

connectives; anthers short and curled over at anthesis; non-fertilized pistillate flowers deciduous after anthesis; staminodial tubes crenulate or shallowly lobed at the apex, those of non-fertilized pistillate flowers not projecting and persistent after anthesis; *fruits* 6.9(5.2–9.3) mm long, 5.4(4.2–7.3) mm in diameter, the bases without a prominent stipe, the apices not conical, the surfaces not splitting at maturity, without fibers emerging, bumpy from the numerous, subepidermal, tangential, short fibers present, these coming to a point at fruit apices; locular epidermis without operculum, smooth, without pores.

Taxonomic notes:—Henderson *et al.* (1995) suggested that this species was part of *G. longivaginata*. It is closely related to that species, differing in its shorter rachillae—8.1(3.8–15.0) cm long versus 22.9(10.0–42.0) cm long—without short, transverse ridges.

Subspecific variation:—One trait (stem branching) varies within this species. The species has a disjunct distribution, and occurs in two areas—Nicaragua and Costa Rica, with outlying specimens in Honduras and Guatemala. Within Costa Rica, there is an isolated, lower elevation subgroup from the Sarapiquí valley. Apart from the outliers, there are three subgroups based on geography.

ANOVA shows that for pair wise comparison probabilities, 13 variables (stem diameter, rachis length, rachis width, pinnae number, basal pinna width, basal pinna angle, apical pinna width, interbract distance, peduncle length, peduncle width, rachilla width, number of rachillae, fruit diameter) differ significantly ($P < 0.05$) between one pair of subgroups, and one (rachilla length) differs amongst all three groups. Based on these results, these three subgroups are recognized as subspecies (subsp. *ferruginea*, *microspadix*, *nicaraguensis*). There are only three specimens from Honduras and Guatemala—too few for analysis—and these outliers are unplaced for subspecies.

Key to the subspecies of *G. ferruginea*

- 1 Nicaragua subsp. *nicaraguensis*
- Costa Rica 2
- 2 Rachillae 10(5–25), 9.7(6.4–15.0) cm long; Cordilleras Tilarán, Central, Talamanca, and Guanacaste 2
- Rachillae 22(11–38), 5.5(3.8–8.0) cm long; Sarapiquí Valley subsp. *ferruginea*
- Rachillae 22(11–38), 5.5(3.8–8.0) cm long; Sarapiquí Valley subsp. *microspadix*

22a. *Geonoma ferruginea* subsp. *ferruginea*

Geonoma versiformis Wendland ex Spruce (1871: 109). Type: COSTA RICA. Cartago: near Turrialba, no date, *H. Wendland s.n.* (holotype K!).

Inflorescences rachillae 10(5–25), 9.7(6.4–15.0) cm long.

Distribution and habitat:—From 9°17'–10°55'N and 83°08'–85°29'W in Costa Rica (Cordilleras Tilarán, Central, Talamanca, and Guanacaste) at 904(400–1500) m elevation in lowland to montane tropical rainforest (Fig. 18).

Several specimens have unusually high numbers of pinnae, 9–15 versus the more usual 3–5. Specimens from Volcan Arenal (*Russell 683, 893, Lent 3335*) have larger leaves and inflorescences than the others.

22b. *Geonoma ferruginea* subsp. *microspadix* (Wendland ex Spruce) Henderson, *comb. & stat. nov.*

Basionym: *Geonoma microspadix* Wendland ex Spruce (1871: 110). Type: COSTA RICA. Heredia: Sarapiquí valley, 1857, *H. Wendland s.n.* (holotype K!).

Inflorescences rachillae 22(11–38), 5.5(3.8–8.0) cm long.

Distribution and habitat:—From 10°11'–10°28'N and 83°54'–84°12'W in Costa Rica (Sarapiquí valley and adjacent areas) at 520(100–950) m elevation in lowland tropical rainforest (Fig. 18).

22c. *Geonoma ferruginea* subsp. *nicaraguensis* Henderson, *subsp. nov.* (Appendix IV, Plate 33)

A *Geonoma ferruginea* subsp. *microspadix* *rhachillis parvioribus* differt.

Type: NICARAGUA. Yelaya: Cerro La Pimienta, ca. 13°45'N, 84°59'W, ca. 900–980 m, 13 April 1979, *J. Pipoly 5112* (holotype NY!, isotype MO, *n.v.*).

Inflorescences rachillae 17(9–30), 7.5(5.5–9.5) cm long.

Distribution and habitat:—From 12°15'–13°47'N and 84°59'–85°52'W in Nicaragua at 956(350–1500) m elevation in lowland to montane tropical rainforest (Fig. 18).

23. *Geonoma fosteri* Henderson, *sp. nov.* (Appendix IV, Plate 34)

A spectebus affinitibus prophyllis brevibus inaequaliter apiculatis atque rachide brevior, crusta fructuum fibris subepidermalibus brevibus numerosis apicem convergentibus tuberculata, operculo carens differt.

Type: ECUADOR. Sucumbios: Sinangoe Station, Shishicho Ridge, Alto Aguatico drainage, above (south of) Rio Cofanes, west of Puerto Libre, NW of Lumbaqui, 00°12'N, 77°31' W, 1300–1450 m, 14 August 2001, *R. Aguinda, N. Pitman & R. Foster 1315* (holotype F!, isotype QCNE, *n.v.*).

Plants height no data; stems 1.5 m tall, 0.7 cm in diameter, cane-like; internodes 1.0 cm long, yellowish and smooth. *Leaves* irregularly pinnate, not plicate, bases of blades running diagonally into the rachis; sheaths 6.5 cm long; petioles 11.0 cm long, drying green or yellowish; rachis 20.5 cm long, 3.1(2.1–4.1) mm in diameter; veins raised and rectangular in cross-section adaxially; pinnae 3 per side of rachis; basal pinna 19.5 cm long, 1.5 cm wide, forming an angle of 63(58–68)° with the rachis; apical pinna 16.5 cm long, 8.5 cm wide, forming an angle 28° with the rachis. *Inflorescences* branched 3 orders; prophylls and peduncular bracts not ribbed with elongate, unbranched fibers; prophylls 5.2 cm long, short, asymmetrically apiculate, the margins curved around the stem, the surfaces flat with dense, felty, brown tomentum, prophyll equal to and early deciduous with the peduncular bract, the surfaces not ridged, without unequally wide ridges; peduncular bracts no data, inserted 0.4 cm above the prophyll; peduncles 5.7 cm long, 3.4(2.9–3.8) mm in diameter; rachillae 10.5 cm long, 1.0(0.9–1.1) mm in diameter, the surfaces without spiky, fibrous projections or ridges, drying brown, with faint to pronounced, short, transverse ridges, filiform with extended narrowed sections between the flower pits; flower pits alternately arranged (sometimes distorted by twisting and contracting of rachillae), glabrous internally; proximal lips without a central notch before anthesis, not recurved after anthesis, not hood-shaped; proximal and distal lips drying the same color as the rachillae, joined to form a raised cupule, the margins not overlapping; distal lips well-developed; staminate and pistillate petals not emergent, not valvate throughout; staminate flowers deciduous after anthesis; stamens 6; thecae diverging at anthesis, inserted almost directly onto the filament apices, the connectives bifid but scarcely developed; anthers short and curled over at anthesis; non-fertilized pistillate flowers deciduous after anthesis; staminodial tubes crenulate or shallowly lobed at the apex, those of non-fertilized pistillate flowers not projecting and persistent after anthesis; *fruits* size no data, the bases without a prominent stipe, the apices not conical, the surfaces not splitting at maturity, without fibers emerging, bumpy from the numerous, subepidermal, tangential, short fibers present, these coming to a point at fruit apices; locular epidermis without operculum.

Distribution and habitat:—From 0°12'–0°19'N and 77°25'–77°31'W on eastern Andean slopes in Ecuador at 1592(1375–1810) m elevation in montane rainforest (Fig. 19).

Taxonomic notes:—*Geonoma fosteri* is similar to a group of species within the *G. lanata* clade. It differs from *G. bernalii*, *G. dindoensis*, *G. lanata*, and *G. venosa* in having short, asymmetrically apiculate prophylls with the margins curved around the stem and the surfaces flat with dense, felty, brown tomentum; from *G. tenuissima* in its fruit surfaces bumpy from the numerous, subepidermal, tangential, short fibers present; and from *G. operculata* by its locular epidermis without an operculum. Only two specimens are known. These share the same character states as *G. braunii*, but the peduncular bract is unknown in *G. fosteri*. Given the large geographic distance between the two, they are kept separate pending more complete material.

Subspecific variation:—No trait varies within this species.

not filiform and not narrowed between the flower pits; flower pits spirally arranged, densely hairy internally proximally and distally; proximal lips without a central notch before anthesis, not recurved after anthesis, hood-shaped at anthesis, sometimes splitting post-anthesis; proximal and distal lips drying the same color as the rachillae, not joined to form a raised cupule; distal lips absent; staminate and pistillate petals not emergent, not valvate throughout; staminate flowers deciduous after anthesis; stamens 6; thecae diverging at anthesis, inserted almost directly onto the filament apices, the connectives bifid but scarcely developed; anthers short and curled over at anthesis; non-fertilized pistillate flowers persistent or deciduous after anthesis; staminodial tubes crenulate or shallowly lobed at the apex, those of non-fertilized pistillate flowers not projecting and persistent after anthesis; *fruits* 6.3(4.9–8.4) mm long, 5.1(3.9–6.8) mm in diameter, the bases without a prominent stipe, the apices not conical, the surfaces not splitting at maturity, without fibers emerging, bumpy from the numerous, subepidermal, tangential, short fibers present, these coming to a point at fruit apices; locular epidermis without operculum, smooth, without pores.

Distribution and habitat:—From 5°52'N–17°23'S and 49°15'–78°35'W on eastern Andean slopes in Colombia, Ecuador, Peru, and Bolivia, the Guayana Highland region and outlying montane areas in Venezuela, Brazil, Guyana, Suriname, and French Guiana, and just reaching the Amazon region of Brazil (Pará, Rôndonia), at 735(200–1630) m elevation in lowland to montane rainforest (Fig. 18).

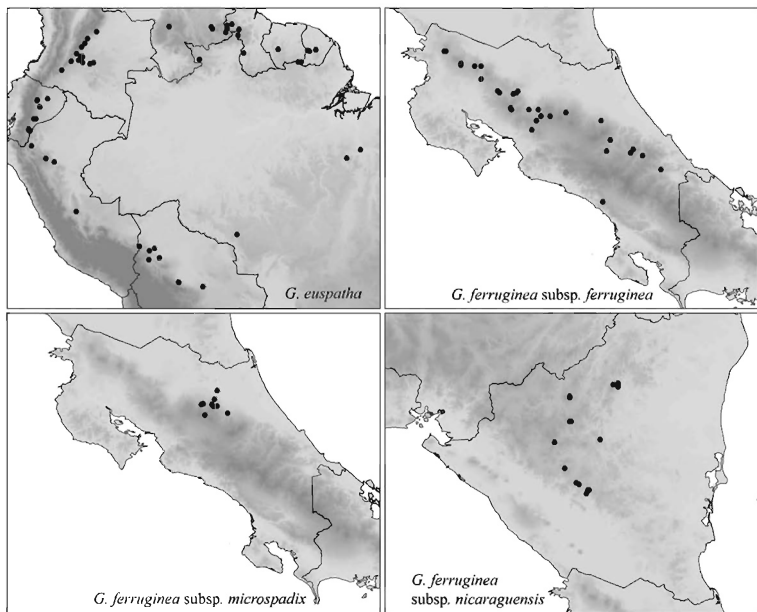


FIGURE 18. Distribution maps of *Geonoma euspatha*, *G. ferruginea* subsp. *ferruginea*, *G. ferruginea* subsp. *microspadix*, and *G. ferruginea* subsp. *nicaraguensis*.

Taxonomic notes:—*Geonoma euspatha* is the first species to be treated here of a group of related species characterized by its lack of a distal lip of the flower pit and flower pits hairy internally. This group, the *G.*