DACTYLOCARDAMUM (BRASSICACEAE), A REMARKABLE NEW GENUS FROM PERU

IHSAN A. AL-SHEHBAZ[1]

Dactylocardamum imbricatifolium, a new genus and species, is described from the Sierra Blanca of Peru. Its relationships to *Eudema* and *Xerodraba* are discussed. Scanning electron micrographs of leaves, fruits, and seeds of *Dactylocardamum* and leaves of *Xerodraba* are presented.

During the past several years I have been studying the systematics and evolution of various South American genera of the Brassicaceae (Cruciferae). Almost every genus that I have examined critically (see, for example, Al-Shehbaz, 1986, 1989a, 1989b, 1989c, 1990) included one or more novelties. However, the discovery of a new genus with unique morphology and evident relationships to well-defined, monophyletic genera was rather surprising.

The new monotypic genus (hereafter called *Dactylocardamum,* which literally means a digitate crucifer—in reference to the fingerlike branches) was collected from Cordillera Blanca, Peru, and was misidentified as *Xerodraba* Skottsb. A close examination of the plant immediately revealed that it belongs to an undescribed genus, not only because it has several unique features that separate it readily from its nearest relatives, *Eudema* Humb. & Bonpl. and *Xerodraba,* as well as from all other genera of the Brassicaceae, but also because its type locality is separated from the nearest known range of *Xerodraba* by at least 3200 air kilometers.

The overall growth habit and certain aspects of the leaves of *Dactylocardamum* are fairly similar to those of *Xerodraba.* However, the two genera are readily distinguished from each other by the nature of their fruits, the length of the style and the fruiting pedicels, and the texture of the leaves (see FIGURE 1 and TABLE). On the other hand, *Dactylocardamum* resembles *Eudema* in the texture of the leaves and in a few characters of the fruits. However, it differs markedly in habit, leaf persistence, number of flowers per branch, pedicel length, and fruit position (see TABLE). The flowers in *Eudema* are few to several on each branch, and they mature in a racemose fashion (Al-Shehbaz, 1990), while those of *Dactylocardamum* are solitary. The three genera are easily separated from each other by the following key:

A. Leaves appressed, densely imbricate, persistent as a whole; branches fragile, fingerlike; flowers 1 at tip of each branch.
  B. Leaves thin, papery; fruits subterete, indehiscent, completely included and sandwiched between leaf bases; septum absent; style 2.5–3 mm long; valves membranaceous; fruiting pedicels to 0.4 mm long. ..... *Dactylocardamum.*
  B. Leaves thick, fleshy; fruits flattened parallel to septum, dehiscent, exserted above

[1]Arnold Arboretum, Harvard University, 22 Divinity Avenue, Cambridge, Massachusetts 02138.

Journal of the Arnold Arboretum **70:** 515–521. October, 1989.

Phenetic comparison of Dactylocardamum, Eudema, and Xerodraba.

CHARACTER	GENUS		
	Dactylocardamum	*Eudema*	*Xerodraba*
Fruits			
Flattening	Not flattened, subterete	Latiseptate or subterete	Latiseptate
Dehiscence	Indehiscent	Dehiscent (rarely indehiscent)	Dehiscent
Valve texture	Membranaceous	Somewhat leathery	Somewhat leathery
Septum	Absent	Complete or perforated	Complete or rarely perforated
Position	Sandwiched between leaf bases	Exserted above leaves	Exserted above leaves
Style length (in mm)	2.5–3	0.4–3.5	0.4–1
Fruiting-pedicel length (in mm)	≤ 0.4	2–20	1.6–6
Flowers per branch	1	Few to several	1
Leaves			
Length (in mm)	2.5–3.5	3–22	1.6–9
Arrangement	Densely imbricate	Loose, not imbricate	Densely imbricate
Blade orientation	Appressed	Divaricate to ascending	Appressed
Texture	Thin, papery	Thin, not papery	Thick, rather fleshy
Persistent portion	Entire leaf	Petiole	Entire leaf
Branch shape	Fingerlike	Various, but never fingerlike	± Fingerlike

leaf rosette; septum complete or rarely perforate; style 0.4–1 mm long; valves somewhat leathery; fruiting pedicels 1.6–6 mm long. ..... *Xerodraba.*

A. Leaves neither appressed nor imbricate, almost always with only petioles persistent; branches neither fragile nor fingerlike; flowers few to several at tip of each branch. ..... *Eudema.*

The evolutionary relationships among the three genera is rather interesting. Although *Dactylocardamum* resembles *Xerodraba* in several aspects of habit and foliage, the bizarre vegetative morphology probably evolved independently in the two genera. On the other hand, *Dactylocardamum* does show certain affinities to *Eudema,* particularly in some aspects of the fruits and in leaf pubescence, and they may be more closely related to each other than either is to *Xerodraba.* However, *Dactylocardamum* is unique in the Brassicaceae in having axillary fruits that are completely concealed and sandwiched between the appressed, densely imbricate leaf bases (see FIGURE 2a–c). These hidden fruits can be seen only after the removal of the subtending leaves. Although the solitary flower of *D. imbricatifolium* is terminal in the bud stage and during anthesis, the developing fruit is gradually pushed to an axillary position due to the production of new leaves by the terminal leaf bud. The fruits of a given

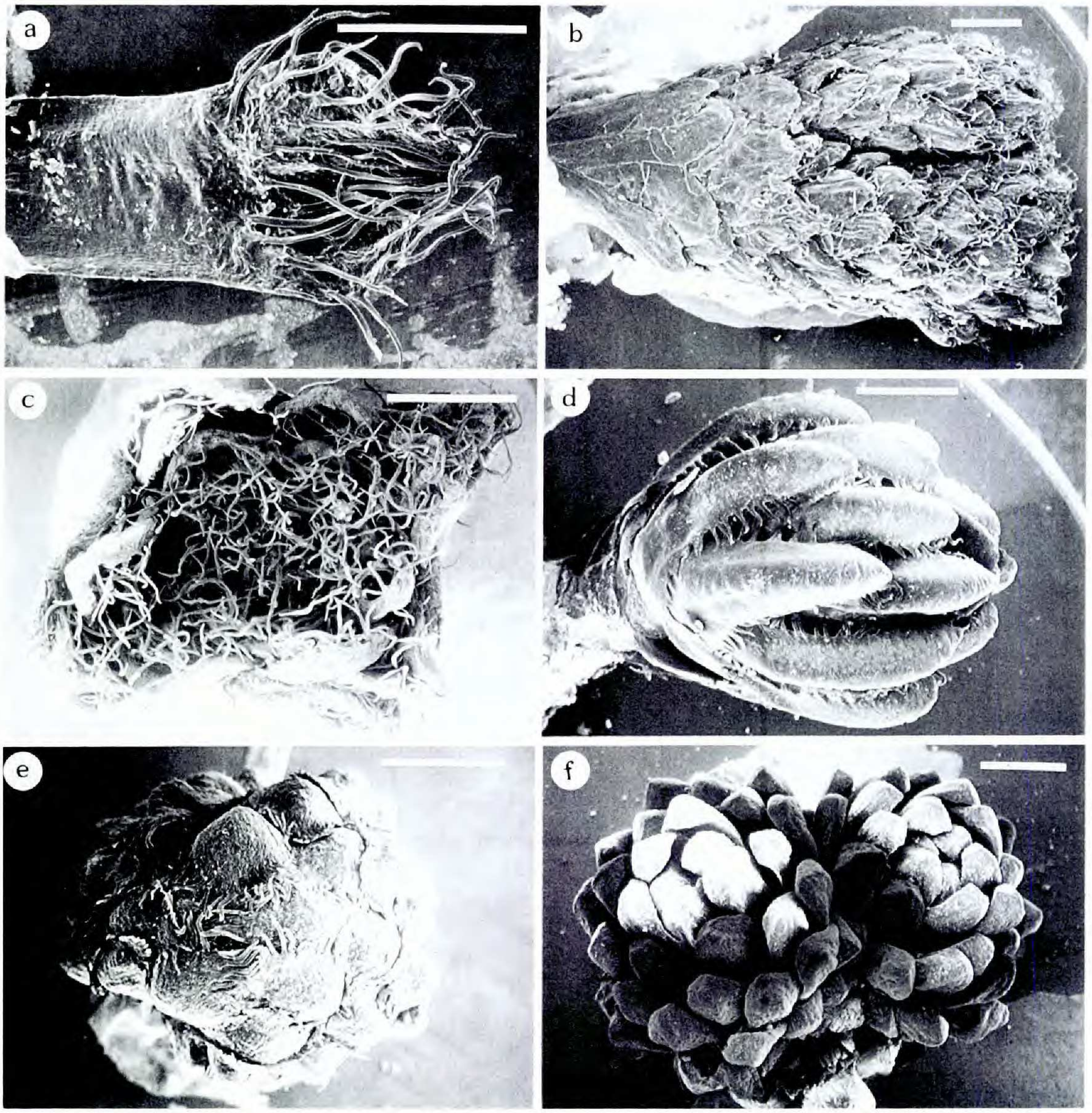

FIGURE 1. Scanning electron micrographs of *Dactylocardamum* and *Xerodraba*. a–c, *D. imbricatifolium* (holotype): a, leaf; b, portion of branched stem; c, top view of branch tip. d, *X. pectinata* (*Pisano & Cárdenas 4749*, HIP), leaves; e, *X. glebaria* (*Koslowsky 19*, Z), leaves; f, *X. patagonica* (*Donat 181*, GH), leaves. Scale bars = 1 mm.

branch can therefore be separated by several to many obsolete to very short nodes.

Dactylocardamum is easily distinguished from all other genera of the Brassicaceae by a unique combination of characters: the septum is completely lacking, the inflorescence is reduced to a terminal subsessile flower, the axillary fruits are sandwiched and completely hidden between the densely imbricate, wholly persistent leaves, the fruiting pedicel is reduced to only 0.4 mm long, the internodes are obsolete or reduced to only 0.05–0.2 mm long, and the branches are subdichotomous and fingerlike (see FIGURES 1a–c, 3).

Two other South American genera of the Brassicaceae, *Delpinophytum* Speg. and *Lithodraba* Boelcke (Boelcke, 1952; Boelcke & Romanczuk, 1984), produce dense cushions and have growth habits fairly similar to those of *Dactylocar-*

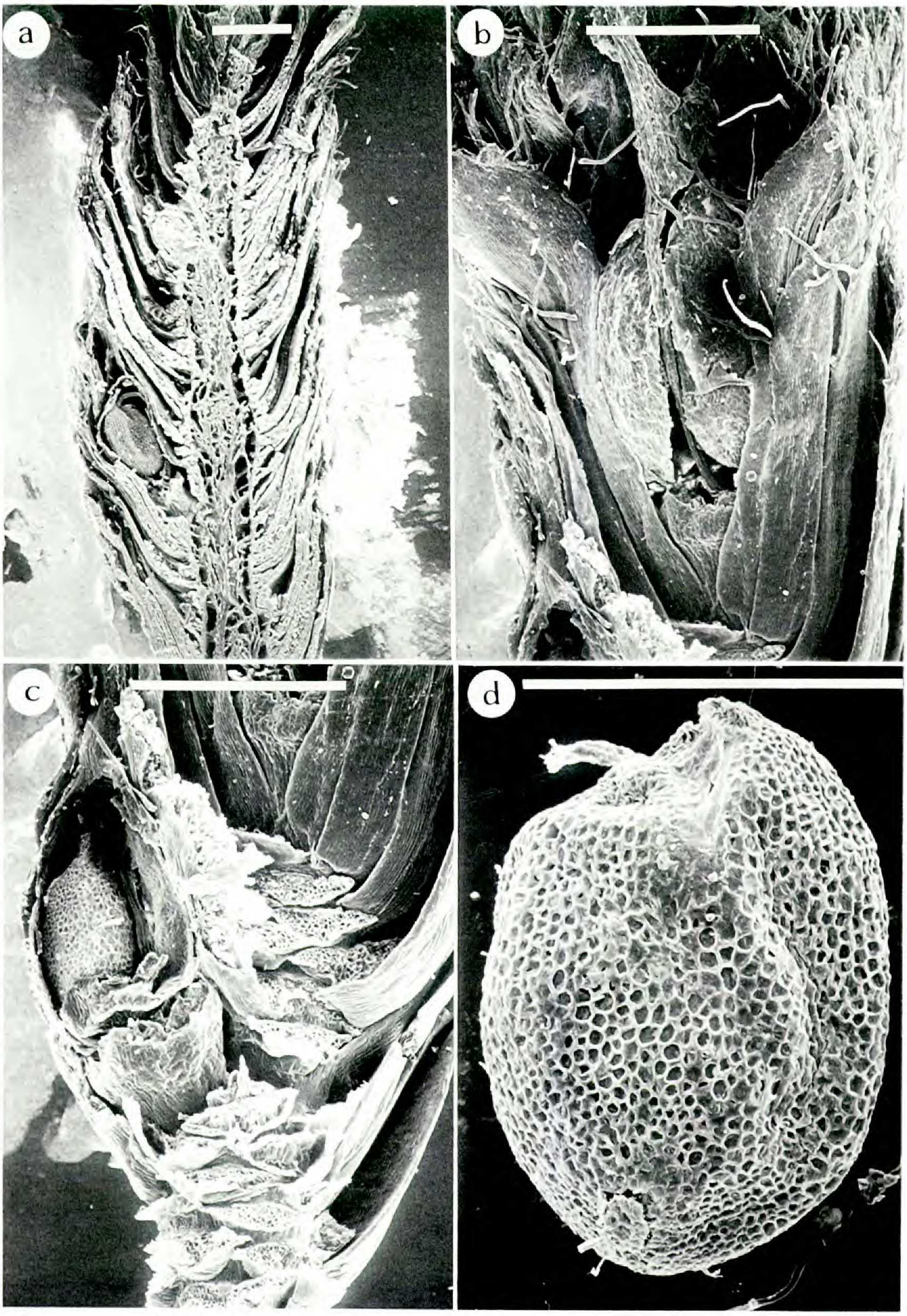

FIGURE 2. *Dactylocardamum imbricatifolium*: a, longitudinal section of branch showing fruit with 1 seed and densely imbricate leaves; b, fruit surrounded by several leaves; c, portion of branch showing fruit on short peduncle and scars of removed leaves; d, seed. Scale bars = 1 mm.

damum and *Xerodraba*. *Lithodraba* is somewhat related and is perhaps a sister group of *Englerocharis* Muschler. It is easily distinguished from the new genus in having racemose inflorescences, four stamens, long nonimbricate leaves, septate fruits, and ringlike nectar glands. *Delpinophytum* is indistinguishable from *Xerodraba* in almost every aspect except the type of fruit flattening: the former has angustiseptate fruits, while the latter has latiseptate ones. Although Schulz (1936) placed *Delpinophytum* in the tribe Lepidieae DC. and *Xerodraba* in the Sisymbrieae DC., I believe that they are sister genera and may even be congeneric.

Dactylocardamum imbricatifolium Al-Shehbaz, gen. et sp. nov.

Plantae perennantes pulviniforme; ramis subdichotomis dactyliformibus dense imbricati-foliosis, usque ad 3 cm longis, 3–4.5 mm latis. Folia minuta oblongo-obovata, imbricata, persistens, subappressa, papyracea, superne pilosi-ciliata, 2.5–3.5 mm longa, 1.1–1.6 mm lata. Flores solitares apicales subsessiles. Sepala erecta oblonga, membranacea, 2.5–3 mm longa. Petala lineari-spathulata, 4–4.5 mm longa, ca. 1 mm lata. Pedicelli fructiferi crassi, axillari, usque ad 0.4 mm longi. Siliqua ovoidea, membranacea, aseptata, glabra, brevissime pedunculata; stylo filiforme 2.5–3 mm longo. Semina 1 vel 2, oblonga vel ovata, pendula; cotyledones incumbentes.

Perennial herb forming dense cushions, woody and much branched at base, the ultimate branches fingerlike, thick, 1–3 cm long, 3–4.5 mm in diameter. Leaves persistent, papery, densely imbricate, separated by internodes 0.05–0.2 mm long, subappressed, oblong-obovate, 2.5–3.5 mm long, 1.1–1.6 mm wide, obtuse at apex, ciliate and sparsely pubescent on the upper surface of the green, distal, bladelike half, the petiolelike lower half conspicuously flattened, straw colored, 1.4–1.9 mm long, 0.8–1 mm wide; trichomes unbranched, 0.5–1.2 mm long. Flowers solitary, subsessile, each terminating a branch, soon becoming lateral as young fruit develops. Sepals erect, membranaceous, oblong, 2.5–3 mm long, 1–1.2 mm wide, sparsely pubescent below rounded apex, nonsaccate at base. Petals spatulate-linear, 4–4.5 mm long, ca. 1 mm wide, attenuate at base, obtuse at apex, somewhat crisped distally. Stamens 6, somewhat tetradynamous; filaments erect, filiform, 2.5–3 mm long; anthers oblong, 0.7–0.8 mm long. Nectar glands 4, 1 on each side of each lateral stamen. Fruiting peduncles thick, axillary, to 0.4 mm long. Fruits ovoid, sessile, sandwiched and completely hidden between leaves, indehiscent except when subjected to force, somewhat inflated, 1.2–1.8 mm long, 1–1.4 mm wide; valves membranaceous, glabrous; septum lacking; style filiform, 2.5–3 mm long in flowering or fruiting material; stigma entire. Seeds 1 or 2 per fruit, oblong to ovate, plump, 1–1.2 mm long, 0.8–0.9 mm wide, dark brown, reticulate, wingless, pendulous from short, subapical funicles; cotyledons incumbent or obliquely so.

TYPE. Peru, Cordillera Blanca, Llanganuco Valley, Pisco Creek, 15,500 ft [ca. 5085 m] alt., August 1959, *J. C. Tothill 144* (holotype, UC; fragment, GH).

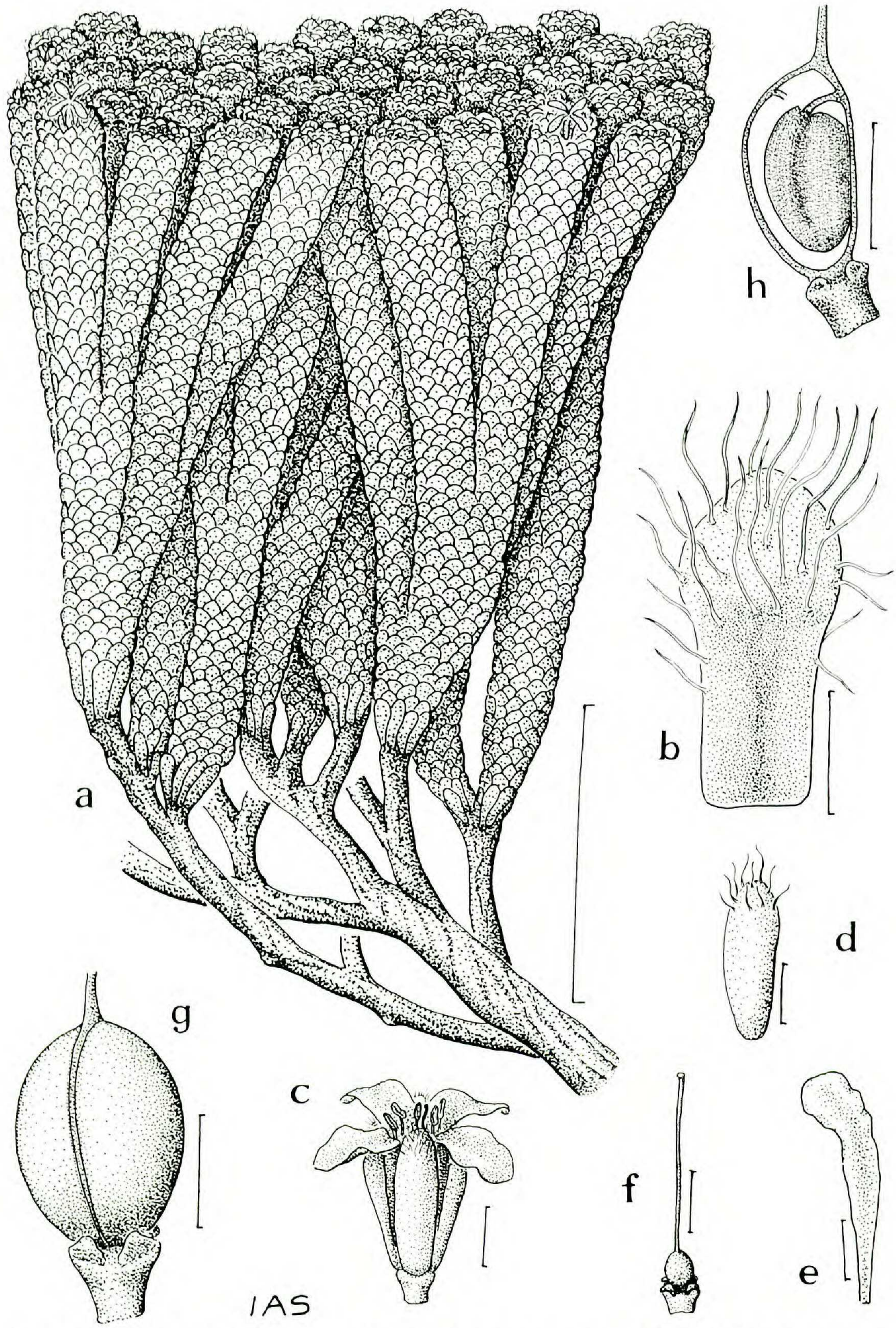

FIGURE 3. *Dactylocardamum imbricatifolium*: a, portion of plant; b, leaf; c, flower (one stamen removed); d, sepal; e, petal; f, pistil; g, fruit with part of style; h, opened fruit. Scale bars: a, 1 cm; b–h, 1 mm. Drawn from the holotype by the author.

Additional field notes on the type read: "Mat plant forming rather tight cushions over rocks of lower talus slope. South exposure, associated with other mat plants."

ACKNOWLEDGMENTS

I am most grateful to Reed C. Rollins for his critical review of the manuscript, and to Donald H. Pfister for obtaining funds from the Harvard University Herbaria that supported the SEM portion of the research. I am thankful to Elizabeth A. Shaw for correcting the Latin description, to Thomas Duncan and Barbara Ertter for permitting the deposition at GH of fragments of the holotype, to Trisha Rice for the SEM work, to Barbara Nimblett for typing the manuscript, to Michael A. Canoso for obtaining the loan, to Elizabeth B. Schmidt and Stephen A. Spongberg for their editorial advice, and last, but certainly not least, to my wife, Mona, for her continuous support.

LITERATURE CITED

AL-SHEHBAZ, I. A. 1986. *Lepidium solomonii* (Cruciferae), a new species from Bolivia. Ann. Missouri Bot. Gard. **73:** 830, 831.

———. 1989a. The South American genera *Brayopsis* and *Englerocharis* (Brassicaceae). Nordic J. Bot. **8:** 619–625.

———. 1989b. Systematics and evolution of *Schizopetalon* (Brassicaceae). Harvard Pap. Bot. **1:** 10–46.

———. 1989c. New and noteworthy *Draba* (Brassicaceae) from South America. J. Arnold Arbor. **70:** 427–437.

———. 1990. Generic limits and taxonomy of *Brayopsis* and *Eudema* (Brassicaceae). *Ibid.* **71:** in press.

BOELCKE, O. 1952. *Lithodraba,* nuevo género de crucíferas de la Argentina. Darwiniana **9:** 348–357.

——— & M. C. ROMANCZUK. 1984. Cruciferae. Fl. Patagonica **4A:** 373–544.

SCHULZ, O. E. 1936. Cruciferae. *In:* H. HARMS, ed., Nat. Pflanzenfam. ed. 2. **17B:** 227–658.