Fig. 346 Two characteristic shrubs or little trees of the littoral deciduous forest: *Omphalea trichotoma* Muell. Arg. with fruits and *Comocladia platyphylla* A. Rich (Photo: A. Borhidi)

14.1 Order: EUGENIO-METOPIETALIA TOXIFERI Knapp (1964) Borhidi hoc loco

Coastal and semicoastal or quasicoastal shrub forests and shrublands of the West Indies.

Characteristic species in Cuba: *Metopium toxiferum, M. brownei, Coccothrinax borhidiana, C. litoralis, C. fragrans, Plumeria obtusa, P. keyensis, P. sericifolia, Omphalea trichotoma,* (Fig. 346.) *Krugiodendron ferreum, Grimmeodendron eglandulosum, Picrodendron macrocarpum, Calyptranthes pallens, C. dodecandra, Colubrina arborescens, C. elliptica, C. cubensis, Guapira longifolia, Castela* spp., *Bumelia celastrina, B. glomerata* ssp. *horrida, Pouteria domingensis, Thouinia elliptica, Croton lucidus,* etc.

Fig. 347 Two characteristic elements of the dry littoral limestone forest at Punta Colorados (Las Villas): *Caesalpinia bonduc* (L.) Roxb. with spiny fruits and *Pouteria domingensis* (Gaertn. f.) Baehni (Photo: A. Borhidi)

14.1.1 Alliance: ***Eugenio-Capparidion***
Borhidi in Borhidi et al. 1979 et hoc loco

Littoral dry forests and dry woodlands (Fig. 347) in the Greater Antilles on coral limestone and low terraces near the coastal belt. They can be characterized by the presence of deciduous and evergreens sclerophyllous trees, palms, evergreen, often spiny shrubs, columnar and arborescent cacti and other succulents.

Characteristic species: *Capparis flexuosa, C. cynophallophora, Colubrina elliptica, Hippomane mancinella, Tabebuia myrtifolia, Krugiodendron ferreum, Grimmeodendron eglandulosum, Eugenia maleolens, Catalpa punctata, Bourreria succulenta, Cordia galeottiana, C. sebestena, Opuntia dillenii* s.l., etc.

Associations studied in Cuba:

Guayaco-Pithecellobietum guadelupensis Borhidi ass. nova

The littoral shrub forest of the northern coast of Central Cuba, well developed in the Hicacos Peninsula. The type relevé was made by Borhidi at Varadero, Rincón Francés in August, 1970 (Table 109).

Picrodendro-Burseretum simarubae Del-Risco

It is a rather common littoral dry forest community along the southern rocky shores of Cuba. It is composed of sclerophyllous and deciduous, bom-shaped, densely ramified small trees. The structure and composition of the association are exhibited in the profile of Fig. 348, made by Borhidi and Del-Risco, in March, 1975, between Playa Girón and Cocodrilo (Matanzas Province).

Table 109 Guayaco-Pithecellobietum guadelupensis Borhidi ass. nova

Life form	Leaf size	Dist. pattern		
		Tree layer: cover 20%; height: 4—6 m		
MesPscap	no	A	*Hypelate trifoliata* Sw.	2.1
MiPsucc	aph	ECoc	*Pilosocereus robinii* (Lem.) Byl. and Row.	1.3
MesPscap	mi	CB	*Picrodendron macrocarpum* (A. Rich.) Britt.	1.2
NPcaesp	mi	ECoc	*Neobracea angustifolia* Britt.	1.1
MesPsucc	aph	EPC	*Dendrocereus nudiflorus* (Engelm.) Britt. and Rose	+.2
		Shrub layer: cover 85%; height: 1—4 m		
MesPscap	no	NCar	*Guajacum sanctum* L.	3.4
MiPscap	no	NCar	*Pithecellobium guadelupense* (Pers.) Chapm.	3.4
MesPscap	mı	A	*Eugenia maleolens* Poir.	2.3
MiPscap	mı	GA	*Erythroxylum rotundifolium* Lunan	1.2
MiPcaesp	no	A	*Forestiera segregata* (Jacq.) Kr. and Urb.	1.2
MiPcaesp	no	NCar	*Jacquinia keyensis* Mez	1.2
NPcaesp	mı	A	*Savia bahamensis* Britt.	1.2
MiPscap	mi	A	*Schaefferia frutescens* Jacq.	1.2
MesPscap	me	NCar	*Citharexylum caudatum* L.	1.2
MesPscap	me	NCar	*Ateramnus lucidus* (Sw.) Rothm.	1.1
NPcaesp	no	PT	*Capsicum frutescens* L.	1.1
MesPscap	no	PCar	*Colubrina elliptica* (Sw.) Briz. and Stearn	1.1
NPcaesp	no	PCar	*Erithalis fruticosa* L.	1.1
MiPscap	no	NCar	*Exostema caribaeum* (Jacq.) R. and S.	1.1
NPcaesp	mi	ECoc	*Guettarda undulata* Gris.	1.1
MesPscap	na	GAB	*Lysiloma sabicu* Benth.	1.1
MiPcaesp	mi	GAB	*Maytenus buxifolius* (A. Rich.) Gris.	1.1
MesPscap	no	NT	*Bursera simaruba* (L.) Sarg.	+.2
MiPscap	mi	NCar	*Caesalpinia vesicaria* L.	+.2
NPcaesp	no	A	*Argythamnia candicans* Sw.	+.1
MesPscap	no	PCar	*Ateleia gummifera* var. *cubensis* (Gris.) Mohl.	+.1
MiPscap	mi	EPC	*Belairia spinosa* A. Rich.	+.1
MiPscap	no	NT	*Capparis cynophyllophora* L.	+.1
NPcaesp	no	A	*Cassia ligustrina* L.	+.1
MiPcaesp	mi	EPC	*Diospyros grisebachii* (Hiern.) Standl.	+.1
NPcaesp	no	ECoc	*Helicteres furfuracea* Gris.	+.1
MiPcaesp	me	A	*H. jamaicensis* Jacq.	+.1
MesPscap	na	CB	*Jacaranda coerulea* (L.) Gris.	+.1
MesPscap	mi	NCar	*Metopium brownei* (Jacq.) Urb.	+.1
MiPros	me	ECoc	*Plumeria sericifolia* Wr. ex Gris.	+.1
MiPscap	me	EPC	*Pseudocarpidium neglectum* Bisse	+.1

Life form	Leaf size	Dist. pattern		
			Herb layer: absent	
			Lianes: cover 25%	
PLfrut	ma	NT	*Gouania polygama* (Jacq.) Urb.	2.2
PLfrut	mi	PT	*Caesalpinia bonduc* (L.) Roxb.	1.3
Chrept	me	NCar	*Urechites lutea* (L.) Hitchc.	1.1
PLfrut	no	NT	*Chiococca alba* (L.) Hitchc.	1.1
PLfrut	mi	A	*Distictis lactiflora* (Vahl) DC.	1.1
Chrept	no	NT	*Echites umbellata* Jacq.	1.1
Chrept	me	PT	*Ipomoea alba* L.	1.1
PLsuff	no	NT	*Cissus trifoliata* L.	+.2
Chrept	me	A	*Galactia dubia* DC.	+.1
Chrept	no	CB	*Ipomoea carolina* L.	+.1

Type relevé made by A. Borhidi 5.8. 1970. Locality: North Cuba, Hicacos Peninsula, Rincón Francés, near Varadero, 2 m a.s.l. Exposition: 0°. Sample plot area: 10×30 m

Grimmeodendro-Gochnatietum sagraeanae Borhidi ass. nova

This is a dry littoral forest community on the second terrace of the northern high limestone shore of Cuba between Jibacoa and Matanzas. The tree layer is formed by the dominant spiny 4—6 m high trees of *Gochnatia sagraeana,* accompanied by *Grimmeodendron eglandulosum, Thrinax radiata, Capparis cynophallophora* and others.

Krugiodendro-Drypetetum Ciferri 1936

Sarcomphalo-Reynosietum septentrionalis Borhidi ass. nova

This is a dry littoral forest association on the low limestone terraces of northern Camagüey and Oriente. The type relevé was made by Borhidi at Playa Pesquero Nuevo in 14. February, 1976. It is a community very rich in species with a high frequency of thorny trees and shrubs and that of cacti.

14.1.2 Alliance: ***Bombacopsi-Burserion simarubae*** Borhidi all. nova

Two-layered deciduous tropical forests on lowland subcoastal reefs of West Cuba, formed by deciduous emergents and sclerophyllous trees in the second tree layer.

Characteristic species: *Bombacopsis cubensis,* (Fig. 349) *Guajacum officinale, G. sanctum, Catalpa punctata, Diospyros crassinervis, Clerodendron calcicola, Vitex acunae, Callicarpa roigii,* etc.

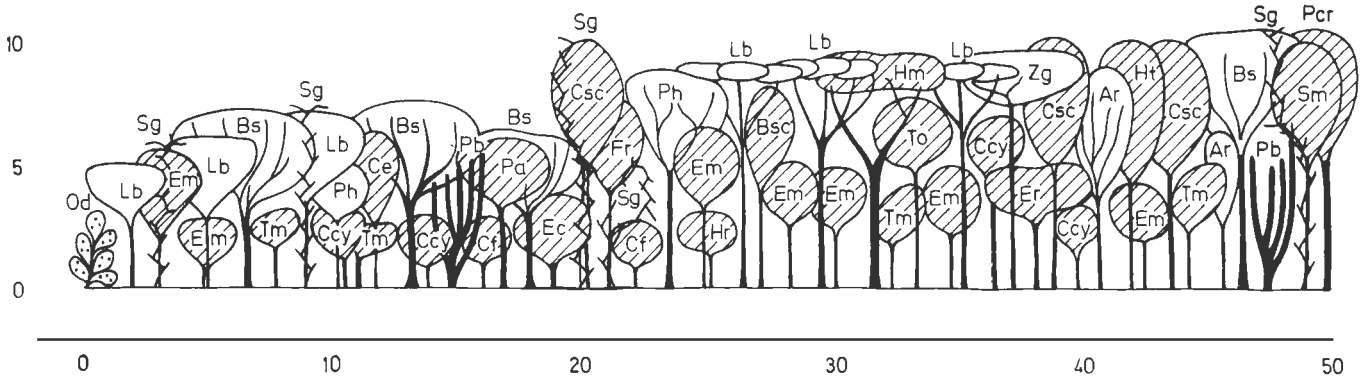

Fig. 348 Structure profile of a subcoastal semi-deciduous scrub woodland *(Eugenio-Capparidion* alliance) in the southern coast of the Zapata Peninsula near Cocodrilo (Borhidi, Del-Risco and Ovideo) Ar=*Adelia ricinella;* Bs=*Bursera simaruba;* Bsc=*Bourreria succulenta;* Ccy=*Capparis cynophyllophora;* Cf=*Capparis flexuosa;* Cr=*Colubrina reclinata;* Csc=*Casasia calophylla;* Ec=*Exostema caribaeum;* Em=*Eugenia maleolens;* Er=*Erythroxylum rotundifolium;* Fr=*Forestiera rhamnifolia;* Hm=*Hippomane mancinella;* Hr=*Hyperbaena racemosa;* Ht=*Hypelate trifoliata;* Lb=*Lysiloma bahamense;* Od=*Opuntia dillenii;* Pa=*Peltophorum adnatum;* Pb=*Pilosocereus brooksianus;* Pcr=*Picrodenron macrocarpum;* Ph=*Piscidia havanensis;* Sg=*Selenicereus grandifolius;* Sm=*Swietenia mahagoni;* Tm=*Tabebuia myrtifolia;* To=*Torrubia* (Guapira) *obtusata;* Zg=*Zuelania guidonia*

Fig. 349 Giant example of *Bombacopsis cubensis* ("Ceibón") in the semi-deciduous littoral limestone forest of the Guanahacabibes Peninsula (Photo: A. Borhidi)

Bombacopsi-Catalpetum punctatae Borhidi and Muñiz ass. nova

This deciduous forest association grows on the limestone reefs of the Guanahacabibes Peninsula 5 to 10 m a.s.l. Its composition is shown in the Appendix Table 25. in column no. 28 in a synthetic list five relevés made by Borhidi and Muñiz January, 1970. The structure of the community can be seen in the profile of Fig. 295, (p. 413), made by Borhidi and Capote in El Veral in January, 1975.

14.2 Order: BOMBACOPSI-THRINACETALIA Borhidi in Borhidi et al. 1979 et hoc loco

Orophytic deciduous tropical forests, shrub forests or shrub woodlands of West Cuba, composed of palms, deciduous xerophytic trees, with special adaptation mechanisms for accumulation of water and creeping and or rosulate succulents, and climbers. The herb layer is formed by epiphytic bromeliaceas.

Characteristic species: *Bombacopsis cubensis, Thrinax morrisii, Erythrina cubensis, Agave tubulata, Thouinia nervosa, Tabebuia petrophila, T. calcicola, T. jackiana, Thouinia canescens, Plumeria emarginata, Terminalia neglecta, Actinostemon brachypodus, Oplonia purpurascens, Leptocereus* spp., *Vitex divaricata* ssp.

cubensis, Celtis iguanaea, Pristimera coriacea, Cuervea integrifolia, Psidium scopulorum, P. thomasianum, P. vicentinum, Plinia spp., *Rochefortia spinosa, Lantana strigosa, Malpighia roigiana*, etc.

14.2.1 Alliance: ***Spathelio-Gaussion***
Borhidi in Borhidi et al. 1979 et hoc loco

Orophilous shrub forests and deciduous forests growing on the Jurassic hard blue limestone in the Sierra de los Organos, Sierra de la Güira, Pan de Guajaibón and the high limestone cliffs of the Sierra del Rosario (Peña Blanca, etc.) These communities are extremely rich in endemic species.

Characteristic species: *Spathelia brittonii, Gaussia princeps, Ceratopyxis verbenacea, Bursera shaferi, Ekmanianthe actinophylla, Siemensia pendula, Guettarda calcicola, Eugenia galeata, E. cristata, Lobelia cubana, Tetrazygia lanceolata* s.l. *Auerodendron acuminatum, Lantana strigosa, Bourreria mucronata, B. polyneura, Leptocereus assurgens, L. ekmanii, Vriesea dissitiflora, Omphalea hypoleuca, Ancistranthus harpochiloides, Microcycas calocoma* (diff.), *Zanthoxylum pimpinelloides*, etc.

Associations studied in Cuba:

Vrieseo-Ceratopyxidetum verbenaceae Borhidi and Capote ass. nova

This is a karstic tropical woodland community of the very tops of the haystack hills. The extremely eroded limestone rock surface of the peaks and tops are covered by a rather continuous carpet of *Vriesea dissitiflora.* Sparsely situated trees and shrubs are growing up from the deep karstic holes and crevices, such as *Bombacopsis, Thrinax morrisii,* and the dominant shrub of the endemic Rubiaceae genus, *Ceratopyxis.* The type relevé was made by Borhidi and Capote in Sierra de la Güira, Mogote de Graveranes, height approx. 480 m a.s.l. Sample plot 10×25 m. Exposition: 0^0. Top of the Mogote. (Table 110).

Ceratopyxidi-Gaussietum principis Borhidi

This is an orophilous shrub woodland community formed by sparse emergent trees and palms and dense shrub layer, without a notable herb layer. It grows mainly on the sunny steep slopes of the mogotes. A synthetic list of five representative relevés can be found in the Appendix, Table 25, column no. 25, made by Borhidi, June, 1970 Viñales, Mogote de Cueva de José Miguel, Mogote del Mural, Sierra de la Valle.

Bombacopsi-Gaussietum principis Borhidi

This is a low orophilous deciduous shrub forest community growing on the moderately declined slopes and on the foothill rubbles. *Bombacopsis* and *Gaussia* are accompanied by *Bursera shaferi* and *Microcycas calocoma;* in the herb layer *Ancistranthus* (endemic Acanthaceae genus) *harpochiloides* is abundant.

Table 110 Vrieseo-Ceratopyxidetum verbenaceae Borhidi and Capote ass. nova

Emergent trees: 4—6 m high, cover 5%			
Thrinax morrisii	+.1	*Tabebuia calcicola*	1.1
Bombacopsis cubensis	+.1	*Plumeria* obtusa *emarginata*	+.1
Shrub layer: 2—3 m high, cover 60—70%			
Ceratopyxis verbenacea	3.4	*Bourreria mucronata*	3.3
Tetrazygia minor	1.1	*Picrammia pentandra*	1.1
Exostema rotundatum	1.1	*Ateramnus lucidus*	1.1
Oplonia purpurascens	1.2	*Tabebuia calcicola*	+.1
Thrinax morrisii	+.1	*Diospyrus crassinervis*	+.1
Caesalpinia bahamensis	+.1	*Psidium scopulorum*	+.1
Polygala montana		*Hippomane mancinella*	+.1
Herb layer: up to 1.5 m height, cover 100%			
Vriesea dissitiflora	5.5	*Hohenbergia penduliflora*	1.1
Tillandsia fasciculata	1.1	*Tillandsia argentea*	1.1
Agave tubulata	+.1	*Selenciereus grandiflorus*	+.1
Leptocereus assurgens	+.1	*Lantana strigosa*	+.1
Lobelia cubana	+.1	*Adiantopsis paupercula*	+.1
Epidendrum nocturnum	+.1	*Erythrodes sagraeana*	+.1
Epiphytes: cover 15%			
Tillandsia fasciculata	2.3	*Tillandsia valenzuelana*	1.2
Tillandsia bulbosa	+.1	*Tillandsia pruinosa*	+.1
Tillandsia usneoides	+.1	*Polypodium heterophyllum*	+.2
Polypodium polypodioides	+.1	*Pleurothallis tribuloides*	+.1
Lianes: cover 20—30%			
Cuervea integrifolia	2.3	*Smilax havanensis*	1.2
Serjania diversifolia	1.1	*Passiflora suberosa*	1.1
Philodendron lacerum	+.2	*Celtis iguanea*	+.1
Securidaca elliptica	+.1	*Duranta repens*	+.1
Cynanchum ephedroides	+.1		

14.2.2 Alliance: ***Thrinacion morrisii***
Borhidi in Borhidi et al. 1979 et hoc loco

Orophilous karstic tropical shrub forests on soft. Tertiary limestone in West Cuba (Sierra de Anafe, Mogotes de Jaruco, Highlands of Habana and Matanzas) poor in species and endemics.

Characteristic species: *Celtis trinervia, Cordia gerascanthus, Hebestigma cubense, Gossypiospermum praecox, Tabebuia myrtifolia, T. petrophila, Leptocereus leoni, Eugenia duplicata, E. serrei, E. anafensis, Tournefortia maculata, Solandra longiflora* (Fig. 350) *Pseudocarpidium neglectum, Sapium leucogynum, Picramnia pentandra,* etc.

Fig. 350 One of the most common woody climbers of the mogote vegetation: *Solandra longiflora* Tuss. (Photo: A. Borhidi)

Bombacopsi-Thrinacetum morrisii Borhidi and Muñiz ass. nova

This is the deciduous karstic shrub forest association of the Habana Matanzas limestone ranges, characterized by the dominance of *Thrinax morrisii* and *Rhytidophyllum exsertum* in the tree and shrub layer, respectively. The type relevé was made by Borhidi and Muñiz in the Escaleras de Jaruco, at Tapaste in September, 1969. Exposition: SSW; declination 35—45°; cover of the nude rocks 75% (Table 111).

Celtidi-Hebestigmentum cubensis Borhidi

This is the deciduous orophilous shrub forest community of the southern slopes of the Sierra de Anafe, characterized by the presence of *Leptocereus leoni, Eugenia anafensis* and *E. duplicata* and the dominance of *Celtis trinevia, Cordia gerascanthus* and *Hebestigma cubense* in the tree layer.

14.3 Order: TABEBUIO-COCCOTHRINACETALIA Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Tropical shrub forests on the Tertiary limestone cliffs in the mountains of Central Cuba and Oriente (Sierra de Escambray, Sierra Maestra and limestone cliffs and

Table 111 Bombacopsi-Thrinacetum morrisii Borhidi et Muñiz ass. nova

Emergent trees: 10—12 m high; cover: 10%			
Bombacopsis cubensis	1.1	*Cecropia peltata*	1.1
Tree layer: 5—8 m high; cover: 70%			
Thrinax Morrisii	4.4	*Ficus jaquinifolia*	1.1
Ficus subscabrida	+.1	*Ficus aurea*	+.1
Shrub layer: 2—3 m high; cover: 60%			
Erythroxylum areolatum	2.2	*Erythroxylum havanense*	2.1
Picramnia pentandra	2.2	*Allophylus Cominia*	2.2
Trichilia glabra	2.2	*Trichilia hirta*	1.1
Bunchosia nitida	1.1	*Bunchosia media*	1.1
Schaefferia frutescens	1.1	*Schoepfia chrysophylloi-des*	1.1
Casearia hirsuta	1.1	*Eugenia maleolens*	1.1
Trema micrantha	1.1	*Trema micrantha*	+.1
Eugenia asperifolia	+.1	*Cordia globosa* ssp. *humilis*	+.1
Ateleia apetala	+.1	*Triumfetta semitriloba*	+.1
Casearia guianensis	+.1	*Eupatorium havanense*	+.1
Trema micrantha	+.1	*Tournefortia glabra*	+.1
Vernonia menthaefolia	+.1		
Hamelia patens	1.1		
Herb layer: up to 1 m high: cover: 20%			
Rhytidophyllum exsertum	2.2	*Pilea microphylla*	2.2
Dryopteris patens	1.1	*Dryopteris sclerophylla*	+.1
Dryopteris normalis	+.1	*Dryopteris reptans*	+.1
Adiantum cristatum	1.1	*Adiantum dentatum*	+.1
Tectaria coriandrifolia	+.1	*Adiantum fragilis*	+.1
Pharus glaber	1.1	*Rivina humilis*	+.1
Fleurya cuneata	+.1		
Lianes up to a height of 3—4 m; cover: 40—50%			
Banisteria pauciflora	2.3	*Platygyne hexandra*	2.2
Philodendron Clementis	2.2	*Chiococca alba*	1.2
Pithecoctenium echinatum	1.2	*Gouania lupuloides*	1.1
Clematis dioica	+.2	*Melothria guadelupensis*	+.2
Passiflora multiflora	+.1	*Passiflora suberosa*	+.2
Lasiacis divaricata	+.1		

Mosses: *Bryum coronatum, Thuidium involvens, Barbula agraria*

ranges of the Sagua-Baracoa Massif). This vegetation type is very rich in species, endemics, and palms. The forests are composed of sclerophyllous trees and shrubs, of climbers and columnar cacti. Unlike in the West Cuban mogote-vegetation, the epiphytic bromeliaceas are missing in the herb layer, and the outstanding abundance of *Pilea* species can be observed as a characteristic feature.

Characteristic species: *Coccothrinax* spp., *Hemithrinax compacta, Tabebuia* spp., *Fagara coriacea, Gesneria heterochroa, G. cubensis, G. salicifolia, G. gibberosa, G. purpurascens, Phyllanthus epiphyllanthus* ssp. *dilatatus, Neobracea susannina, N. howardii, Eupatorium carsticola, Synapsis ilicifolia, Thouinia* spp., *Siphocampylus* spp., *Euleria tetramera, Savia erythroxyloides, Pilea* spp., etc.

14.3.1 Alliance: ***Tabebuio-Coccothrinacion***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Tropical karstic shrub forests or shrub woodlands in montane rather isolated limestone areas, represented by a number of different vicarious associations, characterized by different endemic species of the same genera as *Coccothrinax, Tabebuia, Pilea, Gesneria, Thouinia,* etc. On the highest limestone peaks the mogote-forest tends to have a montane character, manifested as a combination of montane rainforest elements.

Association studied in Cuba:

Coccothrinaci-Tabebuietum bibracteolatae Borhidi and Muñiz ass. nova

It is the endemic community of the limestone cliff area of the Sierra Maestra range, south of Baire. It is characterized by a considerable number of endemics such as *Neobracea susannina, Malpighia acunana, Tabebuia bibracteolata, Pilea uninervis, Coccothrinax elegans,* etc. A synthetic list of five relevés is given in the Appendix Table 25, column no. 25. all made by Borhidi and Muñiz between Baire, Matias and La Tabla in October, 1969 and January, 1970. The type relevé was also made by Borhidi and Muñiz E. of Matias in October, 1969 (Table 112).

Ekmanio-Erythroxyletum baracoënsis Borhidi ass. nova

It is an endemic orophilous shrub forest association of Yunque de Baracoa, living in the limestone cliffs bordering the plateau of the characteristic shaped mount. The community is characterized by a great number of local endemics such as *Ekmania lepidota, Vernonia ekmanii, Pilea pulchra, Auerodendron reticulatum, Erythroxylon baracoënse, Calycogonium plicatum, Croton yunquensis, Coccothrinax yunquensis,* etc. The type relevé was made by Borhidi at the peak of the Yunque de Baracoa, at 520 m a.s.l. in November, 1978 (Table 113).

Tabebuio sauvallei-Garryetum Borhidi and Muñiz ass. nova

Montane karstic shrub woodland community of the high limestone peaks of the Sierra de Escambray, characterized by a number of endemic species such as *Euleria tetramera, Citharexylum matheanum, Rondeletia potrerillona, Rhamnidium potrerilloanum, Erythroxylon clarense, Daphnopsis alainii,* and by montane elements, for example, *Garrya fadyenii, Torralbasia cuneifolia* s.l., *Gesneria viridiflora* s.l.,

Table 112 Coccothrinaci-Tabebuietum bibracteolatae Borhidi and Muñiz ass. nova

Emergent trees: cover: 5%, 10—12 m high;			
Coccothrinax elegans	1.2	*Ficus wrightii*	1.1
Tree layer: cover: 10—15%; 8—10 m high;			
Synapsis ilicifolia	1.1	*Strempeliopsis strempelioides*	+.1
Fagara cubensis	1.1	*Ficus jacquinifolia*	1.1
Alvaradoa arborescens	+.1	*Ficus aurea*	1.1
Tabebuia bibracteolata	1.2	*Swietenia mahagoni*	+.1
Calycophyllum candidissimum	+.1	*Cedrela mexicana*	+.1
Zizyphus rhodoxylon	+.1	*Bursera simaruba*	1.1
Shrub layer: cover: 50—60%; 3—5 m high;			
Neobracea susannina	2.3	*Helietta glaucescens*	1.1
Tabebuia bibracteolata	3.3	*Ateleia apetala*	1.1
Catalpa brevipes	1.1	*Swietenia mahagoni*	2.2
Eugenia asperifolia	1.1	*Erythrina cubensis*	1.1
Pithecellobium hystrix	+.1	*Ateramnus lucidus*	3.3
Fagara cubensis	+.1	*Cordia gerascanthus*	1.1
Eupatorium carsticola	1.1	*Comocladia dentata*	1.1
Malpighia acunana	1.1	*Savia erythroxyloides*	1.1
Krugiodendron ferreum	+.1	*Vernonia wrightii*	1.2
Oplonia acunae	1.1	*Agave underwoodiana*	+.1
Citharexylum caudatum	+.1	*Forsteronia segregata*	1.1
Clerodendron denticulatum	+.1	*Casearia spinescens*	1.1
Climbers: 40%			
Forsteronia corymbosa	2.2	*Allophylus cubensis*	1.1
Celtis iguanea	+.1	*Serjania subdentata*	1.2
Byttneria scorpiura	+.1	*Passiflora sexflora*	+.1
Cynanchum ephedroides	1.1	*Passiflora foetida*	+.1
Platygyne dentata	1.2	*Chiococca alba*	2.2
Melothria guadelupensis	+.1	*Momordica charantia*	1.1
Echites umbellata	1.1	*Galactia spiciformis*	1.2
Selenicereus urbanianus	1.2	*Smilax havanensis*	2.3
Clitoria rubiginosa	+.1	*Centrosema virginianum*	+.1
Philodendron lacerum	1.2	*Trixis radialis*	+.1
Epiphytes: 10%			
Hohenbergia penduliflora	2.2	*Tillandsia fasciculata*	1.1
Tillandsia usneoides	1.1	*Epidendrum cochleatum*	+.1
Epidendrum umbellatum	+.1	*Rhipsalis baccifera*	1.1
Herb layer: cover: 40%; 0.1—1 m high;			
Pilea uninervis	3.3	*Tillandsia fasciculata*	1.1
Epidendrum cochleatum	1.1	*Pilea microphylla*	1.1
Peperomia obovata	+.1	*Begonia cubincola*	+.1
Lasiacis divaricata	2.2	*Lithachne pauciflora*	1.2

Table 113 Ekmanio-Erythroxyletum baracoënsis Borhidi ass. nova

Emergent trees: cover: 30%; 5—8 m high;			
Coccothrinax yunquensis	1.1	*Tabebuia polymorpha*	2.2
Exostema valenzuelae ssp. *wrightii*	1.2	*Guettarda lindeniana*	1.2
Illicium cubense	1.1	*Protium fragrans*	+.1
Shrub layer: cover 70%; 1—4 m high;			
Ekmania lepidota	2.2	*Erythroxylum baracoense*	2.3
Auerodendron reticulatum	1.2	*Exostema valenzuelae* ssp. *wrightii*	1.1
Savia erythroxyloides	2.3	*Croton yuquensis*	2.2
Calycogonium echinatum	1.1	*Ossaea heterotricha*	1.2
Myrtus nummularioides	1.2	*Psidium parvifolium*	+.1
Vernonia yunquensis	1.3	*Strychnos grayi*	+.1
Eupatorium ekmanii	+.1	*Callicarpa wrightii*	+.1
Herb layer: cover: 20%; 0.5—1.5 m high;			
Pilea spathulata	1.1	*Siphocampylus manettiaeflorus*	+.1
Sapium adenodon	+.1	*Gesneria viridiflora* var. *obovata*	+.1
Phyllanthus epiphyllanthus ssp. *dilatatus*	+.1	*Hillia parasitica*	+.1
Vernonia yunquensis	1.2	*Hillia tetrandra*	+.1
Spiranthes elata	+.1	*Zamia latifoliolata*	+.1
Tabebuia polymorpha	+.1	*Liabum wrightii*	+.1
Begonia wrightii	+.1	*Rajania baracoensis*	+.1
Dioscorea grisebachii	+.1		

etc. A synthetic list of five relevés is found in the Appendix Table 25, column no. 27 representing the association. The relevés were made by Borhidi and Muñiz, in June, 1970 at Pico Potrerillo between 850 and 930 m a.s.l.

14.4 Order: LANTANO-CORDIETALIA Borhidi in Borhidi et al 1979 et hoc loco

Littoral scrub woodlands and thickets on the dry limestone terraces in the West Indies. It is a desert-like vegetation type, somewhere really related to a semi-desert vegetation zone, conditioned by a monoxeric or bixeric seasonal, tropical climate, with 8—10 dry months and 600—1000 mm annual rainfall. This vegetation unit is characterized by low boomshaped trees and micro-, nano-, and leptophyllous, sclerophyllous or deciduous, frequently spiny shrubs.

Characteristic species: *Lantana* spp., *Cordia* spp., *Jacquinia berterii, J. maisiana, Croton* spp., *Pseudocarpidium* spp., *Guajacum officinale, Polygala cuneata, Bursera glauca, Guettarda* spp., *Coccothrinax* spp., *Eugenia* spp., *Myrtus oonophylla, Amyris diatrypa, Spirotecoma spiralis, Tabebuia* spp., *Melocactus* spp., *Oplonia polyece, Leucocroton microphyllus, Bellonia spinosa, Maytenus buxifolia* ssp. *cochlearifolia, Barleriola saturejoides* ssp. *hirsuta, Reynosia mucronata* ssp. *azulensis, Neea shaferi,* etc.

14.4.1 Alliance: ***Lantano-Cordion***
Borhidi in Borhidi et al. 1979 et hoc loco

Moderately dry littoral scrub woodlands with emergent palms and succulents and with few spiny elements. This community group can be found mostly in the limestone coastal areas of West and Central Cuba.

Characteristic species: *Cordia sebestena, C. galeottiana, C. globosa* ssp. *humilis, Lantana involucrata, Savia bahamensis, Oplonia tetrasticha, Chionanthus bumelioides, Caesalpinia pauciflora, Malpighia pallens, Castela calcicola, Tabebuia myrtifolia, T. capotei, Vitex* spp.

Association studied in Cuba:

Linociero-Savietum bahamensis Borhidi and Del-Risco ass. nova

Low and dense littoral scrub woodland of the southern limestone shores of West and Central Cuba. The type relevé was made by Borhidi and Del-Risco in Paso Malo, south -west of Cienfuegos. The emergent palm is *Coccothrinax cupularis* and the emergent columnar succulent is *Pilosocereus robinii* (Table 114).

Table 114 Linociero-Savietum bahamensis Borhidi and Del-Risco ass. nova

Life-form	Leaf size	Distr. pattern		
			Emergents 4—5 m tall, cover: 1%	
MesPros		ECoc	*Coccothrinax cupularis* (León) Muñiz	+.1
MiPsucc	aph	ECoc	*Pilosocereus robinii* (Lem.) Byl. and Row.	+.1
			Shrub layer 1—3 m tall, cover: 90%	
MesPscap	me	GA	*Linociera bumelioides* Gris.	2.4
NPcaesp	mi	A	*Savia bahamensis* Britt.	4.4
MesPscap	no	NCar	*Ateramnus lucidus* (Sw.) Rothm.	2.3
NPcaesp	na	A	*Caesalpinia pauciflora* (Gris.) Wr.	2.3
MiPscap	na	EPC	*Tabebuia myrtifolia* (Gris.) Britt.	2.2
MiPscap	mi	NCar	*Caesalpinia vesicaria* L.	1.2
MiPcaesp	mi	GA	*Bumelia glomerata* ssp. *horrida* (Gris.) Borhidi	1.1
MiPcaesp	mi	EPC	*Diospyrus grisebachii* (Hiern.) Standl.	1.1
MiPcaesp	mi	NT	*Erithalis fruticosa* L.	1.1
NPcaesp	lp	CB	*Pithecellobium hystrix* (A. Rich.) Benth.	1.1
MiPros	me	EPC	*Plumeria emarginata* Gris.	1.1
MiPscap	no	GA	*Guapira discolor* (Spr.) Lundell	+.2
NPcaesp	me	EPC	*Cordia galeottiana* A. Rich.	+.2
MesPscap	no	NT	*Capparis flexuosa* L.	+.1
MesPscap	me	EPC	*Casasia calophylla* A. Rich.	+.1
MesPros		ECoc	*Coccothrinax cupularis* (León) Muñiz	+.1
NPcaesp	mi	NCar	*Crossopetalum uragoga* (Jacq.) Rotm.	+.1
NPcaesp	no	GAB	*Croton lucidus* L.	+.1

NPcaesp	no	A	*Malpighia pallens* Small	+.1
MiPscap	mi	GAB	*Maytenus buxifolius* (A. Rich.) Gris.	+.1
MesPscap	no	NT	*Bursera simaruba* (L.) Sarg.	r.1
NPcaesp	no	EPC	*Diospyrus × leonis* (Britt. and Wils.) Borhidi	r.1
MiPscap	me	GAB	*Guapira obtusata* (Jacq.) Lundell	r.1
MiPscap	no	NCar	*Gyminda latifolia* (Sw.) Urb.	r.1
MesPscap	no	NT	*Hippomane mancinella* L.	r.1
MesPscap	no	A	*Hypelate trifoliata* Sw.	r.1
			Herb layer, up to 1 m high, cover: 15—20%	
NPcaesp	na	EPC	*Oplonia tetrasticha* (Wr. ex Gris.) Stearn	2.3
MiPcaesp	mı	GA	*Bumelia glomerata* ssp. *horrida* (Gris.) Borhidi	1.2
NPcaesp	mi	A	*Savia bahamensis* Britt.	1.1
NPcaesp	me	EPC	*Cordia galeottiana* A. Rich.	+.2
MesPscap	me	NCar	*Ateramnus lucidus* (Sw.) Rotm.	+.1
MesPscap	no	NT	*Capparis flexuosa* L.	+.1
NPcaesp	no	A	*Malpighia pallens* Small	+.1
NPcaesp	lp	CB	*Pithecellobium hystrix* (A. Rich.) Benth.	+.1
MesPros		ECoc	*Coccothrinax cupularis* (León) Muñiz	r.1
NPcaesp	mi	NCar	*Crossopetalum uragoga* (Jacq.) Rotm.	r.1
NPcaesp	no	GAB	*Croton lucidus* L.	r.1
MiPcaesp	mi	NT	*Erithalis fruticosa* L.	r.1
			Lianes, cover: 20%	
PLsuff	mı	PCar	*Jacquemontia jamaicensis* (Jacq.) Hall. f.	1.2
PLsuff	mı	EPC	*Mesechites rosea* (A. DC.) Miers	1.1
PLfrut	no	GA	*Stigmaphyllum diversifolium* (Kunth) Juss.	1.1
PLsuff	aph	A	*Vanilla eggersii* Correl	1.1
PLfrut	no	NT	*Chiococca alba* (L.) Hitchc.	+.1
PLfrut	no	PCar	*Morinda royoc* L.	+.1
PLsuff	no	NCar	*Smilax havanensis* Jacq.	+.1
PLsuff	me	GAB	*Stigmaphyllum sagraeanum* Juss.	+.1

Type relevé made by A. Borhidi and E. Del-Risco at 13. 1975. in the Zapata Peninsula, Paso Malo SW of Cienfuegos, on limestone embankment. Sample plot area 10×10 m

Tabebuio-Viticetum guanahacabibensis Borhidi and Capote ass. nova

This is the endemic littoral scrub woodland community of the southern limestone shores of the Guanahacabibes Peninsula. Emergents are *Coccothrinax cupularis, C. miraguama, Copernicia pauciflora* var. *ramosissima, Harrisia taetra* and *Dendrocereus nudiflorus.* In the dominant shrub layer two local endemics *Tabebuia capotei* and *Vitex guanahacabibensis* are abundant. The type relevé was made by Borhidi and Capote in Punta Leones in October, 1978. (Table 115).

Eugenio buxifoliae-Erithalietum fruticosae Borhidi ass. nova

It is a widely distributed littoral scrub woodland association, existing in numerous isolated local variants in the northern limestone shores of Cuba and in the different islands of the Bahamas and Antilles. The local variant of the northern littoral area

Table 115 Tabebuio-Viticetum guanahacabibensis Borhidi and Capote ass. nova

	Emergents: 15%		
Coccothrinax cupularis	1.2		
C. miraguama	+.1		
	High shrub layer 2—3 m tall, cover: 70%		
Vitex guanahacabibensis	2.3	*Tabebuia myrtifolia*	2.3
V. divaricata ssp. *cubensis*	1.2	*T. capotei*	1.1
Savia bahamensis	2.2	*Gymnanthes lucida*	2.2
Capparis flexuosa	1.2	*Croton lucidus*	1.2
C. cynophallophora	1.2	*Erythroxylum areolatum*	1.1
Picrodendron macrocarpum	1.1	*Hippomane mancinella*	+.1
Hyperbaena racemosa	1.1	*Omphalea trichotoma*	+.1
Plumeria emarginata	1.2	*Harrisia taetra*	+.2
	Low shrub layer, less than 1 m tall, cover: 40%		
Lantana involucrata	2.3	*Savia bahamensis*	2.2
Vitex divaricata ssp. *cubensis*	1.1	*Plumeria emarginata*	1.2
Tabebuia myrtifolia	1.1	*Capparis flexuosa*	1.2
Drypetes mucronata	1.1	*Catesbaea spinosa*	1.1
Castela calcicola	1.1	*C. parviflora*	1.1
Malpighia pallens	+.1	*Opuntia dillenii*	1.1
Cordia sebestena	+.1	*Cordia galeottiana*	+.1
	Lianes: cover: 25%		
Cissus trifoliata	2.2	*Echites umbellata*	1.1
Stigmaphyllum sagraeanum	1.2	*Smilax havanensis*	1.1
Angadenia cubensis	1.1	*Ipomoea alba*	+.1
Serjania occidentalis	+.1	*Triopteris rigida*	+.1
Selenicereus grandiflorus	+.1	*Mesechites rosea*	+.1

Sampling plot area: 10×10 m

of the provinces Habana and Matanzas (see Fig. 197, p. 329) is characterized by some local endemics, such as the emergent and highly endangered rare palm *Coccothrinax borhidiana,* and other species such as *Croton litoralis* ssp. *rugelianus, Colubrina cubensis.* The type relevé was made by Borhidi at Punta Guanal (Province Matanzas) in June, 1974. (Table 116).

14.4.2 Alliance: ***Pseudocarpidio-Guettardion***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Dry littoral scrub woodlands formed by sclerophyllous and deciduous, often spiny micro-, nano- and leptophyllous, rarely aphyllous little trees and shrubs, with a notable participation of xerophytic, small-leaved palms and columnar and/or

tree-shaped cacti. This alliance is abundantly represented in the northern limestone shores of the provinces Camagüey. Tunas and Holguin (formerly Oriente), and the southern limestone shores and terraces of Oriente, especially between Guantánamo and Punta Maisi.

Characteristic species: *Pseudocarpidium avicennioides, P. multidens, P. shaferi, Cordia leucosebestena, C. curbeloi, C. pulverulenta, Guettarda cueroensis, G.*

Table 116 Eugenio-Erithalietum fruticosae Borhidi ass. nova

Life-form	Leaf size	Dist. pattern		
			Emergent trees, cover: 10%, 3—4 m tall	
MiPcaesp	mi	NT	*Erithalis fruticosa* L.	3.4
MesPscap	mi	A	*Eugenia maleolens* Poir.	3.3
MesPscap	me	NCar	*Ateramnus lucidus* (Sw.) Rothm.	2.3
NPcaesp	mi	NT	*Lantana involucrata* L.	2.2
MiPscap	me	A	*Coccoloba diversifolia* Jacq.	1.2
MiPscap	me	EPC	*Cordia galeottiana* A. Rich.	1.2
NPcaesp	mi	A	*Savia bahamensis* Britt.	1.2
MiPcaesp	no	NCar	*Bourreria ovata* Miers	1.1
MesPscap	no	NT	*Capparis flexuosa* L.	1.1
MiPscap	no	SCar	*Casearia spinescens* (Sw.) Gris.	1.1
MesPscap	ma	PCar	*Colubrina arborescens* (Mill.) Sarg.	1.1
MiPscap	no	PCar	*Colubrina elliptica* (Sw.) Briz. et Stearn	1.1
NPcaesp	no	GAB	*Croton lucidus* L.	1.1
MiPcaesp	no	NCar	*Gyminda latifolia* (Sw.) Urb.	1.1
MiPscap	no	A	*Adelia ricinella* L.	+.1
MesPscap	me	NCar	*Citharexylum caudatum* L.	+.1
MiPros		ECoc	*Coccothrinax borhidiana* Muñiz	+.1
MiPcaesp	no	ECoc	*Colubrina cubensis* (Jacq.) Brogn. ssp. *cubensis*	+.1
NPcaesp	mi	NCar	*Crossopetalum uragoga* (Jacq.) Rothm.	+.1
MesPscap	no	GAB	*Diospyros crassinervis* (Kr. et Urb.) Standl.	+.1
MiPscap	no	NCar	*Exostema caribaeum* (Jacq.) R. et S.	+.1
MiPscap	no	GA	*Guapira discolor* (Spr.) Lundell	+.1
MiPscap	no	PCar	*Guettarda elliptica* Sw.	+.1
MesPscap	no	NT	*Hippomane mancinella* L.	+.1
MesPscap	mi	CB	*Picrodendron macrocarpum* (A. Rich.) Britt.	+.1
MiPscap	mi	EPC	*Piscidia havanensis* (Britt. et Wils.) Urb. et Ekm.	+.1
MiPros	me	EPC	*Plumeria emarginata* Gris.	+.1
MiPscap	na	EPC	*Tabebuia myrtifolia* (Gris.) Britt.	+.1
			Herb layer, cover 20%, 0.1—1 m tall	
NPsucc	aph	PCar	*Opuntia dillenii* (Ker.-Gawl.) Haw.	1.2
NPcaesp	na	EPC	*Oplonia tetrasticha* (Wr. ex Gris.) Stearn	1.2
MiPscap	me	GA	*Comocladia dentata* Jacq.	1.2
MiPcaesp	mi	EPC	*Castela calcicola* (Britt. et Small) Ekm.	1.1
Hscap	me	NT	*Jatropha gossypifolia* L.	1.1
MiPscap	no	A	*Adelia ricinella* L.	+.1
NPcaesp	no	A	*Argythamnia candicans* Sw.	+.1
NPcaesp	no	PT	*Capsicum frutescens* L.	+.1

Life-form	Leaf size	Dist. pattern		
NPcaesp	lp	NCar	*Catesbaea parviflora* Sw.	+.1
NPcaesp	mı	ECoc	*Croton litoralis* Urb. ssp. *rugelianus* (Urb.) Borhidi	+.1
MiPscap	mi	GA	*Erythroxylum rotundifolium* Lunan	+.1
MiPcaesp	no	A	*Forestiera segregata* (Jacq.) Kr. and Urb.	+.1
Chpulv	lp	GA	*Heliotropium humifusum* HBK.	+.1
NPcaesp	mi	A	*Malpighia coccigera* L.	+.1
Chsuffrept	mi	PT	*Philoxerus vermicularis* (L.) R. Br.	+.1
			Lianes: cover: 15%	
PLsuff	mi	PCar	*Jacquemontia jamaicensis* (Jacq.) Hall f.	1.2
NPcaesp	no	PCar	*Morinda royoc* L.	1.2
Plsuff	no	NCar	*Smilax havanensis* Jacq.	1.1
PLfrut	no	GA	*Stigmaphyllum diversifolium* (Kunth) Juss.	1.1
Chherbrept		PT	*Ipomoea pes-caprae* (L.) Sweet	+.1
Chherbrept	mi	EPC	*Mesechites rosea* (A. DC.) Miers	1.1
Chherbrept		NT	*Sarcostemma clausum* (Jacq.) R. and S.	+.1

Sampling plot area: 10×10 m; relevé made by A. Borhidi 10. 6. 1974. at Punta Guanal, Matanzas Province, on limestone dog-tooth-embankment, in 10m. a.s.l.

coxiana, G. rigida, Thouinia pseudopunctata, T. stricta, T. leonis, Rondeletia apiculata, R. ingrata, Myrtus oonophylla, Guajacum officinale, Tabebuia libanensis, T. polymorpha, Coccothrinax munizii, C. alexandri, C. hiorami, Plumeria lanata, Callicarpa bucheri, and succulents, as *Melocactus acunai, M. borhidii, M. harlowii, Harrisia taylori, Consolea macracantha, Dendrocereus nudiflorus,* etc.

The associations of the alliance often form a vegetation continuum, in which the limits of the individual communities are difficult to mark. A combined synthetic list of the following three associations are found in the Appendix Table 25, column no. 39, based on 10 relevés made by Borhidi in 1970, 1976 and 1978 and by Borhidi and Muñiz made in February and March, 1970 all in the coastal region of southern Oriente between Siboney and Maisi.

Associations studied in Cuba:

Pseudocarpidio-Guettardetum cueroensis Borhidi ass. nova

It is the littoral scrub woodland community of the low limestone terraces and seaside karstic slopes between Santiago de Cuba and Imias. The type relevé was made by Borhidi in the Yunque de Daiquiri in October, 1969 on dry southern limestone slopes (Table 117).

Guettardo-Coccothrinacetum munizii Borhidi and Muñiz ass. nova

It is the dry scrub woodland association on the second and third limestone terraces between. Tortuguilla and Imias (Fig. 351). The tall, extremely xerophytic,

small-leaved *Coccothrinax munizii* (closely related to *C. ekmanii* of Haiti) can also form a closer tree layer on the more eroded limestone surfaces. The type relevé was made by Borhidi and Muñiz in the Terraces of Macambo, west of Imias in March, 1970 (Table 118). Figure 352 shows the place of this association and that of the following community in the coastal zonation.

Table 117 Pseudocarpidio-Guettardetum cueroensis Borhidi ass. nova

Emergents: cover: 20%; height: 4—6 m			
Coccothrinax fragrans	2.2	*Picrodendron macrocarpum*	1.2
Ficus laevigata	+.2	*Grimmeodendron eglandulosum*	+.1
Spirotecoma spiralis	+.1		
Shrub layer: cover 60%; height: 1—3 m			
Colubrina elliptica	3.3	*Thouinia pseudopunctata*	1.2
Lasiocroton bahamensis	1.2	*Cassia emarginata*	1.2
Guettarda cueroensis	2.2	*Pseudocarpidium avicennioides*	2.2
Guettarda coxiana	+.1	*Tabebuia myrtifolia*	+.1
Pseudocarpidium multidens	+.1	*Exostema caribaeum*	1.1
Pseudocarpidium purgens	+.1	*Exostema spinosum*	+.1
Cordia leucosbestena	1.2	*Caesalpinia pauciflora*	1.2
Cordia rotundata	+.1	*Cassia sclerophylla*	+.1
Cordia globosa ssp. *humilis*	1.1	*Belairia spinosa*	1.1
Cordia brittonii	1.2	*Eugenia cowellii*	1.1
Maytenus buxifolia ssp. *cochlearifolia*	1.2	*Myrtus oonophylla*	+.1
Croton myricifolius	+.1	*Forestiera segregata*	2.2
Croton rosmarinoides	+.1	*Randia spinifex*	+.1
Calliandra colletioides	2.2	*Savia clusiifolia*	1.2
Bourreria succulenta	1.2	*Eugenia maleolens*	1.2
Bourreria taylori	+.1	*Rochefortia oblongata*	+.1
Bursera glauca	+.1	*Polygala cuneata*	+.1
Polygala guantanamana	+.1	*Plumeria lanata*	+.1
Erythroxylum rotundifolium	1.1	*Ateramnus lucidus*	1.2
Crossopetalum aquifolium	+.1	*Harrisia taylori*	+.1
Agave underwoodii	1.1	*Callicarpa grisebachii*	+.1
Herb layer: cover: 10%; height: 0.1—1 m			
Paspalum ruperstre	1.1	*Cordia leptoclada*	1.1
Melocactus harlowii	+.1	*Heliotropium ternatum*	1.1
Turnera diffusa	+.1	*Bellonia spinosa*	+.1
Oplonia polyece	1.2	*Malpighia linearis*	+.1
Castela victorini	+.1	*Leucocroton microphyllus*	+.1
Rhytidophyllum acunae	+.2	*Jacquinia stenophylloides*	+.1
Lianes: cover: 10%			
Smilax havanensis	1.2	*Banisteria pauciflora*	+.1
Aristolochia clementis	1.1	*Stigmaphyllum sericeum*	1.1
Mesechites rosea	1.1	*Stigmaphyllum lineare*	+.1
Tournefortia stenophylla	+.1	*Urechites lutea*	+.1
Tournefortia polyochros	+.1	*Echites umbellata*	+.1

Fig. 351 An extremely xerophytic palm: *Coccothrinax munizii* Borhidi in the *Guettardo-Coccothrinacetum munizii* community on the dry rocky limestone slopes of the subcoastal terraces in south-east Oriente between Tortuguilla and Maisi (Photo: A. Borhidi)

Erythroxylo-Coccothrinacetum alexandri Borhidi and Muñiz ass. nova

It is the endemic scrub-woodland association on the low limestone terrace of the coastal plain of Maisi, characterized by continuously elevating, unpenetrable, dense and 1 to 3 m high shrub carpet and by the highly emergent individuals of *Coccothrinax alexandri.* (Fig. 353) The occurrence of columnar and tree-shaped cacti and some leafless dwarf shrubs such as *Schaefferia ephedroides* (Fig. 354) and *Euphorbia marchii* are characteristic. The type relevé was made by Borhidi and Muñiz in the Plain of Maisi in March, 1970 (Table 119). See also Fig 352B.

14.4.3 Alliance: ***Crotono-Lantanion***
Borhidi in Borhidi et al. 1979 et hoc loco

Dry littoral thickets formed by micro-, nano- and leptophyllous shrubs on shallow sandy soils accumulated mostly in the pits and crevices of the eroded limestone reefs and low terraces. They are also characterized by the dominance of the genera *Croton* and *Lantana,* and by a reduced participation of succulents and spiny elements. They can be of natural origin and also as secondary communities, on the sites of disturbed littoral scrub woodlands, distributed over all the West Indies. In Cuba, they are found more frequently in the coasts of Matanzas and Oriente Provinces.

Table 118 Guettardo coxianae Coccothrinacetum munizii Borhidi et Muñiz ass. nova

Life-form	Leaf size	Distr. pattern		
			Emergents 4—5 m tall, cover: 1%	
MesPros		ECso	*Coccothrinax munizii* Borhidi	3.3
			Shrub layer: cover 40%, alt 1—4 m	
NPcaesp	mı	ECso	*Guettarda coxiana* Britt.	2.3
MiPcaesp	no	A	*Forestiera segregata* (Jacq.) Kr. et Urb.	1.2
NPcaesp	na	ECso	*Neea shaferi* Standl.	1.2
NPcaesp	mi	ECso	*Guettarda cueroensis* Britt.	1.1
MiPscap	no	NCar	*Colubrina elliptica* (Sw.) Briz. et Stearn	1.1
MiPscap	mi	ECo	*Pseudocarpidium avicennioides* (A. Rich.) Millsp.	1.1
MiPsucc	aph	ECso	*Consolea macracantha* (Gris.) Berg.	+.1
MiPsucc	aph	GA	*Ritterocereus hystrix* (Haw.) Bakeb.	+.1
NPcaesp	no	GAB	*Cordia brittonii* (Millsp.) Macbr.	+.1
NPcaesp	no	PCar	*C. globosa* (Jacq.) HBK. ssp. *humilis* (Johnst.) Borhidi	+.1
MiPscap	me	ECso	*C. leucosebestena* Gris.	+.1
NPcaesp	mi	ECo	*Croton myricifolius* Gris.	+.1
NPcaesp	mi	CB	*C. rosmarinoides* Millsp.	+.1
NPcaesp	no	ECso	*Callicarpa bucheri* Mold.	+.1
NPcaesp	mi	A	*Lantana arida* Britt.	+.1
MiPcaesp	na	ECso	*Maytenus buxifolius* (A. Rich.) Gris. ssp. *cochlearifolius* (Gris.) Borhidi.	+.1
MiPscap	me	ECso	*Thouina pseudopunctata* Lippold	+.1
NPcaesp	mi	A	*Malpighia linearis* Jacq.	+.1
NPcaesp	na	ECo	*Oplonia polyece* (Stearn) Borhidi	+.1
MiPscap	no	A	*Adelia ricinella* L.	+.r
NPcaesp	mi	AB	*Securinega acidoton* (L.) Fawc. et Rendle	+.r
			Herb layer: cover 1%, alt.: 0.1—0.5 m	
Chsucc	aph	ECso	*Melocactus harlowii* (Britt. et Rose) Vaupel	1.1
			Lianes: cover: 10%	
PLsuff		NCar	*Smilax havanensis* Jacq.	2.1
GL		ECso	*Passiflora santiagana* (Killip) Borhidi	2.1
HL		NCar	*Jacquemontia jamaicensis* (Jacq.) Hall f.	1.2
HL		ECso	*Galactia maisiana* Alain	1.1
Plsuff		ECo	*Stigmaphyllum lineare* Wr. in Sauv.	+.1
HL		NCar	*Urechites lutea* (L.) Britt.	+.1
PLsuff		ECo	*Tournefortia stenophylla* Urb.	+.1
			Epiphytes: cover less than 1%	
Eros		NT	*Tillandsia recurvata* L.	r.1

Type relevé made by A. Borhidi and O. Muñiz, 16. 3. 1970. Locality: SE Cuba, Limestone terrace of Macambo near San Antonio del Sur, 50 m a.s.l. Exposition: S 20° Sample polot area 20×20 m

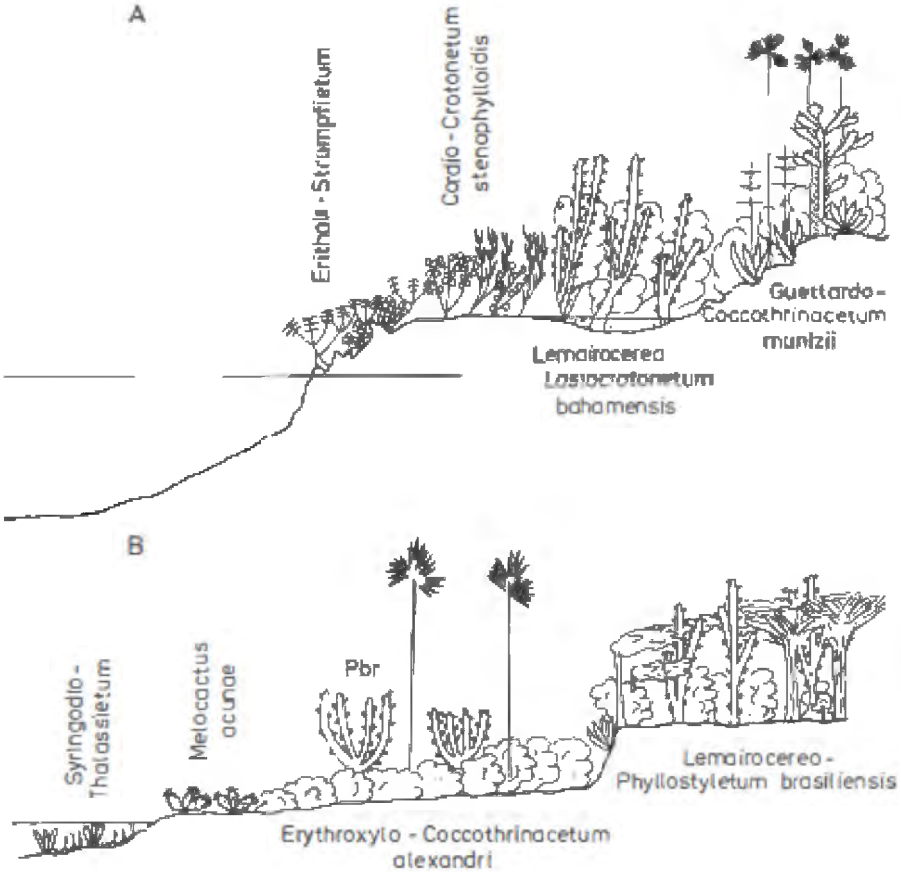

Fig. 352 Zonation of the coastal vegetation at Imias (A) and Maisi (B) Pbr=*Pilosocereus brooksianus, (Lemairocereus=Ritterocereus hystrix)*

Characteristic species in Cuba: *Croton litoralis, C. litoralis* ssp. *rugelianus, C. betulinus, C. micradenus, C. corallicola, C. rosmarinoides, C. myricifolius, C. tenuirameus, C. stenophyllus, C. excisus, C. munizii, Lantana parvifolia, L. involucrata, L. arida, Cordia globosa* ssp. *humilis, C. brittonii, C. leptoclada, C. corallicola, Neea shaferi, Heliotropium ternatum, Eugenia cowellii, Myrtus cabanasensis, Thouinia leonis, Mollugo cuneifolia, Ayenia violacea, Callicarpa bucheri,* etc.

Associations studied in Cuba:

Eugenio-Crotonetum rosmarinioidis Borhidi and Muñiz (ined.)

Cordio-Crotonetum stenophylli Borhidi (ined.)

Heliotropio-Pithecellobietum hystricis Borhidi (ined.)

Fig. 353 Wind-out dry evergreen sclerophyllous scrub — *Erythroxylo-Coccothrinacetum alexandri* community — of the limestone plain of Maisi with emergent palms of *Coccothrinax alexandri* León (Photo: A. Borhidi)

Fig. 354 A typical semi-globose shaped leafless semi-desert shrub: *Schaefferia ephedroides* Urb. at Maisi (Photo: A. Borhidi)

Table 119 Erythroxylo-Coccothrinacetum alexandri Borhidi et Muñiz ass. nova

Life-form	Leaf size	Distr. pattern		
			Emergent trees, cover: 10% 12—15 m tall	
MesPros		ECso	*Coccothrinax alexandri* León	2.1
			Shrub layer, cover: 90%, 1.5—3 m tall	
MesPscap	mi	A	*Erythroxylum brevipes* DC.	3.4
MiPcaesp	mi	ECso	*Guettarda cueroensis* Britt.	3.3
MiPcaesp	lp	ECo	*Neea shaferi* Standl.	2.3
NPcaesp	mi	NT	*Lantana involucrata* L.	2.3
MesPscap	me	NCar	*Ateramnus lucidus* (Sw.) Rothm.	2.2
NPcaesp	mi	ECo	*Croton stenophyllus* Gris.	2.2
MesPscap	mi	A	*Eugenia maleolens* Poir.	2.2
MiPscap	mi	A	*Forestiera segregata* (Jacq.) Kr. et Urb.	2.2
NPscap	na	ECso	*Acacia cowellii* (Britt. et Rose) León	1.2
NPscap	na	A	*Caesalpinia pauciflora* (Gris.) Wr.	1.2
NPcaesp	no	PCar	*Croton lucidus* L.	1.2
MesPscap	mi	A	*Drypetes mucronata* Gris.	1.2
NPcaesp	na	ECso	*Jacquinia maisiana* Borhidi	1.2
NPcaesp	na	ECso	*Oplonia polyece* (Stearn) Borhidi	1.2
MiPsucc	aph	ECo	*Pilosocereus brooksianus* (Britt. et Rose) Byl. et Row.	1.2
NPcaesp	mi	ECso	*Rondeletia baracoensis* Britt.	1.2
NPcaesp	lp	ECso	*Sarcomphalus bullatus* Urb.	1.2
MiPscap	mi	ECso	*Tabebuia polymorpha* Urb.	1.2
NPcaesp	na	ECso	*Gochnatia maisiana* (León) Jerv. et Alain	2.2
NPcaesp	no	ECso	*Callicarpa bucheri* Mold.	1.1
NPcaesp	na	ECo	*Calliandra colletioides* Gris.	1.1
NPcaesp	lp	ECso	*Catesbaea flaviflora* Urb.	1.1
MiPscap	me	ECo	*Cordia leucosebestena* Gris.	1.1
MiPscap	na	GA	*Croton betulinus* Vahl	1.1
NPcaesp	mi	ECso	*Croton tenuirameus* Urb.	1.1
MiPscap	mi	ECo	*Doerpfeldia cubensis* (Britt.) Urb.	1.1
MiPcaesp	mi	NCar	*Erithalis fruticosa* L.	1.1
NPcaesp	mi	A	*Lantana arida* Britt.	1.1
NPcaesp	na	ECso	*Machaonia microphylla* Gris.	1.1
NPcaesp	na	EPC	*Malpighia horrida* Small	1.1
NPscap	na	ECso	*Maytenus buxifolius* ssp. *cochlearifolius* (Gris.) Borhidi	1.1
NPscap	mi	ECso	*Pseudocarpidium pungens* Urb.	1.1
MiPscap	lp	ECso	*Reynosia mucronata* ssp. *azulensis* Borhidi et Muñiz	1.1
NPcaesp	aph	GA	*Schaefferia ephedroides* Urb.	1.1
NPcaesp	na	AB	*Securinega acidoton* (L.) Fawc. et Rendle	1.1
NPcaesp	mi	ECso	*Castela victorini* Acuña et Roig	+.2
NPcaesp	no	GAB	*Cordia brittonii* (Millsp.) Macbr.	+.2
NPcaesp	no	ECso	*C. leptoclada* Urb. et Britt.	+.2
Chsuff	na	ECso	*Barleriola saturejoides* ssp. *acunae* Borhidi et Muñiz	+.1
MiPscap	mi	ECso	*Caesalpinia pinnata* Urb.	+.1
NPsucc	aph	CB	*Consolea millspaughii* (Britt.) Berg.	+.1

MiPscap	mi	PCar	*Crossopetalum rhacoma* Cr.	+.1
NPcaesp	mi	ECso	*Croton micradenus* Urb.	+.1
NPcaesp	mi	ECso	*Jacquinia stenophylloides* Borhidi	+.1
NPcaesp	lp	ECso	*Myrtus oonophylla* (Urb.) Burr.	+.1
NPscap	lp	ECo	*Pithecellobium prehensile* (Wr.) Benth.	+.1
MiPscap	mı	ECso	*Pseudocarpidium shaferi* Britt.	+.1
NPcaesp	mi	A	*Savia bahamensis* Britt.	+.1
NPcaesp	na	ECso	*Scolosanthus nannophyllus* Borhidi	+.1
NPcaesp	na	ECo	*Tabebuia libanensis* Urb.	+.1
MiPscap	mi	ECso	*Thouinia pseudopunctata* Lippold	+.1
			Lianes, cover: 30%	
PLsuff	mi	NCar	*Jacquemontia jamaicensis* (Jacq.) Hall f.	2.3
PLsuff	mı	ECo	*Angadenia cubensis* Lippold	2.2
Chherbrept	mı	EPC	*Mesechites rosea* (A. DC.) Miers	2.2
PLsuff	nt	EPC	*Stigmaphyllum sagraeanum* Juss.	2.2
GL	nt	GAB	*Passiflora cuprea* L.	2.1
PLsuff	nt	ECo	*Stigmaphyllum sericeum* Wr. in Sauv.	1.3
PLfrut	mı	PT	*Cissus trifoliata* L.	1.1
Chherbrept	aph	GA	*Cynanchum ephedroides* (Gris.) Alain	1.1
PLsuff	mi	NT	*Echites umbellata* Jacq.	1.1
PLsuff	na	ECso	*Marsdenia alainii* Woods.	1.1
PLsuff	aph	GA	*Selenicereus grandiflorus* (L.) Britt. et Rose	1.1
PLsuff	mi	GAB	*Tournefortia polyochros* Spr.	1.1
PLsuff	mi	ECso	*T. stenophylla* Urb.	1.1
PLsuff	mi	GA	*Triopteris rigida* Sw.	1.1
HL	me	A	*Urechites lutea* (L.) Britt.	1.1
Chherbrept	no	NT	*Sarcostemma clausum* (Jacq.) R. et S.	+.1

Type relevé made by A. Borhidi and O. Muñiz 19. 3. 1970. in the plain of Maisi, East Cuba, on the first limestone terrace, about 5—15 m a.s.l. Sample plot area 10×10 m

15 Class: **COCCOLOBETEA UVIFERAE**
Del-Risco in Borhidi et al. (1979) et Borhidi hoc loco

Littoral scrub and low forests formed mostly by the monodominant, macrophyl-lous sea-grape *(Coccoloba uvifera)* on the sandy shores and on the first littoral dunes of the low limestone rocky shores of the Antilles, Bahamas and Florida. The unique physiognomy, one-layered structure, the deciduous character and the poor species composition make it necessary to consider these communities as a separate association class. They do not belong to *Coccothrinacio-Plumerietea,* as it was originally suggested by Knapp (1964).

Characteristic species: *Coccoloba uvifera, Leucaena leucocephala, Thespesia populnea, Erithalis fruticosa, Hippomane mancinella, Casasia clusiifolia, Scaevola plumieri, Conocarpus erecta* var. *sericea, Bursera simaruba, Crossopetalum rhacoma, Thrinax radiata,* etc.

15.1 Order: COCCOLOBETALIA UVIFERAE Knapp (1964) Samek 1973

15.1.1 Alliance: ***Coccolobion uviferae*** Samek 1973

Littoral scrubs and low forests, sometimes palm-brakes on the sand dunes and beaches.

Association studied in Cuba:

Coccolobetum uviferae (Gleason and Cook 1926) Samek 1973

Monodominant *Coccoloba uvifera* scrub on the sandy shores of the West Indies. A very common association with *Morinda royoc, Rivina humilis, Commelina elegans*.

Opuntio-Coccolobetum uviferae Borhidi ass. nova

The monodominant *Coccoloba uvifera* scrub community was described first by Gleason and Cook (1926) from Puerto Rico. Although the monodominant character of the *Coccoloba* stands is essential all over the West Indian islands, there are also notable differences with respect to the floristic composition of these communities in the different regions. The community of *Coccoloba* and *Opuntia dillenii* is growing on dry coastal areas, where the sand dunes are settled on shallow coral reefs or low banks. In the herb layer *Hymenocallis arenicola* and dry-tolerant grasses occur scarcely. Five relevés made by A. Borhidi in Boca de Jaruco, Jibacoa and Arroyo Blanco on the northern coast and at Pasa Caballo on the south coast are presented in Table 120 (Type: No. 5).

Coccolobo-Thrinacetum radiatae Borhidi and Muñiz

It is a low littoral forest with an open tree layer formed by the palm *Thrinax radiata* and with a dense shrub layer dominated by *Coccoloba uvifera.* This community originally must have been rather common. It can be found on some undisturbed beaches in the Guanahacabibes Peninsula. South of the Isle of Pine, in some localities it has been transformed by man into a monodominant palm brake of *Thrinax radiata* and generally its stands are completely destroyed. The type relevé was made by Borhidi and Muñiz, in the Casilda Peninsula, S. of Trinidad in August, 1969. (Table 121).

Bursereto-Thrinacetum radiatae Schubert *et al.* 1979

(*Thrinax wendlandiana–Bursera simaruba* Ges. Schubert et al.) It is a higher littoral forest on a higher level or on the second dunes of the sandy shores. It has a deciduous character. The type relevé was made by Schubert et al. near Playa

Table 120 Opuntio-Coccolobetum uviferae Borhidi ass nova.

Life-form	Leaf size	Distr. pattern		1.	2.	3.	4.	5.	A–D	K_5
			Shrub layer, 3–5 m tall, cover in %:	90	85	100	95	80		
MesPcaesp	ma	NT	*Coccoloba uvifera* (L.) Jacq.	5.5	5.5	5.5	5.5	5.5	5	V
			Herb layer, 0.1–1.5 m tall, cover in %:	1	5	1	10	5		
NPsucc	aph	PCar	*Opuntia dillenii* (Ker.-Gawl.) Haw.	+.1	1.3	+.2	2.4	1.2	+–2	V
Chherbrept	me	PT	*Canavalia maritima* (Aubl.) Thouars.	+.1	–	+.1	+.1	+.1	+	IV
NPcaesp	mi	NT	*Borrichia arborescens* (L.) DC.	–	+.1	–	+.1	+.1	+	III
Gbulb	me	NCar	*Hymenocallis arenicola* Northrop	–	+.2	–	–	+.1	+	II
Hcaesp	mi	CB	*Panicum caerulescens* Hack.	+.1	+.1	–	–	–	+	II
Hcaesp	mi	A	*Chloris sagraeana* A. Rich.	–	–	–	+.1	+.1	+	II
Chsuffrept	mi	PT	*Philoxerus vermicularis* (L.) R. Br.	–	–	+.1	–	+.2	+	II
Tscap	me	NT	*Euphorbia heterophylla* L.	–	–	–	+.1	+.1	+	II
Chsuff	me	PCar	*Iresine flavescens* H. et B.	+.r	–	–	–	–	+	I
Tscap	mi	NT	*Chamaesyce brasiliensis* (Lam.) Small	–	–	–	–	+.1	+	I
Tscap	me	Cosm	*Bidens pilosa* L.	–	–	+.1	–		+	I
Hcaesp	mi	PCar	*Chloris petraea* Sw.	–	+.1	–	–	–	+	I
Hcaesp	mi	PT	*Digitaria horizontalis* Willd.	–	–	–	+.1		+	I

Table 121 Coccolobeto-Thrinacetum radiatae Borhidi et Muñiz ass. nova

Life-form	Leaf size	Distr. pattern		
		Tree layer: 8—12 m tall, cover: 30—40%		
MesPros		PCar	*Trinax radiata* Lodd. ex Schult.	3.3
MesPscap	na	PCar	*Lysiloma bahamensis* Benth.	+.1
		Shrub layer: 2—5 m tall; cover: 80%		
MiPcaesp	ma	PCar	*Coccoloba uvifera* (L.) Jacq.	4.4
MiPros		PCar	*Thrinax radiata* Lodd. ex Schult.	2.3
MesPscap	mi	NCar	*Caesalpinia vesicaria* L.	1.1
MesPscap	na	PCar	*Lysiloma bahamensis* Benth.	1.1
NPcaesp	na	A	*Caesalpinia pauciflora* (Gris.) Wr.	+.1
MiPros	no	ECc	*Comocladia intermedia* Urb.	+.1
		Herb layer: up to 1 m tall; cover: 10%		
NPcaesp	mi	GAB	*Cassia lineata* Sw.	1.1
Hscap	me	NT	*Turnera ulmifolia* L.	1.1
Hros		NCar	*Ageratum maritimum* HBK.	+.1
MiPcaesp	ma	PCar	*Coccoloba uvifera* (L.) Jacq.	+.1
MiPros	no	ECc	*Comocladia intermedia* Urb.	+.1
PLfrut	no	PCar	*Morinda royoc* L.	+.1
Hscap	no	NT	*Stachytarpheta jamaicensis* (L.) Vahl.	+.1
MesPros		PCar	*Thrinax radiata* Lodd. ex Schult.	+.1
		Lianes: cover: 10%		
PLsuff	no	NT	*Passiflora suberosa* L.	1.1
PLfrut	no	GA	*Stigmaphyllum diversifolium* (Kunth) Juss.	1.1
Chherbrept	no	NT	*Echites umbellata* Jacq.	+.1
Chherbrept	no	Ncar	*Galactia spiciformis* Torr. et Gray	+.1
Chherbrept	me	NCar	*Urechites lutea* (L.) Britt.	+.1

Type relevé made by A. Borhidi and O. Muñiz at 17. 8. 1969. in the sandy beach of the Casilda Peninsula, south of Trinidad city. Sampling plot area: 10×10 m

Bibijagua, Isle of Pine. The following sample was made by Borhidi and Muñiz in the Guanahacabibes Peninsula, in El Veral, January, 1970. Sample plot area 10×30 m^2, (Table 122).

15.1.2 Alliance: ***Leucaenion leucocephalae***
Borhidi and Muñiz in Borhidi et al. 1979

Dense, essentially monodominant littoral scrubs or low forests on moderately silty or muddy sand beaches or in the estuaries of smaller rivers.

Table 122 Thrinaceto radiatae Burseretum simarubae Schubert et al. 1979

Life-form	Leaf size	Distr. pattern		
		Tree layer: 10—15 m tall, cover: 40—50%		
MesPros		NCar	*Thrinax radiata* Lodd. ex Schult.	2.3
MesPscap	no	NT	*Bursera simaruba* (L.) Sarg.	2.3
MgPscap	me	A	*Ficus crassinervis* Willd.	2.1
MgPscap	me	NT	*Cedrela mexicana* Roem.	1.1
MesPros	ma	NT	*Cecropia peltata* L.	1.1
MesPscap	me	A	*Ficus aurea* Nutt.	+.1
		Shrub layer: 2—6 m tall, cover: 70—80%		
MesPros		NCar	*Thrinax radiata* Lodd. ex Schult.	3.3
MesPscap	no	NT	*Bursera simaruba* (L.) Sarg.	3.3
MiPcaesp	ma	NT	*Coccoloba uvifera* (L.) Jacq.	1.1
MgPscap	me	A	*Ficus crassinervis* Willd	1.1
MiPcaesp	me	GAB	*Allophylus cominia* (L.) Sw.	+.1
NPcaesp	mi	NCar	*Baccharis halimifolia* L.	+.1
MiPscap	me	A	*Bourreria succulenta* Jacq.	+.1
NPcaesp	na	A	*Caesalpinia pauciflora* (Gris.) Wr.	+.1
MesPscap	mi	NCar	*C. vesicaria* L.	+.1
MiPscap	no	NT	*Capparis cynophallophora* L.	+.1
NPcaesp	mi	EPC	*Cassia chrysocarpa* Desv.	+.1
MesPscap	me	PCar	*Cordia gerascanthus* L.	+.1
MiPscap	ma	NT	*C. sebestana* L.	+.1
NPcaesp	nt	NCar	*Erythrina standleyana* Krukoff	+.1
MesPscap	me	A	*Ficus aurea* Nutt.	+.1
MiPcaesp	ma	NT	*Hamelia patens* Jacq.	+.1
MesPscap	na	GA	*Pithecellobium lentiscifolium* (A. Rich.) Wr. in Sauv.	+.1
		Herb layer: up to 1 m tall; cover: 25%		
Hros		NCar	*Ageratum maritimum* HBK.	2.2
Chscap	mi	NT	*Capraria biflora* L.	1.1
Hscap	me	NT	*Argemona mexicana* L.	+.1
NPcaesp	no	PT	*Capsicum frutescens* L.	+.1
Hcaesp		A	*Torulinium filiforme* (Sw.) Clarke	+.1
Hscap	no	GA	*Diodia simplex* Sw.	+.1
Hcaesp		Cosm	*Fimbristylis spathacea* Roth	+.1
Hscap	me	NT	*Iresine celosia* L.	+.1
NPcaesp	mi	NT	*Lantana involucrata* L.	+.1
NPsucc	aph	PCar	*Opuntia dillenii* (Ker.-Gawl.) Haw.	+.1
		Lianes: cover 30%		
PLfrut	no	PT	*Caesalpinia bonduc* (L.) Roxb.	2.2
PLsuff	me	GA	*Solandra longiflora* Tuss.	2.2
PLsuff	mi	NT	*Echites umbellata* Jacq.	1.2
PLfrut	no	GA	*Stigmaphyllum diversifolium* (Kunth) Juss.	1.2
PLsucc	aph	GA	*Selenicereus grandiflorus* (L.) Britt. et Rose	1.1
PLFrut	mi	GA	*Triopteris rigida* Sw.	1.1

Life-form	Leaf size	Distr. pattern		
PLfrut	no	NT	*Chiococca alba* (L.) Hitchc.	+.2
PLfrut	me	NT	*Clematis dioica* L.	+.2
PLfrut	mi	PT	*Duranta repens* L.	+.2
PLfrut	me	NT	*Cissus sicyoides* L.	+.1
Chherbrept	me	NT	*Ipomoea tiliacea* (Willd.) Choisy	+.1
NPcaesp	no	PCar	*Morinda royoc* L.	+.1
PLsuff	me	NT	*Turbina corymbosa* (L.) Raf.	+.1

Relevé made by A. Borhidi and O. Muñiz at 13. 1. 1970. in the Guanahacabibes Peninsula, El Veral Nature Conservation Area. Sample plot area 10×30 m

Associations studied in Cuba:

Leucaenetum leucocephalae
(Stoffers 1956) Borhidi and Muñiz in Borhidi et al. 1979

16 Class: **BYRSONIMO-PINETEA CARIBAEAE**
Samek and Borhidi in Borhidi et al. 1979 et hoc loco

Pine and oak forests and woodlands in the lowlands and colline regions of Honduras, Nicaragua, West Cuba, Bahamas and Florida, developed on acidic to neutral, sometimes slightly basic tropical soils (Fig. 355), derived from white sand, slate, sandstone or rarely limestone rocks. The original stands of these forests occur very scarcely, they are commonly influenced by man or mostly destroyed and transformed into savannas.

Characteristic species: *Pinus caribaea* s.l., *P. tropicalis, P. elliottii, Quercus oleoides* s.l. incl. ssp. *sagraeana, Q. virginiana, Q. minima, Q. myrtifolia, Q. pumila, Byrsonima crassifolia* and other spp. *Curatella americana, Coccothrinax* spp. *Myrica cerifera, Miconia ibaguensis, M. splendens, Conostegia xalapensis, Blechnum serrulatum* ssp. *roigii, Pteridium caudatum, Andropogon* spp. *Aristida* spp. *Rhynchospora* spp., *Trachypogon* spp., *Leptocoryphium lanatum, Axonopus compressus,* etc.

16.1. Order: PINETALIA TROPICALIS-CARIBAEAE
Samek et Borhidi in Borhidi et al. 1979 et hoc loco

Pine forests and woodlands of West Cuba and Isle of Pines.

Characteristic species: *Pinus caribaea* ssp. *caribaea, P. tropicalis, Coccothrinax miraguama* ssp. *arenicola, Pachyanthus poiretii, P. cubensis, P. wrightii, Roigella correifolia, Vaccinium cubense* ssp. *ramonii, Purdiaea cubensis, Tetrazygia delicatula, Hypericum styphelioides, Hyptis minutifolia, Parathesis cubana, Tabebuia lepidophylla, Sachsia polycephala, Andropogon gracilis, Aristida refracta, A. vilfifolia, Arundinella deppeana, Mesosetum loliiforme,* etc.

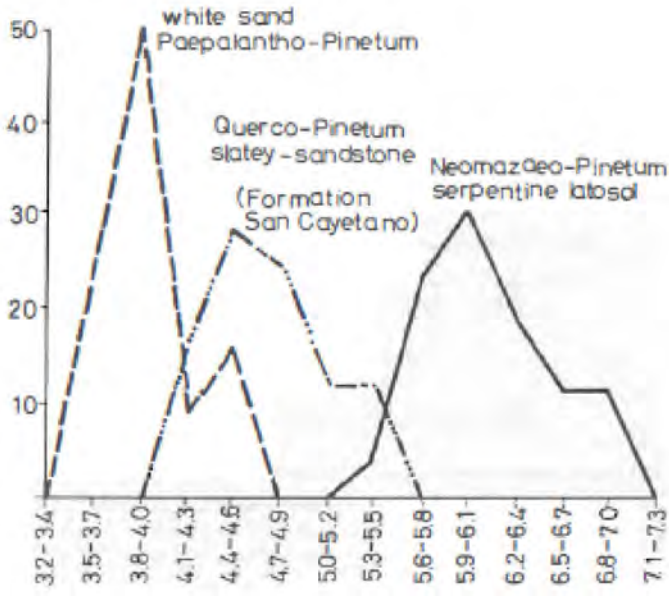

Fig. 355 Ecological range of the West Cuban pine woodland and pine forest associations according to their request of soil acidity (Samek 1973)

16.1.1 Alliance: ***Acoelorrapho-Pinion tropicalis***
Samek in Borhidi et al. 1979

Open or moderately closed pine forests and pine woodlands on hard slate rocks and white sand soils with a trend to get transformed easily into savannas. They are distributed in the Isle of Pines in the western and southern part of the Province Pinar del Rio, Isthmus of Guanahacabibes, where they disappeared almost completely during the last ten years. Their stands can also be found in the western and south-western part of the Sierra de los Organos, on hard crystalline slates.

Characteristic species: *Pinus tropicalis, Acoelorraphe wrightii, Colpothrinax wrightii, Chaetolepis cubensis, Miconia androsaemifolia, Pachyanthus cubensis, P. wrightii, Tetrazygia delicatula, Cuphea pseudosilene, Croton cerinus, C. craspedotrichus, Pachyanthus mantuensis, Byrsonima verbascifolia, B. pinetorum, B. wrightiana, Calyptranthes pinetorum, Melochia savannarum, Befaria cubensis, Pavonia intermixta, Lyonia vaccinioides, Polygala squamifolia, P. wrightii.*

Associations studied in Cuba:

Paepalantho-Pinetum tropicalis Samek 1969

This is an open pinewoodland community in the western part of Isle of Pines on white sand, described based on 11 relevés. Three subassociations have been distinguished: *hypericetosum styphelioidis, typicum* and *jatrophetosum angus-*

tifoliae. Characteristic species are *Paepalanthus seslerioides, P. alsinoides, Syngonanthus insularis, Pachanthus longifolius, Kalmiella* ssp. The combined synthetic list is found in the Appendix, Table 25 column no. 1. A further pattern relevé made by Borhidi and Muñiz N. of Los Indios in December, 1978. here follows: (Table 123).

Table 123 Paepalantho-Pinetum tropicalis Samek 1969

Tree layer: cover: 20%, 6—8 m high;			
Pinus tropicalis	2.2		
Shrub layer: cover: 30%; 1—3 m high;			
Coccothrinax miraguama ssp. *arenicola*	1.1	*Acoelorrhapte wrightii*	+.1
Miconia androsaemifolia	1.1	*Tabebuia leipidophylla*	1.1
Byrsonima crassifolia	2.2	*Lyonia vaccinioides*	+.1
		Roigella correifolia	1.2
Herb layer: cover: 50%; 0.2—0.5 m high;			
Byrsonima wrightiana	1.2	*Croton cerinus*	1.1
Paepalanthus seslerioides	2.2	*Croton craspedotrichus*	+.2
Chaetolepis cubensis	1.1	*Hypericum styphelioides*	3.3
Phyllanthus heliotropus	+.1	*Syngonanthus insularis*	+.1
Lachnorrhiza piloselloides	+.1	*Tetramicra eulophiae*	+.1
Aristida refracta	1.2	*Andropogon multinervosus*	+.2
Aristida vilfifolia	+.2	*Andropogon gracilis*	+.1
Rhynchospora globosa	1.2	*Polygala uncinata*	+.1
Rhynchospora cyperoides	+.2	*Phyllanthus junceus*	+.1
Buchnera elongata	+.1	*Calyptranthes pinetorum*	+.1
Cassytha filiformis	1.1	*Eugenia punicifolia*	+.2
Evolvulus grisebachii	+.1	*Sauvagesia brownei*	+.1
Trachypogon filifolius	1.2	*Xiphidium xanthorrhizon*	1.1
Scleria verticillata	+.2	*Xyris elliottii*	+.1

Pinetum tropicalis-caribaeae Samek 1969

This is the closed pine forest association of the colline belt in the Isle of Pines, characterized by *Byrsonima wrightiana, Tetrazygia delicatula, Clitoria laurifolia, Phyllanthus junceus, Lyonia myrtilloides, Trachypogon filifolius* and by the closed tree and herb layer. The association is divided into two subassociations: typicum and lyonietosum. Ten relevés made by Samek are summarized in the synthetic list of column no. 2 in the Appendix Table 25.

Eragrosti cubensi-Pinetum tropicalis Samek in Hadač and Hadačova 1971 nom. nud.

Open pine woodland association of the white sand area in the West Cuban wetland Remates de Guane.

Byrsonimo-Pinetum tropicalis-caribaeae Borhidi and Capote ass. nova

This is the open pine woodland association of the crystalline slatey range of the Sierra de los Organos and the southern white sand area of the Province Pinar del Rio. The community is characterized by *Pinus caribaea,* (diff.) *Pachyanthus wrightii, P. poiretii* (diff.), *Befaria cubensis, Byrsonima pinetorum, B.×hybrida, Brya depressa, Hyptis pedalipes, Aster grisebachii, Heptanthus cochlearifolius, Stenandrium ovatum,* etc. Five representative relevés were made at La Coloma, S. of Consolación del Sur, Pinar de Herradura, N. of Guane and Dimas. Type relevé: no. 3 (Table 124). Made by Borhidi and Capote between Consolación del Sur and Alonso Rojas, in November, 1975.

16.1.2 Alliance: ***Blechno-Acoelorraphion wrightii***
Hadač in Hadač and Hadačová 1971

Palm brakes of the humid sites and small swamps developed in the depressions of the white sand wetland of West Cuba, usually along the riparian zone of the

Table 124 Byrsonimo-Pinetum tropicalis-caribaeae Borhidi et Capote ass. nova

	1	2	3	4	5
Tree layer, 8–10 m high, cover %	35	20	20	20	30
Pinus tropicalis Morel.	3.2	2.2	2.2	2.2	2.3
Pinus caribaea Morel.	+.1	–	+.1	+.1	1.1
Colpothrinax wrightii Griseb. et Wendl.	+.1	1.1	–	+.r	+.1
Coccothrinax miraguama ssp. *arenicola* (León) Borhidi et Muñiz	+.1	–	–	+.r	+.r
Copernicia curtissii Becc.	–	+.1	–	–	–
Acoelorrhaphe wrightii Wendl.	–	–	–	1.1	+.1
Shrub layer, 2–6 m high, cover %	15	40	40	35	30
Colpothrinax wrightii Griseb. et Wendl.	+.r	+.r	+.1	–	+.1
Acoelorrhaphe wrightii Wendl.	–	3.2	2.4	+.1	+.2
Pinus tropicalis Morel.	–	+.r	+.1	+.r	–
Pinus caribaea Morel.	–	–	+.r	+.r	–
Pachyanthus cubensis A. Rich.	+.1	–	+.r	–	–
Pachyanthus poiretii Griseb.	2.1	+.1	+.1	1.1	2.1
Tabebuia lepidophylla (A. Rich.) Greenm.	2.1	1.2	2.2	2.1	+.1
Roigella correifolia (Griseb.) Borhidi et Fndez.	1.1	1.3	–	+.1	+.1
Byrsonima crassifolia (L.) HBK.	+.1	2.2	2.2	3.2	2.2
B. pinetorum Wr. ex Griseb.	+.1	+.1	+.1	–	1.2
B. hybrida Borhidi	+.1	+.1	+.1	–	+.1
Curatella americana L.	+.1	–	–	+.1	+.1
Brya depressa Borhidi	+.1	+.1	–	–	1.1
Eugenia punicifolia (HBK.) DC.	+.1	+.1	+.1	–	+.1
Pisonia rotundata Griseb.	–	2.2	–	–	1.1

	1	2	3	4	5
Conostegia xalapensis (Bonpl.) D. Don	–	+.1	–	–	+.1
Chrysobalanus pellocarpus G. Mey.	–	+.1	+.2	–	–
Swietenia mahagoni (L.) Jacq.	–	+.r	–	–	–
Eupatorium villosum Sw.	–	+.1	–	–	–
Tabernaemontana amblyocarpa Urb.	–	+.r	–	–	–
Mesechites rosea (A. DC.) Miers	–	+.1	+.1	+.1	+.1
Myrica cerifera L.	–	–	1.1	–	+.1
Pachyanthus wrightii Griseb.	–	–	+.r	–	+.r
Tetrazygia bicolor (Mill.) Cogn.	–	–	1.1	–	+.1
Tetrazygia delicatula (A. Rich.) Borhidi	–	–	+.r	+.1	–
Lyonia myrtilloides Griseb.	–	–	1.1	2.2	–
Miconia ibaguensis (Bonpl.) Triana	–	–	–	+.1	+.r
Befaria cubensis Griseb.	–	–	–	–	+.2
High herb layer, 30—100 cm high, cover %	80	80	80	50	75
Tabebuia lepidophylla (A. Rich.) Greenm.	1.1	+.1	1.1	1.1	+.1
Eugenia punicifolia (HBK.) DC.	+.1	+.1	+.1	+.1	+.1
Byrsonima pinetorum Wr. ex Griseb.	1.2	–	1.1	1.1	1.2
Coccothrinax miraguama HBK. ssp. *arenicola* (León) Borhidi and Mz.	+.r	+.r	–	–	–
Mesosetum liliiforme (Hochst.) Chase	4.4	3.4	3.3	2.3	3.4
Aristida neglecta León	3.3	1.1	1.1	2.2	1.2
Aristida vilfifolia Henr.	1.1	2.2	+.1	1.1	–
Sporobolus virginicus (L.) Kunth	+.1	1.2	1.1	2.2	–
Setaria corrugata (Ell.) Schult.	1.1	+.1	–	–	–
Ichnanthus mayarensis (Wr.) Hitchc.	1.1	–	1.2	+.1	–
Andropogon gracilis Spr.	+.1	–	–	+.1	+.1
Andropogon virginicus L.	–	+.1	1.1	–	–
Andropogon nashianus Hitchc.	–	1.1	1.1	–	+.1
Andropogon virgatus Desv.	–	3.4	2.2	1.1	–
Sida linifolia Cav.	1.1	+.1	+.1	+.1	+.1
Cassia diphylla L.	+.1	+.1	+.1	+.1	–
Waltheria americana L.	+.1	–	–	–	+.1
Achlaena piptostachya Griseb.	1.1	–	–	+.1	–
Piriqueta cistoides (L.) Meyer	+.1	–	–	–	+.1
Mitracarpus glabrescens (Griseb.) Urb.	+.1	–	–	–	–
Eragrostis cubensis Hitchc.	1.2	–	–	+.1	–
Sebastiania corniculata (Vahl) Pax	+.1	+.1	–	+.1	+.1
Croton cerinus Muell. Arg.	1.1	1.2	1.1	+.1	+.1
Rhynchospora cyperoides (Sw.) Mart.	1.1	1.1	1.2	1.1	–
Rhynchospora plumosa Ell.	1.1	1.2	–	+.1	–
Rhynchospora tenuis Link	2.2	2.2	+.1	1.1	1.1
Brya depressa Borhidi	1.1	–	+.1	1.2	+.1
Richarida muricata (Griseb.) B. L. Robins.	+.1	2.2	+.1	+.1	+.1
Diodia teres Walt.	+.1	+.1	–	+.1	+.1
Borreria thymocephala Griseb.	+.1	–	+.1	+.1	+.1
Desmodium barbatum (L.) Benth. et Oerst.	+.1	+.1	–	+.1	+.1
Eriosema crinitum (HBK.) G. Don	–	+.1	–	+.1	+.1
Leptocoryphium lanatum (HBK.) Nees	–	1.2	3.2	+.2	–
Trachypogon filifolius (Hack.) Hitchc.	–	3.2	1.2	+.2	+.2
Cassia pilosa L.	–	+.r	–	+.r	+.1
Melochia savannarum Britt.	1.1	+.2	–	+.1	+.1
Cordia lineata (L.) Roem. et Schult.	–	+.1	–	–	–

Cynanchum savannarum Alain	—	+.1	+.1	—	+.1
Paspalum multicaule Poir.	+.1	+.1	+.1	—	+.1
Richardia scabra L.	+.1	—	—	+.1	+.1
Centrosema virginianum (L.) Benth.	—	+.1	—	+.1	+.2
Commelina angustifolia Michx.	—	+.r	—	—	—
Acoelorrhaphe wrightii Wendl.	—	+.r	+.2	+.1	+.1
Byrsonima crassifolia (L.) HBK.	—	—	1.1	1.1	+.1
Calyptranthes pinetorum Britt. et Wils.	—	—	+.r	—	+.r
Myrica cerifera L.	—	—	+.1	—	—
Aristida ternipes Cav.	—	—	2.2	—	+.1
Panicum fusiforme Hitchc.	—	—	+.1	—	+.1
Rhynchospora wrightiana Boeckl.	—	—	+.1	+.1	—
Rhynchospora seslerioides Griseb.	—	—	2.2	+.1	+.1
Xyris elliottii Chapm.	—	—	+.1	—	—
Xyris navicularis Griseb.	—	—	+.1	—	—
Rhexia cubensis Griseb.	—	—	+.2	—	+.1
Polygala wrightii Chod.	—	—	+.1	—	+.1
Polygala squamifolia Wr. ex Griseb.	—	—	1.1	—	+.1
Jatropha angustifolia Griseb.	—	—	+.1	—	—
Xiphidium xanthorrhizon Wr. in Sauv.	—	—	+.r	—	—
Lachnanthes tinctoria (Walt.) Ell.	—	—	+.1	—	—
Cassytha filiformis L.	—	—	+.1	2.2	1.1
Declieuxia fruticosa (Willd.) Kuntze	—	—	—	+.1	+.1
Malpighia horrida Small	—	—	—	—	+.1
Aeschynomene tenuis Griseb.	—	—	—	—	+.1
Scoparia dulcis L.	—	—	—	—	1.2
Pavonia intermixta A. Rich.	—	—	—	—	+.1
Angelonia pilosella Kickx	—	—	—	+.1	+.1
Chaetolepis cubensis (A. Rich.) Triana	—	+.1	—	—	+.1
Low herb layer, 0—20 cm high, cover %	40	50	25	10	40
Hyptis pedalipes Griseb.	2.3	2.3	2.1	+.1	2.2
Aster grisebachii Britt.	—	+.2	—	1.1	—
Croton craspedotrichus Griseb.	2.3	2.2	1.1	+.1	+.2
Stenandrium ovatum Urb.	+.1	—	1.1	—	—
Heptanthus cochlearifolius Griseb.	1.2	2.2	+.1	+.1	1.2
Galactia isopoda Urb.	+.1	—	—	+.1	—
Cassia serpens L.	1.2	—	+.1	1.1	1.2
Borreria strumpfioides Wr. ex Griseb.	1.1	—	+.1	—	—
Chamaesyce pinariona (Urb.) Alain	—	+.1	+.1	+.1	—
Phyllanthus junceus Muell. Arg.	—	—	+.1	—	+.1
Pinguicula filifolia Wr. ex Griseb.	—	—	+.1	—	—
Cuphea micrantha HBK.	—	—	+.1	—	+.1
Buchnera elongata Sw.	—	—	+.1	—	—
Burmannia capitata (Walt.) Mart.	—	—	+.1	—	+.r
Schultesia guianensis (Aubl.) Malme ssp. *nana*	—	—	—	+.1	+.1
Sauvagesia tenella Lam.	—	—	+.2	—	+.1
Lachnorrhiza piloselloides A. Rich.	—	—	1.1	+.1	—
Sachsia polycephala Griseb.	—	—	+.2	+.1	1.2
Stigmaphyllum microphyllum A. Juss.	—	—	+.1	—	—
Herpyza grandiflora (Griseb.) Wr. in Sauv.	—	—	+.1	+.1	—
Evolvulus grisebachii Peter	—	—	—	—	+.2
Bulbostylis setacea (Griseb.) Svens.	—	—	—	—	1.2
Oxalis pinetorum Urb.	—	+.1	—	—	+.1
Panicum aciculare Desv.	—	—	—	—	1.2

oligotrophic lakes. Communities rather rich in species. Some of the stands can be judged as being natural, but the majority of them are second growth stands resulting after the cut of an originally existing pine woodland.

Associations studied in Cuba:

Blechno-Acoelorraphetum wrightii Hadač in Hadač and Hadačová 1971

Chrysobalano-Colpothrinacetum wrightii Borhidi and Capote (ined.)

16.1.3 Alliance: ***Neomazaeo-Pinion caribaeae***
Borhidi in Borhidi et al. 1979 et hoc loco

Closed pine forests and open rocky pine woodlands on ferritic soils and serpentine rocks of the Sierra de Cajalbana.

Characteristic species: *Neomazaea phialanthoides, Acunaeanthus tinifolius, Psidium cymosum, Tetrazygia coriacea, Coccothrinax yuraguana, Phania cajalbanica, Agave cajalbanensis, Sauvallella immarginata, Mitracarpus glabrescens, Hyperbaena columbica, Tabebuia lepidota, Eugenia rigidifolia, E. ramoniana, Rondeletia chamaebuxifolia, Vernonia valenzuelana, Heptanthus ranunculoides, Anemia cajalbanica.*

Associations studied in Cuba:

Neomazaeo-Pinetum caribaeae (Samek 1973)
Borhidi in Borhidi et al. 1979 nom. nov.

(Syn.: *Pinetum caribaeae cajalbanensis typicum Samek 1973*)

It is the common pine forest association of the Cajalbana range covering all the ridge and slopes on the northern part. It was necessary to give a new name because this community is quite different from *Pinetum caribaeae* Samek 1969 described from the slatey hillsides of Isle of Pines. The type relevé is considered list no. 39 of Samek (1973). A synthetic list of 5 relevés made by Borhidi in Cajalbana in June, 1970 is found in column no. 4. of the Appendix Table 25.

Guettardo-Pinetum caribaeae (Samek 1973)
Borhidi in Borhidi et al. 1979 nom. nov.

(Syn.: *Pinetum cajalbanensis comocladietosum* Samek 1973 p.p.)

This is a humid riverside and lowland pine forest community in the Cajalbana range. It is characterized by the presence of many broad-leaved trees as shrubs.

Characteristic species: *Guettarda valenzuelana, G. calyptrata, Cyrilla racemi-*

flora, Calophyllum calaba ssp. *pinetorum, Gesneria ferruginea, Rondeletia odorata* (diff.) *Comocladia dentata, Copernicia curtissii,* etc. Type relevé: Samek 1973a, Table 15. rel. 57.

Agavo cajalbanensi-Pinetum caribaeae Samek 1973

This is the open rock pinewoodland community on serpentine in the Cajalbana range characterized by a number of heliophilous scrub-elements such as *Agave cajalbanensis, Eugenia rigidifolia, Erythroxylon minutifolium, Jacquinia brunnescens, Lescaillea equisetiformis, Plumeria sericifolia, Garcinia serpentini, Machaonia dumosa* and *Scolosanthus acunae,* etc. The type relevé is considered in list no. 55 of Samek (1973a).

16.1.4 Alliance: ***Pachyantho poiretii-Pinion caribaeae***
Borhidi and Capote in Borhidi et al. 1979 et hoc loco

Pine forests and pine-oak mixed forests living on the special slatey sandstone "San Cayetano" formation in the Sierra de los Organos and Sierra del Rosario.

Characteristic species: *Pinus caribaea, Quercus oleoides* ssp. *sagraeana, Pachyanthus cubensis, P. poiretii, Clidemia neglecta, Vaccinium cubense* ssp. *ramonii, Clidemia strigillosa, Odontosoria wrightiana, Miconia ibaguensis, M. prasina, Psidium salutare, Ossaea parviflora, Rhus copallina* ssp. *leucantha, Xylopia aromatica Roigella correifolia* and *Phania matricarioides.*

Associations studied:

Pinetum caribaeae Samek 1969

Querco-Pinetum caribaeae Borhidi and Capote ass. nova

Mixed pine-oak forests of the colline-submontane belts of the Sierra de los Organos and Rosario ranges on slightly acidic soils derived from Cayetano sandstone. The type relevé was made by Borhidi, Capote and Urbino in Juan Manuel, S. of San Andrés, in August, 1975 (Table 125). See also column no. 3 in the Table 25 (Appendix).

16.2 Order: QUERCETALIA OLEOIDIS
Borhidi in Borhidi et al. 1979 et hoc loco

Sclerophyllous evergreen oak forests in the lowlands and middle altitudes of Honduras, Nicaragua, Mexico, West Cuba and Florida.

Table 125 Querco-Pinetum caribaeae Borhidi and Capote

High tree layer: cover: 40%; 15—18 m high;

Pinus caribaea	3
Quercus sagraeana	1—2

Low tree layer: cover: 60—70%; 6—10 m high;

Quercus sagraeana	3
Calophyllum calaba ssp. *pinetorum*	2
Xylopia aromatica	2
Matayba oppositifolia	1
Clusia rosea	1
Didymopanax morototoni	+
Guarea guidonia	+

Shrub layer: cover: 50—60%; 2—4 m high;

Calophyllum calaba ssp. *pinetorum*	
Didymopanax morototoni	+
Dendropanax cuneifolius	+
Amaioua corymbosa	1
Miconia prasina	2
M. ibaguensis	2
Tetrazygia bicolor	+
Clusia minor	+
Alsophila myosuroides	1
Alchornea latifolia	+
Quercus sagraeana	1
Psychotria revoluta	1—2
Clidemia strigillosa	+
C. hirta	+
Ossaea parviflora	1
Eugenia farameoides	+

Herb layer: cover: 70%; up to 1 m high;

Quercus sagraeana	+
Panicum boliviense	1—2
P. chrysopsidifolium	+
Blechnum serrulatum	2
Rhus copallina ssp. *leucantha*	1
Amaioua corymbosa	+
Davilla rugosa	1—2
Barbieria pinnata	1—2
Scleria cubensis	1
Clusia minor	+
Centrosema virginianum	+
Tillandsia fasciculata	+
Renealmia sp.	+.1
Miconia ibaguensis	+
Rhynchosia minima	+
Alsophila myosuroides	+.1
Didymopanax morototoni	+
Panicum aciculare	+

Panicum ischaemum	1–2
Mikania ranunculoides	+
Phania matricarioides	+(1)
Panicum scoparium	+.1
Jambosa vulgaris	+
Vernonia cubensis	+
V. sagraeana	+
Pachyanthus poiretii	+
Ossaea parviflora	+
Caloiphyllum calaba ssp. *pinetorum*	+
Wedelia rugosa	1
Desmodium canum	1
Lasiacis divaricata	+
Hibiscus costatus	+
Urena lobata	+
Lianes: 1%	
Davilla rugosa	
Cissus sicyoides	
Epiphytes: 4–6%	
Tillandsia fasciculata, on *Quercus sagraeana*	

16.2.1 Alliance: ***Quercion sagraeanae***
Borhidi and Capote in Borhidi et al. 1979 et hoc loco

Sclerophyllous evergreen oak forests of West Cuba on deep, brownish-yellow, pseudogleyic soils derived from San Cayetano sandstone, rarely on humid, white sand. In their composition species of the pine forests, and those of broad-leaved, semi-deciduous forests are united.

Characteristic species: *Quercus oleoides* ssp. *sagraeana, Xylopia aromatica, Amaioua corymbosa, Alibertia edulis, Pithecellobium obovale, P. cubense, Miconia ibaguensis, M. splendens, Henriettea patrisiana, Tabebuia lepidophylla, Clidemia* spp., *Eugenia punicifolia, Psidium salutare, Conostegia xalapensis, Clusia minor, Cordia linnaei, Barbieria pinnata, Eugenia farameoides, Scleria cubensis, Ichnanthus mayarensis* and *Rhynchospora cephalotoides.*

Associations studied:

Miconio ibaguensi-Quercetum sagraeanae Borhidi and Capote ass. nova

The type relevé was made by Borhidi and Capote between Puerta de Golpe and Alonso Rojas on pseugleyized, sandy yellow soil, in October, 1975 (Table 126).

Table 126 Miconia ibaguensis-Quercetum sagraeane
Borhidi and Capote ass. nova

Tree layer: cover: 30%; 10—12 m high;	
Quercus sagraeana	3
Shrub layer: cover: 85%; 1—6 m high;	
Quercus sagraeana	2
Xylopia aromatica	3
Miconia splendens	3
Amaioua corymbosa	2—3
Byrsonima crassifolia	1
Curatella americana	+
Eugenia farameoides	+
Engeria punicifolia	1—2
Eugenia axillaris	+
Roigella correifolia	1
Davilla rugosa	1—2
Clidemia hirta	1
Clidemia strigillosa	+
Byrsonima × hybrida	+
Coccotrinax miraguama ssp. *arenicola*	+
Tabebuia lepidophylla	+—1
Herb layer: cover: 60%; up to 1.5 m high;	
Mesosetum loliiforme	2—3
Andropogon hirtiflorus	1
Andropogon virginicus	1
Imperata cylindrica	1
Panicum virgatum	1
Achlaena piptostachya	1
Sebastiania corniculata	1
Melochia villosa	+
Cassia diphylla	+
Miconia ibaguensis	1
Hirtella americana	1
Cuphaea micrantha	+
Brya ebenus	1
Sacciolepis striata	+
Panicum aciculare	+
Croton glandulosus	+
Cordia linnaei	1
Coccocypselum hirsutum	+
Scleria cubensis	1—2
Eupatorium havanense	+
Rhynchospora cephalotoides	1—2
Polypodium aureum	+
Eugenia sp.	+
Davilla rugosa	1
Clidemia neglecta	+
Xylopia aromatica	1
Wedelia rugosa	+
Erythroxylum areolatum	+

Lasiacis divaricata	+
Urena lobata	+
Allophyllus cominia	+
Casearia aculeata	+
Eriosema crinitum	+
Evolvulus sericeus	+
Chymaesyce pinariona	+
Borreria verticillata	+
Richardia americana	+
Aeschynomene sensitiva	+
Sida linifolia	+
Ichnanthus mayrensis	+
Miconia splendens	1—2

17 Class: **CASEARIO-PINETEA CUBENSIS**
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Pine forests and pine woodlands of eastern Cuba, living on acidic ferritic soils derived from serpentine rocks. Their composition is extremely rich in endemic species.

Characteristic species: *Pinus cubensis, Coccothrinax orientalis, Lyonia macrophylla, L. glandulosa, L. myrsinifolia, Casearia crassinervis, C. moaënsis, C. ophiticola, Clerodendron nipense, Gesneria, duchartreoides, G. norlindii, G. pachyclada, Galactia rudolphioides, Ossaea pauciflora, O. munizii, O. navasensis, Myrtus micarensis, M. ophiticola, Suberanthus canellifolius, S. stellatus, Ouratea striata, Anemia coriacea* s.l., *Eupatorium ayapanoides, E. lantanifolium, E. polystictum, Eugenia pinetorum, E. ramonae, Baccharis scoparioides, B. shaferi, Vernonia urbaniana, Bisgoeppertia scandens, Vaccinium cubense* ssp. *cubense, Schmidtottia shaferi, Coccoloba shaferi, Jacaranda arborea* and *Siphocampylus* spp.

17.1 Order: PINETALIA CUBENSIS
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

With the same characteristics as the class.

17.1.1 Alliance: ***Guettardo-Pinion cubensis***
Borhidi in Borhidi et al. 1979 et hoc loco

Xero-megathermic lowland and colline pine forests on ferritic soils and open pine woodlands on bare serpentine rocks, both with a well-developed evergreen shrub layer formed by the endemics of the serpentine scrubs of East-Cuba (charrascales).

Characteristic species: *Anemia coriacea* s.l. *Casearia* spp. *Euphorbia helenae, Tabebuia simplicifolia, T. pinetorum, Plumeria nipensis, Clerodendron nipense,*

Fig. 356 Guettarda monocarpa Urb. an evergreen shrub of the montane serpentine *Pinus cubensis* forests (Photo: A. Borhidi)

Guettarda crassipes, G. monocarpa, (Fig. 356) *G. ferruginea, G. shaferi, Agave shaferi, Ariadne shaferi, Garcinia ophiticola, Eugenia cycloidea, Mouriri emarginata, Linodendron aronifolium, Callicarpa oblanceolata* and *C. wrightii,* etc.

Associations studied in Cuba:

Anemio coriaceae-Pinetum cubensis (Samek 1973) Borhidi in Borhidi et al. 1979

Extreme xerophytic pine woodland community on eroded, shallow ferritic soils often rich in hardpan or ferrioxide concretions. From the relevés made by Samek only those of "*Pinetum anemietosum Rhynchosia* variant" belong to this association, in my interpretation. Type relevé can be considered the list no. 42 of Samek (1973b: Table 14). A synthetic list of further ten relevés can be found in column no. 6 of the Table 25. (Appendix) made by Borhidi and Muñiz, July, 1970 and by Borhidi and Capote, September, 1974. A pattern relevé of the association made by Borhidi and Muñiz in the Valley of Rio del Medio, Sierra de Nipe, is given in Table 127.

Euphorbio helenae-Pinetum cubensis (Samek 1973)
Borhidi in Borhidi et al. 1979

While *Anemio-Pinetum* occurs mainly in the Sierra de Nipe, *Euphorbio helenae-Pinetum* can be found in all the range of the Sagua-Baracoa Massif on shallow stony serpentine ferritic soils. It is a pine-woodland association with a well-developed shrub layer composed of many elements of serpentine scrub-woodland. Samek

Table 127 Anemio coriaceae-Pinetum cubensis (Samek) 1973 Borhidi in Borhidi et al. 1979

Tree layer: cover: 70%; height: 12—15 m			
Pinus cubensis	4.5	*Coccothrinax orientalis*	1.1
Shrub layer: cover: 200; height: 1—4 m			
Bactris cubensis	+.1	*Coccothrinax orientalis*	×.1
Clerodendron nipense	1.1	*Casearia crassinervis*	1.1
Clidemia rubrinervis	+.1	*Casearia myricoides*	+.1
Dodonaea viscosa	2.2	*Eugenia pinetorum*	1.1
Eupatorium polystictum	1.1	*Vaccinium cubense*	+.1
Eupatorium ayapanoides	+.1	*Guettarda monantha*	+.1
Rondeletia alaternoides	+.1	*Dipholis cubensis*	+.1
Herb layer: cover: 70%; height: 0.1—1 m			
Baccharis scoparioides	2.2	*Bletia purpurea*	+.1
Galactia rudolphioides	+.1	*Sauvagesia brownei*	1.2
Vernonia urbaniana	1.1	*Waltheria americana*	+.1
Andropogon bicornis	+.2	*Aristida refracta*	2.2
Andropogon gracilis	3.3	*Imperata contracta*	+.2
Andropogon nashianus	1.2	*Panicum xalapense*	+.2
Andropogon reinoldii	+.2	*Panicum aciculare*	+.2
Ascyrum hypericoides	+.1	*Panicum fusiforme*	1.2
Ossaea pauciflora	1.1	*Rhynchospora tenuis*	2.2
Ichnanthus mayarensis	1.2	*Rhynchospora shaferi*	+.2
Lianes: cover: 10%			
Angadenia cubensis	1.1	*Odontosoria aculeata*	1.1
Bisgoeppertia scandens	+.1	*Pteridium caudatum*	1.2
Cassytha filiformis	+.1	*Centrosema virginianum*	+.1
Smilax balbisiana	+.1	*Rajania howardii*	+.1
Stigmaphyllum lineare	+.1	*Echites crassipes*	+.1
Epiphytes: cover: < 1%			
Catopsis berteroniana	r.1	*Tillandsia fasciculata*	r.1

published 5 relevés, but any of them can reflect the essential characteristics of this community. I am tempted to consider the following relevé as typical one, (Table 128) made by Borhidi and Muñiz in the NE slope of Loma Mensura in a height of about 800 m. a.s.l. A synthetic list of other 5 relevés made in other serpentine mountains of Oriente, (Moa, Sierra Maguey, Mt. Libano) by Borhidi and Muñiz in February-March, 1970, (Table 25, col. 11., Appendix) can give a more complete idea about this very interesting and showy community.

Agavo shaferi-Pinetum cubensis (Samek 1973) Borhidi in Borhidi et al. 1979

This is the open pine woodland community on the rocky peaks and steep rocky slopes in the serpentine ranges of the Sagua-Baracoa Massif. The association has

been studied in the Sierra de Nipe but it was observed also in the Sierra de Micara and Sierra de Maguey. Samek published five relevés for characterizing the community at the subassociation level, but his relevés are not informative enough. I propose to typify this community as an association based on the following relevé (Table 129) made by Borhidi and Muñiz at the northern foot of the Loma Mensura, 750 m a.s.l. in July, 1970. The community is characterized by a number of species missing from the relevés of Samek. They are: *Callicarpa cuneifolia, Agave shaferi, Phyllanthus shaferi, Vaccinium cubense, Clusia nipensis, Rondeletia myrtacea, Psychotria graminifolia, Xylosma buxifolium* and *Platygyne triandra,* etc. A synthetic list of five relevés made by Borhidi and Muñiz in the Sierra the Nipe is in the column no. 9 of Table 25 (Appendix).

Dracaeno-Pinetum Borhidi ass. nova

It is a xerothermic lowland pine forest community of the coastal plain between Moa and Baracoa in northern Oriente, living on deep acidic ferritic soil. (Fig. 357)

Table 128 Euphorbia helenae-Pinetum cubensis (Samek 1973) Borhidi in Borhidi et al. 1979

Tree layer: cover: 50%; height: 6—10 m			
Pinus cubensis	3.4	*Coccothrinax orientalis*	2.1
Shrub layer: cover: 50%; height: 1—3 m			
Euphorbia helenae	3.3	*Casearia crassinervis*	1.1
Baccharis shaferi	1.2	*Ariadne shaferi*	1.1
Vaccinium cubense	1.1	*Lyonia nipensis*	1.1
Scaevola wrightii	+.1	*Spathelia pinetorum*	1.1
Gochnatia attenuata	+.1	*Guettarda ferruginea*	1.2
Gochnatia shaferi	r.1	*Guettarda monocarpa*	+.1
Machaonia nipensis	+.1	*Phyllanthus shaferi*	+.1
Rhynchosia nipensis	+.1	*Clerodendron nipense*	+.1
Rondeletia myrtacea ssp.	+.1	*Senecio plumbeus*	+.1
Eupatorium lantanifolium	+.1	*Vernonia urbaniana*	+.1
Herb layer: cover: 30%; height: 0.1—1.5 m			
Andropogon gracilis	2.2	*Leptocoryphium lanatum*	1.2
Andropogon nashianus	+.1	*Rhynchospora tenuis*	2.1
Andropogon reinoldii	r.2	*Rhynchospora cernua*	1.2
Aristida refracta	1.2	*Polygala saginoides*	r.1
Aristida eggersii	r.1	*Chaptalia pumila*	r.1
Ichnanthus mayarensis	1.2	*Turnera diffusa*	r.1
Lianes: 10%			
Angadenia cubensis	1.1	*Ipomoea ophiticola*	1.1
Smilax havanensis	1.1	*Bisgoeppertia scandens*	1.1
Rajania howardii	+.1	*Stigmaphyllum sagraeanum*	1.1
Pteridium caudatum	1.2	*Galactia rudolphioides*	+.1
Cassytha filiformis	+.1	*Marsdenia linearis*	r.1

Table 129 Agavo shaferi-Pinetum cubensis (Samek 1973) Borhidi in Borhidi et al. 1979

Tree layer: cover: 20%; height: 6—10 m			
Pinus cubensis	2.3	*Coccothrinax orientalis*	1.1
Shrub layer: cover: 40%; height: 1—3 m			
Pinus cubensis	+.1	*Coccothrinax orientalis*	1.3
Vaccinium cubense	1.1	*Lyonia nipensis*	1.2
Callicarpa cuneifolia	+.1	*Lyonia glandulosa*	1.1
Phyllanthus shaferi	1.1	*Psychotria revoluta*	+.1
Baccharis shaferi	1.2	*Psychotria graminifolia*	+.1
Casearia crassinervis	2.2	*Eupatorium polystictum*	1.1
Clusia nipensis	1.1	*Vernonia nipensis*	+.1
Eupatorium ayapanoides	+.1	*Vernonia urbaniana*	+.1
Eupatorium lantanifolium	+.1	*Eugenia pinetorum*	1.2
Ouratea striata	1.1	*Eugenia subspinulosa*	+.1
Rondeletia myrtacea ssp.	1.1	*Guettarda monocarpa*	1.1
Purdiaea nipensis	+.1	*Xylosma buxifolium*	+.1
Herb layer: cover: 60%; height: 0.1—1 m			
Andropogon gracilis	2.2	*Rhynchospora diodon*	1.2
Andropogon reinoldii	+.2	*Rhynchospora tenuis*	2.2
Aristida refracta	1.2	*Rhynchospora cernua*	1.2
Anemia coriacea	1.1	*Anemia nipensis*	+.1
Ichnanthus mayarensis	+.1	*Chaptalia pumila*	r.1
Polygala saginoides	r.1	*Setaria tenax*	+.1
Paspalum breve	+.2		
Lianes: 25%			
Pteridium caudatum	1.1	*Bisgoeppertia scandens*	1.1
Stigmaphyllum sagraeanum	2.2	*Smilax balbisiana*	1.1
Playgyne triandra	+.1	*Galactia rudolphioides*	1.1
Angadenia cubensis	1.1	*Rajania nipensis*	+.1
Arthrostylidium capillifolium	1.2		
Epiphytes: < 1%			
Catopsis berteroniana	r.1	*Tillandsia bulbosa*	r.1
Epidendrum howardii	r.1	*Epidendrum cochleatum*	r.1
Epidendrum nocturnum	r.1		

The community has a rather closed tree layer, a moderately developed shrub layer and an abundant herb layer. Characteristic species: *Dracaena cubensis, Casearia bissei, Jacquinia roigii, Chaetocarpus oblongatus, Schmidtottia shaferi, Cordia duartei* etc. A synthetic list of 5 relevés made by Borhidi and Muñiz in the Moa Baracoa Jauco range, is column no. 13 of the Table 25 (Appendix). The type relevé was made by Borhidi and Muñiz in March, 1970, between Santamaria and Rio Yamanigüey. (Table 130)

Fig. 357 The lowland pine forest of the Moa range *(Dracaeno-Pinetum cubensis)* between Moa and Punta Gorda, with the relict endemic: *Dracaena cubensis* (Photo: A. Borhidi)

Table 130 Dracaeno-Pinetum cubensis Borhidi ass. nova

Tree layer: cover: 75%; height: 12—16 m			
Pinus cubensis	4.5	*Coccothrinax orientalis*	2.2
Dracaena cubensis	1.1	*Guatteria moralesi*	+.1
Shrub layer: cover: 20%; height: 1—4 m			
Dracaena cubensis	2.1	*Guettarda crassipes*	2.2
Casearia bissei	1.1	*Callicarpa wrightii*	+.1
Euphorbia helenae	+.1	*Lyonia glandulosa*	+.1
Mouriri emarginata	+.1	*Eugenia cycloidea*	+.1
Rheedia polyneura	+.1	*Jacquinia roigii*	+.1
Psidium parvifolium	1.1	*Chaetocarpus oblongatus*	1.1
Schmidtottia shaferi	1.1	*Myrtus ophiticola*	1.1
Phyllanthus pachystylus	+.1	*Spirothecoma apiculata*	+.1
Clidemia rubrinervis	+.1	*Antirhea shaferi*	r.1
Herb layer: cover: 80%; height: 0.1—1 m			
Leptocoryphium lanatum	3.3	*Andropogon gracilis*	2.3
Aristida refracta	1.1	*Andropogon reinolldii*	1.1
Ichnanthus mayarensis	1.2	*Rhynchospora lindeniana*	1.2
Setaria tenax	1.1	*Rhynchospora diodon*	1.1
Panicum xalapense	2.2	*Panicum scoparium*	+.1
Panicum aciculare	1.1	*Panicum breve*	+.1
Cassia lineata	+.1	*Casearia ophiticola*	+.1
Cordia duartei	+.1	*Callicarpa oblanceolata*	+.1
Chaptalia shaferi	r.1	*Heptanthus shaferi*	r.1
Lianes: cover: 5%			
Aristolochia lindeniana	1.1	*Bisgoeppertia scandens*	1.1
Angadenia moaensis	+.1	*Platygyne obovata*	+.1
Echites crassipes	+.1	*Rajania baracoensis*	+.1
Galactia revoluta	+.1	*Stigmaphyllum sagraeanum*	+.1

17.1.2 Alliance: ***Andropogo-Pinion cubensis***
Borhidi in Borhidi et al. 1979 et hoc loco

These are the montane and mesophilous pine forests of the serpentine ranges of eastern Cuba, on ferritic soils with a mixed tree layer with combined broad-leaved evergreen trees and a highly developed herb layer.

Characteristic species: *Pinus cubensis, Tabebuia dubia, Scolosanthus lucidus, Spirotecoma apiculata, Hyeronima nipensis, Terminalia nipense, Terminalia orientensis, Guatteria moralesii, Chaetocarpus* spp. *Miconia cerasiflora, M. obovata, Ossaea rufescens, O. pinetorum, O. pseudopinetorum, Cordia pedunculosa, C. toaensis, Eupatorium grandiceps, Lyonia obovata, L. macrophylla, L. longipes, Calycogonium grisebachii, Myrica shaferi, Cestrum buxoides, Bletia violacea* (Fig. 358), and *Phyllanthus pachystylus,* etc.

Fig. 358 Bletia violacea, a beautiful terrestrial orchid of the *Pinus cubensis* forest belt (Photo: A. Borhidi)

Association studied in Cuba:

Rhynchosporo-Pinetum cubensis (Samek 1973) Borhidi in Borhidi et al. 1979

This is the montane pine forest community of the Sierra de Nipe on humid, more fertile, deep ferritic soils. Samek described this association as two different units: *Pinetum nipense typicum* and *Pinetum panicetusum.* Two synthetic lists of both communities are presented in Table 25 (Appendix) columns no. 7 and 8 each based on 10 relevés made by Borhidi and Muñiz in the Sierra de Nipe in 1970.

Shafero-Pinetum cubensis Borhidi and Muñiz ass. nova

This is the montane pine forest community on deep, rather humid and fertile ferritic soils of the Plateau of Sierra de Maguey (Cupeyal del Norte). It is characterized by a number of endemic species, such as *Shafera platyphylla, Bactris cubensis, Cordia toaensis, Ossaea rufescens, O. vazquezii, O. pseudopinetorum* and *Vaccinium alainii,* etc. A synthetic list of ten relevés made by Borhidi and Muñiz in February, 1970, can be found in Table 25 (Appendix) in column. no. 12.

18 Class: **PHYLLANTHO-NEOBRACETEA VALENZUELANAE**

Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Sclerophyllous evergreen scrub vegetation of the lowland and submontane serpentine areas of Cuba, formed by sclerophyllous micro-, nano- and leptophyllous shrubs and small trees, frequently with a notable spinescence and with a high presence of endemics.

Fig. 359 Leucocroton moaënsis Borhidi et Muñiz endemic of the montane serpentine scrub of the Moa range, at the Cupeyal Reserve (Photo: A. Borhidi)

Characteristic species: *Phyllanthus orbicularis* and other spp. *Neobracea valenzuelana, Moacroton* spp., *Leucocroton* spp., (Fig. 359) *Harpalyce* spp., *Buxus* spp., *Coccoloba* spp., *Euphorbia* sect. *Euphorbiodendron, Erythroxylon minutifolium, Annona bullata, Myrtus anomala, M. elliptica* s.l. *Tabebuia lepidota, Notodon* spp., *Piscidia cubensis, Phialanthus* spp., *Malpighia nummulariifolia, M. cnide, Rondeletia camarioca, R. savannarum, R. chamaebuxifolia, Suberanthus brachycarpus, Zanthoxylum ramoni, Scolosanthus crucifer, Bourreria divaricata, B. microphylla, Passiflora cubensis, Cynanchum ophiticola* and *C. orientensis,* etc.

18.1 Order: ARIADNO-PHYLLANTHETALIA
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Sclerophyllous evergreen scrubs of the lowland and submontane belts of the serpentine ranges of eastern Cuba, formed by an overwhelming majority of endemic species and a great number of endemic genera, on primary, stony shallow serpentine "rendzinas" or on highly mature, sterile and eroded laterites with a shallow hardpan layer in the subsoil. The order is very rich in plant communities occasionally forming a vegetation continuum. Future studies have to distinguish further alliances.

Fig. 360 Byrsonima minutifolium Alain a characteristic leptophyllous shrub of the pine woodlands and serpentine scrubs of North Oriente (Photo: A. Borhidi)

Characteristic species: *Ariadne shaferi* s.l., *Phyllanthus myrtilloides* s.l., *P. chamaecristoides* s.l., *P. comosus, P. chryseus, Ateramnus recurvus, Garcinia ophiticola, G. ruscifolia, G. polyneura, G. revoluta, Moacroton lanceolatus, Adenoa cubensis, Pseudocarpidium pungens, Crossopetalum ternifolium,* s.l., *Galactia revoluta, Annona sclerophylla, Calycogonium rosmarinifolium, C. moanum, Euphorbia podocarpifolia, E. helenae, Coccoloba nipensis, C. acuna, C. praestans, Byrsonima minutifolium* (Fig. 360) *B. biflora, Machaonia nipensis, Antirhea abbreviata* s.l. *Xylosma buxifolium, Guettarda sciaphila, G. shaferi, Oplonia cubensis, Erythroxylon pedicellare, E. coriaceum, Spathelia pinetorum,* and *S. splendens,* etc.

18.1.1 Alliance: ***Ariadno-Phyllanthion***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

With the same characteristics as the order.

Associations studied:

Spathelio-Bourrerietum pauciflorae Borhidi ass. nova

It is the high serpentine scrub-woodland community of the Sierra de Nipe, developed on the western and northern slopes of the mountains (e.g., Loma Mensura, Loma Bandera, Valley of Guayabo river, Valley of Sojo river, etc.). A synthetic list of five relevés made by Borhidi and Muñiz in the Sierra de Nipe, in July, 1970 can be found in Table 25, (Appendix), column no. 18. The type relevé was made by Borhidi and Muñiz in the NE slopes of the Loma Mensura, Sierra de Nipe, at about 850—900 m a.s.l. (declination: 20°) It is presented in Table 131.

Antirheo-Acrosynanthetum minoris Borhidi and Muñiz ass. nova

It is the low serpentine scrub-woodland community of the dry seaside area of the northern coastal region between Cananova and Baracoa. Emergents are: *Thrinax rivularis* var. *savannarum, Acrosynanthus minor, Dracaena cubensis.* The shrub layer is extremely rich in sclerophyllous small-leaved endemic shrubs. The type locality of the association is the south slope of Cerro de Miraflores near Cananova. A combined synthetic list contains three relevés of this association together with those of the following one in Table 25, in column. no 17.

Jacquinio-Tabebuietum linearis Borhidi and Muñiz ass. nova

It is an open serpentine scrub-woodland community on the extremely dry, shallow, stony soils of the northern coastal region of Moa and Baracoa. Two representative relevés were made by Borhidi and Muñiz on the Cerro de Miraflores and on the Cerro de Yamanigüey in March, 1970.

Characteristic species of the association: *Tabebuia linearis, Jacquinia moana, Casasia jacquinioides, Shaferocharis multiflora, Phyllanthus comosus, P. chryseus,* etc.

Byrsonimo-Myrtetum acunae Borhidi

It is a low serpentine scrub formed by spiny and nanophyllous shrubs on rocky sharp ridges, (e.g. Loma Bandera). Characteristic species are *Byrsonima minutifolia, Myrtus acunae, Zanthoxylum* (Fagara) *ramoni, Oplonia cubensis, Erythroxylon pedicellare, Eugenia banderensis, Ateramnus recurvus, Calycogonium rosmarinifolium,* and *Coccoloba reflexa,* etc.

Euphorbio helenae-Lyonietum myrsinifoliae Borhidi and Muñiz ass. nova

It is a low serpentine scrub association on heavily eroded ferritic soils with hardpan concretions, probably a second growth community after the cut of rocky

Table 131 Spathelio-Bourrerietum pauciflorae Borhidi ass. nova

Shrub layer: cover: 70%; height: 2—4 m

Coccothrinax nipensis	1.1	*Myrcia retivenia*	1.2
Bourreria pauciflora	2.3	*Cyrilla cubensis*	2.2
Spathelia cubensis	1.1	*Cestrum pinetorum*	+.1
Coccoloba reflexa	+.1	*Byrsonima minutifolia*	1.1
Coccoloba nipensis	2.2	*Rondeletia myrtacea*	+.1
Coccoloba praestans	+.1	*Croton borhidii*	+.1
Purdiaea nipensis	+.1	*Lyonia nipensis*	1.1
Lagetta pauciflora	+.1	*Calycogonium rosmarinifolium*	1.1
Chaetocarpus globosus	1.1	*Cassine attenuata*	
Cordia pedunculosa	+.1	ssp. *nipensis*	1.1
Annona sclerophylla	1.2	*Colubrina nipensis*	1.1
Exostema nipensis	+.1	*Rondeletia nipensis*	+.1
Maytenus loeseneri	+.1	*Crossopetalum ternifolium*	+.1
Psidium parvifolium	1.2	*Myrtus ekmanii*	+.1
Amyris stromatophylla	+.1	*Eugenia pinetorum*	+.1
Psychotria revoluta	+.1	*Phyllathus shaferi*	+.1
Psychotria lopezii	+.1	*Machaonia nipensis*	1.1
Bumelia glomerata	1.1	*Eupatorium polystictum*	1.1
Ossaea acunae	+.1	*Senecio subsquarrosus*	+.1
Vernonia wrightii	1.1		
Herb layer: cover: 5%;			
Rhynchospora diodon	1.1	*Polygala saginoides*	+.1
Rhynchospora cernua	1.2	*Turnera diffusa*	1.1
Rhynchosia nipensis	+.1	*Pilea mensuraensis*	+.1
Chaptalia nipensis	+.1		
Lianes: 20%			
Triopteris rigida	1.1	*Clematis dioica*	1.2
Jacquemontia nipensis	+.1	*Stigmaphyllum ledifolium*	2.2
Rajania linearis	+.1	*Platygyne triandra*	+.1
Dioscorea nipensis	+.1	*Galactia revoluta*	1.1
Smilax havanensis	1.2	*Angadenia cubensis*	1.1

pine woodland *Euphorbio–Pinetum cubensis* stands. The type relevé was made at Cupeyal, Sierra de Maguey, by Borhidi and Muñiz in February, 1970.

Characteristic species: *Coccothrinax moaensis, Miconia lenticellata, Suberanthus stellatus* (Fig. 361) *Rondeletia vazquezii, Euphorbia helenae, Vaccinium alainii* and *Senecio trichotomus,* etc. (Table 132).

18.2. Order: PHYLLANTHO-NEOBRACETALIA VALENZUELANAE Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Dry sclerophyllous evergreen scrubs and scrub-woodlands with a high proportion of spiny elements, covering the serpentine lowland and submontane areas of West- and Central Cuba to Holguin.

Fig. 361 Suberanthus stellatus (Griseb.) Borhidi and Fernandez, endemic to the Moa and Baracoa ranges, as a characteristic element of the serpentine montane scrub communities (Photo: A. Borhidi)

Characteristic species: *Phyllanthus orbicularis, Neobracea valenzuelana, Tabebuia lepidota, T. trachycarpa, Rondeletia camarioca, R. savannarum, Eugenia camarioca, Scolosanthus crucifer* s.l., *Pseudocarpidium ilicifolium, Zanthoxylum ramoni, Oplonia nannophylla, Coccoloba armata, C. pallida, C. microphylla, Guettarda, calyptrata, G. rigida, G. echinodendron, Galactia galactioides, Erythroxylon minutifolium, Copernicia macroglossa, C. hospita, Bursera angustata, Bourreria divaricata, B. microphylla, B. setoso-hispida,* etc.

18.2.1 Alliance: ***Neomazaeo-Reynosion retusae***
Borhidi and Capote in Borhidi et al. 1979 et hoc loco

Dry evergreen sclerophyllous scrubs and scrub-woodlands of the serpentine-laterite areas of the Cajalbana and Sierra del Rosario ranges, characterized by a high number of endemics.

Characteristic species: *Neomazaea phialanthoides, Reynosia retusa, Zanthoxylum* (Fagara) *dumosum, Buxus wrightii, Scolosanthus acunae, Rheedia fruticosa, Leucocroton revolutus, Moacroton trigonocarpus, Machaonia dumosa, Bourreria badia, Coccoloba coriacea, Lescaillea equisetiformis, Agave cajalbanensis, Ayenia cajalbanensis, Helicteres trapezifolia, Pisonia petiolaris, Rondeletia venosa, R. chamaebuxifolia, Eugenia cajalbanica, Eugenia rigidifolia, Phyllanthus discolor, Maytenus buxifolia* ssp. *serpentini, Gochnatia intertexta, Phialanthus rigidus, Phyllomelia coronata, Plinia dermatodes,* etc.

Associations studied:

Erythroxylo-Coccolobetum armatae Borhidi and Capote ass. nova

Dense, spiny, sclerophyllous evergreen scrub-woodland on stony slopes, with a certain second growth character. The type relevé was made by Borhidi and Capote, in SW slope of the Loma Preluda de Cajalbana in January, 1976 (Table 133).

Eugenio-Moacrotonetum trigonocarpi Borhidi and Capote ass. nova

Dense, evergreen scrub of humid serpentine slopes or riverside areas, with a low participation of spiny elements.

Table 132 Euphorbia helenae-Lyonietum myrsinifoliae Borhidi and Muñiz ass. nova

Emergents: cover: 15%; height: 1.5—3 m			
Coccothrinax moaensis	2.1	*Pinus cubensis*	1.1
Shrub layer: cover: 50%; height: 0.5—1.5 m			
Euphorbia helenae	2.3	*Lyonia myrsinifolia*	2.2
Coccothrinax moaensis	+.1	*Pinus cubensis*	+.1
Ariadne shaferi	1.1	*Rondeletia vazquezii*	+.1
Miconia cerasiflora	1.1	*Clidemia capitellata*	1.1
Miconia lenticellata	+.1	*Clidemia rubrinervis*	+.1
Miconia baracoensis	+.1	*Ossaea pauciflora*	1.1
Guettarda ferruginea	1.3	*Ossaea vazquezii*	+.1
Guettarda monocarpa	1.1	*Cyrilla cubensis*	2.2
Tapura cubensis	1.2	*Rauvolfia salicifolia*	+.1
Ilex macfadyenii	+.1	*Gesneria norlindii*	+.1
Eugenia pinetorum	1.3	*Xylosma buxifolium*	1.1
Suberanthus stellatus	+.1	*Cordia toaensis*	+.1
Psychotria revoluta	+.1	*Senecio trichotomus*	+.1
Psychotria linearifolia	+.1	*Gochnatia recurva*	1.2
Scaevola wrightii	1.1	*Tabebuia simplicifolia*	1.1
Oplonia cubensis	1.1	*Eugenia acrantha*	+.1
Scolosanthus lucidus	+.1	*Vaccinium alainii*	1.1
Baccharis shaferi	1.2	*Lasianthus lanceolatus*	+.1
Eupatorium ayapanoides	+.1	*Vernonia orbicularis*	+.1
Eupatorium polystictum	1.1	*Vernonia segregata*	+.1
Linodendron aronifolium	+.1	*Callicarpa oblanceolata*	+.1
Herb layer: cover: 70%; height: 0.1—1.5 m			
Aristida refracta	3.4	*Rhynchospora tenuis*	2.2
Aristida multinervis	1.2	*Rhynchospora cernua*	1.2
Andropogon gracilis	2.2	*Rhynchospora shaferi*	1.1
Ichnanthus mayarensis	2.2	*Eriochloa setosa*	1.1
Bisgoeppertia scandens	1.1	*Polygala saginoides*	+.1
Sachsia polycephala	+.1	*Chaptalia shaferi*	+.1
Coccocypselum herbaceum	1.1	*Bulbostylis capillaris*	1.1
Clidemia neglecta	+.1	*Cassytha filiformis*	1.1

Table 133 Erythroxylo–Coccolobetum armatae
Borhidi and Capote ass. nova

Emergents: cover: 30%, height: 4–6 m	
Pseudocarpidium wrightii	1.2
Guapira cajalbanensis	1.2
Neomazaea phialanthoides	1.1
Bursera angustata	+
Coccoloba armata	1.2
Phialanthus rigidus	+.1
Phyllanthus discolor	+
Coccothrinax yuraguana	1.2
Tabebuia leptopoda	+.1
Guettarda calyptrata	+.1
Brya ebenus s.l.	1.1
Pisonia petiolaris	1.1
Shrub layer: cover: 90%, height: 2–3 m	
Coccoloba armata	4.5
Erythroxylon minutifolium	2
Brya ebenus	3.3
Phyllanthus orbicularis	3.3
P. discolor	1.1
Reynosia retusa	+.1
Jacquinia brunnescens	+.1
Malpighia horrida	+.1
Maytenus buxifolia ssp. *cajalbanica*	+.1
Bumelia glomerata ssp.	+.1
Zanthoxylum phyllopterum	1.2
Zanthoxylum dumosum	+.1
Garcinia fruticosa	+.1
Coccoloba coriacea	
Tabebuia leptopoda	1.1
Bourreria badia	1.1
Machaonia dumosa	1.1
Rondeletia chamaebuxifolia	1.1
Pisonia petiolaris	+.1
Guettarda calyptrata	+.1
Noemazaea phialanthoides	1.1
Exostema valenzuelae	+.1
Plumeria sericifolia	+.1
Eugenia cajalbanica	+.1
Eugenia rigidifolia	1.1
Calyptranthes enneantha	+.1
Psychotria revoluta	+.1
Lianes: 30%	
Arthrostylidium capillifolium	2
Stigmaphyllon sagraeanum	1
Angadenia sagraei	+
Mesechites rosea	+
Galactia galactioides	+
Lescaillea equisetiformis	1
Smilax havanensis	1.2

Herb layer: cover: 20%

Agave cajalbanensis	2.2
Oplonia nannophylla	1.1
Evolvulus sericeus	+.1
Chamaesyce pinariona	+.1
Rhynchospora tenuis	1.2
Aristida refracta	+.1
Aristida vilfifolia	+.1
Heptanthus ranunculoides	+.1
Heliotropium humifusum	2.1
Coccoloba armata	1.1
Erythroxylon minutifolium	+.1
Rondeletia chamaebuxifolia	+.r
Neomazaea phialanthoides	+.r
Phyllanthus discolor	+.r
Mitracarpus glabrescens	+.1
Phania cajalbanica	+.1

Epiphytes: 1%

Tillandsia flexuosa	+
T. balbisiana	+
T. bulbosa	+
Epidendrum plicatum	+

Zanthoxylo-Reynosietum retusae Borhidi

Dry, extremely spiny serpentine scrub on rolling serpentine stones.

Characteristic species: *Reynosia retusa, Zanthoxylum phyllopterum, Z. dumosum, Pseudocarpidium ilicifolium, Scolosanthus acunae, Oplonia nannophylla, Machaonia dumosa, Jacquinia brunnescens, Brya ebenus, Eugenia rigidifolia,* etc.

Neomazaea-Phyllanthetum orbicularis Borhidi and Capote ass. nova

It is the most common, widely distributed dry sclerophyllous scrub community covering the majority of the southern slopes of the Sierra de Cajalbana. The type relevé was made by Borhidi near the peak of Cajalbana in July, 1974. SW slope, in about 450 m a.s.l. (Table 134).

18.2.2 Alliance: ***Coccothrinaci-Tabebuion lepidotae***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Dry evergreen sclerophyllous scrubs or scrub-forests with numerous spiny elements, growing in the serpentine areas of the western part of Central Cuba (Habana and Matanzas Provinces).

Characteristic species: *Bucida ophiticola, Leucocroton havanensis, L. moncadae, Lasiocroton bahamensis, Eugenia sauvallei, E. camarioca, Psidium havanense,*

Table 134 Neomazaeo-Phyllanthetum orbicularis
Borhidi and Capote ass. nova

Emergents: cover: 5%, height: 4—6 m	
Coccothrinax yuraguana	+.1
Neobracea valenzuelana	+.1
Coccoloba armata	1.1
Pisonia petiolaris	+.1
Bursera angustata	(+)
Guettarda calyptrata	+(2)
Tabebuia leptopoda	1.1
Phialanthus rigidus	+.1
Plumeria sericifolia	+.(2)
Shrub layer: cover: 90%; height: 1—3 m	
Brya ebenus	3.3
Eugenia rigida	2.3
Leucocroton revolutus	3.3
Neomazaea phialanthoides	1.2
Coccoloba pallida	2.2
Coccoloba coriacea	+.3
Gochnatia intertexta	1.3
Erythroxylum minutifolium	2.3
Phyllanthus orbicularis	2.3
Buxus wrightii	2.3
Moacroton trigonocarpus	2.(3)
Phialantus rigidus	+.1
Bonania emarginata	+.1
Ottoschmidtia dorsiventralis	+.1
Reynosia retusa	+.1
Zanthoxylum phyllopterum	1.1
Bourreria badia	1.1
Tabebuia leptopoda	1.2
Rondeletia chamaebuxifolia	1.1
Machonia dumosa	+.1
Bumelia glomerata	+.1
Malpighia horrida	+.1
Oplonia nannophylla	+.r
Plumeria sericifolia	+.r
Scolosanthus acunae	+.r
Jacquinia brunnescens	+.r
Herb layer: cover: 10%, height: 0—30 cm	
Rhynchospora tenuis	1.2
Hepthanthus ranunculoides	1
Heliotropium humifusum	+.1
Borreria erithrichoides	+
Anemia cajalbanica	+
Evolvulus cf. *minimus*	+
Agave cajalbanensis	1.2
Aristida vilfifolia	+
Aristida refracta	+.1
Chamaesyce sp.	+

Coccoloba armata	+.1
Leococroton revolutus	+
Coccoloba pallida	+
Phyllanthus orbicularis	+.1
Mitracarpus glabrescens	+

Lianes: 60—70%

Arthrostylidium capillifolium	4
Mesechites rosea	+
Jacquemontia serpyllifolia	+
Lescaillea equisetiformis	1
Stigmaphyllon sagraeanum	1
Galactia galactioides	+.1

Epiphytes: 1%

Tillandsia flexuosa	+
Catopsis floribunda	+

Harpalyce cubensis, Buxus flaviramea, Reynosia intermedia, Guilleminia heterophylla, Borreria eritrichoides, Ottoschmidtia dorsiventralis, Melocactus matanzanus, Moacroton revolutus, Acacia daemon, Coccothrinax miraguama ssp. *roseocarpa, Copernicia ramosissima.*

Association studied:

Coccothrinaci-Bucidetum ophiticolae Berazain 1981

It is the zonal dry sclerophyllous scrub community of the area of the Loma Galindo (Prov. Matanzas) and Tetas de Camarioca (Fig. 362). The following relevé made by Borhidi, Del-Risco and Capote in Piedra Sola, Loma Galindo near Corral Nuevo in May, 1974 can give an idea about the composition of this characteristic association (Table 135). A synthetic list of five relevés made by Borhidi and Muñiz on the Loma de Coca (Habana Province) and Loma Galindo represents a combined floristic composition of different communities belonging to the *Coccothrinaci–Tabebuion lepidotae* alliance (see Table 25, column. no. 31.).

Bucido-Pseudocarpidietum ilicifolii Borhidi (ined.)

Eugenio-Coccothrinacetum roseocarpae Borhidi (ined.)

18.2.3 Alliance: ***Guettardo-Jacarandion cowellii***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Dry evergreen sclerophyllous serpentine scrubs with high participation of spiny elements growing on the lowland and submontane serpentine areas of the eastern part of Central Cuba (Motembo, Santa Clara, Escambray, Camagüey,Holguin).

Fig. 362 The dry evergreen thorn woodland *(Coccothrinaci-Bucidetum ophiticolae)* of the serpentine areas of Habana and Matanzas, with *Bucida ophiticola* Bisse, *Coccothrinax miraguama* ssp. *roseocarpa* (León) Borhidi et Muñiz and *Tabebuia lepidota* (HBK.) Britt. (Photo: A. Borhidi)

They are composed of micro-, nano- and leptophyllous shrubs and small trees, and a considrable number of them are local vicarious endemics.

Characteristic species: *Guettarda clarensis, G. roigiana, G. camagüeyensis, Zanthoxylum nannophyllum, Coccoloba geniculata, Jacaranda cowellii, Pictetia marginata, Behaimia cubensis, Notodon savannarum, Henoonia myrtifolia, Croton heteropleurus, C. camagüeyensis, C. nephrophyllus, C. acunae, Eugenia melanadenia* and other spp. *Copernicia cowellii, C. hospita, Coccothrinax clarensis, C. pseudorigida, C. garciana, Tabebuia trachycarpa* (Fig. 363), *Platygyne parvifolia, Machaonia subinermis, M. minutifolia, M. urbinoi, Jacquinia shaferi* (Fig. 364), *Karwinskia oblongifolia, K. orbiculata, Daphnopsis oblongifolia, Melocactus actinacanthus, M. holguinensis,* etc.

Associations studied:

Rondeletio camariocae-Guettardetum clarensis Borhidi and Muñiz ass. nova

It is the zonal dry evergreen serpentine scrub of the Las Villas Province, characterized by the presence of local endemics such as *Coccothrinax clarensis, Guettarda clarensis, G. roigiana, Xylosma acunae, Polygala scabridula, Agave brittoniana, Eugenia clarensis, Machaonia subinermis.* A synthetic list of ten

Table 135 Coccothrinaci roseocarpae-Bucidetum ophiticolae Berazain 1981

Emergents: cover: 30%; height: 4—6 m			
Coccothrinax miraguama ssp. *roseocarpa*	2.1	*Bucida ophiticola*	1.2
		Pseudocarpidium ilicifolium	1.1
Shrub layer: cover: 80%; height: 0.5—3 m			
Bucida ophiticola	1.1	*Bursera angustata*	1.1
Moacroton revolutus	1.2	*Bumelia glomerata*	1.2
Pisonia rotundata	2.2	*Rondeletia camarioca*	1.2
Buxus flaviramea	+.1	*Leucocroton havanensis*	2.2
Guettarda rigida	1.1	*Zanthoxylum ramoni dumosa*	2.2
Guettarda echinodendron	1.1	*Myrtus matanzasia*	1.1
Guettarda calyptrata	+.1	*Simaruba laevis*	+.1
Reynosia mucronata	1.1	*Ottoschmidtia*	
Reynosia microphylla	2.3	*dorsiventralis* +.1	
Plumeria obovata	+.1	*Phyllanthus orbicularis*	2.2
Pera bumelioides	+.1	*Harpalyce cubensis*	+.1
Maytenus buxifolia	1.2	*Acacia daemon*	+.1
Calliandra pauciflora	+.1	*Malpighia horrida*	+.1
Brya ebenus	1.2		
Herb layer: cover: 40%; height: 0.1—1 m			
Coccothrinax miraguama ssp. *roseocarpa*	1.1	*Borreria erithrichoides*	1.2
Buchnera elongata	+.1	*Borreria matanzasia*	1.1
Reynosia microphylla	1.1	*Oplonia nannophylla*	2.2
Polygala saginoides	+.1	*Jacquinia brunnescens*	1.1
Mitracarpus glabrescens	1.1	*Bourreria microphylla*	1.1
Stenandrium droseroides	+.1	*Crossopetalum ilicifolium*	+.1
Aristida refracta	2.3	*Furcraea hexapetala*	+.1
Aristida vilfifolia	1.1	*Andropogon gracilis*	1.1
Rhynchospora tenuis	2.2	*Trachypogon filifolius*	+.1
Gossypianthus heterophylla	+.1	*Chaptalia media*	+.1
Lianes: cover: 25%			
Smilax havanensis	1.2	*Evolvulus sericeus*	+.1
Mesechites rosea	2.2	*Angadenia sagraei*	2.2
Galactia galactioides	1.1	*Platygyne hexandra*	1.1
Cynanchum savannarum	+.1	*Jacquemontia serpyllifolia*	+.1
Centrosema virginianum	+.1	*Cassytha filiformis*	+.1
Rajania ekmanii	+.1	*Clitoria ternatea*	+.1
		Ipomoea microdactyla	+.1

representative relevés made by Borhidi and Muñiz in 1969 and 1970 can be found in column. no. 32 of the Table 25. The type relevé was made by Borhidi and Muñiz, in Cerro Pelo Malo east of Santa Clara in July, 1970 (Table 136).

Copernicio cowellii-Tabebuietum trachycarpae Borhidi and Muñiz ass. nova

It is the zonal sclerophyllous dry evergreen scrub and scrub-woodland community of the serpentine areas of Camagüey Province. Characteristic species are: *Cocco-*

Fig. 363 Tabebuia trachycarpa (Griseb.) K. Schum. a dominant shrub of the dry thorn serpentine scrub of Camagüey Province near Cromo (Photo: A. Borhidi)

Fig. 364 Jacquinia shaferi Urb. a thorny endemic element of the serpentine scrubs of Camagüey and Holguin (Photo: A. Borhidi)

Table 136 Rondeletio camariocae-Guettardetum clarensis Borhidi and Muñiz ass. nova

Emergents: cover: 30%; height: 4—5 m			
Coccothrinax clarensis	2.3	*Gastrococos crispa*	1.1
Bucida ophiticola	+.1	*Swietenia mahagoni*	+.1
Shrub layer: cover: 80%; height: 2—3 m			
Plumeria obtusa	+.1	*Annona bullata*	1.1
Brya ebenus	3.4	*Tabebuia lepidota*	3.4
Bourreria microphylla	3.4	*Erythroxylum minutifolium*	2.3
Lasiocroton bahamensis	1.1	*Bucida ophiticola*	+.1
Myrtus anomala	2.2	*Eugenia clarensis*	1.2
Rondeletia camarioca ssp.	2.3	*Ouratea ilicifolia*	+.1
Guettarda clarensis	2.2	*Pseudocarpidium ilicifolium*	1.1
Guettarda scabra	1.2	*Ternstroemia peduncularis* ssp.	+.1
Guettarda elliptica	1.1	*Jacaranda cowellii*	+.1
Diospyrus crassinervis	1.2	*Polygala scabridula*	+.1
Zanthoxylum nannophyllum	+.1	*Noebracea valenzuelana*	+.1
Phyllanthus orbicularis	2.2	*Xylosma acunae*	+.1
Banara reticulata	+.1	*Croton heteropleurus*	+.1
Rheedia cubensis	+.1	*Diospyrus grisebachii*	1.1
Coccothrinax clarensis	+.1	*Bourreria setoso-hispida*	r.1
Gochnatia cowellii	+.1	*Acidocroton acunae*	1.2
Herb layer: cover: 50%; height: 0.1—1 m			
Aristida refracta	3.3	*Eragrostis cubensis*	2.3
Rhynchospora tenuis	2.3	*Paspalum rupestre*	1.1
Ayenia euphrasifolia	1.1	*Buchnera elongata*	+.1
Croton nummulariifolius	2.3	*Sachsia polycephala*	1.1
Evolvulus sericeus	+.1	*Stenandrium droseroides*	+.1
Heliotropium humifusum	+.1	*Diodia rigida*	1.1
Borreria thymocephala	+.1	*Jacquinia stenophylla*	+.1
Scleria lithosperma	1.1	*Andropogon gracilis*	1.2
Agave brittoniana	1.1	*Furcraea hexapetala*	+.1
Zamia kickxii	+.1	*Polygala saginoides*	+.1
Lianes: cover: 30%			
Galactia savannarum	1.2	*Lygodium cubense*	+.1
Centrosema virginianum	1.1	*Smilax havanensis*	2.2
Triopteris rigida	1.1	*Aristolochia passiflorifolia*	1.1
Urechites lutea	+.1	*Stigmaphyllum sagraeanum*	1.1
Mesechites rosea	2.2	*Echites crassipes*	1.1
Passiflora cubensis	+.1	*Cassytha filiformis*	1.1
Cynanchum ophiticola	1.1	*Passiflora foetida* var. *polyadena*	+.1
Jacquemontia serpyllifolia	+.1		
Lygodium cubense	+.1		

Table 137 Coprnicio cowellii-Tabebuietum Borhidi and Muñiz ass. nova

Emergents: cover: 10%; height: 4—6 m			
Coccothrinax camagüeyena	2.1	*Phyllanthus orbicularis*	2.2
Shrub layer: cover: 60%; height: 3—4 m			
Tabebuia trachycarpa	3.3	*Phyllanthus orbicularis*	2.2
Guettarda camagüeyensis	1.2	*Ateleia apetala*	1.1
Guettarda scabra	+.1	*Plumeria obtusa*	2.2
Guettarda calyptrata	1.1	*Bourreria microphylla*	2.2
Solanum bahamense	+.1	*Bourreria setoso-hispida*	+.1
Diospyrus crassinervis	1.1	*Ouratea ilicifolia*	+.1
Copernica cowellii	1.2	*Machaonia microphylla*	+.1
Coccothrinax pseudorigida	2.2	*Randia spinifex*	1.1
Rondeletia camarioca ssp.	+.1	*Annona bullata*	+.1
Banara reticulata	1.1	*Bourreria divaricata*	1.1
Brya ebenus	2.2	*Coccoloba cowellii*	1.2
Cordia grisebachii	+.2	*Coccoloba geniculata*	+.1
Erythroxylum minutifolium	1.2	*Eugenia camarioca*	1.1
Gochnatia cowellii	+.1	*Eugenia melanadenia*	+.1
Exostema spinosum	+.1	*Jacquinia shaferi*	+.1
Malpighia nummulariifolia	1.1	*Myrtus anomala*	1.1
Notodon savannarum	2.2	*Fagara ramoni*	+.1
Herb layer: cover: 60%; height: 0.1—1 m			
Andropogon gracilis	2.3	*Eriochloa setosa*	1.2
Andorpogon hirtiflorus	1.1	*Eragrostis cubensis*	+.1
Aristida refracta	2.3	*Chloris ekmanii*	1.2
Aristida vilfifolia	1.3	*Andropogon bicornis*	+.2
Angelonia pilosella	+.1	*Buchnera elongata*	+.1
Anisantherina hispidula	+1	*Paspalum rupestre*	+.2
Croton nummulariifolius	2.2	*Rhynchospora tenuis*	2.3
Croton origanifolius	+.1	*Ayenia euphrasifolia*	1.2
Chamaesyce camagüeyensis	+.2	*Ayenia tenuicaulis*	+.1
Sachsia polycephala	+.1	*Polygala saginoides*	+.1
Piscidia cubensis	+.1	*Borreria thymocephala*	+.2
Evolvulus sericeus	+.1	*Mitracarpus squarrosus*	+.1
Elytraria planifolia	+.1	*Heliotropium humifusum*	+.1
Thymopsis thymoides	+.1	*Sporobolus cubensis*	+.1
Lianes: cover: 25%			
Stigmaphyllum sagraeanum	1.2	*Aristolochia passiflorifolia*	+.1
Triopteris jamaicensis	1.1	*Mesechites rosea*	2.2
Angadenia cubensis	1.2	*Cassytha filiformis*	2.2
Passiflora foetida var *polyadena*	+.1	*Centrosema virginianum*	1.1
Cynanchum ophiticola	+.1	*Echites crassipes*	1.1
Galactia galactioides	1.1	*Ipomoea polydactyla*	+.1
Platygyne parvifolia	1.1	*Smilax havanensis*	2.2

Fig. 365 Coccothrinax garciana León, an endemic little palm of the serpentine areas near Holguin (Oriente) (Photo: A. Borhidi)

thrinax camagüeyana, Coperinicia cowellii, Guettarda camagüeyensis, Coccothrinax pseudorigida, Gochnatia cowellii, Coccoloba cowellii, Croton camagüeyenus, Machaonia minutifolia, Richardia pectidifolia. A synthetic list of 5 relevés made by Borhidi and Muñiz July, 1970 in the San Serapio savannas can be found in column no. 33. of Table 25. The type relevé was made by Borhidi and Muñiz in July, 1970 at Santayana, NE of Camagüey (Table 137).

Erythroxylo-Spirotecometum holguinensis Borhidi ass. nova

It is zonal sclerophyllous dry evergreen scrub and scrub-woodland association of the lowland and colline serpentine areas NE of Holguin (Maniabón group). In this area several serpentine communities are to be distinguished. A combined synthetic list of these associations is in column no. 34. of Table 25. To *Erythroxylo–Spirotecometum* the following species are characteristic: *Coccothrinax garciana* (Fig. 365) *Erythroxylon minutifolium, E. horridum, Croton holguinensis, Henoonia myrtifolia, Spirotecoma holguinensis, Cordia holguinensis, Rondeletia savannarum, Notodon savannarum, Acacia belairioides* etc. The type relevé was made by Borhidi in February, 1976. in the Ceja de Melones, NE of Holguin (Table 138).

Table 138 Erythroxylo-Spirotecometum holguinensis Borhidi ass. nova

Emergents: cover 20%; height: 3—5 m			
Coccothrinax garciana	2.2	*Spirotecoma holguinensis*	1.2
Acacia belairioides	+.1	*Phialanthus oblongatus*	+.1
Copernicia hospita	1.1	*Henoonia myrtifolia*	1.2
Neobracea valenzuelana	+.1	*Guettarda calyptrata*	+.1
Bursera glauca	+.1	*Coccoloba nipensis*	1.1
Shrub layer: cover: 80%; height: 1—2 m			
Zanthoxylum nannophyllum	+.1	*Jacaranda cowellii*	1.1
Erythroxylum minutifolium	2.3	*Guettarda shaferi*	1.2
Erythroxylum horridum	1.3	*Notodon savannarum*	3.3
Croton holguinensis	2.2	*Piscidia cubensis*	1.2
Malpighia nummulariifolia	2.2	*Coccoloba nipensis*	1.2
Cordia holguinensis	+.1	*Coccoloba microphylla*	+.1
Pictetia marginata	1.1	*Phyllanthus orbicularis*	2.2
Comocladia dentata	1.1	*Bursera glauca*	1.1
Neobracea valenzuelana	1.1	*Henoonia myrtifolia*	+.1
Coccothrinax garciana	+.2	*Jacquinia shaferi*	1.1
Rondeletia savannarum	+.2	*Euphorbia podocarpifolia*	1.2
Eugenia melanadenia	+.1	*Exostema myrtifolium*	+.1
Psychotria revoluta	+.1	*Scolosanthus pycnophyllus*	+.1
Bourreria divaricata	1.1	*Connarus reticulatus*	+.1
Bourreria cassinifolia	+.1	*Maytenus buxifolia*	+.1
Herb layer: cover: 10%; height: 0.1—1 m			
Aristida refracta	1.2	*Heliotropium humifusum*	1.1
Aristida vilfifolia	2.1	*Turnera diffusa*	+.1
Rhynchospora tenuis	1.2	*Eupatorium hypoleucum*	1.1
Helicteres furfuracea	+.1	*Evolvulus sericeus*	+.1
Hybanthus havanensis	+.1	*Dorstenia* sp.	r.1
Diospyrus grisebachii	+.1	*Cordia grisebachii*	1.1
Croton nummulariifolius	1.2	*Randia spinifex*	+.1
Lianes: cover: 20%;			
Platygyne parvifolia	2.2	*Salacia nipensis*	1.1
Mesechites minima	+.2	*Angadenia sagraei*	+.1
Stigmaphyllum nipense	1.1	*Echites crassipes*	1.1
Aristolochia passiflorifolia	+.1		

19 Class: **SABALO-ROYSTONIETEA**
Borhidi and Muñiz in Borhidi and Herrera 1977

Savannas formed by high palms and herbs, generally as a secondary vegetation type on alluvial or deep red ferralitic soils influenced regularly and repeatedly by human activities, mainly by fire and pasture.

19.1 Order: PASPALO-ROYSTONIETALIA
Borhidi and Muñiz in Borhidi et al. 1979

Royal palms savannas distributed on the lowland plains and in the colline areas of Central Cuba, mostly on fertile ferralitic soils.

19.1.1 Alliance: ***Ceibo-Roystonion***
Borhidi and Muñiz in Borhidi and Herrera 1977

Royal palm savannas on deep latosolic soils of the fertile lowland belts, distributed in the areas originally occupied by humid tropical seasonal forests conditioned by a seasonal tropical climate with a 1—2 months long dry winter season.

Characteristic species: *Roystonea regia, Ceiba pentandra, Spondias mombin, Andira inermis, Guazuma ulmifolia, Chrysophyllum oliviforme, Andropogon virginicus, A. caricosus, A. pertusus, Paspalum notatum, P. distichum, P. divaricatum, P. fimbriatum, Panicum geminatum, P. caespitosum, P. pilosum, P. adspersum, Sporobolus indicus, Cyperus haspan, C. surinamensis, Setaria tenax, Imperata contracta, Reynaudia filiformis, Rhynchelytrum repens,* etc.

19.1.2 Alliance: ***Samaneo-Roystonion***
Borhidi and Muñiz in Borhidi and Herrera 1977

Royal palm savannas on moderately fertile, less deep ferralitic soils of the lowland areas. They can be found in areas originally covered by semi-deciduous forests and conditioned by a seasonal tropical climate with a 3—6 month-long dry winter season.

Characteristic species: *Roystonea regia, Samanea saman, Peltophorum adnatum, Pithecellobium cubense, Psidium guayava, Anacardium edule, Bursera simaruba, Cordia gerascanthus, Paspalum plicatum, Andropogon saccharoides, Panicum ghisbreghtii, Setaria geniculata, Sorghastrum setosum, Cassia aeschynomene, Stylosanthes hamata, Alysicarpus vaginalis, Pectis floribunda, Borreria verticillata,* and the formerly mentioned gramineas and ciperaceas.

19.2 Order: MACROCOPERNICIO-SABALETALIA
Borhidi in Borhidi et al. 1979

Semi-anthropic, more or less edaphically conditioned savannas, seasonally flooded in the valleys of rivers on alluvial, gleyized soils or in shallow hardpans or mocarreros.

19.2.1 Alliance: ***Copernicion giganti-rigidae***
Borhidi in Borhidi and Herrera 1977

Seasonally flooded savannas on gleyized or mocarrero soils sometimes in natural conditions. They are controlled edaphically by the extreme fluctuation of the soil water table. The majority of their stands have a secondary character resulting after a cut of the original alluvial forests of the eastern Central Cuban lowland areas. (Las Villas, Camagüey, Oriente).

Characteristic species: *Copernicia gigas, C. baileyana, C. sueroana, C. rigida, C. hospita, C.×vespertilionum, C. textilis, Belairia mucronata, Acacia* spp., *Caesalpinia* spp., *Pithecellobium* spp., *Andropogon* spp., *Scleria* spp., *Rhynchospora* spp., *Fimbristylis* spp., etc.

19.2.2 Alliance: ***Andropogoni-Sabalion***
Borhidi in Borhidi and Herrera 1977

Natural edaphic or semi-anthropical savannas on seasonally flooded mocarrero soils, controlled by the fluctuation of the water table and by fire. They are distributed mainly in the lowland areas of West and western Central Cuba (Isle of Pines, province of Pinar del Rio, Habana and Matanzas).

Characteristic species: *Sabal parviflora, Bucida subinermis, Belairia savannarum, Cameraria retusa, Croton sagraeanus, Caesalpinia savannarum, Acacia* spp., *Cheilophyllum* spp., *Andropogon virginicus, A. saccharoides, A. gracilis, Paspalum distortum, Panicum stenodes, Eriochloa setosa, Chloris cubensis, Setaria geniculata, Scleria* spp., *Rhynchospora* spp., etc.

19.3 Order: ARCHLAENETALIA PIPTOSTACHYAL
Bal.-Tul. in Bal.-Tul. and Capote 1982.

Treeless submontane tall grasslands in the natural area of the royal palm, with the *Achlaenion piptostachyae* alliance and the *Bletio purpureae-Andropogonetum gracilis* Bal.-Tul. and Capote 1982 association. **Achlaena piptostachya, Panicum aciculare, Scleria ciliata, Cynanchum savannarum Erigeron cuneifolius, Lisianthus silenifolius, Fibristylis autumnalis** and **Pteridium caudatum** are proposed for characteristic species.

20 Class: **CURATELLO-BYRSONIMETEA**
Borhidi in Borhidi et al. (1979)
ex Balátová–Tuláčková and Surli 1983

Dry Neotropical shortgrass savannas on poor sandy or loamy soils of low fertility usually with a shallow hardpan layer in the subsoil (arrecife or mocarrero). The communities are generally characterized by dispersed groups of sclerophyllous evergreen shrubs, or micro-, nano- or leptophyllous small trees, pines or small palms.

Characteristic species: *Byrsonima crassifolia, B. verbascifolia, Curatella americana, Bulbostylis paradoxa, Andropogon gracilis, Rhynchospora tenuis,* etc.

20.1 Order: PARVICOPERNICIO—COCCOTHRINACETALIA Borhidi and Muñiz in Borhidi and Herrera 1977

Semi-anthropic serpentine and sandy savannas, resulting from the cutting, burning, and pasturing of the original pine woodlands and scrubs.

Characteristic species: *Andropogon virgatus, A. gracilis, Aristida* spp. *Leptocoryphium lanatum, Eriochloa setosa, Eragrostis cubensis, Rhynchospora diodon, Panicum aciculare, P. chrysopsidifolium, Ichnanthus mayarensis,* etc.

20.1.1 Alliance: ***Parvicopernicio—Coccothrinacion*** Borhidi and Muñiz in Borhidi and Herrera 1977

Serpentine savannas in Cuba.

Characteristic species: *Copernicia, macroglossa* (Fig. 366), *C. pauciflora, C. cowellii, C. yarey, Coccothrinax miraguama* ssp. diff. *C. pseudorigida, C. clarensis, C. camagüeyana, C. garciana, Rondeletia* spp., *Tabebuia lepidota, Bourreria* spp., *Mitracarpus squarrosus, Tripogon spicatus, Ayenia euphrasifolia, Croton nummulariifolius, Polygala saginoides, Evolvulus* spp., *Aristolochia passiflorifolia,* etc.

20.1.2 Alliance: ***Cassio lineatae–Aristidion neglectae*** Bal.-Tul. in Bal.-Tul. and Capote 1985

Heavily disturbed serpentine savannas in Havana and Matanzas provinces originated from different communities of the *Coccothrinaci–Tabebuion lepidotae* alliance. Perhaps it does not differ from the 20.1.1 alliance. It is represented by the *Cassio lineatae–Aristidion neglectae* association.

20.2 Order: ACOELORRAPHO–COLPOTHRINACETALIA Bal.-Tul. in Bal.-Tul. and Capote 1985

20.2.1 Alliance: ***Acoelorrapho-Colpothrinacion*** Borhidi and Capote in Borhidi et al. 1979

Dry and moderately humid savannas on white sand areas formed by a short, occasionally open herb layer with dispersed individuals of pines and palms, in SW-Cuba and Isle of Pines, mostly as a result of the degradation of sand pine woodlands.

Fig. 366 Copernicia macroglossa Wend. ex Becc. a characteristic palm species of the serpentine areas, at the foot of the Loma de Galindo, Matanzas (Photo: A. Borhidi)

Characteristic species: *Acoelorraphe wrightii, Colpothrinax wrightii, Pinus tropicalis, Melochia savannarum, Hyptis pedalipes, Aster grisebachii, Aristida* spp., *Mesosetum loliiforme, Turnera acaulis, Croton cerinus, C. craspedotrichus,* and synusia of eriocaulaceas and xyridaceas.

Association studied:

Phyllantho selbyi–Aristidetum brittonorum
Bal.-Tul. and Capote 1985

20.3 Order: BYRSONIMO–ANDROPOGONETALIA TENERIS Balátová–Tuláčková in Balátová–Tuláčková and Surli 1983

Seasonally dry, shortgrass savannas without trees or scattered palms, growing on seasonally flooded alluvial or mocarrero soils, controlled by a considerable fluctuation of the water table.

Characteristic species: *Andropogon gracilis, A. tener, A. hirtiflorus, A. multinervosus, Rhynchospora diodon, R. plumosa, R. cubensis, Stenandrium droseroides, Buchnera elongata.*

20.3.1 Alliance: ***Guillemineo-Aristidion refractae***
Balátová-Tuláčková in Balátová-Tuláčková and Surli 1983

Dry shortgrass savannas on extremely dry mocarrero soils with a shallow hardpan layer and conditioned by a long flood in the summer.

Characteristic species: *Aristida refracta, A. vilfifolia, Gossypianthus brittonii, Stenandrium ovatum, Scleria georgiana, Bulbostylis tenuifolia, B. junciformis,* etc.

Association studied:

Sclerio interruptae Rhynchosporetum semiterbis
Balátová-Tuláčková in Balátová-Tuláčková and Surli 1983

Polygalo omissae-Rhynchosporetum diodontis Bal.-Tul. in Bal.-Tul. and Surli 1983

20.3.2 Alliance: ***Byrsonimo-Andropogonion teneris***
Bal.-Tul. in Bal.-Tul. and Surli 1983

Semi-dry shortgrass mocarrero savannas on moderately dry soils, conditioned by shorter inundation period and a better drainage in the subsoil.

Characteristic species: *Byrsonima crassifolia, Andropogon tener, Scleria geogiana, Bulbostylis setacea, Buchnera elongata.*

Association studied:

Byrsonimo-Andropogonetum teneris Bal.-Tul. in Bal.-Tul. and Surli 1983

20.3.3 Alliance: ***Roigello–Andropogonion multinervosi***
Bal.-Tul. in Bal.-Tul. and Surli 1983

Short grass savannas on siliceous acid soils of Pinar del Rio and Isle of Pines originated from the *Pinus tropicalis* and Picaribaea woodlands.

Association studied:

Roigello-Andropogonetum multinervosi: Bal.-Tul. in Bal.-Tul. and Garcia 1987.

21 Class: **CERCIDI-PROSOPIDETEA**
Knapp (1964) ex Borhidi hoc loco

Deciduous thorn woodlands and thorn-shrub forests formed mostly by thorny mimosaceas and caesalpiniaceas in Central America and West Indies.

21.1 Order: ACACIO-CAPPARIDETALIA
Knapp (1964) ex Borhidi hoc loco

Thorn woodlands and dense thorn scrub forests of the hyperxerophytic coastal and subcoastal zones in the West Indies, growing mainly on limestone conditioned by a bixeric climate with 7—9 dry months and 600—800 mm of annual precipitation.

21.1.1 Alliance: ***Acacio-Caesalpinion coriariae***
Borhidi in Borhidi et al. 1979

With the same characteristics as the order.

Characteristic species: *Acacia farnesiana, A. curbeloi, A. cupeyensis, A. roigii, A. lutea, A. cowellii, Pithecellobium mucronatum, P. oppositifolium, Prosopis juliflora, Phyllostylon brasiliense, Cassia stenophylla, Haematoxylon campechianum, Caesalpinia bahamensis* s.l., *C. pauciflora, C. coriaria, C. pinnata, C. subglauca, Capparis* spp., *Agave underwoodii, A. legrelliana, Scolosanthus bahamensis,* etc.

22 Class: **CERCIDI-CEREETEA**
Knapp (1964) in Borhidi hoc loco

Open desert and semi-desert vegetation with the dominance of columnar and tree-shaped cacti in North and Central America and the West Indies (Fig. 367).

22.1 Order: RITTEROCEREETALIA HYSTRICIS
Knapp (19647 in Borhidi hoc loco

Semi-desert vegetation in the coastal and subcoastal belts of the Greater Antilles and the Bahamas, conditioned by an arid climate with 9—11 dry months and 300 to 600 mm annual precipitation.

Characteristic species: *Ritterocereus hystrix, Pilosocereus* spp., *Consolea* spp., *Melocactus* spp., *Cylindropuntia hystrix, Opuntia dilleni, Capparis* spp., *Guajacum officinale, Croton* ssp., *Agave* spp.

22.1.1 Alliance: ***Consoleo-Ritterocereion hystricis***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Semi-desert vegetation with the dominance of columnar and tree-shaped cacti, represented by local vicarious endemics in each island of the Greater Antilles and the southern Bahamas.

Characteristic species in Cuba: *Consolea macracantha, C. millspaughii* (Fig. 368), *Ritterocereus hystrix, Pilosocereus brooksianus, P. robinii, Cylindropuntia*

Fig. 367 Dry cactus-scrub vegetation in the valley of Tacre river in Sierra de Imias near Cajobabo (Photo: A. Borhidi)

Fig. 368 Individuals of *Consolea millspaughii* at Maisi (Photo: A. Borhidi)

Fig. 369 Capparis flexuosa L., a common tree and shrub of the semi-desert cactus-scrub in South Oriente (Photo: A. Borhidi)

hystrix, Melocactus harlowii, M. borhidii, M. acunai, Rhodocactus cubensis, Opuntia militaris, Harrisia fernowii, Agave albescens, Caesalpinia pinnata, C. pauciflora, Capparis grisebachii, C. flexuosa (Fig. 369), *Gochnatia microcephala,* etc.

Association studied:

Consoleo-Colubrinetum ellipticae Borhidi and Muñiz ined.

Ritterocereo-Lasiocrotonetum bahamensis Borhidi and Muñiz ined.

It is a common semi-desert community distributed on the shallow sand covering the limestone terrace along the coastal plain of South Oriente between Tortuguilla and San Antonio del Sur, frequently forming a mosaic-complex with the following association.

Cappari-Ritterocereetum hystricis Borhidi and Muñiz

This community replaces the former one on the deeper sandy soils on the coastal semidesert plains. A synthetic combined list of three associations belonging to this alliance represented with ten relevés is found in column no. 40 of table 25.

Ritterocereo-Guettardetum cueroensis Borhidi

It is a semi-desert community growing on the steep slopes of the second coastal limestone terrace along the southern rocky shores of Oriente, especially between

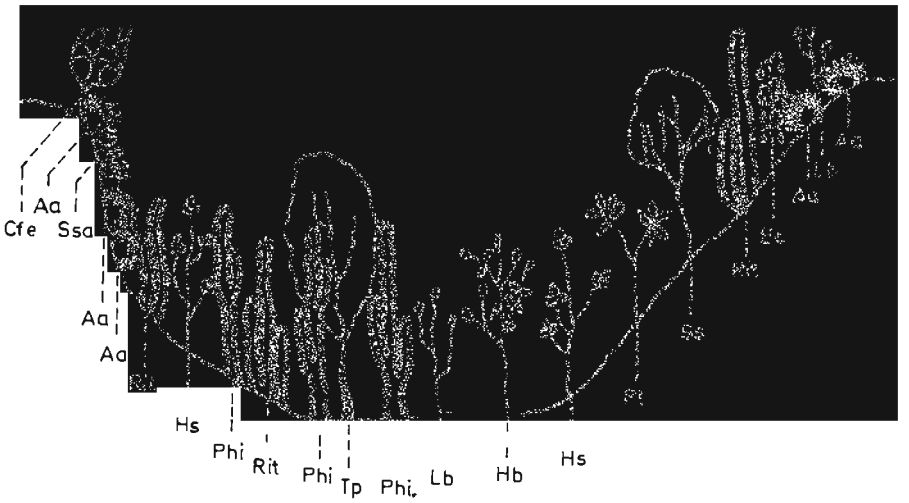

Fig. 370 Vegetation transect in the *Ritterocereo-Lasiocrotonetum bahamensis* community (made by Rodriguez N. N. *et al.* 1982) Aa: *Agave albescens;* Cfe: *Capparis ferruginea;* Ec: *Exostema caribeum;* Hs: *Helicteres semitriloba;* Hb: *Henoonia brittonii;* Lb: *Lasiocroton bahamensis;* Rhi: *Pilosocereus brooksianus;* Pl: *Plumeria lanata;* Rit: *Ritterocereus hystrix;* Sa: *Stigmaphyllon sagraeanum:* Ss: *Spirotecoma spiralis;* Tp: *Thuinidium pulverulentum*

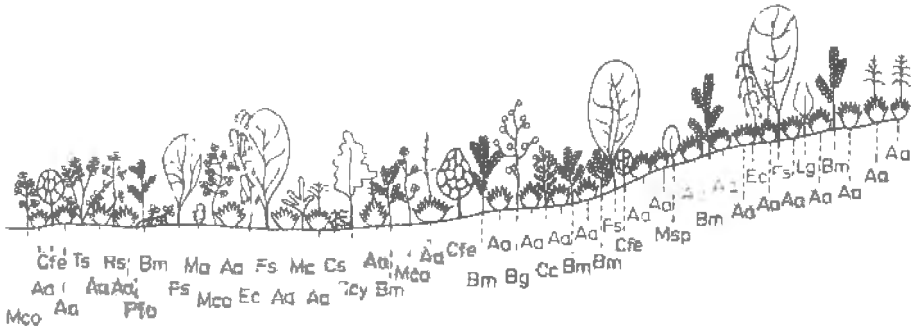

Fig. 371 Vegetation transect in the *Agavo-Melochienum tomentosae* Rodriguez N. N. et al. community made by the authors in 1982. For abbreviations see Fig. 370 and the following: Bm: *Brya microphylla*, Cs: *Caespalpinia decapetala*, Cr: *Colubrina elliptica*, Fs: *Forestiera segregata*; Go: *Guaiacum officinale*; Ma: *Melocactus acunai*; Mco: *Maytenus cochlearifolius*, Rs: *Randia spinifex*, Tsp: *Tetrapteris buxifolia*

Daiquiri and Maisi. The semi-desert plant associations usually form a vegetation continuum, in which the delimitation of the different communities is problematic. (Figs 370—371)

23 Class: **OCOTEO-MAGNOLIETEA**
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Montane rainforests of the Caribbean region, especially in the eastern ranges of Mexico and in the mountains of the Antilles. They are characterized by the constant presence of the fern trees, by the abundance of epiphytes, mosses and epiphyllous liverworts.

Characteristic species: *Ocotea* spp., *Magnolia* spp., *Laplacea* spp., *Cyrilla* spp., *Brunellia comocadifolia, Freziera* spp., *Podocarpus* spp., *Talauma* spp., *Cyathea* spp., *Nephelea* spp., *Lophosoria quadripinnata, Hemitelia horrida, Clethra* spp., *Prestoea montana, Calyptronoma* spp.

23.1 Order: OCOTEO-MAGNOLIETALIA
Muñiz in Borhidi et al. 1979 et hoc loco

Humid montane broad-leaved rainforests growing on mountain yellow tropical soils and forming a vegetation belt — in Cuba between 800 and 1600 m a.s.l. in the Sierras de Escambray, Maestra and Imias ranges.

Characteristic species: *Magnolia cubensis* s.l., *M. cacuminicola, Ocotea cuneata, O. leucoxylon, O. acunaiana, O. ekmanii, Persea* spp., *Beilschmiedia pendula, Guatteria blainii, Laplacea angustifolia, L. urbanii, Matayba domingensis, Prestoea montana, Talauma minor, Ossaea ottoschmidtii, O. turquinii, Hedyosmum nutans, Mecranium amygdalinum, Meriania leucantha* s.l. *Gesneria viridiflora* s.l., *Torralbasia lenticellata, Freziera grisebachii,* etc.

23.1.1 Alliance: ***Magnolion cubensis***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

With the same characteristics as the order:

Associations studied:

Magnolio-Laplaceetum angustifoliae Borhidi and Muñiz ass. nova

It is the zonal montane rainforest community of the Sierra Maestra, between 800 and 1600 m a.s.l. The upper tree layer is formed by the co-dominant *Magnolia cubensis* spp. *cubensis* and *Laplacea angustifolia,* accompanied by many other sclerophyllous trees as *Guatteria blainii, Ocotea ekmanii, O. cuneata, Freziera grisebachii, Laplacea urbanii, Cleyera nimanimae, Cyrilla racemiflora* s.l., etc. The second tree layer is composed of meso- and macrophyllous melastomataceas and fern trees. The synthetic list of five relevés made by Borhidi and Muñiz in the Turquino-group between 1300 and 1600 m a.s.l. in December 1969 is represented in column no. 20 of Table 25. For structure profile see Fig. 278 (p. 394).

Ocoteo ekmanii-Cyrilletum racemiflorae Borhidi

It is the dry montane rainforest community of the Sierra Maestra, at the same high level as the former one but conditioned edaphically on the humid sandstone areas, or mesoclimatically on the steep, dry ridges and slopes.

It can be characterized by microphyllous sclerophyllous trees as *Ocotea ekmanii, Cyrilla racemiflora, Persea similis, Tabebuia oligolepis, Myrsine coriacea,* and by the absence of the tree ferns in the second tree layer.

Magnolio acunae-Cyrilletum racemiflorae Borhidi and Muñiz ass. nova

It is the zonal or usually extrazonal montane rainforest association of the Sierra de Escambray between 800 and 1100 m a.s.l. Its species composition is poorer than that of the Sierra Maestra community. Of this association the presence of *Magnolia cubensis* ssp. *acunae, Ocotea acunaiana, Torralbasia lenticellata, Ocotea floribunda, Gesneria viridiflora* ssp. *colorata, Miconia cubensis* and *M. albescens* are characteristic. The synthetic list of five relevés made by Borhidi and Muñiz in June, 1970 on the northern slopes of the Potrerillo Peak, is presented in column no. 21 of Table 25 (Appendix).

23.2 Order: PINETALIA OCCIDENTALIS-MAESTRENSIS
Knapp 1964 emend. Borhidi in Borhidi et al. 1979 et hoc loco

Montane pine forests in the montane rainforest belts of the Greater Antilles.

Characteristic species: *Pinus occidentalis, P. maestrensis, Gleichenia bifida, G. flexuosa, G. palmata, G. pectinata, Alsophila* spp., *Cyathea* spp., *Clethra* spp.

23.2.1 Alliance: ***Pinion maestrensis***
Borhidi in Borhidi et al. 1979 et hoc loco

Montane pine forests rich in ferns and tree ferns on acidic sandy soils derived from sandstone and andesite tuffs in the Sierra Maestra.

Characteristic species: *Myrsine coriacea, Pinus maestrensis, Cyathea arborea, Alsophila aspera, Clethra cubensis, Viburnum villosum, Vaccinium leonis, Lyonia calycosa, L. maestrensis, L. affinis, Ilex macfadyenii, Solonia reflexa, Myrica punctata, Miconia acunae, M. remotiflora, Eugenia papayoensis, Clusia tetrastigma, Eupatorium dalea, Vernonia praestans, V. parvuliceps, Psychotria ekmanii, Podocarpus aristulatus,* etc.

Associations studied:

Clethro-Pinetum maestrensis Borhidi ass. nova

It is a pine forest community formed by two tree layers on the oligotrophic soils of the montane rainforest belt in the Sierra Maestra. The upper tree layer is formed by the dominant *Pinus maestrensis* accompanied by evergreen broad-leaved trees. In the lower tree layer the constant presence of tree ferns and acidophilous elements *(Clethra, Vaccinium, Lyonia, Viburnum, Myrica)* is characteristic. Five representative relevés made by Borhidi in the pine forest area of Alto de la Siberia-Pico Bayamesa in January, 1976 and November, 1978. These are presented in Table 139. Type relevé: no. 4. Loma Ruiseñor, Pico Bayamesa above Pino de Agua, 1300 m a.s.l. For structure profile see Fig. 318 (p. 441).

23.3 Order: PODOCARPO-SLOANETALIA
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Montane, semi-dry, micro- and notophyllous rainforests, poor in epiphytes, mosses and epiphyllous liverworts. They grow on acid ferralitic serpentine soils poor in nutrients, in the Sierra de Nipe, Sierra del Cristal, Cuchillas de Moa, Toa and Baracoa ranges (eastern Cuba).

23.3.1 Alliance: ***Podocarpo-Byrsonimion orientensis***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Characteristic species: *Podocarpus aristulatus, P. ekmanii, Sloanea curatellifolia, Hyeronima nipensis, Talauma minor* ssp. *oblongata, Guatteria moralesii, Byrsonima orientensis, B. biflora, Calophyllum utile, Terminalia nipensis, T. pachystyla, T. orientensis, Mozartia gundlachii, Ocotea moaënsis, Coccoloba costata, Leucocroton wrightii, L. longibracteatus,* etc.

Table 139 Clethro-Pinetum maestrensis Borhidi ass. nova

	1	2	3	4	5
High tree layer 18—22 m high, cover %:	70	65	60	75	70
Pinus maestrensis Bisse	4.5	4.4	4.4	4.5	4.5
Cyrilla nipensis Urb.	+.1	–	+.1		
Myrsine coriacea (L.) R. Br.	–	–	+.1	+.1	1.1
Brunellia comocladifolia H. and B.	+.1	+.1	–	–	+.1
Tabebuia hypoleuca Griseb.	–	–	–	+.1	–
Low tree layer 3—8 m high, cover %:	30	40	25	20	35
Pinus maestrensis Bisse	–	–	+.1	–	+.1
Myrsine coriacea (L.) R. Br.	+.1	+.1	+.1	1.1	–
Brunellia comocladifolia H. and B.	+.1	1.1	–	–	–
Weinmannia pinnata L.	–	+.1			+.1
Myrica punctata Griseb.	1.1	+.1	+.1	–	–
Vaccinium leonis Acuña and Roig	–	1.1	+.1	+.1	–
Clusia rosea Jacq.	+.1	–	–	–	+.1
Clethra cubensis A. Rich.	+.1	1.1	+.1	+.1	–
Matayba domingensis (DC.) Radlk.	–	–	–	+.1	+.1
Clusia minor L.	–	–	–	–	+.1
Clusia tetrastigma Vesque	–	+.1	+.1	–	–
Viburnum villosum Sw.	1.1	1.2	+.1	+.1	1.1
Trema cubensis Urb.	+.1	+.1	–	–	
Ilex macfadyenii (Walp.) Rehder	1.1	2.2	+.1	+.1	2.2
Cyathea araneosa Max.	+.1	–	–	+.1	–
Cyathea armata (Sw.) Domin	+.1	+.1	+.1	–	
Cyathea arborea (L.) Sm.	–	+.1	–	+.1	+.1
Lophosoria quadripinnata (Gmel.) C. Chr.	–	–	+.1	+.1	–
Myrica cacuminis Britt. and Wils.	–	–	–	+.1	1.2
Miconia dodecandra (Desv.) Cogn.	+.1	–	–	–	1.1
Miconia punctata (Desm.) D. Don	–	+.1	+.1	–	–
Heterotrichum umbellatum (Mill.) Urb.	+.1	1.1	+.1	+.1	+.1
Shrub layer 1—2 m high, cover %:	5	10	25	25	10
Viburnum villosum Sw.	+.1	1.1	1.2	1.2	+.1
Ilex macfadyenii (Walp.) Rehder	+.1	1.1	1.2	1.2	+.1
Solonia reflexa Urb.		+.1	+.r	+.r	–
Sapium erythrospermum (Griseb.) Muell. Arg.	–	–	+.r	–	+.r
Garrya fadyenii Hook.	–	+.1	+.r	+.r	+.r
Palicourea alpina (Sm.) DC.	+.r	–	–	+.1	–
Ageratina paucibracteata (Alain) King et Robins.	+.1	1.1	1.2	1.2	1.1
Clethra cubensis A. Rich.	–	+.1	+.1	–	+.1
Lyonia calycosa (Small) Urb.	–	+.r	–	–	+.r
Lyonia maestrensis Acuña and Roig	–	–	+.r	+.r	–
Cyrilla racemiflora L.	+.1	+.1	+.1	+.1	–
Critonia dalea (L.) DC.	–	1.1	1.1	1.1	–
Tibouchina longifolia (Vahl) Baill.	+.1	+.r	–		+.r
Trema cubensis Urb.	+.r	+.1	–	–	

	1	2	3	4	5
Lobelia assurgens L.	+.r	—	—	+.r	—
Callicarpa ferruginea Sw.	+.1	+.1	+.1	1.1	+.1
Ascyrum hypericoides L.	+.1	1.2	—	—	—
Gesneria viridiflora (Dcne) Kuntze	+.1	+.1	+.r	+.r	—
Clidemia strigillosa (Sw.) DC.	—	—	—	+.1	+.2
Clidemia hirta (L.) C. Don	+.1	+.1	+.1	+.1	—
Miconia alternifolia Griseb.	—	—	+.1	+.1	—
Miconia acunae Borhidi	—	—	—	—	+.2
Ossaea muricata (Griseb.) Wr. ex Sam.	—	—	+.1	+.1	—
Vaccinium leonis Acuña and Roig	—	—	+.1	+.1	+.1
Vernonia parvuliceps Ekm.	—	+.1	+.2	—	—
Sapium jamaicense Sw.	+.1	—	—	—	—
Pteridium caudatum (L.) Max.	—	+.1	1.2	+.2	—
Eugenia rigida Berg	—	+.1	—	—	—
Myrcia splendens (Sw.) DC.	—	+.1	+.1	—	—
Hedyosmum grisebachii Solms	—	+.1	+.1	+.r	—
Rubus turquinensis Rydb.	—	—	—	+.2	+.2
Wigandia reflexa Brand	—	—	+.r	+.1	—
Purdiaea maestrensis Borhidi and Catasus	—	—	—	+.2	—
Rondeletia naguensis Britt. and Wils.	—	—	—	+.2	—
Graffenrieda rufescens Britt. and Wils.	—	+.1	—	+.1	—
Herb layer 10—80 cm high, cover %:	50	60	100	100	80
Dicranopteris flexuosa (Schrad.) Mett.	—	—	5.5	5.5	4.4
Nephrolepis biserrata (Sw.) Schott	2.2	2.3	—	—	—
Blechnum occidentale L.	1.1	1.2	—	—	—
Dennstaedtia adiantoides (H. and B.) Moore	—	—	+.1	—	+.1
Odontosoria aculeata (L.) J. Sm.	+.2	+.1	+.1	—	—
Odontosoria uncinella (Kunze) Fée	—	—	—	+.1	+.1
Coccocypselum × lanceolatum (Urb.) Borhidi	—	+.r	+.r	—	—
Dalbergaria cubensis (Urb.) Borhidi.	—	—	+.r	—	+.r
Desmodium barbatum (L.) Benth. and Oerst.	+.2	+.1	+.1	+.r	—
Pityrogramma sulphurea (Sw.) Max.	—	+.1	+.r	—	—
Coccocypselum herbaceum Aubl.	+.1	+.1	+.1	—	—
Habenaria monorrhiza (Sw.) Rchb. f.	+.r	+.r	—	—	—
Phaius tankervilliae (Banks) Blume	+.r	+.r	—	—	—
Hedyosmum grisebachii Solms	—	—	+.r	+.1	—
Lycopodium dichotomum Jacq.	1.1	1.2	—	—	—
Lycopodium cernuum L.	+.1	+.1	—	—	+.r
Panicum scoparium L.	1.1	1.2	—	—	+.r
Panicum boliviense Hack.	—	+.1	—	—	+.1
Rondeletia calophylla Standl. ex Britt.	—	—	+.1	+.1	—

Associations studied:

Hieronymo-Sloanetum curatellifoliae Borhidi ass. nova

This is the zonal serpentine rainforest community of the ranges Sierra de Nipe and Sierra del Cristal, formed by two tree layers, a rather dense shrub layer and a poor herb layer. The association is poor in treeferns, epiphytes and epiphyllous

liverworts. Table 140, exhibits five representative relevés made by Borhidi and collaborators in the Sierra de Nipe in September, 1975, and in the Sierra del Cristal in April, 1976. Type relevé: no. 3. Cayo Verde, Northern slope, in 700 m a.s.l., Sierra del Cristal, near Corea, made by Borhidi and Vales. Structure profile is shown on p. 397, Fig. 281.

Podocarpo-Bonnetietum cubensis Borhidi and Muñiz

This is the zonal serpentine rainforest community of the high plateaus of the Cuchillas de Moa and Toa. (Fig. 372) Characteristic species are *Bonnetia cubensis, Moacroton ekmanii, Tabebuia dubia, T. clementis, Podocarpus ekmanii, Pera ekmanii, Laplacea moaënsis, Purdiaea moënsis*, etc. A synthetic list of ten relevés made by Borhidi and Muñiz in Sierra de Moa, Sierra de Iberia, Rio Jaguani and Sierra de Maguey in February and March 1970 is found in column no. 15 of Table 25 (Appendix).

23.3.2 Alliance: ***Cyrillo-Pinion cubensis***
Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Montane riverside forests on humid ferritic soils in the pine forest belt of the serpentine ranges of northern Oriente.

Characteristic species: *Cyrilla nipensis, Calyptronoma orientensis, Bactris cubensis, Senecio polyphlebius, S. rivalis, Hedyosmum crassifolium, Pachynathus reticulatus, Calyptranthes punctata, C. calyptrata, C. cardiophylla, C. monocarpa, Isachne leersioides, Litachne pauciflora, Ichnanthus nemorosus, Cladium restioides, Paepalanthus riparius,* etc.

Association studied:

Cyrillo nipensi-Pinetum cubensis Borhidi and Muiñiz ass. nova

The riparian riverside pineforest community of the montane belt in the serpentine ranges of Oriente. A synthetic list of five relevés made by Borhidi and Muñiz in the upland near the headwaters of Rio Toa, Sierra de Maguey, Cupeyal in February, 1970, is in column no. 14, of Table 25.

23.4 Order: CALYPTRONOMO-CYRILLETALIA
Borhidi in Borhidi et al. 1979 et hoc loco

Montane and submontane off-serpentine riverside forests of Cuba, irrigated by oxygen-rich freshwaters.

Characteristic species: *Calyptronoma* spp., *Cyrilla* spp., *Didymopanax morototoni, Isertia haenkeana, Senecio* spp., *Calophyllum* spp., *Calyptranthes* spp., *Myrcia* spp., *Mozartia* spp., *Hirtella americana, Alsophila* spp., *Cyathea minor, Pilea* spp., etc.

Table 140 Hyeronimo-Sloanetum curatellifoliae Borhidi ass. nova

Sample plots 30×30 m²	1.	2.	3.	4.	5.	C_5
High canopy layer: 18—25 m tall, cover	80	85	75	90	80	
Hyeronima nipensis Urb.	2.3	3.4	3.3	2.2	3.3	V
Sloanea curatellifolia Griseb.	3.3	1.1	1.2	1.1	1.2	V
Chionanthus domingensis Lam.	1.2	2.2	1.2	3.4	2.2	V
Podocarpus ekmanii Urb.	1.1	+.1	—	1.1	1.1	IV
Calophyllum utile Bisse	+.1	1.2	—	1.2	3.3	IV
Byrsonima coriacea R. Br.	2.2	1.1	2.2	1.1	2.2	V
Terminalia nipensis Alain	+.1	1.1	1.2	1.2	1.2	V
Myrsine coriacea (Sw.) R. Br.	2.2	1.2	1.2	2.2	1.2	V
Didymopanax morototoni (Aubl.) Dec. et Planch.	+.1	—	1.1	1.1	1.1	IV
Ocotea cuneata (Griseb.) Urb.	—	1.1	1.2	1.1	1.2	IV
Byrsonima orientensis Bisse	+.1	1.1	1.1	—	—	III
Matayba domingensis (DC.) Radlk.	1.1	1.1	—	—	+.1	III
Buchenavia capitata (Vahl.) Eichl.	—	1.1	—	—	1.1	II
Pithecellobium arboreum (L.) Urb.	—	1.1	—	1.1	—	II
Magnolia cubensis Urb.	+.1	+.1	—	—	—	II
Ocotea leucoxylon (Sw.) Mez	—	—	1.1	1.1	—	II
Micropholis polita (Griseb.) Pierre	—	—	1.1	+.1	—	II
Alchornea latifolia Sw.	—	1.2	—	2.2	—	II
Zanthoxylum cubense P. Wils.	—	—	1.1	—	1.1	II

Accidentally: *Guarea guidonia* (1), *Cupania glabra* (2), *Cupania americana* (4), *Chaetocarpus globosus* (5), *Guatteria moralesii* (1), *Ocotea floribunda* (5), *Licaria jamaicensis* (2), *Cinnamomum montanum* (3), *Guapira ophiticola* (3), *Manilkara albescens* (5)

Low canopy layer: 6—12 m tall, cover %	30	40	35	20	25	
Hyeronima nipensis Urb.	+.1	+.1	+.1	+.1	+.1	V
Myrsine coriacea (Sw.) R. Br.	+.1	+.1	1.1	1.2	1.1	V
Coccoloba retusa Griseb.	1.1	1.2	+.1	+.1	+.1	V
Chrysophyllum argenteum Jacq.	1.1	1.1	+.1	+.1	+.1	V
Miconia serrulata (DC.) Naud.	+.1	1.1	+.1	+.1	+.1	V
Dipholis cubensis (Griseb.) Pierre	+.1	1.1	+.1	+.1	1.1	V
Byrsonima biflora Griseb.	+.1	+.1	+.1	+.1	—	IV
Ocotea ekmanii O. C. Schmidt	—	+.1	1.1	+.1	1.2	IV
Coccoloba costata Wr. in Sauv.	—	1.1	+.1	+.1	1.2	IV
Guatteria moralesii Urb.	1.1	1.2	+.1	—	1.1	IV
Bactris cubensis Burret	+.1	+.1	—	+.1	+.1	IV
Ocotea cuneata (Griseb.) Urb.	1.1	+.1	+.1	—	+.1	IV
Guettarda lindeniana A. Rich.	+.1	—	+.1	+.1	+.1	IV
Calophyllum utile Bisse	+.1	+.1	—	—	+.1	III
Byrsonima coriacea R. Br.	1.1	—	—	1.1	1.1	III
Byrsonima orientensis Bisse	+.1	1.1	+.1	—	—	III
Protium cubense (Rose) Urb.	—	—	+.1	+.1	+.1	III
Terminalia nipensis Alain	1.1	1.1	1.1	—	—	III
Talauma minor Urb. ssp. *oblongifolia* (León) Borhidi	—	—	+.1	+.1	1.2	III
Alsophila aquilina C. Chr.	+.1	+.1	—	—	+.1	III
Leucocroton wrightii Griseb.	—	—	1.1	+.1	+.1	III
Pilocarpus racemosus Vahl.	+.1	+.1	—	—	+.1	III
Miconia tetrandra (Sw.) D. Don	—	+.1	+.1	+.1	—	III
Simaruba laevis Griseb.	—	—	+.1	+.1	1.2	III

Sample plots 30×30 m²	1.	2.	3.	4.	5.	C_5
Alchornea latifolia Sw.	1.1	+.1	—	—	+.1	III
Illicium cubense A. C. Sm.	1.1	1.1	—	—	+.1	III
Podocarpus ekmanii Urb.	—	+.1	+.1	—	—	II
Pera ekmanii Urb.	—	—	+.1	+.1	—	II
Annona cristalensis (Alain) Borh. et Monc.	—	—	+.1	+.1	—	II
Ocotea leucoxylon (Sw.) Mez	+.1	—	—	—	+.1	II
Calycogonium grisebachii Triana	—	—	—	+.1	+.1	II
Wallenia laurifolia (Jacq.) Sw.	+.1	+.1	—	—	—	II
Pithecellobium obovale (A. Rich.) Wr. in Sauv. ssp. *pinetorum* (Britt.) Borhidi	+.1	+.1	—	—	—	II
Ditta myricoides Griseb.	—	—	+.1	+.1	—	II

Accidentally: *Buchenavia capitata* (2), *Pithecellobium cubense* (1), *Pithecellobium nipense* (5), *Pisonia macracantha* (4), *Pisonia byrsonimifolia* (3), *Henriettea fascicularis* (3), *Pachyanthus neglectus* (3), *Pachyanthus discolor* (2), *Miconia guianensis* (5), *Cameraria latifolia* (5), *Leucocroton cordifolius* (5).

Shrub layer: 1—3 m tall, cover %	40	30	50	20	10	
Dipholis cubensis (Griseb.) Pierre	1.2	1.1	2.2	+.1	+.1	V
Rauvolfia salicifolia Griseb.	+.1	1.1	1.2	+.1	+.1	V
Antirhea shaferi Urb.	+.1	+.1	+.1	+.1	+.1	V
Cestrum laurifolium L'Hérit.	1.2	+.1	1.1	+.1	—	IV
Savia cuneifolia Urb.	+.1	+.1	2.2	+.1	+.1	V
Protium cubense (Rose) Urb.	+.1	—	1.1	+.1	+.1	IV
Meriania leucantha Sw. ssp. *nana* (Naud.) Borhidi	+.1	1.1	+.1	+.1	—	IV
Mozartia gundlachii (Kr. and Urb.) Urb.	2.2	1.1	+.1	—	—	III
Phyllanthus subcarnosus Wr. ex Muell. Arg.	+.1	—	+.1	+.1	—	III
Terminalia nipensis Alain	+.1	1.2	—	—	+.1	III
Dendropanax nervosus (Urb. et Ekm.) A. C. Sm.	—	—	1.2	+.1	+.1	III
Allophylus cristalensis Lippold	—	—	1.1	+.1	+.1	III
Solanum cristalense Amsh.	—	—	1.2	+.1	+.1	III
Polygala oblongata (Britt.) Blake	—	+.1	1.2	+.1	—	III
Illicium cubense A. C. Sm.	1.1	1.2	+.1	—	—	III
Calyptranthes punctata Griseb.	+.2	+.2	+.1	—	—	III
Psychotria shaferi Urb.	—	+.1	+.1	+.1	—	III
Calycogonium lindenianum Naud.	+.1	+.1	—	—	—	II
Phyllanthus pachystylus Urb.	+.1	+.1	—	—	—	II
Solanum pachyneurum C. E. Schulz	+.1	+.1	—	—	—	II
Psidium balium Urb.	+.1	—	—	—	+.1	II
Ouratea revoluta (Wr. ex Griseb.) Engl.	1.1	1.2	—	—	—	II
Coussarea urbaniana Standl.	+.1	+.2	—	—	—	II
Rhamnidium nipense Urb.	+.1	+.1	—	—	—	II
Lasianthus lanceolatus (Griseb.) Urb.	+.1	—	—	+.1	—	II

Accidentally: *Myrsine cristalensis* (3), *Jacquinia robusta* (2), *Manilkara wrightiana* (4), *Chionanthus axilliflorus* (1), *Cameraria latifolia* (5), *Tabebuia shaferi* (2), *Tabebuia pachyphylla* (4), *Tabebuia simplicifolia* (3), *Pera orientensis* (3), *Alsophila aquilina* (5), *Psychotria graminifolia* (1), *Myrtus leiophloeus* (2), *Krokia odiolens* (4).

Herb layer: 30—100 cm tall, cover %	20	15	15	10	15	
Piper holguinianum Trel.	+.1	+.1	+.1	+.1	+.1	V
Lithachne pauciflora	+.1	+.2	+.1	+.2	+.2	V

Sample plots 30×30 m²	1.	2.	3.	4.	5.	C_5
Oplismenus hirtellus (L.) Beauv.	1.2	1.2	1.1	1.1	1.2	V
Ichnanthus mayarensis (Wr.) Hitchc.	1.1	1.1	1.2	+.1	+.2	V
Pharus latifolius L.	1.2	+.1	+.1	—	+.1	IV
Savia cuneifolia Urb.	+.1	+.1	+.1	+.1	—	IV
Sapium cubense Britt. et Wils.	1.1	+.1	+.1	—	—	III
Allophylus cristalensis Lippold	—	—	+.1	+.1	+.1	III
Panicum glutinosum Sw.	—	+.1	1.1	—	—	II
Hedyosmum grisebachii Solms	+.1	+.1	—	—	—	II
Polygala oblongata (Britt.) Blake	—	—	+.1	+.1	—	II
Gesneria pachyclada Urb.	—	—	+.1	—	+.1	II

Accidentally: *Eulophia alta* (2), *Malaxis uniflora* (5), *Lycopodium cernuum* (3), *Thelypteris totta* (1), *Asplenium erosum* (3), *Tectaria heracleifolia* (2), *Adiantum trapeziforme* (4), *Phyllanthus myrtilloides* (1), *Pilea mayarensis* (2), *Thelypteris pennata* (3), *Nephrolepis pectinata* (4), *Lindsaya stricta* (3).

Lianes; cover %	10	25	10	5	5	
Scleria pilosissima Britt.	+.1	1.1	+.2	+.1	1.2	V
Schradera cubensis Steyerm.	+.2	+.2	1.2	+.1	+.1	V
Marcgravia evenia Kr. et Urb.	1.1	1.2	1.1	+.1	+.1	V
Smilax domingensis L.	1.2	2.2	—	1.2	+.1	IV
Lasiacis sloanei (L.) Hitchc.	+.1	+.1	—	+.1	+.1	IV
Platygyne triandra Borhidi	+.2	1.1	—	—	1.1	III
Odontosoria uncinella (Ktze) Fée	+.1	2.3	—	+.2	—	III
Vanilla phaeantha Rchb.f.	+.1	+.1	—	—	—	II
Vanilla wrightii Rchb.f.	—	+.1	+.1	—	—	II
Salacia nipensis Britt.	+.1	+.1	—	—	—	II
Philodendron lacerum (Jacq.) Schott	1.1	—	—	+.1	—	II
Rajania nipensis Howard	+.1	+.1	—	—	—	II

Accidentally: *Dicranopteris flexuosa* (2), *Angadenia lindeniana* (3), *Banisteria laurifolia* (5), *Smilax balbisiana* (1), *Dioscorea tamoidea* (5).

Epiphytes; cover %	25	25	25	15	20	
Jacquiniella globosa (Jacq.) Schltr.	+.1	+.2	+.2	+.1	+.1	V
Stelis ophioglossoides (Jacq.) Sw.	+.1	+.1	+.1	1.1	1.2	V
Polypodium phyllitidis L.	1.1	1.1	1.1	+.1	+.1	V
Mecodium polyanthos (Sw.) Copel.	+.1	+.2	1.1	1.2	1.1	V
Trichomanes crispum L.	1.2	2.2	2.2	2.3	1.3	V
Vandenboschia scandens (L.) Copel.	2.2	1.1	2.2	+.1	+.1	V
Dinema cubincola (Borhidi) H. Dietr.	+.1	+.1	+.1	—	+.1	IV
Pleurothallis tribuloides (Sw.) Lindl.	+.2	+.2	+.1	—	+.1	IV
Meringium fucoides (Sw.) Copel.	1.1	1.2	1.1	—	2.2	IV
Hillia parasitica Jacq.	+.1	+.1	+.1	—	—	III
Dichaea hystricina Rchb.f.	—	—	+.1	+.1	+.1	III
Dilomilis oligophylla (Schltr.) Summerh.	—	—	+.1	+.1	+.1	III
Psychotria guadelupensis (DC.) Howard	—	—	—	+.1	+.1	II
Polystachya cubensis	+.1	—	+.1	—	—	II
Pleurothallis velaticaulis Rchb.f.	+.1	—	—	+.1	—	II
Elaphoglossum firmum (Mett.) Urb.	—	+.1	—	—	+.1	II
Feea rigida (Sw.) Copel.	—	+.1	—	+.1	—	II

Accidentally: *Didymoglossum kraussii* (2), *Mecodium abruptum* (3), *Vandenboschia capillacea* (2), *Lepanthes grisebachii* (2), *Epidendrum hioramii* (4), *Dichaea glauca* (1), *Elaphoglossum pusillum* (5), *Grammitis serrulatum* (1), *Grammitis shaferi* (3), *Hymenodium crinitum* (1).

Fig. 372 Sclerophyllous evergreen montane rainforests on serpentine and riverside scrub on the eastern slope of El Toldo at about 600 m a.s.l. (Photo: A. Borhidi)

23.4.1 Alliance: ***Calyptronomo-Cyrillion racemiflorae***
Borhidi in Borhidi et al. 1979 et hoc loco

Riverside broad-leaved, evergreen forests in Central and West Cuba.

Characteristic species: *Calyptronoma dulcis, C. intermedia, C. microcarpa, Calophyllum antillanum, C. antillanum* ssp. *rivularis, Dendropanax cuneifolius, Calyptranthes ferruginea, C. clementis, Pachyanthus angustifolius, Calyptropsidium sartorianum, Mitranthes ottonis, Alsophila myosuroides, Henriettea patrisiana,* etc.

Assocation studied:

Calyptronomo-Cyrilletum racemiflorae Borhidi and Capote

This is the riverside forest community of West-Cuba, mainly in the Sierra de los Organos range but descending also to the southern plain of the Province Pinar del Rio. The type relevé was made in the valley of Rio Frio, N orth Guane on crystalline slate rock.

23.4.2 Alliance: ***Calyptronomo clementis-Cyrillion racemiflorae***
Borhidi (1979) nom. nov.

Riverside humid, broad-leaved evergreen forest, mixed with "Manaca-palm" in the upper tree layer, occurring mainly in the Sierra Maestra range (Fig. 373).

Characteristic species: *Calyptronoma clementis, Bactris cubensis, Cyrilla racemiflora, Mozartia manacalensis, maestrensis, Rondeletia calophylla, Callophyllum antillanum* ssp. *rivulare, Chimarrhis cubensis, Phaius tankervilliae, Eugenia laeteviridis, E. maestrensis,* etc.

Associations studied:

Calyptronomo clementis-Cyrilletum racemiflorae Borhidi

24 Class: **RONDELETIO-GESNERIETEA**
Borhidi and Muñiz in Borhidi et al. (1979) in Borhidi and Capote 1984

Riverside evergreen scrub and suffrutescent vegetation, growing on the stony stream-deposits along the montane rivers of the mountain ranges in the Antilles.

Characteristic species and genera: *Rondeletia* spp., *Gesneria humilis* and other spp., *Exostema longiflorum* and other spp., *Buxus spp., Eugenia* spp., *Calyptranthes* spp., *Plinia* spp., *Aster* spp., *Ginoria americana* and spp., *Pilea* spp., *Heptanthus* spp., *Sapphoa rigidifolia, Phyllanthus* spp., *Erigeron bellioides* and other spp., *Chaptalia* spp., etc.

24.1 Order: RONDELETIO-GINORIETALIA
Borhidi in Borhidi et al. (1979) in Borhidi Capote 1984

Riverside off-serpentine evergreen scrubs and suffrutescent vegetation.

24.1.1 Alliance: ***Rondeletio microphyllae-Ginorion***
Borhidi and Capote in Borhidi et al. (1979) in Borhidi and Capote 1984

Riverside evergreen scrubs and suffrutescent vegetation in Central and West Cuba.

Characteristic species: *Rondeletia microphylla, R. peduncularis, R. pedicellaris, R. leonis, Ginoria americana, G. ginorioides, Exostema longiflorum* (Fig. 374), *Jussiaea decurrens, Aster burgessii, Cuphea lobelioides, Eugenia oligantha, Erigeron thrincioides, E. paucilobus, E. capillipes, Oldenlandia capillipes,* etc.

Fig. 373 "Manacal", the montane riverside palm gallery forest of the Moa range with *Calyptronoma clementis* ssp. *orientensis* Borhidi et Muñiz in the valley of the Anacleto river, Jaguani Reserve (Photo: A. Borhidi)

Fig. 374 Exostema longiflorum (Lamb.) R. and S. a characteristic subshrub of the riverside scrubs in Cuba (Photo: A. Borhidi)

Associations studied:

Rondeletio microphyllae-Gesnerietum humilis Borhidi in Borhidi and Capote 1984

This is a suffrutescent low plant community on the different (limestone, slate, sandstone) rocks continuously irrigated or flooded by the river stream and formed by creeping or decumbent dwarf shrubs in West Cuba. The association is poor in species, as illustrated in Table 141. The type relevé is no. 1, made in the Rio Mantua, (Pinar del Rio Province) in December, 1975, by Borhidi and Capote.

Eugenio-Cuphaeetum lobelioidis Borhidi in Borhidi and Capote, 1984

Suffrutescent riverside community mainly on limestone rocks, in the Sierra de los Organos. Five representative relévés made by Borhidi in 1975—1976, near Sumidero and Guane. Type relevé no. 3 (Table 142), at the Resolladero of the Guyaguateje river.

Exostemo-Ginorietum americanae Borhidi and Capote 1984

This is an evergreen riverside scrub association with two layers growing on limestone rocks of the Sierra del Rosario (Fig. 375) and perhaps in other limestone

Table 141 Rondeletio microphyllae-Gesnerietum Borhidi in Borhidi Capote 1984

	1	2	3	4	5
Cover %	50	55	60	45	40
Rondeletiamicrophylla Griseb.	2.3	2.3	2.2	2.2	1.2
Gesneria humilis L.	2.3	3.3	3.4	2.3	3.3
Erigeron thrincioides Griseb.	+.1	+.1	1.1	–	–
Oldenlandia capillipes Griseb.	+.1	–	–	+.2	–

Table 142 Eugenio-Cupheetum lobelioidis Borhidi in Borhidi and Capote 1984

	1	2	3	4	5
Cover %	40	45	50	35	45
Eugenia oligandra Urb.	1.3	2.3	2.3	+.2	2.3
Cuphea lobelioides Griseb.	2.3	2.2	2.3	2.2	2.2
Sauvagesia brownei Planch.	+.2	1.2	1.2	–	–
Pilea microphylla (L.) Liebm.	+.2	1.2	+.2	+.2	1.2
Pilea pubescens Liebm.	–	–	+.1	–	–
Anemia wrightii Baker	–	+.1	–	–	+.1
Erigeron hyoseroides Griseb.	–	–	+.1	–	–

mountains as well. Five representative relevés were made by Borhidi and Capote in different river valleys of the Sierra del Rosario near Soroa, San Diego de los Baños and Rangel in 1975 and 1976. Type relevé no. 1, (Table 143) was made in the valley of Rio San Diego in November, 1975.

24.2 Order: RONDELETIO-PURDIAEETALIA
Borhidi in Borhidi et al. (1979) in Borhidi and Capote 1984

Riverside scrub vegetation on humid serpentine rocks of the mountains of Oriente (East Cuba).

Characteristic species: *Rondeletia pachyphylla, R. alaternoides* s.l. *Purdiaea* spp., *Leucocroton* spp., *Heptanthus* spp., *Pilea* spp., *Mozartia* spp., *Myrcia* spp., *Calyptranthes* spp., *Gundlachia* spp., *Schmidtottia* spp., *Chaptalia* spp., etc.

24.2.1 Alliance: ***Purdiaeo-Rondeletion pachyphyllae***
Borhidi in Borhidi et al. (1979) in Borhidi and Capote 1984

Riverside sclerophyllous evergreen scrub vegetation in the serpentine mountains of the northern part of Oriente, represented by a number of different communities composed of vicarious species of the same genera.

Fig. 375 Riverside evergreen scrub (*Exostemo-Ginorietum americanae* association) in the valley of Rio Los Palacios, Sierra del Rosario (Photo: A. Borhidi)

Table 143 Exostemo-Ginorietum americanae Borhidi and Capote 1984

	1	2	3	4	5
Shrub layer 1 m high cover %	50	60	60	55	45
Ginoria americana Jacq.	3.4	4.4	4.5	3.4	3.3
Mithranthes ottonis Berg	+.1	1.1	+.1	1.2	1.2
Exostema longiflorum (Lamb) R. and S.	1.2	1.1	—	1.2	+.2
Herb layer 30 cm high cover %	70	65	70	80	95
Rondeletia microphylla Griseb.	2.3	2.2	2.3	3.3	3.3
Gesneria humilis L.	3.3	2.3	2.3	3.4	4.4
Jussiaea decurrens (Walt.) DC.	+.1	—	—	+.1	—
Aster burgessii Britt.	—	—	+.2	—	+.1

Fig. 376 Pinguicula lingnicola Barnh. a peculiar epiphytic carnivorous plant of the montane rainforest of the Moa and Iberia ranges (Photo: A. Borhidi)

Characteristic species: *R. pachyphylla, R. shaferi, R. alaternoides, R. vacciniifolia, Calyptranthes monocarpa, C. moaensis, C. toaensis, C. pseudomoaensis, Leucocroton stenophyllus, L. acunae, L. obovatus, Purdiaea shaferi, P. ekmanii, P. moaënsis, P. velutina, Acrosynanthus revolutus, Oldenlandia polyphylla, Schmidtottia cubensis, S. monantha, S. uliginosa, Buxus foliosa, Exostema stenophyllum, Heptanthus cordifolius, H. shaferi, Chaptalia nipensis, C. shaferi, Phyllanthus chamaecristoides,* the epiphytic carnivorous *Pinguicula lignicola* (Fig. 376)

Fig. 377 Riverside evergreen scrub (*Leucocrotoni-Rondeletietum pachyphyllae* association) on the serpentine of the Nipe Mountains, at the Guayabo River (Photo: A. Borhidi)

Associations studied:

Exostemo-Leucocrotonetum stenophylli Borhidi in Borhidi and Capote 1984

This is the riverside serpentine scrub-community of the Sierra de Nipe (Fig. 377), formed by a dense shrub and a low dispersed herb layer, many lianes and few epiphytes. Five representative relevés were made by Borhidi in February, 1976 in the valleys of Rio Guaro, Rio Sojo, and Rio Piloto, in the Sierra de Nipe. The type relevé: no. 1, Table 144 made in the Rio Guaro above the waterfall.

Buxo foliosae-Acrosynanthetum revoluti
Borhidi and Muñiz in Borhidi and Capote 1984

This is the riverside serpentine scrub community in the montane rivers of the Moa range. The structure of the community is similar to that of the former association, but the lianes are poorly represented. The high participation of endemics is an outstanding feature. Five relevés were made by Borhidi and Muñiz in March, 1970 in the valley of the Rio Iberia about 550—600 m a.s.l. The type relevé is no. 1, (Table 145).

Table 144 Exostemo-Leucocrotonetum stenophylli Borhidi in Borhidi and Capote 1984

	1	2	3	4	5
Shrub layer: height: 1—2 m; cover %:	60	50	65	70	55
Leucocroton stenophyllus Urb.	2.3	2.2	2.3	3.3	2.2
Rondeletia pachyphylla Krug et Urb.	2.2	2.2	2.2	1.1	+.1
Calyptranthes monocarpa Urb.	—	—	—	+.2	+.1
Schmidtottia cubensis (Standl.) Urb.	—	—	—	1.1	1.1
Scolosanthus reticulatus Borhidi	+.1	1.1	—	—	—
Psychotria linearifolia Urb.	—	—	+.1	—	—
Brya hirsuta Borhidi	—	—	—	1.1	+.1
Calycogonium rosmarinifolium Griseb.	1.1	+.1	+.1	+.1	—
Ateramnus recurvus (Urb.) Rothm.	+.1	+.1	—	1.2	+.1
Gundlachia apiculata Britt. et Blake	—	+.2	—	—	—
Purdiaea nipensis M. Vict.	+.1	+.1	+.1	—	+.1
Clidemia rubrinervis Cogn.	+.1	—	—	+.1	—
Cassia shaferi Britt. et Wils.	—	+.1	—	—	—
Hypericum fasciculatum Lam.	+.2	1.2	1.2	—	+.2
Phyllanthus shaferi Urb.	+.2	—	+.1	+.1	—
Herb layer: height: 5—40 cm; cover %:	20	25	15	15	25
Exostema stenophyllum Britt.	1.1	1.2	+.2	+.2	1.1
Spaniopappus shaferi (Robins.) King et Robins.	+.1	+.r	—	—	—
Heptanthus cordifolius Britt. et Wils.	+.2	+.2	+.2	—	—
Chaptalianipensis Urb.	+.r	+.1	—	+.1	+.r
Salvia cubensis Britt.	—	+.1	—	+.1	+.1
Paepalanthus rivularis Griseb.	1.2	2.2	1.2	1.2	2.2
Lianes:					
Platygyne triandra Borhidi	+.1	+.1	+.1	—	—
Serjania nipensis Urb.	—	—	+.1	+.1	+.1
Harnackia bisecta Urb.	—	—	—	+.1	+.r
Rajania linearis Howard	—	+.1	+.r	—	—
Epiphytes:					
Oncidium ghibertianum A. Rich.	—	—	—	+.1	—

24.2.2 Alliance: ***Gundlachio-Bryon subinermis***
Borhidi in Borhidi et al. 1979

Riverside scrubs pioneering on the sandbanks deposited by the lower sections the mountain rivers in Oriente.

Characteristic species: *Gundlachia lindeniana, G. cubana, G. apiculata, Brya subinermis, B. chrysogonii, Tabebuia rivularis, Ginoria montana, G. arborea,* etc.

Associations studied:

Gundlachio-Bryetum subinermis Borhidi and Muñiz in Borhidi et al. 1979

Table 145 Buxo foliosae-Acrosynanthetum revoluti Borhidi and Muñiz in Borhidi and Capote 1984

	1	2	3	4	5
Shrub layer: 1–2 m high; cover %	60	70	75	80	70
Buxus foliosa (Britt.) Urb.	2.3	3.3	3.4	2.3	1.2
Acrosynanthus revolutus Urb.	3.3	2.2	2.2	3.4	2.3
Rondeletia pachyphylla Kr. et Urb.	1.2	1.2	1.2	2.2	2.3
Calyptranthes pseudomoaensis Borhidi et Muñiz	–	+.2	+.2	–	–
Schmidtottia monantha Urb.	+.1	–	–	+.1	–
Purdiaea velutina Britt. et Wils.	1.1	1.2	–	1.1	1.2
P. moaensis M. Vict.	+.2	+.1	1.2	+.1	+.2
Moacroton ekmanii (Urb.) Croiz.	–	–	+.1	+.r	–
Psychotria moaensis Britt. et Wils.	+.1	+.1	–	–	+.1
Ateramnus recurvus (Urb.) Rothm.	+.1	+.2	+.2	1.2	+.1
Miconia moaensis Alain	+.1	–	–	+.1	–
Ossaea baracoensis Borhidi et Muñiz	–	–	+.1	–	+.1
Hypericum fasciculatum Lam.	+.1	+.2	1.2	1.2	1.2
Scolosanthus lucidus Britt.	+.2	+.2	–	–	+.2
Croton monogynus Urb.	+.1	–	–	–	+.r
Rondeletia vacciniifolia Urb.	–	–	–	1.2	+.r
Pithecellobium nipense Britt. et Wils.	–	–	1.1	–	–
Garcinia polyneura (Urb.) Borhidi	–	+.1	+.2	–	–
Herb layer: height: 5–40 cm; cover %	30	35	20	15	40
Paepalanthus rivularis Griseb.	2.3	2.3	2.2	1.2	2.3
Heptanthus shaferi Britt.	+.2	+.1	–	+.1	–
Chaptalia shaferi Britt.	+.1	+.r	+.r	+.r	+.1
Oldenlandia polyphylla Urb.	–	+.1	–	+.1	–
Mniochloa pulchella (Griseb.) Chase	–	–	–	+.2	–
Pilea fruticulosa Morton	+.2	–	+.1	+.2	2.2
Phyllanthus erythrinus Muell. Arg.	1.1	–	–	–	1.2
Lianes:					
Mikania alba Taylor	–	+.1	+.1	–	–
Epiphytes:					
Octadesmia oligophylla Schltr.	–	–	+.1	–	–
Pinguicula lignicola Barnh.	–	+.r	–	–	–

25 Class: **WEINMANNIO-CYRILLETEA** Knapp 1964

Cloud and mossy forests of the high mountain belts of the Antilles. They are rich in epiphytic micro-orchids, tree ferns and epiphytic and filmy ferns (e.g., *Polypodium, Microlepis, Grammitis, Hymenophyllum, Feea, Trichomanes, Elaphoglossum* species), in lycopodiaceas, in terrestrial, ramicolous and epiphyllous mosses and liverworts.

Characteristic species in Cuba: *Weinmannia pinnata, Cyrilla nipensis, Persea similis, P. anomala, Ocotea ekmanii, Cyathea arborea, C. balanocarpa, C. insignis, Nephelea pubescens, Dennstaedtia* spp., *Marattia alata, Gleichenia* spp., *Torralbasia lenticellata, Ternstroemia monticola, T. leonis,* ericaceas and melastomataceas, etc.

25.1 Order: WEINMANNIO-CYRILLETALIA Knapp 1964

With the same characteristics as the class.

25.1.1 Alliance: ***Cyrillo-Myrsinion*** Borhidi and Muñiz in Borhidi et al. 1979

Cloud forests of the Greater Antilles, in Cuba mainly occurring in the Sierra Maestra range between 1600 and 1900 m a.s.l. and by inversion also in the Gran Piedra and in the Loma del Gato in 1100—1200 m a.s.l.

Characteristic species: *Myrsine microphylla, Nectandra reticularis, Sapium maestrense, Ditta maestrensis, Torralbasia lenticellata, Garrya fadyenii, Hedyosmum cubense, H. nutans, Henriettea ekmanii, Tetrazygia elegans, Ternstroemia leonis, T. monticola, Miconia turquinensis, Ossaea maestrensis, Scolosanthus maestrensis,*

Fig. 378 Lepanthes ekmanii, one of the tiniest orchids of the Cuban flora, in the elfin forest of Pico Turquino (Photo: A. Borhidi)

Lepanthes spp. (Fig. 378), *Pleurothallis* spp., *Microlepanthes* spp., *Stelis* spp., and mosses, such as *Phyllogonium fulgens, Meteriopsis patula, Mettenothamnium reptans, Macromitrium* spp.,, *Hypnum polypterum, Pilotrichella flexilis, Rhizogonium spiniforme, Drepanolejeunea* spp., *Cololejeunea* spp., etc.

Associations studied:

Myrsino-Nectandretum reticularis Borhidi and Muñiz in Borhidi et al. 1974

This zonal cloud forest or elfin forest association of the highest level of the Sierra Maestra range, developed especially in the Turquino group between 1600 and 1900 m a.s.l. The characteristic species are the same as those of the alliance. The association is composed of a unique canopy level in which tree-ferns and microphyllous small evergreen trees are combined. The shrub layer is abundant and densely covered by mosses and hepatics even on the leaf-surfaces. Five representative relevés were made by Borhidi and Muñiz in the Turquino group in December 1969. The synthetic list of these relevés is column no. 22 in the Table 25 (Appendix).

26 Class: **MYRICO-BACCHARIDETEA** Knapp 1964

Subalpine, humid, microphyllous evergreen scrubs, thickets or elfin thickets between the zones of the cloud forests and paramos.

Characteristic genera: *Myrica, Baccharis, Lyonia, Vaccinium, Ilex,* etc.

26.1 Order: MYRICO-LYONIETALIA Knapp 1964 emend, Borhidi in Borhidi et al. 1979 et hoc loco

Microphyllous subalpine thickets or elfin thickets of the Greater Antilles.

26.1.1 Alliance: ***Ilici-Myricion*** Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Elfin scrubs and thickets on the steep rocky slopes and cliffs in the elfin forest belt (in Cuba exclusively in the Turquino group, between 1800 and 2000 m a.s.l.).

Characteristic species: *Ilex turquinensis, I. nunezii, I. nannophylla, Lyonia calycosa, L. turquini, Peratanthe cubensis, Myrica cacuminis, Lobelia cacuminis, Micromeria bucheri, Salvia speirematoides, Rubus turquinensis, Vernonia praestans* var. *cacuminis, Agave pendentata, Juniperus saxicola, Ternstroemia monticola, Mitracarpus acunae, Eupatorium turquinense, Pleurothallis* spp. *Microlepanthes* spp.

Fig. 379 The *Ilici-Myricetum cacuminis* elfin thicket community on the southern slope of Pico Turquino at 1950 m altitude. (Photo: A. Borhidi)

Associations studied:

Ilici turquinensi-Myricetum cacuminis Borhidi and Muñiz ass. nova

The elfin thicket association (Fig. 379) of the highest part of the Sierra Maestra. It is formed by a 2—3 m high, extremely dense shrub layer formed by microsclerophyllous evergreen bushes and small trees. The herb layer is scarcely developed and is sometimes formed by suffrutescent plants *(Ascyrum, Hypericum)* and by rosulate hemicryptophytes such as *Chaptalia turquinensis.*

Agavo pendentatae-Mitracarpetum acunae Borhidi and Muñiz ass. nova

Low elfin thicket association developing as a completely closed carpet on the steep, rocky, intensively insolated and rather dry southern slopes of the Turquino group, in the elfin forest belt. From the low shrub layer emerge the individuals of *Agave pendentata* (endemic of the Turquino Peak) and the shrubs, dwarf shrubs *(Mitracarpus acunae)* and creeping hemicryptophytes *(Peratanthe cubensis)* — all endemics are often densely interwined by the montane bamboo-like climber, *Chusquea abietifolia.* A combined synthetic list of the five relevés reperesenting the two associations of the alliance is found in Table 25. column no. 23. The relevés were made by Borhidi and Muñiz on the southern slopes and high ridge of the Pico Real—principal peak of Turquino group at about 1900—1990 m a.s.l.

Fig. 380 Siphocampylus glaber McVaugh, an endemic sub-shrub of the evergreen montane serpentine scrub of the Nipe Mountain (Photo: A. Borhidi)

27 Class: **CLUSIO-ILICETEA**
Borhidi and Muñiz in Borhidi et al. 1979

Semi-dry montane and elfin forests and thickets on serpentine rocks, replacing the cloud forests and elfin thickets of the non serpentine mountains in the serpentine ranges of the Greater Antilles, first of all in north-eastern Cuba. This vegetation type is formed by micro-sclerophyllous shrubs and small trees, with an extremely reduced participation or complete absence of tree-ferns, epiphytes, mosses and epiphyllous liverworts.

Characteristic genera: *Clusia, Ilex, Laplacea, Acrosynanthus, Calyptranthes, Buxus, Schmidtottia, Dasytropis, Phidiasia, Calycogonium, Pachyanthus, Ossaea, Miconia, Coccoloba, Feddea,* etc.

27.1 Order: CLUSIO-ILICETALIA
Borhidi and Muñiz in Borhidi et al. 1979

Semi-dry montane and elfin forests and thickets on serpentine rocks with an extremely high participation of endemic elements.

Characteristic species: *Clusia nipensis, C. monocarpa, C. callosa, C. alainii, C. moaënsis, Ilex moaënsis, I. shaferi, I. berteroi, I. hypaneura, I. subavenia,*

Schmidtottia sessiliflora, S. monticola, Laplacea moaënsis, L. benitoënsis, L. cristalensis, Acrosynanthus trachyophyllus, Phialanthus macrostemon, P. glaberrimus, Purdiaea microphylla, Siphocampylus glaber (Fig. 380), *Vaccinium shaferi, Myrica shaferi, Shaferocharis cubensis, Buxus crassifolia, B. retusa, B. historica, B. shaferi, Coccoloba nervosa, C. oligantha, Shafera cubensis, Feddea cubensis, Euphorbia munizii, Leucocroton moaënsis,* etc.

27.1.1 Alliance: ***Ilici-Laplaceion moaënsis***
Borhidi and Muñiz in Borhidi et al. 1979

Montane semidry sclerophyllous evergreen elfin forests and thickets in the serpentine highlands and mountains in the Sierra del Cristal, Cuchillas de Moa, Toa and Baracoa between 650—1300 m a.s.l.

Associations studied:

Ilici-Laplaceetum benitoensis Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Semi-dry evergreen sclerophyllous low forest (elfin forest type) on the deeper latosols of the serpentine plateaus of Sierra de Iberia and Cupeyal.

Clusio-Ilicetum shaferi Borhidi and Muñiz in Borhidi et al. 1979 et hoc loco

Dry evergreen sclerophyllous elfin forests on the high serpentine ridges of shallow, rocky soils in the serpentine mountains of the Sierra de Moa, Cuchillas de Toa, Sierra de Iberia, etc.

A combined synthetic list of five relevés representing the two above associations, made by Borhidi and Muñiz, in March, 1970 can be found in Table 25 column no. 16 (Appendix).

According to Balátová-Tulácková and Garcia 1987, the list of the studied anthropic weed vegetation is the following:

Class: **PARTHENIO–DICHANTHIETEA ANNULATI** Bal.-Tul. 1987
- Order: PARTHENIO–BIDENTETALIA PILOSAE Samek in Bal.-Tul. and Garcia 1987
  - Alliance: ***Parthenio–Bidention pilosae*** Samek 1971
    - Ass.: **Amarantho siponosi–Parthenietum hysterophori** Samek 1971
- Order: DICHANTHIETALIA ANNULATI Bal.-Tul. 1987
  - Alliance: ***Dichanthion annulati*** Bal.-Tul. 1987
    - Ass.: **Hyparrhenietum rufae** Bal.-Tul. 1987
      - **Centrosemo–Panicetum maximi** Bal.-Tul. and Garcia 1987
      - **Chamaesyci–Cynodontetum dactylonis** Bal.-Tul. 1987
      - **Sporoboletum indici** Bal.-Tul. 1987
      - **Axonopetum compressi** Bal.-Tul. 1987
      - **Brachiario–Dactyloctenietum aegyptii** Bal.-Tul. 1987
- Order: HYPTIDI–PASPALETALIA CONJUGATI Bal.-Tul. 1987
  - Alliance: ***Hyptido–Paspalion conjugati*** Bal.-Tul. 1987
    - Ass.: **Hyptido–Paspaletum conjugati** Bal.-Tul. and Urquiola 1987

Table 25 Synthetic phytosociologic table of Cuban woody communities
For the columns see pages 198—199

Abbreviations for life form types

A Giant trees (taller than 30 m), megaphanerophyte
B Tall trees (between 15—30 m), mesophanerophyte
C Small trees (between 5—15 m), mesophanerophyte
D Dwarf trees and tall shrubs (2—5 m) microphanerophyte
E Shrubs (0.5—2 m) nanophanerophyte
G Tall palms and rosulate trees (8—30 m), rosulate mesophanerophyte
H Small and dwarf palms and rosulate trees, rosulate microphanerophyte
I Woody epiphytes, phanerophytic epiphyte
J Woody lianes
K Trunk succulents, phanerophytic succulent
M Tree-sized herbs
N Tree-ferns
O Herbaceous perennials, hemicryptophyte
P Geophytes
Q Helo-hydatophytes
R Annuals, therophyte
T Herbaceous lianes
U Herbaceous, shade-tolerant and hygrophylous epiphytes
X Herbaceous drought-resistant epiphytes
V Subshrubs, chamaephyte
Y Dwarf or leaf-succulents, chamaephytic succulents

/2 macrophyllous plant
/3 mesophyllous plant
/4 notophyllous plant
/5 microphyllous plant
/6 nanophyllous plant
/7 leptophyllous plant
/8 aphyllous plant
! spinose and/or thorny plant

Note: the symbols are used in combinations,
e.g., A/2 macrophyll megaphanerophyte,
E/7! spinose leptophyll shrub

Abbreviations for phytogeographic elements

a/ local endemics

a/1 endemics of Isle of Pines
a/2 endemics of the pine belt of Pinar del Rio
a/3 endemics of Cajalbana

a/4 endemics of the Sierra de Nipe
a/5 endemics of the Moa-Toa-Baracoa ranges
a/6 endemics of the Turquino Peak
a/7 endemics of the Sierra de Escambray
a/8 endemics of the limestone karsts of the Sierra Maestra
a/9 endemics of the Sierra de los Organos
a/10 endemics of the provinces Havanna and Matanzas
a/11 endemics of Las Villas province
a/12 endemics of Camagüey province
a/13 endemics of the serpentines of Holguin
a/14 endemics of the south-eastern dry coastal belt of Oriente

b/ regional endemics

b/1 endemics of the Isle of Pines and Pinar del Rio
b/2 endemics of the Nipe-Baracoa serpentine zone
b/3 endemics of the montane belts of Oriente
b/4 endemics of Central Cuba

c/ endemics of wider distribution

d: endemics of West Cuba
e: endemics of East Cuba
f: pan-Cuban endemics

d/ phytogeographical elements of the Caribbean

g: elements of the Greater Antilles
h: elements of the Antilles
i: elements of the Antilles and Bahamas
j: elements of the Bahamas and Cuba
k: elements of Cuba–Florida and SE-USA
l: North Caribbean elements
m: South Caribbean elements
n: pan-Caribbean elements

e/ tropical elements of wider distribution

o: elements of the Antilles and South America
p: Neotropical elements (Antilles+Central America+South America)
r: Pantropical elements

f/ other elements

s: American and extratropical elements
u: Cosmopolitan elements
v: Neotropical adventives
x: Paleotropical adventives