
Charadranaetes, a New Genus of the Senecioneae (Asteraceae) from Costa Rica

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ABSTRACT. A new genus of the Senecioneae, Asteraceae, from Costa Rica, *Charadranaetes*, is described based on *Senecio durandii* Klatt, characterized by an obnoxious odor emitted by crushed parts, elongate linear corolla lobes that are not recurved, and a prominently rounded style apex that bears little or no apical coma. A key to the genera of Senecioneae in Costa Rica is furnished.

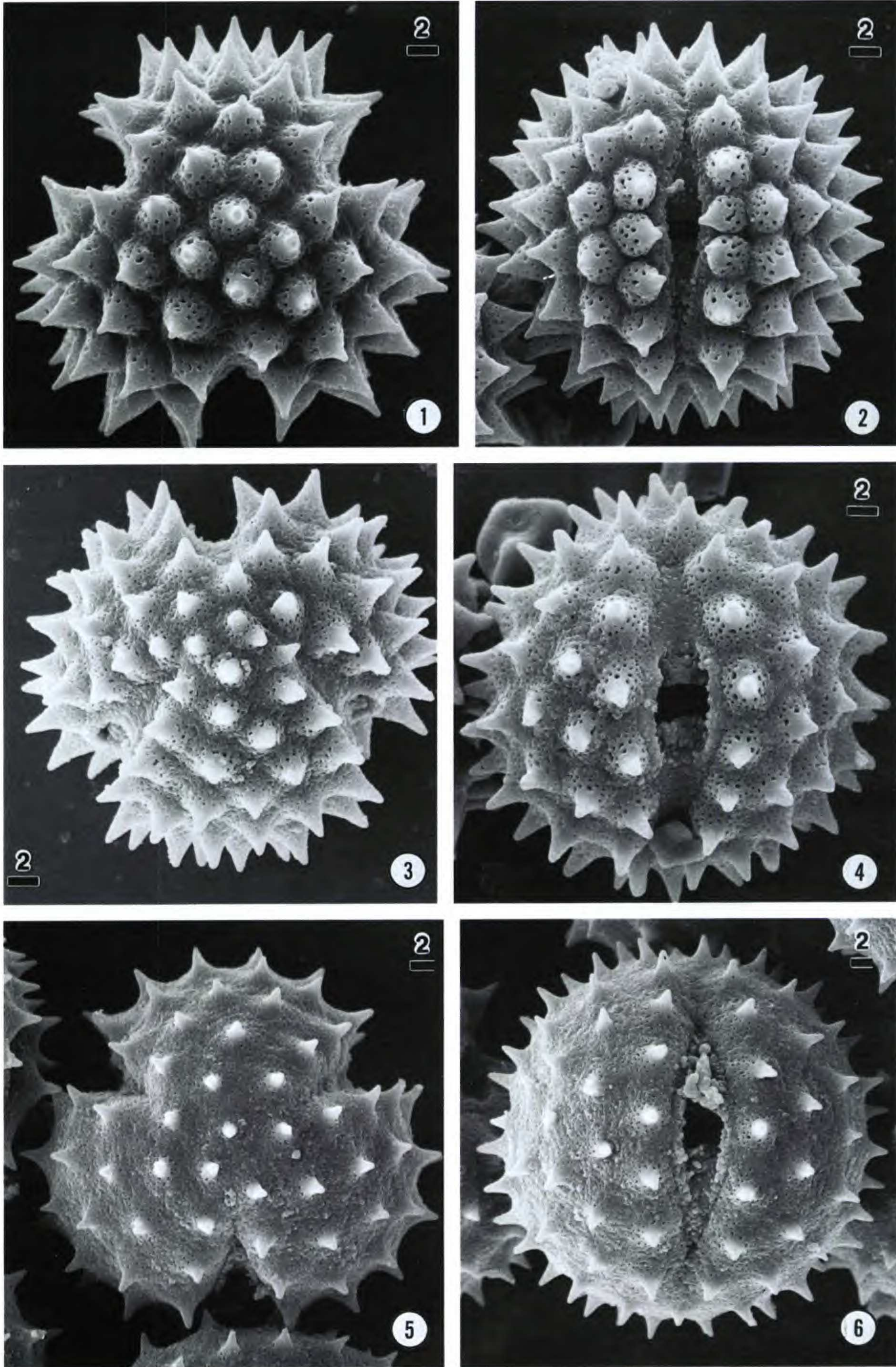
The purpose of this paper is to describe a new genus, *Charadranaetes*, based on the single species *Senecio durandii* of Costa Rica. The species was based by Klatt (1892) on a collection from near Volcán Barba in the Province of Heredia, Costa Rica. Generic position was not in question, since *Senecio* traditionally grew to include approximately 3400 species of diverse form and distribution defined by principal involucre bracts in a single series, a small but distinct calyculus, and a pappus of abundant capillary bristles. The species has since been noted as anomalous by numerous botanists but has continued by default to be included in the overly broad concept of *Senecio* because of its capillary pappus, yellow rays, and blunt style tips. The present study relies on recent progress in the understanding of the tribe Senecioneae, as reviewed below, and offers some additional evidence illustrated by scanning electron micrograph (SEM) study of pollen (Figs. 1–7) raphides of the gynoeceum (Fig. 8), and number of rows of pappus bristles (Figs. 9, 10).

Early efforts at division of *Senecio* in North and Central America were mostly infrageneric (Greenman, 1901, 1916), and Greenman, the well-known authority in the genus, was credited by Standley (1938) with referring *S. durandii* to his section *Streptothamni*, a subgroup of vines now treated in the segregate genus *Pentacalia* (Robinson & Cuatrecasas, 1978). Standley, in his Flora of Costa Rica (1938) stated that “. . . this species is a most distinct one, altogether unlike any other with which I am familiar.” He further added

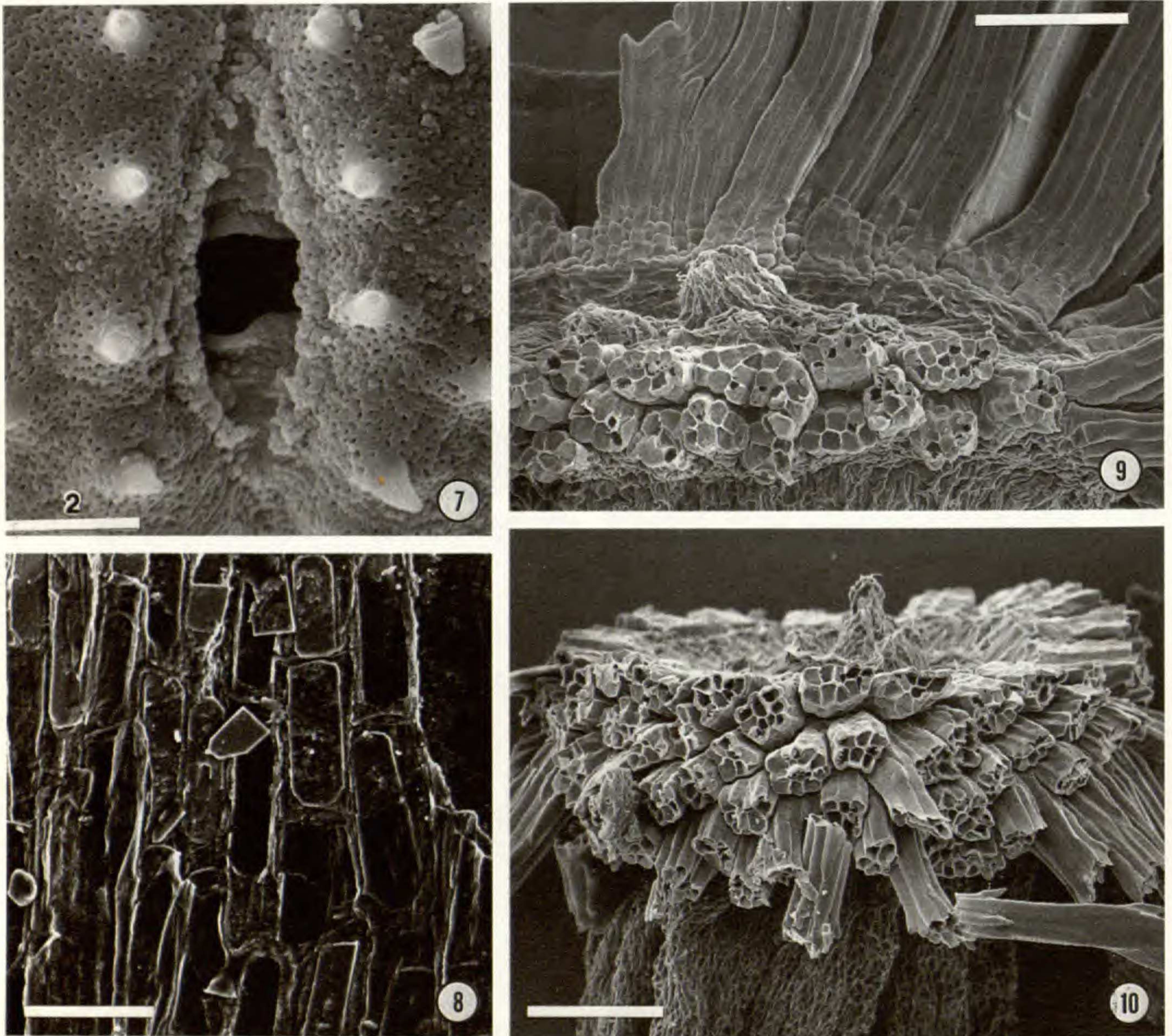
that *Senecio durandii* has little if anything in common with other species grouped in the section *Streptothamni* of Greenman. More recently, Barkley et al. (1996) left *S. durandii* as a species within *Senecio* sensu stricto whose accurate taxonomic disposition had yet to be ascertained.

Previous subdivisions of *Senecio* at the generic level have not included the Costa Rican *S. durandii*. It was not among the genera with pointed style tips such as *Gynoxys* Cassini or *Pseudogynoxys* (Greenman, 1916, as subgenus; Cabrera, 1950, Cuatrecasas, 1955, and Robinson & Cuatrecasas, 1977, as genus). *Senecio durandii* was not in the distinctive tussilagionoid (“cacalioid”) lineage mostly of East Asia and Mexico that is distinct by cylindrical anther collars, continuous stigmatic surfaces, and a chromosome base number of $x = 30$ (Robinson & Brettell, 1973, 1974). As noted above, the Costa Rican species did not belong to the scandent or heath-like genus *Pentacalia* (Robinson & Cuatrecasas, 1978). *Dresslerothamnus* Robinson (1989) is from Panama and adjacent areas, but it differs by the scandent or scrambling habit and complex T-shaped hairs. The nearest likely relatives, *Jessea* and *Talamancalia* (Robinson & Cuatrecasas, 1994), still were not considered to include *Senecio durandii*.

The present new genus, *Charadranaetes*, cannot be included in *Senecio*, which is typified by the European native and widely adventive species *Senecio vulgaris* L. The latter species and its closest relatives are rosetiform herbs with decrescent upper foliage, fistulose receptacles, short recurved corolla lobes, and truncate style tips without an apical coma. The most typical elements of *Senecio* also have enlarged plate-like raphides in the cells of the ovule (Fig. 8). *Senecio durandii* is a semi-woody to woody, decumbent to somewhat erect subshrub with non-decrescent foliage, solid receptacles, linear and non-recurved corolla lobes, and a prominently



Figures 1–6. Scanning electron micrographs of pollen grains. 1, 2. *Senecio vulgaris*, Thomas 8975 (US). —1. Polar view. —2. Colpar view. 3, 4. *Jessea multinervia*, Davidse & Pohl 1577 (US). —3. Polar view. —4. Colpar view. 5, 6. *Charadranaetes durandii*, Burger & Gentry 9052 (US). —5. Polar view. —6. Colpar view. Scales = 2 μ m.



Figures 7–10. Scanning electron micrographs of pollen, ovule, and pappus bases. —7. *Charadranaetes durandii*, Burger & Gentry 9052 (US), enlargement of colpar view showing minute perforations of tectum, scale = 2 μm . —8. *Senecio vulgaris*, Thomas 8975 (US), surface of ovule showing shape of included raphides, scale = 10 μm . 9, 10. Upper callus of achenes showing bases of pappus bristles, scales = 100 μm . —9. *Charadranaetes durandii*, Lent 1597 (US), showing pappus bristles in 1–2 series. —10. *Jessia cooperi*, King 6832 (US), showing pappus bristles in 3–4 series.

rounded style tip with or without trace of an apical coma. The Costa Rican species and its potential relatives have only small, slender raphides in the ovules. It is a peripheral discovery of the study, that raphides of the gynoecium have not been seen in the actual achene wall of any of the many members of the Senecioneae observed in a broad survey of the tribe, only in the outer layer of the ovules. Such raphides may seem to be in the achene wall when viewing clearings of undissected achenes under the microscope or when viewing ripe achenes from which embryos have been removed.

The disk corolla lobes seem to offer the best evidence of relationship for *Charadranaetes durandii* at this time. The elongate non-recurved form is seen in three other recently described genera of the Costa Rica–Panama–Ecuador region. *Jessia* and

Talamancalia are known mostly from Costa Rica and Panama (Robinson & Cuatrecasas, 1994), with the latter since recognized from Ecuador (Nordenstam & Pruski, 1995). The probable close relative, *Garcibarrigoa* Cuatrecasas (1986), occurs on both sides of the Río Maldonado on the border of Colombia and Ecuador. *Charadranaetes* is distinct from each of these by the lack of a well-developed apical tuft of hairs on the style tip. It differs from *Garcibarrigoa* further by the lack of a petiole base fused in a basal ring around the stem. *Talamancalia* differs by the pubescent and lobed leaves, the winged petioles, and the setuliferous achenes with obscure carpodia. *Jessia* differs by the involucre of ca. 8(–12) bracts, the compact corymbiform inflorescence, and the large scale-like projections on the receptacle. The achene of *C. durandii* has only

1–2 rows of pappus bristles (Fig. 9), while *Jessia*, like many members of the Senecioneae, has more (3–4, Fig. 10). The achenes of *Charadranaetes* have elongate cells on their surfaces, while *Jessia*, *Talamanca*, and *Garcibarrigoa* have short usually mamilllose cells on the surfaces of their achenes.

During the study, the distinctive nature of *Charadranaetes durandii* has been reinforced by observations of the pollen. Light microscopy showed a thicker wall and smaller spines than are seen in potential relatives. SEM studies of a limited sample show that pollen in the Senecioneae, though generally uniform in type, as seen in *Senecio vulgaris* L. (Figs. 1, 2), may be worth careful study. *Charadranaetes durandii* is particularly distinct in its slight relief as though only the points of the spines were projecting (Figs. 5, 6). The exine perforations of the species are unusually small and seem scattered evenly between the points of the spines (Fig. 7). In comparison, *Jessia multivenia* has larger spines like typical *Senecio*, but it seems to have the colpi reaching closer to the poles of the grain than in other Senecioneae pollen observed (Figs. 3, 4).

Many collectors have referred to the odor of *Charadranaetes durandii*. Labels of various collections by W. C. Burger state the plants have the odor of coriander when crushed. Other collections cite the odor of *Eryngium*. The most complete description referred to the obnoxious smell of crushed stems, leaves, and inflorescence (*Almeda et al.* 5791, NY).

The new genus is named *Charadranaetes* from the Greek *Charadra*, bed of a mountain stream, and *naetes*, inhabitant.

Charadranaetes J. Janovec & H. Robinson, gen. nov. TYPE: *Senecio durandii* Klatt.

In foliis non decrescentibus non alate petiolatis non lobatis glabris inflorescentibus sparsis receptaculis nudis vel subnudis et in partibus contusis foetidis differt.

Decumbent or partially erect, semi-woody to woody, slender herbs or subshrubs, 20–60 cm tall, typically growing near margins of streams in rocky soil; stems, leaves, and inflorescence glabrous, emitting obnoxious odor when crushed; stems often purplish, losing leaves from base upward. Leaves alternate, often with base clasping but not surrounding stem; petioles slender, not winged; blade linear-lanceolate, dorsal surface paler than ventral surface, margins serrate with cartilaginous teeth, apex acuminate, secondary veins pinnate, ascending, inter-reticulation not prominent. Inflorescence terminal, with ascending branches, laxly subcorymbose to cymose, peduncles slender, elongate, glabrous, usually bearing numerous linear bracts.

Heads usually 2 or 3, heterogamous, radiate, narrowly campanulate to cylindrical, with ca. 7–10 filiform calycular bracts in 1–2 series; involucre bracts usually 13 or 14, subequal, uniseriate; receptacle usually glabrous, in few plants with minute scale-like projections. Ray florets 7–11; corollas yellow to orange, glabrous, apex usually 3-toothed. Disk florets 15–28; corollas yellow, glabrous, basal tube narrow, elongate, lobes linear-lanceolate to linear, 3 times as long as wide or longer, with central and marginal resin ducts; anther collars with basal cells inflated; thecae with bases minutely sagittate or rounded, median endothelial cells with numerous thickenings on vertical walls, with few small thickenings on transverse walls; apical appendage oblong-lanceolate, narrowing toward apex; style base with distinct node; style branches with distinctly separated paired stigmatic lines or stigmatic surface with a narrow median gap, short apical appendage prominently rounded with basal fringe of hairs, without or with slight apical projection. Achenes cylindrical with 8–10 ribs, glabrous, with elongate cells on the surface; raphides restricted to ovule, elongate; carpopodium annuliform with 4–8 series of sclerified cells; pappus with slender easily deciduous bristles staggered in 1–2 series, tips acute. Pollen grains 30–40 μm diam., with short spines and minute perforations.

The genus contains the single following species.

Charadranaetes durandii (Klatt) J. Janovec & H. Robinson, comb. nov. Basionym: *Senecio durandii* Klatt, Bull. Soc. Roy. Bot. Belgique 31: 211. 1892 [1893]. *Pseudogynoxys durandii* (Klatt) B. L. Turner, Phytologia 80: 255. 1996. TYPE: Costa Rica. San José: Passage du Rio de las Vueltas (versant du Rio Sueio), 2100 m, 1888, *Pittier 220* (lectotype, selected here, BR).

Material seen. COSTA RICA. **Cartago:** El Retiro, Santa Cruz de Turrialba, 1400 m, Jan. 1941, *Valerio 1274* (F); Cerro Dean, 9°51'N, 83°46'W, 3 km E of Cachi, 9°50'N, 83°48'W, 1450 m, 23 Apr. 1969, *Lent 1597* (US); about 7 km NE of Santa Cruz on road beyond Agua, southern slopes of Volcán Turrialba, about 6400 ft., 8 Mar. 1978, *Almeda & Nakai 4170* (CAS, F, NY); Tapantí, Orosi, 1400 m, 29 Jan. 1983, *Chacón 263* (MO); along road from bridge over Río Grande de Orosi (near jet. with Río Villegas) to Río Humo, Cordillera de Talamanca, 1600–1900 m, 9°42'N, 83°47–48'W, 11 Aug. 1984, *Grayum, Jacobs & Sleeper 3746* (KSC); Refugio Nacional de Fauna Silvester Tapantí, 9°46'N, 83°48'W, along and off the switchback rock road diverging to the right just beyond the Puente Dos Amigos, 1500–1620 m, 26 Mar. 1986, *Almeda et al.* 5791 (F, NY); Tapantí National Park, 9°48'18"N, 83°57'12"W, 4 Jan. 1996, *Maraga, Chavarria & Janovec s.n.* (INBio). **Heredia:** Fôrets du Rancho Flores, 2043 m, 22 Feb. 1890, *Pittier 2099* (GH); Yerba Bue-

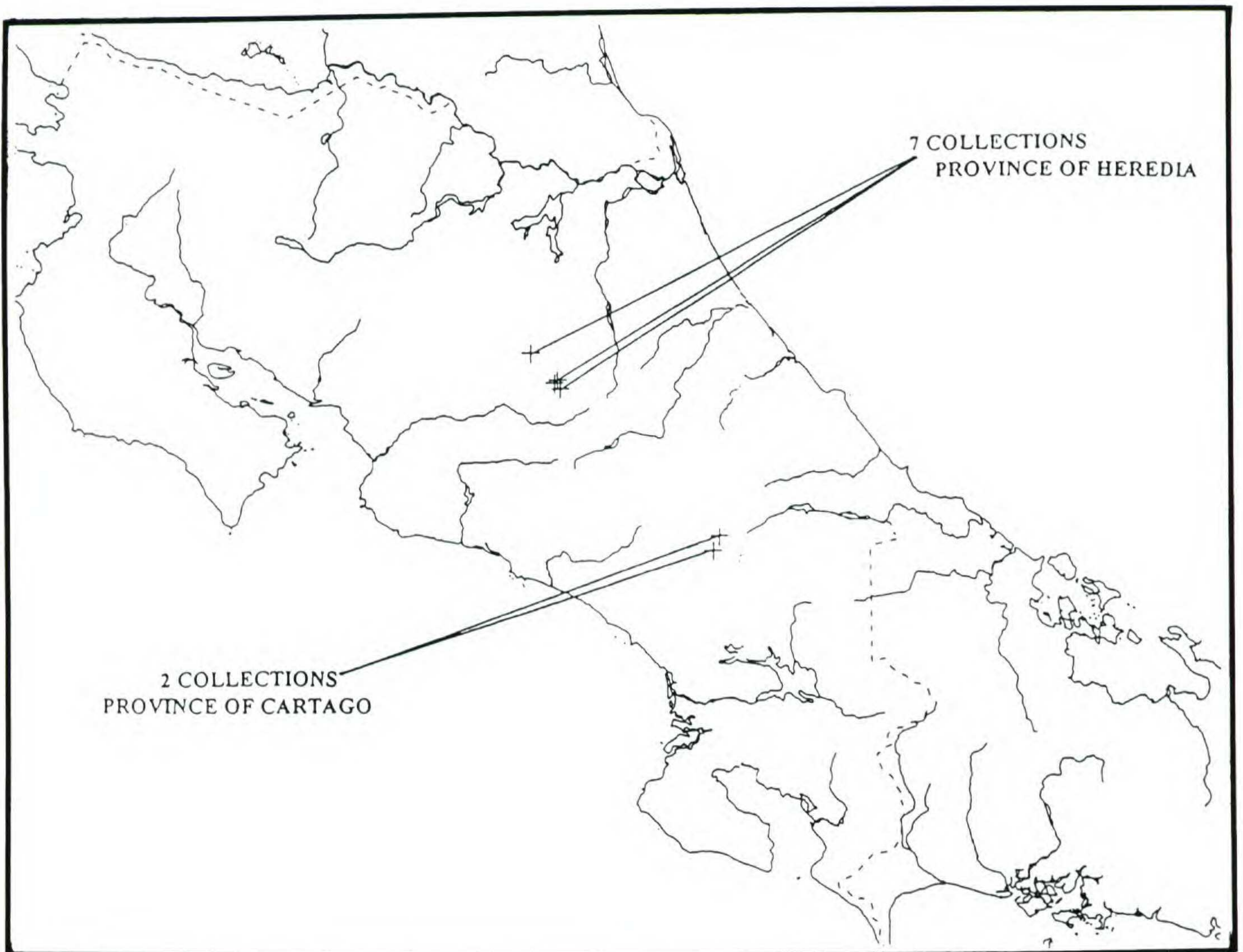


Figure 11. Distribution of *Charadranaetes durandii* in Costa Rica, based on specimens in US, showing concentrations in Cartago and Heredia.

na, NE of San Isidro, 10°02'N, 84°00'W, 2000 m, 22, 28 Feb. 1926, *Standley & Valerio 49223* (MO, US), 49798 (F, MO, US); Cerro de las Caricias, N of San Isidro, 10°04'N, 84°02'W, 2000–2400 m, 11 Mar. 1926, *Standley & Valerio 51951* (MO, US), 51973, 52006 (US); Cerro Gallito, hasta 2000 m, 3 Feb. 1935, *Valerio 1099* (F); saddle between Volcán Barba and Volcán Irazú, headwaters of Río Patria, ca. 2220 m, 3 Feb. 1965, *Godfrey 66123a* (MO); forest of Río Vueltas, 2100 m, 23 May 1969, *Gómez 2242* (CAS, F, GH); Río Vueltas (upper Río Patria) on eastern slope of Volcán Barba on the Caribbean side of the Continental Divide, 10°14'N, 84°10'W, 1900 m, 1, 3 Apr. 1973, *Burger & J. L. Gentry 9052* (US); eastern slopes of Volcán Barba between Río Las Vueltas and Río Nuevo (upper Río Patria), 10°6'N, 84°3'W, ca. 2000 m, 25 Oct 1975, *Burger & Baker 9482* (F); border of San José and Heredia Provinces, on ridges and steep slopes along Río Para Blanca (Pacific drainage), Cerros de Zurquí, 10°3'N, 84°1'W, 1600–1800 m, 6 & 7 Feb. 1977, *Burger, Visconti & Gentry 10252* (F); south-facing slopes of Cerro Zurquí at termination of Calle Zurquí, 10°05'N, 84°01'W, 1800–2000 m, 19 Feb. 1978, *Almeda & Nakai 3692* (NY); along Río Vueltas from old road to Carillo, “Alto de Roble” above San Raphael and Uvita, 2000 m, 10°5'N, 84°5'W, 6 May 1982, *Huft & Barringer 2013* (F, MO); a la vera del Río Patria, Alto del Roble, 2000 m, 22 June 1982, *Gomez 8585* (F); pie de monte El Chompipe, 12 Feb. 1983, *Poreda & Hasbun 3417* (F).

Collections have been made in two separate areas in central Costa Rica (Fig. 11): Heredia, with drainage mostly toward the Pacific; and Cartago, with drainage toward the Atlantic. The Heredia plants have no apical coma on the styles and the groove between the stigmatic lines is weak. The Cartago material from between 9°46' and 9°50'N is disjunct from the others, and it has a stronger separation of the stigmatic lines and a small but distinct coma on the style tip. The two types of plants may eventually prove worthy of varietal distinction. The coma in the Cartago plants of *Charadranaetes* is not nearly as large as that of the supposedly related genera, and the near or complete lack is a useful generic distinction. However, it seems likely that apical comas were plesiomorphic in the whole *Jessea–Talamancalia–Charadranaetes* clade, and that they were lost in *Charadranaetes*.

The receptacles of the Heredia collections all seem to be completely glabrous, but minute scale-like projections can be seen on the receptacles of the distinctive Cartago material.

KEY TO THE COSTA RICAN GENERA OF THE TRIBE SENECEONEAE: ASTERACEAE

- 1a. Stigmatic papillae continuous across at least upper third of inner surface of style branch; base of anther collar cylindrical, not inflated (tussilaginoïd genera).
- 2a. Stout herbs, shrubs, or small trees; stems with resin ducts in cortex; inflorescence abruptly terminating stems, subumbellate; leaves mostly clustered near ends of stems *Telanthophora*
- 2b. Stout herbs or subshrubs; stems without resin ducts in cortex; inflorescence not abruptly terminating stems, a terminal corymbose, pyramidal, or racemose panicle; leaves variously disposed *Roldana*
- 1b. Stigmatic papillae divided into two distinct longitudinal lines on inner surface of style branch; anther collar balusterform, with basal cells inflated.
- 3a. Vines or reclining to scandent shrubs, often epiphytic.
- 4a. Style branches terminated by an acute or triangular appendage with numerous hairs prominent along margins and apex; ray corollas deep orange *Pseudogynoxys*
- 4b. Style branches papillose but not terminated by an acute or triangular appendage.
- 5a. Stems, foliage, and involucre bracts bearing T-shaped or pseudostellate hairs
. *Dresslerothamnus*
- 5b. Stems, foliage, and involucre bracts glabrous or with simple hairs, hairs not T-shaped or pseudostellate *Pentacalia*
- 3b. Plants erect or decumbent, never epiphytic.
- 6a. Achenes 5-ribbed; Costa Rican species with heads homogamous.
- 7a. Dense heath-like or ericoid plants of the paramos; size of stem leaves not progressively smaller upward; in Costa Rican species foliage glabrous above, somewhat glaucous or white-tomentose beneath; achenes glabrous; chromosome numbers $n = 10, 20$. . . *Pentacalia* subg.
Microchaete (*Scrobicaria*, *Monticalia*)
- 7b. Somewhat succulent, weedy herbs; leaves progressively smaller; heads solitary or few in lax corymbose panicles; achenes pubescent on at least the ribs; chromosome number $n = 5$ *Emilia*
- 6b. Achenes 8–10-ribbed; heads heterogamous.
- 8a. Heads disciform, with 2 or more rows of tubular-filiform, pistillate, eligulate flowers; achenes pubescent *Erechtites*
- 8b. Heads with obvious rays; achenes glabrous or pubescent.
- 9a. Plants sessile rosettes; heads sessile or solitary; ecalyculate *Werneria*
- 9b. Plants caulescent; heads in branching inflorescence, calyculate.
- 10a. Disk corolla lobes triangular, 2.5 times as long as wide or shorter, often recurved at anthesis *Senecio*
- 10b. Disk corolla lobes oblong-lanceolate to linear, 3 times as long as wide or longer, erect or distorted, not recurved.
- 11a. Involucre bracts ca. 8(–12); inflorescences a compact corymbiform mass of numerous crowded heads; receptacle surfaces between florets with large scale-like projections *Jessea*
- 11b. Involucre bracts 13 or more; inflorescences rather lax, usually of less than 25 non-contiguous heads; receptacle surfaces between florets essentially glabrous, scale-like projections minute or lacking.
- 12a. Leaves pilose to lanuginose, lobed at least near the base; petioles winged to the base; achenes pubescent; carpodium obscure . . .
. *Talamancalia*
- 12b. Leaves glabrous; margins serrate, unlobed; petioles not winged; achenes glabrous; carpodium obvious *Charadranaetes*

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