

*Inflorescences* rachillae 19.1(15.0–23.0) cm long.

**Distribution and habitat:**—From 8°31'–9°17'N and 83°17'–83°46'W in the Osa Peninsula and adjacent areas on the Pacific slope in Costa Rica at 263(97–700) m elevation in lowland tropical rainforest (Fig. 13).

14. *Geonoma cuneata* Wendland ex Spruce (1871: 104). Type: COSTA RICA. Heredia: Sarapiquí, 1857, *H. Wendland s.n.* (holotype K!).

*Plants* 1.4(0.3–2.5) m tall; stems 0.7(0.1–3.0) m tall, 1.5(0.4–3.4) cm in diameter, solitary or clustered, not cane-like or cane-like; internodes 0.9(0.2–2.2) cm long, yellowish and smooth, or, if short and congested, not scaly. *Leaves* 10(4–17) per stem, undivided or irregularly pinnate, not plicate, bases of blades running diagonally into the rachis; sheaths 20.0(9.0–51.0) cm long; petioles 30.7(0.2–113.5) cm long, drying orange-brown, reddish-brown, or green or yellowish; rachis 46.4(12.0–250.0) cm long, 4.1(1.3–9.0) mm in diameter; veins raised and rectangular in cross-section adaxially or not raised or slightly raised and triangular in cross-section adaxially; pinnae 3(1–35) per side of rachis; basal pinna 32.7(12.5–68.0) cm long, 5.8(0.3–21.5) cm wide, forming an angle of 31(3–95)° with the rachis; apical pinna 22.9(8.5–44.0) cm long, 10.7(1.5–37.0) cm wide, forming an angle of 31(10–50)° with the rachis. *Inflorescences* unbranched; prophylls and peduncular bracts ribbed with elongate, unbranched fibers, both bracts tubular, narrow, elongate, closely sheathing the peduncle, more or less persistent; prophylls 16.5(4.0–38.0) cm long, not short and asymmetrically apiculate, the surfaces not ridged, without unequally wide ridges; peduncular bracts 32.6(16.5–67.0) cm long, well-developed, inserted 1.4(0.4–5.7) cm above the prophyll; peduncles 51.3(13.7–117.0) cm long, 3.0(1.1–8.2) mm in diameter; rachillae 1, 20.4(5.5–52.0) cm long, 5.4(1.9–10.5) mm in diameter, the surfaces without spiky, fibrous projections or ridges, drying brown or yellow-brown, without short, transverse ridges, not filiform and not narrowed between the flower pits; flower pits spirally arranged, glabrous internally; proximal lips pits with a central notch before anthesis, often the two sides of the notch overlapping, recurved after anthesis, not hood-shaped; proximal and distal lips drying the same color as the rachillae, not joined to form a raised cupule, the proximal lip margins overlapping the distal lip margins; distal lips well-developed; staminate and pistillate petals not emergent, not valvate throughout; staminate flowers persistent or 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 flowers not projecting and persistent after anthesis; *fruits* 7.6(5.0–11.6) mm long, 5.4(4.4–6.5) mm in diameter, the bases without a prominent stipe, the apices not conical, the surfaces not splitting at maturity, without fibers emerging, ridged from the numerous, subepidermal, meridional, elongate fibers present, these coming to a point at fruit apices; locular epidermis without operculum, smooth or sculpted and then usually also with a raised, meridional ridge, without pores.

**Taxonomic notes:**—*Geonoma cuneata* is a member of the *G. cuneata* clade, along with *G. brenesii*, *G. epetiolata*, *G. hugonis*, and *G. monospatha*, from which it differs in its crenulate or shallowly lobed staminodial tubes. *Geonoma cuneata* is very variable; in fact it is the fourth most variable species in the genus. Borchsenius (1999) studied variation within *G. cuneata* in western Ecuador using morphometric methods and data taken from living plants. At a local scale he found that four different varieties (based on Henderson *et al.*, 1995) of *G. cuneata* could be distinguished. However, when he included plants from other sites in western Ecuador in the analysis, differences between the varieties broke down. Borchsenius concluded that the varietal classification of Henderson *et al.* was not applicable in western Ecuador, much less throughout the whole range of the species. Borchsenius' study is of interest because of its quantitative approach. However, he used only quantitative variables and not qualitative traits. Of the four varieties recognized by Borchsenius—var. *cuneata* (here as *ecuador* morphotype), var. *gracilis* (here as *esmeraldas* morphotype), var. *procumbens* (here as *multipinnate* morphotype), and var. *sodiroi* (here as subsp. *sodiroi*)—one, the last, can be recognized as a subspecies based on both quantitative variables and qualitative traits. In

the present study, quantitative variables and qualitative traits, as well as geographic distributions are used and allow for separation into subspecies, as explained below.

**Subspecific variation:**—Eight traits vary within this species (stem branching, stem type, leaf division, petiole color, adaxial veins, staminate flower persistence, pistillate flower persistence, locular epidermis sculpting). Excluding those traits with few data (stem branching, stem type, locular epidermis sculpting), the remaining five traits (leaf division, petiole color, adaxial veins, staminate flower persistence, pistillate flower persistence,) divide the specimens into seven subgroups. None of these are geographically separate. *Geonoma cuneata* has a widespread and almost continuous distribution from Nicaragua through Central America and western Colombia to western Ecuador. In some cases there are too few specimens for quantitative analysis, and each subgroup is considered separately.

The first subgroup, with undivided leaves, petioles drying reddish-brown, and raised adaxial veins, is confined to a small area of the Pacific coast of Colombia, in Valle, and is recognized as a subspecies (subsp. *rubra*).

The second subgroup, with undivided leaves, petioles drying orange-brown, and non-raised adaxial veins, is confined to a small area in northern Costa Rica, on the Cordilleras de Guanacaste and Tilarán, and is recognized as a subspecies (subsp. *guanacastensis*).

The third subgroup, with pinnate leaves, petioles drying green, and raised adaxial veins, occurs in western Colombia and Ecuador and is reported to be a rheophyte, growing along the banks of fast-flowing rivers, and this is recognized as a subspecies (subsp. *linearis*).

The fourth subgroup, with pinnate leaves, petioles drying green, and non-raised adaxial veins, is widespread, from Nicaragua to Ecuador. This subgroup can be separated geographically and morphologically into specimens from western Ecuador with 5–7 pinnae per side of the rachis, and specimens from Nicaragua, Costa Rica, and Panama with 6–28 pinnae per side. These two are recognized as subspecies (subsp. *sodiroi*, *procumbens*, respectively).

The fifth subgroup, with undivided leaves, petioles drying green, and non-raised adaxial veins is also widespread. This subgroup can be separated based on morphology, and a lesser extent geography, into specimens from central Panama (El Copé, Coclequito Road, El Valle) with small leaves with the rachis 19.0–29.0 cm long, and specimens from central Panama (Santa Fé to the western end of the Serranía de San Blás) with large leaves with the rachis 40.0–88.0 cm long. These two are recognized as subspecies (subsp. *minor*, *indivisa*, respectively).

The sixth subgroup, with both undivided and pinnate leaves, petioles drying green, and raised adaxial veins, is widespread from Nicaragua to Ecuador. It consists of numerous local morphotypes, as discussed below, and cannot be divided into subspecies. It is recognized as a subspecies (subsp. *cuneata*).

The seventh subgroup, with pinnate leaves and raised veins, also has persistent staminate and pistillate flowers. It occurs in western Ecuador and is recognized as a subspecies (subsp. *irena*).

### Key to the subspecies of *G. cuneata*

- 1 Staminate and non-fertilized pistillate flowers persistent after anthesis; western Ecuador.....subsp. *irena*
- Staminate and non-fertilized pistillate flowers deciduous after anthesis; widespread including western Ecuador ..... 2
- 2 Petioles drying orange-brown or reddish-brown ..... 3
- Petioles drying green or yellowish..... 4
- 3 Petioles drying reddish-brown; Colombia (Valle)..... subsp. *rubra*
- Petioles drying orange-brown; Costa Rica (Cordilleras de Guanacaste and Tilarán) ..... subsp. *guanacastensis*
- 4 Leaves with the veins raised and rectangular in cross-section adaxially ..... 5
- Leaves with the veins not raised or slightly raised and triangular in cross-section adaxially ..... 6
- 5 Rheophytes; western Colombia and Ecuador .....subsp. *linearis*
- Non-rheophytes; widespread ..... subsp. *cuneata*
- 6 Pinnae 6(5–7) per side of rachis; western Ecuador.....subsp. *sodiroi*
- Leaves undivided or pinnate; Nicaragua, Costa Rica, Panama ..... 7
- 7 Pinnae 12(1–28) per side of rachis; Nicaragua, Costa Rica, Panama.....subsp. *procumbens*