

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.

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).

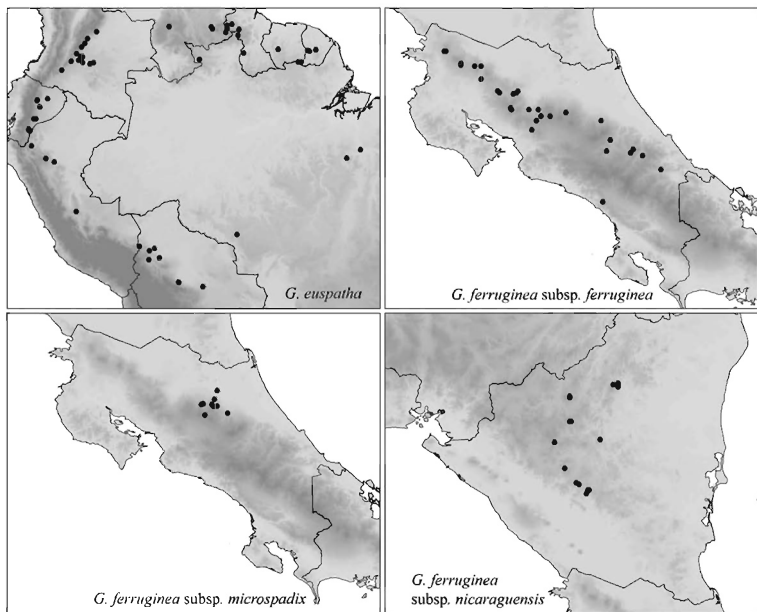


FIGURE 18. Distribution maps of *Geonoma euspatha*, *G. ferruginea* subsp. *ferruginea*, *G. ferruginea* subsp. *microspadix*, and *G. ferruginea* subsp. *nicaraguensis*.

**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.*