

THE CRASSULACEAE OF CAJAMARCA, PERU

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Abstract: Eleven species of Crassulaceae were found in the Department of Cajamarca, northern Peru. (1) *Echeveria eurychlamys* was collected at its type locality for the first time since its description. (2) Geographical variants of *Echeveria oreophila* are described. (3) *Echeveria cuencaensis*, known previously only from Ecuador, is reported for the first time in Peru. (4) *Sedum decipiens*, a species common in Ancash, is reported from farther north. (5) *Sedum isidorum* is described as a new species related to *S. decipiens*, but forming redder, more compact plants. (6) *Sedum reniforme* is found at its type locality, which appears to be its northern limit; it is relatively more abundant farther south in Ancash. (7) *Villadia klopfensteinii* is described as a new species with greenish-yellow, bell-shaped, *Echeveria*-like flowers with stiff, fused petals. (8) *Villadia aureistella* is a new species with showy, star-shaped, yellow flowers, unique among Peruvian species in having a petal completely recurved to form a loop. (9) *Villadia thiedeii* is a new species closely related to *Villadia virgata* from Chiquián, but the plants are taller and the flowers smaller, with incurving apices. (10) *Villadia paniculata* is a new species with panicles of spikes which, when bractless, resemble racemes; the apical flowers are greenish white with slightly recurving petals. (11) *Villadia kimnachii* is a new species with erect, narrow, lycopodium-like branches with adpressed, almost upright leaves and dense spikes of small flowers with distinctive salmon-colored nectaries.

1. *Echeveria eurychlamys*

Echeveria eurychlamys (DIELS) A. BERGER in Engl and Prantl, *Nat Pflanzenfam.* II: 18a: 473, 1930. McBride, *Flora of Peru* Vol III Part II No 3: 1014. 1938.

Basionym: *Cotyledon eurychlamys* DIELS in *Englers Bot Jahrbuch* 37: 411, 1906.

Holotype: Dept. Cajamarca, pr. Hualgayoc juxta praedium La Tahona in rupibus 3100 m, flor. m. Maj. 1904 (*Weberbauer 04/4056*, B, destroyed according to Walther).

Lectotype: Photo of the type-specimen, Rockefeller Foundation no. 18,249 (F).

A succulent glabrous herb with usually a single rosette (Fig 1). Roots many, fibrous, 0.8–1.5 mm diam, light gray. Stem not growing aboveground, when subterranean up to 3.5 cm high, 1.2–1.5 cm diam Rosette (6–) 9–15 cm diam Leaves 26–38, sessile, succulent, horizontal, flat, widely obovate-oblong, rarely spatulate in older plants, (3–) 6–8 cm long, (2–) 3–4 cm wide 2 cm from apex, 2–4.5 cm wide at middle, 0.9–1.3 cm wide at base, 3–4 mm thick, upper side concave in young plants, flat to slightly concave in older leaves, light green to glaucous-whitish, darker on apical third where exposed to

light, lower side slightly convex and keeled, light green, with a minute deltoid hyaline recurved mucro 2–4 mm long, 2–4 mm wide, margins hyaline (Fig 2).

Flowering stem an equilateral raceme, rarely 2–3, nodding at first, then erect, rachis 20–25 (–30) cm long, 4–8 mm diam at base, 1.5–3 mm diam at apex, light green to glaucous, pink where exposed (Fig 3). Peduncular bracts 18–30, appearing from the proximal 4–7 cm, the lower ones spaced 1–1.5 cm apart, the upper ones more crowded, erect, widely obovate to orbicular, (1–) 1.6–2.6 cm long, 0.6–1.7 cm wide, 2–4 mm thick, inner side concave, glaucous to light green, outer side convex and keeled, darker near the acute apex, with a trilobed transparent spur at the base. Flowers 8–16, appearing from May to July, only in the distal half or third, 1.2–1.5 cm long and 7–8 mm diam Pedicels 2–6 mm long, 2–3 mm diam, light green to reddish, with 1–2 minute deltoid bracteoles, 1–3 mm long and 0.5–1.5 mm wide, pale green. Calyx lobes united at base, erect, sepals ovate-deltoid, acute, 5–7 mm long, 2.5–3 mm wide, light green–glaucous, apex reddish. Corolla ovoid, pentagonal, 6–7 mm thick near base, petals



Figures 1–7. *Echeveria eurychlamys*. **Figure 1.** *E. eurychlamys*, a mature plant *ex situ*. **Figure 2.** Detail of the leaves of *E. eurychlamys*. **Figure 3.** Detail of the nodding inflorescence of *E. eurychlamys*. **Figure 4.** (above, left to right) detail of bract, complete flower with bractlets and bracts (2), flower section, fruit. (below, left to right) bract-outer side, bract-inner side, sepals, petals (3), gynoecium. **Figure 5.** *E. eurychlamys* at type locality, La Tahona, near Hualgayoc, Cajamarca. **Figure 6.** Cultivated *E. eurychlamys* at the Botanical Garden of San Marcos. **Figure 7.** *E. eurychlamys*, young glaucous plant from Celendin.

oblong, acuminate, 1.1–1.2 (–1.5) cm long, 2.5–3 mm wide, outer surface yellow to pink at base, salmon to pink towards apex, keeled, apex uncinately recurving, inner surface yellow in the proximal half, salmon in the distal half. Stamens ten, the five epipetalous 5.5–6 mm long, the antepetalous 6.5–7 mm long, fila-

ments cream, 0.7 mm thick at base, gradually tapering to 0.3 mm. Anthers ovoid, yellow, 1.5–1.6 mm long and 0.5–0.6 mm wide. Gynoecium ovoid, 6–7 mm long, 4–5 mm thick. Carpels 5, white with a pinkish blush. Styles 2–3 mm long, parallel, almost touching each other, greenish, stigma white. Fruit a dehis-

cent capsule 0.9–1 cm long, 0.7–1 cm diam, dark brown. Seeds narrowly ovoid, 0.65–0.75 × 0.2–0.3 mm brown (Fig 4).

PERU. Dept. Cajamarca, Prov. Hualgayoc, Dist. Hualgayoc, “La Tahona Alta,” road from Hualgayoc to Bambamarca, on 45° slopes, 100 m above the road., on soil among rocks, growing together with *Peperomia* sp aff *nivalis*, *Peperomia galioides* KUNTH and *Sedum reniforme* (H.JACOBSEN) THIEDE & T HART, 3180 m, 6°44'35" S 78°35'06" W, 29 Apr 2007, G. Pino 1705 (USM 217,132, type locality). Above Pariocota, growing with a *Masdevallia* sp, 8000 ft., pressed Feb 15, 1963 by P. C. Hutchinson from cultivated plants (UCBG 54.2331), collected by Harry Johnson s.n. (UCB 088,118). Prov. Chota, Dist. Lajas, Río Chotano, below Lajas, 2350 m, 19 Oct 1964, P. C. Hutchinson & J. Kenneth Wright 7049 (USM 19,598, USM 19,601). Dist. Chiguirip, road from Conchán to Chiguirip, on rocks, with *Peperomia hartwegiana* var *minutifolia* Pino, 3500 m, 06°26' S, 78°44' W, 15 Sept 1995 G. Pino s.n. (Pino, 1995). Dist. Miracosta, Between Miracosta and Pampa del Lirio, 3380 m, 06°22' S, 79°14' W, Nov, 2000, I. Sánchez-Vega 10312 (CPUN 14422) Huambos, Y. Soukup, 56/4560 (US). Prov. Cajamarca, Dist. Cajamarca, Porcón, Cooperativa Atahuallpa, cultivated from nearby rocks, said to be growing with *Peperomia rotundata* KUNTH, 1 May 2000, G. Pino 275. Prov. Celendín, Dist. Celendín, above Río Marañón, near the summit, in grassland, with *Epidendrum* sp, 3000 m, 7 Aug 1958, R. Freyreya 13,291 (USM 19,981). Dist. Utco, road from Celendín to Balsas, km 120, on 45° descending slope, growing with *Peperomia cymbifolia* PINO var *goodspeedii* PINO & CIEZA, *Matucana aureiflora* RITTER, and *Peperomia galioides* KUNTH, 3030 m, 06°51'49" S, 78°06'54" W, 14 Jan 2005, G. Pino 1464. El Limón, on rocks growing with *Matucana intertexta* RITTER var *celendinensis* BREGMAN, MEERSTADT, MELLIS & PULLEN, *Epidendrum* sp, *Masdevallia* sp, *Peperomia cymbifolia*, 3030 m, 6°51'45" S, 78°06'55" W, 28 Jan 2004, RRP 615.

Since August Weberbauer, the German botanist who lived in Peru from 1901 to 1948, first collected this plant in 1904 near Hualgayoc, few botanists have reported it again. It was first described as *Cotyledon eurychlamys* by Diels in 1906 and later moved to the genus *Echeveria* in a short comment by Berger in Engler and Prantl's *Natürlichen Pflanzenfamilien*. In these descriptions no illustrations were published, and a photo of this plant was not available until we found it in Chota

(Pino 1995) while looking for a new species of *Peperomia*. According to Walther, the holotype had been destroyed in the World War II bombing of the Berlin herbarium, so we looked for the type locality near Hualgayoc to make an accurate description. Luckily, we found a small town with the same name as the estate of La Tahona where it was originally described and here plants are relatively abundant (Fig 5). This collection could have been declared as a neotype, but according to article 9.11 of the ICBN, the lectotype present in F (photo of the destroyed type) has precedence over it.

The name of this plant, “eurychlamys,” from the Greek “εὐρύς” (eurys) wide and “χλαμύς” (chlamys) cloak, probably refers to the unique, almost orbicular bracts of the raceme. This character, as well as the very light glaucous leaf-color (white according to Walther 1972) and nodding flowering stems, distinguish it easily from all other Peruvian species (Fig 6). In cultivation, this plant prefers strong sunlight and well-drained compost to maintain its light color and compact shape. Its habitat (Fig 7) extends widely in the provinces of Hualgayoc, Chota, and Celendín. Plants from all localities show only slight variation. *E. eurychlamys* is never found together with *E. oreophila* KIMNACH, which grows farther south, more or less restricted to the province of Cajamarca.

2. *Echeveria oreophila*

Echeveria oreophila KIMNACH, *Cact Succ J* (US) 74(6): 290–293. 2002.

Holotype: PERU: Dept. Cajamarca. Prov. Cajamarca. Dist. Cajamarca. Cumbemayo, ca. 6 miles SW of Cajamarca, cultivated, said to be native on nearby high peaks, ca. 3000–3500 m, 7°11'16.5" S, 78°34'34" W, 3 June 2000, R. Bauer & M. Kimmach 10/2000 (SM); HNT (Paratype).

A succulent glabrous herb with single rosettes at the end of the stems. Roots 3–7, tuberous, 0.3–0.5 cm diam, 10–15 cm long, grayish brown. Stem simple, rarely 2–4 growing from base, (0.5–) 1.5–2.5 cm diam at base, 9–30 cm long, shortly decumbent at first but then erect, light green when young, then grayish brown with leaf scars. Rosette 11–15 (–25) cm diam (Fig 8). Leaves (12–) 22–28 (–38), sessile, succulent, widely obovate when young, then narrowly obovate to subspathulate and suboblong in older leaves, 4.5–6.5 (–13) cm long, 2.4–3.6 (–4.5) cm wide 2 cm from apex, 2.2–3.1 cm wide at middle, 0.9–1 cm wide at base, 3–7 mm thick, apex sub-

obtuse in most plants but acute or subacute in some specimens, with a minute reddish deltoid mucro 1–2 mm long, 1–2 mm wide, sometimes upcurving, upper side flat to concave, dull green or reddish on the distal half, sometimes covered with scarce purple spots near margins, lower side convex, light green to glaucous, sometimes entirely reddish, obscurely keeled on distal half, margins smooth, reddish-violet when exposed (Fig 9).

Flowering stem 1–2 (–3) equilateral racemes, rachis emerging at 30–45° from stem, 12–20 (–30) cm long, 5–8 mm diam at base, 2–3 mm diam at apex, glaucous-pinkish at base, bright pink near apex. Peduncular bracts 15–28, erect, spreading, present along the entire rachis, oblong to narrowly obovate, blunt-subacute, upper side concave, lower side convex to sub-keeled, dull green to glaucous, reddish at the tip and keel, 1.2–1.8 (–3) cm long, 4–7 mm wide, 3–4 (–6) mm thick (Fig 10). Flowers 12–15, appearing from May to June, only at distal $\frac{2}{3}$, 1–1.5 cm long and 8–9 mm diam, bright red. Pedicels ascending, 4–5 mm long and 1.8–2 mm diam, reddish, with a minute ascending elliptical bracteole at the middle, 2–4 mm long, 1 mm wide. Calyx lobes united at base, spreading, sepals deltoid-ovate, subacute, frequently asymmetrical, 6–8 mm long, 2.5–4 mm wide, upper side concave, green-glaucous with a red tip, lower side dull reddish-green, convex. Corolla ovoid, pentagonal, 10–12 mm diam near base, petals oblong, acuminate, 1.3–1.6 cm long, 4–6 mm wide, outer surface dull pink, keeled, apex uncinatate, recurving, inner surface light cream along proximal $\frac{2}{3}$, reddish along the distal third. Stamens ten, the five epipetalous 8–11 mm long, the antepetalous 10–11 mm long, filaments cream, 0.8–1 mm thick at base, gradually tapering to 0.4–0.5 mm. Anthers ovoid, yellow, 1.2–1.5 mm long and 0.8–1 mm wide. Gynoecium ovoid, 1.1–1.2 cm long, 5–6 mm diam. Carpels five, white. Styles 3–4 mm long, parallel, almost touching each other, dark red, stigma red (Fig 11). Fruit a dehiscent capsule 1.2–1.3 cm long, 0.9–1.2 cm diam, dark brown (Fig 12). Seeds narrowly ovoid, 0.85 × 0.25–0.4 mm, brown.

PERU. Dept. Cajamarca, Prov. Cajamarca, Dist. Cajamarca. Cumbemayo, on very steep rocks growing together with moss and *Peperomia hartwegiana* MIQ., *Peperomia parvifolia* DC, *Matucana aurantiaca* (VAUPEL) BUXB., *Sedum reniforme* (H. JACOBSEN) THIEDE & T HART, 3350 m, 7°11'19" S, 78°34'41" W, 8 May 2001, *G. Pino* 669 (USM 217,133).

Huacariz, in rock-cracks with *Peperomia galioides* KUNTH, *Peperomia macrorhiza* KUNTH, *Oncidium cajamarcae* SCHLTR, 7°11'50" S, 78°28'28" W, 2584 m, 30 Dec 2006, *RRP* 947. Dist. Llacanora, waterfall of Llacanora, growing with *Peperomia rotundata* KUNTH and *Peperomia nivalis* MIQ., 2520 m, 7°11'09" S, 78°25'26" W, 24 Aug 2002, *G. Pino* 1045. Dist. Namora, road from Cajamarca to Namora, km 8.5, on rocky vertical walls beside road, growing with *Peperomia nivalis* MIQ., shaded plants with slender curved stems, 2630 m, 7°10'57" S, 78°25'46" W, May 4, 2000, *G. Pino* 314. Dist. Cospán, road from San Juan to Huacararucu, on 60° slope with moss and grasses, growing with *Matucana fruticosa* RITTER, *Peperomia galioides* KUNTH, 2530 m, 07°18'09" S, 78°28'26" W, 16 May 2001, *G. Pino* 647. Dist. San Juan, road from Cajamarca to San Juan, km 147.8. "Peña Gritona," on 80° rocky slope in cracks, growing in moss with *Peperomia cymbifolia* PINO, *Peperomia galioides* KUNTH, 2610 m, 7°16'15" S, 78°31'06" W, 16 May 2001, *G. Pino* 635. San Juan, on rocks, 2200 m, 16 Aug 1984, *A. Sagástegui*, *J. Mostacero* & *S. Leiva* 11,999 (F 1974,570, identified as *E. peruviana*). Yumagual, foggy slope, growing with *Peperomia galioides* KUNTH, *Puya* sp, *Pitcairnia* sp, 7°14'41" S, 78°31'00" W, 2581 m, 15 Jan 2006, *RRP* 836. Dist. Baños del Inca: Purhuay, growing with *Peperomia nivalis*, *Matucana aurantiaca*, *Epidendrum secundum* JACQ., 7°05'44" S, 78°31'17" W, 2860 m, 12 Jan 2006, *RRP* 824.

Long before Myron Kimnach collected this species for publication in 2000, we had observed it throughout the province of Cajamarca. In fact, it is widely cultivated, including impressive specimens at the small botanical garden of the National University of Cajamarca. *E. oreophila* is probably the easiest Peruvian *Echeveria* to cultivate. It is used not only as an ornamental but occasionally for medicinal purposes with the local name of "Pinpin."

Although until now it has only been observed in the southern portion of the province of Cajamarca, some evidence indicates it may exist also in the nearby province of San Marcos and in the department of La Libertad. In Cajamarca it seems to have a wide altitudinal distribution, from 2500 to 3400 m, but plants from different localities show some phenotypic variation. Plants from the type locality at Cumbemayo are small, lilac-glaucous, and strongly succulent, sometimes many-stemmed,



Figures 8–16. *Echeveria oreophila*. **Figure 8.** *E. oreophila*, plant *ex situ* from San Juan. **Figure 9.** Detail of leaves of *E. oreophila*. **Figure 10.** Detail of large bract of basal flowers. **Figure 11.** (above, left to right) detail of bracts, sepals (inner face), petal (inner face), fruit, gynoecium. (below, left to right) bracts, sepals (outer face), petal (outer face), flower, flower section. **Figure 12.** *E. oreophila*, racemes of flowers (left) and fruits (right). **Figure 13.** *E. oreophila* at the type locality in Cumbemayo, plants are purple and leaves are very succulent and acute. **Figure 14.** *E. oreophila* in habitat at Gavilán. It resembles an aeonium. **Figure 15.** Young *E. oreophila* showing purple dots and margins. **Figure 16.** *E. oreophila* with many decumbent stems on the road to Llacanora. Note the glaucous color and loosely attached leaves near the distal end of the stem.

and their leaves are very concave and thick, with acute tips and keeled on the lower side, possibly an adaptation to sun-exposure at high altitude (Fig 13). They can only be seen on very high cliffs, because plants within reach have normally already been removed by local people. Plants from the Jequetepeque Valley (Dist. San Juan, Cospán) are the largest, mostly single-stemmed, with very flat distal rosettes resembling an aeonium (Fig 14). Leaves have obtuse tips with a small mucro, their color is dull green to light reddish green or purplish where exposed, and purple spots on young plants are common (Fig 15). Plants from the east (Llacanora and Namora) are mostly glaucous, with narrow stems and leaves, sometimes decumbent and curved. Leaves are loosely attached and persistent up to the distal one-third of the stem (Fig 16).

3. *Echeveria cuencaensis*

Echeveria cuencaensis POELLNITZ. in *Fedde Repert*, Vol 38: 187. 1935; Vol 39: 248. 1936.

Holotype: Rose, Pachano & Rose, 18/22,941, from near Cuenca, Ecuador (US 1,022,515).

A succulent glabrous herb with a single rosette. Roots many, fibrous, 1.5–3 mm diam. Stem absent. Rosette 9.5–18 cm diam (Fig 17). Leaves 30–45, sessile, succulent, oblong-obovate, 4–8 cm long, 1.8–3 cm wide 2 cm from apex, 2–3.5 cm wide at middle, 1.5–2.7 cm wide at base, 4–10 mm thick, upper side flat to slightly concave, bright green, darker on apical third near margins where exposed, lower side convex or obscurely keeled, with a minute deltoid mucro at apex, 1.5 × 1.5 mm, margins rounded (Fig 18).

Flowering stem with 1–3 equilateral racemes, nodding at first, then erect, rachis 25–



Figures 17–21. *Echeveria cuencaensis*. **Figure 17.** *E. cuencaensis* in habitat at Tabaconas. **Figure 18.** Detail of leaves of *E. cuencaensis*. **Figure 19.** *E. cuencaensis*, shaded plant with longer leaves. **Figure 20.** Flowers of *E. cuencaensis* in habitat. **Figure 21.** (above, left to right) detail of flower, bracts. (below, left to right) petal (outer side), inner side, sepals, flower section, gynoecium.

35 cm long, 5–6 mm diam at base, 1.3–2.8 mm diam at apex, light green to glaucous, pink where exposed (Fig 19). Peduncular bracts 35–45, erect, present from above the proximal 6–10 cm all along rachis, attached every 0.8–1.5 cm, widely ovate to oblong, (1–) 1.5–2.5 cm long, 1–1.3 cm wide, 2–3 mm thick, inner side concave, outer side convex and keeled, bright green to glaucous, reddish at the acute tip, mucronate, with a trilobed transparent spur at the base. Flowers 25–35, appearing in habitat from June to July, only along the distal half, 1–1.4 cm long and 6–6.5 mm diam. Pedicels 3–5 mm long, 1.5–1.8 mm diam. Calyx lobes united at base, spreading, sepals triangular, acute, 4–5 mm long, 3–4 mm wide, bright green to glaucous with a reddish tip. Corolla ovoid, pentagonal, petals oblong, acuminate, 1.1–1.2 cm long, 2.1–2.5 mm wide, outer surface cream at base, then yellow, reddish towards tip and margins, keeled, apex uncinately recurving (Fig 20). Stamens ten, the five epipetalous 3–4 mm long, the anteseptalous 6–8 mm long, filaments cream. Anthers ovoid, yellow, 1.8 × 0.8 mm wide. Gynoecium ovoid, 4 mm long, 3.5 mm thick. Carpels five, reddish. Styles 2 mm long, parallel, almost touching each other, greenish, stigma white (Fig 21). Fruit and seeds not seen.

PERU. Dept. Cajamarca, Prov. San Ignacio, Dist. Tabaconas, San Miguel de Tabaconas, Cerro el Salado, on a southwest-facing 45° slope, in soil among grasses that eventually cover them (*Chusquea* sp), growing with *Oncidium* sp, and *Pteridium* sp “lashipa”, 5°18'04" S, 79°17'53" W, 1888 m. 12 June 2007. SNS-001 & SNS-002 (USM 217,134). On the road to Huancabamba, just a few kilometers from the shortcut to San Miguel de Tabaconas, towards the town of Granadillas, a few specimens were growing along soil bank of road excavation. Prov. Chota, Dist. Huambos. Huambos, growing with *Peperomia galioides* KUNTH. 2486 m, 06°27'01" S, 79°00'36" W, 21 Feb 2009, RRP 1405.

Previously known only from Ecuador, this is a new record for this species in Peru. It was found by Sidney Novoa Sheppard during a World Wildlife Fund (WWF) expedition to the Buffer (non-protected) Zone and surroundings of the Tabaconas Namballe Sanctuary, 260 km south of the type locality. Plants agree with the original description except for the absence of occasional geminate flowers, which we did not observe. This species seems to be close to *E. excelsa* (Pino 2006), both having very glossy, very thick (up to 1 cm) bright

green leaves, growing on soil amongst grasses and not on rocks. The main difference is the size of the inflorescence and flowers, which are much smaller in *E. cuencaensis*, and the presence of conspicuous pedicels, which are absent in *E. excelsa*. Further research is needed at the type locality of *E. cuencaensis* in Ecuador to determine if this species is conspecific or might be better given subspecific status under *E. excelsa*.

4. *Sedum decipiens*

Sedum decipiens (BAKER) THIEDE & 'T HART. *Novon* 9(1): 124. 1999.

Lectotype: Sine loco, Farris s.n. *Saunders' Ref Bot*, 3 tab. 200.

Basionym: *Cotyledon decipiens* BAKER. *Saunders' Ref Bot*, 3 tab. 200. 1870.

Synonyms: *Sedum plicatum* THIEDE & 'T HART. *Novon* 9(1): 124. 1999.

Villadia dielsii BAEHNI & J.F.McBRIDE, *Candollea* VII: 285. 1937. McBride. *Flora of Peru*. Vol III Part II No 3: 1011. 1938.

PERU. Dept. Cajamarca, Prov. Cajamarca, Dist. San Juan, road from Magdalena to Cajamarca, km 132, on south-facing, vertical clay slopes, growing with *Peperomia dolabriformis* KUNTH, *Peperomia cymbifolia* PINO, *Peperomia lanuginosa* PINO, *Anredera* sp, 1850 m, 7°17'26" S, 78°32'35" W, 30 Apr 2007, G. Pino 1715 (USM 217,150) (Fig 22, 23). Between Choropampa and San Juan, near Los Naranjos Bridge, on rocky slope, 1900 m, 7 Jun 1986, I. Sánchez-Vega 4124, (CPUN 2396) Prov. San Pablo, Dist. San Pablo, on the road to Chilete, 5.5 km below San Pablo, 2080 m, 14 May 1964, P. C. Hutchison & J. Kenneth Wright 5075 (US 2,830,712, F 1,793,309). North of Sangal, near the Christ Monument, on road between Chilete and San Pablo, 2120 m, 2 Jun 1994, I. Sánchez-Vega 7234 (F 2216,150, CPUN 17748).

We updated a description of this species, found in the Department of Ancash (Pino 2006). We were looking for the type locality of *S. plicatum* at Caraz, but then realized that the lectotype of *S. decipiens* (a species described without a type locality) exactly matched the plant we had found. Thus we had to accept the older name for the species, reducing *Sedum plicatum* to a synonym. *Sedum decipiens* was first described by Baker in 1870 as *Cotyledon decipiens*, later transferred in turn to *Echeveria*, *Altamiranoa*, and *Villadia* until Thiede and 't Hart finally placed it in *Sedum* in 1999. It has a wide distribution in Ancash along the Santa River basin between 2000–

3000 m, and it reaches Cajamarca perhaps at its northernmost locality, where it grows relatively lower at 1800–2200 m. It probably also exists in the intervening department of La Libertad, though it has not yet been reported there. Despite this ample range, it is very scarce in nature and difficult to find. It has also been reported to be somewhat difficult in cultivation. The distinctive characters of this species are its overall light-green-glaucous color, very narrowly ovoid to almost terete leaves (Fig 24), diffuse scorpioid cincinni of pure white flowers with petals plicate on the outer surface, and margins that are occasionally undulate (Fig 25).

5. *Sedum isidorum* PINO SP. NOV.

Planta succulenta glabra e basi ramosa 8–13 cm alta. Caulis ad basim erectus 6–10 mm diam, griseobrunneus, 1–6 ramis erectis vel leviter decumbentibus. Rami secundarii conspicue erecti 4–14, sterili 1.5–4 cm longi, floriferi 6–13 cm longi, caule 1.8–2 mm diam rubro purpureo. Folia succulenta imbricata spiraliter disposita sessilia anguste ovoidea vel subtriangularia 8–12 mm longa, 3–5 mm lata, subacuta, e glauci rubentia in apricis. Inflorescentia terminalis 1–3 cincinnis alternis 0.5–3 cm longis, 6–12 floribus sessilibus. Sepala ovata 1.5–5 mm longa 1–2 mm lata. Petala oblonga acuta 6–7 mm longa, 1.8–2 mm lata, extus subcarinata, a basi usque ad dimidiam partem coalita, demum deltoidea extrorsum recurvata, albida erubescens. Stamina filamentis rubescentibus. Carpela 5 fusiformia rosea. Floret a Majo ad Julium.

Holotype: PERU. Dept. Cajamarca, Prov. Cajamarca, Dist. Cajamarca, road from Cajamarca to Cumbemayo, km 6, on rocky wall with moss, growing with *Peperomia andina* PINO, 7°10'23" S, 78°31'51" W, 3050 m, 30 Apr 2007, *G. Pino 1710* (USM 217,146) (Fig 26).

A succulent glabrous herb, branched from the base, 8–15 (–30) cm tall. Basal stem erect, 2–6 cm long, 6–10 mm diam, 1–6-branched, each primary branch erect to slightly decumbent, rooting along the sides, 3.5–4 (–6) mm diam at base, 2–8 cm long, light gray brownish. Secondary branches 4–14, erect, vegetative shoots 1.5–4 cm long, flowering shoots 6–13 cm long, stem 1.8–2 mm diam, reddish green to purple (Fig 27). Leaves succulent, spirally attached, densely imbricate at proximal half and on young shoots, more widely spaced towards tip, sessile, semialexicaule, narrowly ovoid to subtriangular on young leaves, (6–) 8–12 mm long, 3–4 (–5) mm wide, 1.5–2.5 mm thick, blunt-subacute, upper side convex, lower side obscurely keeled, glaucous to dull green with

minute reddish spots near base and where exposed, margins entire (Fig 28).

Inflorescence terminal, with three alternating cincinnoid branches, the distal two generally longer, 1.5–3 cm long, each bearing (2–) 3–5 flowers, proximal cincinnus 0.5–1.5 (–2.5) cm long, with 2–4 flowers, rachis 1.2–1.6 mm diam, light green with reddish to purple spots (Fig 29). Flowers 6–12 (–16), appearing from May to July, sessile. Flower buds 5–6 mm × 2.5–3 mm, reddish green with reddish dots, bracteoles ovate, 4–6 mm long, 1.8–2 mm wide, with a hyaline spur. Sepals ovate, blunt-subacute, (1.5–) 3.5–5 mm long, 1–2 mm wide. Petals oblong, acute-deltoid at tip, united at the base, folded outwards at the middle, 6–7 mm long extended, 1.8–2 mm wide, induplicate, outer surface white to light pink with a reddish keel, inner surface white to light pink with a central pink stripe, margins entire. Stamens ten, the five epipetalous 3–4 mm long, the antesealous 5–6 mm long, filaments white to pink. Anthers ovoid, yellow, 0.5 × 0.3 mm. Gynoecium ovoid, 2.5 × 4 mm, carpels five, light green to reddish. Style 1 mm long, greenish white to light pink. Nectary scales yellow, 0.8 mm. Fruit: pentalocular, dehiscent, 4 × 7 mm. Seeds: narrowly ovoid to pyriform, 0.6–0.65 mm long, 0.23–0.26 mm diam, brownish orange (Fig 30).

PERU. Dept. Cajamarca, Prov. Cajamarca, Dist. Cajamarca. Road from Cajamarca to Cumbemayo, km 5, on mossy rocky wall along road, growing with *Peperomia nivalis* MIQ., 7°10'16" S, 78°31'35" W, 2980 m, 2 May 2000, *G. Pino 282*. Road from Cajamarca to Gavilán on eroded rocky slope with shrubs, 2850 m, 3 July 1987, *I. Sánchez-Vega 4445*, (CPUN 2399) Dist. Baños del Inca: Otuzco Necropolis, on rocks of the ruins and in cracks, growing with *Peperomia nivalis*, 7°07'24" S, 78°27'18" W, 2850 m, 2 Oct 1999, *G. Pino 143* (USM 217,145). Purhuay, on rocks along the river banks, up to 30 cm high, 7°05'45" S, 78°31'18" W, 2836 m, 12 Jan 2006, *RRP 821* (USM 217,149). Dist. Llacanora: Callacpuma cave, on rocks of the path leading to the cave, 7°11'03" S, 78°26'21" W, 2700 m, 4 May 2000. *G. Pino 318* (USM 217,143). Cerro de Rumicocho, on slope 11 km away from the road, 2620 m, 25 Apr 1981. *J. Sánchez-Vega 3381*, (CPUN 2400) Dist. San Juan, road from Cajamarca to San Juan, km 145.5, in cracks of a rocky slope, growing with moss, *Peperomia andina* PINO, *Echeveria oreophila* KIMNACH, 2370 m, 7°17'37" S, 78°29'16" W, 16 May 2001, *G. Pino 898* (USM 217,144). Footpath from



Figures 22–25. *Sedum decipiens*. **Figure 22.** *S. decipiens*, in habitat at San Juan. **Figure 23.** *S. decipiens*, ex-situ plant. Note the long, flexible stems. **Figure 24.** Young plantlet of *S. decipiens* in habitat near Magdalena. **Figure 25.** Detail of mature inflorescence (left) and bud formation (right). Flowers have pure white petals born on loose scorpioid cincinni.

Yumagual to the Cajamarca-San Juan road, on rocks, growing with *Matucana fruticosa* RITTER. 3030 m, 7°14'11" S, 78°31'19" W, 7 Nov 2003, G. Pino 1234. Yumagual, on rocks, growing with *Peperomia andina* PINO and a whitish-flowered species of *Begonia*, 7°14'12" S, 78°31'19" W, 2890 m, 15 Jan 2006, RRP 833 (USM 217,147). Dist. Jesús: road from Jesús to San José de Tuminá, on rocks, growing with *Peperomia cymbifolia* PINO and *P. andina* PINO, 2700 m, 23 Nov 1999, G. Pino 198. Jesús, 1 km south of the town, southeast of Cajamarca, 2550 m, 22 May 1994, I. Sánchez-Vega 7190 (F 2216,147). Prov. Celendín, Dist. Sucre, between Cajamarca and Celendín, low shrubland, 2900 m, 25 Jun 1963, R. Ferreyra 15,157 (USM 19,613). Prov. San Marcos, Dist. Eduardo Villanueva, La Grama, grayish leaves, growing with *Peperomia dolabriformis* KUNTH var *multicaulis*

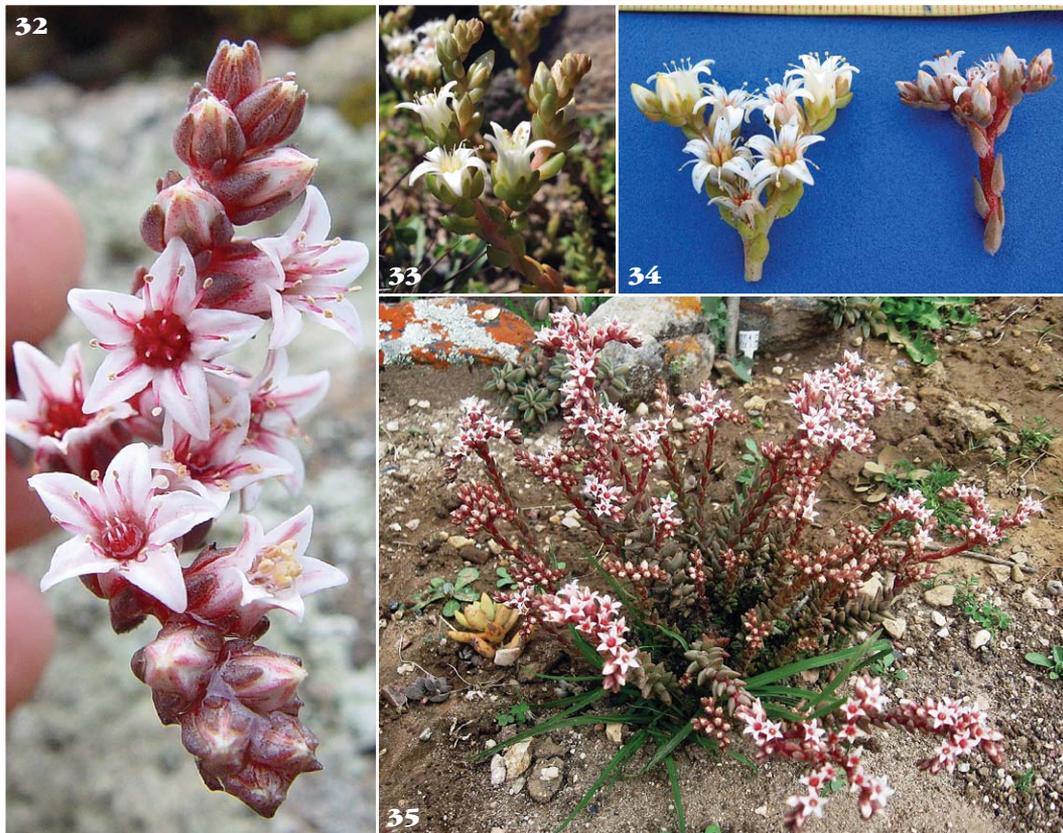
PINO ET CIEZA, *Peperomia cymbifolia* PINO, *Lasiocereus rupicola* RITTER, *Matucana intertexta* RITTER, *Puya* sp, and *Deuterocohnia longipetala* MEZ, 2156 m, 7°25'36" S, 78°07'14" W, 2156 m, 29 Jan 2007, RRP 1055 (USM 217,148). Dist. Chancay: Between Chancay and the Valley of Condebamba, on slope, 2600 m, 6 May 1972, I. Sánchez-Vega 952 (CPUN 2398). Dept. La Libertad, Prov. Otuzco, Dist. Salpo, Cerro de los Enamorados, 1 km N of Salpo, rocky slopes, growing with *Ephedra* sp, *Tagetes* sp, *Monnina* sp, and *Oxalis* sp, 3540 m, 8°00'02" S, 78°36'23" W, 6 May 2006, P. Carrillo-Reyes, M. Choce and S. Leiva 5173 (USM 210,582). Yamebamba, on very steep slopes, 2900 m, 13 Aug 1951, A. López 0698 (USM 19,616). Prov. Santiago de Chuco, Dist. Mollebamba, El Castillo, between rocks, 3260 m, 22 June 1954, A. López 1103 (USM 19,606).



This species was first noticed on the Huntington expedition to northern Peru in May 1984. Near its roots, *Peperomia dolabella* RAUH & KIMNACH was discovered, and a photo of the *Sedum* was published in the article describing the new *Peperomia* (Rauh and Kimmnach 1986). However, in that article, the *Sedum* was identified as *Villadia dielsii*. The latter was originally described in 1906 by Diels as *Cotyledon stricta*, transferred to *Altamiranoa* by Berger, and finally renamed as *Villadia*

dielsii by Baehni and McBride because of a previous *Villadia stricta* described by Rose in 1905. When Thiede and 't Hart transferred it to *Sedum* they had to choose a new specific name, resulting in their publication of *Sedum plicatum*. We finally concluded that *S. plicatum* is a synonym of the earlier-described *Sedum decipiens* (Pino 2007).

Sedum isidorum and *S. decipiens* are very closely related, but *S. isidorum* is a smaller, more compact plant, its primary stem is generally



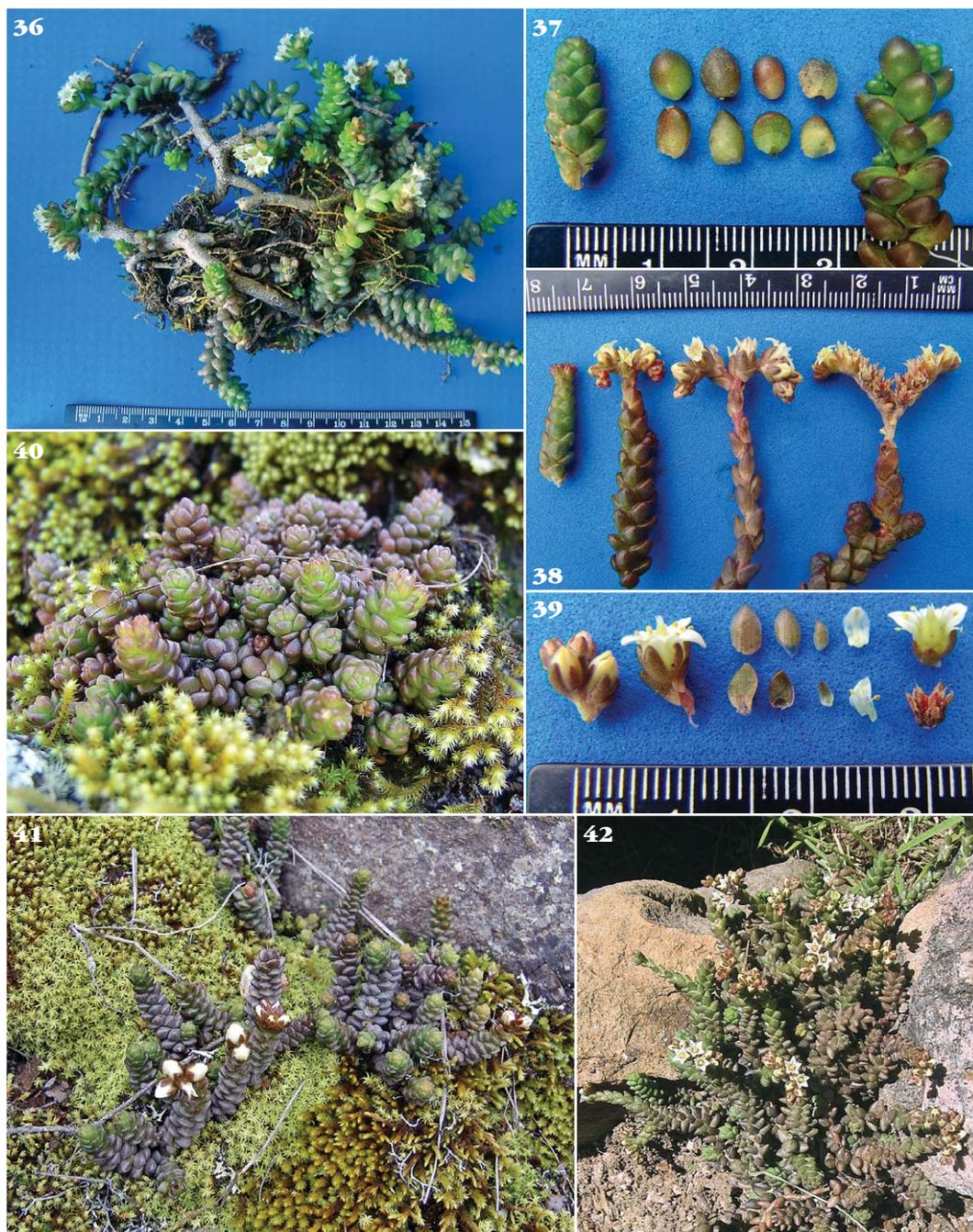
Figures 26–31 (facing page), 32–35. *Sedum isidorum*. **Figure 26.** *S. isidorum* in habitat at the type locality on the road from Cajamarca to Cumbemayo. **Figure 27.** *S. isidorum*, *ex situ* plant, note the erect, stiff stems. **Figure 28.** Detail of (left to right) stem with leaf implantation, leaves. **Figure 29.** *S. isidorum*, detail of inflorescence. **Figure 30.** Detail of (left) cincinnus; (above, left to right) flower section, bracts, flower with bracts; (below, left to right) petal-outer side, lateral view, sepals, fruit. **Figure 31.** *S. isidorum* in habitat before flowering, plants are very red and stiff at the end of the dry season. **Figure 32.** Inflorescence in habitat near Isidora Infante. **Figure 33.** Detail of a plant with whitish flowers. **Figure 34.** Two plants with large whitish flowers. **Figure 35.** A large pink-flowered *S. isidorum* cultivated at the Botanical Garden of San Marcos.

simple and can be much thicker, the branches are fewer, erect or slightly decumbent and stiff, in contrast to the loose, decumbent stems of *S. decipiens*. Although the leaves of *S. isidorum* are dull green to lightly glaucous, they have a reddish tinge where exposed to light, and the stems are sometimes contrastingly bright red (Fig 31), while *S. decipiens* has a consistently overall light-green color (Fig 23). Both species have inflorescences with alternate cincinnoid branches, but *S. decipiens* may have more than three branches, looser and curving, with pure white flowers, the petal margins sometimes undulate, the carpels green. By contrast, *S. isidorum* almost always has three branches, the distal ones larger and so close and compact as to resemble a dichasium. In bright light, flowers have petals that are frequently pinkish, and the carpels are red, with margins always straight (Fig 32), although some plants that

thrive in cloudy locations have whitish petals and paler carpels (Figs 33, 34).

This new species is fairly common in the province of Cajamarca, and also San Marcos and Celendín, extending to the adjacent provinces of the Department of La Libertad. Its local name is “Chuqllu-chuqllu” (little corn). Flowers are sweet and are commonly eaten by children. It has not been observed in cultivation in Cajamarca, and many attempts to cultivate it in warm regions like Lima have failed because of the heat and aridity; it thrives in a mild climate and could then prove to be highly ornamental (Fig 35).

The name “isidorum” is a latinization of the Greek “*isidoron*,” (from Ἴσις [Isis], the Greek name of the Egyptian goddess of fertility and maternity Aset or Iset, and δῶρον [gift]). It honors two people: Dr Isidoro Sánchez-Vega, who also collected this plant and is founder



Figures 36–42. *Sedum reniforme*. **Figure 36.** *S. reniforme* *ex situ*, collected at the type locality near Hualgayoc. **Figure 37.** *S. reniforme*, detail: (left to right) young vegetative shoot, leaves, branch of cultivated plant. **Figure 38.** Detail of cymes (dichasia) of different length from different localities. **Figure 39.** Detail of (left to right): cincinnus, complete flower with bract, (above, left to right), bract outer side (2), sepal outer side, petal outer side, flower section. (below, left to right) bract inner side (2), sepal inner side, petal inner side, fruit. **Figure 40.** Young *S. reniforme* in habitat at Cumbemayo. Note the crowded broad leaves, very red at the end of the dry season. **Figure 41.** *S. reniforme* starting to bloom in habitat at Pamparomás, Ancash. **Figure 42.** Cultivated *S. reniforme* at the Botanical Garden of San Marcos.

and director of Herbarium CPUN, National University of Cajamarca, and my mother, Luisa

Isidora Infante, the woman who brought me into this world and patiently accompanied me

more than twelve times to Cajamarca, land of our ancestors. Without her help, many species of Piperaceae and Crassulaceae would not have been found and described.

6. *Sedum reniforme*

Sedum reniforme (H.JACOBSEN) THIEDE & T HART. *Novon* 9(1): 125. 1999.

Holotype: Dept. Cajamarca, pr. Hualgayoc juxta praedium La Tahona in rupibus 2600 m flor m Maj. 1904 (Weberbauer, 04/4053, B).

Basionym: *Cotyledon imbricata* DIELS in *Englers Bot Jahrbuch* 37: 411. 1906.

Synonyms: *Villadia reniformis* H.JACOBSEN. *Nat Cact Succ J* 13: 76. 1958.

Villadia imbricata (DIELS) BAEHNI & J.F.MC BRIDE, *Candollea* VII: 286, 1937. McBride. *Flora of Peru*. Vol III Part II No 3: 1013. 1938.

Altamiranoa imbricata (DIELS) A.BERGER in *Engl and Prantl, Pflanzenfam.* ed 2, 18a: 470. 1930.

A succulent glabrous herb, subcaespitose, forming mats to 15–20 cm diam, 7–10 (–15) cm tall (Fig 36). Stem procumbent at base, 1.8–2.5 (–4) mm diam, 4–8 cm long, light gray-brownish, with 3–5 primary roots 4–5 cm long, 1–1.2 mm diam, secondary roots fibrous, densely attached to moss. Branches 20–50 or more, erect to slightly decumbent, 3–6 (–8) cm long, stem 0.9–1.2 (–2) mm diam, light green to reddish. Leaves succulent, sessile, spirally attached to stem, subtriangular when young, then broadly ovate, sometimes elliptical to rotundate in very rainy seasons, 3–6 mm long, 3.5–5 mm wide, 2–3 mm thick, subacute to obtuse, upper side flat to slightly convex, lower side very convex, obscurely keeled, both sides dull green with minute reddish dots, almost dark purple in very exposed plants, margins entire (Fig 37).

Inflorescence a terminal cyme (dichasium) with two cincinnoid branches 1.4–1.7 mm diam at base, 0.6–2 cm long, light green to reddish (Fig 38). Flowers 5–9 per cincinnus, sessile, in habitat appearing from May to June. Flower buds 3–3.5 × 2.5–3 mm, dark red. Bracteoles narrowly ovate, 2.5–6.5 mm long, 1.5–2.5 mm wide, subacute, dull green with reddish dots, upper side flat, lower side convex. Sepals narrowly ovate, 2–5 mm long, 1.2–2.2 mm wide, similar to bracteoles. Petals oblong, acute-deltoid at tip, united at the base, bending outward at the middle, 3.5–4.5 (–7) mm long, 2–2.5 mm wide, greenish white. Stamens ten, the five epipetalous 1.2–1.4 mm long, the antesealous 1.5–1.7 mm long, filaments white. Anthers ovoid, yellow,

0.3 × 0.5 mm. Gynoecium ovoid, 2.1–2.5 × 2.5–3 mm. Carpels five, light green. Style 1–1.2 mm long, white, stigma white. Fruit 3.5 × 3.5 mm, carpels red. Seeds: narrowly ovoid, 0.55–0.65 mm long, 0.25–0.30 mm diam, brownish orange (Fig 39).

PERU. Dept. Cajamarca, Prov. Hualgayoc, Dist. Hualgayoc, “La Tahona Alta,” road from Hualgayoc to Bambamarca, on 45° slopes, 100 m above the road., on soil among rocks growing with *Peperomia* sp aff *nivalis*, *Peperomia galioides* KUNTH and *Echeveria eurychlamys* (DIELS) A.BERGER, 3180 m, 06°44′35″ S, 78°35′06″ W, 29 Apr 2007, *G. Pino 1709* (USM 217,140, type locality). Prov. Cajamarca, Dist. Cajamarca, Cumbemayo, on vertical rock walls growing with moss and *Peperomia hartwegiana* MIQ., *Peperomia parvifolia* C DC, *Echeveria oreophila* KIMNACH, 3610 m, 7°11′19″ S, 78°34′40″ W, 29 Apr 2007, *G. Pino 1711* (USM 217,139). Cumbemayo, on rocks with moss, large plants with white flowers, 7°11′04″ S, 78°32′30″ W, 3150 m, 22 Jan 2006, *RRP 847* (USM 217,141) (Fig 40). Dist. Baños del Inca: Purhuay, on rocks with moss, very compact plants, flowers greenish, 7°04′51″ S, 78°01′36″ W, 2914 m, 12 Jan 2006, *RRP 825* (USM 217,142). Dept. La Libertad, Prov. Santiago de Chuco, Dist. Santiago, Santiago–Shorayo road, 26 km from Santiago, 4000 m, 8°07′ S, 78°18′ W, 26 Aug 1982, *David Smith 2328* (USM 154,374). Dept. Ancash, Prov. Huaylas, Dist. Pamparomás, road from Cajabamba to Pamparomás, on rocks, with moss, 3400 m, 9°05′50″ S, 77°59′30″ W, 14 Apr 2006, *G. Pino 1663*. Prov. Yungay, Dist. Yungay, Umacchuco, km 18, road to Vaquería, crossing Huashao, rocky slope, 3410 m, 9°06′18″ S, 77°41′20″ W, 7 May 2006, *P. Carrillo-Reyes 5174* (USM 210,585). Huascarán National Park, Llanganuco sector, María Josefa Trail between Chinancocha and Pucayacu, *Polylepis sericea* woods and shrubland, 3850 m, 9°05′ S, 77°39′ W, 7 May 1985, *D. N. Smith 10,570*. (USM 68,957). Llanganuco, rocky slopes, 3800 m, 2 May 1961, *R. Ferreyra 14,366* (USM 19,607). Prov. Carhuaz, Dist. Shilla, Quebrada Ulta, on road to Ulta pass, 4000 m, 9°07′ S, 77°32′ W, 29 July 1985, *D. N. Smith 11,400* (USM 70,104). Prov. Huaraz, Dist. Huaraz, San Jerónimo Bridge (formerly Calicanto) at Río Santa, on west-facing rocky banks of the river on a 60° slope, growing with *Peperomia nivalis*, *Peperomia* cf *verruculosa*, *Sedum decipiens*, *Portulaca* sp, 3080 m, 9°31′37″ S, 77°31′48″ W, 17 Apr 2006, *G. Pino 1674*. Prov. Bolognesi, Dist. Chiquián, 5 km (in a straight line) N

of Chiquián on the way to Tallenga, on very wet rocks, 3260 m, 10°06'00" S, 77°09'28" W, 8 May 2006, P. Carrillo Reyes & M. Chocce 5177 (USM 210,321).

This species was collected by Weberbauer at the same time and locality as *Echeveria eurychlamys*. It was described initially as *Cotyledon imbricata* by Diels in 1906. After being transferred to *Altamiranoa* and to *Villadia*, the last combination proved to be illegitimate because of *Villadia imbricata*, published by Rose in 1903. Therefore Jacobsen renamed it *Villadia reniforme* in 1958. Finally in 1999 Thiede and 't Hart renamed it *Sedum reniforme* because of the previously published *Sedum imbricatum* by Walpers.

This species is unique among those included in this paper for its relatively wide leaves. However, we could not find any leaves that are broader than long as Thiede (2003) states, although some leaves are definitely reniform (kidney-shaped). After finding the type locality, we confirmed that this is the same species found much farther to the south in the departments of La Libertad and Ancash, where it is relatively more abundant (Fig 41).

In the present paper it is clear that the true *Sedum reniforme* from the type locality and the province of Cajamarca, as well as the specimens from the department of Ancash, have large, white, recurving petals (Fig 42). Diels' original description mentions "viridulo alba" (greenish white) petals. Many similar plants with no exact location have been grown in the USA and Europe and match the description but have clearly yellowish, greenish, or brownish flowers with shorter petals. Moreover, similar plants found by Nelson Cieza near the Río Marañón close to the border of Cajamarca with the departments of La Libertad and Amazonas have smaller, reddish flowers (RRP 432). *Sedum grandyi* HAMET is a species described from Chachapoyas, Amazonas at "el Caño de Santa Lucía," a disturbed locality where we searched exhaustively without success. On herbarium sheets *S. grandyi* is exactly like *S. reniforme* except for the brick color of the dried flowers. None of the descriptions of *S. grandyi* mention the color of the flowers. Future studies in the departments of La Libertad and Amazonas have to be made to see if these similar taxa with non-white flowers belong to new undescribed species, to *S. grandyi*, or to new varieties of *S. reniforme*.

James E Low (2006) of California published several articles about these closely related taxa, of which only *S. reniforme* has been discussed

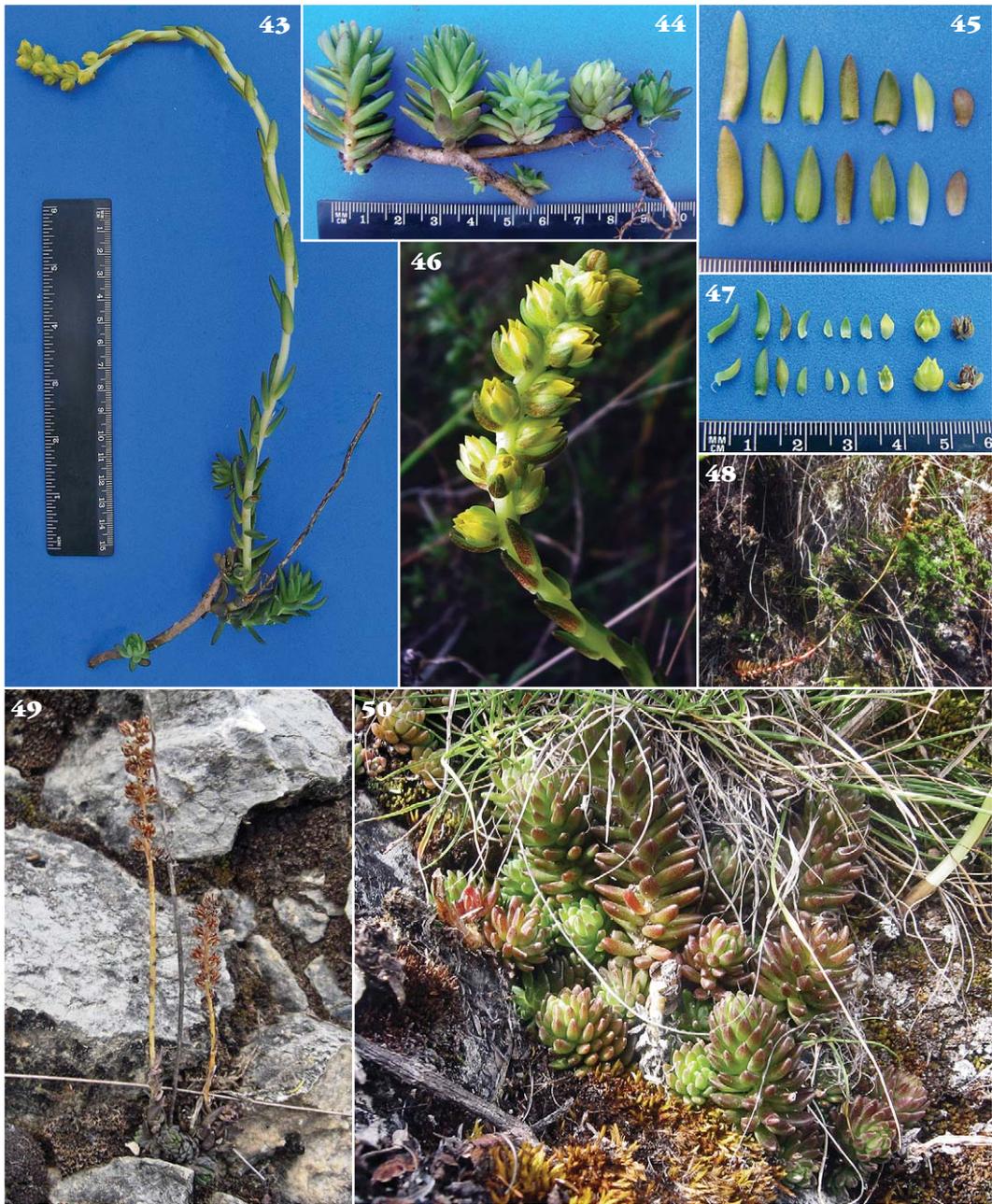
in detail. All of those mentioned above, plus *Sedum andinum*, a species from far south of Lima (Pino 2006), share two basic features: (1) widely oval to orbicular, bead-like leaves, often crowded along the stems, mostly dull green, reddish in the sun; and (2) the inflorescence is a cyme of two-forked branches, with light-colored petals often marked with red. Low thought all these should be included in a group for which he proposes the name "*Sedum andinum* complex," based on the best-known species, which is the smallest of this group. As soon as *Sedum grandyi* and the new taxa are clearly defined, this group could be formally established.

7. *Villadia klopfensteinii* PINO & CIEZA sp. nov.

Planta succulenta glabra, florens usque ad 28–35 cm alta. Caulis procumbens fuscus 2.5–5 mm diam, 1–6 ramis erectis, sterilibus 1.7–5 cm longi, florigeris usque ad 35 cm, caulibus 2.5–3.5 mm diam flavovirentibus. Folia succulenta sessilia spiraliter disposita, infima confertim inserta, suprema erecta laxe dispersa, anguste ovata vel oblonga 1.3–1.8 cm longa, 4–5 mm lata, subacuta, flavovirentia, calcari hyalino instructa. Inflorescentia terminalis spica 4–11 cm longa, 16–34 floribus sessilibus. Bractee ovatae, 6–7 mm longae 2–2.5 mm latae, in quoque flore ternae, angulo fere recto divergentes. Sepala triangularia-oblonga 3–6 mm longa 1.3–1.5 mm lata. Petala oblonga acuta 5.5–6 mm longa, 2.5–3 mm lata, a basi usque ad apicem coalita, flavovirentia. Stamina filamentis albis. Carpela 5 fusiformia albobirentia. Floret ab Aprile ad Majum.

Holotype: Dept. Cajamarca, Prov. Celendín, Dist. Sucre, on road to Celendín, 33 km east of Cajamarca, 5 km west of Encañada, 3190 m, 16 May 1964, P. C. Hutchison & J. Kenneth Wright 5117 (UCB 1410,141); F 1793,301, K (isotypes).

A succulent glabrous herb 28–35 cm tall when flowering. Roots 3–5 cm long, 1–1.8 mm diam, whitish. Stem procumbent, 2.5–5 mm diam, gray-brownish, branching every 2–6 cm (Fig 43). Branches 1–6 (–10), erect, vegetative shoots 1.7–5 cm long (Fig 44), flowering shoots up to 35 cm, stem 2.5–3 (–3.5) mm diam, light green-yellowish, rarely reddish. Leaves succulent, sessile, spirally arranged; crowded near the base, spreading and recurved inwards in young shoots, more widely spaced and erect in the distal $\frac{4}{5}$, narrowly ovate to narrowly oblong, (0.9–) 1.3–1.8 (–2.4) cm long, (3.5–) 4–5 mm wide, 2–2.5 mm thick, obtuse-subacute, upper (inner) side convex



Figures 43–50. *Villadia klopfensteinii*. **Figure 43.** *V. klopfensteinii* *ex situ* from San Isidro. **Figure 44.** Young vegetative shoots of *V. klopfensteinii*. **Figure 45.** Detail of the leaves of *V. klopfensteinii*. **Figure 46.** Spike of *V. klopfensteinii* in habitat. **Figure 47.** Detail of (left to right) bract lateral view, opposite bract, lateral bracts (2), sepals (3), petal, flower, fruit. **Figure 48.** *V. klopfensteinii* in habitat at Río Seco, spike several times larger than the plant. **Figure 49.** *V. klopfensteinii* in the dry season. Plants with small rosettes and dried spikes could be mistaken for *Echeveria* when not observed carefully. **Figure 50.** Young plant of *V. klopfensteinii* in habitat.

to flat, lower (outer) side convex, obscurely keeled, spurred at base, dull green-yellowish, rarely purplish with yellowish dots, margins entire (Fig 45).

Inflorescence a terminal spike 4–11 cm long

(Fig 46). Flowers (12–) 16–34, appearing from April to May. Bracteoles three per flower, up-curved, the largest opposite the stem and the other two lateral, placed at 90° one at each side, 6–7 (–10) mm long, 2–2.5 mm wide,



Figures 51–56. *Villadia aureistella*. **Figure 51.** *V. aureistella* ex situ, Cajabamba. **Figure 52.** Detail of leaves (left) and young shoot (right). **Figure 53.** Detail of spike of *V. aureistella*. The golden yellow flowers have strongly recurving petals, a unique character among the Peruvian species. **Figure 54.** (above, left to right) detail of, flower bud, flower showing bract disposition, flower section, fruit. (beneath, left to right) opposite bract, lateral bracts (2), sepals (2), petals, lateral view, outer side, inner side, gynoeceum. **Figure 55.** *V. aureistella* in habitat growing on the rock walls around Cajabamba. **Figure 56.** Young *V. aureistella* at Liclic. It could easily be mistaken for *V. paniculata*.

narrowly ovate, subacute, inner side concave, outer side convex and sometimes with reddish dots, with a hyaline spur at base. Pedicels absent. Sepals deltoid to oblong, obtuse, 3–6 mm long, 1.3–1.8 mm wide, light green. Petals oblong, acute-deltoid at tip, united along margins, curved inwards, tips slightly spreading

outwards, 5.5–6 mm long, 2.5–2.8 mm wide, outer surface convex, green-yellow, inner surface concave, light green, margins entire. Stamens ten, the five epipetalous 2.5–3.2 mm long, the antesealous 3.5–4.2 mm long, filaments white, 0.4 mm diam Anthers deltoid-ovoid, 0.8 × 0.7 mm, yellow. Gynoeceum ovoid,

3.2 × 4.8 mm. Carpels five, 2.5–3.5 mm long, light green. Style 0.6 mm diam, 0.8 mm long, green, stigma white. Nectary scales oblong-spathulate, 1–1.2 mm. Fruit a dehiscent capsule, 4 × 5.2 mm, dry carpels reddish (Fig 47). Seeds narrowly ovoid, 0.65–0.70 mm long, 0.25–0.35 mm diam, orange.

PERU. Dept. Cajamarca, Prov. Celendín, Dist. Celendín, canyon of Río Marañón above Balsas, 3–4 km below summit of the road to Celendín, 2950 m, 23 May 1964, *P. C. Hutchison & J. Kenneth Wright 5280* (USM 43,488). Prov. Cajamarca, Dist. Baños del Inca, Route to ex-Estate Sangal, towards Encañada, 3190 m, 07°04'46" S, 78°23'55" W, 2 Apr 2002, *I. Sánchez-Vega 11355* (CPUN 15470). Dist. Encañada, near Encañada, on rocks, 2870 m, 4 May 1970, *A. Sagástegui 7384* (US 2588,359). Road from Encañada to Celendín, 1 km before Quinuamayo, growing with *P. nivalis* forma *diminuta*, 3410 m, 07°03'14" S, 78°19'44" W, 30 Apr 2000, *G. Pino 269* (USM 217,137). Prov. San Marcos, Dist. Gregorio Pita: road from San Isidro to Casablanca, on rocks, 7°14'38" S, 78°00'33" W, 3660 m, 15 May 2003, *G. Pino 1147*. Río Seco, 7°13'09" S, 78°12'07" W, 3097 m, 17 May 2002, *RRP 388*. (USM 217,138) (Fig 45). Ullillín, 7°15'47" S, 78°08'03" W, 2924 m, 24 Jun 2001, *RRP 26*. Prov. San Pablo, Dist. Tumbadén: Inгатambo, west of the floodgate on grassy highland, 6°55'20" S, 78°40'04" W, 3240 m, 13 Mar 2002, *I. Sánchez-Vega and A. Miranda Leiva 11,318* (CPUN 15,431) Loc. Cit., 10.5 km from detour of the road Cajamarca-Hualgayoc, on rocky outcrops, 6°55'20" S, 78°40'04" W, 3450 m, 25 Feb 2004, *I. Sánchez-Vega and W. Díaz Miranda 12,554* (CPUN 17,987). Dept. La Libertad, Prov. Sánchez Carrión, Dist. Huamachuco, road to Cajabamba, between Sausacocha and Cajabamba, 7°41' S, 78°01' W, 3000 m, 15 Feb 1983, *D. N. Smith & R. Vásquez 3383* (USM 125,278).

This species was collected for the first time in Celendín by Hutchison in 1964, who never named it, and it was found again by the team of the Botanical Garden of San Marcos led by Olivier Klopfenstein while looking for new species of *Peperomia*. From a distance this plant looked to them like a miniature *Echeveria* with yellow flowers (Fig 48), a character that can be even more confusing in the dry period (Fig 49). Vegetative shoots emerge as rosettes (Fig 50), flowers with campanulate flowers with erect, stiff, adnate petals are born in terminal spikes of the flowering stems,

which at first were thought to be lateral inflorescences. A closer look shows that vegetative and flowering branches emerge separately from the procumbent primary stem buried in moss. The plant is named for Olivier Klopfenstein, born in Switzerland, forester and amateur botanist who came to Peru to visit his wife's country and remained for many years. He is the founder of the Botanical Garden of San Marcos, a tireless researcher of Peruvian flora, and co-author of several species of *Peperomia*. This is a homage to all his work during his stay among us. We hope he will return someday to continue exploring our land.

8. *Villadia aureistella* PINO & CIEZA sp. nov.

Planta succulenta glabra florens usque ad 28–30 cm alta. Caulis erectus, ad basim 6–10 mm diam, ramis erectis 1–6, 3–5 mm diam, griseobrunneis. Rami secundarii steriles 3–6 cm longi, floriferi usque ad 30 cm longi, caulibus 1.8–2 mm diam rubiginosis. Folia succulenta imbricata spiraliter disposita sessilia anguste ovata vel anguste oblonga 8.5–10 mm longa, 1.8–2.5 mm lata, subacuta, flavovirentia. Inflorescentia terminalis spica 4–8 cm longa, 16–32 floribus sessilibus. Bractee anguste ovatae-oblongae, 5–8 mm longae 1.5–1.8 mm latae, in quoque flore ternae, angulo fere recto divergentes. Sepala anguste ovata vel triangularia 4–6 mm longa 1.5–1.8 mm lata. Petala oblonga acuta 7.5–8 mm longa, 2.2–2.6 mm lata, flava, a basi usque ad dimidium vel $\frac{2}{3}$ partem coalita, demum deltoidea extrorsum recurvata. Stamina filamentis albis. Carpela 5 fusiformia alba. Floret ab Majo ad Julium.

Holotype: Dept. Cajamarca, Prov. Cajabamba, Dist. Cajabamba, outskirts of the city of Cajabamba, road from Cinco Esquinas to the waterfall of Cochecorral, on rock-walls along field-borders, growing with *Echinopsis pachanoi*, *Opuntia ficus-indica*, *Peperomia galioides*, *Opuntia exaltata* [*Austrocylindropuntia subulata* ssp. *exaltata*], 7°36'30" S, 78°02'35" W, 2600 m, 29 Jul 2005, *RRP 810* (USM 217,136).

A succulent glabrous herb, 28–30 cm tall when flowering. Primary roots 3–6, 3.5–5 cm long, 2–2.5 mm diam, light brown, secondary roots numerous, 1–1.2 mm diam, 3–4 cm long. Stem decumbent, apices erect, 6–10 mm diam at base, gray-brownish, branching profusely. Primary branches 1–4 (–6), erect, 3–5 mm diam, up to 15 cm long (Fig 51). Secondary branches numerous, vegetative shoots (1–) 3–6 cm long, flowering shoots up to 30 cm long, stem 1.8–2 (–4.5) mm, reddish. Leaves succu-

lent, sessile, spirally attached to stem, denser on young shoots, attached to stem at a right angle, tip later recurving upwards, narrowly ovate to oblong, 8.5–10 (–13) mm long, 1.8–2.5 mm wide, 1.5–1.8 mm thick, obtuse-subacute, upper side flat to slightly convex, lower side convex, yellowish green, reddish near tip, margins entire (Fig 52).

Inflorescence a terminal spike 4–6 (–8) cm long (Fig 53). Flowers 16–32, appearing from May to July, the lower third rarely geminate. Rachis 2–2.2 mm diam, reddish. Flower buds 6 × 5 mm, light green. Bracteoles three per flower, the largest opposite the stem and the other two lateral, placed at 90° one at each side, 5–8 mm long, 1.5–1.8 mm wide, narrowly ovate-oblong, obtuse to acute, upper side concave, lower side convex, slightly curved upwards, with a hyaline spur at base. Pedicels absent. Sepals narrowly ovate to oblong, obtuse, 4–6 mm long, 1.5–1.8 mm wide, light green. Petals oblong, acute-deltoid at tip, united at the base, recurving along the distal two-thirds, 7.5–8 mm long, 2.2–2.6 mm wide, outer surface convex, greenish yellow to bright yellow, paler at base, inner surface concave, yellow, margins entire. Stamens ten, the five epipetalous 4–4.2 mm long, the antesealous 6–6.2 mm long, filaments white, conical, 0.4 mm diam. Anthers deltoid-ovoid, 0.4 × 0.5 mm, yellow. Gynoecium ovoid, 3.2 × 4 mm, carpels five, 3.5–4 mm long, whitish. Style 2 mm long, light green, stigma white. Nectary scales widely oblong, 1 × 1 mm, yellowish green. Fruit a dehiscent capsule, 6.5 × 7 mm, dry carpels light brown tinged with orange. Seeds narrowly ovoid, 0.65–0.75 mm long, 0.30–0.35 mm diam, light brown (Fig 54).

PERU. Dept. Cajamarca, Prov. Cajabamba, Dist. Cajabamba, Cajabamba, road from Cinco Esquinas to Cohecorral, 7°36'24" S, 78°02'30" W, 2730 m, 2 Feb 2008, *G. Pino 1895*. Prov. San Marcos, Dist. José Manuel Quiroz, road from Liclic to Platanillo, on borders of footpath partially shaded by shrubs, growing with *Villadia thiedeii*, 7°20'09" S, 77°59'16" W, 2920 m, 1 Feb 2008, *G. Pino 1883*.

This species was discovered by the San Marcos Botanical Garden team during an expedition to Cajabamba and was first noticed by Nelson Cieza on 22 January 2004 growing on rocky walls around the city (Fig 55). Later we discovered that plants we had supposed to be a new species found at Liclic and Alisopata and growing with *V. thiedeii* and *V. paniculata* also belonged to this new taxon. Young plants have erect reddish stems with terete, al-

most linear yellowish-green leaves, a character it shares with *Villadia paniculata* (described below), making the two indistinguishable without flowers (Fig 56). A photo of *V. aureistella* was published by Low (2006). It is unique among the known species of *Villadia* in Peru in having showy flowers with petals totally recurved, forming loops, as is found in the Mexican *Villadia recurva* MORAN, KIMNACH & UHL. The name "aureistella" refers to the golden, star-shaped flowers.

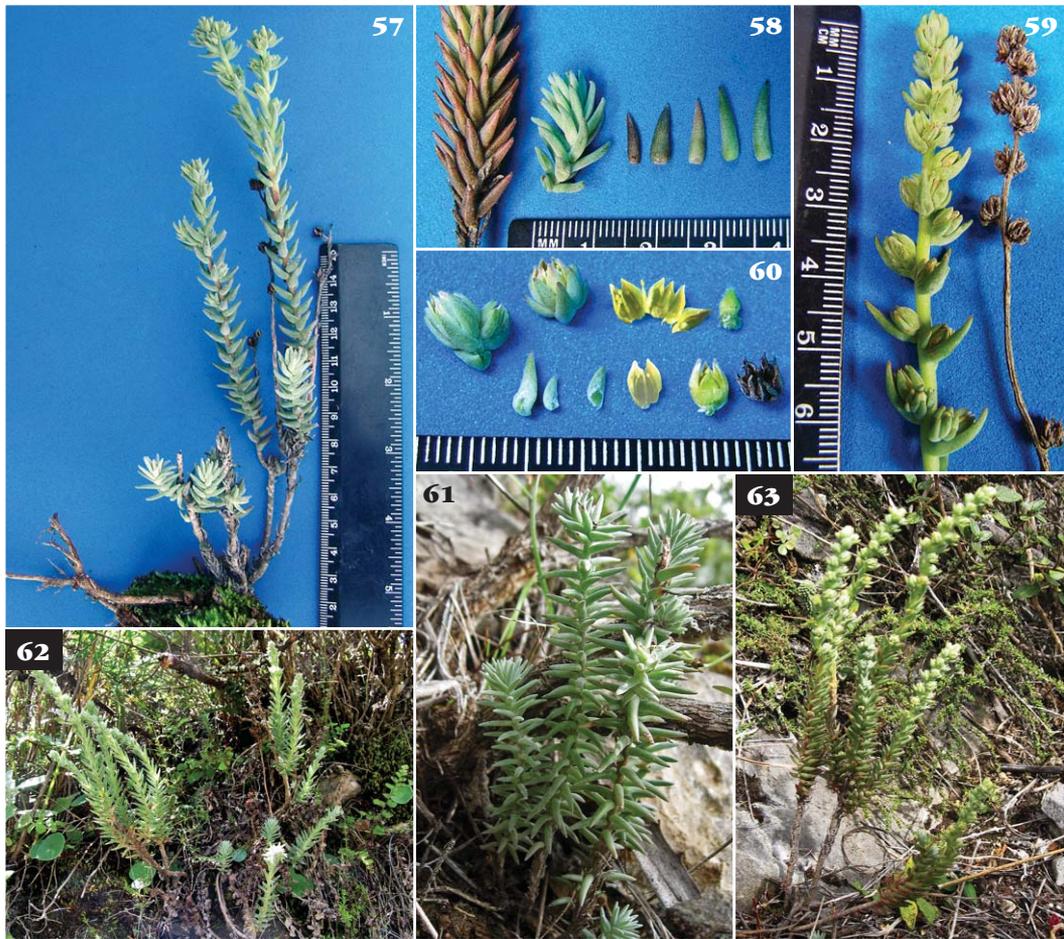
9. *Villadia thiedeii* PINO & CIEZA sp. nov.

Species habitu cum Villadia virgata congruens, sed differt ab ea ramificatione staturaque majoribus, usque ad 35 cm alta, foliis longioribus anguste triangularibus 9–13 mm longis 2–3 mm latis glaucis saepe rubescentibus; inflorescentia longiore spica 3–13 cm longa 13–30 floribus sessilibus minoribus, sepalis 3.2–3.5 mm longis 1.4–1.6 mm latis, petalis oblongis acutis 3.3–3.7 mm longis 1.4–1.6 mm latis pallide flavovirentibus apice introrsum recurvato. Floret ab Decembro ad Februarium.

Holotype: Dept. Cajamarca, Prov. San Marcos, Dist. José Manuel Quiroz, road from Liclic to Platanillo, on borders of footpath partially shaded by shrubs, growing with *Villadia aureistella*, *Peperomia cereoides* Pino et Cieza, *Peperomia rupiseda* DC, and *Sedum isidorum*, 7°20'09" S, 77°59'16" W, 2920 m, 1 Feb 2008, *G. Pino 1882* (USM 218,481).

A succulent glabrous herb, 14–35 cm tall when flowering. Roots 3–7 cm long, 0.1–0.25 mm diam, grayish. Stem erect, 1.8–4 (–5) mm diam at base, gray-brownish, branching every 5–8 cm. Branches 1–5, erect, vegetative shoots 7–13 cm long, flowering shoots up to 20 cm long, stem 2–2.5 mm diam, glaucous, reddish where exposed and at base in young plants (Fig 57). Leaves succulent, sessile, spirally arranged, crowded near the base and in young plants attached at an acute angle, straight to slightly upcurved, narrowly ovate to narrowly deltoid, (6–) 9–13 mm long, 2–3 mm wide, 1.4–3 mm thick, obtuse-subacute, upper side flat to slightly concave, lower side convex, light green-glaucous, reddish in very exposed plants, margins entire (Fig 58).

Inflorescence a terminal single spike 3–9 (–13) cm long, rarely with 3–5 basal branches (Fig 59). Flowers 13–30, appearing from December to February, rarely geminate along the lower third. Rachis 1.8–3 mm diam, light green-glaucous. Flower buds 4.5 × 4 mm. Bracteoles three per flower, the largest opposite the stem and the other two laterally placed at 90°, one

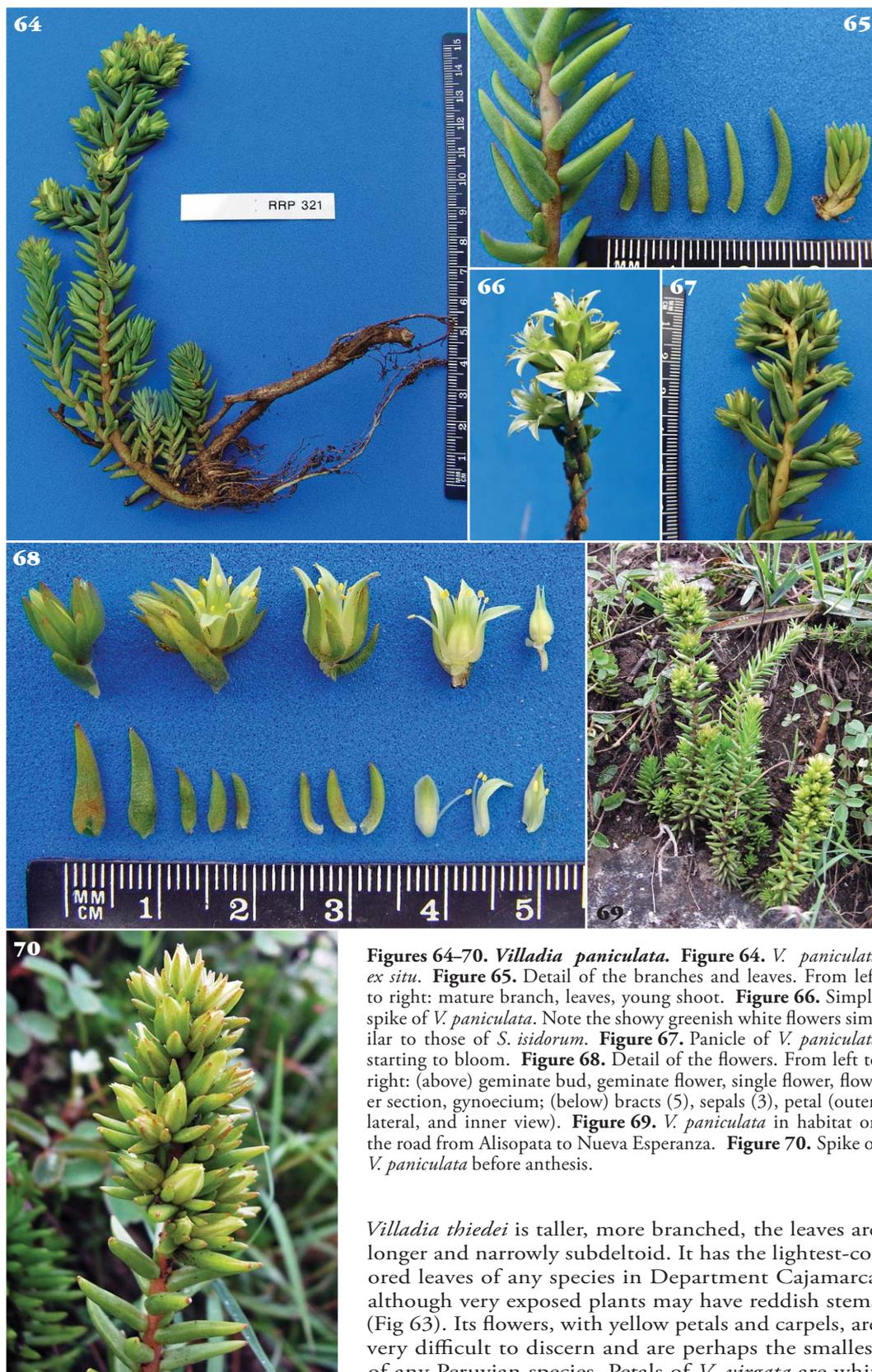


Figures 57–63. *Villadia thiedeii*. **Figure 57.** *V. thiedeii* ex situ. **Figure 58.** Detail of the branches and leaves. From left to right: mature branch, young shoot, leaves. **Figure 59.** Comparison of immature (left) and mature, dry (right) spikes. **Figure 60.** Detail of the flowers. From left to right: geminate flower bud, (above) flower, extended calyx, gynoecium; (below) bracts (2), sepal, petals, flower section, dry fruit. **Figure 61.** Young *V. thiedeii* in habitat without flowers in the dry season. Note the light glaucous color. **Figure 62.** Shaded *V. thiedeii* in habitat at Liclic growing with *Peperomia rupiseda*. **Figure 63.** *V. thiedeii* in habitat initiating anthesis. Note the reddish stems of very exposed plants.

at each side, 3.5–5.5 mm long, 1.2–1.7 mm wide, narrowly ovate-deltoid, obtuse to acute, upper side flat to concave, lower side convex, slightly upcurved, with a hyaline spur at base. Pedicels absent. Sepals narrowly ovate to deltoid, 3.2–3.5 mm long, 1.4–1.6 mm wide, light green-glaucous. Petals oblong, apex obtuse to acute-deltoid, united along the proximal three fourths, incurved along the distal fourth, 3.3–3.7 mm long, 1.4–1.6 mm wide, outer surface convex, greenish pale yellow with a reddish flush near distal keel, inner surface concave, yellow, margins entire. Stamens ten, the five epipetalous 1.8–2 mm long, the antepetalous 2.8–3 mm long, filaments pale yellow, conical, 0.3 mm diam. Anthers ovoid, 0.3 × 0.5 mm, yellow. Gynoecium ovoid, 1.82 ×

2.00 mm, green. Carpels five. Styles 0.7 mm long, light green. Nectary scales oblong-deltoid, greenish-white, 1.2 × 0.6 mm. Fruit a dehiscent capsule, 4.5 × 3.5 mm, dry carpels brown (Fig 60).

In 2000, this species was discovered by the San Marcos Botanical Garden team at the type locality of *Peperomia cereoides* and *P. liclicensis* (Pino and others 2003) (Fig 61). However, its flowers were not seen until 2007, when Nelson Cieza and Philippe Corman discovered its spikes, establishing its position in *Villadia* (Fig 62). It was not until recently that we could differentiate it from *Villadia virgata* (DIELS) BAEHNI & MCBRIDE, from Chiquián, Ancash, not very distant geographically (Pino 2006).



Figures 64–70. *Villadia paniculata*. **Figure 64.** *V. paniculata* *ex situ*. **Figure 65.** Detail of the branches and leaves. From left to right: mature branch, leaves, young shoot. **Figure 66.** Simple spike of *V. paniculata*. Note the showy greenish white flowers similar to those of *S. isidorum*. **Figure 67.** Panicle of *V. paniculata* starting to bloom. **Figure 68.** Detail of the flowers. From left to right: (above) geminate bud, geminate flower, single flower, flower section, gynoecium; (below) bracts (5), sepals (3), petal (outer, lateral, and inner view). **Figure 69.** *V. paniculata* in habitat on the road from Alisopata to Nueva Esperanza. **Figure 70.** Spike of *V. paniculata* before anthesis.

Villadia thiedeii is taller, more branched, the leaves are longer and narrowly subdeltoid. It has the lightest-colored leaves of any species in Department Cajamarca, although very exposed plants may have reddish stems (Fig 63). Its flowers, with yellow petals and carpels, are very difficult to discern and are perhaps the smallest of any Peruvian species. Petals of *V. virgata* are whit-

ish, slightly recurved at the apex, and the outer side has a brownish keel. The new species has coriaceous petals with incurved apices and with a pinkish tinge on the outer side of the apex. The species is dedicated to the German botanist Joachim Thiede, an authority on Crassulaceae, who together with Henk 't Hart transferred all cymose Peruvian Sedoideae to *Sedum* (1999). He kindly forwarded to us all his papers and photos to make this article possible. Although his name is pronounced "tee-duh" in German, I suggest the specific name be pronounced "TEE-dee-eye" for the sake of euphonics.

**10. *Villadia paniculata*
PINO & CIEZA sp. nov.**

Planta succulenta glabra florens usque ad 25 cm alta. Caulis procumbens, 2–4 mm diam, ferrugineus. Rami 1–5 erecti, steriles 4–12 cm longi, florigeri usque ad 25 cm longi, caulibus ad basin 1.8–2 mm diam rubiginosis. Folia succulenta, spiraliter disposita sessilia congesta ubi juvenia, anguste oblonga vel subteretia 8–14 mm longa, 1.5–1.8 mm lata, subacuta, flavovirentia apicem versus rubescentia. Inflorescentia terminalis spica 3–8 cm longa, 5–20 floribus sessilibus, vel plerumque paniculata usque ad 9 ramis spicatis 6–9 floribus terminalibus. Bracteae in quoque ramo basales et inter ramos, foliorum similes sed calcari instructae et sursum planae. Bracteolae ovatae-triangulares 5.5–6.5 mm longae 1.4–1.7 mm latae. Sepala anguste oblonga vel subteretia ad basin dealbata curvata 6.5–8 mm longa 1.4–1.6 mm lata. Petala oblonga 7–7.8 mm longa, 2–2.5 mm lata, albivirentia, a basi usque ad tertiam partem coalita, demum deltoidea a dimidia parte extrorsum leviter recurvata. Stamina filamentis albis. Carpela 5 fusiformia albivirentia. Floret ab Aprile ad Majum.

Holotype: Dept. Cajamarca, Prov. San Marcos, Dist. José Sabogal, road from Alisopata to Nueva Esperanza, among shrubs along the road, with *Oxalis* sp, *Piper* sp, *Peperomia cymbifolia* var *goodspeedii*, *P. nivalis*, 7°18'36" S, 77°59'41" W, 3028 m, 23 Aug 2002, RRP 321 (G. Pino 1075) (USM 224,792).

A succulent glabrous herb, 12–25 cm tall when flowering (Fig 64). Roots filiform, 2–4 cm long, 0.2 mm diam, brownish. Stem procumbent, subterranean, 2–4 mm diam at base, reddish-brown, branching every 1.5–7 cm. Branches 1–5, erect, vegetative shoots 4–12 cm long, flowering shoots up to 25 cm long, rachis 1.5–3 mm diam at base, reddish-brown at base to reddish-green at apex. Leaves sessile, succulent, spirally arranged, crowded on young shoots, attached at a right to acute

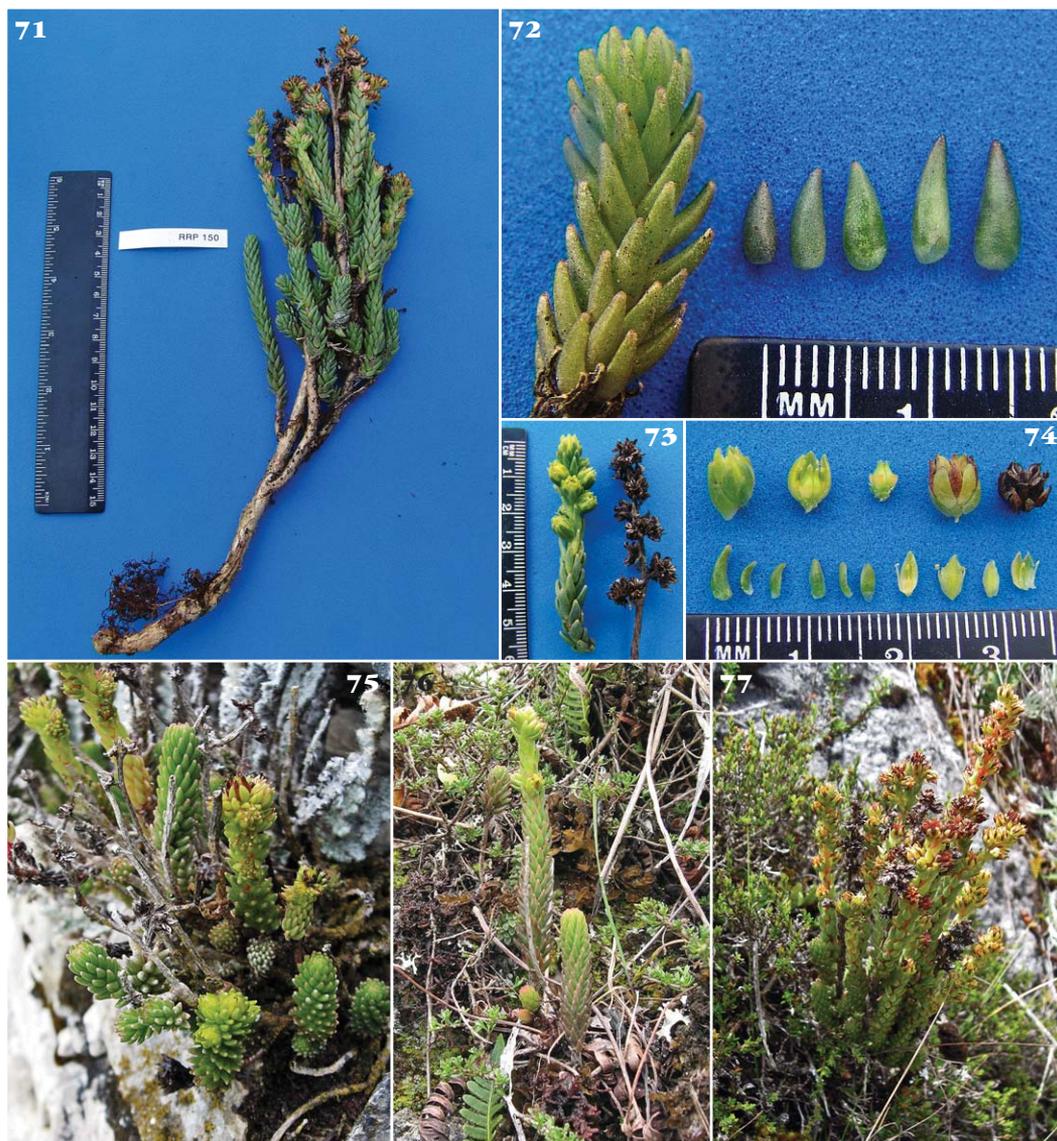
angle, straight to very slightly upcurved, narrowly oblong to subterete, 8–14 mm long, 1.5–1.8 mm wide, 1–1.3 mm thick, obtuse-subacute, upper and lower sides convex, light yellowish-green, reddish at the apex, margins entire (Fig 65).

Inflorescence a terminal single spike 3–8 cm long, rachis 1.2–2 mm diam, with 5–20 crowded flowers (Fig 66) or a panicle with up to nine branches (spikes), each with (3–) 6–9 flowers crowded at the tips, rachis 0.5–3 cm long, 1.1–1.5 mm diam, light reddish-green to bright red, bracts at the base of each branch and between them, like the leaves but flat above and hyaline-spurred (Fig 67). Flower buds 6–8 × 4 mm, frequently geminate, appearing from April to May. Bracteoles two per flower, 5.5–6.5 mm long, 1.4–1.7 mm wide, narrowly ovate-deltoid, obtuse to acute, upper side flat-concave, lower side convex, with a hyaline spur at base. Pedicels very short. Sepals narrowly oblong to subterete, curved at the whitish base, 6.5–8 mm long, 1.4–1.6 mm wide, light yellowish-green. Petals oblong, obtuse-acute-deltoid at tip, united along the proximal third, outcurved along the distal half, 7–7.8 mm long, 2–2.5 mm wide, outer surface keeled, pale greenish-white at center and tip, inner surface concave, white, margins entire. Stamens ten, the five epipetalous 3.5–4 mm long, the antesealous 4.5–5 mm long, filaments white, conical, 0.6–0.8 mm diam Anthers ovoid, 6–8 mm long, yellow. Gynoecium ovoid, 2.5 × 3.5–4 mm, greenish-white. Carpels five. Styles 2.2–2.5 mm long, conical, greenish. Nectary scales reniform, 0.8 × 0.6 mm, greenish white (Fig 68). Fruit not seen.

In December 2000, Alfred Lau visited Peru and attempted unsuccessfully to locate the type locality of *Matucana huagalensis* (DONALD & LAU) BREGMAN, discovered by him in 1968. Two years later Olivier Klopfenstein and Nelson Cieza found the exact locality at Nueva Esperanza, and on the way they collected a few specimens of an unidentified species of *Villadia* (Fig 69). Plants were cultivated at the Botanical Garden of San Marcos, where it became clear that this was a new species, its most striking character being the terminal inflorescence with lateral, alternate branches along the main central axis, forming a panicle of spikes (Fig 70), which in old plants resembles a raceme without bracts. Flowers are showy, petals are greenish white, with apices folded outwards but not as curved or golden yellow as in *Villadia aureistella*. When Klopfenstein and Cieza returned later, they

reported seeing plants with whitish and yellow flowers. It is likely that they saw *V. au-reistella*, which may also grow there. These two species can be easily be mistaken for one other because of similar foliage, even though *V. paniculata* has straighter leaves. We visited this locality recently and found very few plants due to the building of new roads. We

hope this species will prove to have a wider distribution in the province of San Marcos to the north, and perhaps in the province of Celendín, for it has never been found further south. The name “paniculata” refers to the inflorescence, uncommon in the genus. Simple spikes can also be observed in small, weak plants.



Figures 71–77. *Villadia kinnachii*. **Figure 71.** *V. kinnachii* in habitat. **Figure 72.** Detail of the young shoot (left) and leaves (right). **Figure 73.** Comparison of spike with flowers (left) and mature dry spike (right). **Figure 74.** Detail of the flowers. From left to right: (above) flower, flower section, gynoecium with nectaries, immature fruit, dry fruit; (below) bracts (3), sepals (3), petal (inner, outer, and lateral view). Note the remarkable salmon-colored nectaries. **Figure 75.** *V. kinnachii* in habitat at Casablanca initiating anthesis. **Figure 76.** Young *V. kinnachii* with lycopodium-like growth. **Figure 77.** Mature *V. kinnachii* with mature spikes. Figures 17, 19, 20 by Sidney Novoa; Figures 33, 34, 35, 42, 46, 48, 49, 50, 56, 61, 63, 69, 70, 75, 76, 77 by Nelson Cieza; all others by Guillermo Pino.

**11. *Villadia kinnachii*
PINO & CIEZA sp. nov.**

Planta succulenta glabra, florens usque ad 28 cm alta. Caulis erectus chalybeus decorticans, supra basin 6–9 mm diam, 3–10 ramis erectis. Rami lycopodiiformes, steriles 3.5–8 cm longi, floriferi 10 cm longi, caulibus ad basin 1.8–2 mm diam, griseobrunneis, apicem versus rubescentibus. Folia succulenta dense imbricata spiraliter disposita sessilia perdurantia anguste ovata vel triangularia 5–7.5 mm longa, 2–2.5 mm lata, subacuta, flavovirentia apicibus rufescentibus. Inflorescentia terminalis spica 2.5–7 cm longa, 5–15 floribus sessilibus. Bractee ovatae-triangularis, 3–5.5 mm longae 1–1.5 mm latae, in quoque flore ternae, angulo fere recto divergentes. Sepala oblonga 3.2–3.8 mm longa 1.4–1.5 mm lata. Petala oblonga lanceolata 4–4.5 mm longa, 1.8–2 mm lata, pallide flavovirentia, a basi usque ad $\frac{3}{4}$ partem coalita, demum deltoidea introrsum recurvata. Stamina filamentis albis. Carpela 5 fusiformia albobirentia. Squamae nectariferae rectangulares obtusangulae conspicue salmonaeae. Floret ab Martio ad Aprilem.

Holotype: Dept. Cajamarca, Prov. San Marcos, Dist. José Sabogal, road from San Isidro to Casablanca, on rocks of ruins, growing with *Peperomia cereoides* var. *reducta*, *P. hartwegiana* var. *minutifolia*, *Ephedra* cf. *americana*, *Pleurothallis* sp., *Oncidium* sp., *Oxalis* sp., 7°14'38" S, 78°00'33" W, 3660 m, 15 May 2003, G. Pino 1147 (RRP 150) (USM 224,793).

A succulent glabrous herb, 15–28 cm tall when flowering. Roots fibrous, short, 0.5–1.5 cm long, 0.1 mm diam, brown. Stem erect, (0.4–) 0.6–0.9 cm diam at base, shiny light gray-brownish, epidermis peeling off easily, branching every 2–3 cm (Fig 71). Branches 3–10, rarely arising from base, erect, vegetative shoots 3.5–8 cm long, 1.8–2.5 mm diam at base, grayish, stem and leaves together forming a column 6–8 mm diam, flowering shoots up to 10 cm long, stem tapering to 1.5–2 mm diam, light reddish-green near apex. Leaves succulent, sessile, spirally arranged, crowded and adpressed to stem on all vegetative and flowering shoots but absent on primary stem and branches, attached at an acute angle, slightly incurved, narrowly ovate to narrowly deltoid, 5–7.5 mm long, 2–2.5 mm wide, 2–2.2 mm thick, obtuse to subacute, upper side flat to slightly concave, lower side convex, bright yellowish-green, apices reddish, margins entire (Fig 72).

Inflorescence a terminal single spike 2.5–7 cm long. Flowers (5–) 9–15, appearing from March to April, rarely geminate at the base (Fig 73). Rachis 1.3–2 mm diam, light red-

dish-green. Flower buds 4 × 4 mm. Bracteoles three per flower, the largest opposite to the stem and the other two lateral placed at 90°, one at each side of the flower, 3–5.5 mm long, 1–1.5 mm wide, narrowly ovate-deltoid, apex obtuse, upper side flat-concave, lower side convex, slightly upcurved, with a hyaline spur at base, bright green. Pedicels absent. Sepals oblong, 3.2–3.8 mm long, 1.4–1.5 mm wide, bright green, apex obtuse. Petals oblong to lanceolate, apex deltoid obtusely acute, adnate along the proximal three fourths, incurved along the distal fourth, 4–4.5 mm long, 1.8–2 mm wide, outer surface convex, pale greenish-yellow, inner surface concave, light greenish-yellow, margins entire. Stamens ten, the five epipetalous 2.4–2.6 mm long, the antesealous 2.8–3 mm long, filaments white, conical, 0.25 mm diam. Anthers ovoid, 0.4 × 0.3 mm, yellow. Gynoecium ovoid, 2 × 2.4 mm, light green. Carpels five. Styles 0.8 mm long, green. Nectary scales oblong to deltoid, 1.2 long × 0.8 mm wide, bright salmon-pink. Fruit a dehiscent capsule appearing from May to June, 5.5 × 4 mm, dry carpels brown (Fig 74).

This species was observed in 2003 at the type locality of *P. cereoides* var. *reducta* and *P. hartwegiana* var. *minutifolia* (Pino and others 2004) and mistaken for the common *Sedum* species of Cajamarca, *S. isidorum* (Fig 75). However, the stems of *Villadia kinnachii* are erect and very long, with non-deciduous leaves adpressed closely to the stem as in some species of *Lycopodium* (Fig 76). Fertile stems produce spikes with flowers similar to those of *V. klopfensteinii*, but in that species the distal leaves on the long flowering stems are very laxly attached (Figs 46, 48, 49), while *V. kinnachii* forms very compact plants with erect, stiff inflorescences (Fig 77). The salmon-colored nectary scales are conspicuous (Fig 74).

The species is dedicated to Myron Kinnach, horticulturist, taxonomist, Director Emeritus of the Huntington Botanical Gardens, former editor of the *Cactus and Succulent Journal* (USA) and *Haseltonia*, and a student of the flora of Peru. He has described four new species of Peruvian echeverias and was one of the Huntington Botanical Gardens team that discovered *Sedum isidorum*.

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