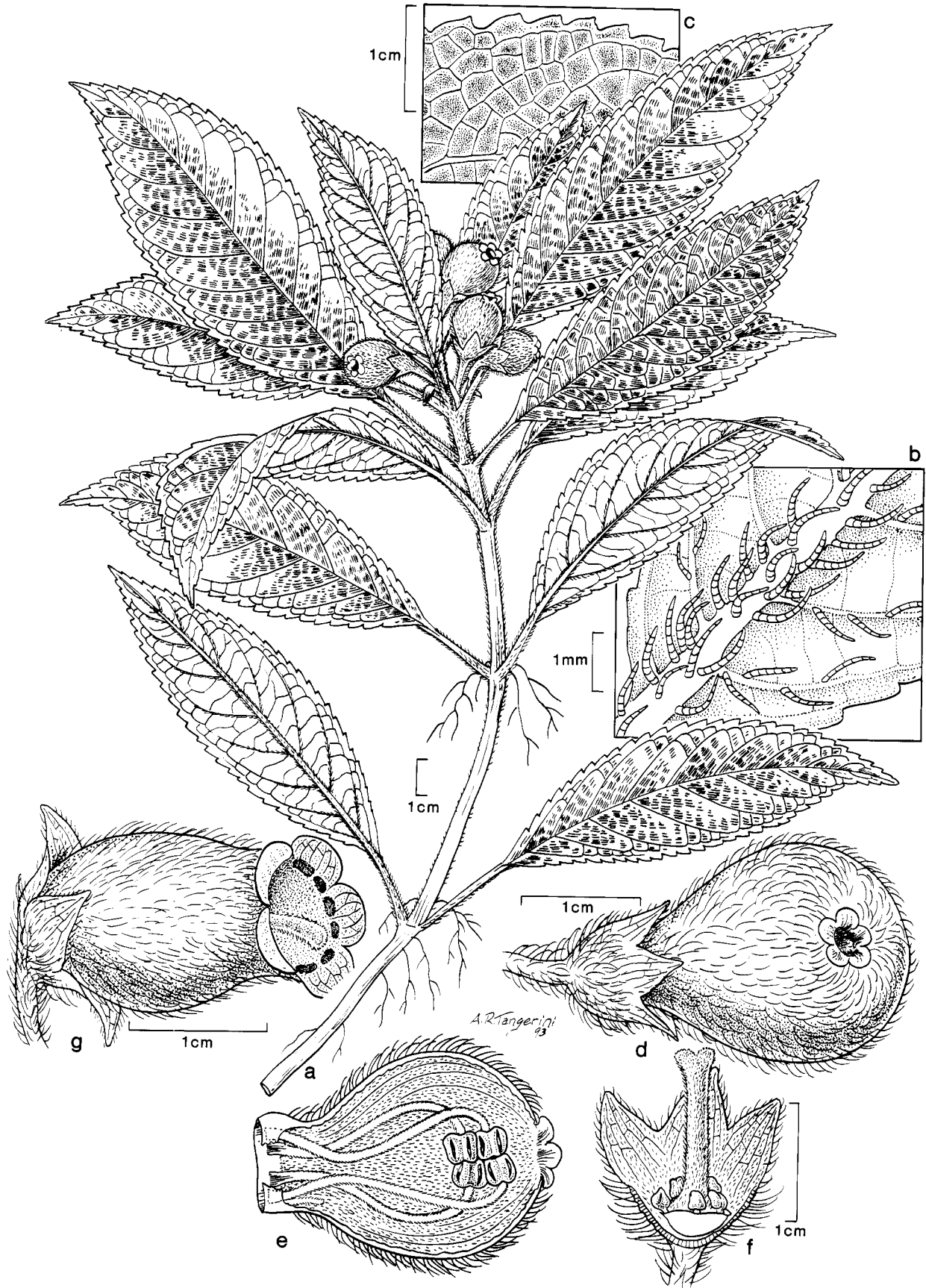


FIGURE 20 (opposite page).—*Pearcea schimpffii*: a, habit and inflorescences; b, indument of lower leaf surface; c, upper leaf surface; d, flower; e, laterally opened flower showing androecium; f, calyx, nectary, and gynoecium (front calyx lobes removed). *Pearcea intermedia*: g, flower. a–c from Asplund 18673 (S); d–f from Lugo 417 (GB); g from Harling & Andersson 16357 (GB).

21852 (GH, NY, US); Pastaza valley, *Kvist 60319* (AAU, NY, QCA, QCNE, US). Total of 20 collections seen.

DISTINGUISHING FEATURES.—The combination of urceolate corollas and adaxially glabrous, serrate leaves distinguishes *Pearcea schimpffii* (Figure 20a–f; illustration in Kvist, 1991:21) from all other species. *Pearcea intermedia* has similar vegetative characters but has ventricose corollas (Figure 20g).

NOTES.—Mansfeld (1936) named the species for Heinrich Schimpff who collected in South America in the 1920s and 1930s. Unfortunately, Mansfeld misspelled Schimpff's name, which he had spelled correctly when he honored the same collector with a species of *Columnea* in 1934.

16. *Pearcea sprucei* (Britton) L.P. Kvist & L.E. Skog, new combination

FIGURES 6, 21

Isoloma sprucei Britton, 1896:97. [Type: Bolivia, La Paz, Mapiri, *Bang 1541* (NY, holotype; BM, E, F, G (2), GH (2), K, NY, PH, US (2), isotypes).]

Stems 30–100(–150) cm long, rarely to frequently branched, yellow green or purplish, sericeous, rarely villous. Leaves equal to subequal in each pair, blades weakly to conspicuously oblique, lanceolate, less commonly ovate, elliptic or oblanceolate, (2–)5–12(–16) × (1–)2–4(–6) cm, base usually attenuate, less commonly obtuse or cuneate, margin serrulate, rarely serrate, apex acute to acuminate, often rugose, above dark green to purplish, often with conspicuous primary and secondary veins, velutinous, pilose or hirsute, rarely nearly glabrous, below often purple, velutinous-pilose with sericeous veins. Inflorescences with 1–8(–18) flowers, sericeous, less commonly villous; peduncles 1–2(–9) cm long, rarely epedunculate; bracts 2(–6), lanceolate or ovate, 2 lowest 0.5–2 cm long, other bracts smaller; pedicels (0.5–)1.5–2.5 (–4.5) cm long. Floral tube villous; calyx lobes erect or less commonly reflexed, lanceolate, less commonly subulate, rarely ovate, (2–)5–11 mm long; corolla (12–)15–23 mm long, tube funnellform, subventricose, diameter 6–11 mm medially and 4–10 mm in throat, red, often yellow ventrally and basally, rarely entirely yellow, outside pilose-villous, inside occasionally sparsely glandular-puberulent, lobes 1.5–3 mm long, often yellow with red purple dots, rarely entirely red; filaments glabrous, rarely sparsely puberulent; style often puberulent and/or glandular-puberulent, rarely glabrous. Capsule subglobose, 3–5 mm long, diameter 3–7 mm; seeds ovoid, 0.5–0.7 mm long, brown black, striate.

DISTRIBUTION.—*Pearcea sprucei* is by far the most widespread and common species in the genus ranging along the eastern Andean slopes from the southern Colombian department of Caquetá to the department of Cochabamba in Bolivia (Figure 6). It is the sole member of the genus extending into the inter-Andean valleys, to the western slopes of southern Ecuador, and to the upper Río Magdalena watershed in the department of Huila in southern Colombia. Here, however, *P. sprucei* has only been collected at 2000 m elevation, close to the ridge of the eastern Colombian Cordillera that separates the Río Magdalena watershed from the Amazon basin. The range of *P. sprucei* is nearly identical to the range of the entire genus (Figures 4, 6), and consequently *P. sprucei* is sympatric with nearly all other *Pearcea* species (Figures 7–12). Only *P. abunda* seems also to occur in areas where *P. sprucei* has not yet been found, because this species ranges considerably farther to the east in Amazonian lowland rainforest (Figure 11), whereas *P. sprucei* is restricted to more humid lowland rainforest along Andean slopes (Figure 6).

Most collections of *Pearcea sprucei* come from the provinces of Napo and Pastaza in eastern Ecuador (Figure 6). In Peru, most collections come from the region near Tingo María in the department of Huánuco, from the adjacent northwestern part of Ucayali, and from Cuzco farther to the south. *Pearcea sprucei*, however, as well as the entire genus, seems rare or rarely collected in northern Peru (Figures 4–6).

On the western Andean slopes of Ecuador, *P. sprucei* has been found in the southern and central provinces of Chimborazo, Cañar, and El Oro (Figure 6), but not north to Pichincha, Imbabura, or Carchi. The species may have spread from the eastern to the western Andean slopes fairly recently and may not yet have reached the extensive humid forests farther to the north. Collections of *P. sprucei* from the inter-Andean valleys of the south-central provinces of Cañar and Azuay (Figure 6) strongly suggest that the dispersal across the Andes occurred here. This also is likely because the Andean Cordilleras are lower here and are less of a barrier than in northern Ecuador.

Pearcea sprucei has been collected at 300–2800 m elevation but seems rare above 2000 m. While collecting on the eastern Andean slopes along the border of Ecuador and Colombia, we encountered the first *P. sprucei* populations at 2300 m (*Kvist 60251*). Herbarium studies provided evidence that 2300 m is usually the upper limit throughout much of its range. The highest records of *P. sprucei* are from Ecuador and come from 2600 m and 2800 m elevation from the western Andean slopes and inter-Andean valleys, respectively.

DISTINGUISHING FEATURES.—Most *Pearcea sprucei* collections, particularly those from Ecuador and central Peru, are easily recognized by having most of the following characters: leaves lanceolate with a conspicuous and often pilose indumentum, blades more or less rugose, with conspicuous secondary veins, dark green upper surfaces and purplish lower surfaces, inflorescences also purplish and covered with an appressed indumentum, and peduncles shorter than pedicels.

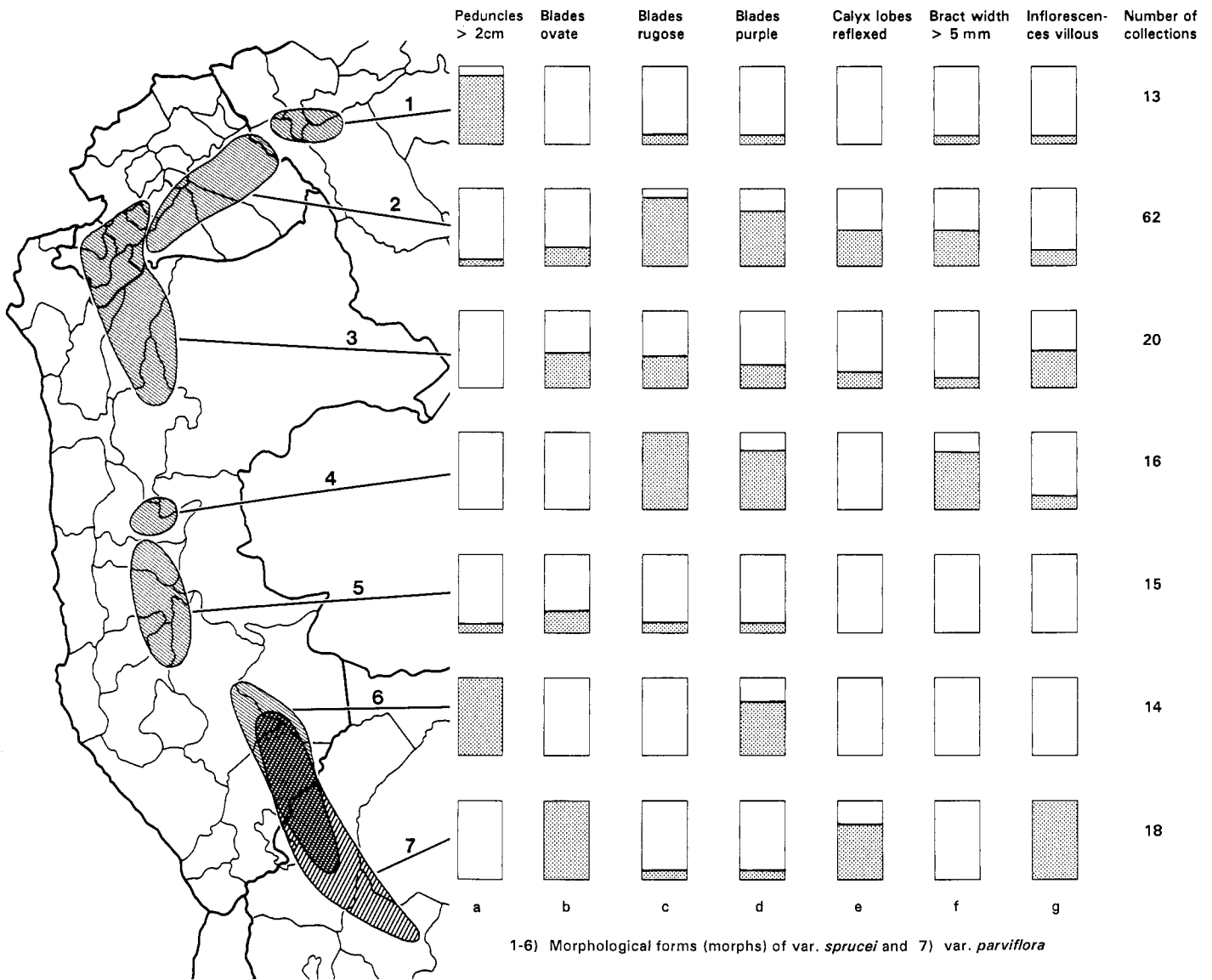


FIGURE 21.—Frequencies of 7 characters in 7 morphological forms of *Pearcea sprucei*. 1-6 show var. *sprucei*; 7 shows var. *parviflora*. Amount of hatching in each rectangle is relative to frequency of character state in each morph: a, presence of peduncles longer than 2 cm; b, leaves with ovate blades; c, leaves with rugose blades; d, leaves with purple-colored blades particularly on lower surface; e, calyx lobes reflexed (rather than erect); f, inflorescences in which largest bracts are more than 5 mm wide; g, inflorescences, stems, and veins of the lower leaf surface with patent, usually villous indumentum rather than appressed and usually sericeous indumentum.

Populations of *Pearcea sprucei*, however, may be confused with several other species because specimens may have only some of the above-mentioned attributes. Short-peduncled *P. sprucei* populations may be confused with species such as *P. hispidissima*, *P. rhodotricha*, and particularly *P. strigosa* (see those species). In most cases apparent reasons for the similarity may include hybridization and introgression (see "Variation," preceding key).

Long-peduncled populations of *Pearcea sprucei* also may be

confused with *P. purpurea* and *P. reticulata*, which both develop peduncles more than 5 cm long and longer than the pedicels, but they differ from *P. sprucei* by having ovate rather than lanceolate calyx lobes and in several other characters. In addition, they are not sympatric with the long-peduncled populations of *P. sprucei*, which are found in Colombia, Bolivia, and nearby Peru (Figure 21a), whereas *P. purpurea* (Figure 12) and *P. reticulata* (Figure 10) occur in central Peru and Ecuador, respectively. Unfortunately, both species

may hybridize with *P. sprucei*, causing identification problems in both Ecuador and Peru (see *P. purpurea*, *P. reticulata*, and "Variation," preceding key).

VARIATION.—*Pearcea sprucei* is extremely variable, particularly in the vegetative characters, although the obvious and even the more subtle details of the corolla characters remain fairly stable throughout. Apparent reasons for the vegetative variation are discussed herein (see "Variation," preceding key).

Populations from upper montane forests and cloud forests often have shorter stems and internodes, smaller leaves, and a denser and more villous indumentum. The latitudinal and longitudinal variation, however, is much more pronounced than the altitudinal variation.

Figure 21 illustrates the frequencies of different characters throughout the range of *Pearcea sprucei*. Seven morphologically distinctive forms or morphs are recognized (numbered 1 to 7). In some areas these morphs are separated by natural barriers, such as mountain ranges higher than ~2500 m, e.g., in central Peru (morphs 4 and 5 and morphs 5 and 6). In other areas there is no obvious physical barrier, e.g., between Colombia and northern Ecuador (morphs 1 and 2), and in southern Ecuador (morphs 2 and 3). In both these areas the transitions seem more gradual. In addition, the plants in southern and western Ecuador and in northern Peru (morph 3) are less distinctive as a group than are the other six morphs shown in Figure 21.

In Bolivia and southern Peru there are two sympatric *Pearcea sprucei* morphological forms (morphs 6 and 7 in Figure 21). Britton (1896) and Rusby (1896) described these as *Isoloma sprucei* and *Isoloma parviflorum*, respectively. This was quite understandable because the morphs appear to be consistently distinct in Bolivia; the former (morph 6) has long peduncles, a sparse indumentum, and lanceolate blades, and the latter (morph 7) has short peduncles, a villous indumentum, and ovate blades. Herein they are treated as varieties (Figure 6) because the morphs are distinct in Bolivia but not farther to the north in central Peru, and because all the attributes that characterize them also can be found in other *P. sprucei* morphological forms, e.g., pedunculate inflorescences in Colombia (shared between morphs 1 and 6 in Figure 21) and ovate leaves, particularly in southern Ecuador (shared between morphs 3 and 7).

NOMENCLATURE AND TYPIIFICATION.—*Isoloma sprucei* and *Isoloma parviflorum* were described in 1896 in the same publication by Rusby and by Britton, respectively. Both were based on "atypical" *Pearcea sprucei* collections. Intermediate specimens are found to the north in Peru (Figure 21). There are consequently neither nomenclatural nor taxonomic arguments to decide which is the more appropriate epithet to use for the most common species in the genus *Pearcea*. We have selected *P. sprucei* because this epithet has been used most frequently in identifying collections of this species from Ecuador and Peru.

16a. *Pearcea sprucei* var. *parviflora* (Rusby) L.P. Kvist & L.E. Skog, new status

FIGURES 6, 21

Isoloma parviflorum Rusby, 1896:97. *Diastema parviflorum* (Rusby) Fritsch, 1913:406.—Hoehne, 1970:175, pl. 87. *Parakohleria parviflora* (Rusby) Wiehler, 1978:8. [Type: Bolivia, La Paz, Mapiri, *Bang* 1563A (NY, holotype), duplicates distributed as *Bang* 1565 (G, GH (2), K, MO, NY, US (2), isotypes).]

Isoloma patentipilosum O. Kuntze, 1898:242. *Kohleria patentipilosa* (O. Kuntze) Schumann, 1900:386. [Type: Bolivia, Cochabamba(?), Yungas, *Kuntze s.n.* (NY, holotype).]

Isoloma flexuosum Rusby, 1900:28. [Type: Bolivia, Cochabamba(?), Yungas, *Rusby* 2424 (NY, holotype; US, isotype).]

Isoloma urticifolium Rusby, 1900:28. *Kohleria urticifolia* (Rusby) Fritsch, 1913:430. [Type: Bolivia, La Paz, Mapiri, *Rusby* 2422 (NY, holotype; BM, GH, K, NY (3), PH, US (2), WIS, isotypes).]

Diastema galeopsis Fritsch, 1913:405. [Type: Bolivia, Cochabamba(?), Yungas, *Bang* 544 (NY, lectotype selected by Wiehler, 1978; BM, E, F, G, GH, K, PH, US (2), WIS, isoelectotypes).]

Stems frequently branched, villous with white to yellow green trichomes. Leaf blades ovate, (2-)4-10(-15) × 1-5 cm, margin serrate, rarely and only weakly rugose, rarely purplish, veins villous below. Inflorescences with 1-5 flowers, often on short shoots, villous, yellow green to white; the largest bracts to 6 mm wide; peduncles to 2 cm long. Calyx lobes often reflexed, lanceolate; corolla red, 1.5-2.5 cm long, outside villous.

DISTRIBUTION.—*Pearcea sprucei* var. *parviflora* has been collected from southern Peru (Cuzco, Puno) and adjacent Bolivia (Cochabamba, La Paz) (Figure 6). Most collections come from elevations between 500 m and 1000 m, but *Pearcea sprucei* var. *parviflora* has been collected as high as 2300 m elevation.

REPRESENTATIVE COLLECTIONS.—BOLIVIA. *La Paz*: Mapiri region, San Carlos by Sarampium, *Buchtien* 1348 (GH, NY, US (2)); Nor Yungas, 14 km SW of Yolosa-Chuspipata road, km 14, *Solomon et al.* 12085 (US). *Cochabamba*: Chapare, road to Villa Tunari, *Luer et al.* 4902 (SEL).

PERU. *Cuzco*: Quispicanchi, Quincemil-San Lorenzo road, km 3, *Moore et al.* 8576 (BH (2), US); Quispicanchi, between Inambari and Forteleza, *Vargas* 16536 (US). *Puno*: San Gabón along Río Gabón, *Dillon et al.* 1184 (MO, US); vicinity of Sangaban, *Maas et al.* 6079 (USM); Carabaya, Ollachea valley, *Vargas* 16124 (US (2)). Total of 25 collections seen.

DISTINGUISHING FEATURES.—*Pearcea sprucei* var. *parviflora* is distinguished from sympatric var. *sprucei* populations by having a villous indument of whitish trichomes rather than a sericeous indument, particularly on the inflorescences and the veins of the lower leaf surfaces, by having peduncles no more than 2 cm long, ovate leaves with obtuse bases rather than lanceolate leaves with cuneate bases, mostly reflexed rather than erect calyx lobes, and serrate rather than serrulate margins of the leaves. Some high-elevation collections of var. *sprucei* from southern Ecuador are difficult to distinguish from var.

parviflora plants, however. The Ecuadorian plants may have developed these characteristics independently of var. *parviflora* in southern Peru and Bolivia, and we refer them to var. *sprucei*. In contrast to populations of the true var. *parviflora*, the similar Ecuadorian populations are not well separated from sympatric more "typical" *P. sprucei* var. *sprucei* populations, and it is unlikely that the plants have dispersed from Bolivia to Ecuador or vice-versa (see "Ecology," above).

NOMENCLATURE AND TYPIFICATION.—Rusby (1896:97) wrote following the original description of *Isoloma parviflorum* that the type, *Bang 1563A*, was "perhaps partly distributed as 1565," but apparently all duplicates of *Bang 1563A* were distributed as 1565, as no other specimens of the type number have been found.

NOTES.—According to its label, *Luer et al. 4902* was a collection of an epiphytic plant.

16b. *Pearcea sprucei* var. *sprucei*

FIGURES 6, 21

Isoloma sprucei Britton, 1896:97. *Kohleria sprucei* (Britton) Fritsch, 1913:429. *Parakohleria sprucei* (Britton) Wiehler, 1978:9. [Type: Bolivia, La Paz, Mapiiri, *Bang 1541* (NY, holotype; BM, E, F, G (2), GH (2), K, NY, PH, US (2), isotypes).]

Kohleria jamesoniana Fritsch, 1913:429. *Parakohleria jamesoniana* (Fritsch) Wiehler, 1978:6. [Type: Ecuador, Pastaza, Archidona, *Jameson 236* (B, holotype, no longer extant); Ecuador, Napo, Canton Archidona, Hollín-Loreto road, km 17, *Hurtado & Shiguango 1608* (US, neotype, selected herein; MO, isoneotype).]

Kohleria avilana Cuatrecasas, 1935:256 [reprint 1935, p. 53], pl. 22, 23. *Parakohleria avilana* (Cuatrecasas) Wiehler, 1978:5. [Type: Ecuador, Avila, *Isern 169* (MA, holotype; F, MA, isotypes).]

Kohleria baezana Cuatrecasas, 1935:257 [reprint 1935, p. 54]. *Parakohleria baezana* (Cuatrecasas) Wiehler, 1978:6. [Type: Ecuador, Tungurahua or Pastaza, between Baeza and Archidona, *Isern 180* (MA, holotype; F, fragment of holotype).]

Kohleria sancti-josephi Cuatrecasas, 1935:258 [reprint 1935, p. 55]. *Parakohleria sancti-josephi* (Cuatrecasas) Wiehler, 1978:8. [Type: Ecuador, San José, *Isern 504* (MA, holotype).]

Parakohleria vinicolor Wiehler, 1978:9, pl. 1D. [Type: Plants cultivated at the Marie Selby Botanical Gardens, Sarasota, FL, from specimens originally collected as *Moore et al. 8387* in Peru, at Boquerón del Padre Abad between Aguaytía and Divisoria in Ucayali, *Wiehler 75266* (SEL, holotype).]

Stems rarely branched; inflorescences usually sericeous, often purplish, rarely villous with whitish trichomes. Leaf blades usually lanceolate with attenuate base, rarely ovate with obtuse base, frequently rugose and purplish. Inflorescences with 1–8(–18) flowers, mostly sericeous; largest bracts to 12 mm wide. Calyx lobes usually erect, occasionally reflexed.

DISTRIBUTION.—The range of *P. sprucei* var. *sprucei* is nearly identical with the range of the species (Figure 6).

REPRESENTATIVE COLLECTIONS.—BOLIVIA. *La Paz*: Road to Tipuani, *Buchtien 5567* (NY, US), *7487* (US (2)).

COLOMBIA. *Caquetá*: Florencia-Guadalupe road, km 86, *Londoño & Kvist 106* (AAU, COL, TULV, US). *Huila*: Resina, *García-Barriga 18194* (COL, GH, US); Altamira-Florencia road, Rosa Blanca, *Vogel 168* (US). *Putumayo*: San Francisco de Sibundoy, trail to Planada de Minchoy, *Londoño & Lozano 227* (US).

ECUADOR. *Azuay*: Cuenca-Colas de San Pablo highway,

Boeke & Loyola 688 (AAU, NY, SEL, US). *Cañar*: Above Rivera on road to Pindilig, *Harling & Andersson 23024* (GB, QCA, US), *23025* (GB, QCA, US). *Chimbarazo*: Guayllanac, *Acosta-Solis 5284* (F), *5316* (F). *El Oro*: 11 km W of Piñas, *Dodson et al. 9020* (MO, SEL). *Loja*: Loja-Zamora road, km 19, *Harling & Andersson 13640* (GB, SEL). *Morona-Santiago*: Sangai National Park close to Macas, *Kvist 60440* (AAU, COL, GB, MO, NY, QCA, QCNE, US); Gualaceo road, km 17, *Harling & Andersson 12676* (GB, SEL). *Napo*: Baeza-Tena road, Cordillera de Guacamayos, *Kvist 60356* (AAU, COL, GB, MO, NY, QCA, QCNE, US). *Pastaza*: Vicinity of Puyo, *Skutch 4456* (A, F, K, MO, NY, US). *Tungurahua*: Pastaza river valley between Baños and Cashurco, *Hitchcock 21866* (GH, NY, US). *Zamora-Chinchipec*: 10 km S of Zamora on road along Río Jamboe, *Harling & Andersson 24031* (GB, US).

PERU. *Amazonas*: Bagua, Mesones-Muro road below Montenegro, *Hutchison & Wright 3685* (F, K, MO, NY, UC, US, USM). *Ayacucho*: Between Huanta and Río Apurimac, *Estrella, Killip & Smith 23059* (F, NY, US). *Cuzco*: Río Mapituri, tributary to Río Apurimac, *Wasshausen & Encarnación 659* (K, NY, MO, US, USM). *Huánuco*: Leoncío Prado, Divisoria, *Skog et al. 5121* (US, USM). *Junín*: Pichis trail, Porvenir, *Killip & Smith 25926* (F, NY, US). *Loreto*: *Wurdack 2381* (USM). *Madre de Dios*: Inambari, *Chávez A. 1160* (MO). *Pasco*: Cordillera Yanachaga, 8 km E of Oxapampa-Villa Rica road, *Gentry & Smith 35851* (MO, US). *San Martín*: Lamas, Alosa de Alvarado, Cerro Blanco, road to Moyobamba, *Schunke V. 6265* (NY, US). *Ucayali*: Coronel Portillo, Boquerón de Padre Abad, *Schunke V. 3060* (F, G, IBE, MO, NY, US, USM), *3061* (F, G, MO, NY, US, USM). Total of 171 wild collections seen.

DISTINGUISHING FEATURES.—See the discussion of *Pearcea sprucei* var. *parviflora*.

NOMENCLATURE AND TYPIFICATION.—The only species that fits the description of *Kohleria jamesoniana* (Fritsch, 1913) is *Pearcea sprucei*. A collection (*Hurtado et al. 1608*) from the same area and with similar short, reflexed calyx lobes and a similar indumentum has been chosen as a neotype to substitute for the holotype (*Jameson 236*), which is no longer extant.

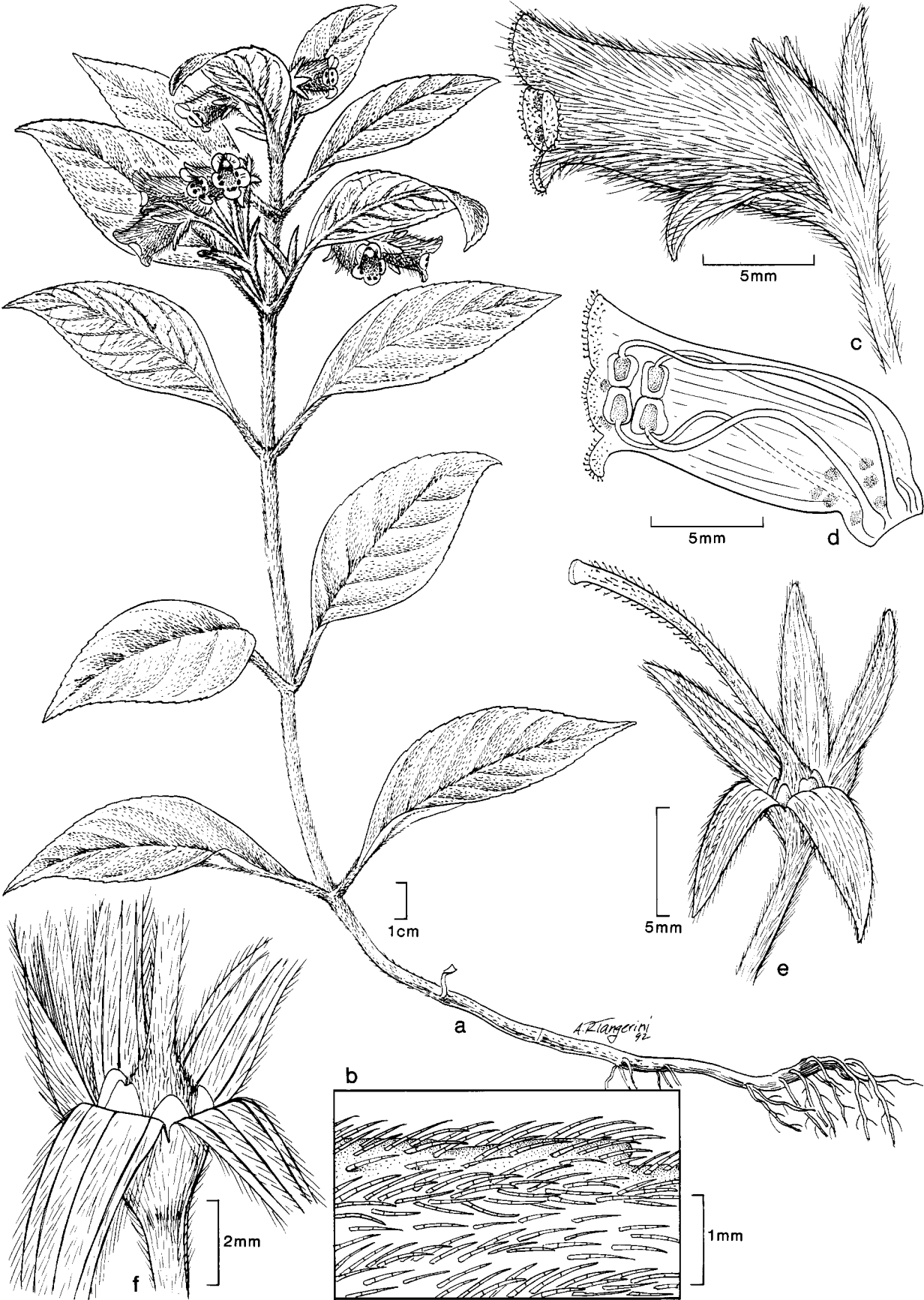
17. *Pearcea strigosa* L.P. Kvist & L.E. Skog, new species

FIGURES 12, 22

Pearceae gracile L.P. Kvist & L.E. Skog affinis, sed pedunculis quam pedicellis brevioribus, lobis calycum 5–12 mm longis, corollis sericeis, trichomatibus ~2 mm trans limbum extensis differt.

Stems often decumbent, 30–80 cm long, basal diameter to 4 mm, occasionally branched, basally pilose to sericeous and yellow green apically; internodes 1–9 cm long. Leaves equal in

FIGURE 22 (opposite page).—*Pearcea strigosa*: a, habit and inflorescences; b, indument of lower leaf surface; c, lateral view of flower; d, laterally opened corolla showing androecium; e, calyx, nectary, and gynoecium; f, enlarged view of calyx, nectary, and gynoecium. a,b from *Rimachi 4976* (US); c–f from *Woytkowski 34523* (UC).



each pair, blades weakly oblique, lanceolate, less commonly elliptic, 4–10 × 1.5–3.5 cm, base cuneate, rarely attenuate, apex acute-acuminate, margin nearly entire or serrulate-undulate, above green, strigose, below (slightly) lighter green, glabrous apart from the sericeous-strigose veins, lateral veins 7–9 per side; petioles 1–4 cm long. Inflorescences of (1–)3–7 flowers in upper leaf axils, yellow green, sericeous; peduncles 0.2–0.8 cm long; bracts 2, lanceolate-subulate, 10–20 × 2–4 mm; pedicels 1–4 cm long. Floral tube conic, 1.5–2.5 mm long, yellow green, sericeous; calyx strigose, 6–13 mm long, lobes erect, lanceolate-subulate, 5–12 mm long and 1–2 mm wide at base, apex acute-acuminate; corolla 14–20 mm long, base saccate, tube funnelform, 12–18 mm long, diameter 4–9 mm medially and 3–9 mm in throat, red, outside sericeous, inside glabrous, limb with lobes subequal, rotund, 1.5–2.5 mm long and 2.5–3.5 mm wide at base, glandular-puberulent at least along margin, apex obtuse-truncate; stamens subincluded, filaments 10–18 mm long, often sparsely glandular-puberulent and puberulent, anthers ~2 × 1.2 mm; staminode 2–3 mm long; nectariferous disc of 5 glands, all ~0.6 mm high and 0.8 mm wide at base; ovary ~²/₃ inferior, 2.5–3.5 mm long, diameter 2–3 mm, sericeous, style subincluded, 12–18 mm long, puberulent, stigma stomatomorphic. Capsule globose, 4–5 mm long, diameter 5–6 mm, splitting into 2 valves from apex to base; seeds irregularly globose, 0.2–0.3 mm long, brown black, striate.

TYPE.—PERU. *Huánuco*: Tingo María-Pucallpa road, La Divisoria, 1600 m, 22 Mar 1980, *Rimachi Y. 4976* (US, holotype; F, IBE, MO, USM, isotypes).

ETYMOLOGY.—The specific epithet refers to the strigose upper leaf surfaces.

DISTRIBUTION.—Most collections of *Pearcea strigosa* have come from along the Tingo María-Pucallpa road close to the border of the departments of Huánuco and Ucayali in Peru (Figure 12). *Pearcea strigosa* occurs at 1500 to 1600 m

elevation on both sides of the ridge known as La Divisoria on the border of the departments. In addition, collections from the department of Cuzco in the south indicate that the species actually may be widespread in the mostly unexplored Peruvian front ranges of the Andes (Figure 12). Only one collection from Cuzco (*Skog & Skog 5209*), however, appears to be pure *P. strigosa*, and the remaining specimens may be the result of introgression with *P. sprucei*. These plants have wider ovate-lanceolate leaves with serrate-serrulate margins but still have a strigose indumentum. They have been collected at 400–1800 m elevation.

OTHER COLLECTIONS.—PERU. *Cuzco*: Quincemil-San Lorenzo road, km 17, *Moore et al. 8584* (BH); Manu National Park, Paucartambo-Manu road between Pillahuata and Milcopata, *Skog & Skog 5209* (US, USM); NE of Cuzco, *Sandeman 3681* (K); Paucartambo, Santa Isabel, *Vargas 5165* (US); Quincemil toward Río Negro, *Vargas 15354* (US); San Pedro-Santa Isabel, *Vargas 16843* (US); Paucartambo, *Vargas 17679* (WIS). *Huánuco*: Near La Divisoria between Tingo María and Pucallpa, *Asplund 12603* (S); La Divisoria, ~1 km from Ucayali, *Gentry et al. 29595* (AMAZ, MO, US); Dtto. Hermilio Valdizán, *Schunke V. 11455* (US); La Divisoria, *Woytkowski 34523* (F, MO, UC). *Ucayali*: La Divisoria on the border between Huánuco and Ucayali, *Ferreya 1031* (GH, US, USM), *1072* (US, USM), *1643* (US, USM); Padre Abad, La Divisoria, close to Río Chino, *Schunke V. 9266* (MO, US), *9860* (MO, U, US). Total of 17 collections seen.

DISTINGUISHING FEATURES.—*Pearcea strigosa* is characterized by its lanceolate, yellow green or grayish green, strigose, and somewhat undulate leaves with nearly entire margins and by lanceolate calyx lobes and corollas that are covered with sericeous, red trichomes extending to 2 mm beyond the lobes of the corolla (Figure 22). *Pearcea strigosa* also has a conspicuous, gibbous corolla base, and the sericeous-strigose indument on the lower leaf surfaces is restricted to the veins.

Appendix 1

Numerical List of Taxa

1. *Pearcea abunda* (Wiehler) L.P. Kvist & L.E. Skog
2. *Pearcea bella* L.P. Kvist & L.E. Skog
3. *Pearcea bilabiata* L.P. Kvist & L.E. Skog
4. *Pearcea cordata* L.P. Kvist & L.E. Skog
5. *Pearcea fuscicalyx* L.P. Kvist & L.E. Skog
6. *Pearcea glabrata* L.P. Kvist & L.E. Skog
7. *Pearcea gracilis* L.P. Kvist & L.E. Skog
8. *Pearcea grandifolia* L.P. Kvist & L.E. Skog
9. *Pearcea hispidissima* (Wiehler) L.P. Kvist & L.E. Skog
10. *Pearcea hypocyrtiflora* (J.D. Hooker) Regel
11. *Pearcea intermedia* L.P. Kvist & L.E. Skog
12. *Pearcea purpurea* (Poeppig) L.P. Kvist & L.E. Skog
13. *Pearcea reticulata* (Fritsch) L.P. Kvist & L.E. Skog
14. *Pearcea rhodotricha* (Cuatrecasas) L.P. Kvist & L.E. Skog
15. *Pearcea schimpfii* Mansfeld
16. *Pearcea sprucei* (Britton) L.P. Kvist & L.E. Skog
 - 16a. *Pearcea sprucei* var. *parviflora* (Rusby) L.P. Kvist & L.E. Skog
 - 16b. *Pearcea sprucei* var. *sprucei*
17. *Pearcea strigosa* L.P. Kvist & L.E. Skog

Appendix 2

List of Exsiccatae

(Numbers in parentheses following collection numbers refer to species numbers in taxonomic treatments and in Appendix 1.)

- Acosta-Solis, M., 5284 (16b); 5316 (16b); 7336 (16b); 7345 (16b); 7406 (16b); 7414 (16b); 7426 (16b); 7432 (13).
Allard, H., 20411 (16b); 20838 (5); 21658 (12); 21856 (5); 22101 (16b); 22233 (5); 22287 (5).
Asplund, E., 7831 (13); 8518 (13); 9522 (16b); 9523 (9); 10341 (16b); 12073 (12); 12603 (17); 12684 (5); 18306 (13); 18336 (16b); 18673 (15); 19424 (9); 19444 (16b); 20048 (13); 20077 (13).
Balslev, H., et al., 2584 (16b); 10284 (13).
Bang, M., 544 (16a); 1524 (16b); 1541 (16b); 1563A (16a); 1565 (16a).
Beck, S., 3067 (16a); 4918 (16b).
Bennett, B., et al., 4176 (16b); 4180 (10); 4377 (16b); 4509 (14).
Besse, L., et al., 68 (14); 77 (13); 599 (16b); 1573 (1); 1601 (1); 1602 (1); 1671 (10).
Boeke, J., et al., 688 (16b).
Bohlin, J., et al., 709 (16b); 1485 (13); 1562 (15).
Brandbyge, J., et al., 31943 (9); 32014 (1); 32112 (1).
Bristol, M., 546 (16b).
Buchtien, O., 1348 (16a); 1411 (16a); 5567 (16b); 7487 (16b).
Camp, W., 761E (7); 902E (1); 1469E (1).
Cazalet, P., et al., 7598 (1).
Cerón M., C., 344 (1); 1316 (14); 1456 (16b); 1560 (13); 1703 (10); 3582 (14); 3675 (16b).
Cerón M., C., et al., 2098 (16b); 2937 (16b); 5600 (10); 5604 (1).
Chávez A., R., 1160 (16b).
Croat, T., 21261 (5); 49522 (16b); 49713 (15); 49725 (16b); 57926 (12); 58554 (16b).
Croat, T., et al., 59046 (16b).
Cuatrecasas, J., 8727 (16b); 9154A (16b); 9161 (2); 11402 (13); 11428 (16b).
D'Arcy, W., 14005 (16b).
Davidse, G., et al., 5626 (16b).
Davidson, C., 3461 (16b).
Davis, E., 400 (13).
Dillon, M., et al., 1184 (16a).
Dodson, C., et al., 906 (13); 1926 (13); 2071 (15); 2134 (16b); 9020 (16b); 14102 (16b).
Dorr, L., et al., 6297A (3).
Dudley, T., 10481 (16b); 11579 (16b).
Espinoza, O., 16 (16b).
Ewan, J., 16734 (1).
Fagerlind, F., et al., 1082 (16b); 1277 (13).
Ferreira, R., 965 (12); 1031 (17); 1072 (17); 1598 (12); 1643 (17); 1941 (12); 4189 (12); 4205 (12); 6450 (12); 6750 (12); 18042 (16b).
Foster, R., 2374 (16b); 7602 (12); 9112 (12).
Foster, R., et al., 9161 (12).
García-Barriga, H., 18194 (16b).
Gentry, A., et al., 15941 (5); 28743 (13); 29595 (17); 30865 (7); 30921 (15); 30975 (15); 35851 (16b); 41994 (16b); 60027 (14).
Grisar, M., s.n. (16b).
Grubb, P., et al., 85 (16b); 150 (10); 1432 (16b); 1503 (10).
Gudiño, E., et al., 1002 (16b).
Haenke, T., 1961 (12).
Harling, G., 941 (16b); 1000 (13); 1052 (16b); 1126 (1); 3146 (13); 3165 (16b); 3197 (13); 3350 (13); 3419 (13); 3756 (6); 13058 (16b).
Harling, G., et al., 7649 (1); 9732 (13); 12676 (16b); 12685 (7); 12755 (3); 13015 (15); 13640 (16b); 13817 (16b); 16208 (16b); 16355 (16b); 16357 (11); 16430 (16b); 16826 (16b); 16916 (15); 17238 (13); 21410 (16b); 23024 (16b); 23025 (16b); 23880 (16b); 24031 (16b).
Heinrichs, E., 262 (13); 858 (13).
Hirtz, A., 4087 (16b).
Hirtz, A., et al., 3116 (14); 3160 (15); 7130 (3).
Hitchcock, A., 21773 (13); 21790 (13); 21852 (15); 21866 (16b); 21893 (15).
Hodge, W., 6028 (16a).
Holm-Nielsen, L., 16278 (16b).
Holm-Nielsen, L., et al., 946 (16b); 4057 (16b); 16277 (11); 26512 (4).
Hurtado, F., 1197 (16b).
Hurtado, F., et al., 79 (16b); 117 (16b); 227 (16b); 422 (16b); 1608 (16b); 1619 (15); 1626 (16b); 1638 (15); 1656 (9); 1751 (15); 2786 (16b).
Hutchinson, P., et al., 3685 (16b); 6052 (16b).
Infantes, J., 5524 (12).
Isern, J., 169 (16b); 180 (16b); 186 (10); 187 (10); 496 (14); 504 (16b); 596 (14).
Jameson, W., 786 (10).
Jaramillo, J., et al., 3058 (1); 3566 (10); 5631 (16b).
Kennedy, H., 3892 (16b).
Killip, E., et al., 22673 (16b); 22770 (16b); 23059 (16b); 25926 (16b); 26103 (16b); 26111 (16b).
Klug, G., 1659 (1); 4216 (1).
Knight, D., 182 (16b); 346 (16b).
Kuntze, O., s.n. (16a).
Kvist, L., 60251 (16b); 60315 (13); 60319 (15); 60351 (13); 60356 (16b); 60378 (16b); 60386 (11); 60419 (16b); 60440 (16b); 60451 (1); 60452 (1); 60455 (1).
Lehmann, F., 443 (13).
Lewis et al., 11309 (1).
Løjtnant, B., et al., 11494 (11).
Londoño, X., et al., 106 (16b); 134 (16b); 136 (2); 141 (2); 154 (16b); 158 (9); 227 (16b).
Luer, C., et al., 1665 (13); 3293 (13); 4902 (16a); 11870 (3).
Lugo, M., 260 (13).
Lugo S., H., 28 (9); 93 (13); 222 (14); 235 (10); 417 (15); 688 (13); 788 (16b); 810 (15); 1083 (9); 1099 (9); 1125 (13); 1806 (13); 1894 (6); 2107 (10); 2124 (1); 2163 (10); 2165 (14); 2189 (14); 2412 (13); 3147 (14); 3503 (14); 3562 (14); 3931 (9); 4018 (1); 4417 (9); 4494 (16b); 4611 (9); 5060 (1); 5243 (9); 5327 (14); 5402 (14); 5443 (1); 5923 (6); 7090 (14).
Luteyn, J., et al., 4933 (16b).
Maas, P., et al., 6079 (16a).
MacBryde, B., 133 (13); 720 (11); 1550 (13).
Madison, M., 955 (12); 10016-70 (16b).
Madison, M., et al., 2521 (9); 2573 (9); 3194 (1); 7534 (7); 7553 (3); 7569 (16b).
Martin, R., 98 (1).
Martinet, J., 1489 (12).

- Mason, H., 13937 (16b).
 Matthews, A., 150 (12); 2012 (12).
 McCarroll, D., 18 (16a).
 McDaniel, S., et al., 11139 (1).
 Metcalf, R., 30659 (16a).
 Mexía, Y., 6824 (13); 6851 (16b); 6852 (16b).
 Miller, J., et al., 2197 (14).
 Molau, U., et al., 1291 (13); 1362 (16b); 2474 (16b).
 Moore, H., et al., 8387 (16b); 8546 (12); 8576 (16a); 8584 (17); 8622 (16b).
 Moran, R., et al., 5142 (16b); 5178 (16b); 5185 (16b).
 Neill, D., 6556 (14).
 Neill, D., et al., 5824 (16b); 7239 (14); 8632 (16b).
 Nuñez, P., 11953 (17).
 Øilgaard, B., et al., 9097 (16b); 9268 (6); 9270 (9); 35532 (13); 35583 (6); 35849 (16b).
 Palacios, W., 5610 (9).
 Palacios, W., et al., 48 (16b); 49 (16b); 484 (10); 862 (14); 3743 (16b); 5155 (16b).
 Pavon, J., s.n. (12).
 Pearce, R., s.n. (6).
 Penland, C., et al., 112 (13); 278 (15).
 Pennell, F., 13969 (16b).
 Plowman, T., et al., 4060 (1); 4937 (16b); 4986 (16b); 7403 (16b); 11611 (8).
 Poeppig, E., 1239 (12); 1632 (12).
 Poortmann, H., 319 (16b).
 Prance, G., 26587P (10).
 Prieto, F., CuP8 (9).
 Rimachi Y., M., 4976 (17).
 Ruiz, H., et al., s.n. (9).
 Rusby, H., 2151 (16b); 2422 (16a); 2424 (16a).
 Sagastegui, A., et al., 7155 (16b).
 Sallier, 476 (10).
 Sandeman, C., s.n. (16b); 79 (13); 3681 (17); 5162 (12).
 Schimpff, H., 704 (15).
 Schultes, R., et al., 2054 (13).
 Schunke V., J., 3060 (16b); 3061 (16b); 3111 (5); 3262 (12); 5116 (5); 6263 (16b); 6265 (16b); 7558 (8); 9266 (17); 9368 (16b); 9858 (16b); 9860 (17); 10366 (5); 11262 (16b); 11455 (17).
 Scolnik, R., 1490 (3).
 Skog, L., et al., 5121 (16b); 5147 (12); 5209 (17).
 Skutch, A., 4456 (16b).
 Smith, D., et al., 5578 (12); 5600 (12); 5788 (12); 8624 (12).
 Smith, E., 232 (12).
 Sobel, G., et al., 2443 (16b); 2457 (16b).
 Solomon, J., 9320 (16a); 9515 (16a).
 Solomon, J., et al., 12085 (16a).
 Soukup, J., 5254 (16b).
 Sparre, B., 17501 (10); 17508 (13).
 Spruce, R., s.n. (10); 4962 (14); 5841 (13).
 Stein, B., et al., 2337 (16b); 2789 (16b).
 Steyermark, J., 53639 (13); 54231 (16b); 54682 (16b); 54863 (13); 54899 (15).
 Stork, H., et al., 9872 (16b).
 Sullivan, G., et al., 1142 (16b).
 Synge, P., 11 (13).
 Vargas C., C., 5165 (17); 7399 (16b); 11766 (16a); 15354 (17); 15380 (16a); 16124 (16a); 16486 (16a); 16536 (16a); 16843 (17); 16954 (16b); 17679 (17).
 Vidal-Sénège, M., s.n. (12); s.n. (16b); s.n. (16b).
 Vogel, S., 168 (16b).
 Wasshausen, D., et al., 659 (16b); 1250 (16a).
 Weberbauer, A., 2109 (12).
 Webster, G., 23166 (13); 23238 (11).
 Webster, G., et al., 28449 (16b); 28467 (14).
 Werff, H. van der et al., 9224 (16b); 10408 (3); 11210 (9).
 Wiehler, H., 7176 (9); 75266 (16b); 77129 (1).
 Wiehler, H., et al., 79300 (11).
 Wiggins, I., 10935 (16b).
 Woytkowski, F., 156 (16b); 34496 (17); 34523 (17).
 Wurdack, J., 2381 (16b).
 Zak, V., et al., 3143 (16b); 3558 (13); 3776 (16b).
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