

July 2005

Acanthaceae of La Selva Biological Station

Lucinda A. McDade & Erin A. Tripp, with Thomas F. Daniel

Terrestrial (rarely aquatic) perennial herbs or shrubs, more rarely vines or trees; often with cystoliths visible in epidermis (these absent in subfamilies Nelsonioideae and Thunbergioideae, and in tribe Acantheae of Acanthoideae); nodes usually articulate / jointed; leaves simple, opposite and decussate, estipulate, sessile to petiolate, margins entire to undulate. Flowers axillary or in distinct inflorescences, these cymose or thyrsoid (i.e., with the main axis indeterminate and with lateral axes determinate), the basic unit a variably reduced or expanded dichasium which may be opposite (paired) or alternate (solitary) at nodes, sessile or pedunculate, and 1-many flowered such that the inflorescence is spicate, racemose or paniculate; bracts large and brightly colored to small and green; flowers sessile or pedicellate, usually subtended by 2 bracteoles, complete, bisexual, chasmogamous (cleistogamous flowers not known in species at La Selva), rarely heterostylous (at La Selva, *Odontonema*); calyx of 5 sepals, usually synsepalous and deeply 4-5 lobed (rarely divided all the way to the base), lobes equal to unequal in length and width, sometimes partially or completely fused, usually in pairs, to form heteromorphic segments; corolla of 5 petals, sympetalous, tube cylindrical or funnellform (i.e., gradually or abruptly expanded distally into a more or less distinct throat), resupinate in *Dicliptera*, limb sub-regular to strongly bilabiate, with upper lip of two lobes and lower lip of three lobes; stamens (fertile) 2 or 4, sometimes with 2 or 3 staminodes, epipetalous, filaments free or briefly connate in pairs proximally, included in corolla tube or exerted from corolla, anthers 1-thecous or 2-thecous, sometimes with basal or apical appendages, thecae of a pair parallel to perpendicular, proximate to superposed to widely separated by an expanded connective; gynoecium 2-carpellate, ovary superior, generally 2-locular, placentation axile, ovules 2-many in each locule, style simple, terminal, filiform, variable in length relative to the corolla, stigma funnellform 2-lobed, lobes sometimes markedly unequal, one or both sometimes recurved; fruit a loculicidal, explosively dehiscent, stipitate or estipitate, 2-valved capsule except a fleshy drupe in *Mendoncia*; seeds 2-several in capsular-fruited taxa, each subtended by a prominent hook-shaped retinaculum (except Nelsonioideae and *Thunbergia*), globose to lenticular, glabrous or pubescent, trichomes often hygroscopic,

The family includes about 275 genera and likely more than 4,000 species; tropical and subtropical regions worldwide, including arid and semi-arid habitats, a few species extending into temperate areas.

About 36 (26 native) genera and 140 (ca. 125 native) species in Costa Rica.

Acanthaceae are part of the order Lamiales, which includes mints (Lamiaceae), scrophs (Scrophulariaceae), African violets (Gesneriaceae) and the bignon family (Bignoniaceae). Within this group, the vast majority of acanths are marked by having few-seeded, explosively dehiscent fruits within which the seeds are borne on woody hook-like structures called retinacula (Acanthoideae). Three lineages of plants that lack retinacula are closely related to Acanthoideae and treated as part of the family: Nelsonioideae (*Nelsonia*, *Elytraria* and relatives) have capsules that lack retinacula; Thunbergioideae comprise *Mendoncia* (vines with drupes) and *Thunbergia* and relatives (vines with explosively dehiscent capsules lacking retinacula), and *Avicennia* have one-seeded leathery capsules.

Acanths are generally characterized by showy bracts and flowers, although especially bracts may be diminutive in many native species. Many species are cultivated as ornamentals.

Cultivated Acanthaceae at and near La Selva: *Pachystachys lutea*, a shrub usually 1-1.5 m tall with large yellow bracts and long white corollas, is cultivated around the dining hall at La Selva, as is *Justicia aurea* (long yellow flowers, small green bracts) a species native to La Selva. *Megaskepasma erythrochlamys*, a spectacular shrub to at least 4 m tall, with large branching inflorescences with magenta bracts (ca. 4 cm long), bracteoles and calyces, and white corollas >6cm long, is cultivated in yards all along the roads leading to La Selva. *Pachystachys* and *Megaskepasma* are native to South America and are widely cultivated. *Odontonema cuspidatum* and species of *Thunbergia* are also commonly cultivated in yards in the Sarapiquí area; these are known from old home sites on La Selva and are at least persisting unattended. The *Odontonema* and two species of *Thunbergia* are included in the keys and descriptions presented here as they seem to be persisting and perhaps naturalizing at La Selva. Other species of *Thunbergia* may occur in secondary areas.

KEY

1. Fertile stamens 4. 2
1. Fertile stamens 2. 9

2. Plants scandent (exc. *T. erecta*); flowers subtended by paired, equal, large foliaceous bracts; calyx annular or of irregular, numerous segments; fruits lacking retinacula. 3
2. Plants erect herbs, shrubs or trees; flowers subtended by a bract and two bracteoles; capsule of 4 or 5 regular segments; fruit with seeds borne on woody, hook-like retinacula. 4

3. Fruit a drupe; plants native vines of the forest. *Mendoncia*
3. Fruit a beaked, explosively dehiscent capsule lacking retinacula; plants native to Old World, plants occurring as remnants or escapees from cultivation at La Selva. *Thunbergia*

4. Anthers monothealous; leaves lacking cystoliths; calyx of five unequal segments (or highly reduced in *A. dolichantha*) *Aphelandra*
4. Anthers of at least one pair of stamens bithealous; leaves with cystoliths; calyx of 4 or 5 more or less equal segments. 5

5. Trees frequently with stilt roots; inflorescences of lax, much branched panicles; calyx lobes broadly elliptic, 4-6 mm wide, coriaceous. *Bravaisia integerrima*
5. Herbs or suffrutescent shrubs lacking stilt roots; inflorescences not as above; calyx lobes linear to lanceolate, less than 3 mm wide, membranous. 6

6. Shorter pair of stamens with 1-celled anthers; flowers borne in terminal clusters of pedunculate spikes, peduncles to 1 cm long; corolla strongly bilabiate, middle lobe of lower lip greater than 2x as wide as lateral lobes. *Herpetacanthus panamensis*
6. Both pairs of stamens with 2-celled anthers; inflorescences if spicate, not pedunculate; corolla regular to bilabiate, if bilabiate the lobes of lower lip nearly equal. 7

7. Riparian herb; leaves lanceolate, at least 6x longer than wide; flowers in axillary fascicles; capsules cylindrical, seeds 16, less than 1 mm in diameter. *Hygrophila costata*
7. Herbs of forest understory or weedy clearings; leaves ovate to elliptic; inflorescences various, but not of axillary fascicles; capsules clavate, seeds ≤ 12 (in ours). 8

8. Lax herbs of maintained open areas, frequently rooting at nodes; inflorescences of dense sessile spikes to 3.5 cm long, bracts closely imbricate; corolla less than 1 cm long; capsule about 6 mm long. *Blechum*
8. Erect herbs or small shrubs of forest understory; inflorescences various, bracts not closely imbricate; corollas > 2 cm long; capsules clavate, greater than 1 cm long. *Ruellia*

9. Corolla with strongly reduced lip, the lower lip scarcely distinct from tube; anthers monothealous, long-exserted. *Razisea*
9. Corolla with well developed upper and lower lips distinct from tube; anthers bithealous, included within tube or not extending beyond tip of upper lip of corolla. 10
10. Small shrubs with a 3-parted calyx, the lobes longer than 3 cm at anthesis *Louteridium costaricense*
10. Herbs, shrubs or vines with 5-parted calices, the lobes less than 2.5 cm in length. 11
11. Stem 6-angled; flowers borne in pedunculate, head-like, fan-shaped axillary and terminal fascicles; floral bracts subtending each flower paired and obovate. *Dicliptera podocephala*
11. Stem 4-angled or terete; flowers borne in axillary and terminal spikes, panicles or cymes. 12
12. Staminodes present; corolla red, only slightly bilabiate, the 5 lobes more or less equal. *Odontonema*
12. Staminodes absent; corolla yellow, white or lavender, strongly bilabiate, the lobes unequal. 13
13. Floral bracts 4-ranked, toothed, adaxial and abaxial calyx segment ovate, as large as bracts, lateral segments linear; corolla bright yellow, drying purple. *Barleria oenotherioides*
13. Floral bracts not 4-ranked, entire; calyx segments equal; corolla white or lavender. *Justicia*

Quick and Dirty Key for Flowering Material

1. Corolla pale green to yellow; calyx of three segments. *Louteridium costaricense*
1. Corolla color otherwise; calyx of five (rarely four) segments. 2
2. Corolla red, orange or yellow. 3
2. Corollas purple or white. 10
3. Corolla red. 4
3. Corolla orange or yellow. 7
4. Corolla essentially lacking lips, anthers long-exserted. *Razisea*
4. Corolla with well developed lips, anthers included. 5
5. Herbs < 1m tall. *Aphelandra aurantiaca*
5. Larger plants. 6
6. Sparsely branched, weak shrubs to 3 m tall, corolla < 3.5 cm long, lip nearly regular, *Odontonema*
6. Freely branched shrubs to 4 m tall, corolla > 5 cm long, lip strongly bilobed. *A. golfodulcensis* x *sinclairiana*
7. Plants vines, corolla with a contrasting purple throat. *Thunbergia alata*
7. Plants not vining, corolla without a contrasting throat. 8
8. Corolla and bracts orange. *Aphelandra storkii*
8. Corolla yellow. 9
9. Corolla maintaining color when dried; bracts not conspicuous. *Justicia aurea*
9. Corolla turning purple when dried, bracts conspicuous. *Barleria oenotherioides*

10. Corollas pure white. 11
10. Corollas white with darker lobes or spots, yellowish green, or purple. 12
11. Vines with magenta bracts and calyx lobes, corolla strongly bilabiate. *Justicia sarapiquensis*
11. Erect herbs with green bracts, corolla not strongly bilabiate. *Aphelandra dolichantha*
12. Vines, each flower with paired foliaceous bracts that exceed buds and fruits. 13
12. Shrubs or herbs; flowers with one bract and two bracteoles. 14
13. Native plants of intact forest. *Mendoncia* species
13. Remnants from cultivation, edges, abandoned homesites. *Thunbergia* species
14. Four stamens. 15
14. Two stamens. 18
15. Riparian herbs with lanceolate leaves. *Hygrophila costata*
15. Herbs of forest understory. 16
16. Corolla strongly bilabiate. *Herpetacanthus panamense*
16. Corolla only weakly bilabiate. 17
17. Lax herbs of open areas; inflorescences densely bracteate, corolla < 1 cm long. *Blechnum* species
17. Erect herbs or small shrubs of forest understory; inflorescences not densely bracteate, corolla > 2 cm long. *Ruellia* species
18. Flowers in pedunculate, head-like, fan-shaped axillary and terminal fascicles; floral bracts subtending each flower paired and obovate; corolla resupinate (i.e., twisted through 180 degrees). *Dicliptera podocephala*
18. Inflorescences otherwise, flowers subtended by one bract and two bracteoles; corolla not resupinate. *Justicia* species

***Aphelandra* R.Br.**

Genus with nearly 200 species, all in the Americas from n. Mex. to n. Argentina, WI; 12 spp. in Costa Rica.

Suffructescent perennial herbs or shrubs; cystoliths absent; leaves opposite, petiolate; infls. of terminal and sometimes axillary spikes or panicles of spikes, spikes usually with conspicuous bracts and showy flowers; bracts usually imbricate, entire or toothed, with paired dorsal patches of glands in some species; bracteoles two per flower, often keeled; calyx of five unequal lobes, lateral (narrowest) and abaxial paired segments plus adaxial (widest) segment; corolla usually showy and strongly bilabiate, lobes variously modified in some species; stamens four, monothealous; fruits retinaculate, 4-seeded.

Plants belonging to *Aphelandra* are distinguished from all other La Selva acanths by absence of cystoliths, calyx of five unequal segments (2+2+1), and four monothealous stamens; among acanths, only *Aphelandra* have paired dorsal patches of glands on floral bracts but not all *Aphelandra* have these. At La Selva, spicate inflorescences often with dense, imbricate bracts and corollas > 4 cm long are distinctive except for *Barleria* which has yellow flowers.

1. Suffrutescent herbs to 1 m tall; stems and leaves essentially glabrous; floral bracts green or green tinged with purple, lacking extrafloral nectaries; lower lip of corolla with three lobes. 2
1. Shrubs to 4 m tall; stems and leaves pubescent to pilose; floral bracts brightly colored, with extrafloral nectaries; lower lip of corolla with a single lobe. 3
2. Floral bracts toothed, green tinged with purple; calyx of well developed segments about 10 mm long; corolla orange to red, the tube about 3.5 cm long, lip strongly bilabiate, the upper lip entire, acute, the lower lip 3-lobed. *A. aurantiaca*
2. Floral bracts entire, green; calyx minute to lacking; corolla white, the tube about 5 cm long, very narrow, only slightly expanded at throat, the limb 5-lobed, weakly bilabiate. *A. dolichantha*
3. Sparsely branched shrubs; stems and leaves pilose; leaves obovate, to 20 cm wide; floral bracts 25-30 cm long; bracts and corolla salmon-orange; anthers well-developed, 7-9 mm long. *A. storkii*
3. Profusely branching shrubs; stems and leaves with appressed trichomes; leaves to 8 cm wide, oblanceolate; floral bracts 9-12 mm long; anthers shriveled and bearing little pollen, 6-6.5 mm long. *A. golfodulcensis* x *sinclairiana*

Aphelandra aurantiaca Lindl., in Edwards, Bot. Reg. 31: pl 12. 1845.

Herb to 1 m tall but usually < 50cm. Leaves (8-) 12-18 (-28) x (2-) 5.5-9 (-12.5) cm, glabrous, slightly succulent in texture, usually entire but sometimes undulate or sinuate-repand marginally; infl. of 1-3 sessile, quadrangular spikes, each 9-17 x 1-1.5 cm (excluding flowers); bracts 24-32 x 7.5-15 mm, green to purplish, elliptic, apically acute, margins strongly toothed, lacking nectaries; bracteoles 6.5-10 x 0.5-1.5 mm, pale greenish-yellow, narrowly lanceolate; sepals 8-12 mm long, 2-2.5 mm (adaxial), 1-1.5 mm (abaxial and lateral pairs) wide, pale greenish-yellow; corolla 5.5-6.5 cm long, red or orange-red, membranous, upper lip 15-20 mm long, apically emarginate, folded to form a sheath in which the anthers lie at anthesis, the lower lip three-lobed, the lateral lobes 10-15 x 6-9 mm, narrowly ovate, the middle lobe 17-25 (-30) x 10-18 mm, ovate; anthers 4.5-5 mm long; stigma oblique, somewhat funnel-shaped; fruits 12-16 mm long, clavate, stipe 3-5 mm long, seed bearing portion 10-11 mm long, flattened, 4-5 mm wide, ca. 2 mm thick; seeds to 4, sub-orbicular, 3-5 mm in diameter.

The large green to purplish toothed bracts and red to orange-red corollas distinguish this species from all other La Selva acanth.

Distribution. Mexico to Bolivia. In Costa Rica, 0-1500 m, vert. Carib. ± throughout; vert. Pac. mid-elev. slopes of Cord. de Guanacaste SE to Arenal, then lowlands of Puntarenas. At La Selva, only one patch of this species is known: off the right side of Sura trail as one walks from the River Station or lab clearing to the Arboretum, ca 50-100 m off the trail, in old cacao among some very large *Terminalia oblonga*. The plants have not been collected or seen in recent years and should be looked for.

Natural History. The plants flower during the wet season (Jul-Jan) and flowers are pollinated by hermit hummingbirds.

Aphelandra dolichantha Donnell Smith, Bot. Gaz. (Crawfordsville) 27: 438. 1899.

Herb 0.4-0.7 (-1) m tall, stems somewhat succulent; leaves 10--29 x 3.5--13 cm, essentially glabrous, slightly succulent, entire to crenulate; infl. of 1-5 (-7) sessile, quadrangular spikes, each

5-13 x 1-1.5 cm; bracts 25-40 x 7-13 mm, pale green, ovate-lanceolate to oblanceolate, imbricate (spreading to reflexed when fruiting); bracteoles 5-10 x 0.5-1 mm, pale greenish, linear; sepals minute, ca. 1.5-2 x 0.25 mm, hyaline, linear; corolla 5-5.5 cm long, white, tube slender, 2-4 mm wide, only slightly ampliate at throat, upper lip ca. 12 x 7 mm, bilobed, the lobes 4.5-5 x 2.5-3 mm, apically rounded, the lower lip three-lobed, lateral lobes 15-17 x 4-6 mm, middle lobe 18-22 x 6-9 mm, elliptic; stamens with filaments attached 35-43 mm from base of tube, free portions 5-6 mm long; anthers included, positioned just below throat of corolla, thecae 2.5-3 mm long, pollen white; style 43-53 mm long, stigma slightly exerted beyond anthers, infundibular with an apical protrusion nearly 1 mm long; bracts strongly reflexed in mature infructescences, fruits green until maturity, 15-18 mm long, clavate, stipe 6-7 mm long, seed bearing portion 10-12 mm long, flattened, 4-5 mm wide, ca. 3 mm thick, grooved around narrowest edge, seeds 4, orbicular, ca. 4 mm in diameter.

The fleshy, nearly succulent stems and leaves, large green bracts, long, white corollas with very narrow tubes, and minute sepals distinguish this species from all other La Selva acanths.

Distribution. Nicaragua to Colombia. In Costa Rica, understory of moist forests; near sea level-1400 m; vert. Carib. \pm throughout; vert. Pac., Tilarán (Guanacaste), Osa (Puntarenas). At La Selva, common on recent alluvium near intersection of SER and SCL.

Natural History. Flowers more or less year around, less abundantly in the late dry season. Pollinated by flies.

Aphelandra storkii Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1197. 1938.

Sparsely branched shrubs 1-3 m. Leaves 30-45 x 15-20 cm, densely pubescent below, moderately above. Infl. of few (1-5) short pedunculate, terete to subquadrangular spikes, each 15-25 (45) cm long, 2 cm wide (excluding flowers); bracts 25-30 x 13-18 mm, orange, imbricate, rhombic oblong-ovate, apically acute, entire (rarely with 2-3 pairs of minute teeth), nectarial patches medial, of ca. 25 glands, each ca. 0.5 x 0.25 mm; bracteoles 9-15 x 2-4 mm, pale orange, lanceolate; sepals 13-17 mm long, 3.5-7 mm (adaxial), 2-4 mm (abaxial pair), 1-2 mm (lateral pair) wide, pale orange, apically acute; corolla 6.5-7.5 cm long, orange, membranous, moderately pubescent (trichomes ca. 0.5 mm long), upper lip bilobed and folded at anthesis to form pocket concealing anthers, lower lip 3-lobed with lateral lobes reduced to 1-2 mm long, the central lobe 27-30 x 9-12 mm, elliptic; anthers 7-9 mm long, pollen orange; stigma bilobed, pale orange; fruits clavate, 28-32 mm long, green until maturity.

Distinguished from other La Selva *Aphelandra* by the combination of sparsely branching habit, very large leaves, pilose stems and leaves, inflorescences of few very long spikes, large, bright orange bracts with nectarial patches, and very long orange corollas.

Distribution. Known only from NE Costa Rica (Heredia and northern Limon province) and SE Nicaragua. At La Selva, plants of this species are fairly common on recent alluvium along the SCC, SCL and the SES.

Natural History. Flowers during the wet season, although occasional individuals can be found in flower at other times of year. Pollinated by long-tailed hermit hummingbirds, nectar robbed by little hermits and pollen robbed by *Trigona* sp. Plants at La Selva seem prone to infection (fungal?) that damages the apex and causes production of malformed leaves.

***Aphelandra golfodulcensis* McDade x *Aphelandra sinclairiana* Nees**

Plants along the banks of the Río Puerto Viejo, and many plants along the Rio Peje (SR) have been identified as putative hybrids between *A. golfodulcensis* and *A. sinclairiana* (McDade 1984). They have abortive pollen, do not produce seed, and are intermediate in other characters between the two putative parents. They appear to propagate from branches carried along and lodged in the bank by floods. Unlike other La Selva *Aphelandra*, these plants are large, freely branching shrubs to small trees.

Distribution. Plants of this hybrid combination are collected occasionally in NE Costa Rica, usually along streams. At La Selva, plants are sporadic along the Río Puerto Viejo and very frequent along the Peje and Sarapiquí rivers. A large one is presently (2005) in the patch of forest between the River Station and the river.

Natural History. These plants flower during the dry season. Flowers are visited by long-tailed hermit hummingbirds, nectar robbed by little hermits and pollen robbed by *Trigona* sp.

***Barleria* L.**

Genus with about 250 species, all Old World (Africa, Madagascar, Asia) except 1 species of tropical dry forests in Mexico, Central America and northern South America.

***Barleria oenotherioides* Dum. Cours.** Bot. cult., ed. 2, 2:561. 1811. *Barleria micans* Nees in Benth. Bot. voy. Sulphur 146. 1846.

Perennial herbs or shrubs to 2 m tall, leaves petiolate, (3-)7—33 x (0.7-)1.5--11cm. Infl. of terminal (and sometimes axillary from distal-most node) densely bracteate 4-sided sessile spikes to 15 cm long; bracts 15-35 x 6-19mm, ovate to ovate-elliptic, proximal-most bracts often larger; bracteoles 11-20(-23) x 1-3(4.5) mm, subulate to linear-subulate to oblanceolate to lance-elliptic; calyx 4-lobed, anterior and posterior lobes outermost, 17-35 x 8-20mm, ovate to ovate-elliptic to obovate-elliptic, anterior lobe apically 2-dentate, inner lateral lobes 8-18 x 1-2.2mm, lance-linear to lanceolate; corolla 3.5--6.5(--8.0) cm long, yellow, usually turning purplish on drying, tube cylindric (or slightly expanded distally), 18--37mm long, bilabiate, upper lip 16--45mm long, 4-lobed, lobes 10—24 x 4.5--13mm, lower lip one-lobed, 10—41 x 5--17 mm; stamens 2, inserted near base of corolla tube, 28--60mm long, thecae 3.5—9 mm long; staminodes 3, 1--4mm long; style 30—60 mm long, stigma linear, 1—3 mm long; fruits 12--20mm long, stipe to 1.5mm long, head ellipsoid; seeds 4, subelliptic, 4.5--6.5 x 4--5.5mm.

This species is quite distinct among La Selva Acanthaceae for its long yellow flowers (drying purple) with 4-lobed upper lip and 1-lobed lower lip borne in long densely bracteate spikes. Only *Justicia aurea* has yellow flowers of similar dimensions but these have a 2-lobed upper lip and 3-lobed lower lip and are in freely branching inflorescences with much smaller bracts. The calyx structure of larger, external anterior and posterior lobes and smaller, inner lateral lobes is also unique among LS Acanthaceae.

Distribution. This species ranges widely in tropical dry forest, from Mex to northern South America; in Costa Rica it is almost entirely restricted to tropical dry forest from northern Guanacaste province to Puntarenas (Area de Conservacion Pacifica Central). It occurs at La Selva along the Rio Peje at the far southwestern extreme of the reserve. Although it is possible that plants are remnants from cultivation, this species is not commonly cultivated in Costa Rica. Further, at this site, it co-occurs with a number of other species more typical of drier forest (e.g., *Hybanthus* sp., *Toxosiphon lindenii*) (B.E. Hammel, pers. comm.).

Natural History. Flowers during the dry season in tropical dry forest and at La Selva (specimens collected Jan-Mar). Pollinators are unknown. The chemistry of the corolla change from yellow to deep blue or purple is unknown and merits investigation.

***Blechum* P. Br.**

Genus of < 10 species, all native to tropical America although *Blechum pyramidatum* is said to be naturalizing in parts of the Paleotropics, 2 species in Costa Rica.

(Genus and *B. pyramidatum* contributed by T.F. Daniel & L.A. McDade)

Spreading to decumbent to erect perennial herbs or shrubs with cystoliths. Leaves entire to crenate to ± dentate. Inflorescence of mostly terminal densely bracteate dichasiate spikes; dichasia opposite, 1--3-flowered, sessile to subsessile (i.e., peduncles to 1 mm long), subtended by a bract (or sometimes a distal leaf). Bracts opposite, green, margin entire (in ours; elsewhere also dentate-crenate). Flowers sessile, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic or subequal in length. Corolla white to blue to purplish, tube expanded distally into a distinct throat, limb subregular and ± equally 5-lobed to subbilabiate with upper lip 2-lobed and lower lip 3-lobed, corolla lobes contorted in bud. Stamens 4, didynamous, inserted distal to midpoint of corolla tube, at or near base of throat, included in corolla tube or barely exerted from mouth of corolla, anthers 2-theous, thecae equal in size, parallel, equally inserted, lacking basal appendages, dehiscing toward lower lip. Style included in corolla tube, stigma 2-lobed or with only 1 lobe prominent or evident. Capsule substipitate, ellipsoid, retinacula present, septa with attached retinacula separating from inner wall of mature capsule. Seeds 8--12, homomorphic, lenticular, with hygroscopic trichomes on and near margin.

The elongate, densely bracted, 4-sided spicate inflorescences with weakly zygomorphic small lavender flowers on herbaceous plants with a lax growth form distinguishes plants belonging to *Blechum* from all other acanths at La Selva. Plants are most likely to be confused with (and should perhaps be synonymized with) *Ruellia* species; La Selva species of this latter genus differ in inflorescence structure and are erect herbs with markedly stipitate fruits.

Corolla 10-15 mm long, plants usually lax, rooting at nodes. *B. pyramidatum*
Corolla 20-25 mm long, plants erect. *B. costaricense*

1. *Blechum pyramidatum* (Lam.) Urb. edde Repert. Spec. Nov. Regni Veg. 15:323. 1918. Sornia

Spreading to erect perennial herbs to 9 (--15) dm tall. Leaves with petioles to 50 mm long, blades ovate to elliptic, 2--12 x 1--7 cm, acute to acuminate at apex, (truncate to) rounded to acute to attenuate at base, surfaces pubescent, margin entire to crenate. Inflorescence of axillary or terminal subsessile to pedunculate densely bracteate 4-sided spikes to 11 (--18) cm long (including peduncles and excluding flowers), 1--3 cm in diameter (excluding flowers) near midspike, peduncles to 13 (--37) mm long. Bracts imbricate, sessile to petiolate, petioles (if present) to 2.5 mm long, broadly ovate to cordate, 8--19 (--30) mm long, (4--) 5.5--14 (--20) mm wide (proximal-most pair sometimes foliose and larger), acute at apex, margin ciliate; bracteoles ovate to lance-ovate to lance-elliptic to oblanceolate, 4.5--11 mm long, 1--4.5 mm wide, secondary bracteoles (if present) linear to subulate, smaller than bracteoles. Flowers 1-3 per bract, sessile, calyx 2.5--5 mm long, lobes homomorphic, subulate, 2--3.8 mm long. Corolla white to blue, 9--15 (-18) mm long, tube 7.5--13 mm long, 1.8--3.3 mm in diameter near midpoint, throat 3.5--6 mm long, limb nearly regular to slightly bilabiate, upper lip 1.5--6 mm long, lobes 1.5--6 mm long, 1--4.5 mm wide, lower lip 1.5--6 mm long, lobes 1.5--5.5 mm long, 1--6 mm wide, all lobes broadly subelliptic to subcircular; stamens included in corolla tube or

barely exerted from mouth of corolla, longer pair 2.5--5 mm long, shorter pair 1.5--3 mm long, filaments glabrous, thecae 1--1.6 mm long, glabrous; style 6--13 mm long, stigma with only 1 lobe evident, linear (sometimes coiled), 0.5--1.2 mm long. Capsule 5.5--7 mm long, stipe essentially lacking, seed bearing portion ellipsoid, not strongly flattened, 5--6.5 mm long, ca. 4 mm wide, ca. 3 mm thick. Seeds 8--12, 1.5--2 mm long, 1.3--1.7 mm wide, at ca. same level in fruit, surfaces smooth or with short and stiff often glandlike protuberances, margin conspicuously enlarged with a ring of hygroscopic trichomes that become a jellylike mass when wet.

Compared to the other species of *Blechnum* at La Selva, plants of *B. pyramidatum* have bracts and corollas only about half as large, and leaves that differ in length : width.

Distribution. This species is widely distributed from northern Mexico, Florida and the Antilles, through Central America, east to French Guiana, south to Peru. It has also been introduced to the Old World. It occurs in all parts of Costa Rica except at elevations above about 1400 m. These are weedy plants of edges and open areas. At La Selva, plants of this species are common along trails that run through fairly open, secondary areas and also in clearings.

Natural History. Flowers most abundantly in the dry season but flowering plants can be found year around. The plants are said to be used medicinally in Costa Rica to relieve intestinal problems (Durkee 1986).

2. *Blechnum costaricense* Oerst., Vidensk. Meddel. Dansk Naturhist. oren. Kjobenhavn 1854: 168. 1855. *Blechnum dariense* Lindau, Repert. Spec. Nov. Regni Veg. 12: 423. 1913.

Herbs (older individuals may be woody at base) to 0.8 m tall, erect; leaves with petioles to 23 mm long, blades 2-10 (-14) x 1-5 cm, 2-3.2 times longer than wide, narrowly ovate to sub-elliptic, acute to acuminate at apex, acute at base, surfaces and margins with scattered trichomes to nearly glabrous, leaf margins entire to crenate and sometimes undulate. Infl. a terminal, densely bracteate 4-sided spike to 5 cm long; bracts imbricate, sessile to petiolate, 8-15 x 5.5--14 mm (proximalmost pair sometimes foliose and larger), ovate-deltoid; bracteoles 7-10 x 0.5-2mm, linear to lanceolate; sepals 5-5.5 x 0.5-0.75mm, shape; corolla 20-25 mm, pale lavender to purple, tube 16-19 mm long, 1.5 mm in diameter at base, expanding to 5-6 mm in diameter at throat, trumpet shaped, limb nearly regular, lobes subequal, suborbicular, 5-6 x 4-5 mm. Capsules 5-9 mm long; stipe essentially lacking, seed bearing portion ca. 5 mm long, ca. x mm wide, ca. x mm thick, seeds more than four, at about the same level in fruit, regularly circular, 2-2.5 mm, Capsules 5-9 mm long, broadly elliptic to ovate, with short trichomes, stipe nearly lacking, seed bearing portion ellipsoid, slightly flattened, ca. 5 mm long, 3-6 mm wide and 1.5-2 mm thick; seeds to 8, 2-3 mm in diameter, orbicular, margins discolorous because of a ring of hygroscopic trichomes, these become jelly-like when wet.

Plants of *B. costaricense* are erect (versus sprawling) and have corollas nearly twice as large as those of *B. pyramidatum*.

Distribution. Nicaragua to Panama. In Costa Rica, this species occurs along edges and in forest understory, 100-1100 m elevation on both slopes more or less throughout except in NW Costa Rica and in tropical dry forest. We have seen no specimens from La Selva although it is to be expected there.

Natural History. Flowering specimens have been collected November - April.

***Bravaisia* DC**

Genus with 3 species, Mex and Cuba south to northern South America; 1 species in Costa Rica.

Bravaisia integerrima (Spreng.) Standl., Contr. U.S. Natl. Herb. 23: 1335. 1926. *Amasonia integerrima* Spreng., Sys. Veg., editio decima sexta 2: 765. 1825. Mangle Blanco.

Trees to 20 m tall with prominent stilt or prop roots at base; stems articulated, leaves petiolate, petioles of a pair often unequal, blades 3-30 x 1-16 cm. Infl. a pedunculate, branched raceme of dichasia; bracts 2-14 x 0.7-4.0 mm, linear to ovate, bracteoles 1.6-5 x 1.0-2.5 mm, linear to suborbicular, apically obtuse to acute; sepals 2-8 x 2-3 mm, elliptic, apically rounded; corolla campanulate, 1.5-2.2 cm long, tube 13-14 mm long, 11 mm wide at throat, white with yellow spot on central lobe of lower lip, and purplish-pink markings lateral to the spot, lower throat also 'ornamented' with sparse coarse pink trichomes, the throat slightly bilabiate, the upper lip following the same line as tube or slightly reflexed, the lower lip perpendicular to the tube to reflexed, lobes 10-15 mm x 9-11 mm, nearly equal except middle lobe of lower lip slightly wider than lateral lobes; stamens four, one pair slightly shorter than other, filaments and thecae reddish purple, filaments attached 3-4 mm from base of tube, filaments 6-9 mm long, dense long trichomes around basal 1 mm and point of attachment to tube, anthers 2-3 mm long, spurred basally; fruits 5-13 x 4-5 x 3 mm thick, clavate, flattened; seeds usually 1 (to 4), 3-5 x 2.8-4 x .5-1.2 mm, flattened.

This species is quite distinct among La Selva Acanthaceae for being a relatively large tree with prop roots: there is no acanth even remotely similar.

Distribution. This species has a wide distribution from Mexico through Central America to Colombia and Venezuela. In Costa Rica, this species occurs from 0-1250 (mostly below 100) on the Caribbean slope from the Cord. de Guanacaste (Arenal) to the Llanuras de San Carlos (La Selva), and more or less throughout on the Pacific slope. At La Selva, it occurs along streams and in low-lying areas along the Sendero Tres Ríos, near and along streams draining into the Ríos Puerto Viejo and Sarapiquí.

Natural History. Flowering is during the dry season. Flowers are presumably pollinated by bees although studies of reproductive biology are lacking. It would be interesting to know whether there is secondary dispersal via water in this species as there is for the *mangrove thistle*, *Acanthus ilicifolius*.

***Dicliptera* Juss.**

Genus with about 300 described species from tropical and temperate regions worldwide, 6-8 species in Costa Rica.

Dicliptera podocephala Donnell Smith, Bot. Gaz. (Crawfordsville) 48: 299. 1909.

Herbs or small shrubs to 1.5 m tall. Leaves petiolate (to 2.5 cm), 2.5-10 x 1-4 cm, apically acuminate, basally acute, glabrous. Infl. of peduncled axillary "heads" of 5-7 flowers, 1-several per axil, peduncles to 9.5 cm, minutely puberulous; bracts subtending the heads subulate, 3.5-5 x 1 mm, glabrous; flowers sessile, floral bracts ovate to elliptic, apically rounded or obtuse, apiculate, narrowed at the base, margins ciliolate, unequal, larger 10-14 x 8-9 mm (apparently of diff. sizes among flowers in head); 2 pairs of bracteoles subtending each flower, linear-lanceolate, puberulous, 5-8 mm long; calyx segments resembling bracteoles, slightly shorter; corolla pinkish lavender, puberulous, 14 mm long; tube 6-8 mm long, lips 7-8 mm long; stamens exerted, anthers ca. 1.5 mm long. Fruit ovoid, 5-6 mm x 1 mm wide, puberulous; placenta separating as a unit from fruit wall as fruit dehisces. Seeds 2-2.5 mm in diameter, flattened, puberulous.

This species is distinguished from other La Selva by inflorescence structure (cymose units on elongate peduncles); flowers that are subtended by paired obovate and apiculate bracts. Plants of the genus *Dicliptera* are alleged to have 6-sided stems (versus terete or four-sided); this character merits further investigation. Corollas of many species are resupinate (twisted through 180 degrees) which results in a two lobed “lower” lip and three lobed “upper” lip.

Distribution. This species occurs only in Costa Rica and is very poorly collected (about eight total collections, five from La Selva; if you find it, alert the resident naturalist). Although collections from La Selva pre-date the STR, the plants have been collected several times from near where the current STR, SEN and SOR trails are most proximate, and from scattered other localities (including near the south boundary).

Natural History. Flowering specimens have been collected in March-May and Aug.

***Herpetacanthus* Nees**

Genus with about 10 species, distributed in Central America and Brazil; 2 species in Costa Rica.

***Herpetacanthus panamensis* Leonard.** J. Wash. Acad. Sci. 32: 185. 1942. *Standleyacanthus costaricana* Leonard, Ceiba 3: 143. 1952. Figure 7.

Herbs or small shrubs to 1 m tall. Leaves petiolate (to 1 cm long), 4-14.5 x 2.5-6cm, ovate to ovate-elliptic, with distinctive venation involving secondaries looping to connect with each other near margin, apex and base acute, midrib purplish, especially basal portion. Infls. in terminal and axillary spikes to 3.5 cm long, often held more or less perpendicular to the stem rather than erect; bracts 9-14 x 4-7 mm, ovate to elliptic, loosely imbricate; next bracteoles 6 x 3-4 mm, ultimate bracteoles 6-8 x 0.5-1mm, linear to narrowly elliptic; sepals 5, 3-4 x 0.5 mm, subulate; corolla white, to 17 mm long, tube 11 mm long, 2 mm wide at base, 3.5 mm wide at mouth, upper lip minutely two lobed, 4 mm wide; lower lip 3-lobed, lobes 2-3 mm long, middle lob 2.5 mm wide, lateral lobes 1.5 mm wide; stamens 4, one long pair bithecate, one shorter pair monothebate. Fruit clavate, 9-10 mm long, stipe 3.5-4 x 0.5 mm, seed-bearing portion 3 mm wide, 1.5 mm thick, violin shaped. Seeds 4, flattened, 2.5 mm in diameter.

The distinctive venation of the leaves, spicate inflorescences with fairly large bracts, small bilabiate corolla and androecium of two pairs of stamens that differ in height and number of thecae (longer pair bithecaous, lower pair monothealous) distinguish this species from all others at La Selva.

Distribution. Costa Rica and Panama. Widely distributed in Costa Rica in moist and wet forests on both slopes. At La Selva, this is among the most widespread of acanths. Plants occur along edges and in fairly open areas near the front of the property and it is especially common in the arboretum where it flowers at very small sizes presumably due to repeated cutting. However, plants are also found abundantly in old growth forest, in and along trails and often near streams.

Natural History. Flowering seems to occur essentially year around, perhaps peaking Jul-Sep.

***Hygrophila* R.Br.**

(description by T.F. Daniel & L.A. McDade)

Genus with 80-100 species, distributed pantropically, some warm temperate species in the Old World; 1 species in Costa Rica.

Hygrophila costata Nees. Pl. hort. bonn. icon. 2: 7. t. 3, 1824, and in DC., Prodr. 11: 88. 1847. *H. guianensis* Nees, London J. Bot. 4:634. 1845. *H. conferta* Nees in Mart., Fl. bras. 9: 21. 1847. Fig. 7.

Erect to spreading aquatic to subaquatic herbs to 1 m tall; leaves (proximal nodes often leafless) subsessile to petiolate, petioles to 25 mm long (unwinged portion to 10 mm long), blades linear to narrowly elliptic, 1.5–17.5 x 0.7–2.3 cm wide, acute to attenuate-tapering (often nearly to node) at base, acuminate at apex, surfaces and margin sparsely pubescent with eglandular trichomes, margin entire to subcrenate; inflorescences axillary, often appearing as verticels, 3--many-flowered, sessile to subsessile (i.e., borne on peduncles up to 1 mm long); bracts and bracteoles ovate-lanceolate to lanceolate to narrowly elliptic, 2–13 x 0.6--2.5 mm, abaxial surface glabrous or with a few scattered eglandular trichomes (especially along midvein), margin ciliate; flowers sessile to subsessile (i.e., with pedicels to 1 mm long); calyx 5-lobed, 6--12 mm long, tube often rupturing in weak hyaline areas between lobes, lobes narrowly lanceolate, 1.3--3.3 times longer than tube, long-attenuate at apex, abaxial surface and margin glabrous or pubescent like bracteoles, margin hyaline; corolla white, 7--11.5 mm long, externally pubescent with flexuose to retrorse eglandular trichomes 0.1--0.2 mm long, tube 4--7 mm long, proximal cylindrical portion of tube 2--4 mm long, throat 2--3 mm long, upper lip 2.8--4.5 mm long, lobes rounded, 0.3--1.2 mm long, 0.7--1 mm wide, lower lip 3--4.5 mm long, lobes linear to elliptic, 2.2--3 mm long, 0.8--1.5 mm wide; stamens inserted near base of throat, longer pair 3--6 mm long, shorter pair 2.2--4 mm long, filaments proximally pubescent with eglandular trichomes, thecae 0.8--1 mm long; style 3.5--6 mm long, glabrous, longer stigma lobe 0.5--0.6 mm long, shorter lobe 0.2 mm long or inconspicuous; capsule cylindrical, not markedly stipitate (fertile nearly to base), 10--12 mm long, glabrous; seeds 16--20, subcircular in outline, 1.2--1.4 mm long, 0.8--1.1 mm wide.

The very narrow leaves, inflorescences in the leaf axils (often appearing as verticels), cylindrical fruits with many seeds, and habitat (riparian areas) distinguish this species from all other acanths at La Selva. Across this range, there is quite a bit of variability particularly in leaf form and many segregate species have been recognized previously.

Distribution. This species occurs from Central Mexico south to Peru, Bolivia, Paraguay and Uruguay; it also occurs on the Antilles. In Costa Rica, the species is known from sea level to ca. 1600m elevation on both slopes more or less throughout. At La Selva, it is known from the banks of the Ríos Sarapiquí and Puerto Viejo; it has not been collected from the Peje or from the tributaries of the main rivers but might be expected along the larger ones (e.g., El Salto, El Sura).

Natural History. At La Selva flowering specimens have been collected Jan-Aug. The genus *Hygrophila* includes many species, including ours, that are adapted for aquatic habitats; some are cultivated as decorative aquarium plants. Given the riparian habitat of these plants, it would be interesting to know whether there is secondary dispersal via water in this species as there is for the *mangrove thistle*, *Acanthus ilicifolius*.

***Justicia* L.**

(genus and species 1-3 by T.F. Daniel & L.A. McDade)

Genus with >500 species, distributed tropical and temperate regions worldwide; more than 35 species in Costa Rica.

Decumbent to erect perennial herbs, shrubs, or small trees with cystoliths; leaves opposite, sessile to petiolate, margin entire to sinuate to crenate; inflorescences of axillary or terminal dichasiate spikes, racemes, thyrses, or panicles; dichasia alternate or opposite, 1 (--3)-flowered, subtended by a leaf or a bract, sessile or pedunculate; bracts alternate or opposite, green or brightly colored, prominent or inconspicuous, margin entire (in ours); flowers sessile or pedicellate, subtended by 2 homomorphic bracteoles; calyx deeply 4--5-lobed, lobes equal or unequal in size, posterior lobe sometimes greatly reduced in flowers with 5 calyx lobes; corolla (in ours) greenish, white, yellow, or purplish, usually with contrasting markings on lower lip, tube cylindrical to expanded distally, usually lacking a distinct throat, limb strongly zygomorphic, bilabiate, upper lip internally rugulate (i.e., with a stylar furrow), entire to 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud; stamens 2, inserted at various positions within corolla tube, exerted from mouth of corolla, anthers 2-theous (1 theca rarely sterile), thecae equal or unequal in length, equally or unequally inserted (but overlapping for some portion of their length) or superposed (i.e., not overlapping), parallel to perpendicular, 1 or both with a basal appendage or appendages absent, dehiscing toward lower lip (i.e., flower nototribal); staminodes lacking. Style exerted from mouth of corolla, stigma lobes indistinct to distinct, when distinct equal to unequal in length (1 lobe sometimes vestigial); capsule stipitate, retinacula present; seeds 2--4, lenticular to globose.

As currently circumscribed, *Justicia* more than 500 species, is pan-tropical and subtropical in distribution and is the largest genus of Acanthaceae. Plants of *Justicia* have two bithecate stamens, the thecae of which are usually not parallel, not equally inserted on the filament and appendaged in various ways. Corollas also have a stylar furrow or rugula in the internal surface of the upper lip.

1. Shrubs to 4 m tall; leaves to 30 cm long, 12 cm wide; corolla yellow, 5-6 cm long. *J. aurea*
1. Herbs or vines; leaves much smaller (to 17 cm in length); corolla white or lavender. 2
2. Plants high-climbing vines of primary forest; bracts and bracteoles magenta; corolla white, about 6 cm long. *J. sarapiquensis*
2. Plants herbs of mostly secondary forest, edges and waste places, also stream banks; bracts and bracteoles green (something with colored veins); corollas at least tinged with lavender on lips, much shorter, to 17 mm long. 3
3. Flowers in axillary or terminal spicate inflorescences with densely imbricate, ovate bracts at least 10 mm long. *J. refractifolia*
3. Inflorescences of axillary or terminal panicles or cymes; bracts inconspicuous, linear, to 5 mm long. 4
4. Leaves of a pair strongly unequal; inflorescences of short, axillary cymes, flowers erect; calyx about 8 mm long; corollas 12-17 mm long. *J. trichotoma*
4. Leaves of a pair equal; inflorescences paniculate, terminal (occasionally axillary at distal nodes), flowers secund, unilaterally disposed along rachis; calyx < 5 mm long; corollas < 10 mm long. 5
5. Inflorescences verticillate at least at lower nodes, dense and congested, corollas 2-6 mm long; fruits 4-5 mm long. *J. comata*
5. Inflorescences with opposite or alternate branching throughout, lax, corollas 8-9 mm long; fruits 7-8 mm long. *J. pectoralis*

1. ***Justicia aurea*** Schltld. Linnaea 7:393. 1832, non *Justicia aurea* (Rose) Lindau (1897).

Erect shrubs to 3 m tall. Leaves with petioles to 70 mm long, blades ovate to elliptic, (10.0--15.3--41.0 cm long, (3.1--7.0--16.5 cm wide, acuminate at apex, acute to attenuate at base, margin entire to subcrenate. Inflorescence of dichasiate spikes, racemes, thyrse, or panicles from axils of distal leaves or bracts forming a terminal densely-flowered panicle to 30 cm long (excluding flowers) and 2.5--10 cm in diameter (excluding flowers) near midpoint, inflorescence bracts sometimes caducous, proximal ones (or those along main axis) subfoliose, to 35 mm long and 12 mm wide, distal ones (or those of lateral branches) triangular to linear to lanceolate to elliptic, 1--22 mm long, 0.5--5 mm wide. Floral bracts opposite, triangular to linear-lanceolate to linear-oblong to elliptic, 1--23 mm long, 0.6--4.7 mm wide. Bracteoles triangular to linear-lanceolate, 0.6--21 mm long, 0.4--1.8 mm wide. Flowers subsessile to pedicellate, pedicels to 1.5 mm long. Calyx 5-lobed, 3.5--8 mm long, lobes linear-lanceolate to lance-subulate, equal to subequal, 2.8--7.5 mm long, 0.9--1.3 mm wide. Corolla yellow, cobralike in bud (i.e., erect but prominently curved near apex so that distal portion of bud is horizontal), 48--70 mm long, externally pubescent (particularly densely so at apex of bud), tube 24--33 mm long, subcylindric, only slightly expanded distally, 2.5--3.7 mm in diameter near midpoint, upper lip 23--37 mm long, entire to emarginate at apex, lobes to 0.2 mm long, lower lip 16--35 mm long, lobes 1--2 mm long, 0.7--1 mm wide. Stamens inserted a few mm proximal to mouth of corolla, 27--35 mm long, filaments glabrous, thecae 2.5--3.5 mm long, subequal, parallel to subsagittate, subequally inserted, unappendaged at base. Style 47--65 mm long, glabrous, stigma subcapitate, 0.2--0.3 mm long, inconspicuously 2-lobed. Capsule 16--23 mm long, stipe 6--11 mm long, head subellipsoid with a prominent medial constriction, 10--12 mm long. Seeds 4, lenticular, 3--3.2 mm long, 2.5--3 mm wide, surfaces roughened with \pm rounded or mound-like papillae evident, lacking trichomes.

This is the only acanth at La Selva with long (>6 cm) yellow corollas and inconspicuous bracts (*Barleria oenotherioides* has yellow corollas but large, conspicuous bracts and is known only from the Peje Annex).

Distribution. *Justicia aurea* occurs from southern Mexico through Central America to Panama. This plant is widely cultivated and it may now be difficult to determine its native range accurately. In Costa Rica, it is known from sea level to 2000m on both slopes although it has not been collected from Limon province or from the Osa region; it is especially frequently collected in Guanacaste. At La Selva, plants were formerly common along the LOC but have not been observed in recent years; in 2005 there is a plant cultivated in the comedor clearing.

Natural History. Flowers during the dry season. Pollinated by long-tailed hermit hummingbirds and nectar robbed by little hermits. These plants seem to fruit only very rarely at La Selva. The plants spread by cuttings when the path is cleared and trimmed branches are pushed out of trail.

2. *Justicia comata* (L.) Lam. Encycl. 1:632. 1785.

Erect to spreading to decumbent perennial herbs to 1 m tall (usually much shorter), often rooting at nodes; very diminutive in mowed places. Leaves sessile to short petiolate, the two to three pairs of leaves below infl. with auriculate bases, narrowly ovate to elliptic to lanceolate, 2.5--12 (-16) cm x 0.7--3 (-3.5) cm wide, acuminate at apex, attenuate to truncate to cordate-auriculate at base, surfaces and margin glabrous or sparsely pubescent with eglandular trichomes, margin entire. Inflorescence of axillary and terminal pedunculate panicles of spikes to 20 cm long (including peduncle and excluding flowers), axillary spikes or panicles usually whorled (to 5 per node) at base of infl., opposite in central portion of infl. and alternate distally, bracts subtending infl. branches lanceolate to subulate to triangular-subulate, 1--6 mm long, 0.3--1.4 mm wide, glabrous; spikes with flowers mostly alternate, \pm secund, sessile. Bracts reddish apically, subulate to triangular-subulate, 0.8--2.2 x 0.3--0.5 mm; bracteoles reddish apically, subulate to triangular-subulate, 0.7--2 x 0.2--0.5 mm; calyx 5-lobed, 1.5--3.5 mm long, lobes

lance-subulate, equal, 1.2--3 x 0.3--0.5 mm wide. Corolla white, upper lip suffused with lavender, lower lip with maroon chevrons, 5--7 mm long, tube cylindric, slightly inflated, 1--3 mm long, 1--1.7 mm in diameter near midpoint, upper lip 2-4 mm long, emarginate, lobes 0.1 mm long, rugulate within, the rugula ridges purple, lower lip 3--5 mm long, lobes 0.5--1.2 mm long, 0.4--1 mm wide. Stamens inserted just proximal to mouth of corolla, 1.8--3 mm long, thecae 0.3--0.5 mm long, unequal, nearly perpendicular, superposed, glabrous, lacking basal appendages. Style 2--3.5 mm long, sparsely pubescent with eglandular trichomes to nearly glabrous, stigma subcapitate, 0.1 mm long, lobes not evident. Capsule 3--4 mm long, stipe 1--1.7 mm long, seed bearing portion ovoid to subellipsoid to obovoid (often with a medial constriction), 2--2.7 mm long. Seeds 2--4, lenticular, 0.9--1.3 mm long, 0.9--1.2 mm wide, surfaces covered with knoblike papillae, margin fringed, minutely papillose.

Among La Selva acanths, *Justicia comata* could only be confused with *J. pectoralis* from which it differs in having sessile to very short petiolate leaves that tend to be auriculate, especially at nodes near inflorescences (versus petiolate and acute to rounded at base), inflorescence structure (dense, congested and at least lower nodes of inflorescence with whorled branches versus lax and with alternate or opposite branches), corolla size (to 7 mm versus 7.5-10 mm) and capsule length (3-4 mm versus 5.5-9 mm).

Distribution. Mexico south to Argentina, Antilles. In Costa Rica, the plants occur from sea level to 800 m (usually lower than 500m), essentially throughout. Plants of this species are very common along open trails through secondary forest and in clearings at La Selva; it frequently grows on stumps in the lab clearing. Plants respond to repeated cutting by flowering at a very diminutive size.

Natural History. Plants of this species seems to flower essentially year around at La Selva.

3. ***Justicia pectoralis*** Jacq. Enum. syst. pl. 11. 1760.

Erect to spreading to decumbent perennial herbs to 5 dm tall. Leaves subsessile to petiolate, petioles to 10 (-15 at lower nodes) mm long, blades ovate to lanceolate, 2.5--12.0 mm long, 5--25 mm wide, acuminate to acuminate-attenuate at apex, acute to sometimes obtuse or rounded at base, margin entire to subsinuate. Inflorescence of terminal (sometimes also axillary in distalmost pair of leaves) pedunculate panicles to 20 cm long, infl. branches alternate or opposite, peduncles to 50 mm long, infl. bracts often subfoliose, lance-subulate to subulate, 2--21 mm long, 0.3--1.5 mm wide, flowers alternate or opposite. Floral bracts opposite, subulate to narrowly lanceolate, 1.3--2.2 mm long, 0.3--0.4 mm wide. Bracteoles subulate, 1--2.3 mm long, 0.2--0.3 mm wide, abaxially glandular-puberulent. Flowers sessile to subsessile with pedicels to 0.5 mm long. Calyx 5-lobed, 2--3.5 mm long, lobes subulate, posterior lobe 0.6--1.5 mm long, 0.2 mm wide, other lobes 1.5--3 mm long, 0.3--0.5 mm wide, Corolla white to rose-pink to bluish-violet to purple with white and/or maroon markings on lower lip, 7.5--10 mm long, tube \pm expanded distally, 3.0--5.7 mm long, 1.2--1.4 mm in diameter near midpoint, upper lip 2.5--4 mm long, entire, lower lip 3--4.5 mm long, lobes 0.8--1.5 mm long, 1--2.5 mm wide. Stamens inserted ca. 1--1.5 mm proximal to mouth of corolla, 3--4 mm long, filaments glabrous, thecae 0.6--0.9 mm long, unequal, subparallel to parallel, equally to subequally inserted, separated by a \pm broad connective, glabrous, lacking basal appendages (although sometimes \pm apiculate at base). Style 4.5--7 mm long, stigma 0.3--0.5 mm long, lobes usually not evident (or 1 lobe rudimentary, to 0.1 mm long). Capsule 5.5--9 mm long, stipe 2--3.5 mm long, seed bearing portion subellipsoid with a medial constriction, 3.5--5.5 mm long. Seeds 4, lenticular, 1.2--1.8 mm long, 1.2--1.5 mm wide, surfaces and margin covered with prominent knoblike tubercles, lacking trichomes.

Among La Selva acanths, *Justicia pectoralis* could only be confused with *J. comata*. The characters distinguishing these two species are presented following the description of *J. comata*.

Distribution. Mexico south to Peru, Bolivia, Brazil, Antilles. In Costa Rica, the species is known from below 1000m on both slopes; it is not known from tropical dry forest. At La Selva, plants have mostly been collected in secondary areas near the developed parts of the reserve, and along the edges of trails running through fairly open areas. This species is much less frequently collected than *J. comata* and additional collections are necessary to understand the range of the species at LS.

Natural History. Plants of this species at La Selva flower during the dry season and into the early wet season (Jan-July).

4. ***Justicia refractifolia*** (O.Ktze.) Leonard, Publ. Field Mus. Natl. Hist., Bot. Ser. 18: 1232. 1938.

Erect herbs / shrublets to 0.8 m; stems usually unbranched; leaves oblanceolate, short petiolate, 11-21 (25) x 3-6.5 (8.5) cm, apex acute, base attenuate then rounded to acute, margins entire to undulate and sometimes revolute; infls. terminal and in axils of upper leaves, 1-4 per node, to 15 x 1 cm, one-sided, each fertile bract opposed by a sterile bract, bracts 8-13 mm long, 5-9 mm wide, ovate, imbricate, apically acute, drying brown; bracteoles 6.5-9 x 1.5-3 mm, lanceolate; calyx of 5 equal lobes, 6-9 mm long, lobes linear; corollas 11-13 mm long, tube 7-8 mm long, 1.5 mm wide, yellowish-green, upper lip erect, 4-5 mm long, 2 mm wide, apically 2-lobed; purplish at apex, outer surface furrowed, lower lip 4-5 mm long, 3-lobed, the lobes 2-2.5 mm long, obtuse, the middle lobe 2-2.5 mm wide, lateral lobes 1.5-2 mm wide, with purple in throat; stamens exserted to near tip of upper lip, filaments inserted just below the mouth, anthers strongly superposed, the upper theca mucronate, the lower theca spurred; style ca. 9 mm long, lying in rugula at anthesis, stigma infundibular; fruits clavate, 8-12 mm long, stipe 4-5 mm long, seed-bearing portion 3-7 mm long, ca. 4 mm wide and 2-2.5 mm thick, seeds to 4, irregularly orbicular, 1.5-2mm in diameter, flattened.

This is the only *Justicia* (two stamens with thecae superposed, no staminodes, rugula in upper lip of corolla) at La Selva with densely bracteate inflorescences. The bracteate inflorescences might lead to confusion with *Blechnum* (four bithecos stamens with parallel thecae, no rugula, small, subglobose fruit lacking stipe, plant of weedy areas) or with *Herpetacanthus* (leaves with distinctive looping venation near margin, four stamens, upper pair bithecos, lower pair monotheocous, no rugula).

Distribution. Costa Rica and Panama. In Costa Rica, the plants occur from sea level to 700m (usually lower than 400m), on both slopes in moist forest. At La Selva, plants of this species are common along edges and in second growth but are not especially weedy.

Natural History. At La Selva, plants of this species flower during the dry season and into the wet season (Feb-Aug).

5. ***Justicia sarapiquensis*** McDade, Syst. Bot. 7: 489-493. 1982.

Suffrutescent vine; lvs. petiolate, 4.5-7.7 x 2.2-3.5 cm, apically acuminate, basally obtuse to rounded or slightly cordate, margins entire. Infl. of lax, terminal panicles with up to 15 flowers; bracts subtending flowers borne singly or in pairs, ovate, magenta, 15-21 x 14-16 mm, apically obtuse; bracteoles two per flower, lanceolate, magenta, 16-19 x 6-10 mm, apically acute, glabrous; calyx of five equal lobes, 15-22 x 2-4 mm, white, apically acute and apiculate,

glabrous; corolla white, 6-5-7 cm long, externally pubescent with white pilose trichomes 1-1.5 mm long, the tube 38-40 mm long, 5-6 mm wide at the throat, upper lip erect, 23-26 mm long, apically acute, the lower lip slightly reflexed at anthesis, 27-29 mm long, apically 3-lobed, each lobe 2-3 mm long; stamens extending to just below the upper lip, anther cells slightly superposed, ca. 4 mm long; fruits clavate, dark brown, 15-20 mm long, the stipe 8-9 mm long, the seed bearing portion 8-11 mm long, constricted between seeds, somewhat flattened, 5-6 mm broad x 3-4 mm thick, glabrous; floral bracts, bracteoles and calyx retained and strongly reflexed when fruits are mature; seeds to 4, orbicular, flattened, 3-4 mm in diameter, glabrous.

This is a very distinctive plant and it is difficult to imagine confusing plants of *Justicia sarapiquense* with other plants that occur at La Selva (or anywhere else!).

Distribution. Endemic to Costa Rica. This species was first discovered at La Selva toward the back of the property in old forest; it has since been collected at multiple locations on the Atlantic slope of northern Costa Rica from the Cordillera de Guanacaste (Volcán Tenorio) to La Selva and lower Braulio Carrillo N.P.

Natural History. Plants have been collected in flower in all mos. except Jan, Aug, Oct, and Nov. Almost certainly pollinated by hummingbirds although studies of the reproductive biology of this species are lacking.

6. *Justicia trichotoma* (Kuntze) Leonard

Erect herbs to weak shrublets to 1 m but sometimes taller when supported by taller plants. Leaves with petioles to 3 cm long, leaves of a pair strongly unequal, the larger 5-11 x 2-4.5 cm, the smaller 2-5.5 x 1-2 cm, apically acuminate, basally attenuate, margins undulate; infls. in axillary few-flowered (ca. 4-6) cymes, peduncles to 2.7 cm long; bracts and bracteoles subulate, to 1.5 x 0.5 mm; flowers sessile, calyx five-lobed, segments to 7 mm long, 1 mm wide; corolla 16-20 mm long, the tube pale green, funnellform, 1.5 mm in diameter at base, expanding to 4 mm in diameter at the mouth, upper lip pale green, to 6 mm x 4 mm, apically acute and rounded, lower lip pale purple turning pale green internally into throat, to 7 mm long, 3-lobed, the lobes 3 mm long, middle lobe 2.5 mm wide, grooved, the lateral lobes 2 mm wide; stamens with filaments attached ca. 10 mm from base of corolla, free portions ca. 5 mm long, exerted nearly to tip of upper lip, thecae superposed on expanded connective, ca. 1 mm long, lower cells spurred; fruits clavate to 12 mm long, stipe 6 mm long, seed bearing portion 5-6 mm long, flattened, 2.5 mm broad, 1 mm thick; seeds 4, suborbicular, ca. 2 mm in diameter.

The strongly unequal leaves and growth form readily distinguish plants of *Justicia trichotoma* from other acanths at La Selva.

Distribution. Costa Rica and Panama. In Costa Rica, *J. trichotoma* is known from elevations below 700 m on the Atlantic slope from La Selva south. At La Selva, the plants are common along edges in second growth; they are especially common along the path that leads past the old Tosi house to the river on the comedor side of the river, around the old Chavarría homestead near the mouth of the El Salto with the Puerto Viejo and near the bat *Dipteryx* on the SOR just before the successional plots.

Natural History. Plants of this species seem to flower essentially year around at La Selva.

Louleridium S. Watson

Poorly known genus with about 10 species, distributed from northeastern Mexico to Panama; 1 species in Costa Rica.

Louteridium costaricense Radlk. & Donnell Smith, Bot. Gaz. (Crawfordsville) 37: 422. 1904.

Shrubs to 1.5 m tall; leaves petiolate, 21-32 x 9.5-15 cm, pale below. Infls. paniculate, pedunculate; bracts and bracteoles ovate-lanceolate 8-12 x 3-5 mm; flowers pedicellate, calyx of three segments, these narrowly elliptic, 2-4.5 cm x 1-2 cm; corolla pale green or yellow, 3.5 cm long, gibbous-saccate in throat, slightly bilabiate, the lobes nearly equal, 8-9 mm x 6-8 mm, gibbous in throat; stamens two, exserted, anthers 10-12 mm long, versatile; stigma exserted, equally two-lobed, the lobes 4-5 mm long; fruits narrowly clavate, 3-3.5 cm long, stipe ca. 1 cm long, seed bearing portion 1.8-2.2 cm long; seeds to 20, orbicular, flattened, 7-8 mm in diameter.

The three-merous calyx and large, pale-colored corolla with gibbous throat and two stamens will distinguish *L. costaricense* from all other CR acanths. Even in fruit, the large size of capsules restricts possible confusion to *Spathacanthus*, plants of which have a distinctive spathaceous calyx, tubular corolla lacking gibbous-saccate throat, and four stamens.

Distribution. Costa Rica and Panama. In Costa Rica, plants of this species have been collected from moist forests on mountain slopes from 100-1000m (usually above 500m), more or less throughout on the Caribbean slope, known only from Las Cruces (Puntarenas) on the Pacific slope. At La Selva, the plants occur only toward the southern extreme of the reserve, along the LEP, and Quebradas El Ceibo and Paralela. Collections are few, and range and phenology data may need revision.

Natural History. Fl Apr-Nov. Essentially nothing is known about the biology of these plants; floral morphology suggests bat pollination but studies are lacking.

***Mendoncia* Vell.**

(Genus and *M. retusa* contributed by T.F. Daniel & L.A. McDade)

Genus with ca. 60 species, distributed from southern Mexico to southern Brazil in the neotropics and in tropical western Africa and Madagascar in the paleotropics; 7 species in Costa Rica.

Herbaceous or woody twining vines lacking cystoliths. Leaves opposite, petiolate, margin entire. Inflorescence of 1 to several pedunculate flowers in axils of leaves. Bracteoles (= bracts of some authors) two, green, spathaceous, variously shaped and vestured, large (often equaling corolla tube), flat or keeled, valvate, often partially connivent or connate in bud, then clasping around flower, often widely spreading in fruit. Calyx inconspicuous, annular or cupular, entire to irregularly dentate or lobed. Corolla white externally (in ours, elsewhere also greenish, reddish, and purplish), with colored markings on internal surfaces of lobes and throat, tube cylindrical to ± gradually expanded distally, limb subequally 5-lobed or bilabiate with the upper lip 2-lobed and lower lip 3-lobed, corolla lobes contorted in bud, spreading or reflexed in anthesis. Stamens 4, didynamous, included in corolla tube, anthers 2-theous, thecae subequal to unequal in size, parallel, equally to subequally inserted, lacking basal appendages although ± pubescent at base, often with an apical elongation of connective, dehiscing longitudinally or by subapical pores or slits. Style included in corolla tube or slightly exserted from mouth of corolla,

stigma subfunneliform or subequally to unequally 2-lobed. Fruit drupaceous, ovoid to ellipsoid, mesocarp fleshy, endocarp osseous, retinacula absent. Seeds 1, subellipsoid.

In many species of *Mendoncia*, the bracts continue to elongate such that those subtending fruits are larger than those subtending flowers. Unless noted, all measurements reported here are for flowering bracts (maturity of fruits is difficult to assess on herbarium specimens such that data on size of bracts subtending mature fruits is not easily taken).

1. Stems and bracts glabrate or with scattered sparse white trichomes, hairs lacking stellate bases, young stems usually minutely winged. *M. retusa*
1. Stems and especially bracts strigose to pilose with brown trichomes, hairs of upper leaf surface from stellate bases; young stems unwinged. 2
2. Bracts elliptic, (flowering) 3-4 cm long (usually ca. 3.5 cm) and 1.3-1.6 cm wide, truncate to abruptly rounded and apiculate at apex; corolla about 4.5 cm long. *M. tonduzii*
2. Bracts ovate, (flowering) 1.4-1.8 cm long, 0.8-1.1 cm wide, rounded and apiculate at apex; corolla 2.5-3 cm in length. *M. costaricana*

The ecology of *Mendoncia* species is essentially unstudied, including pollination and dispersal ecology. The developing flowers of *M. retusa* (and likely the other species) are held immersed in liquid within the connivent bracts and reports suggest that this may be the case for immature fruits as well. The source and nature of the liquid have not been studied.

1. ***Mendoncia costaricana*** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1854: 113. 1855.

Suffrutescent vine; young stems quadrangular, strigose to sericeous, hairs appressed upward; leaves with strigose to sericeous petioles (0.5-)1-1.7 (-2) cm long; laminae ovate to elliptic ovate to elliptic, 5-12.5 x 3.5-8 cm, apically rounded to acute to acuminate, often with a mucro to 2 mm long, basally rounded to obtuse, margins entire, the veins prominent, 3-4 pairs, sparingly strigose above, hairs emerging from stellate bases, strigose below; inflorescences of 1-2(-4) axillary flowers, pedicels 1.2-1.5 (-2.0) cm long, strigose to sericeous; bracteoles elliptic to ovate, entire, in flower 14-20 x 8-12 mm wide (wider in fruit), apically rounded and apiculate, basally rounded, strigose to sericeous externally; flowers with calyx reduced to an entire membranous cup, glabrous; corolla tube white, funneliform, ca. 3 cm long, basally 3 mm broad, expanding to ca. 6 mm broad at the throat, the throat dark reddish brown-purple with white veins, oblique, the upper lip extending ca. 1 cm longer than lower lip, the lobes 5-6 x 4-5 mm, shallowly emarginate, the tube glandular puberulous inside below the stamens, remainder of corolla glabrous; stamens included; style extends to near mouth of corolla, stigma unequally bilobed, fruits ovoid 1.7-2 cm long, purple-black and fleshy at maturity.

Plants of this species have sometimes been referred to *M. gracilis* Turrill which was described from Colombian material. Study of the types of both species indicates that Costa Rican plants are consistent with *M. costaricana* and further suggests little basis for distinguishing *M. gracilis* from *M. costaricana*.

Compared to both of the other species of *Mendoncia* at La Selva, *M. costaricana* has smaller bracts and flowers. Plants are more pubescent than those of *M. retusa* (which are essentially glabrous) and not as densely so as those of *M. tonduzii* (which have dense tawny trichomes on most structures). This species is apparently much less common than the other two as collections are few. In Feb. 2005, we searched localities from which it has been collected with no success.

Distribution: Costa Rica and Panama, perhaps extending into Colombia but comparative studies are needed. In Costa Rica, the species is known from mid to low elevation forests in Alajuela, Cartago (but not collected from this province since Oersted described the species), San Jose, Heredia (La Selva and environs) and in the southern half of Puntarenas province. At La Selva, plants are known from trees along the Sarapiquí, the former West boundary trail, between 1100 and 1200 m and along the south boundary; more collections are needed to understand the distribution of the species.

Natural history. Flowering specimens (most also with fruits) collected in Feb-Apr and Sep-Nov.; fruiting specimens in these months and additionally in July.

2. *Mendoncia retusa* Turrill, Kew Bull. 1919:423. 1919.

Perennial vine. Young stems quadrate with angles often minutely winged, at first evenly pubescent with appressed eglandular trichomes 0.2--0.5 mm long, internodes soon glabrate. Leaves petiolate, petioles 1.5-3.0 (- 3.8) cm long, blades ovate to elliptic to obovate, 6.7—14.0 x 3.2—6.8 cm wide, rounded to acute at base, acute to acuminate (rarely rounded) and apiculate at apex, surfaces sparsely pubescent with cauline type trichomes, trichomes sparse and mostly restricted to major veins at maturity, margin entire; flowers usually 1 per leaf axil, peduncles to 36 mm long, sparsely pubescent with cauline type trichomes or nearly glabrous. Bracteoles ovate to elliptic, 17--35 mm long, 11--18 mm wide, abaxial surface glabrous or nearly so (i.e., with a few scattered antrorsely appressed eglandular trichomes 0.2--0.3 mm long) or puberulent (i.e., with inconspicuous erect eglandular trichomes 0.05--0.1 mm long), adaxial surface mealy-glandular, (rounded- to) retuse-apiculate at apex, margin connivent when young, ciliate with antrorsely appressed eglandular trichomes 0.2--0.5 mm long. Calyx a small rigid entire often flaring annular or cupular ring, 1--1.5 mm long. Corolla white with purplish markings internally, 30--55 mm long, externally glabrous, tube 18--39 mm long, distally expanded, upper lip 6--8 mm long, lobes rounded, reflexed, 4--7 mm long, 4.5--6.5 mm wide, lower lip 10.5--12 mm long, lobes rounded, reflexed, 6--10 mm long, 3--9 mm wide. Stamens didynamous, with filaments adnate to the corolla tube and evident via a prominent ridge, filaments short, intergrading with connective, thecae 5--8.5 mm long, each dehiscent by a short apical slit or pore, densely pubescent at base with a tuft of stout eglandular trichomes, connective projecting 1.2 mm beyond thecae, triangular, very sparsely pubescent with glandular trichomes 0.1 mm long or glabrate; staminode, if present, not seen. Style 17--35 mm long, stigma asymmetrically funnelliform to subequally 2-lobed, lobes 0.5--1.6 mm long. Drupe greenish turning blackish purple when mature, oval, 11--18 mm long, 7--14 mm in diameter, nearly terete, surface minutely mealy-glandular. Seed 1.

Mendoncia retusa may be distinguished from the other two species of *Mendoncia* by its young stems that are square and minutely winged on the ridges (versus lacking wings), essentially glabrous stems, leaves and bracts (except youngest leaves and stems, trichomes on young leaves lacking stellate bases); and bracteoles that are retuse (rarely blunt/truncate). Bracteoles are intermediate in size between those of the other two species of *Mendoncia* at La Selva.

Distribution: Mexico through Central American to Panama. In Costa Rica, the species occurs in moist primary forest and edges, usually below 500m, often higher in Guanacaste, on both slopes more or less throughout except SW CR. At La Selva, this appears to be our most common species, at least near the developed parts of the reserve; it has been collected between the lab clearing and the River station, along the trail to the arboretum, along the STR from near its origin to 2500m, and along the SAZ (100m).

Natural history. Flowering plants have been collected or observed during much of the year at La Selva (Jun-Nov, Feb, Apr).

3. ***Mendoncia tonduzii*** Turrill, Kew Bull. 413. 1919 (type from Tucurrique, CR).

Woody vines with old stems developing corky ridges, young stems quadrangular, densely pilose, hairs 1-1.5 mm long, tawny, especially dense on the angles; leaves with petioles to 3 cm long, densely pubescent, with tawny hairs, laminae elliptic to elliptic-ovate, 7-16 cm x 5-8.3 (-10) cm, apically short acuminate, often with an apicule to 2 mm long, basally acute to rounded, margins entire, pilose hairs from stellate bases above, more densely pilose below. Flowers solitary to 3 (rarely more) in the axils of upper leaves, peduncles 1.8-4.5 cm long, pilose; bracts oblong to oblong-elliptic, (3.5-)4.2-4.7 x 1.3-1.8 (-2) cm, apically rounded and with a distinct mucro, basally rounded, densely pilose, hairs tawny to 2 mm long; calyx a pale green disk ca. 2 mm tall; corolla tube, lobes and throat white to cream, with sparse pale reddish markings on internal surfaces of lobes, 4.5-5.5 cm long, 8-11 mm broad at the throat, throat oblique, upper lip extends beyond lower such that tube measured dorsally ca. 1 cm longer than tube measured ventrally, tube somewhat flattened laterally, sigmoidal (i.e., curved ventrally from base then arching dorsally to throat), 9 mm wide at base, 5 mm wide at narrowest point, 11 mm wide at throat (all measured dorsiventrally), the lobes equal, shallowly lobed to emarginate, spreading to recurved at anthesis, 9-12 mm long, 8-12 mm wide, glabrous; stamens didynamous, with filaments adnate to the corolla tube and evident via a prominent ridge, free portions ca. 3 mm long (lower pair), 1 mm long (longer pair), longer pair with thecae extending 3-4 mm beyond shorter pair, thecae 7--9 mm long, each dehiscent by a short apical slit or pore, densely pubescent at base with a tuft of stout eglandular trichomes more like tubercles, connective projecting 2-3 mm beyond thecae, triangular, no staminode; style 42 mm long, stigma subequally 2-lobed, lobes 1--2 mm long; fruit purplish black at maturity, ca. 2 cm long, nearly terete, ca. 1.7 cm wide and thick, densely minute puberulous. Seed 1, flattened.

Plants of *M. tonduzii* have far denser pubescence of far longer, markedly tawny trichomes than those of the other two species at La Selva. Bracts are longer (>3.5 versus <3.0 cm) and rectangular with an abruptly short acuminate apex (versus ovate to elliptic in the other two species). Plants of this species are apparently woodier, with marked development of corky bark on older stems; however, growth form of all species of *Mendoncia* merits further study.

Distribution: Costa Rica and Panama. In Costa Rica, plants of this species occur in moist forests below 1100m, on both slopes more or less throughout. At La Selva, the plant has been collected or observed in woods along the Sabalo – Esquina at the north end of the successional plots, along line 1000 on the SW trail, around the lab clearing, and along the SAZ (100 m).

Natural History: Most flowering specimens have been collected Jun-Aug, also Feb, Mar. Elsewhere, flowering specimens have been collected May-Oct.

***Odontonema* Endl.**

Genus with ca. 30 species restricted to the New World tropics and subtropics; 1 species is native to Costa Rica and an additional species is very widely cultivated and seems to be escaping in some locations.

Erect perennial herbs or shrubs (in ours, elsewhere rarely, and perhaps erroneously, reported as lianas) with cystoliths. Leaves opposite, sessile to petiolate, margin entire to crenate. Inflorescence of mostly terminal loose to dense sometimes basally branched spikes, racemes, or thyrses; individual cymes alternate to opposite to whorled, 1--18 or more-flowered, variously contracted or expanded along the length of the infl., sessile or pedunculate, subtended by a bract. Bracts subopposite, opposite, or whorled, green or colored, usually \pm inconspicuous, margin entire. Flowers heterostylous, usually pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes equal in length. Corolla infundibular, red (in ours, white, yellow, purple, or pink in other species), tube usually expanded distally into a prominent throat, limb subactinomorphic to bilabiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 2, thrum stamens exerted from mouth of corolla, pin stamens usually included in corolla tube, anthers 2-theous, thecae equal in size, parallel, equally inserted, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); staminodes 2. Thrum style included in corolla tube, pin style exerted from mouth of corolla, stigma \pm funnellform or 2-lobed, lobes equal or unequal in length. Capsule stipitate, head obovoid to subellipsoid (often with a medial constriction), retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 4, homomorphic, lenticular, lacking trichomes.

Cauline leaves with petioles \leq 4 mm, leaf bases crisped, at least near apex of plant; calyx lobes 3-4 mm long; corolla 6-8 mm wide at lip; native plants of forest edges. *O. tubaeforme*
Cauline leaves with petioles to 15 mm long, leaf bases smooth; calyx lobes < 1.5 mm long; corolla very narrow, only 3-3.5 mm wide a lip; cultivated plants remaining at abandoned homesites and escaping along disturbed edges. *O. cuspidatum*

1. ***Odontonema tubaeforme*** (Bertol.) Kuntze, Revis. gen. pl. 2:494. 1891.

Shrubs to 3 m tall. Leaves subsessile to petiolate, petioles to 4 mm long, blades ovate to elliptic to obovate-elliptic, (4.7--) 15.5--34 cm long, (1.6--) 6--14 cm wide, margins entire to crenulate, acuminate to falcate at apex, abruptly acute to attenuate at base. Inflorescence of loose terminal pedunculate dichasiate racemes to 600 mm long, dichasia mostly whorled, 1--3 or more-flowered. Bracts lanceolate to lance-subulate, those near middle of inflorescence 2.5--5.5 mm long, 1--1.5 mm wide. Bracteoles and secondary bracteoles lance-subulate, 1.5--3.5 mm long, 0.5--0.6 mm wide. Flowers pedicellate, pedicels 2--6 mm long, pubescent like rachis. Calyx dull red, 2--4 mm long, tube 0.5--1 mm long, lobes subulate, 1.5--3 mm long, 0.6--1 mm wide. Corolla red, 24--33 mm long (including upper lip), externally glabrous (although margins of lobes ciliolate), tube 20--27 mm long, basal portion 11 x 1.5-2 mm, the expanding expanded distally into a distinct throat, 9--13 mm long, 3.2--6 mm in diameter (measured pressed), upper lip 4--8 mm long, lobes rounded, 2--6 mm long, 1.5--3.8 mm wide, lower lip 4--8 mm long, lobes elliptic to suborbicular, 4--7 mm long, 2.5--4.5 mm wide. Thrum stamens with filaments attached ca. 11-15 mm from base of tube, free portions 12--15 mm long, extending to within 2-3 mm of tip of upper lip, pin stamens with filaments 6.5--8 mm long, thecae 2--2.8 mm long; staminodes 1--4 mm long. Ovary pale yellowish green, ca. 3 mm long; thrum style 10--16 mm long, pin style 22--26 mm long, the style usually proximally pubescent with eglandular trichomes, stigma 2-lobed, lobes 0.2--0.4 mm long. Capsule 17--23 mm long, glabrous, stipe 7--11 mm long, head 10--13 mm long. Seeds subcircular to subelliptic to broadly obovate in outline, 4--5 mm long, 2.5--3.5 mm wide, surfaces bumpy to tuberculate.

Plants of *O. tubaeforme* have leaves that are nearly sessile, especially on distal parts of the stem, calyx lobes that are 3-4 mm long (versus < 1 mm long), and a corolla that is more ampliate in the throat than *O. cuspidatum*,

Distribution. Mexico to Panama. In Costa Rica, the plants occur from sea level to 1700m (but usually below 1000m) both slopes except in tropical dry forest. At La Selva, plants are fairly common along trails through secondary forest areas near the developed part of the reserve (e.g., the SER toward the successional plots and along the trail toward the arboretum) and along streams in primary forest (e.g., the El Salto where crossed by the CC).

Natural History. Flowers during the dry season. Likely pollinated by hummingbirds but data are lacking.

2. ***Odontonema cuspidatum*** (Nees) Kuntze, Revis. Gen. Pl. 2: 494. 1891

Shrubs to 5 m tall; young stems quadrate to quadrate sulcate, sparsely pubescent, soon glabrate; lvs. with petioles to 30 mm long, ovate-elliptic to elliptic to obovate-elliptic, 4-31 x 1.5-13 cm, 1.7-5.6 x longer than wide, acuminate to falcate apically, acute to attenuate at base, surfaces pubescent as stems to glabrate; infls. of loose to dense terminal pedunculate often basally branched racemes of cymes to 50 cm long; cymes opposite, 1-3 or more flowered, usually pedunculate, peduncles to 2.5 cm long; bracts lance-subulate to subulate to triangular, those near middle of inflorescence 15-2.5 (-6) x 0.7-1.5 mm; bracteoles and secondary bracteoles triangular to triangular-subulate, 0.7-1.5 x 0.5-0.8 mm; flowers with pedicels to 2.5-15 mm long; calyx 2-5.5 mm, tube 0.8-11 mm long, lobes lanceolate to triangular 1-5 mm x 0.8-1.3 mm; corolla red, tube ca. 27 mm long, narrow basal portion ca. 15 mm x 1-2 mm, then expanded slightly to ca. 3 mm wide at mouth, upper lip oriented as tube, 5 x 5 mm, bilobed, lobes ca. 2.5 x 1.5-2 mm, lower lip perpendicular to tube, 3-lobed, lobes elliptic, 5 x 4-5 mm, subequal, lateral lobes slightly narrower; stamens of pin flowers with filaments attached 17-19 mm from base of tube, free portions 2.5-3 mm long, stamens of thrum flowers with filaments attached 24-25 mm from base of tube, free portions 7-9 mm long, thecae 2.3-3.5 mm long, staminodes ca. 1.5 mm long; style of pin flowers 26-28 mm long, style of thrum flowers ca. 21 mm long, distal portion of style pale reddish, stigma terminal, shallowly infundibular, fruits 16-27 mm long, stipitate, stipe 7-11 mm long, seed bearing portion 9-16 mm long; seeds subcordate to subrectangular in outline, 2.9-4.2 mm long, 2.2-3.7 mm wide.

Distinguishing features are noted in the key and following the description of *O. tubaeforme*.

Distribution. Native to the Antilles, this species is widely cultivated; it sometimes persists and seems to spread modestly after being abandoned. Collections from Costa Rica are few and from scattered localities. At La Selva, the species seems to have been cultivated at one or more of the (now abandoned) houses along the Ríos Puerto Viejo and Sarapiquí. It now occurs as well at spotty locations along the STR.

Natural History. Plants are reported to flower during most months of the year.

***Razisea* Oersted**

A small Central American to Colombian genus with five described species all of which are known from Costa Rica; 3 species at La Selva.

Sparsely branching shrubs to 2.5 m tall; leaves petiolate except those subtending the inflorescence which are frequently sessile or subsessile; laminae elliptic to ovate or lanceolate, cystoliths dense and prominent on both surfaces of dried specimens. Inflorescence racemose to thyrsoid, mostly terminal, sometimes branched; flowers sessile or pedicellate; bracts and bracteoles small, not distinctively colored, and inconspicuous. Flowers with 5-merous calyx, tube short, calyx lobes equal; corolla apically rectangular in bud, bilabiate, the upper lip narrow,

the lower lip barely distinct from tube, broad and shallowly trilobate; stamens 2, exserted, the filaments flattened, the anthers 1-celled; style exserted, the stigma capitate to deltoid. Fruit capsular, clavate, 4-seeded.

Razisea has been circumscribed to include plants with two monothecate stamens and highly reduced corolla lips (the upper is usually elliptic to strap-shaped and much shorter than the tube, the lower consists of very short lobes scarcely distinct from the tube). Among the three species at La Selva, *R. spicata* is rare but is otherwise the most wide-ranging member of the genus. In fact, the three species at La Selva seem to be clearly distinguished but differences are subtle and the taxa should be studied in terms of reproductive biology and barriers to interspecific gene flow. Phylogenetic work indicates that this very small genus is part of a larger monophyletic group that includes *Hansteinia*, *Habracanthus*, *Kalbreyeriella* and *Stenostephanus* in the New World, with the last name having priority. Recombinations will be made shortly as we finalize the treatment of Acanthaceae for the *Manual de Plantas de Costa Rica*.

1. Corolla tube > 4 cm long, upper lip 8-11 mm long. *R. spicata*

1. Corollas <4 cm long, upper lip to 6 mm long 2

2. Stems, undersurfaces of leaves and rachis densely pubescent, the trichomes septate, erect and twisting, >1 mm long; calyx lobes (5) 8-10 mm long; corolla tube 33-40 mm long; low suffrutescent plant of primary forest. *R. villosa*

2. Stems and leaves sparsely pubescent, rachis more densely so, trichomes <0.5 mm long, appressed; calyx 4-5 mm long; corolla tube 25-28 mm long; sparsely branched small shrubs of secondary areas, trailsides, old cacao. *R. wilburii*

1. ***R. spicata*** Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854: 142. 1855.

Shrubs to 3 m tall; stems glabrous to sparsely to densely pubescent with trichomes <0.5 mm long; leaves petiolate, petioles 1-4 (8.5) cm long, glabrous; laminate elliptic to ovate, 9.5-30 (37) x 3.5-14 (18) cm, apically acuminate, basally attenuate, acute, obtuse, rounded or (rarely) cordate, margins entire to crenate, glabrous above, glabrous to sparingly pubescent along the costa and veins beneath, cystoliths dense and prominent on both surfaces; inflorescences in terminal racemes or few-branched panicles of racemes, peduncles 3-8 cm long, often with a pair or two of distantly spaced leaf-like bracts below fertile nodes, fertile portion to 32 cm long, rachis glabrous or sparsely to densely pubescent with eglandular trichomes <0.5 mm long, flowers numerous, solitary or in fascicles of 2-10 at opposite nodes, pedicels 2.5-13 mm long, subtended by a bract and two bracteoles, bracts 4-10 x 1-2 mm long, puberulous, bracteoles similar but smaller; flowers with 5-merous calyx, often red or tinged red, calyx tube 1-2 mm long, lobes linear 4-9 x 0.75-1 (at base) mm, glabrous to sparsely pubescent; corolla bright red, often lighter colored at apex especially in bud, gradually expanded from 1.5-2 mm at base to 9-14 mm at throat (pressed), curved, the tube 3.9-4.8 cm long, glabrous, upper lip erect, narrowly elliptic, often erose at apex, blunt, 8-12 x 4-5.5 mm, the lower lip forming an oblique angle with the tube, minutely 3-lobed, lobes 1.5-2 mm long, stamens exserted 10-20 mm beyond the tip of upper lip, filaments red, free portions ca. 4.5 cm long, glabrous, anthers 3-5 mm long, style red, filiform, extending 18-30 mm beyond the tip of upper lip, always extending beyond stamens, stigma capitate to deltoid, fruits clavate, 20-25 mm long, stipe 13-15 mm long, seed-bearing portion 9-10 mm long, 4-5.5 mm broad, 3-4 mm thick, slightly invaginated between pairs of seeds, glabrous, seeds orbicular, 2.5-3 mm in diameter, tuberculate.

Compared to the other two species of *Razisea* at La Selva, plants of *R. spicata* are of larger stature and have longer corollas. Corollas of *R. villosa* may be nearly as long, but plants of this latter species are villose with multicellular trichomes 1-2 mm long. Corollas of *R. wilburii* are about half as long as those of *R. spicata*.

Guatemala south to Colombia; in Costa Rica widespread, low elevation to nearly 2000m essentially throughout except not occurring in tropical dry forest; at La Selva, only one collection has been made that is definitively of this species: Hammel 7974, along Sura trail from arboretum to station.

Plants flower during the dry season and are pollinated by hummingbirds although studies of reproductive biology are lacking.

2. **R. villosa** Gómez-Laur. & Hammel, Novon 4: 357. 1994.

Herbs 25-70 (120) cm tall; stems quadrangular, villose with curling, multicellular 1-2 mm long trichomes; internodes 3-7 cm long; petioles 1-20 mm long, villose; laminae elliptic 15-29 x 5-8.5 (15) cm with ca. 11 pairs of secondary veins, apically acuminate, basally short attenuate to cuneate, margins undulate, villose on both surfaces; infl. a terminal raceme or few-branched panicle of racemes, peduncle to 12 cm long, often with a pair or two of distantly spaced leaf-like bracts below fertile nodes, fertile portion 11-42 cm long, many-flowered, flowers 1-3 (-5) at opposite nodes, rachis villose, pedicels 3-10 mm long; bracts 5-8.5 mm long, subulate, glabrous; bracteoles similar to bracts; calyx 5-merous, (6.5) 9-11 mm long, tube ca. 1 mm long, segments equal, subulate, (5.5) 8-10 mm long, glabrous; corolla bilabiate, arched, tube 3.3-4 cm long, red, glabrous, throat 5-7 mm in diam, upper lip 5-7 mm long, straight, acute, lower lip shallowly 3-lobed, lobes ca. 1 mm long; stamens 2, exserted 5-12 (17) mm beyond tip of upper lip, filaments inserted ca. 15 mm from base of tube, free portions ca. 35 mm long, flattened, glabrous, anthers monothebate, theca 3-3.5 mm long; ovary glabrous, style exserted 8-14 (-20) mm beyond tip of upper lip, glabrous, stigma capitate, sometimes borne below or among the anthers; fruit clavate, 18-20 mm long, stipe 10-11 mm long, seed bearing portion 8-9 mm long, 4-5 mm wide, 3.5 mm deep, violin shaped (i.e., invaginated between pairs of seeds), glabrous; seeds more or less deltoid, 2.2-2.5 x 1.8-2.2 mm, papillose-tuberculate throughout.

Plants of this species have corollas intermediate in length between *R. spicata* and *R. wilburii*; stems and leaves villose (versus nearly glabrous to sparsely pubescent in the other two species), and are of small stature. At La Selva, these are plants of swampy and wet areas along streams in primary forest; they have been collected along the SSE / SHO trails, CC and CCL where these trails cross wet areas. Also known from Rara Avis, Parque Nacional Braulio Carrillo, Limon and Puntarenas (Osa area) provinces.

Flowers mainly in the wet season but flowering collections have also been made in Jan, Feb and April. Presumably pollinated by hummingbirds.

3. **Razisea wilburii** McDade, Systematic Botany 7: 493. 1982.

Sparsely branched shrubs to 1.5m tall; stems glabrous to sparsely pubescent, mostly along 2 lines, trichomes <0.5 mm long (a few plants have scattered trichomes characteristic of *R. villosa*: septate, reddish), leaves petiolate (except the pair immediately subtending the infl sessile), petioles 1.5-11.5 cm long, young leaves sometimes reddish beneath, glabrous to sparsely pubescent especially on veins beneath, laminae ovate to elliptic or obovate, 12-25 x 5-12 cm, apically acuminate, basally acute to obtuse, margins entire to crenate, glabrous above, moderately puberulous on costa and veins beneath, cystoliths dense and prominent on both surfaces; inflorescences in terminal racemes borne single or to 5; peduncles 4-7 cm long, often with a pair or two of distantly spaced leaf-like bracts below fertile nodes, fertile portion to 25 cm long, peduncles and rachis pubescent like stems although sometimes more densely; flowers numerous, borne single or in fascicles of 2-3 at opposite nodes, these lax in proximal portions of infl., dense in distal portions, pedicels 2.5-6 mm long, sparingly puberulous; bracts subulate, 5-7

mm x 1-1.5 mm, ciliolate, bracteoles similar but smaller, borne along the pedicel; flowers with a 5-merous calyx 4.5-6.5 x ca. 1 mm, tube 0.5-1 mm long, segments 4.5-5.5 x 1 mm, green; corolla bright red, narrowly funnelform, tube 2.5-2.8 cm long, 1.5-2 mm wide at base, gradually expanded to 4-5 mm wide at throat, curved, upper lip follows same plane as tube, 4-6 mm long, unlobed, lower lip barely differentiated from tube, truncate, very shallowly 3-lobed, lobes <1 mm long, stamens exserted 3-10 mm beyond tip of upper lip, filaments attached 11-12 mm from base of tube, free portions 28-29 mm long, white below, distal portions red, anthers monotheate, thecae 2.5-4 mm long; style 38-40 mm long, extending 4-8 mm beyond tip of upper lip, usually borne below or among the anthers, white below, distal portion reddish, stigma capitate; fruits 17-21 mm long, clavate, stipe 7-11 mm long, seed bearing portion about 10 mm long, violin shaped (i.e., invaginated between pairs of seeds), flattened, 3-4 mm wide, ca. 3 mm thick; seeds to 5, 2.5-3 mm in diam, covered with irregularly shaped tubercles.

This species is distinguished from *R. spicata* most clearly by having a corolla of about half the size and from *R. villosa* by stems and leaves glabrous to sparsely pubescent. It is the most commonly seen and collected species of *Razisea* at La Selva as it occurs along edges and in secondary growth near developed areas of the reserve (e.g., along SOR between the CCL and the successional plots, along El Sura trail between the developed areas of the reserve and the arboretum and along STR).

Pollinated by Little hermit hummingbirds (McDade, pers. obs.).

***Ruellia* L.**

Genus with more than 250 species distributed pantropically and with a few species extending into temperate regions of both hemispheres; about 20 species are native to Costa Rica.

Decumbent to erect subcaulescent to caulescent perennial herbs or shrubs, vegetative and floral surfaces sometimes glandular-punctate, glands mostly 0.05--0.2 mm in diameter. Leaves opposite, sessile to petiolate, margin entire to sinuate to crenate. Inflorescences extremely variable in structure among species. Floral bracts opposite, green (in ours), margin entire (in ours). Flowers usually subtended by 2 isomorphic bracteoles (sometimes absent or vestigial). Calyx deeply 5-lobed, lobes homomorphic or heteromorphic, equal to unequal in length. Corolla blue-purple, lavender or white (in ours, elsewhere also red, yellow or blackish), generally concolorous, sometimes with whitish or greenish markings, tube usually funnelform, often curved, gradually or abruptly expanded distally into a \pm distinct throat (rarely saccate), limb bilabiate (sometimes subactinomorphic), upper lip 2-lobed, lower lip 3-lobed, corolla lobes contorted in bud. Stamens 4, usually didynamous, usually inserted near base of corolla throat, included in corolla tube or exserted from mouth of corolla, anthers 2-theous, thecae equal in length, parallel to subsagittate, equally inserted, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); staminodes 0 or 1. Style included in corolla tube or exserted from mouth of corolla, stigma 2-lobed, lobes equal or unequal, often with 1 lobe greatly reduced, rudimentary, or not evident. Capsule substipitate or stipitate, head terete or compressed, narrowly ellipsoid to broadly ellipsoid to subglobose to obovoid, retinacula present. Seeds 4--20 per capsule, lenticular, pubescent with hygroscopic trichomes (sometimes restricted to margin).

1. Corolla < 4 cm long, lavender to pink (often with the tube white); plants of disturbed areas. 2
1. Corollas > 7 cm in length, pure white; plants of mature forest understory. 3

2. Leaves usually variegated gray and green above, purple below, but some plants with uniformly green leaves; flowers in axillary cymes with peduncles to 23 cm long, bracts and bracteoles < 5 mm long, inconspicuous. *R. biolleyi*

2. Leaves solid green; inflorescences axillary and terminal, essentially sessile in axils of leaves, clusters of 3-5 flowers subtended by full-sized leaves at lower nodes, these decreasing in size to linear bracts about 1.5 cm x 1.5 mm at most distal nodes of inflorescence. *R. metallica*

3. Young stems densely pubescent, the trichomes about 1.5 mm long; leaves lacking glandular dots below; calyx lobes 2.5-3 cm long; narrow, basal portion of corolla tube 3.8-5.0 cm long; swamps and water-logged soils. *R. palustris*

3. Young stems glabrous or with a few short trichomes; leaves with glandular dots below; calyx lobes 4-6 mm long; narrow, basal portion of corolla tube 3.0-3.5 cm long; along streams. *R. tubiflora*

1. ***Ruellia biolleyi*** Lindau, in Anales Inst. Fis.-geogr. Nac. Costa Rica 9:188. 1898 and in Pitt., Prim. fl. costaric. 2: 301. 1900.

Herb to 1 m (occasionally taller when supported by a taller plant), stems quadrangular, sharply angled or slightly winged, wooly to villous when young; lvs petiolate, petioles 2-4 (5.5) cm long, laminae elliptic to obelliptic, (5)10-18 x (3) 4-6 cm, apically short attenuate, basally acute to short attenuate, margins entire to undulate, pale green to gray regions along margin above, purplish below; infls. of axillary cymes of ca. 9-ca.20 flowers, peduncles 15-30 cm long, sometimes longer, quadrangular and narrowly winged, sometimes branching again at summit of primary peduncle, ultimate infl units of 3-flowered cymes, these sometimes several and short pedicellate such that flowers appear densely clustered, pedicels 2-4 mm long, densely glandular pubescent; paired bracts at each node of inflorescence, basal, largest pair 8-10 x 2-3 mm, oblanceolate, reduced in size until paired bracteoles subtending pedicels, triangular, 1-2 x 1 mm; calyx (in flower) 4-5 mm long (central flower of a cyme sometimes with markedly longer calyx, 6-8 mm long), basal tube 1-2 mm long, lobes 2.5-4 mm long, one slightly longer, densely glandular pubescent; corolla 18-22 mm long (excluding lobes), basal narrow portion of tube 10-12 mm long, 1 mm wide, then ampliate gradually to 8-10 mm in throat, ampliate portion of tube 8-10 mm long, often bent at transition point between narrow and ampliate portions of tube, greenish white, lobes suffused pink to purple, nearly equal, 4.5-5.5 x 4-4.5 mm, emarginate, basal portion of tube densely glandular pubescence, expanded portion less densely so; stamens 4, didynamous, included, filaments attached at end of narrow portion of tube, free portion of shorter to 3mm long, free portion of longer to 4 mm long, bithecous, thecae 2.5-3 mm long; style extends beyond anthers nearly to tip of upper lip, stigma unequally bilobed; fruit clavate, 20-22 mm long, stipe (9)12-14 mm long, green with purple splotches, seed bearing portion green (imm) to dark purple, orbicular and apiculate, glandular pubescent, 7-8 mm long, slightly flattened, 4-5 mm wide, 3-4 mm thick, seeds to eight, orbicular, 2.5-3 mm in diameter, at nearly the same vertical position in fruit (i.e., seed bearing portion barely longer than diam of one seed). Seeds with sparse trichomes on face, dense on margins.

This is our only *Ruellia* with long pedunculate inflorescences. Most plants have leaves that are gray/green variegated above and often purplish below; these are unique among acanths at La Selva. However, we have observed plants with green leaves intermixed with plants with variegated leaves so these leaf traits are apparently not fixed among plants of this species.

Distribution. Nicaragua, Costa Rica and Panama. In Costa Rica, the plants occur below 1000m (usually below 100m) on the Caribbean slope from Arenal to southern Limon. At La Selva, this species occurs along trails in relatively open areas in the forest, and under old cacao and in secondary forests near the developed parts of the reserve. In 2005, there were large patches of plants along the CC where it crosses the El Salto and along the STR near its intersection with the LEP.

Natural History. Flowering seems to be more or less year around.

2. **Ruellia metallica** Leonard, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 1253. 1938.

Herb to 0.8 m tall, lvs. petiolate, margins crenate, elliptic to elliptic-ovate, 7-18 x 2.5-8 cm, gradually reduced in apical / inflorescence portions, apically acuminate, basally attenuate, glabrous above, sericeous beneath along costa and veins, the lower surface with a metallic sheen, the upper surface often purplish especially when young. Infl. of clustered flowers in axils of upper (reduced) leaves and distally in more or less distinct terminal inflorescences; main bracts subtending inflorescences smaller and narrower than cauline leaves, 2-4.5 cm x 0.5-1.5 cm, lanceolate, these gradually reduced to ca. 1 cm long, subulate, additional floral bracts and bracteoles triangular, 1-2 mm x 1 mm; calyx 6.5-8 mm long, lobes ca. 7 mm long. Corolla 21-23 mm long (excluding lobes), basal narrow portion of tube white, ca. 13 mm long, 1.5 mm wide, above this narrow portion, tube suffused with purple, bent, 11-12 mm long, gradually expanding to 6-7.5 mm at throat; limb ca. 2 cm in diam, nearly regular, lobes nearly perpendicular to tube; pale lavender, upper lip 2-lobed, lobes 10 x 8 mm, slightly emarginate at apex; lower lip with darker purplish lines, 3-lobed, lobes 11-12 x 8-9 mm, cleistogamous flowers of reduced dimensions also present; stamens included, filaments pale purple, attached ca. 15 mm from base of tube, free portions of longer pair 8 mm long, free portions of shorter pair 4 mm long, anthers bithecal, thecae parallel, ca. 2 mm long; style and stigma exerted ca. 3 mm beyond longer pair of stamens, stigma unequally bilobed, only one lobe evident, 1-1.25 mm long. Fruits strongly clavate, 12-14 mm long, stipe 7-8 mm long, seed bearing portion 4.5-5.5 mm long, 4 mm wide, nearly terete; seeds to 8, borne at nearly the same level in fruit, spherical, 2-2.5 mm in diameter

Although the flowers of *R. metallica* are similar to those of *R. biolleyi*, the inflorescences differ markedly (long pedunculate in *R. biolleyi* versus lacking peduncles in *R. metallica*). Further, the leaves of *R. metallica* are green in marked contrast to the usually bi-colored leaves of *R. biolleyi*. Finally, the corolla of plants of *R. biolleyi* have a white tube and pink lobes, with an abrupt transition between the two regions whereas corollas of *R. metallica* are lavender and, although the tube is nearly white basally the transition between tube and lobe color is not abrupt.

Distribution. Guatemala to Panama. In Costa Rica, the plants occur below 800m on the Caribbean slope of the Cordillera Central and de Guanacaste. At La Selva, this species is common under old cacao and in secondary forests near the developed parts of the reserve. In 2005, there were large patches of plants along the distant, unpaved portions of the STR and also along the SR.

Natural History. Flowers predominantly during the dry season. Plants of this species also produce cleistogamous flowers that produce fruits directly from closed flowers presumably via autogamy.

3. **Ruellia palustris** Durkee

Suffrutescent herb to 1 m tall; stems erect; stems pubescent with erect trichomes, often dense toward apex. Leaves petiolate, laminae 5-18 cm long, 2.2-8.5 cm wide, apically abruptly acuminate, basally acute, margins entire to slightly undulate, glabrous above, a few scattered appressed hairs on lamina, costa and main veins below, cystoliths abundant and visible on both surfaces. Inflorescence of axillary and terminal clusters of 1-5 flowers, flowers borne on short pedicels 2-4 mm long, strigose; bracts 2 per flower, shape variable from broadly elliptic to obovate or oblanceolate, 2.2-4 cm long, 0.6-2.3 cm wide, apically acute, puberulous, trichomes sometimes glandular, calyx 5-lobed, lobes equal, 2.5-3 cm long, 4-5 mm wide, glandular-puberulous, corolla white, funnellform, 7.4 cm long (excluding lobes), narrow tubular portion 3.8-5.0 cm long, 3.5-4.0 mm wide (pressed), abruptly expanding to a funnel-shaped portion 2-3 cm long, 10-16 mm broad at the mouth (pressed), glandular-puberulous, the lobes equal,

suborbicular, 1.6-2 cm long, 2-2.5 cm broad; stamens exerted to just beyond the mouth, anthers 4-5 mm long, 0.8-1 mm broad, filaments attached near transition between narrow tube and funnel-shaped portion of corolla; style ca. 6.5 cm long, stigma unequally bilobed, the dorsal lobe 1.2 mm long, the ventral lobe 4-5 mm long. Fruits clavate, 20-23 mm long, with a marked apicle 1-2 mm long, stipe 7-9 mm long, seed bearing portion ca. 10 mm long, nearly terete, 7-8 mm wide, 6-8 mm thick, puberulous; seeds 6-8, ca. 5 mm in diam.

Ruellia palustris could be confused with *R. tubiflora* from which it can be readily distinguished by its conspicuous calyx with lobes >2 cm long (vs. 3-6 mm). Vegetatively, distal portions of the stems are densely pubescent (versus inconspicuously pubescent or glabrate in *R. tubiflora*), and abaxial leaf surfaces lack the glandular dots that are present in *R. tubiflora*. Both species of *Ruellia* with very large white corollas could be confused with *Louteridium* and *Spathacanthus*. *Louteridium* is known only from the extreme southern portions of the reserve; these plants have a unique three-lobed calyx and a markedly gibbous corolla that is less than 5 cm long. *Spathacanthus* is not currently known from LS but is known from just south of the reserve, in the sector of Braulio Carrillo National Park accessible by the Virgen del Socorro road. These plants are treelets that are distinguished by the combination of the two-lobed, spathaceous calyx 2-3.5 cm long and white to dull yellow corollas to 9.5 cm long.

Distribution. This species was described from La Selva and has now been collected from adjacent areas of Cordillera Volcanica Central conservation area (Rara Avis and lower Braulio Carrillo N.P.). At La Selva it is known from swampy areas along the SHO and SSE, and from a small patch near 1000m on the CCL. As it is inconspicuous unless in flower, it may well occur more widely and is definitely to be looked for in swampy areas.

Natural History. At La Selva, plants of this species flower during the wet season and into the early dry season (July-Feb). With narrowly tubular white corollas that open a night, these plants are likely moth-pollinated but research is lacking.

4. ***Ruellia tubiflora*** H.B.K. var. ***tetrastichantha*** (Lindau) Leonard, Contr. U.S. Natl. Herb. 31: 91, 1951. *R. tetrastichantha* Lindau, Anales Inst. Fis.-Geogr. Nac. Costa Rica 2: 300. 1900. Fl. Costaricensis 2: 300. 1900.

Suffrutescent plants to treelets to 4.5 m tall; stems quadrangular, appressed-strigose to glabrous; leaves with petioles to 5 cm long, petioles strigose to puberulous; blades broadly elliptic, 8-23 cm long, 3.5-11.2 cm wide, apically acuminate, basally attenuate to acute, margins undulate, glabrous or rarely puberulous above, glabrous or strigose to puberulous on costa and veins below and dotted with yellow to reddish-brown glands, occasionally gland-dotted above, cystoliths visible above, obscure below. Inflorescences of short, congested spikes, terminal and in axils of most distal nodes, rachis to 2 mm long; bracts pale green to greenish white, leafy, elliptic, 3.8-6.1 cm long, 1.2-2.5 (-4.3) cm wide, gland-dotted; bracteoles small, subulate, pilose (especially on margins), ca. 2 mm long. Flowers sessile; calyx 8-10 mm long, short basal tube 2-3 mm long, segments subulate, 5-6 mm long, ca. 1 mm broad basally, pilose; corolla pure white (buds pale yellow) (to orange?, Folsom 10099), funnellform, 7.5-9.7 cm long, puberulous, often gland-dotted, narrow portion of tube 2.5-3.8 cm long, 2-4 mm wide, then expanding gradually to a broader cylindrical portion 3-5 cm long, throat compressed dorso-ventrally, 2 cm wide x 1 cm tall, limb ca. 5 cm wide x 4 cm tall (fresh), 1.5-2.3 cm broad (pressed), lobes suborbicular, 16-22 mm long, 15-20 mm wide, lobes emarginate at apex; stamens included, didynamous, filaments attached 36-45 mm from base of tube, those of the shorter pair 10-13 mm long, those of the longer pair 17-20 mm long, anthers 6-7.5 mm long; ovary ca. 10 mm long, green, style 7-7.3 mm long, stigma unequally bilobed, upper lobe 2-3 mm long, lower lobe 4.5-6 mm long; fruits clavate, 2.2-3 cm long, stipitate, the stipe ca. 12 mm long,

seed bearing portion ca. 18 mm long, nearly terete, 7-8 mm wide, 6-7 mm thick, glabrous to minutely puberulous; seeds 8-12, suborbicular, 4.5-5.5 mm in diameter.

See *Ruellia palustris* for characters distinguishing these two species from each other and from *Louleridium* and *Spathacanthus*. Additionally, post-seed dispersal, old infructescences of *R. tubiflora* present a distinctive short, cone-like structure at the apex of branches reflecting dense scars where the reproductive structures were attached to a very short rachis.

Distribution. Nicaragua to Colombia In Costa Rica, this species occurs below 1200 m on both slopes; no collections have apparently been made from Guanacaste. At La Selva, plants have been collected from scattered localities along the Puerto Viejo and Peje rivers and also along the Salto at its confluence with the Puerto Viejo and at the south boundary; in early 2005, they are especially abundant along the STR beginning near 1800m and extending to the intersection with LEP.

Natural History. Plants of this species flower in the dry season, with collections (Dec-May); with flowering specimens collection at La Selva in Feb-May. Flowers are often nectar-robbed.

***Thunbergia* Retz.**

(Genus and species descriptions contributed by T.F. Daniel & L.A. McDade)

An Old World (mostly African) genus of more than 100 species, a dozen or more of which are cultivated in the New World. In Costa Rica, three or four species show signs of naturalizing or at least persisting long following abandonment of planted areas. In addition to the two species treated here, *Thunbergia fragrans*, a profusely branching vine with white flowers, has been collected in the Sarapiquí region but is apparently not persisting at La Selva.

Perennial herbaceous to woody twining vines, rarely erect perennial herbs or weak shrubs, lacking cystoliths; leaves opposite, petiolate, often cordate to hastate at base, margin entire to lobed or dentate; inflorescence in ours of solitary axillary flowers, of solitary or clustered axillary or terminal cymes in other species, pedunculate; flowers subtended by 2 bracteoles, these green (in ours), spathaceous, enclosing most or all of corolla tube, free or fused along one side; flowers sessile; calyx reduced, annular, entire or \pm irregularly 5--20 lobed; corolla white, yellow, orange, blue or purple (in ours, elsewhere also red), tube expanded distally into a distinct throat, throat sometimes greatly expanded and open, limb 5-lobed, subregular to bilabiate, if bilabiate then upper lip 2-lobed, lower lip 3-lobed, corolla lobes homomorphic or nearly so, contorted in bud, spreading to reflexed; stamens 4, often didynamous, included in corolla tube, anthers 2-theous, thecae (in ours) equal to unequal, parallel to subparallel, equally to subequally inserted, often appendaged at base, variously pubescent, dehiscing toward lower lip (i.e., flower nototribal); staminodes lacking; style included in corolla tube, stigma funnelliform or 2-lobed, lobes equally inserted or superposed; capsule estipitate, with expanded seed-bearing portion at base, prominently beaked at apex, retinacula absent; seeds 2--4, homomorphic, hemispheric, with a prominent invagination on flattened side.

1. Plants more or less erect; leaves ovate-elliptic to elliptic, to ca. 5.5 cm long, petioles not winged; corolla purple (rarely white). *T. erecta*

1. Plants vining, at least some leaves sagittate, usually longer than 10 cm, petioles winged; corolla orange or yellow often with a dark purple throat (rarely white). *T. alata*

1. ***Thunbergia alata*** Bojer ex Sims, Bot. Mag. 52:t. 2591. 1825.

Herbaceous vines; leaves with petioles 10--85 mm long, alate, blades sagittate, 2.0—13.5 x 0.9—8.4 cm wide, (rounded to) acute at apex, cordate-hastate at base and decurrent along petiole as a narrow wing 1.3--7 mm across, surfaces pubescent with erect to appressed eglandular trichomes and covered with sessile dark reddish glands < 0.1 mm in diameter, major veins palmate, margin entire to undulate or shallowly and irregularly coarsely dentate; flowers solitary in leaf axils (sometimes accompanied there by a branch shoot as well), peduncles 3.0—9.0 cm long, pubescent with cauline type trichomes; bracts lance-ovate to ovate, 1.1—2.5 x 0.4—1.5 cm wide, rounded to truncate to cordate at base, acute to acuminate at apex, surfaces pubescent like leaves; calyx 2--4.5 mm long, > 10 [11--13]-lobed, lobes subulate, unequal, pubescent with ascendant eglandular trichomes 0.2--0.3 mm long and glandular trichomes 0.1 mm long; corolla yellowish-orange to orange (rarely white) with a dark purple and glandular "eye" in throat, 2.5—4.3 cm long, externally sparsely and inconspicuously pubescent with glands up to 0.1 mm long, limb subactinomorphic, lobes obovate to obdeltate, 7.5--15 x 6--22 mm, apically truncate; stamens didynamous, anthers of longer pair with both thecae appendaged at base with a single curved awn-like projection 1--1.6 mm long, anthers of shorter pair with 1 theca appendaged at base, thecae 3--5 mm long (including basal appendage), subequal to unequal in size, subparallel, equally to subequally inserted, pubescent with beaded papilla-like trichomes along line of dehiscence and at base; style 12 mm long, glabrous, stigma lobes ± funnellform, superposed, 1.5--2 mm long; capsule 14--23 mm long, densely pubescent with erect eglandular trichomes 0.1--0.7 mm long, base subglobose, 5--10 mm in diameter, beak 9--15 mm long; seeds 2, 4--5 mm in diameter, with a prominent pore on flat side, covered with ± appressed scalelike tubercles to 0.5 mm long (these forming a ± homobrochate reticulum) and covered with appressed scalelike trichomes to 0.1 mm long.

Plants of *Thunbergia alata* are distinguished from other *Thunbergias* at La Selva by habit (herbaceous vine vs. erect shrub or woody vine), sagittate leaves with winged petioles, and yellowish orange corolla with a dark center.

Distribution. Native to eastern and southern Africa, this species is very widely cultivated and has been reported to have become naturalized in many areas of tropical America.

Natural History. Plants appear to flower during the dry season at La Selva (Jan-Feb).

2. *Thunbergia erecta* (Benth.) T. Anderson, J. Linn. Soc. 7:18. 1863.

Erect to arching shrubs to 2 m tall; stems subquadrate to quadrate-alate to ± flattened, sparsely pubescent with eglandular trichomes 0.1--0.2 mm long, soon glabrate, nodes pubescent with flexuose eglandular trichomes to 0.3 mm long; leaves with petioles 2--6 mm long, blades ovate-elliptic to elliptic, 12--50 x 5--30 mm, acuminate at apex, acute to attenuate at base, surfaces pubescent with a few eglandular trichomes mostly along veins to glabrous, major veins pinnate, margin usually entire, rarely coarsely and shallowly sinuate-dentate; flowers solitary in leaf axils, peduncles 20--23 mm long, sparsely pubescent with eglandular trichomes to nearly glabrous; paired floral bracts caducous, ovate, 13--25 x 8--17 mm, truncate at base, rounded to acute at apex, abaxial surface glabrous or nearly so; calyx 3--10 mm long, 10--12-lobed, lobes lance-subulate to subulate, unequal, abaxially pubescent with glandular trichomes 0.05--0.1 mm long; corolla purple (rarely white) with throat yellow within, 50--75 mm long, externally sparsely pubescent with erect to flexuose glandular trichomes 0.1--0.3 mm long, limb subactinomorphic, lobes broadly obovate, 14--19 x 15--25 mm, rounded to truncate at apex; stamens didynamous, 11--15 mm long, basal 1 cm thickened and yellow (otherwise white), thecae 3--3.5 mm long (including basal spines), unequal in size, subparallel, subequally inserted, with a cluster of ca. 20 stiff straight spines 0.2--0.4 mm long at base, pubescent with beaded papilla-like trichomes flanking line of dehiscence and at base; style 26--34 mm long, glabrous, stigma 2-lobed, lower lobe broad, upper lobe narrow, superposed, 2.5--3 mm long; capsule 25--

29 mm long, glabrous, base subglobose, 11--12 mm in diameter, beak 15--17 mm long. Seeds apparently 4, 5--6.5 mm in diameter, with a shallow invagination 3--4 mm in diameter on flat side, surfaces dimpled, lacking trichomes.

Notable among other *Thunbergia* at La Selva (and Costa Rica) for its erect to semi-erect habit and small leaves. Flowers are purple with a yellow throat rather than yellow to orange with a dark throat as in *T. alata* (although rare plants of both species apparently have white flowers).

Distribution. Native to western tropical Africa, this species is cultivated worldwide; it persists after abandonment but is not reported as becoming naturalized in the American tropics. In Costa Rica, the species is widely cultivated but is apparently not naturalizing. At La Selva, this plant has been collected in the La Guaria Annex, along Avenida Marañon where it was said to be "probably cultivated as a house was within 100m."

Natural History. Collected with flowers in May.