

A REVISION OF
ATRACTANTHA (POACEAE:
BAMBUSOIDEAE:
BAMBUSEAE)¹

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ABSTRACT

A revision of the South American woody bamboo genus *Atractantha* is presented, including a key to the species, and descriptions, illustrations, and distribution maps for all five recognized taxa. The Bahia (Brazil) species *A. aureolanata* and *A. cardinalis*, both with large, attenuate florets but differing in culm leaf morphology, foliage leaf blade width, and lemma indument, are newly described. Possible affinities of *Atractantha* with *Alvimia*, *Arthrostyidium*, and *Elytrostachys* are discussed.

Its pungent, needlelike florets, often arrayed in elegant, fan-shaped clusters or capitate heads, make *Atractantha* McClure (Poaceae: Bambusoideae: Bambuseae: Arthrostyliidiinae) one of the most easily recognizable genera of American bamboos. It is a characteristic element of the rich Bahian (Brazil) bamboo flora (Soderstrom et al., 1988). First collected in 1943 by Ricardo de Lemos Fróes (Soderstrom & Londoño, 1987), the genus was described by McClure (1973) on the basis of *A. radiata* McClure (the type species) and *A. falcata* McClure. Explorations in Bahia by C. E. Calderón and T. R. Soderstrom in the 1970s made it evident that several more taxa of this genus awaited description. Thus, Calderón & Soderstrom (1980) estimated 9–10 species for the genus; Clayton & Renvoize (1986), about 10 species; while Soderstrom & Londoño (1988) noted that there were 5–6 “additional” species. Except for the newly described, Amazonian *A. amazonica* Judziewicz & L. G. Clark (Judziewicz et al., 1991), the *Atractantha* folders in the U.S. National Herbarium, Smithsonian Institution (US) have for many years borne Soderstrom’s unpublished names for six new Bahian species of *Atractantha*. An opportunity to evaluate this abundant material resulted in the decision to validate only two of these names as new

species and enabled the completion of this first formal revision of the genus.

Most collections of *Atractantha* were made during the years 1972–1983 by Soderstrom, Calderón, and the Brazilian botanists acknowledged above. The first set of specimens is in the herbarium of the Centro de Pesquisas do Cacau (CEPEC), Itabuna, Brazil, where they were examined during a February 1986 visit. The ample duplicates were studied at US using classical alpha taxonomic methods before being distributed to numerous herbaria. Unless noted, all collections cited are sterile.

MORPHOLOGY AND ANATOMY

HABIT AND BRANCHING

Species of *Atractantha* are caespitose woody bamboos from sympodial rhizomes. The slender, flexible culms are scandent, vining, and are ultimately pendent from or curtaining upon trees (Figs. 6, 12). Branching and rebranching is profuse from the middle and upper nodes. Soderstrom & Londoño (1988) discussed in some detail the functional adaptations of the culm leaf sheath girdle (Figs. 2C, D, 4C, 5), promontory (Fig. 2B), and branching patterns found in climbing bamboos in general and *Alvimia* Soderstrom & Londoño in particular, and

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many of their generalizations apply to the closely related *Atractantha* as well.

CULMS

Although most are typically solid (Fig. 4B), an unusual feature in the culms of several species of *Atractantha* is the presence of small but well-developed peripheral air canals (Fig. 2A). The canals are most frequently seen in *A. aureolanata* Judziewicz but occasionally develop in *A. cardinalis* Judziewicz and *A. radiata* (Calderón *et al.* 2452) as well. Air canals are not common in New World bamboos but are known from the rhizomes and culm bases of *Arundinaria gigantea* (Walter) Muhl. (North America), as well as from throughout the culms of an undescribed species of *Rhipidocladum* McClure (Amazonian Peru; Dillon *et al.* s.n., US). In both of these species there is a central canal in addition to the peripheral canals, and all are much larger than those found in *Atractantha*. Air canals are well developed in the roots of Old World bamboos such as *Arundinaria densifolia* Munro (Sri Lanka) and *Thamnocalamus tessellatus* (Nees) Soderstrom & R. P. Ellis (South Africa). These species, as well as *Arundinaria gigantea*, grow in wet swamps and bogs quite unlike the dry, terrestrial habitat of the Bahian species of *Atractantha*.

CULM LEAVES

The culm leaves are caducous to tardily deciduous. In several of the Bahian species (e.g., *A. aureolanata*, *A. cardinalis*) a prominent, dark, corky, swollen sub-basal callus is located on the abaxial surface of the sheath (Fig. 4E, F), while in *A. cardinalis* one basal margin of the sheath is auricled (Figs. 4E, 7). The blades are variable. In *A. amazonica* they are erect, triangular, persistent, and not subtended by sheath summit oral setae (Fig. 1F); in *A. radiata*, they are absent or represented by a tiny mucro (Fig. 2G); and in *A. aureolanata*, *A. cardinalis*, and *A. falcata* the blades are horizontal becoming reflexed, linear to narrowly lanceolate, readily deciduous, and often subtended by prominent oral setae (Figs. 2C-G, 4D). *Atractantha aureolanata* is noteworthy for its prominently flattened, basally confluent culm leaf sheath oral setae.

FOLIAGE LEAVES

The foliage leaves consist of a sheath, a small, indurate outer ligule, a membranous inner ligule, rather delicate, curling oral setae (Figs. 11C, 14B), and a linear-lanceolate to lanceolate-ovate blade.

The blades are similar to those of other arthrostylidoid genera, which can often be easily recognized by the absence of a prominent midvein, and the frequent presence of a narrow, lighter or darker zone of tissue along one margin.

INFLORESCENCES

The inflorescences of the Bahian species of *Atractantha* are compound and consist of a few to numerous partial inflorescences produced from all leafy axes and sometimes at branch and culm nodes as well. Individual partial inflorescences are either loosely to densely fascicled (*A. aureolanata*, *A. cardinalis*, and *A. falcata*) or densely capitate (*A. radiata*). McClure (1973) interpreted the inflorescences of *A. falcata* and *A. radiata* (Figs. 11D, 15D) to be composed of itercaucant pseudospikelets that rebranch in either distichous or sympodial fashion. *Atractantha amazonica* has semelaucant inflorescences with true spikelets produced in spicate racemes.

FLORETS

Atractantha has particularly distinctive florets. Each pseudospikelet or spikelet is 1- or occasionally 2-flowered, with a large, slender, spindlelike, falcate, indurate, obscurely nerved, pungent, functional lower floret, and, if present, a tiny, rudimentary upper floret borne on an elongate, bristlelike prolongation of the rachilla. The lemma is typically rounded on the back and externally nerveless, but *A. radiata* (Fig. 15B, C, E, F) is exceptional in its raised midnerve and occasionally raised lateral nerves. Although the florets of all species normally disarticulate intact from the summit of the rachilla, in *A. aureolanata* (Fig. 3D), *A. cardinalis*, and *A. falcata* there is a small area of tissue on the back of the lemma near its base where the nerves are prominent for a short distance and separated by depressed, fragile areas of thin tissue. The floret sometimes pulls apart in this zone of weaker tissue before it disarticulates from the rachilla.

FLOWERS

The flowers of *Atractantha* consist of three relatively large, lanceolate lodicules (*A. amazonica* may lack lodicules), three stamens, and a gynoeceium with one style and two hispidulous stigmas.

FRUITS

The fruit of *Atractantha* has not been described until now. Based on Calderón *et al.* 2402 (*A.*

TABLE 1. Comparison of *Atractantha* with putatively related genera.

Character	<i>Alvimia</i>	<i>Arthrostylidium</i>	<i>Atractantha</i>	<i>Elytrostachys</i>
Habit	Delicate, vining	Delicate, scandent or uncommonly erect, arching	Delicate, scandent	Robust, erect and arching (but not self-supporting)
Culms	Nearly solid with a small lumen	Hollow with a small lumen, uncommonly solid	Solid, or with a ring of peripheral air canals, or rarely with a small lumen	Hollow with a large lumen
Culm node promontory	Present	Present	Present	Absent
Oral setae, culm and foliage leaves	Curling, not prominent	Curling, not prominent	Curling, not prominent except on culm leaves of some species	Straight, prominent
Inflorescence	Diffuse	Spicate raceme	Diffuse, capitate, or rarely a spicate raceme	Diffuse
Pseudospikelets	Present	Absent	Present (rarely absent)	Present
Florets/spikelet	10-30	3-10	1(-2)	1(-2)
Floret texture	Membranous	Membranous	Indurate	Firmly membranous, slightly inflated
Floret shape	Elliptical, acute	Lanceolate to elliptical, acute to acuminate	Lanceolate, pungent	Elliptical, acute
Rachilla internode prolonged past last floret bearing rudimentary spikelet?	No	Yes, moderately large	No or yes, very small	No or yes, very small
Stamen number	2	3	3	6
Fruit type	Fleshy	Dry	Dry	Dry
Distribution	Brazil (Bahia)	Mexico and West Indies to Bolivia and central Brazil	Brazil (Amazonas, Bahia) and Venezuela (Amazonas)	Central America, Colombia, Venezuela, Peru, and Bolivia

cardinalis), it is a dry, narrowly fusoid, slightly dorsally compressed caryopsis with a small, basal embryo and an elongate linear hilum extending the full length of the fruit (Fig. 3K-M). The slender beak appears to represent the remnants of the summit of the ovary.

LEAF ANATOMY

The foliage leaf blade cross-sectional anatomy of *Atractantha* clearly places it within the Arthrostylidiinae (Soderstrom & Ellis, 1987). In addition to typically bambusoid features such as fusoid cells and arm cells, an anatomical slide of *A. aureolanata* (Calderón & Pinheiro 2256, US slide collection) exhibits arthrostylidioid characters such as the presence of intercostal sclerenchyma subjacent to both epidermises and an inconspicuous midvein with simple vasculature.

RELATIONSHIPS

Of the 11 genera of arthrostylidioid bamboos, only *Atractantha*, *Alvimia* Soderstrom & Londoño (Soderstrom & Londoño, 1988), and *Elytrostachys* McClure (McClure, 1942, 1973) have some or all species with pseudospikelets instead of true spikelets. Table 1 compares these three taxa with *Arthrostylidium* Rupr., an unspecialized and heterogeneous genus that may be the paraphyletic core group of the subtribe (Judziewicz & Clark, in press).

Arthrostylidium and *Atractantha* have similar vegetative branching patterns in which a promontory produces one to several main branches that quickly rebranch to produce numerous smaller secondary and tertiary branchlets. *Arthrostylidium* differs in producing semelauctant, spicate racemes of true spikelets, each with three to many mem-

branous florets lacking the specialized morphology of those of *Atractantha*. *Atractantha amazonica*, with true semelauctant spikelets borne in spicate racemes, is a possible intermediate between the two genera. In their decision to describe this species in *Atractantha* rather than in *Arthrostylidium*, Judziewicz et al. (1991) chose to emphasize the distinctive and presumably uniquely derived floret morphology shared by *A. amazonica* and all Bahian species, and stressed the possibility that, by reduction, true spikelets may have evolved from pseudospikelets several times in the bamboos. Aside from its determinate inflorescences, *A. amazonica* differs from its Bahian congeners in its culms with a small, central lumen and culm leaves with triangular, erect, persistent blades. Further study could indicate that this anomalous species requires recognition as a separate genus.

Another possible relative of *Atractantha* is *Elytrotachys*. This genus is occasionally encountered in wet forests at elevations from 0 to 900 m in Central America, but is quite rare at elevations from 100 to 1,700 m in Andean South America (Fig. 9); examination of US material suggests that the two described species are not distinct and that *E. clavigera* McClure should be united with the type species *E. typica* McClure. Similarities between *Atractantha* and *Elytrotachys* include narrow, reflexed culm leaf blades, often subtended by prominent oral setae; setose, laminiferous pseudospikelet bracts; and the single "pedicellate," readily disarticulating floret, often with a setose prolongation of the rachilla internode bearing a rudimentary spikelet. *Elytrotachys* differs from *Atractantha* in its erect, arching, only semiscandent habit; more robust culms with a large central lumen; apiculate branch complements with many equal-sized branches not situated on a promontory; and the rigid and straight rather than flexible and curling oral setae.

Alvimia is clearly related to *Atractantha* (Soderstrom & Londoño, 1988). Both genera share a vining habit, similar branching morphologies, pseudospikelets, and sympatric distributions. In fact, the range of *Alvimia* lies wholly within that of *Atractantha* (Fig. 9). *Alvimia* differs from *Atractantha* most strikingly in its olive-sized, fleshy fruits, but other differences include the presence of two rather than three stamens and very elongate pseudospikelets with numerous, small, membranous florets. Each of these observed differences can be interpreted as representing derived character states in *Alvimia*, when compared with those found in *Atractantha*. As discussed under that species, *Atractantha radiata* frequently exhibits a diverse

array of intriguing flowering teratologies, and in some of these the proliferated partial inflorescences produce elongate, apparently several-flowered pseudospikelets with firmly membranous (rather than indurate), distant florets slightly reminiscent of those of *Alvimia*. The available evidence does not exclude the possibility that *Alvimia* evolved from a species of *Atractantha*, perhaps even directly from *A. radiata* or a related species.

TAXONOMIC TREATMENT

Atractantha McClure, Smithsonian Contr. Bot. 9: 42. 1973. TYPE SPECIES: *A. radiata* McClure.

Small- to medium-sized, caespitose woody bamboos. Rhizomes short-necked, sympodial, pachymorph. Culms scandent to vining and pendent, slender, either solid, or with a ring of small air canals near the epidermis, or uncommonly with a small, central lumen. Midculm nodes solitary with a horizontal nodal line, initially bearing a single branch bud at the summit of a promontory, this rebranching to form secondary and tertiary branchlets. Culm leaves deciduous or persistent; sheaths clasping culm, the base attached to the culm by a dark, thickened girdle; oral setae absent to abundant; blades either absent or present; if present, then small, narrow, reflexed, and caducous to less commonly triangular, erect, and persistent. Branching intravaginal. Foliage leaves with both inner and outer ligules present, membranous; oral setae usually short, numerous, and curling; blades linear to lanceolate-ovate. Inflorescence a group of 1-several partial inflorescences, each consisting of a capitate head, a fascicled or scorpioidal cluster, or a spicate raceme, iterauctant (producing pseudospikelets) or less commonly semelauctant (producing true spikelets); if iterauctant, pseudospikelets with branching axes subtended by a glumelike bract, each bearing a prophyllate bract as the first lateral appendage, and 1-several gemmiparous bract(s) above this. Spikelets or pseudospikelets with one functional floret and occasionally a second, tiny, sterile rudiment on a filiform prolongation of the rachilla; floret with lemma narrowly lanceolate, falcate, attenuate, indurate, smooth, glabrous to pubescent, abaxially obscurely 7-15-nerved, mucronate to short-awned, basally clasping and nearly concealing the palea. Palea about as long as lemma, narrowly lanceolate, the apex acute to bifurcate, bicarinate, the margins strongly inrolled and overlapping, the keels set close together and usually concealing the prolongation of the rachilla (if present) in the dorsal sulcus. Lodicules (0-)3,

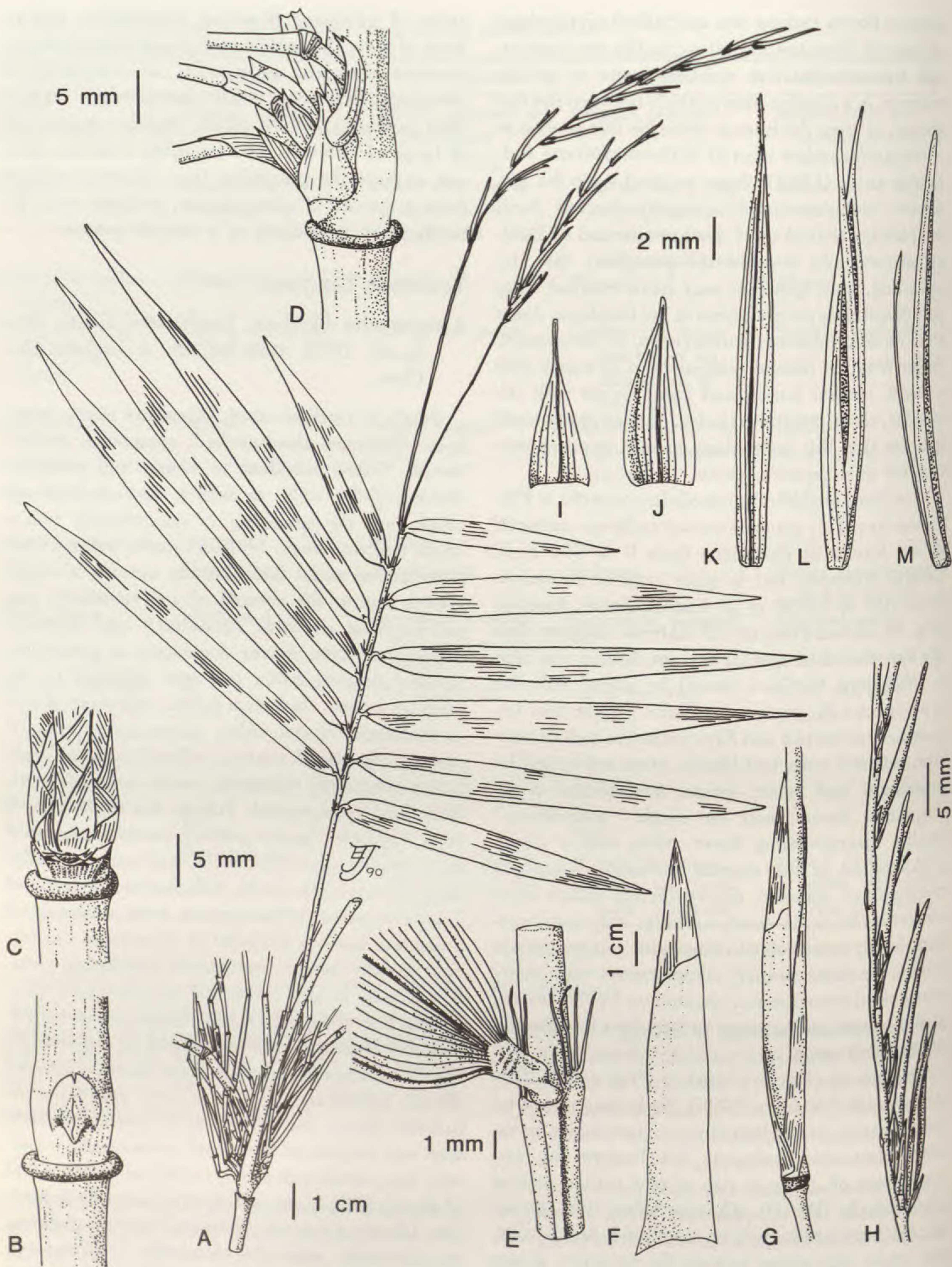


FIGURE 1. *Atractantha amazonica*.—A. Habit of fertile foliage leaf complement.—B. Culm node with bud.—C. Culm node with three main branches.—D. Branch complement, lateral view.—E. Foliage leaf, ligular area.—F. Culm leaf, spread.—G. Culm leaf, in situ.—H. Portion of raceme.—I. Lower glume.—J. Upper glume.—K. Lemma, dorsal view.—L. Floret, showing palea protruding from lemma.—M. Palea (right) and rachilla internode with rudimentary spikelet (left), lateral view. (A, E, H–M based on Kubitzki *et al.* 79-222; B–D, F, G based on Kubitzki *et al.* 79-209.)

rather large, lanceolate, acuminate, membranous to diaphanous, sometimes ciliate on the apical margins, otherwise glabrous. Androecium with stamens 3, the filaments free, the anthers linear, basifixed. Gynoecium with ovary glabrous below, glabrous to puberulent above; style 1; stigmas 2(-3), hispidulous. Fruit a fusiform caryopsis; embryo small, basal; hilum linear, extending the full length of the fruit; endosperm solid. Chromosome number unknown.

Distribution. *Atractantha* is a genus of five species known from Venezuela (Amazonas) and Brazil (Amazonas and Bahia) (Fig. 9). Calderón &

Soderstrom (1980) also give northern Espírito Santo (Brazil) as part of the range but no collections have been examined from that state.

Habitat. The Bahian species of *Atractantha* grow at elevations from 0 to 650 m in several forest types but are most characteristic of the sandy "restinga" and "mata littorânea" vegetation types. Some species are locally dominant and cover the tree canopy, hanging down in festoons and curtains (Figs. 6, 12). The Amazonian *A. amazonica* is a scandent plant found along riverbanks in "igapó" forest. All Bahian species are doubtlessly threatened by forest destruction (Mori et al., 1983).

KEY TO THE SPECIES OF *ATRACTANTHA*

- 1a. Inflorescence a simple spicate raceme of true spikelets; culms with a small, central lumen; Amazonian Brazil and Venezuela 1. *Atractantha amazonica*
- 1b. Inflorescence a complexly branched, fascicled or capitate group of pseudospikelets; culms solid or with a ring of tiny peripheral air canals; Atlantic coastal Brazil (Bahia).
 - 2a. Florets 27-36 mm long, the apex of the lemma and keels of the palea 2-5 mm long, curving, attenuate, and awnlike.
 - 3a. Foliage leaf blades 1-2(-2.8) cm wide; florets glabrous to sparsely and minutely hispidulous; culms smooth or siliceous below the nodes; bracts subtending secondary and tertiary branchlets greenish or stramineous, rarely slightly reddish; culm leaf sheaths with finely ciliate lower margins, bases lacking auricles, and leaf-base girdles usually with prominent skirts of retrorse, golden cilia that remain attached to the culm after the leaf has fallen 2. *Atractantha aureolanata*
 - 3b. Foliage leaf blades 0.4-0.8 cm wide; florets densely pubescent; culms ± harshly asperous throughout; bracts subtending secondary and tertiary branchlets bright reddish; culm leaf sheaths with glabrous lower margins, bases with one side auricled, and glabrous leaf-base girdles 3. *Atractantha cardinalis*
 - 2b. Florets 11-17(-19) mm long, the apex of the lemma and keels of the palea acuminate-attenuate to pungent or acute, not awnlike and straight.
 - 4a. Inflorescences loosely to densely fascicled, the rachises sympodially inserted, with 5-25(-40) pseudospikelets; foliage leaves with sheaths pubescent and not maculate, the blades (0.4-)0.7-1.1 cm wide, linear-lanceolate, symmetrical at the base; lemmas with midnerve not raised and evident abaxially 4. *Atractantha falcata*
 - 4b. Inflorescences densely capitate, the rachises distichously inserted, with 50-250 pseudospikelets; foliage leaves with sheaths glabrous and maculate, the blades (2-)3-5 cm wide, lanceolate, asymmetrical at the base; lemmas with midnerve raised and evident abaxially 5. *Atractantha radiata*

1. ***Atractantha amazonica*** Judziewicz & L. G. Clark, *Novon* 1: 76-87. 1991. TYPE: Brazil. Amazonas: Rio Marié ca. 40 km above confluence with Rio Negro, right bank beyond rapids and cachoeira, clumps at edge of river in igapó forest [ca. 0°35'S, 66°40'W], ca. 100 m, 10 Sep. 1979 (fl), K. Kubitzki, C. E. Calderón & H.-H. Poppendieck 79-222 (holotype, INPA; isotypes, B, CANB, COL, CTES, F, G, INPA, ISC, K, LE, MO, NY, P, PE, PRE, SI, SP, TULV, US—2 sheets, USCH, W, WIS). Figure 1.

Densely caespitose woody bamboo, the clumps up to 1 m diam., with up to 20 culms per clump; rhizomes not seen, presumably sympodial. Culms erect at first, later scandent and pendent, climbing

in vegetation to at least 6 m; internodes hollow with a small lumen, cylindrical, glabrous, smooth to siliceous, 4-8 mm diam., straight and rather rigid; nodal line slightly annular, corky, dark; bud positioned about 2-4 mm above the nodal line. Bud at midculm node initially producing 3 subequal, widely spreading branches, these soon rebranching so that the upper portions of the culm appear to have 20-40 branches at each node. Culm leaves papery, stramineous, glabrous, deciduous, appressed to the culm; sheaths 7-9 cm long, 2 cm wide (spread width), rounded on the back, confluent with the base of the much smaller blade; inner ligule 0.2-0.3 mm long, very oblique, rimlike, glabrous; oral setae and outer ligule absent; blades 3-5 cm long, 1.4-1.6 cm wide, triangular, acute, erect, persistent. Foliage leaves in complements of

5–9; sheaths glabrous and rounded on the back below, prominently keeled at the summit, ciliate on the margins; inner ligule ca. 0.5 mm long, membranous, brown; outer ligule rimlike, inconspicuous; oral setae 3–6 mm long, numerous, delicate, golden-brown; pseudopetioles 1.5–3 mm long, glabrous, brownish, slightly winged, sometimes deflexed; blades 10–17 cm long, 1–1.4 cm wide, linear-lanceolate, acute to obtuse above the pseudopetiole, acuminate at the apex, glabrous, the upper surface slightly scaberulous near the base, the lower surface slightly whitened, the midnerve evident only in the lower $\frac{1}{3}$ of the blade, the margins scabrous. Inflorescences abundantly produced on peduncles 5–13 cm long, each consisting of 1(–2) spicate racemes terminal to leafy branches; individual racemes 7–15 cm long, alternately bearing 8–13 loosely overlapping, short-pedicelled spikelets, often twisted so that the spikelets appear to be secund; rachis glabrous, shiny; pedicels 0.5–1 mm long, indurate, stout, shiny. Spikelets 20–28 mm long, linear-lanceolate, coriaceous, nearly glabrous, loosely appressed to or slightly divergent from the rachis, 1- or rarely 2-flowered, the lower floret functional, if present the upper floret a tiny, long-pedicelled rudiment; glumes subequal, persistent, membranous, keeled above the middle, one or both short-awned, separated by a distinct internode ca. 1 mm long; lower glume 6–9 mm long (including awn), triangular-elliptical, rounded on the back, 5-nerved, the prominent, raised midnerve prolonged into an awn 1.5–3.5 mm long; upper glume 8–10 mm long, lanceolate-ovate, 7-nerved, the apex mucronate or prolonged into an awn up to 3 mm long; rachilla internodes separating the upper glume from the lower floret 2–3.5 mm long, persistent, slightly obtuse at the apex. Functional floret bisexual, 18–23 mm long, 1.2–2 mm wide, slenderly lanceolate, slightly falcate, indurate, brownish, deciduous; lemma smooth, shiny, and obscurely nerved below, 7–11-nerved above with minutely ciliate margins, the base with a squat, peglike callus ca. 0.3 mm long, the apex pungent or the midnerve abruptly prolonged into an awn up to 3 mm long; palea slightly shorter to as long as the lemma, enclosed within it or prominently protruding, linear, 4-nerved, 2-keeled, the keels ciliate; rachilla internode (if present) slender, filiform, prolonged beyond the lower floret by 10–20 mm, tipped by a rudimentary spikelet up to 1.5 mm long. Lodicles not apparent. Androecium with stamens 3; anthers 4–10 mm long. Gynoecium with ovary 1.5–2 mm long, stipitate, glabrous; style 1; stigmas 2. Fruit not seen.

Distribution. Endemic to affluents of the Río Negro in southwestern Amazonas, Venezuela, and northwestern Amazonas, Brazil (Fig. 9).

Habitat. Occurring at elevations from 80 to 100 m in wet, lowland, seasonally flooded forests (vegetation type known as “igapó” in Brazil).

Additional specimens examined. VENEZUELA. AMAZONAS: Dept. Río Negro, middle part of Río Baria, margin of flooded forest around small *laja*, ca. 1°05'N, 66°25'W, 80 m, 29 June 1984 (fl), *Davidse & Miller 26846* (MO, US, VEN). BRAZIL. AMAZONAS: Rio Marié, 30–40 km above confluence with Río Negro, near Macobeta village, climbing bamboo in forest on high river banks, in sandy soil [ca. 0°35'S, 66°40'W], ca. 100 m, 9 Sep. 1979, *Kubitzki et al. 79-209* (B, INPA, ISC, K, LE, MO, NY, P, SI, SP, TULV, US, USCH).

The generic placement of this species is only tentative; see comments in the introduction.

2. *Atractantha aureolanata* Judziewicz, sp. nov. TYPE. Brazil. Bahia: Munic. Belmonte, 31 km SW of Belmonte, 84 km E of Itapebí, low forest on white sand above creek, 30 m, 11 Apr. 1976 (fl), *T. R. Soderstrom, G. F. Russell & J. Hage 2148* (holotype, CEPEC; isotypes, B, C, CANB, COL, F, G, ISC, K, LE, MO, NY, P, PE, PRE, SGO, SI, SP, US—4 sheets, W, WIS). Figures 2A–E, 3A–G, 5, 12.

Bambusa lignosa. Culmi graciles, scandentes, viminei, usque ad 20 m longi, 5–20 mm diametro. Vaginae culmorum 6–25 × 1.5–4.5 cm, a cingulo incrassato aureo-fimbriato affixa; setis oralibus prominentis; laminae culmorum 3–12 × 0.4–1.2 cm, attenuatae. Ramificatio intravaginalis. Laminae foliorum (6–)9–17(–23) × 1–2(–2.8) cm. Inflorescentiae ad apices ramulorum foliosurum vel aphyllorum omnium ordinum iterauctantes, diffusae, ex pluribus pseudospiculis constantes; rachidibus omnium ramificationum et bracteatis et prophyllatis, omnis rachidis segmento terminali pro pedicello flosculi consistenti. Flosculi 27–36 × 1.7–2.3 mm, decidui, indurati, lanceolati, attenuati, glabri. Paleae apice bifurcatae, dorso sulco angustissimo instructae. Lodicae 3, 3.5–5 mm longae, lanceolatae, acuminatae. Stamina 3, antherae 10–13 mm longae, lineares. Stylus 1, stigmata 2. Caryopsis non vidi.

Delicate, vining woody bamboo forming loose to dense clumps, erect at the base, then scandent, turning upwards and climbing into trees up to 20 m, abundantly rebranching, finally pendent in curtains. Culms 5–20 mm diam., slender, flexible, solid or often with a ring of 7–20 tiny air canals subjacent to the epidermis, circular to slightly elliptical in cross section; internodes dark green to blackish or occasionally violet, either glabrous, puberulent, or uncommonly densely pubescent, smooth to si-

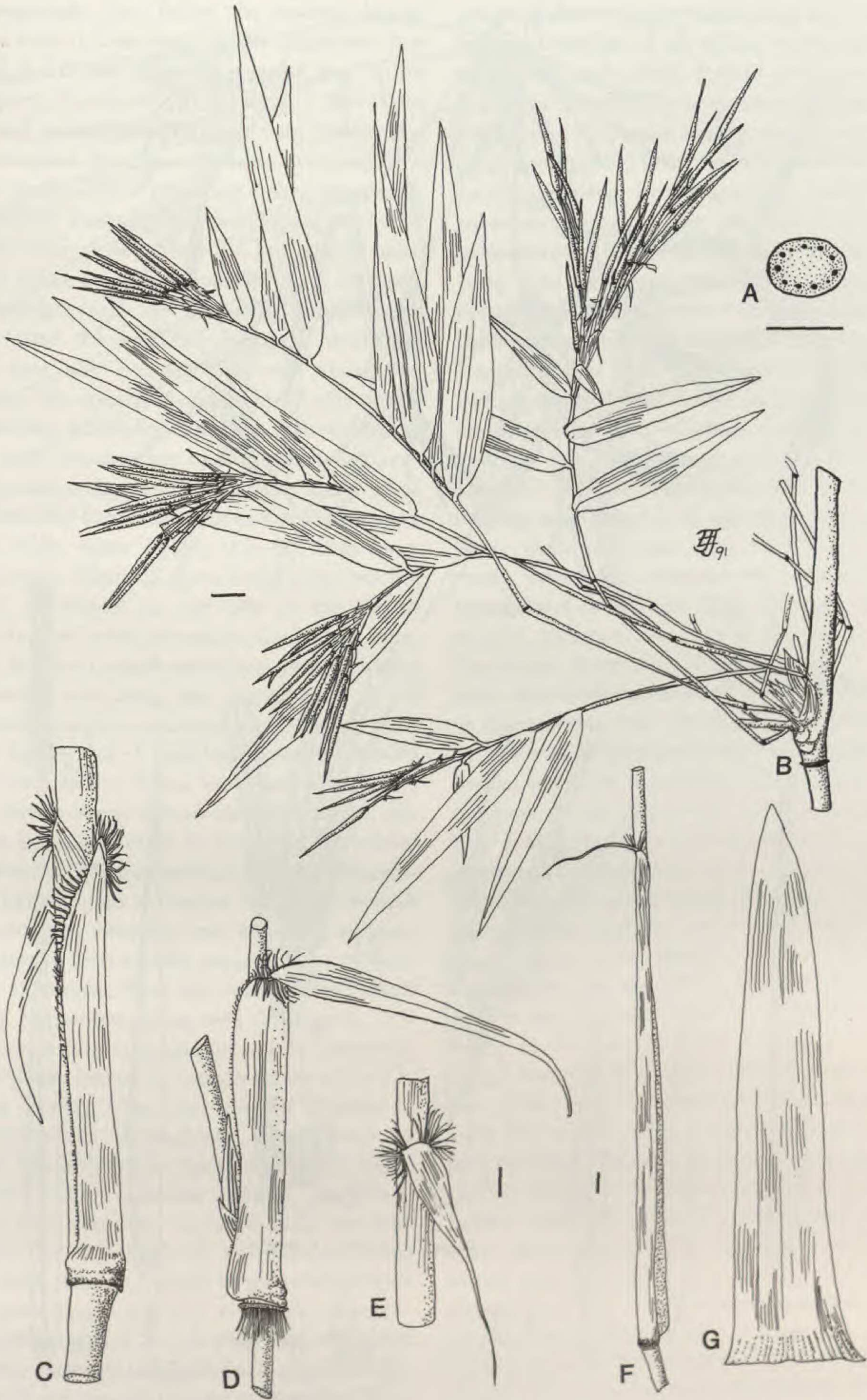


FIGURE 2. A-E. *Atractantha aureolanata*.—A. Cross section of culm showing peripheral air canals.—B. Fertile foliage leaf complement.—C-E. Culm leaves. F. *Atractantha falcata*.—F. Culm leaf in situ. G. *Atractantha radiata*.—G. Culm leaf, spread. (All scale bars = 1 cm; A, B based on Calderón & Pinheiro 2233; C, E based on Calderón et al. 2377; D based on Calderón & Pinheiro 2256; F based on Calderón et al. 2408; G based on Calderón et al. 2442.)

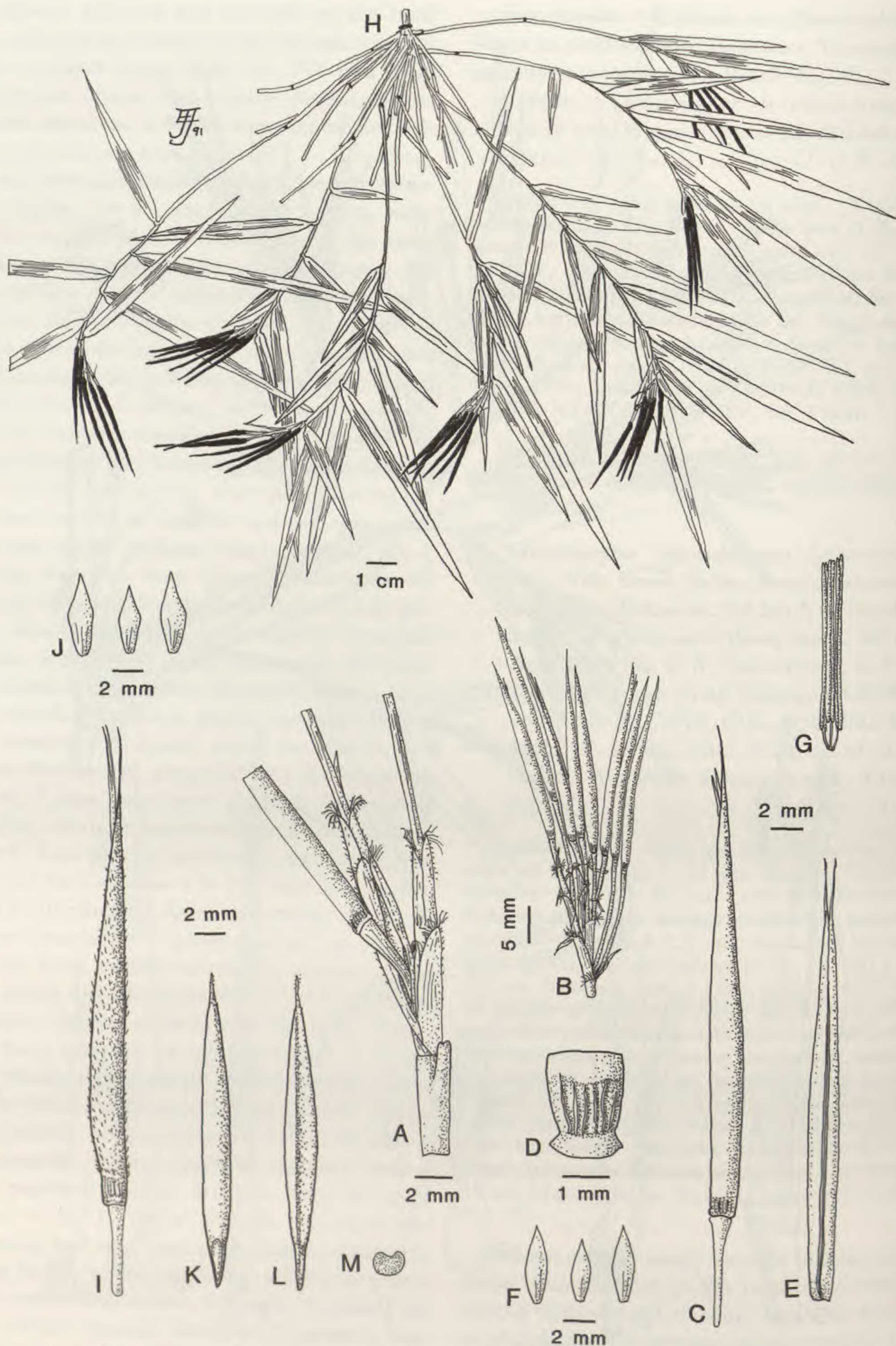


FIGURE 3. A-G. *Atractantha aureolanata*. —A. Bases of three pseudospikelets. —B. Cluster of pseudospikelets. —C. Floret. —D. Base of lemma, dorsal view. —E. Palea, dorsal view. —F. Lodicule complement. —G. Androecium. H-M. *Atractantha cardinalis*. —H. Fertile foliage leaf complement. —I. Floret. —J. Lodicule complement. —K-M. Caryopsis, dorsal, ventral, and cross-sectional views. (A-G based on *Calderón & Pinheiro 2233*; H-M based on *Calderón et al. 2402*.)

liceous (especially just below the nodes); lowest internodes 0.4–0.7 m long; nodes glabrous; bud positioned 4–10 mm above the nodal line. Culm leaves papery; sheaths 6–25 cm long, 1.5–4.5 cm wide (spread width), persistent or very tardily deciduous, clasping the culm, strongly attached by a flangelike girdle 1–2.5 mm long below the promontory, pushed away by the developing branches above, the base rarely glabrous but much more commonly with a dense band of stiff, silky, retrorse, golden, fimbriate hairs 2–7 mm long remaining on the culm after the leaf has fallen, a thickened calluslike scar also present 2–4 mm above the sheath base, the sheath margins finely ciliate, the back glabrous, adaxially shiny and stramineous, abaxially dull, stramineous to less commonly reddish and occasionally pruinose, widest about $\frac{2}{3}$ of the way from the base, tapering to a truncate apex ca. 1 cm wide; outer ligules 0.1–0.2 mm long; auricles present, elliptical, up to 3 mm long, bearing oral setae, developed on one side of the sheath summit only; oral setae abundant, 5–15 mm long, yellowish, flattened, confluent below, present at the sheath summit and along the uppermost 1–2 cm of the sheath margins, antrorsely pubescent, curling; inner ligules 0.5–1 mm long, ciliolate; blades 3–12 cm long, 0.4–1.2 cm wide, much narrower than the sheath summit, narrowly lanceolate, obtuse at the base, attenuate at the apex, horizontal and concave becoming reflexed, caducous. Branching intravaginal, with a central dominant branch many meters long reaching into trees for support, with a cluster of 1–6 smaller secondary or tertiary branchlets at its base, these also rebranching; bracts subtending branchlets often well developed, 1–3 cm long, greenish or stramineous to less commonly reddish. Foliage leaves in complements of 5–13, not wilting quickly when cut; sheaths sparsely to densely pubescent throughout, stramineous or sometimes minutely green spotted, slightly auriculate or not at the truncate summit, auricles if present up to 2 mm long, found on only one side; outer ligules 0.2–0.4 mm long, glabrous; oral setae 2–12 mm long, delicate, whitish to yellowish, crisped apically; inner ligules 0.2–0.5 mm long, membranous; pseudopetioles 1.5–3.5 mm long, adaxially stramineous, glabrous to hispidulous, abaxially glabrous or with one margin hirsute with golden hairs; blades (6–)9–17(–23) cm long, 1–2(–2.8) cm wide, linear-lanceolate to lanceolate, obtuse to less commonly asymmetrically cuneate at the base, acute at the apex, sparingly pubescent on both surfaces near base, elsewhere hispidulous becoming glabrous, adaxially bright green and rarely with scattered pilose hairs 1–1.5 mm long, abaxially bluish

green. Inflorescences terminating leafy and nearly leafless branches of all orders, itercaucant, diffuse, congested and often falcate and pendent, the branches sympodially or distichously inserted, consisting of 1–3 partial inflorescences each 3–5 cm long, each partial inflorescence consisting of 7–20 pseudospikelets. Pseudospikelets comprising one subtending bract, a tiny prophyll if present, 1–3 gemmiparous bracts (which may or may not develop into additional pseudospikelets), one functional floret, and (rarely) a setose prolongation of the rachilla internode bearing a tiny rudimentary sterile spikelet at its apex; subtending bract and gemmiparous bracts similar in morphology, 8–17 mm long, lanceolate-elliptical, clasping the rachilla, strongly 7–13-nerved, somewhat inflated, membranous, pubescent, laminiferous, at the summit bearing oral setae 1–4 mm long and a reflexed linear blade 4–8 mm long; rachilla segment between uppermost gemmiparous bract and functional floret 4–12 mm long, 0.5–1.2 mm diam., smooth, glabrous, clavate and cupulate at the apex. Functional floret 27–36 mm long, 1.7–2.3 mm wide, disarticulating from the summit of the rachilla or fragmenting near the base and leaving behind ca. 0.5 mm of the base of the floret on the rachilla; lemma narrowly lanceolate, slightly falcate, near the base on the dorsal side with a squarish patch 0.7–1 mm long with 5–9 strong nerves evidently separated by depressed areas, curving attenuate-aristate at the apex, indurate, shiny, glabrous or sparsely and minutely scabrous-hispidulous, green when young becoming olivaceous or nearly black at maturity, the nerves not evident abaxially (except in the aforementioned basal patch), adaxially finely 11–15-nerved; palea as long as or slightly longer than the lemma, the dorsal sulcus very narrow, glabrous or the keels antrorsely ciliolate, the keels bifurcate at the apex and prolonged 2–4 mm past the sinus. Rachilla internode rarely prolonged ca. 30 mm past the functional floret as a setose bristle. Lodicules lanceolate, acuminate, membranous, finely 2–4-nerved, the apical margins glabrous; anterior pair 4–5 mm long, the posterior one 3.5–4.5 mm long. Androecium with stamens pendent; anthers 10–13 mm long, linear, purplish. Gynoecium with ovary glabrous below, pubescent toward the apex; stigmas hispidulous. Fruit not seen.

Distribution. Endemic to coastal Bahia, Brazil (Fig. 10); the most widespread Bahian species of *Atractantha*, in terms of both geography and ecological amplitude.

Habitat. Occurring at elevations from 30 to

650 m, in low to tall forests or forest edges on loam or white sand ("mata littorânea"), on flat to steep slopes. The plants are sometimes dominant, forming thick masses as they climb over trees (Fig. 12).

Phenology. Apparently, entire populations flower and then die.

Additional specimens examined. BRAZIL. BAHIA: Munic. Itacaré, 10 km SW of Itacaré City, ca. 14°18'S, 39°05'W, 100 m, 19 Mar. 1972, *Calderón & Pinheiro 2180* (CEPEC, US); Munic. Wenceslau Guimarães ex Nilo Peçanha, km 104, rodovia BA-2, 14 km N of Gandú, ca. 13°40'S, 39°27'W, 200 m, 21 Apr. 1972 (fl), *Calderón & Pinheiro 2233* (CEPEC, US); Munic. Jaguaquara, Riacho de Ouro, 22 km SE of Jaguaquara city, ca. 13°38'S, 39°52'W, 625–650 m, 8 May 1972, *Calderón & Pinheiro 2256* (US); 12 Apr. 1976, *Calderón et al. 2377* (CEPEC, US); Munic. Ibirataia, 12 km NW of Ibirataia on connecting road with BR-101, 350–400 m, 3 Apr. 1976, *Calderón et al. 2357* (B, CEPEC, F, G, K, LE, MO, NY, P, SI, SP, TULV, US, USCH); Munic. Jequié, 25 km N of road Ipiaú-Jequié, on road to Apuarema-Jaguaquara, 600–650 m, 8 Apr. 1976, *Calderón et al. 2370* (CEPEC, ISC, SI, SP, TULV, US); Munic. Una, road Una-Olivença, 19 km N of Una, 50 m, 27 Apr. 1976, *Calderón et al. 2399* (B, CEPEC, ISC, K, LE, MO, NY, P, SI, SP, TULV, US, USCH); Munic. Ilhéus, road Olivença-Vila Brasil, 17.3 km SW of Olivença, then 31.2 km to right on side road Sapucaieira-Cururupe, 24 Feb. 1979, *Calderón & dos Santos 2484* (B, CEPEC, F, G, ISC, K, LE, MO, NY, P, PRE, SI, SP, TULV, US, USCH, W, WIS); Munic. Itacaré, rodovia BA-654, 6 km W of Itacaré, ca. 14°18'S, 39°02'W, ca. 60 m, 12 Apr. 1980 (fl), *Plowman et al. 10088* (CEPEC, F, US), *dos Santos et al. 3559* (CEPEC, US); Munic. Pôrto Seguro, Fazenda Carvalho, ca. 26 km W of town of Monte Pascoal, 380–460 m, 15 May 1976 (fl), *Soderstrom et al. 2211* (B, CEPEC, F, G, ISC, K, LE, MO, NY, P, SI, SP, US); Munic. Itacaré, 5 km SW of Itacaré and 25 km E of Taboquinhas, 100 m, 20 May 1976, *Soderstrom et al. 2214* (B, C, CANB, CEPEC, CHR, COL, CTES, DD, F, G, ISC, K, LE, MO, NY, P, PE, PRE, SGO, SI, SP, TULV, US, USCH, W, WIS); Munic. Una, 7 km E of São José do Macuco on road to Una, 140 m, 24 May 1976 (fl), *Soderstrom et al. 2221* (CEPEC, ISC, SI, SP, TULV, US, USCH); Munic. Ilhéus, camino de Olivença a Una, ramal para Vila Brasil, 60 m, 19 May 1985, *Zuloaga et al. 2481* (SI, US); Munic. Una, camino de Olivença a Una, km 35, 50 m, 19 May 1985, *Zuloaga et al. 2484* (SI, US).

The specific epithet, suggested by Soderstrom, refers to the golden, woolly-appearing "skirt" of retrorse cilia that develops on the culm leaf sheath base girdle and remains attached to the culm after the leaf has fallen (Figs. 2D, 5). The skirt is best developed in young shoots, and poorly developed or absent on smaller branches. A similar-appearing feature is the ring of cilia present on the culm nodes of *Arthrostylidium fimbriodum* Judziewicz & L. G. Clark (Judziewicz & Clark, in press).

Atractantha aureolanata is most closely related

to *A. cardinalis*. Besides having the largest florets of any species in the genus, both taxa also have in common culms with tiny, peripheral air canals (Fig. 2A; common in *A. aureolanata*, uncommon in *A. cardinalis*), scorpioid inflorescences, and florets with attenuate lemma apices and attenuate, bifurcate palea keels (Fig. 3C, E, I).

Included in *A. aureolanata* are three unpublished herbarium names used by Soderstrom for US material. "Longispiculata" (*Calderón & Pinheiro 2256*) differs in no discernable way from typical *A. aureolanata*, while "unaensis" (*Calderón et al. 2399*) is a sterile collection with atypically large foliage leaf blades up to 23 cm long and 2.8 cm wide and asperous culms. More problematical is "robusta," collected four times along the Itacaré to Ubaitaba road about 5–10 km SW of Itacaré: these collections are atypical in the usual absence of leaf sheath base skirts (in *Calderón & Pinheiro 2180*, *Plowman et al. 10088*, and *dos Santos et al. 3559*; but skirts present in *Soderstrom et al. 2148*, an ample collection), pubescent branchlet bracts, large florets 32–36 mm long, and smaller foliage leaf blades only 8–14 cm long and 1–1.6 cm wide. This series of populations tends toward *A. cardinalis* but, based on their glabrous florets, merely siliceous culm internodes, and greenish to stramineous branchlet bracts and culm leaves (reddish in *Soderstrom et al. 2148*, which does have skirts), they appear to be closer to and not well segregated from *A. aureolanata*.

3. *Atractantha cardinalis* Judziewicz, sp. nov.

TYPE: Brazil. Bahia: Munic. Una, road Una-São José, 34 km NW of Una, remains of humid forest partially cut down, with mixed, rich soil, 175 m, 22 Apr. 1976 (fl), *C. E. Calderón, T. S. dos Santos & L. B. de Oliveira 2385* (holotype, CEPEC; isotypes, ISC, K, MO, NY, P, SI, SP, TULV, US—8 sheets, USCH). Figures 3H–M, 4, 6, 7.

Bambusa lignosa. Culmi graciles, scandentes, usque ad 15 m longi, 5–13 mm diametro. Vaginae culmi 13–25 × 1.5–3.5(–4.5) cm, a cingulo incrassato glabro affixa; setis oralibus prominentis; laminae culmi 3–13 × 0.1–0.3 cm, lineares. Ramificatio intravaginalis. Laminae foliorum 6–11 × 0.4–0.8 cm. Inflorescentiae ad apices ramulorum foliosorum vel aphyllorum omnium ordinum iterantantes, diffusae, ex pluribus pseudospiculis constantes; rachidibus omnium ramificationum et bracteatis et prophyllatis, omnis rachidis segmento terminali pro pedicello flosculi consistenti. Flosculi 29–35 × 1.8–2.3 mm, decidui, indurati, lanceolati, attenuati, pubescentes. Paleae apice bifurcatae, dorso sulco angustissimo instructae. Lodiculae 3, 4.5–5 mm longae, lanceolatae, acuminatae. Stamina non vidi. Stylus 1, stigmata 2. Caryopsis 20 × 1.8 mm, fusiforma sulcataque.

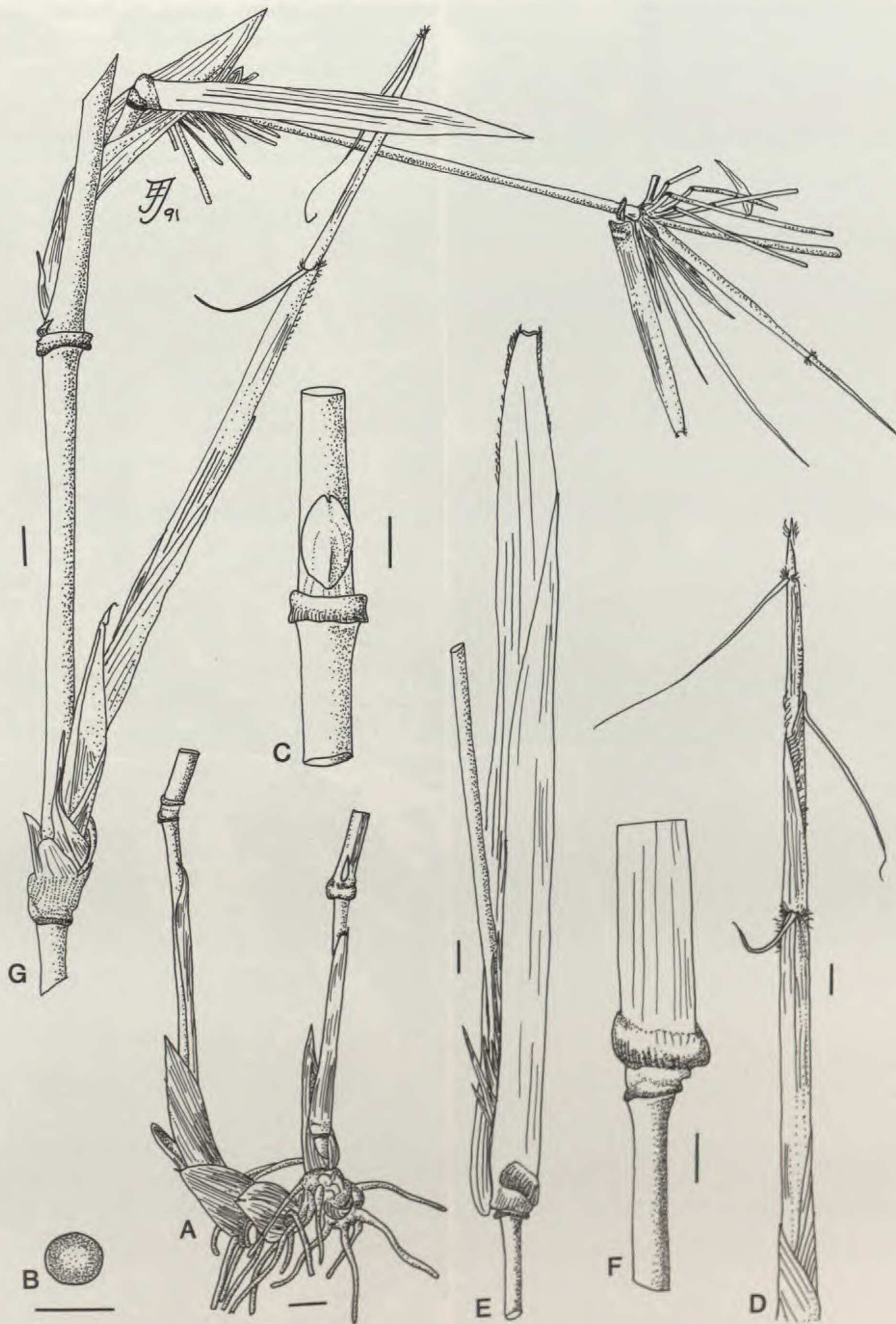


FIGURE 4. *Atractantha cardinalis*.—A. Base of plant.—B. Cross section of culm.—C. Culm node with bud.—D. Shoot with culm leaves.—E. Culm leaf in situ, the blade having fallen; note the auricled sheath base (left).—F. Base of culm leaf sheath.—G. Branching at midculm nodes. (All scale bars = 1 cm; A, B based on *Soderstrom et al.* 2159; C based on *Zuloaga et al.* 2486; D based on *Calderón et al.* 2372; E, F based on *Calderón et al.* 2402; G based on *Calderón et al.* 2385.)

Delicate, scandent woody bamboo forming loose clumps, climbing into trees up to 15 m, profusely rebranching, finally pendent. Culms 5–13 mm diam., slender, solid or occasionally with up to 10

tiny peripheral air canals, terete; internodes dark green to blackish, glabrous to puberulent (especially in upper branches), harshly retrorsely asperous or less commonly siliceous; lowest internodes 0.2–



FIGURES 5-8. Bahian species of *Atractantha*, photographed and collected by C. E. Calderón.—5. *A. aureolanata*, culm leaf in situ. (Based on 2256.)—6. *A. cardinalis*, habit. (Based on 2401.)—7. *A. cardinalis*, culm leaf in situ. (Based on 2372.)—8. *A. radiata*, plant in full flower. (Based on 2397.)

0.5 m long, clothed in bright reddish, bladeless sheaths; nodes glabrous; bud positioned 5–10 mm above the nodal line. Culm leaves papery; sheaths 13–33 cm long, 1.5–3.5(–4.5) cm wide (spread width), persistent or very tardily deciduous, clasping the culm, strongly attached by a prominent, glabrous, flangelike girdle 1–2 mm long below the promontory, pushed away by the developing branches above, the base glabrous, one margin projecting slightly downwards by up to 1 cm as an auriculate extension, a prominent, knobby, thickened, calluslike scar present 3–8 mm above the sheath base, the sheath margins glabrous, adaxially smooth, shiny, stramineous, and glabrous, abaxially asperous, dull, reddish, and glabrous or sparsely pubescent near the margins, tapering evenly to the minutely truncate apex ca. 0.5 cm wide; outer ligules 0.1–0.2 mm long; auricles not noted; oral setae 5–10 mm long, those at the sheath summit orangish yellowish, terete, separate, those along the uppermost 3–10 cm of the sheath margins confluent basally, flattened, yellowish, curling; inner ligules ca. 1 mm long, ciliolate; blades 3–13 cm long, 0.1–1.3 cm wide, linear, attenuate, erect or horizontal and concave becoming reflexed, deciduous. Branching intravaginal, with a central dominant primary branch and a cluster of 1–5 smaller secondary or tertiary branchlets at its base, these also rebranching; bracts subtending branchlets often well developed, 1–4 cm long, strongly tinged with red or orange-yellow. Foliage leaves in complements of 5–15, wilting quickly when cut; sheaths sparsely to densely pubescent throughout or only on margins, sometimes stramineous or minutely green spotted, not auriculate at the truncate summit; outer ligules 0.2–0.3 mm long, glabrous; oral setae 3–8 mm long, delicate, yellowish, crisped apically; inner ligules 0.2–0.4 mm long, membranous; pseudopetioles 1–2 mm long, glabrous to hispidulous on both surfaces, adaxially purplish; blades 6–11 cm long, 0.4–0.8 cm wide, linear to linear-lanceolate, obtuse to cuneate at the base, acute at the apex, glabrous, adaxially dark green, abaxially light bluish green. Inflorescences terminating leafy and nearly leafless branches of all orders, itercauctant, congested and often fascicled, often pendent, the branches sympodially or distichously inserted, consisting of 1–5 partial inflorescences each 3–6 cm long, each partial inflorescence consisting of 5–13 pseudospikelets. Pseudospikelets comprising one subtending bract, an inconspicuous prophyll, 1–3 gemmiparous bracts (which may develop into additional pseudospikelets), one functional floret, and (rarely) a setose

prolongation of the rachilla internode bearing a tiny rudimentary sterile spikelet at its apex; subtending bract and gemmiparous bracts similar in morphology, 7–20 mm long, lanceolate-elliptical, clasping the rachilla, strongly 7–11-nerved, somewhat inflated, membranous, pubescent, often laminiferous, bearing at the summit oral setae 1–3 mm long and a reflexed linear blade 3–6 mm long; rachilla segment between uppermost gemmiparous bract and functional floret 5–13 mm long, 0.6–1 mm diam., smooth, pubescent, slightly clavate and cupulate at the apex. Functional floret 29–35 mm long, 1.8–2.3 mm wide, densely pubescent, disarticulating from the summit of the rachilla or fragmenting near the base and leaving behind ca. 0.5 mm of the base of the floret on the rachilla; lemma narrowly lanceolate, slightly falcate, near the base on the dorsal side with a squarish patch 0.4–0.8 mm long (Fig. 10).

Habitat. Occurring at elevations from 0 to 320 m in tall forest on rich soil at inland sites, or in low coastal forests in mixed, sandy soil (“mata littorânea”).

Phenology. Colonies apparently die after massive flowering.

Additional specimens examined. BRAZIL. BAHIA: Munic. Una, road Una–Olivença 7 km N of Una, ca. 15°15'S, 39°06'W, 50 m, 12 May 1972, *Calderón & Pinheiro* 2264 (CEPEC, US); Munic. Jaguaquara, 16 km N of Apuarema on road Apuarema–Jaguaquara, 275 m, 10 Apr. 1976, *Calderón et al.* 2372 (CEPEC, ISC, MO, SI, SP, TULV, US, USCH); Munic. Una, road Una–Olivença, 3 km N of Una, 55 m, 28 Apr. 1976, *Calderón et al.* 2401 (CEPEC, ISC, MO, SI, SP, TULV, US, USCH); Munic. Una, road Una–Olivença, 5 km N of Una, 55 m, 28 Apr. 1976 (fl), *Calderón et al.* 2402 (CEPEC, US); without locality, 15 Mar. 1943, *Frões* 20060 (US) [mixed with *Merostachys* sp.]; estrada de Itabuna a Una, 24 Jan. 1980, *Heringer et al.* 3264 (IBGE, US); Munic. Ituberá, ca. 2 km from Ituberá on road to Gandú, Fazenda Inferno Verde, 320 m, 23 Apr. 1976, *Soderstrom et al.* 2159 (B, CEPEC, F, G, ISC, K, LE, MO, NY, P, SI, SP, US); Munic. Una, 7 km E of São José do Macuco on road to Una, 140 m, 24 May 1976, *Soderstrom et al.* 2222 (CEPEC, ISC, K, MO, NY, P, SI, SP, TULV, US, USCH); Munic. Canavieiras, camino de Canavieiras a Camacã, km 15, 20 m, 20 May 1985, *Zuloaga et al.* 2486 (SI, US); Munic. Maraú, camino de Maraú a Ubaitaba, 15 km de Maraú, near sea level, 18 May 1985, *Zuloaga et al.* 2470 (SI, US).

The bright reddish bladeless bracts that subtend the secondary branchlets and the often reddish culm leaf sheaths prompted Soderstrom to suggest the specific epithet. In contrast to its close relative *A. aureolanata*, the blades of *A. cardinalis* reportedly curl up quickly upon being cut; see further comments under the former species.

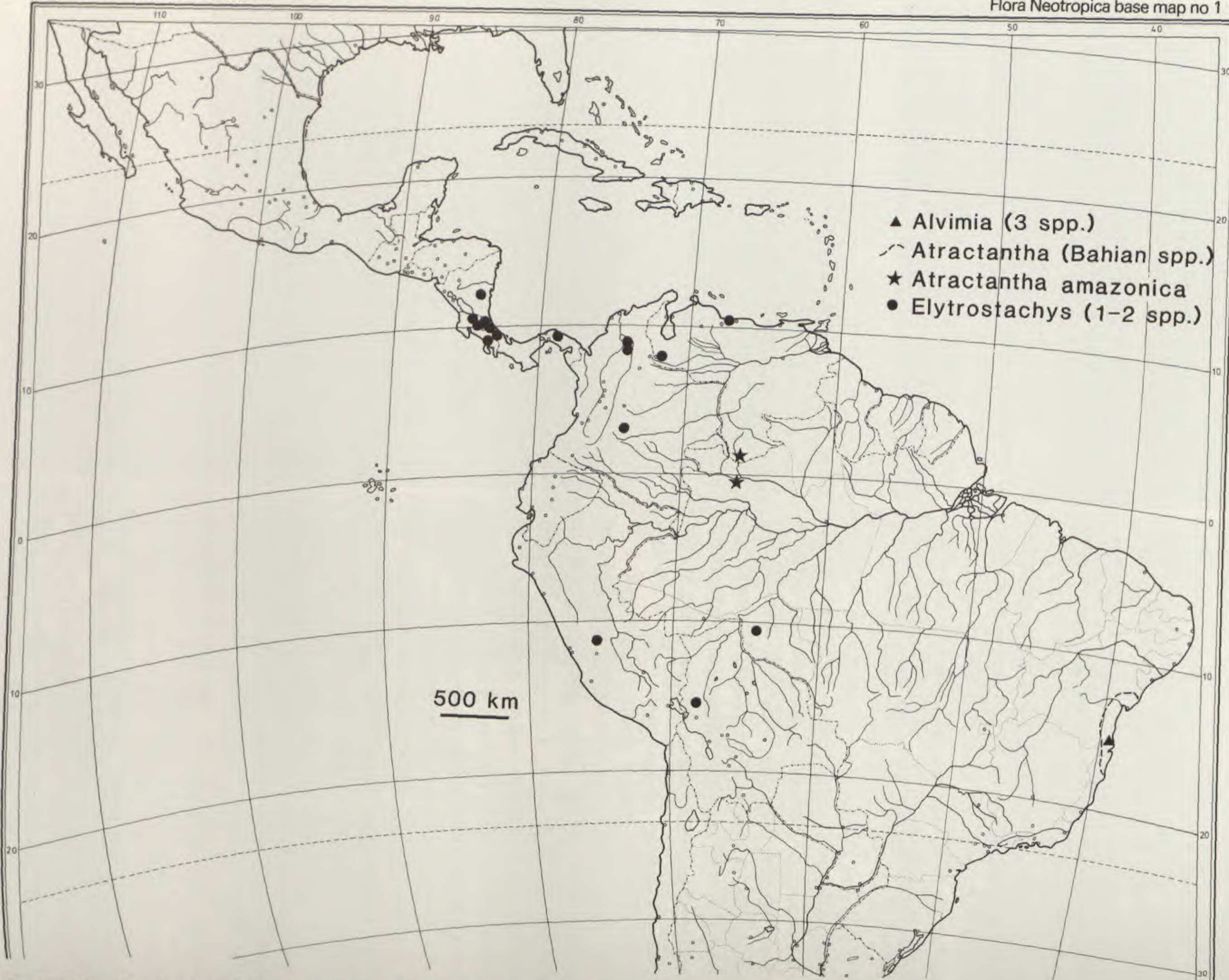


FIGURE 9. Distribution of the genera of Arthrostylidiinae that have members with pseudospikelets.

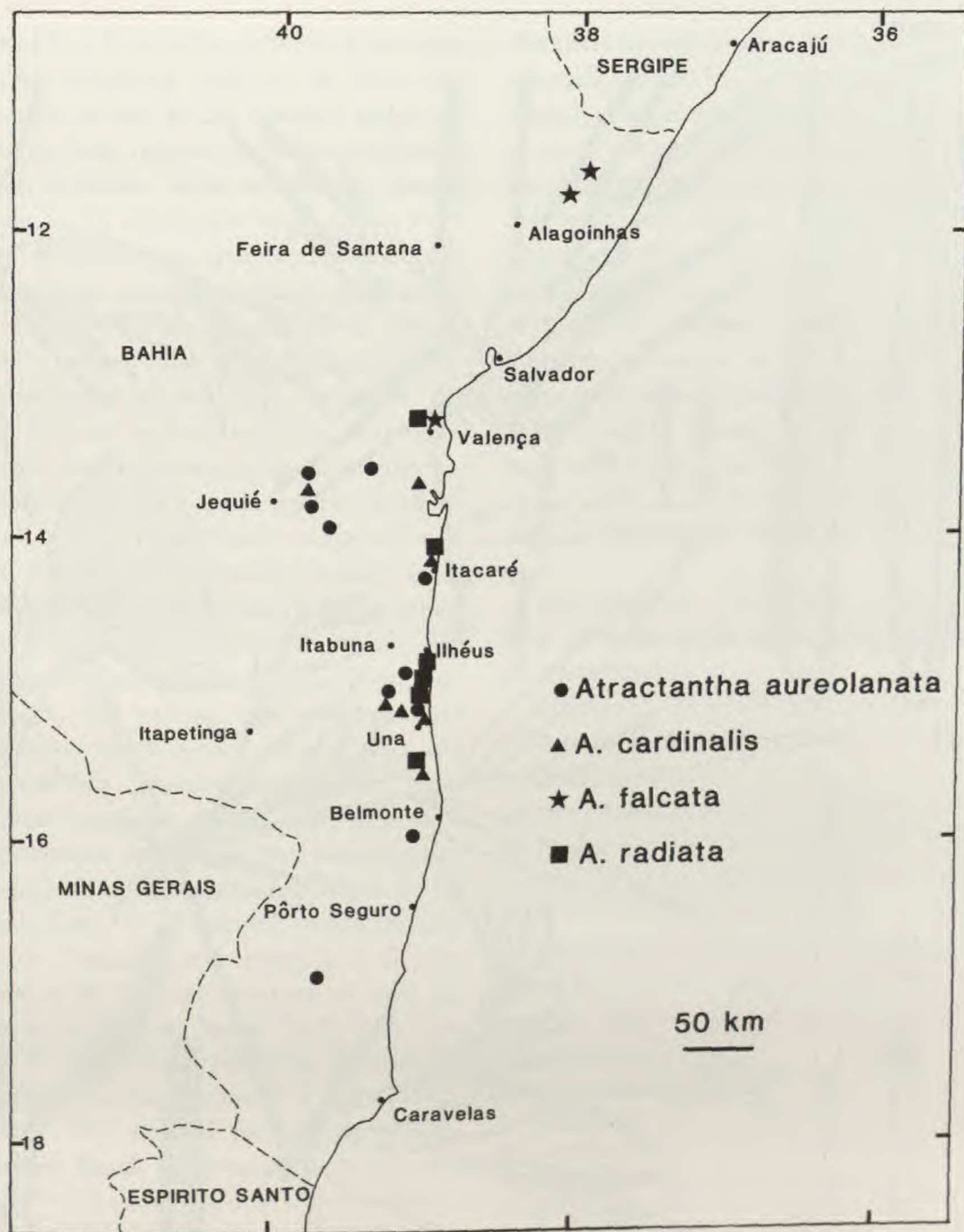
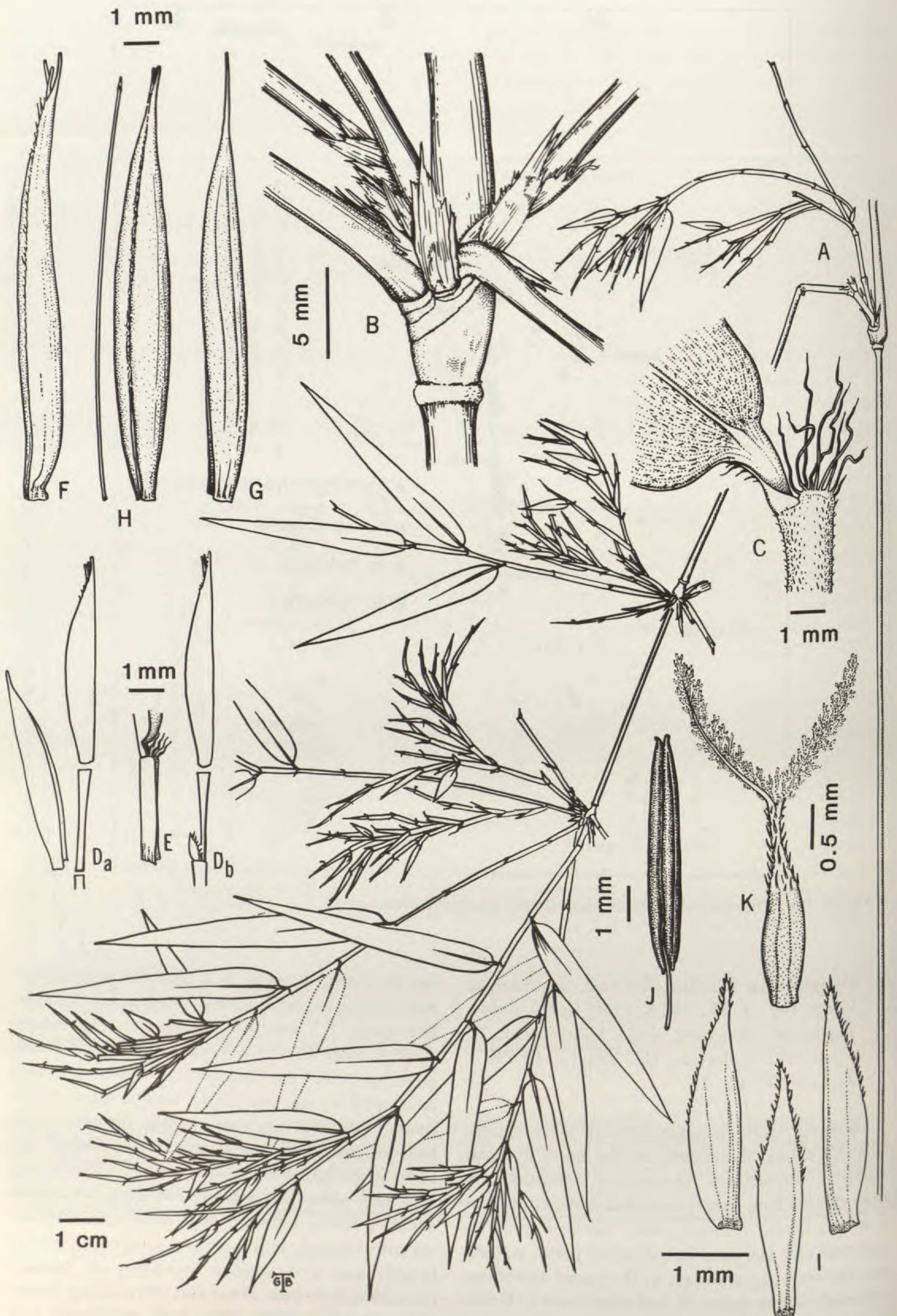


FIGURE 10. Distribution of the Bahian (Brazil) species of *Atractantha*.

4. *Atractantha falcata* McClure, Smithsonian Contr. Bot. 9: 48. 1973. TYPE. Brazil. Bahia: Esplanada, carrascal, anno 1950–1951, G. Pinto 681 (holotype, US; isotype, CEPEC). Figures 2F, 11, 13.

Climbing woody bamboo forming loose clumps of 3–10 culms, decumbent at the base, arching, scandent, abundantly rebranching, climbing into trees up to 12 m, then pendent in festoons. Culms 5–8 mm diam., slender, solid, terete; internodes asperous and glabrous in the lower parts, smooth and glabrous to pubescent in the upper branches, yellowish; nodes glabrous; bud positioned 5–8 mm above the nodal line. Culm leaves papery; sheaths 20–35 cm long, 2–3 cm wide (spread width), clasp-

ing the culm, tapering to a truncate apex, persistent, rotting in place, strongly attached by a flange-like girdle 1.5 mm long below the promontory, pushed away by the developing branches above; outer ligules 0.1 mm long; auricles absent or weakly developed on one side of the sheath summit; oral setae 5–10(–15) mm long, straight, golden-orange, lustrous, antrorsely pubescent below, crisped apically; inner ligules not noted; blades 7–15 cm long, 2–3 mm wide, much narrower than the sheath summit, linear, reflexed, soon deciduous. Branching intravaginal, with a central dominant primary branch and 1–4 smaller secondary or tertiary branchlets at its base, these also rebranching; bracts subtending branchlets often well developed, 1–3 cm long, stramineous to reddish. Foliage leaves in



complements of 5–15; sheaths pubescent throughout, sometimes becoming glabrous at maturity, slightly auriculate or not at the summit; outer ligules 0.1–0.3 mm long, minutely ciliolate; oral setae 1–3 mm long, delicate, white to yellow, crisped apically, fragile, easily deciduous; inner ligules 0.2–0.4 mm long, membranous, truncate; pseudopetioles 1.7–3 mm long, adaxially golden, glabrous to hispidulous, abaxially hirsute; blades (4–)6–16 cm long, (0.4–)0.7–1.1 cm wide, linear-lanceolate, obtuse and symmetrical at the base, acute at the apex, sparsely hirsute on both surfaces near base, elsewhere hispidulous becoming glabrous. Inflorescences terminating leafy and nearly leafless branches of all orders, itercauctant, congested and often falcate, sometimes appearing loosely scorpioid, the branches sympodially inserted, consisting of 1–6 partial inflorescences with each 5–25(–40) pseudospikelets. Pseudospikelets comprising one subtending bract, the rachis, one prophyll, one basal gemmiparous bract (which may or may not develop into another pseudospikelet), one functional floret, and (rarely) a setose prolongation of the rachilla internode bearing a tiny rudimentary sterile spikelet at its apex; subtending bract 5–13 mm long, lanceolate, 7–13-nerved, membranous, pubescent, often laminiferous, bearing 1–3 mm long oral setae at its summit, bearing an awn up to 3 mm long or a reflexed linear blade 3–6 mm long; prophyll 3–5 mm long, elliptical, bicarinate, pubescent; basal gemmiparous bract 4–8 mm long, lanceolate, acute, 5–7-nerved, pubescent; rachilla segment between basal gemmiparous bract and functional floret 5–15 mm long, 0.3–0.8 mm diam., smooth, glabrous, shiny, clavate and cupulate at the apex. Functional floret 12–16 mm long, 1.5–2 mm wide, disarticulating from the summit of the rachilla or fragmenting near the base and leaving behind ca. 0.5 mm of the base of the floret on the rachilla; lemma narrowly lanceolate, slightly falcate, near the base on the dorsal side with a patch 0.5–0.9 mm long with 5–9 strong nerves evidently separated by depressed areas, at the apex acuminate-attenuate to pungent, indurate, shiny, glabrous or sparsely and minutely scabrous-hispidulous, green when young becoming olivaceous or nearly black at maturity, the nerves not evident

abaxially (except in the aforementioned basal patch), adaxially finely 9–13-nerved; palea as long as or slightly longer than the lemma, the sulcus very narrow, glabrous or the keels antrorsely ciliolate. Rachilla internode often prolonged 10–14 mm past the functional floret as a setose bristle. Lodicules lanceolate-elliptical, acuminate, membranous, diaphanous, weakly 1–2-nerved, the apical margins glabrous to ciliolate; anterior pair 2.7–3.5 mm long, the posterior one 2.5–3 mm long. Androecium with stamens pendent; anthers 5–6 mm long, linear, purple drying to dark brown. Gynoecium with ovary glabrous below, pubescent toward the apex; style exerted from below the stamens, the stigmas hispidulous. Fruit not seen.

Distribution. Endemic to coastal Bahia, Brazil (Fig. 10); this is the most northerly Bahian species of *Atractantha*.

Habitat. Occurring at elevations from 0 to 120 m in white sand “restinga,” a vegetation type with small trees and shrubs, an abundance of epiphytes, and a groundlayer dominated by terrestrial Bromeliaceae and Orchidaceae; also found in “carascal,” a dense, relatively dry, low forest on sandy soil.

Phenology. Populations flower massively, then die, with even the smallest shoots bearing inflorescences. The stamens and stigmas are produced simultaneously.

Additional specimens examined. BRAZIL. BAHIA: Munic. Esplanada, N of Esplanada, near BR-101, 120 m, 6 May 1976 (fl), Calderón et al. 2408 (CEPEC, US); Munic. Entre Rios, 14 km N of Entre Rios, on road intersecting BR-101 across from Fazenda Lagoa Preta, 7 May 1976 (fl), Calderón et al. 2413 (CEPEC, US); Munic. Valença, 8 km from Valença on road to Guaibim, 24 Apr. 1976 (fl), Soderstrom et al. 2161 (B, CANB, CEPEC, COL, F, G, K, LE, MO, NY, P, PRE, SI, SP, US, W, WIS).

5. *Atractantha radiata* McClure, Smithsonian Contr. Bot. 9: 50. 1973. TYPE. Brazil. Bahia: Estrada de Bom Gosto a Olivença, 15 Mar. 1943 (fl), R. de L. Fróes 19947 (holotype, US; isotypes, CEPEC, IAN, US). Figures 2G, 8, 14, 15.

FIGURE 11. *Atractantha falcata*. —A. Culm internode with fertile foliage leaf complement. —B. Branch complement. —C. Apex of foliage leaf sheath and base of blade. —Da, b. Variations in structures forming terminal portion of a twig, diagrammatic. —E. Laminiferous bract from base of branch of inflorescence. —F. Floret, lateral view. —G. Lemma, lateral view. —H. Rachilla internode (left) and palea (right). —I. Lodicule complement. —J. Stamen. —K. Gynoecium. (Illustration by Gesina B. Threlkeld, first published in McClure, Smithsonian Contr. Bot. 9: 51. 1973; all based on Pinto 681.)



FIGURES 12, 13. Bahian species of *Atractantha*, photographed and collected by C. E. Calderón.—12. *A. aureolanata*, habit. (Based on 2256.)—13. *A. falcata*, inflorescence. (Based on 2413.)

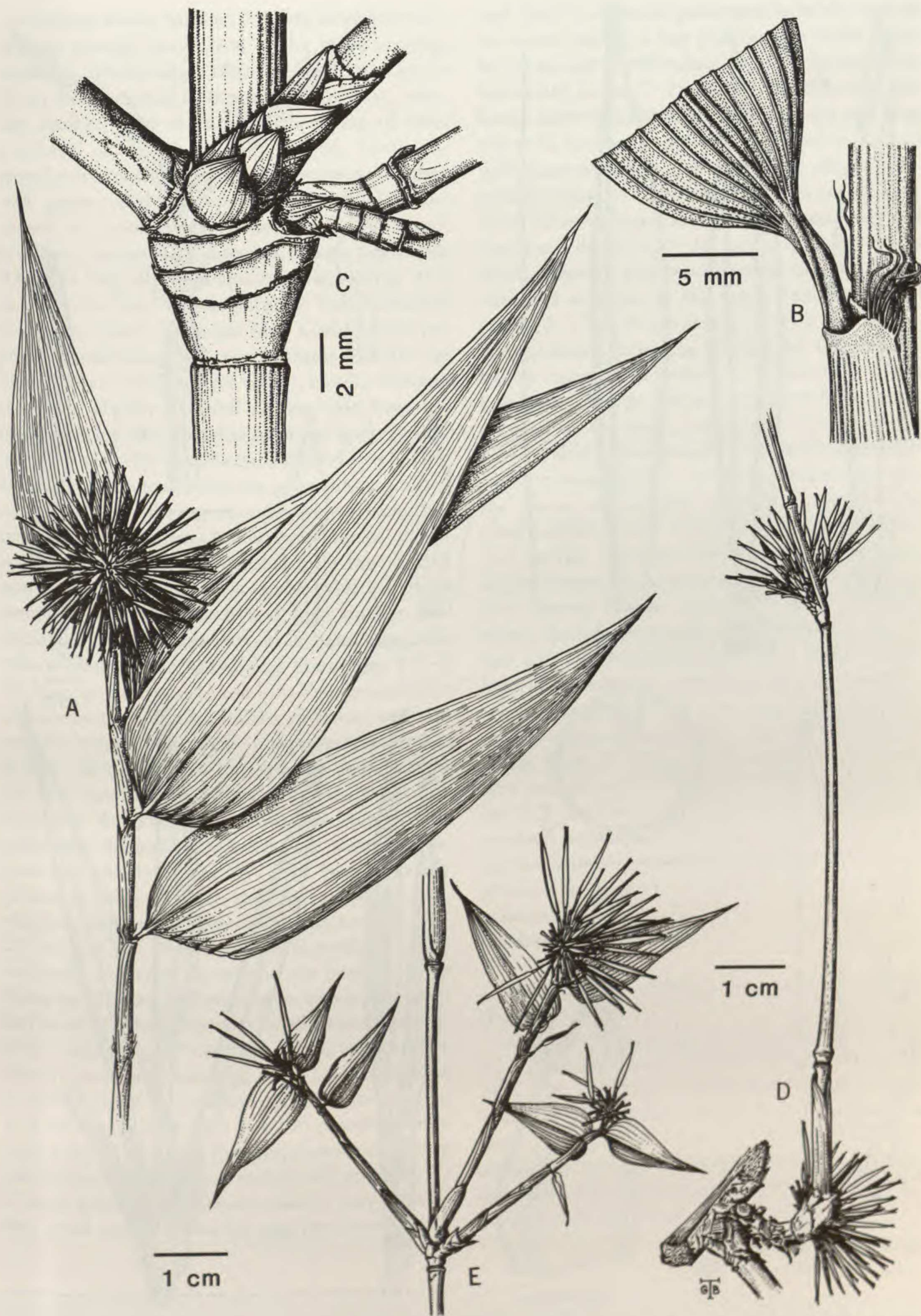


FIGURE 14. *Atractantha radiata*.—A. Fertile foliage leaf complement.—B. Foliage leaf, apex of sheath and base of blade.—C. Base of branch complement.—D, E. Variants of flowering axes. (Illustration by Gesina B. Threlkeld, first published in McClure, *Smithsonian Contr. Bot.* 9: 52. 1973; all based on Fróes 19947.)

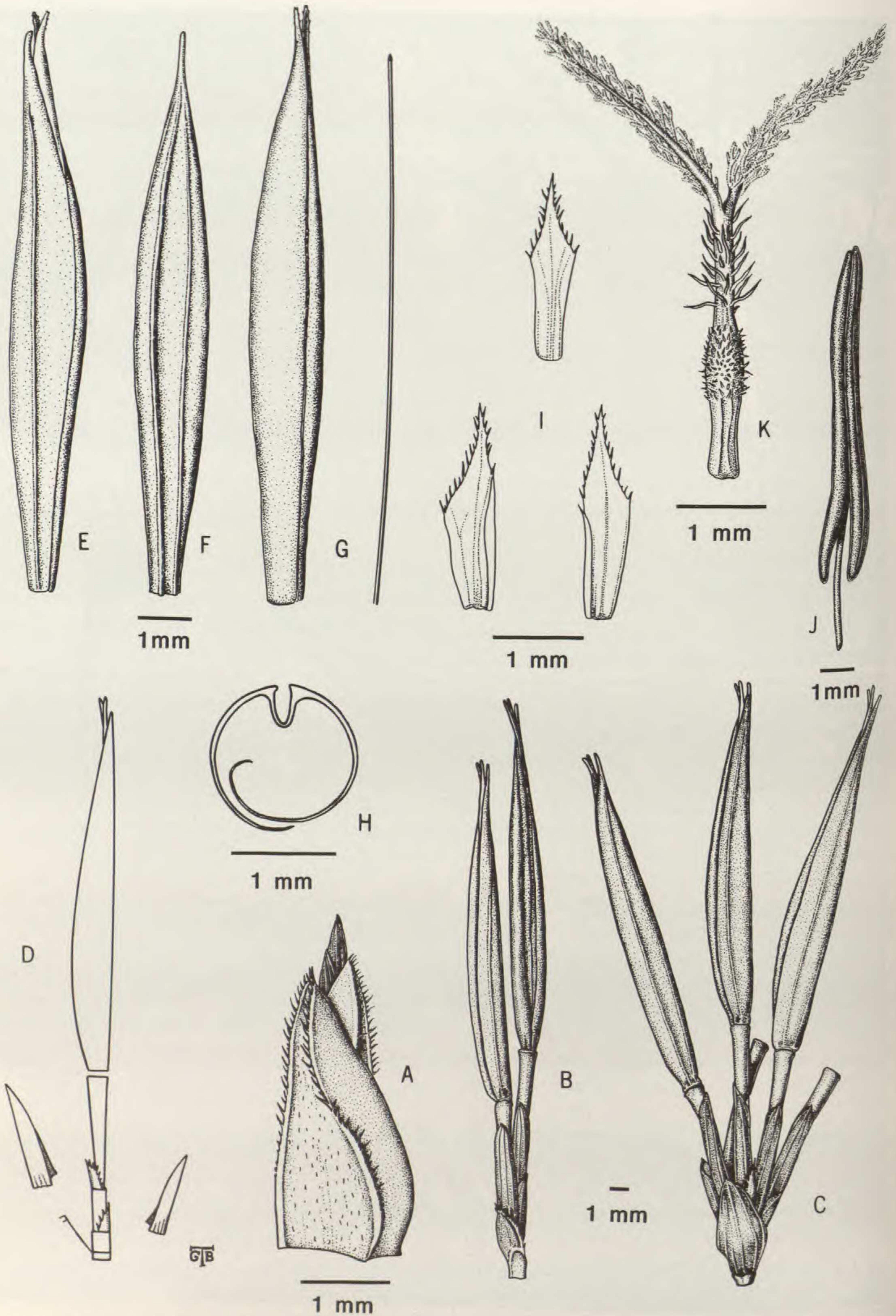


FIGURE 15. *Atractantha radiata*.—A. Pseudospikelet in early stage of development.—B. Two pseudospikelets, showing the prophyll at the base of the one on the left.—C. Cluster of pseudospikelets.—D. Pseudospikelet, dia-

Climbing woody bamboo forming large but rather loose clumps, decumbent at the base, arching, scandent, rebranching, climbing into trees up to 12 m, then pendent. Culms 6–13 mm diam., slender, flexible, solid or rarely with a ring of tiny, peripheral air canals in cross section, terete; internodes stramineous but minutely striate-maculate with green, slightly depressed spots, glabrous, smooth or uncommonly asperous in the upper branches, occasionally glaucous; lowest internodes 0.6–1 m long, the first branches appearing 4–5 m above the base; nodes glabrous; bud positioned 5–12 mm above the nodal line. Culm leaves papery, stramineous, glabrous; sheaths 20–30 cm long, 3–6 cm wide (spread width), loosely clasping the culm, slightly auricled on one side near the base, tapering to a rounded to acute apex, persistent, rather readily deciduous, attached by a flange-like girdle 1 mm long below the promontory, pushed away by the developing branches above; outer ligules, auricles, oral setae, and inner ligules all absent; blades absent, represented by a mucro 1–2 mm long. Branching intravaginal, with a central dominant primary branch and 2–6 smaller secondary or tertiary branchlets at its base, these also rebranching; bracts subtending branchlets 0.5–2 cm long, stramineous to reddish. Foliage leaves in complements of 7–13; sheaths glabrous, stramineous but minutely maculate with green spots, weakly if at all auricled at the summit; outer ligules 0.2–0.3 mm long, glabrous; oral setae 5–10 mm long, fine, delicate, white to orangish, crisped apically; inner ligules 0.3–0.5 mm long, membranous, truncate; pseudopetioles 3–7 mm long, adaxially golden or dark purple, glabrous to puberulent, abaxially glabrous; well-developed blades (10–)15–26 cm long, (2–)3–5 cm wide, lanceolate, asymmetrically obtuse to cuneate at the base, acute at the apex, glabrous. Inflorescences terminating leafy and nearly leafless branches of all orders, iterant, congested and capitate, the branches distichously inserted, consisting of 1–7 hemispherical to spherical, often pendent partial inflorescences 4–8 cm diam., each with 50–250 pseudospikelets with \pm equal rachises. Pseudospikelets comprising one subtending bract, the rachis, one prophyll, 1–2 basal gemmiparous bracts (which may develop into more pseudospikelets), one functional floret,

and (rarely) a setose prolongation of the rachilla internode bearing a tiny rudimentary sterile spikelet at its apex; subtending bract 5–10 mm long, lanceolate, acute, 7–11-nerved, membranous, glabrous, never laminiferous; prophyll 3–4.5 mm long, elliptical, bicarinate, pubescent on keels only; basal gemmiparous bracts 4–6 mm long, elliptical-lanceolate, acute, 3–7-nerved, glabrous; rachilla segment between uppermost gemmiparous bract and functional floret (4–)7–12 mm long, 0.3–0.5 mm diam., smooth, glabrous, stramineous, shiny, clavate and cupulate at the apex. Functional floret (11–)14–17(–19) mm long, 1.5–2(–2.5) mm wide, disarticulating from the summit of the rachilla; lemma narrowly lanceolate to uncommonly ovate-lanceolate, slightly falcate, acuminate-attenuate to pungent at the apex, indurate to less commonly papery, shiny, glabrous, green when young becoming olivaceous, reddish, or nearly black at maturity, the nerves not evident abaxially except for the raised midnerve and occasionally 1–2 pairs of lateral nerves, adaxially finely 5–11-nerved; palea slightly longer than the lemma, glabrous, the sulcus very narrow or less commonly wider, the apex acute. Rachilla internode often prolonged 12–17 mm past the functional floret as a setose bristle, filiform to flattened, rarely bearing a rudimentary sterile spikelet up to 5 mm long. Lodicules lanceolate-elliptical, acuminate, membranous, diaphanous, finely 3–5-nerved, the apical margins ciliate; anterior pair 2.5–2.7 mm long, the posterior one 2.2–2.4 mm long. Androecium with stamens pendent; anthers 6–9 mm long, linear, yellow drying to orangish or purplish. Gynoecium with ovary glabrous below, pubescent toward the apex; style exerted from below the stamens, the stigmas hispidulous. Fruit not seen.

Distribution. Endemic to coastal Bahia, Brazil (Fig. 10).

Habitat. Occurring at elevations from 10 to 75 m in hilly "mata littorânea" on white sand, often with the bamboo *Alvimia*; in "campos" and "restinga" vegetation, rich in *piçaba* palms (*Attalea funifera* C. Martius); in "mata atlântica arrestingada" (secondary forest after restinga is cut), on nearly pure white sand; and in "mata baixa," a low forest type found on sandy soil.

←
grammatic.—E. Floret, lateral view.—F. Lemma, dorsal view.—G. Palea (left) and prolongation of rachilla (right), lateral view.—H. Palea, diagrammatic cross section.—I. Lodicule complement.—J. Stamen.—K. Gynoecium. (Illustration by Gesina B. Threlkeld, first published in McClure, *Smithsonian Contr. Bot.* 9: 54. 1973; all based on Fróes 19947.)

Phenology. At the presumed type locality between Una and Olivença, flowering episodes are recorded from 1943 and from 1976 through 1978; a nearby (ca. 200 m away) population at this locality began flowering in 1979, after the death of the 1976–1978 flowering population.

Additional specimens examined. BRAZIL. BAHIA: Munic. Maraú, 5.5 km S of Maraú, ca. 15 km from ocean, 20 May 1976 (fl), *Calderón et al.* 2442 (CEPEC, ISC, SI, SP, US), 27 Feb. 1975 (fl), *dos Santos* 2928 (CEPEC, US); Munic. Una, road Una–Olivença, 28 km N of Una, passing Rio Maroim, 55 m, 26 Apr. 1976 (fl), *Calderón et al.* 2397 (CEPEC, US), 7 Apr. 1977 (fl), *Calderón* 2454 (US), 2 Feb. 1978 (fl), *Calderón* 2474 (US), 25 Feb. 1979 (fl), *Calderón & dos Santos* 2485 (B, C, CANB, CEPEC, COL, CTES, DD, F, G, INPA, ISC, K, LE, MO, NY, P, PE, PRE, SGO, SI, SP, TNS, TULV, U, US, USCH, W, WIS); Munic. Canavieiras, 5 km W from intersection of fazenda side road with main road (40 km S of Una), 75 m, 26 May 1976 (fl), *Calderón et al.* 2452 (CEPEC, US); Munic. Ilhéus, road Olivença–Vila Brasil (road to Fazenda Ipiranga), 6 km SW of Olivença, 2 Feb. 1978 (fl), *Calderón* 2473 (US); Munic. Ilhéus, road Olivença–Vila Brasil, ca. 18.5 km SW of Olivença, 23 Feb. 1979 (fl), *Calderón & dos Santos* 2479 (B, CEPEC, F, G, ISC, K, LE, MO, NY, P, SI, SP, TULV, US, USCH, W); Munic. Maraú, camino de Maraú a Ubaitaba, km 5, 10 m, 18 May 1985, *Zuloaga et al.* 2465 (SI, US); Munic. Ilhéus, estrada Olivença–Maroim, km 7–10, 50 m, 19 May 1985, *Zuloaga et al.* 2476 (SI, US); without locality or date, *Pirajá da Silva s.n.* ("Hoehne 28692") (US).

Flowering teratologies are common in *A. radiata* (e.g., *Calderón et al.* 2397, 2442, 2454, 2474, 2479, and 2485). In these individuals some to most of the pseudospikelets of a capitate partial inflorescence proliferate into equal-sized branchlets bearing complements of small blades ca. 3 cm long and 0.5 cm wide, and, near the apex, a few loosely spicate pseudospikelets, a few of these strongly resembling a single large pseudospikelet with several, distant florets. There appears to be a complete gradation between this extreme type and shoots with normal inflorescences. *Calderón et al.* 2397 has proliferated capitate inflorescences bearing branches with larger foliage leaf blades ca. 6 cm long and 1.3 cm wide, and small, loosely fascicled to capitate inflorescences, while *Calderón et al.* 2485 exhibits a full spectrum of inflorescence structure, with different shoots from the same plant bearing spherical, hemispherical, loosely fascicled (reminiscent of *A. falcata*), or spicate racemose partial inflorescences.

Calderón et al. 2452, given the herbarium name "cristata" by Soderstrom, has foliage leaf blades only 2–2.3 cm wide; partial inflorescences with pseudospikelets arrayed in dense, fan-shaped fascicles (cristate) rather than hemispherical or spher-

ical heads; the rachilla internode between the uppermost gemmiparous bract and the floret relatively short (ca. 4 mm long); small (11–13 mm long), papery, gaping, slightly inflated, ovate-lanceolate florets; and paleas with a broad dorsal sulcus embracing a prominent, flattened (up to 0.4 mm wide), sterile prolongation of the internode that often noticeably exceeds the floret. The inflorescence of this collection bears some superficial resemblance to the monotypic arthrotylioid genus *Athroostachys* Benth. (*A. capitata* (Hook.) Benth., Bahia to Paraná, Brazil), but the latter has true, semelaucant spikelets and lacks a prolongation of the rachilla internode past the functional floret. It is possible that *Calderón et al.* 2452 represents a new species distinct from *A. radiata*, but the population from which it was collected was reportedly one from near the end of its flowering period, and perhaps the peculiarities of the inflorescence and floret structure can be accounted for by its senescence. It seems best to await further collections before describing it as new, especially in view of the abundance and diversity of teratological inflorescences exhibited by this species. Several other collections of *A. radiata* with otherwise normal inflorescences and spikelets exhibit tendencies toward cristate partial inflorescences (e.g., *Calderón et al.* 2397, US sheet no. 9) and occasionally have gaping, papery, inflated florets.

A common name is *taboca* (*dos Santos* 2928).

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