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XYLOTOMIC STUDY OF SOME WOODY PLANT SPECIES FROM CUBA, II

By

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The authors describe the most important anatomical features of the xylem, external morphology, occurrence and habitat of eight woody species of the Flora of Cuba, namely: *Curatella americana* L. (*Dilleniaceae*), *Luehea speciosa* Willd. (*Tiliaceae*), *Alvaradoa amorphoides* Liebm. ssp. *psilophylla* (Urb.) Cronq. (*Simarubaceae*), *Cyrilla racemiflora* L. (*Cyrillaceae*), *Lysiloma bahamensis* Benth. (*Mimosaceae*), *Myrsine cubana* A. DC. (*Myrsinaceae*), *Mastichodendron foetidissimum* (Jacq.) Cronquist (*Sapotaceae*), *Linociera bumelioides* Griseb. (*Oleaceae*).

Materials and methods

Blocks of the different woods were softened (2—3 atm., in the 1 : 1 mixture of water-glycerine in an J. BRINZER autoclave, then cross, tangential and radial sections were obtained. The sections were dyed in an alcoholic solution of the microdyestuff of Toluidin blue. The maceration of the xylem was performed by the SCHULZE's method (SÁRKÁNY—SZALAI 1964). Length of the fibers and vessel elements, tangential and radial diameters of the vessels, width and height of the medullary rays, and other features were measured. Minimum-maximum values for each anatomic feature of individual species were calculated from 50—100 measurements.

Suitably enlarged microphotographs were prepared of each section.

External morphology, distribution and ecology

Curatella americana L.

Shrub or little tree up to 6—8 mm height. Leaves ovate or elliptic-ovate, 12—30 cm long, rounded and emargined at the apex, rounded to decurrent at the base; blades scabrous on both surfaces, margin sinuate-undate, coriaceous. Flowers fragrant, white; sepals 4—5, petals 5—6 mm long, filaments thickened at the apex, anthers oblong. Ovary apocarpic, carpels 2, biovulate, globose when mature, hirsute, 6—7 mm long. Seeds black, enclosed in a membranous arilus.

This species is widely distributed all over the neotropic regions; it is a common and well-known savanna-shrub. In Cuba it occurs on shallow, mostly sandy soils generally poor in nutrients; lives in pine-woodland, evergreen-oak-forests and secondary savannas in the provinces of Pinar del Rio, Habana, Matanzas, Camagüey and in the Isle of Pine.

Luehea speciosa Willd.

Tree up to 20—25 mm height. Bark smooth, gray; branches densely tomentose by ferrugineous stellate-hairs. Leaves soft, deciduous, elliptic to ovate or elliptic-ovate, 10—20 cm long, abruptly acuminate at the apex, rounded or cordate at the base; blades stellate-

scabrous above, pale tomentose beneath, serrulate at the margin. Flowers white, bracteoles 1.5 cm long; calyx densely tomentose, 1.5 cm long, petals white, 2.5—4 cm long, with 5 glands at the base; stamens numerous, obscurely connate into 5—10 fascicles, the exterior ones without anthers. Ovary 5-locular, cavities multi-ovulate, style simple, stigma capitate and obscurely 5-lobulate; capsule lignose, 3—4 cm long, brown-tomentose, obtusely 5-angulate, dehiscent at the apex. Seeds imbricate, testa prolonged into a wing, endosperm fleshy.

This species has a neotropical distribution pattern. In the Antilles it does not occur except West-Cuba, in the provinces Pinar del Rio, Habana, Matanzas, Las Villas and Isle of Pine. It is a rather common tree in the first canopy layer of the lowland and submontane seasonal evergreen tropical forests, growing mostly on tropical brown, yellowish-red and red soils derived from different rocks.

Alvaradoa amorphoides Liebm. ssp. *psilophylla* (Urb.) Cronq.

Shrub or tree up to 15—20 m height. Leaves imparipinnate, alternate, leaflets 18 –50, alternate, oblong-elliptic, somewhat acute at the apex, 1—3.5 cm long and 4—12 mm wide, blades bright-green above, strigillous-hirsute beneath. Flowers dioic in axilar or subterminal racemes. Sepals of the male flowers ovate, 1—2 mm long, somewhat united at the base; petals linear-filiform 2—2.5 mm long. Stamens 5, filaments 3—5 mm long, inserted in the lobes of the disc, absent in the female flowers. Ovary 2—3-locular with an only fertile carpel; ovulas 2, carpels pulvinate-puberulent. Fruit samaroide, winged, lanceolate or lanceolate-ovate, 8—18 mm long, margin ciliate; seed 1.

This subspecies has a North-Caribbean distribution pattern occurring all over Cuba, in the Bahamas and Florida (United States). It grows in the littoral and semideciduous forests as a rather frequent element of the first canopy layer, sometimes as an emergent tree. From an ecological point of view it is in the littoral dog-tooth areas further on shallow limestone rendzinas and protorendzinas, less frequently on tropical brown soils and red latosolic soils, mainly in the lowland and submontane regions up to 400—500 m above the sea evel.

Cyrilla racemiflora L.

Shrubs or trees up to 15—20 m height. Leaves elliptic, oblong-elliptic, obovate or oblanceolate, 3—12 cm long and 6—30 mm wide, attenuate at the base, attenuate, obtuse or rounded, sometimes retuse and mucronulate at the apex; blades glabrous, shiny, nerves prominulous and densely reticulate-veined on both surfaces, coriaceous. Flowers white, numerous in a dense raceme, inflorescence mostly longer than the leaves; pedicels 2—4 mm long, calyx 5-lobulate to the base, 1 mm long, lobes acuminate; petals 5, acute 2 mm long; stamens 5, filaments free, subulate, adnate to the corolla; connective apiculate, dehiscent by an apical porus. Ovary oblong, 2-locular, style short, obconic, stigma 2-lobulate, ovules 1—3 in each cavity, pendulous; fruit a 2—3 mm long, ovoide, capsule 2-locular, seed 1 in each cavity.

An extremely polymorphic species as for the form and shape of leaves and length of inflorescence. Therefore THOMAS (1960) united all the Antillean *Cyrilla*-species into an only species (*C. racemiflora* L. *sensu lati simo*) and did not separate any subspecific taxon on a morphological basis. As to our opinion (s. BORHIDI and MUÑIZ 1971) *C. racemiflora* sensu Thomas non L. is a collective species or an agglomeration of very closely related and valid species. The specimen studied in this paper belongs to the real *C. racemiflora* L. s. str. A thorough taxonomic revision of this species is still needed.

This species has a Caribbean distribution pattern occurring in the Southern United States, in Central America, the Northern part of South America and in the Antilles. In Cuba it can be found in the Western part of the country (Pinar del Rio province and Isle of Pine). It is reported also from the Sierra Maestra range (Oriente province), but that population only doubtfully belongs to this species. As for its ecological pattern in West-Cuba, it occurs in the

lower hills and submontane regions between 20—700 m above sea level. It lives mostly in pine woodlands on siliceous sandy soils and on shallow yellowish-red pseudopodsols derived from sandstone rocks, associated with *Pinus caribaea* Morelet, *Vaccinium cubense* (A. Rich.) Griseb. ssp. *ramoniana* (Griseb.) Borhidi, *Rondeletia correifolia* Griseb., etc.; it is also frequent in pine forests on serpentine-latosols associated with *Pinus caribaea*, *Psidium cymosum* Urb., *Tetrazygia coriacea* Urb., etc., furthermore, it is a subdominant tree in the first canopy layer of the riverside evergreen tropical forests associated with the "Manaca palms", *Calyptrogyne intermedia* and *C. dulcis*, and in the montane rain forests.

Lysiloma bahamensis Benth.

Tree up to 20—25 m height. Bark smooth, gray; stipules ovate, acuminate. Leaves large, paripinnate, petiole 1—3 mm long with a thick gland, 2—5 pairs of pinnae, leaflets 10—33 pairs, oblong, membranous, pale green, 8—15 mm long, puberulent. Inflorescences composed racemous, axillar, or terminal; flowers capitate globose, peduncles generally 1—1.5 cm long; calyx campanulate 5-merous, 1—1.5 mm long; corolla funnelform, white or bluish-white, 2—2.5 mm long, pilose, lobes valvate. Stamens numerous, much exerted, tube of filaments short. Ovary multiovulate, style stout, thin. Pods straight, erect, linear or linear-oblong, 2—5 cm wide, acuminate, complanate, dehiscent marginally. Seeds compressed, about 12 mm wide.

This species has a North-Caribbean distribution pattern, occurring in the Yucatan Peninsule, all over the territory of Cuba and Isle of Pine, in the Bahamas and Florida (United States). In Cuba it is a rather common tree and has an important phytocenological role in the first canopy layer of the swamp-forests and marsh-forests (*Chrysobalano-Annonetea*), in the semideciduous alluvial forests (*Ceibetea occidentalis*) and in the costal semideciduous forests (*Lysilomo-Burserion*). It is a very frequent tree in the swamp-region of the Zapata-Peninsule, in which it associates with *Bucida palustris* Borhidi et Muñiz, *Fraxinus caroliniana* Mill. ssp. *cubensis* (Griseb.) Borhidi, *Tabebuia angustata* Britt., *Metopium brownei* (Jacq.) Urb. and *Bursera simarouba* (L.) Sarg. forming the associations *Lysilomo-Metopietum brownei* Borhidi et Del-Risco, the *Lysilomo-Burseretum simaroubae* Borhidi et Del-Risco and taking part as a dominant species in the composition of other associations, e.g. *Hibisco-Calophylletum antillanae* Del-Risco. It is a very agressive invader species after the exploitation of the alluvial and swamp-forests. The wood of this species is widely used for charcoal-burning.

Myrsine cubana A. DC.

Shrubs or little trees up to 10 m height. Twigs and young branches glabrous. Leaves obovate or oblong, 3—10 cm long, 1.8—4 cm wide, rounded or obtuse at the apex and long attenuate at the base; blade shiny above, pale and dull beneath, lateral veins inconspicuous, glandular points hardly or not raised. Flowers in subsessile axillary fascicles, green, spotted by ferrugineous points, 4—5-merous. Sepals ovate, acute at the apex, 1.5 mm long. Corolla with obtuse lobes, ferrugineous puberulent at the margin. Stamens 5, filaments absent, anthers adnate to the corolla lobes. Ovary ovate, fruit globose, black when mature, about 5 mm in diameter.

Formerly this species was identified with *Rapanea guianensis* Aubl. or *Myrsine guianensis* (Aubl.) Kuntze, but STEARN (1969) proved this later species to live only in South America and did not occur in the Antilles, in which it is replaced by a number of different species of mostly restricted areas. One of these vicariant species of the guianensis-group is *Myrsine cubana* A. DC., endemic to Cuba (BORHIDI, IMCHANITSKAYA and MUÑIZ 1978).

It lives probably in all the provinces of Cuba, mostly in humid and inundated areas, in swamp-scrub forests, swamp- and alluvial forests, in which it grows as a rather common tree of the first or second canopy layer; sometimes it occurs also in the littoral marsh-forests as well, behind the mangrove-zone. It tolerates the long inundation, rather well even in brackish water.

Mastichodendron foetidissimum (Jacq.) Cronq.

Tree up to 25—30 m height. Bark separating into laminar plates, latex slightly orange, tastes bitter; twigs purplish, smooth, thin and glabrous. Leaves very diverse in size and shape, generally oblong, oblong-ovate, ovoide or sometimes elliptic to suborbicular, 5—15 cm long, mostly short-acuminate and obtuse or less frequently acute, rarely rounded at the apex, rounded or attenuate and obtuse at the base; blades shiny above, chartaceous, glabrous and characteristically undulate at the margin, petiole slender, 2—7 cm long. Flowers in few- or manyflowered axillary fascicles, which are shorter than the petioles. Pedicels 4—10 mm long, sepals 5, orbicular or suborbicular, obtuse, 2 mm long, glabrous; corolla greenish-yellow, 7 mm wides, lobes 5, oblong and obtuse; staminoids lanceolate, acuminate, 1 mm long. Ovary glabrous, ovules with basic-lateral placentation, mostly only 1 developing in each fruit. Berry drupaceous, ovoid, yellow, 2—2.5 cm long, glabrous, sour.

This species has an Antillean distribution pattern. It occurs in the West Indies except the Bahama Islands, but it can be found in Florida (United States) as well. In Cuba it is a very common tree species, growing in all the provinces of this country, and lives mostly in the lowland and submontane levels, up to 600—700 m a. s. l. It can be found in very different soils but more frequently in limestone areas and ranges. As for its phytocenological conditions, it plays an important role in the semideciduous forests and seasonal evergreen forests as a common member of the first canopy layer or sometimes as high emergent trees. Its wood is pale yellow, solid, heavy and resistant, used for balks, timbers and railway-sleepers.

Linociera bumelioides Griseb.

Shrub or tree up to 10—15 m height. Twigs glabrous; leaves elliptic, oblong-elliptic or sometimes obovate (ssp. obovalis Borhidi et Muñiz), 4—10 cm long, rounded to obtuse at the apex, long attenuate and cuneate at the base; blade glabrous, reticulate-veined on both surfaces, shiny above, subcoriaceous. Inflorescences axillary or terminal panicles, 2—3 cm long, puberulent; calyx 1.5—2 mm long, lobes ovate, acute, separated to the middle of the calyx; petals white, linear, 6—8 mm long. Stamens 2, filaments filiform, as long as the anthers. Ovary 2-locular, style short, stigma oblong, capitate; ovules 2 in each cavity. Fruit drupaceous, ovate, purplish, 11—12 mm in diameter; endocarp stone-hard.

This species has a Great-Antillean distribution pattern occurring in Cuba, Hispaniola and Andros Island, but fails in Jamaica and Porto Rico. It grows in the littoral limestone dogtooth areas on the nacked rocks or in very shallow rendzina- and protorendzina-soils, living in littoral semideciduous scrub-forests, dry evergreen littoral scrubs and thickets, associated with *Bombacopsis cubensis* A. Robyns, *Capparis cynophallophora* L., *Savia bahamensis* Britt., *Diospyros grisebachii* (Hiern.) Standl., etc. In the West Cuban dry littoral thickets, named *Linociero-Savietum bahamensis* Borhidi et Del Risco, plays an outstanding role as a dominant species of the association.

Wood anatomy

Curatella americana L.

Wood porous diffuse; the ground mass of the wood is formed by polygonal-shaped fibers with thick wall and narrow lumen and by wide medullary rays. Apotracheal and contact-vasicentric longitudinal parenchyma. Medullary rays with more cells in width (Fig. 1). Tracheae are round or flattened in radial direction, with medium sizes, and sometimes filled up by thyllis. Number is very few, 3 per 1 sq millimeter. Tangential diameter 86.7—165.6 μ. Radial diameter 34.5—133.4 μ. Vessel members are 426.0—923.0 μ long, with oblong bordered pits on the wall (Fig. 2). Perforation plate is simple.

Heterogeneous medullary rays with 4—12 cells in width. Height 230.0—10 350.0 μ. Width 23.0—414.0 μ. Cells of the medullary rays often contain bundle-shaped group of acicular crystals named "raphids" (Figs 3, 4).

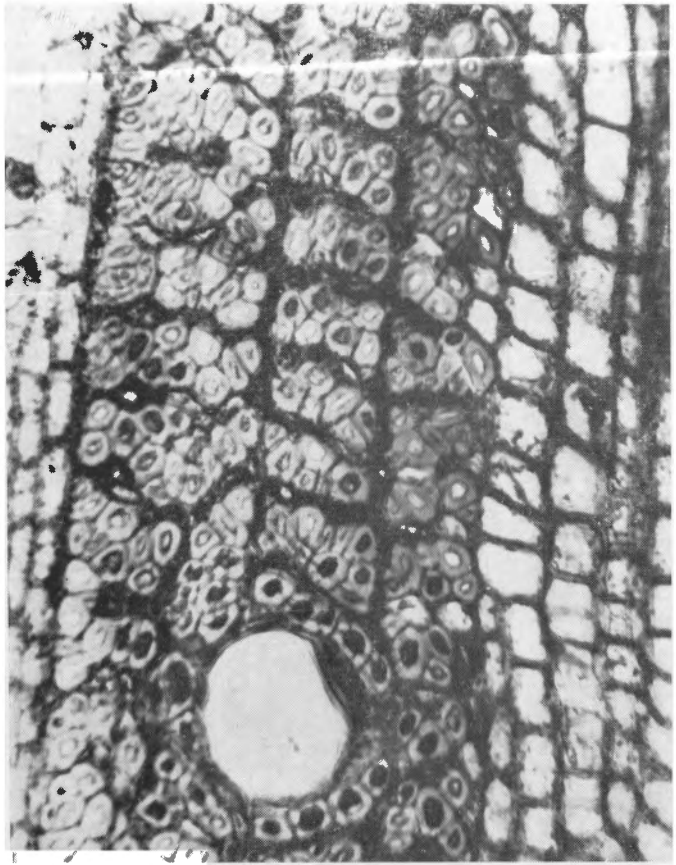

Fig. 1. Curatella americana L. Cross section ×120. Roundish solitary vessel. Wide medullary rays, apotracheal and contact parenchyma filled up with gum material. Wall of fibers thick, cavity filled up with gum material

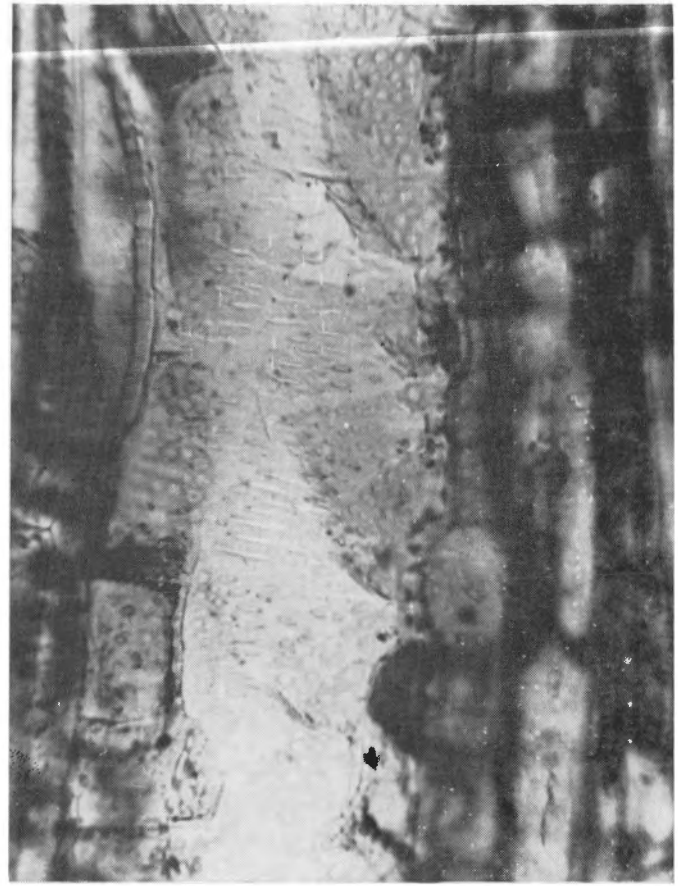

Fig. 2. Curatella americana L. Tangential section ×300. The oblong pits are distinctly visible on the wall of vessels

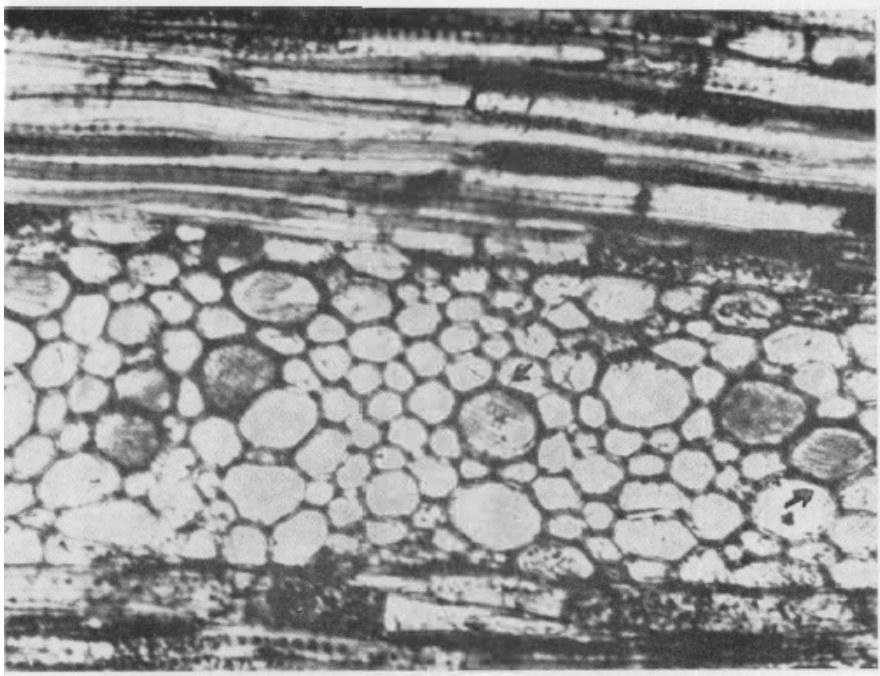

Fig. 4. Curatella americana L. Tangential section ×120. Wide medullary rays and fibers. Cells of medullary rays contain raphid crystals (→)

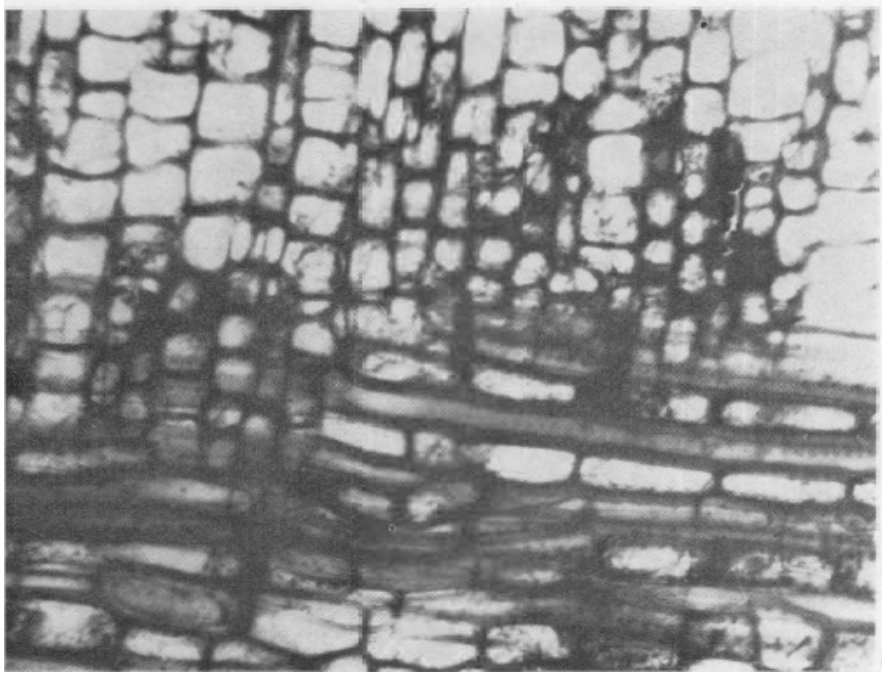

Fig. 3. Curatella americana L. Radial section ×120. Heterogeneous medullary rays. Longitudinal parenchyma and fibers

Fibers arranged in irregular lines. Diameter 25.3—48.3 μ. Wall thickness 3.4—12.6 μ. Full length 1065.0—2343.0 μ. Radial and tangential wall of fibers with bordered pits. Tips of the fibers commonly ending in a smooth peak, rarely toothed or forking. Diameter of the longitudinal parenchyma cells 9.3—37.2 μ. Height 55.8—181.3 μ. Cells rarely contain tetragonal bipyramidal crystals and often gum.

Luehea speciosa Willd.

Wood porous diffuse with annual ring structure. The ground mass of the wood is formed by fibers with thin wall and wide lumen. Apotracheal and contact-vasicentric longitudinal parenchyma. Medullary rays one or more cell in width (Fig. 5).

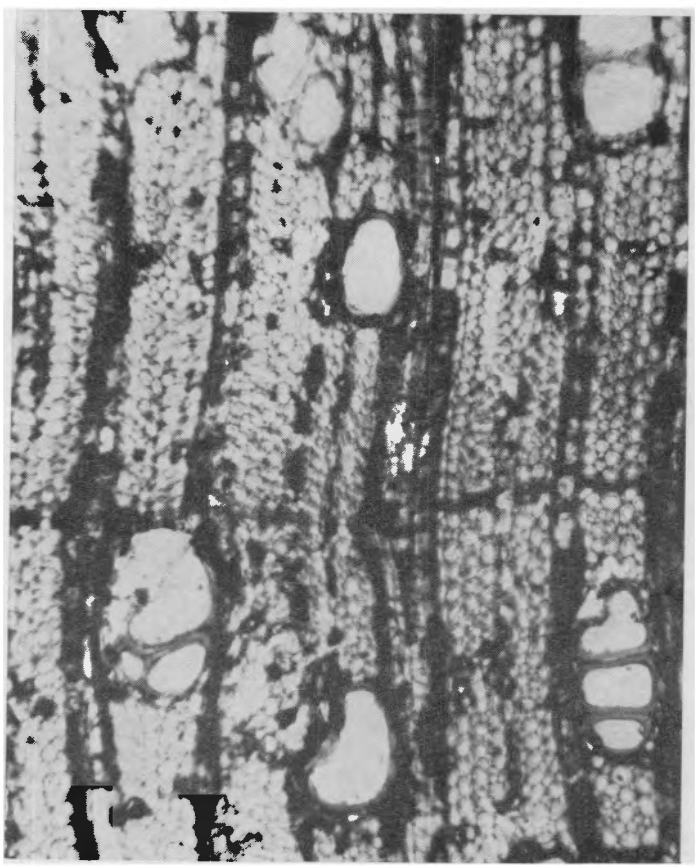

Fig. 5. Luehea speciosa Willd. Cross section ×120. Solitary vessels and groups of vessels. Medullary rays with 1 or more cells in width, filled up with mastic material. Scarce apotracheal and contact longitudinal parenchyma. Fibers with thin wall. The annual ring structure is distinctly visible

Fig. 6. Luehea speciosa Willd. Radial section ×120. Heterogeneous medullary rays, vessels and fibers. Cells of medullary rays contain mastic material. Marginal cells contain polygonal-shaped crystals

Fig. 7. Luehea speciosa Willd. Tangential section ×120. The very small pits are distinctly visible on the wall of vessels. Contact longitudinal parenchyma and fibers. Medullary rays with one or more cells in width

Solitary vessels are oval-shaped. Groups of vessels containing 2—4 members are flattened in radial direction. Number is 28 per 1 sq millimeter. Medium size. Tangential diameter 28.4—82.8 μ. Radial diameter 20.7—115.0 μ. Vessel members are 142.0—568.0 μ long, with small bordered pits on the wall. Simple perforation plate. Vessels sometimes filled up with gum material.

Medullary rays are 3—4 cells in width, with heterogeneous structure. Height 92.8—494.5 μ. Width 11.5—69.0 μ. Cells of the medullary rays contain gum material, marginal cells contain polygonal-shaped crystals (Figs 6 and 7).

Fibers in radial lines. Diameter 9.2—18.4 μ. Constant wall thickness 2.3 μ. Full length 710.0—1846.0 μ. Tips of the fibers longitudinally ending in a peak, rarely with saw-teeth, very rarely bifurcating.

Diameter of longitudinal parenchyma cells 9.3—23.2 μ. Height 41.8—106.95 μ. Cells contain gum material and polygonal-shaped crystals.

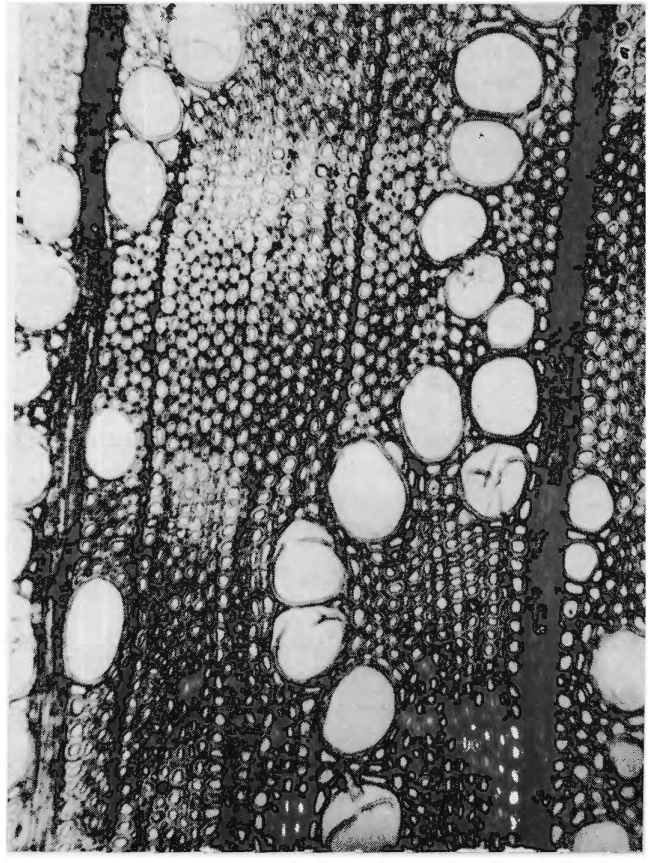

Fig. 8. Alvaradoa amorphoides Liebm. ssp. *psilophylla.* Cross section ×120. Roundish and oval-shaped groups of vessels. Fibers with medium wall thickness and a very scarce apotracheal longitudinal parenchyma. Medullary rays with one or more cells in width. Medullary rays contain mastic material

Alvaradoa amorphoides Liebm. ssp. *psilophylla* (Urb.) Cronq.

Wood porous diffuse. The ground mass of the wood is formed by fibers with medium wall thickness and vessels. Very scarce apotracheal longitudinal parenchyma. Medullary rays with one or more cells in width (Fig. 8). Solitary vessels are oval-shaped or slightly flattened in radial direction. The flame-shaped or obliquely settled vessel groups with more members are frequent. Number is 54 per 1 sq millimeter. Small size. Tangential diameter 20.7—69.0 μ. Radial diameter 23.0—62.0 μ. Length of vessel members 142.0—568.0 μ, with small oblong bordered pits on the wall. Simple perforation plate. They rarely contain gum material. Fiber tracheids with vasicentric position.

Medullary rays with 2—4, rarely 7 cells in width, with heterogeneous structure. 2—4 lines of marginal cells are characteristic. Height of medullary rays 69.0—675.0 μ. Width 11.5—68.6 μ. Cells of medullary rays contain gum material and polygonal-shaped crystals (Figs 9 and 10).

Fibers in radial lines or in irregular arrangement. Diameter 22.5—44.5 μ. Full length 852.0—2130.0 μ. Wall thickness 2.3—4.6 μ. Tips of fibers longitudinally ending in a peak or with saw-teeth, rarely bifurcating.

Cellular fibers form zones.

Diameter of longitudinal parenchyma cells 9.4—24.2 μ. Height 48.2—296.0 μ.

Cyrilla racemiflora L.

Wood porous diffuse, rarely with annual ring structure. The ground mass of the wood is formed by fibers with medium wall thickness. Apotracheal longitudinal parenchyma. Medullary rays with 1 or 2 cells in width (Fig. 11). Solitary vessels are round or oval-shaped. Vessel groups of 2—11 members in radial direction are frequent. Number is 46 per 1 sq millimeter. Small size. Tangential diameter 25.3—71.3 μ. Radial diameter 20.7—57.5 μ. Length of vessel members 213.0—639.0 μ, with bordered pits on the wall. Simple perforation plate.

Medullary rays one, rarely two cells in width, with heterogeneous structure. Marginal cells are often in 4 series (Figs 12, 13).

Fibers in irregular arrangement. Diameter 16.1—26.6 μ. Wall thickness 6.9—11.0 μ. Full length 710.0—1278.0 μ. Tips of fibers commonly ending in a smooth peak, sometimes with saw-teeth.

Diameter of longitudinal parenchyma cells 16.1—26.6 μ. Height 55.8—125.5 μ. Cells often contain gum material and cellular crystal holder longitudinal parenchyma.

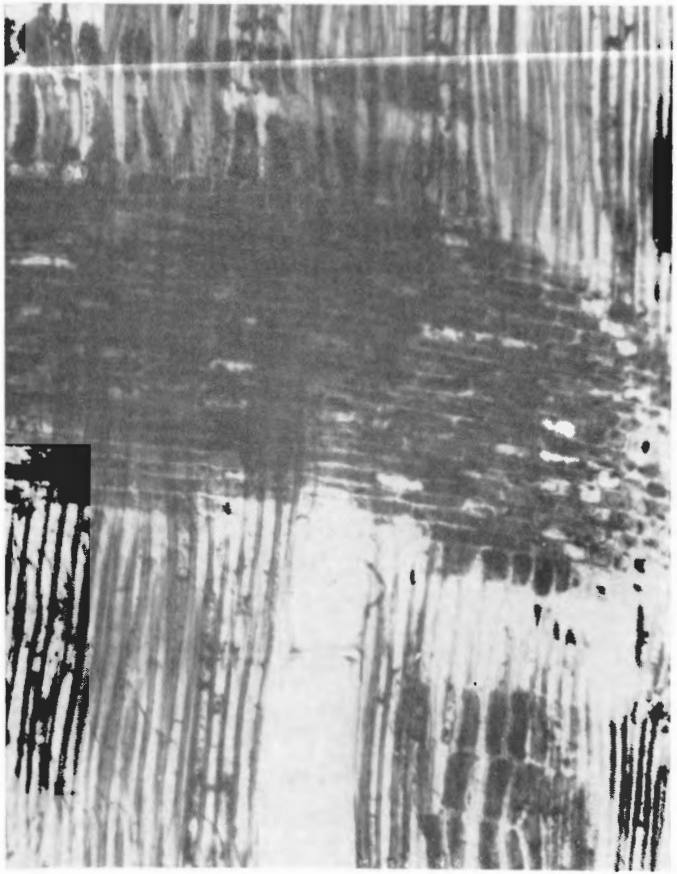

Fig. 9. Alvaradoa amorphoides Liebm. ssp. *psilophylla.* Radial section × 120. Heterogeneous medullary rays with marginal cell lines of 3 cells in width. Cells of medullary rays contain a large quantity of mastic material. Cells often contain polygonal-shaped crystals. Fibers and cellular fibers

Fig. 10. Alvaradoa amorphoides Liebm. ssp. *psilophylla.* Tangential section × 120. Vessel, contact longitudinal parenchyma, heterogeneous medullary rays. Fibers and fiber tracheids

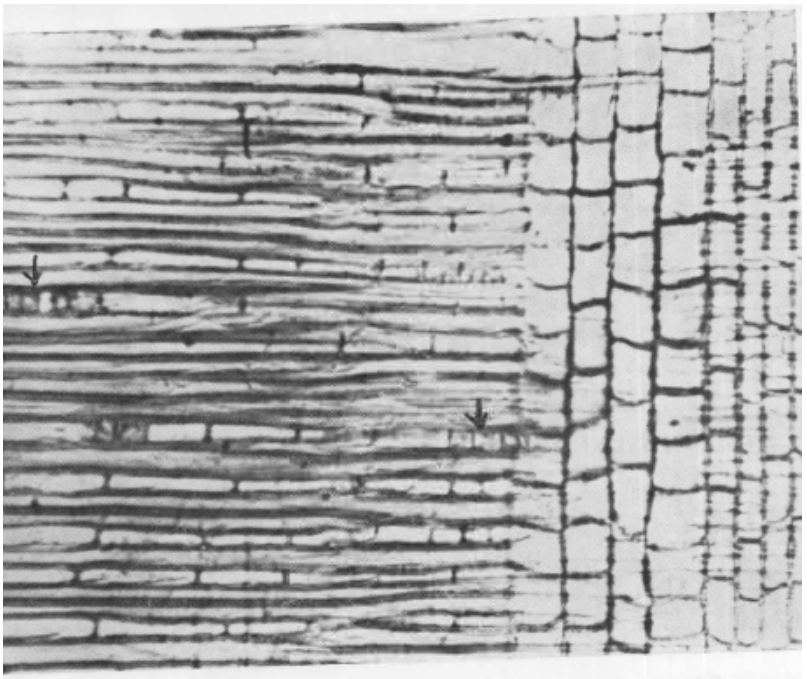

Fig. 12. Cyrilla racemiflora L. Radial section ×120. Heterogeneous medullary rays with marginal cell lines of 4 cells in width. Fibers, longitudinal parenchyma and cellular crystal holder longitudinal parenchyma ( )

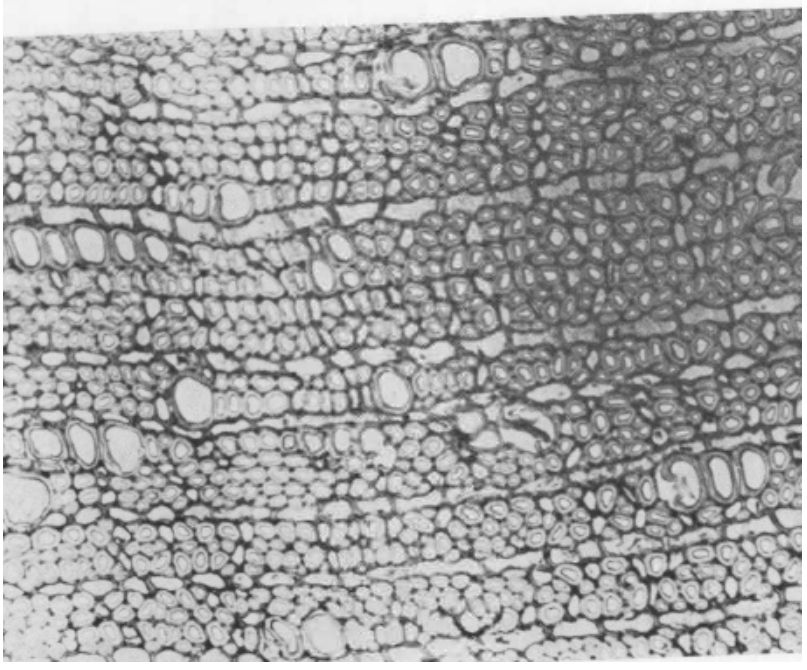

Fig. 11. Cyrilla racemiflora L. Cross section ×120. Vessels and groups of vessels and medullary rays with one cell in width. Wall of vessels relatively thick, small size. Medium thickness of fiber wall. Apotracheal longitudinal parenchyma

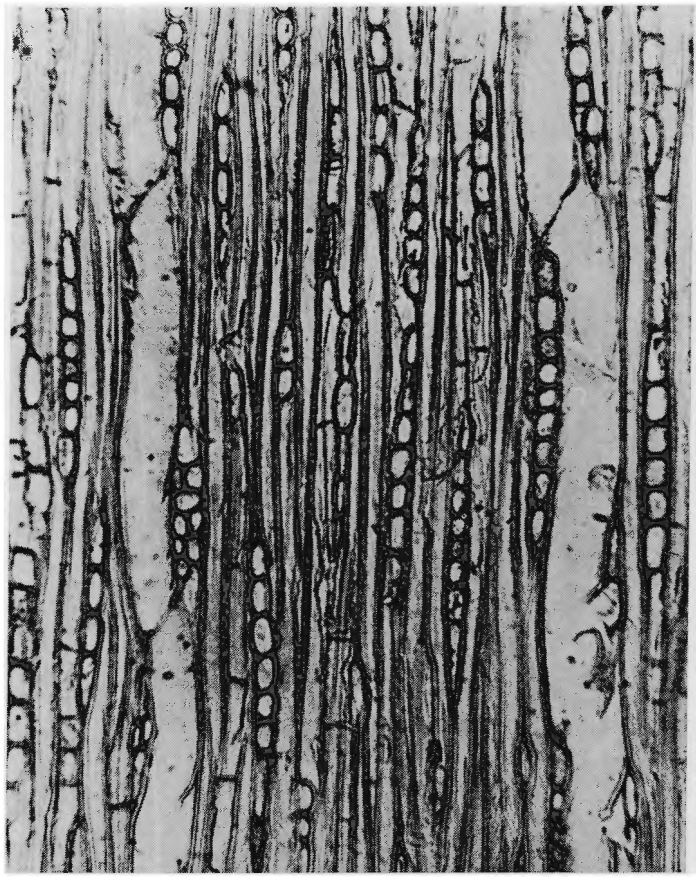

Fig. 13. Cyrilla racemiflora L. Tangential section ×120. Heterogeneous medullary rays with one and two cells in width, vessel and fibers

Lysiloma bahamensis Benth.

Wood porous diffuse; the ground mass of the wood is formed by longitudinal parenchyma and fibers with thin wall. Abundant paratracheal and contact-vasicentric longitudinal parenchyma. Medullary rays uni- or triseriate (Fig. 14).

The solitary vessels with oval shape. Vessel groups of 2—4 members in radial direction are frequent. The vessels of the vessel groups are flattened in tangential direction. Number of vessels 7 per 1 sq mm. Medium size. Tangential diameter 41.1—184.0 μ. Radial diameter 20.7—181.7 μ. Length of vessel members 213.0—426.0 μ, with small alternative pits on the wall. Simple perforation plate.

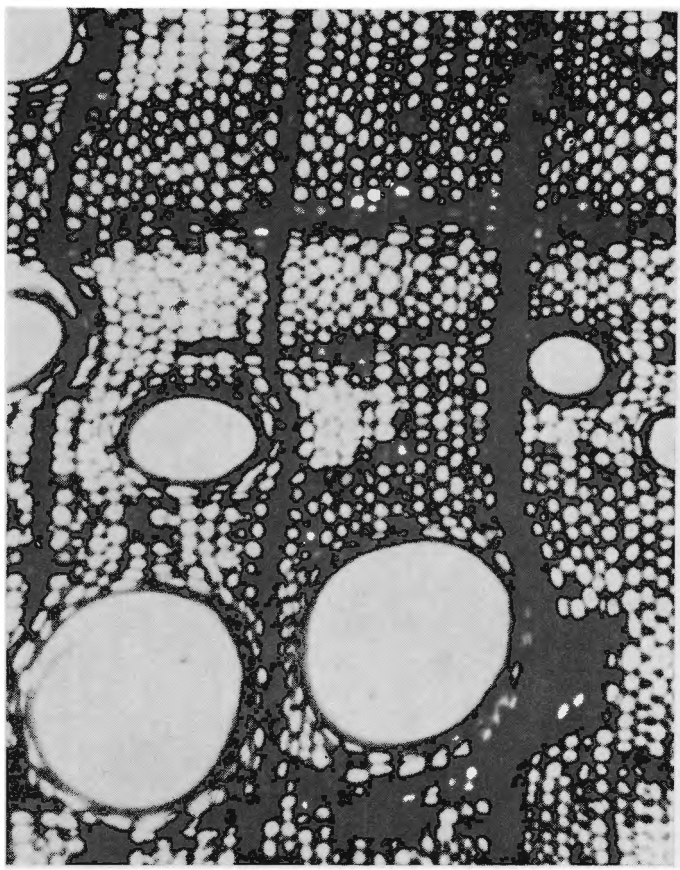

Fig. 14. Lysiloma bahamensis Benth. Cross section ×120. Solitary vessels and medullary rays with 1 and 3 cells in width. The wall of vessels is relatively thick, with medium sizes. Fibers with thin wall and large lumen. Paratracheal, contact-vasicentric longitudinal parenchyma

Medullary rays with one, two or three cells in width. Homogeneous structure. Height 69.0—345.0 μ. Width 11.5—34.5 μ. Cells are sometimes filled up by mastic material, rarely with crystals. Medullary rays within the wood almost scalariform (Figs 15, 16).

Fibers arranged in irregular lines. Diameter 11.5—20.7 μ. Wall thickness 6.9—9.2 μ. Full length 639.0—1207.0 μ. Tips of the fibers commonly ending in a smooth peak.

Diameter of longitudinal parenchyma cells 9.3—23.2 μ. Height 37.2—134.8 μ. Cells are often filled up with mastic. Cellular crystal holder longitudinal parenchyma is frequent.

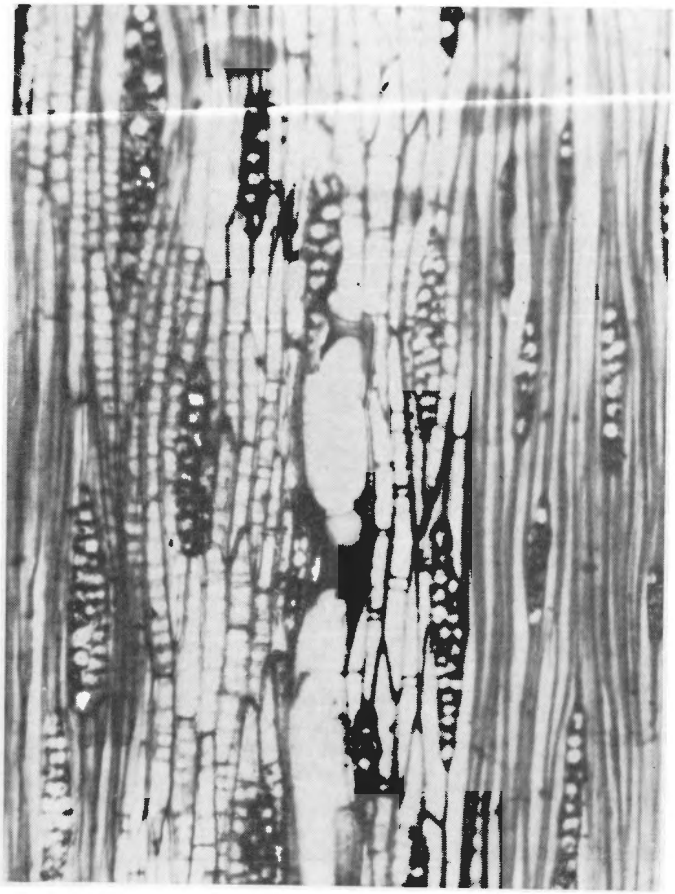

Fig. 15. Lysiloma bahamensis Benth. Radial section ×120. Homogeneous medullary rays, vessel and fibers

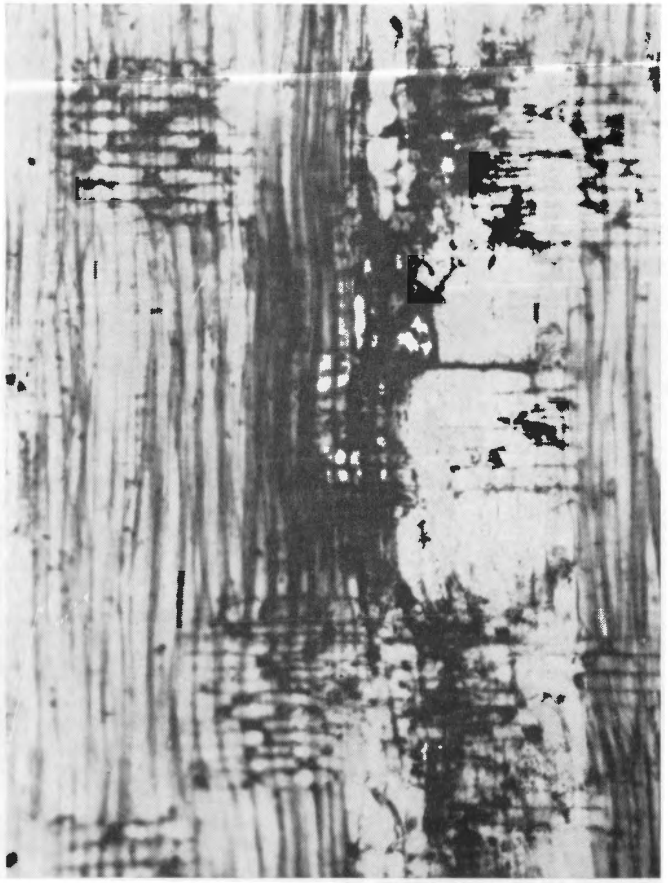

Fig. 16. Lysiloma bahamensis Benth. Tangential section ×120. Homogeneous medullary rays with 1—2—3 cells in width, vessel, with mastic material, fibers. Large quantity of crystal holder longitudinal parenchyma

Fig. 16. Lysiloma bahamensis Benth. Tangential section ×120. Homogeneous medullary rays with 1—2—3 cell in width, vessel, with mastic material, fibers. Large quantity of crystal holder longitudinal parenchyma

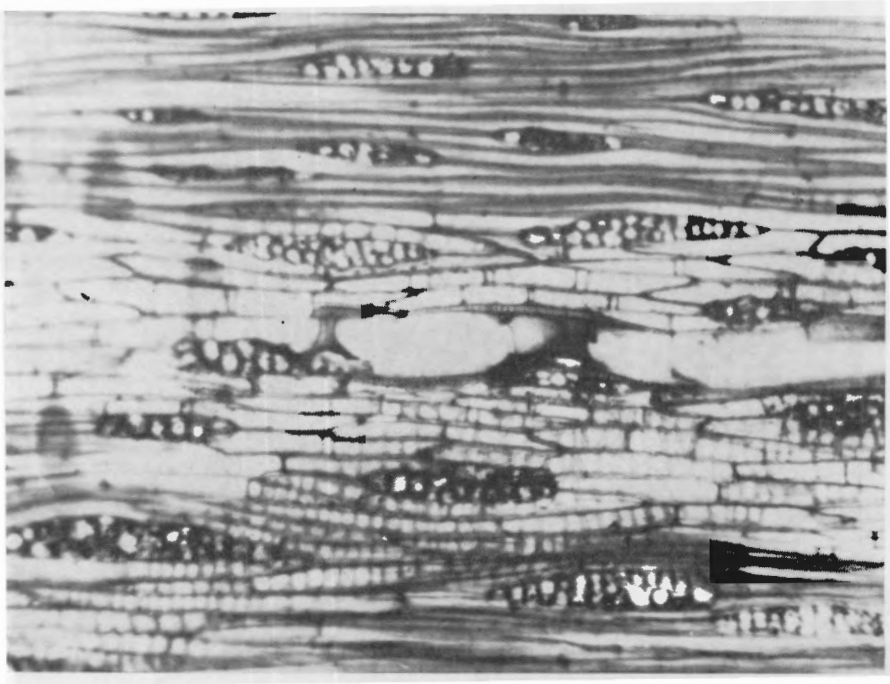

Fig. 15. Lysiloma bahamensis Benth. Radial section ×120. Homogeneous medullary rays, ves el and fibers

Myrsine cubana A. DC.

Wood porous diffuse. The ground mass of the wood is formed by fibers with thick wall and narrow lumen. Scarce paratracheal and contact-vasicentric longitudinal parenchyma (WAGENFÜHR—SCHREIBER 1974, JANE 1950). Medullary rays are triseriate or sextain (Fig. 17).

The solitary vessels are polygonal-shaped. The vessel groups of 2—5 members in radial direction are frequent. Number of vessels 50 per 1 sq mm. Small sizes. Tangential diameter 27.6—69.0 μ. Radial diameter 41.4—73.6 μ. Length of vessel members 284.0—781.0 μ, with small, alternative pits on the wall. Simple perforation plate. Medullary rays with three or six cells in width.

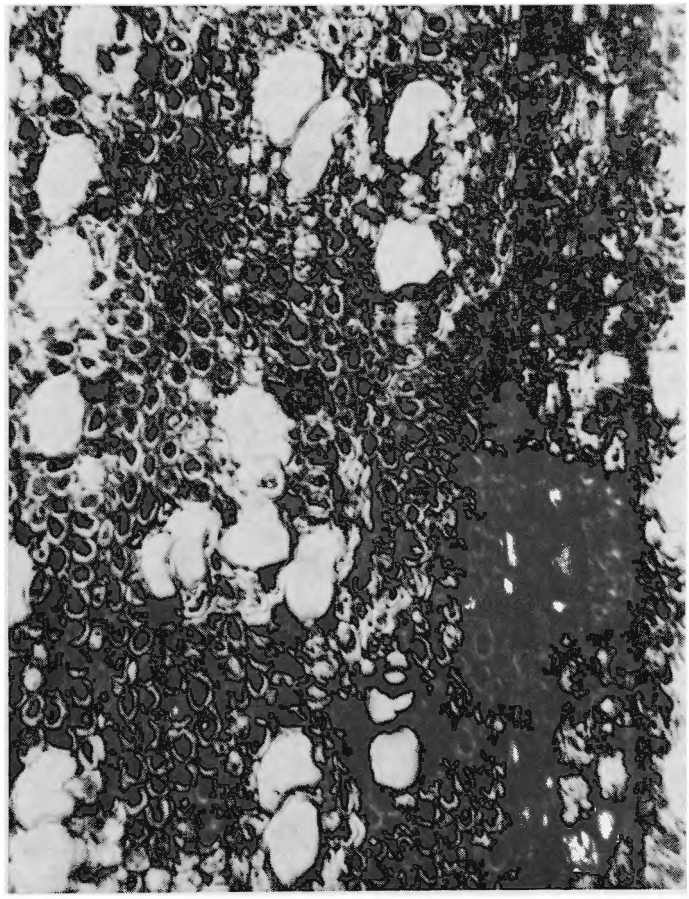

Fig. 17. Myrsine cubana A. DC. Cross section ×120. Vessels and vessel groups; medullary ray with 6 cells in width. The wall of vessel is thin; small sizes. The wall of fibers is thick, the lumen contains mastic material. Scarce paratracheal and contact-vasicentric longitudinal parenchyma

Heterogeneous structure. Height 5750.0—7245.0 μ. Width 115.0—172.5 μ. 1—4 rows of marginal cells (standing cells). The marginal cells often change into idioblast and contain crystal sand. Medullary rays often filled up by mastic material (Figs 18, 19).

Fibers arranged in radial lines. Diameter 16.1—34.5 μ. Wall thickness 9.2—14.2 μ. Full length 639.0—1420.0 μ. Tips of the fibers end in a smooth peak.

Diameter of longitudinal parenchyma cells is 4.65—27.9 μ. Height 46.5—195.3 μ. Cells sometimes filled up by mastic.

Mastichodendron foetidissimum (Jacq.) Cronquist

Wood porous diffuse. Thenground mass of the wood is formed by fibers with thick wall and narrow lumen. Apotracheal longitudinal parenchyma.

Fig. 18. Myrsine cubana A. DC. Radial section ×120. Heterogeneous medullary rays with idioblast cell (→). Medullary rays contain mastic material and crystal. Vessels and fibers

Medullary rays uni- or biseriate (Fig. 20). Solitary vessels are oval-shaped. Groups of vessels containing 3—4 members are frequent. The vessels of the groups are flattened in tangential direction. Number of vessels 28 per 1 sq mm. Small size. Tangential diameter 18.4—82.8 μ. Radial diameter 34.5—82.8 μ. Length of vessel members 568.0—781.0 μ, with small, alternative pits on the wall. Simple perforation plate. Medullary rays with one or two cells in width. Heterogeneous structure. Height 172.5—483.0 μ. Width 11.5—23.0 μ. The uniseriate medullary rays commonly consist of procumbent cells. The biseriate medullary rays consist of 1—4 marginal cell rows (standing cells). Medullary rays rarely contain mastic material and calcium oxalate crystals (Figs 21, 22). Fibers are arranged in irregular lines. Diameter 13.8—23.0 μ. Wall thickness 11.5—20.7 μ. Full length 1065.0—2401.0 μ. Gelatinous and cellular fibers are scarce (METCALFE and CHALK 1950).

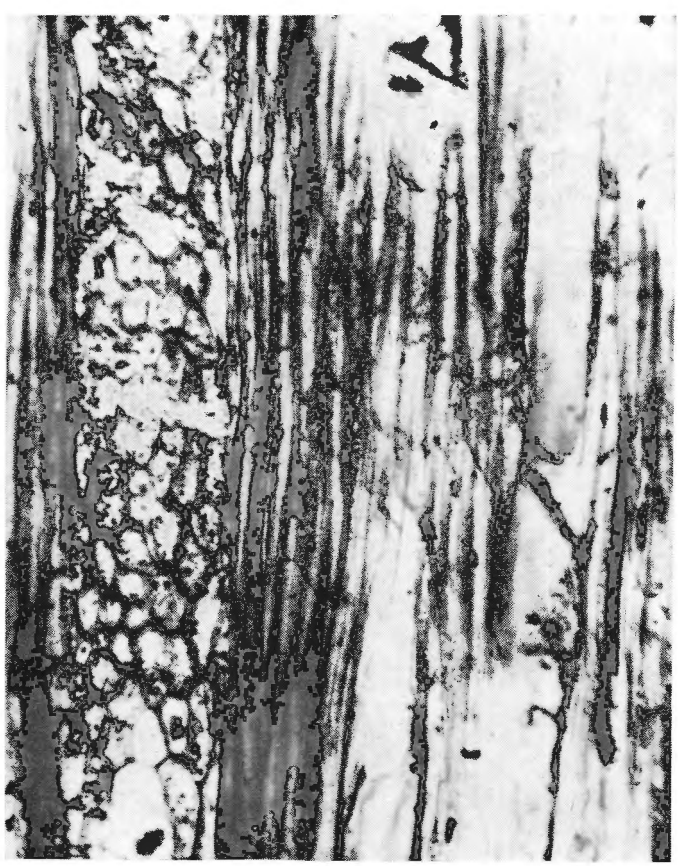

Fig. 19. Myrsine cubana A. DC. Tangential section ×120. Wide medullary ray with idioblast cells. Vessels and fibers. Besides the vessels contact-vasicentric longitudinal cells. The cels contain mastic material

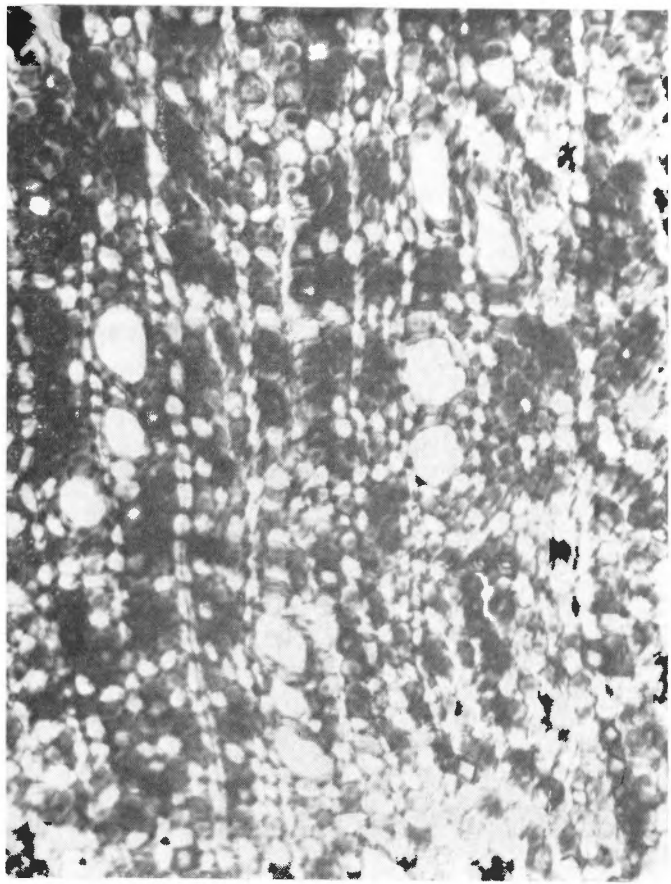

Fig. 20. Mastichodendron foetidissimum (Jacq.) Cronquist. Cross section ×120. Vessels and medullary rays with 1 and 2 cells in width. Vessels with thin wall and small sizes. The wall of fibers is thick, the lumen is narrow, with mastic material. Large quantity of apotracheal longitudinal parenchyma

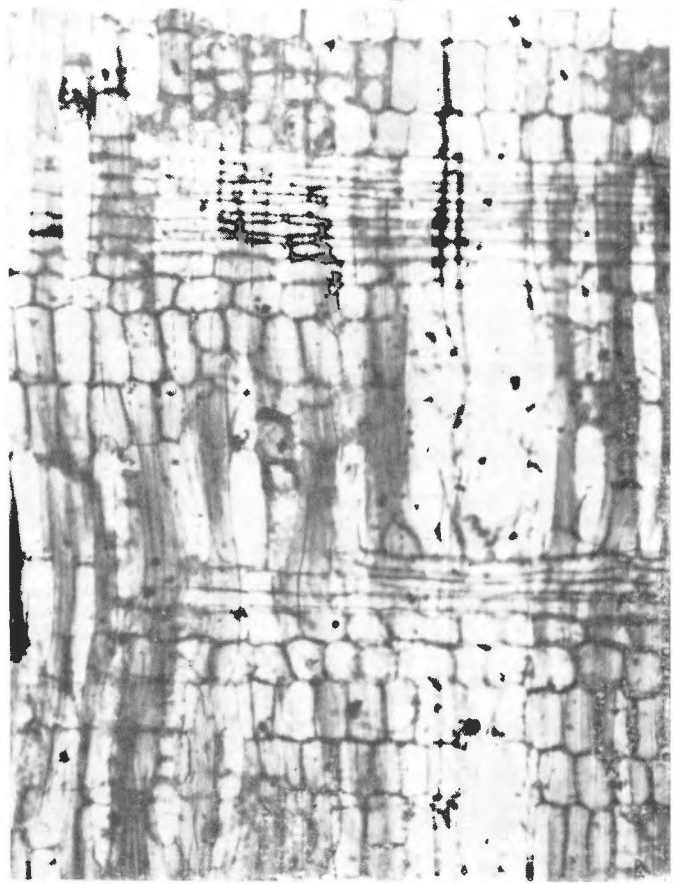

Fig. 21. Mastichodendron foetidissimum (Jacq.) Cronquist. Radial section ×120. Heterogeneous medullary rays. Vessel, fibers, and longitudinal parenchyma

Tips of the fibers end in smooth peak or bifurcate, with toothed margin. Diameter of longitudinal parenchyma cells 9.3—13.8 μ. Height 32.5—106.9 μ. The longitudinal crystal holder parenchyma is frequent.

Linociera bumelioides Griseb.

Wood porous diffuse. The ground mass of the wood is formed by fibers with thinner wall and narrower lumen. Terminal and contact-vasicentric, scarce apotracheal longitudinal parenchyma. Medullary rays uni- or biseriate (Fig. 23).

Solitary vessels are oval-shaped. Groups of vessels containing 2—6 members in radial direction are frequent. The vessels of the groups are flattened in tangential direction. Number of vessels 50 per 1 sq millimeter. Small sizes. Tangential diameter 20.7—59.8 μ. Radial diameter 20.7—73.6 μ. Length of

Fig. 22. Mastichodendron foetidissimum (Jacq.) Cronquist. Tangential section ×120. Medullary rays with 1 or 2 cells in width, fibers and longitudinal parenchyma

vessel members 284.0—639.0 μ, with small pits on the wall. Simple perforation plate. Vessels often contain tyloses and mastic material.

Medullary rays with one or two cells in width; heterogeneous structure. Height 69.0—644.0 μ. Width 11.5—34.5 μ. Marginal cells form 1—4 rows (standing cells). Medullary rays cells contain a large quantity of crystals and crystal sand (Figs 24, 25).

Fibers are arranged in radial lines. Diameter 6.9—18.4 μ. Wall thickness 4,6—13.8 μ. Full length 710.0—1420.0 μ. Tips of fibers lengthwise end in a smooth peak, rarely toothed and forking.

Diameter of longitudinal parenchyma cells 9.3—23.2 μ. Height 69.7—153.4 μ. Cells rarely contain crystals.

Detailed anatomical features of the species are shown in Tables, 1, 2, 3, and 4.

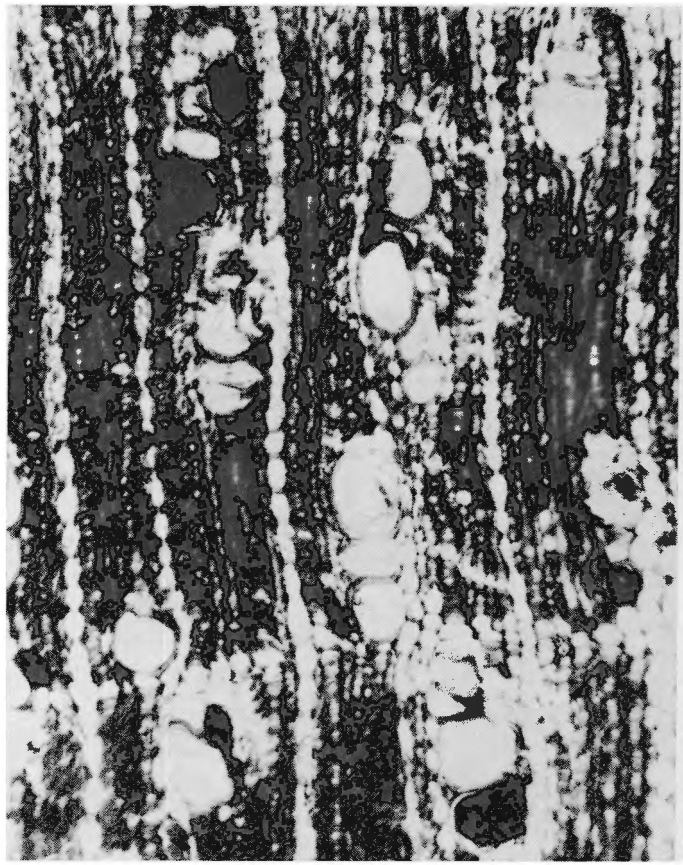

Fig. 23. Linociera bumelioides Griseb. Cross section ×120. Vessels and vessel groups, fiber with moderately thick wall and medullary rays with 1 cell in width. The wall of vessels is thick, lumen with mastic material. Contact-vasicentric longitudinal parenchyma in terminal position

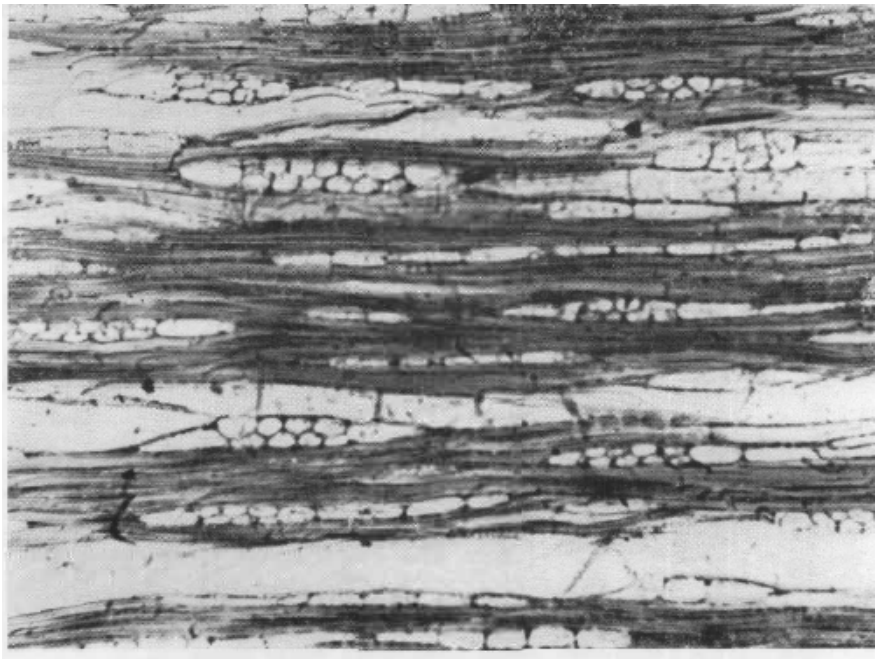

Fig. 25. Linociera bumelioides Griseb. Tangential section ×120. Medullary rays with 1 and 2 cells in width. Vessels, longitudinal parenchyma and fibers

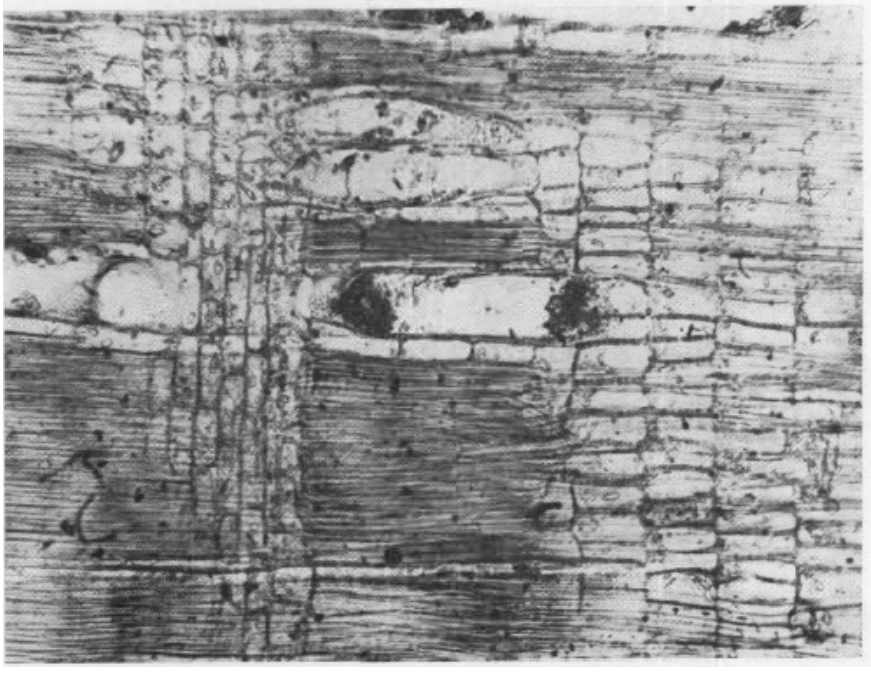

Fig. 24. Linociera bumelioides Griseb. Radial section ×120. Heterogeneous medullary rays, vessels with mastic material, fibers. Around the vessels contact-vasicentric longitudinal parenchyma cells

Table 1

Detailed anatomical features of the species

Elements	Features	*Curatella americana*	*Luehea speciosa*
Trachea members	Arrangement	diffuse, solitary	diffuse, solitary or radial groups of 2—4 members
	Shape	roundish or flattened in radial direction	oval
	Tangential diameter	86.7—165.6 μ	28.4— 82.8 μ
	Radial diameter	34.5—133.4 μ	20.7—115.0 μ
	Length of vessel members	426.0—852.0 μ	142.0—568.0 μ
	Number per sq mm	3	28
	Wall thickness	2.3—11.5 μ	2.3—9.2 μ
	Intervascular pitting	oblong pit	pit
	Perforation plate	simple	simple
	Content	tyloses	gum
Medullary	Width	multiseriate	uni- to twoseriate
	Number of cells	4—12	1—4
	Classification	heterogeneous	heterogeneous
	Height	230.0—10 350.0 μ	92.8—494.5 μ
	Width	23.0—414.0 μ	11.5— 69.0 μ
	Content	acicular crystals-raphids	crystal, gum
Fibers	Arrangement	irregular	in radial lines
	Shape	polygonal	polygonal
	Full diameter	25.3—48.3 μ	9.2—18.4 μ
	Wall thickness	3.4—12.6 μ	2.3 μ
	Full length	1065.0—2343.0 μ	710.0—1846.0 μ
	Type of pitting	bordered	simple
Longitudinal parenchyma	Arrangement	apotracheal and contact vasicentric	apotracheal and contact vasicentric
	Diameter	9.3— 37.2 μ	9.3— 23.2 μ
	Height	55.8—181.3 μ	41.8—106.9 μ
	umber of cells	1	1—2
	Content	gum	mastic
	Other	crystal	crystal

Table 2

Detailed anatomical features of the species

Elements	Faetures	*Alvaradoa amorphoides* ssp. *psilophylla*	*Cyrilla racemiflora*
Trachea members	Arrangement	diffuse, grouped	diffuse or in radial direction group of 2—11 members
	Shape	oval	roundish or oval
	Tangential diameter	20.7— 69.0 μ	25.3— 71.3 μ
	Radial diameter	23.0— 62.0 μ	20.7— 57.5 μ
	Length of vessel members	142.0—568.0 μ	213.0—639.0 μ
	Number per sq mm	54	46
	Wall thickness	2.3 μ	2.3—6.9 μ
	Intervascular pitting	oblong pit	pit
	Perforation plate	simple	simple
	Contain	rarely mastic	
Medullary rays	Width	uni- to multiseriate	uni- to twoseriate
	Number of cells	1—4—7	1—2
	Classification	heterogeneous	heterogeneous
	Height	69.0—675.0 μ	69.0—632.5 μ
	Width	11.5— 68.6 μ	11.5— 23.0 μ
	Content	mastic	
Fibers	Arrangement	in radial lines or irregular	irregular
	Shape	polygonal	polygonal
	Full diameter	22.5— 44.5 μ	16.1— 26.6 μ
	Wall thickness	2.3— 4.6 μ	6.9— 11.0 μ
	Full length	825.0—2330.0 μ	710.0—1278.0 μ
	Type of pitting	simple	bordered
Longitudinal parenchyma	Arrangement	scarce apotracheal	apotracheal
	Diameter	9.4— 24.2 μ	16.1— 26.6 μ
	Height	48.2—296.0 μ	55.8—125.5 μ
	Number of cells	1	1
	Content		mastic
	Other		crystal holder longitudinal parenchyma

Table 3

Detailed anatomical features of the species

Elements	Features	*Lysiloma bahamensis*	*Myrsine cubana*
Trachea members	Arrangement	diffuse, solitary or radial lines of 2—4 members	diffuse, rarely solitary, radial lines of 2—5 members
	Shape	oval or flattened in tangential direction	oval
	Tangential diameter	41.4—184.0 μ	27.6— 69.0 μ
	Radial diameter	20.7—181.7 μ	41.4— 73.6 μ
	Length of vessel members	213.0—426.0 μ	284.0—781.0 μ
	Number per sq mm	7	49
	Wall thickness	4.6—13.8 μ	2.3 μ
	Intervascular pitting	pit	pit
	Perforation plate	simple	simple
	Content	mastic	mastic
Medullary rays	Width	uni- or multiseriate	multiseriate
	Number of cells	1—2—3	3—6
	Classification	homogeneous	heterogeneous
	Height	69.0—345.0 μ	5750.0—7245.0 μ
	Width	11.5— 34.5 μ	115.0— 172.5 μ
	Content	mastic, rarely crystals	mastic, idioblast with crystal sand
Fibers	Arrangement	irregular	in radial lines
	Shape	polygonal	polygonal
	Full diameter	11.5—20.7 μ	16.1— 34.5 μ
	Wall thickness	6.9—9.2 μ	9.2— 14.2 μ
	Full length	639.0—1207.0 μ	639.0—1420.0 μ
	Type of pitting	simple	bordered
Longitudinal parenchyma	Arrangement	paratracheal, contact-vasicentric	scarce paratracheal contact-vasicentric
	Diameter	9.3— 23.2 μ	4.65— 27.9 μ
	Height	37.2—134.8 μ	46.5 —195.3 μ
	Number of cells	2—3	1
	Content	mastic	mastic
	Other	crystal holder longitudinal parenchyma	

Table 4

Detailed anatomical features of the species

Elements	Features	*Mastichodendron foetidis-*	*Linociera bumelioides*
Trachea members	Arrangement	diffuse, solitary or radial lines of 3—4 members	diffuse, solitary or radial lines of 2—6 members
	Shape	oval or flattened in tangential direction	oval or flattened in tangential direction
	Tangential diameter	18.4— 82.8 μ	20.7— 59.8 μ
	Radial diameter	34.5— 82.8 μ	20.7— 73.6 μ
	Length of vessel members	568.0—781.0 μ	284.0—639.0 μ
	Number per sq mm	28	50
	Wall thickness	2.3—6,9 μ	2.3—6.9 μ
	Intervascular pitting	pit	pit
	Perforation plate	simple	simple
	Contain		mastic and tyloses
Medullary rays	Width	uni- or biseriate	uni- or biseriate
	Number of cells	1—2	1—2
	Classification	heterogeneous	heterogeneous
	Height	172.5—483.0 μ	69.0—644.0 μ
	Width	11.5— 23.0 μ	11.5— 34.5 μ
	Content	mastic, crystals	crystal and crystal sand
Fibers	Arrangement	irregular	in radial lines
	Shape	polygonal	polygonal
	Full diameter	13.8— 23.0 μ	6.9— 18.4 μ
	Wall thickness	11.5— 20.7 μ	4.6— 13.8 μ
	Full length	1065.0—2401.0 μ	710.0—1420.0 μ
	Type of pitting	bordered	bordered
Longitudinal parenchyma	Arrangement	apotracheal	terminal and contact-vasicentric, scarce apotracheal
	Diameter	9.3— 13.8 μ	9.3— 23.2 μ
	Height	32.5—106.9 μ	69.7—153.4 μ
	Number of cells	1, rarely 2	1
	Content	crystal sand, crystal	crystal
	Other	crystal holder longitudinal parenchyma	

Origin of the samples

Curatella americana L.: Cuba; Prov. Pinar del Rio: Sierra de los Organos near Minas de Matahambre, in altit. of approx. 200 m. Collected by M. VALES and A. BORHIDI, 25. 11. 1974. No.: 56.

Luehea speciosa Willd.: Cuba: Prov. Pinar del Rio: Sierra del Rosario, Loma el Salón near Cayajabos, in altit. approx. 350 m. Collected by M. VALES, 20. 11. 1974. No.: 47

Alvaradoa amorphoides Liebm. ssp. *psilophylla* (Urb.) Cronq.: Cuba: Prov. Pinar del Rio; Peninsule of Guanahacabibes: El Veral Nature Conserv. Area, in altit. approx. 10—20 m. Collected by M. VALES and A. BORHIDI, 14. 12. 1974. No.: 91

Cyrilla racemiflora L.: Cuba; Prov. Pinar del Rio; Sierra de Cajalbana, Loma Preluda in altit. approx. 150 m. Collected by M. VALES and A. BORHIDI, 27. 11. 1974. No.: 70

Lysiloma bahamensis Benth.: Cuba; Prov. Matanzas; Peninsule of Zapata near to Playa Larga. Collected by M. VALES, 8. 4. 1974. No.: 122

Myrsine cubana A. DC.: Cuba; Prov. Pinar del Rio; Peninsule of Guanahacabibes: El Veral ature Conserv. Area, in altit. approx. 5—10 m. Collected by M. VALES and A. BORHIDI, 14. 12. 1974. No.: 104

Mastichodendron foetidissimum (Jacq.) Cronq.: Cuba: Prov. Camagüey; Sieara de Cubitas, Cerro Tuabaquey, in alt. approx. 300m. Collected by M. VALES 8. 5. 1975. No.:127.

Linociera bumelioides Griseb.: Cuba; Prov. Pinar del Rio; Peninsule of Guanahacabibes: El Veral Nature Conserv. Area in altit. approx. 10—20 m. Collected by M. VALES and A. BORHIDI, 12. 12. 1974. No.:78.

The samples are registered in the wood collection of the Botanical Institute of the Academy of Sciences of Cuba; Havanna.

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