

prophyll length 0.39, interbract distance 0.26, and peduncle length 0.33. Prophylls, interbract distances, and peduncles increase in length with increasing elevation.

On eastern Andean slopes in Ecuador, particularly from Mera and Puyo, specimens (*mera-puyo* morphotype) have relatively slender inflorescences, 14.9(9.8–21.0) cm long and 2.1(1.5–2.5) mm wide rachillae, and 6.0(5.9–6.0) mm long and 4.6(4.1–5.0) mm wide fruits.

Also on eastern Andean slopes in Ecuador, there are specimens (*intermediate* morphotype) which appear intermediate between the *margaritoides* morphotype and *Geonoma orbignyana*. They have small leaves and inflorescences, like the latter, but the bracts of the inflorescence are like those of the former. They have 16.8(8.8–29.3) cm long and 3.8(3.1–5.0) mm wide rachillae and 8.2(7.6–8.8) mm long and 6.1(5.8–6.3) mm wide fruits.

One specimen (*sira* morphotype) from Peru (Huánuco) has small leaves like those of *Geonoma orbignyana*, slender rachillae 13.5 cm long and 1.9 mm wide, almost decussately arranged flower pits, and 8.9 mm long and 6.3 mm wide fruits.

67b. *Geonoma undata* subsp. *appuniana* (Spruce) Henderson, comb. & stat. nov.

Basionym: *Geonoma appuniana* Spruce (1871: 106). Type: GUYANA. Cuyuni-Mazaruni: Mount Roraima, 1864, *C. Appun 1141* (holotype K!).

Geonoma roraimae Dammer (1915: 261). Type: GUYANA. Cuyuni-Mazaruni: Mount Roraima, 1800–2300 m, February 1910, *E. Ule 8805* (holotype B, destroyed, isotypes K!, L!, US!).

Leaves veins raised and rectangular in cross-section adaxially; basal pinna 3.8(0.5–27.0) cm wide; apical pinna 6.4(1.5–15.0) cm wide. *Inflorescences* prophyll margins with irregular, spine-like projections; flower pits usually spirally arranged, not distantly spaced.

Distribution and habitat:—From 0°46'–6°04'N and 59°50'–66°04'W in the Guayana Highland region of Venezuela, Brazil, and Guyana at 1752(810–2700) m elevation in montane rainforest (Fig. 42).

There is geographic discontinuity and specimens occur on many, isolated mountains, but there are too few specimens from each mountain to test for differences amongst them.

There is geographical variation in this subspecies. Linear regression shows there are significant associations between elevation and three leaf and four inflorescence variables. Squared multiple *R* for the regression of rachis width on elevation is 0.40, basal pinna angle 0.29, apical pinna angle 0.58, prophyll length 0.23, rachilla width 0.23, fruit length 0.49, and fruit diameter 0.45. The rachis becomes thicker, pinna angles narrower, prophylls longer, rachillae thicker, and fruits longer and wider with increasing elevation.

67c. *Geonoma undata* subsp. *dussiana* (Becc.) Henderson, comb. & stat. nov.

Basionym: *Geonoma dussiana* Beccari (1920: 436). Lectotype (designated by Read 1979): GUADELOUPE. Bois du Nez-Cassé, 28 February 1904, *A. Duss 4198* (lectotype US!, duplicates F!, FI!, LE!, MO!, NY!).

Geonoma hodgsonum Bailey in Hodge (1942: 108). Type: DOMINICA. Mome Trois Pitons, 763–1400 m, 23 February 1940, *W. Hodge 1430* (holotype BH!, isotype NY!).

Leaves veins raised and rectangular in cross-section adaxially; basal and apical pinna width no data. *Inflorescences* prophyll margins with irregular, spine-like projections; flower pits usually spirally arranged, not distantly spaced.

Distribution and habitat:—From 14°40'–16°05'N and 61°00'–61°40'W in Dominica, Guadeloupe and Martinique at medium elevations in lowland or montane rainforest (Fig. 42).

67d. *Geonoma undata* subsp. *edulis* (Wendland ex Spruce) Henderson, comb. & stat. nov.

Basionym: *Geonoma edulis* Wendland ex Spruce (1871: 106). Type: COSTA RICA. Cartago: Turrialba, 1857, *H. Wendland s.n.* (holotype K!).

Geonoma seleri Burret (1930a: 211). Type: GUATEMALA. Huehuetenango: Yalambohoch, no date, *E. Seler 2757* (holotype B, destroyed). Neotype (designated by de Nevers & Grayum 1998): GUATEMALA. Alta Vera Paz: between Sepacuite and Panzas, 24 June 1904, *O. Cook & Doyle 327* (neotype US!).

Geonoma polyneura Burret (1932b: 500). Type: GUATEMALA. Alta Vera Paz: near Finca Sepacuite, 19 March 1902, O. Cook & R. Griggs 36 (holotype US!, isotype BH!).

Leaves veins raised and rectangular in cross-section adaxially; basal pinna 4.9(0.8–13.7) cm wide; apical pinna 12.6(5.7–23.2) cm wide. *Inflorescences* prophyll margins with irregular, spine-like projections; flower pits usually spirally arranged, not distantly spaced.

Distribution and habitat:—From 7°18'–16°19'N and 80°06'–93°15'W in Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, and Panama at 1523(850–2400) m elevation in lowland or montane rainforest (Fig. 42).

There is geographic discontinuity and specimens occur in two areas separated by the lowlands of southern Nicaragua. There are few significant differences in variables between specimens from these two areas (basal pinna length, basal pinna width, prophyll length). There is variation in pit arrangement throughout the range of the subspecies, from spirally arranged to irregularly decussate or tricusate. A few specimens have the pits loosely spiraled proximally and tricusate or decussate distally, or tricusate proximally and decussate distally.

One specimen (*Evans 1459*) from Honduras is larger in inflorescence size than other specimens from that area and has a narrow, elongate prophyll, more like that of subsp. *hoffmanniana*.

The range of this subspecies overlaps with that of subsp. *hoffmanniana* in several places—northern Nicaragua, Atlantic and Pacific slopes of the Central Cordillera in Costa Rica, and both slopes on the Cordillera de Talamanca in Costa Rica and Panama. In this last area specimens are much larger in size than those from other areas (as are most specimens of subsp. *hoffmanniana*, which see). Hammel (2003) considered that specimens of subsp. *edulis* (as *G. edulis*) and larger, sympatric specimens of subsp. *hoffmanniana* (as *G. hoffmanniana*) were 'virtually indistinguishable' in this area.

All specimens from the Cordillera de Talamanca and all others from Panama have much thicker peduncles than other specimens.

67e. *Geonoma undata* subsp. *pulcherrima* (Burret) Henderson, comb. & stat. nov.

Basionym: *Geonoma pulcherrima* Burret (1930a: 195). Type: ECUADOR. Morona-Santiago: confluence of Río Boamboza and Río Zamora, 700–800 m, no date, *F. Lehmann 5289* (holotype B, destroyed, isotypes F!, GH!, K!).

Leaves veins raised and rectangular in cross-section adaxially; basal pinna 0.7(0.3–1.0) cm wide; apical pinna 0.8(0.5–1.0) cm wide. *Inflorescences* prophyll margins without irregular, spine-like projections; flower pits usually spirally arranged, not distantly spaced.

Distribution:—From 3°30'–4°18'S and 78°30'–78°41'W on eastern Andean slopes in southeastern Ecuador at 923(750–1130) m elevation along river banks in areas subject to flooding (Fig. 43). Plants are reported to be rheophytes.

67f. *Geonoma undata* subsp. *skovii* (Henderson, Borchsenius, & Balslev) Henderson, comb. & stat. nov.

Basionym: *Geonoma skovii* Henderson, Borchsenius & Balslev (2008: 60). Type: ECUADOR. Morona-Santiago: along the Limón-Cuenca road 4 km above Plan de Milagro, 3°04'S, 78°30'W, 1920 m, 19 May 1988, *B. Bergmann & H. Pedersen 62589* (holotype NY!, isotypes AAU!, QCA n.v.).

Leaves veins raised and rectangular in cross-section adaxially; basal pinna 1.3(0.6–2.0) cm wide; apical pinna 7.3(2.7–11.3) cm wide. *Inflorescences* prophyll margins with irregular, spine-like projections; flower pits usually spirally arranged, distantly spaced.

Distribution and habitat:—From 2°40'–3°38'S and 78°00'–78°30'W in Ecuador on eastern Andean slopes at 1778(1470–1920) m elevation in montane rainforest (Fig. 43).

Subspecific variation:—There is geographic discontinuity, and specimens come from three different mountain areas. Specimens from the Cordilleras Cutucú and Cóndor have more pinnae per side of the rachis than those from the eastern slopes of the main Cordillera. However, there are too few specimens to test for differences. Jean-Christophe Pintaud (pers. comm.) reports that this subspecies also occurs in adjacent Peru.

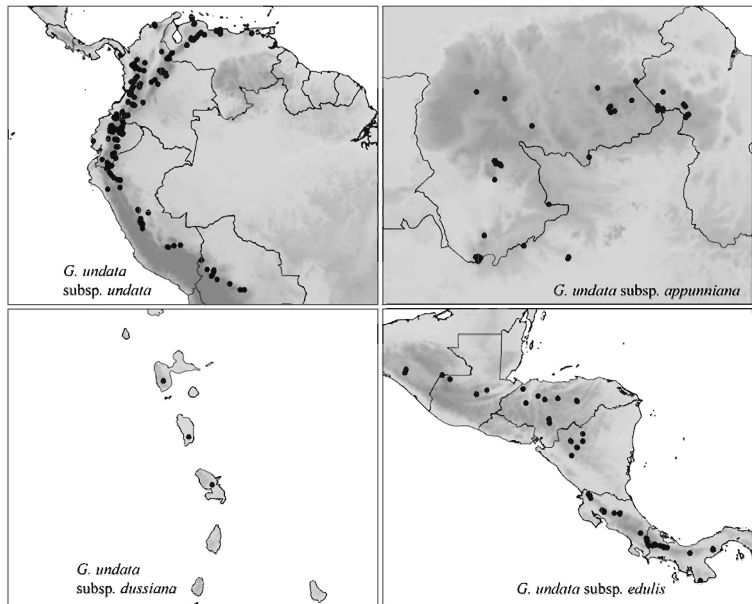


FIGURE 42. Distribution maps of *Geonoma undata* subsp. *undata*, *G. undata* subsp. *appunniiana*, *G. undata* subsp. *dussiana*, and *G. undata* subsp. *edulis*.

Some specimens lack distal lips of the flower pits (*megalospatha* morphotype). These are hypothesized to be hybrids between the *margaritoides* morphotype and *Geonoma trigona*. They share with *G. trigona* the absence of an upper lip, and occur in two areas where *G. trigona* occurs (Ecuador, Peru). It is predicted that *G. trigona* will be found in Bolivia at the third hybrid locality. The type of *G. megalospatha* has this kind of flower pits.

Specimens from the Western Cordillera of the Colombian Andes (*iodolepis* morphotype) have small leaves like those of *G. orbignyana* and inflorescences with short, thin rachillae 9.0(7.0–11.0) cm long and 2.6(2.1–3.5) mm wide. Fruits are 8.5 mm long and 6.3 mm wide. The type of *G. iodolepis* is of this morphotype.

In the Venezuelan, Colombian, Ecuadorian, and Peruvian Andes, and also the Sierra Nevada de Santa Marta in Colombia, there is an extremely variable morphotype (*weberbaueri* morphotype). Specimens have plicate leaves, short, thick rachillae 19.0(9.0–33.0) cm long and 5.7(3.0–9.4) mm wide, and 12.5(8.0–15.4) mm long and 8.7(5.0–12.0) mm wide fruits. Most specimens with fruits have large-sized fruits, but a few specimens (*Dodson 15213*, *Vásquez 26597*) have small, globose fruits. This morphotype differs from the *margaritoides* morphotype in 10 variables. See under *Geonoma orbignyana* subsp. *orbignyana* for potential hybrids with that subspecies.

There is geographical variation in this morphotype. Linear regression shows there are significant associations between elevation and three inflorescence variables. Squared multiple *R* for the regression of