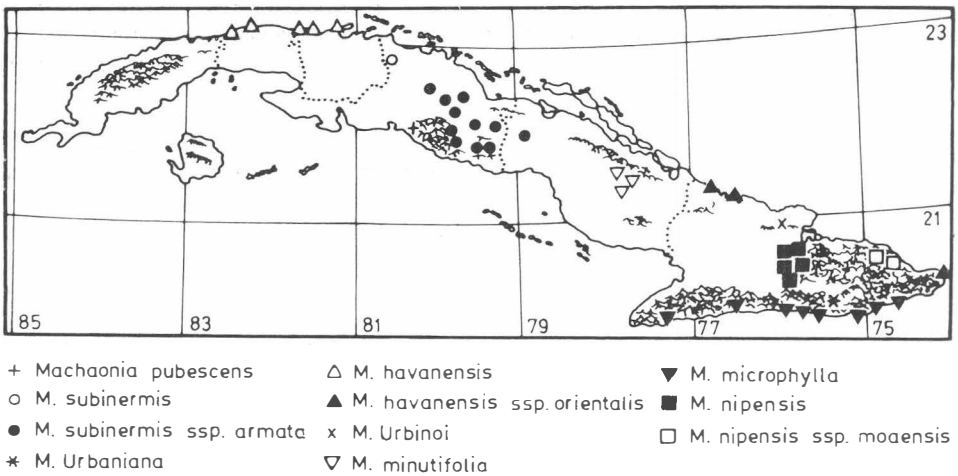


*Fig. 38.* Geographical distribution of some central and East-Cuban species of the genus *Machaonia* (after FERNANDEZ et BORHIDI 1984)

*dota*, *Cissus torreana*, *Eugenia camarioca*, *Rondeletia camarioca*, *Machaonia subinermis* s. l. (Fig. 38), *Plumeria cubensis*, *P. keyensis*, *Mesechites minima*, *Scolosanthus crucifer*, *Hyptis armillata*, and *Pectis cubensis*, etc. Recently, more than 75% of this area is a managed or cultivated land. Its original vegetation may be reconstructed only from relict of some fragmental stands. The native vegetation survived in the mountains, on the coast, keys and the less fertile serpentine areas.

## *Sector B.1.: Western central Cuba (Havanicum)* (Fig. 37)

This area ranges from Bahia Honda and Artemisa to Cardenas, Cienfuegos and, on the southern coast, as far as Casilda. Coastal zones with rich flora, mountainous and hilly regions of varied bedrocks and diverse plant communities and flatland with monotonous vegetation are included. The plains have been cultivated for centuries. In addition to the few local endemic species, endemic genera [e.g., *Amphiolanthus*, *Acunaeanthus*, *Phania* (Fig. 25)] and species [*Eriochloa setosa*, *Coccothrinax littoralis* (Fig. 34)], *Zephyranthes rosea*, *Crinum oliganthum*, *Bombacopsis cubensis*, *Coccoloba pallida*, *Harpalyce cubensis*, *Phyllanthus discolor*, *Hyeronima havanensis*, *Callitriche occidentalis*, *Comocladia mollifolia*, *Terminalia intermedia*, *Eugenia farameoides*, *Rauvolfia cubana*, *Cordia angiocarpa*, *Brunfelsia nitida*, *Rhytodophyllum wrightianum*, *Oplonia nannophylla* (Fig. 39), *Machaonia havanensis* (Fig. 38), etc. in common with western Cuba are characteristic.

### District B.1.1.: Limestone and serpentine areas between Bahia-Honda and Limonar (Jarucoënse)

The Las Pozas-Cabañas hilly range at the northern edge of Sierra del Rosario, and Sierra de Anafe, the Habana-Matanzas hills and, south of and parallel to it, the Bejucal-Madruga-Limonar range are included.

**a. Geography:** This area, being divided into several smaller hilly ranges by valleys, has a varied geological structure. The mosaic-like intermingling of limestone and serpentine rocks is typical. As a consequence, the soil conditions are also diversified. On the Cretaceous limestone (Habana-Matanzas heights) tropical brown soils predominate, often in form of their very shallow, rocky variant. On the Jurassic limestone of Anafe Mountains and the Jaruco karst calcareous soils have developed. Red latosolic, nutrient poor soils cover the serpentine outcrops. On the Tertiary, mainly Oligocene, limestone of the Bejucal–Madruga–Coliseo range calcareous, ferralitic soils of good quality predominate.

**b. Climate:** Seasonal, dry in the winter. 3–4 dry months and 1400–1600 mm annual precipitation in the western part of the district, 1–2 dry months and an average precipitation up to 1100–2300 mm to the south-southeast of Havana, and 5–6 dry months and 1400–1800 mm annual precipitation east of Jaruco.

**c. Flora:** Due to the mosaic-like geological and soil structure the number of common endemic is lower than that of the local endemics. For instance, four local endemics occur in the Sierra de Anafe (e.g., *Eugenia anafensis* and *Guapira leonis*). Two vicarious subspecies of *Tabebuia anafensis* occur in the whole limestone range, like *Rhytidophyllum exsertum*. Endemic species of the serpentine of Campo Florido are *Pectis havanensis* and *Psidium havanense*. The richest in endemics is the Canasi serpentine area: *Melocactus matanzanus*, *Coccothrinax miraguana* ssp. *roseocarpa* (Fig. 34). *Myrtus matanzasia*, *Moacroton revolutus* (Fig. 12), *Buxus gonoclada*, *Reynosia microphylla*, *Bucida ophiticola*, *Borreria matanzasia* occur here. Some of them are also found on the serpentine of Camarioca. There are a number of species in common either with Cajalbana (*Anemia cajalbanica*, Fig. 11, *Ottoschmidtia dorsiventralis*, *Harpalyce cubensis*) or with the serpentine areas of Las Villas (*Acacia daemon*, *Buxus flaviramea*).

**d. Vegetation:** Dominant types are semi-deciduous forests in the northern and middle part of the district and dry evergreen forests in the Sierra de Anafe. The species poor variant of the karstic forests of the Sierra de los Organos predominates on the Jaruco mogotes and other karstic hills, with *Thrinax morrisii* as dominant species. The foothills and the valleys are covered by fragments and derived savannas of seasonal evergreen forests. Dry evergreen forests grow on the serpentine areas, whereas at Canasi evergreen shrubwoods with dwarf palms are found.

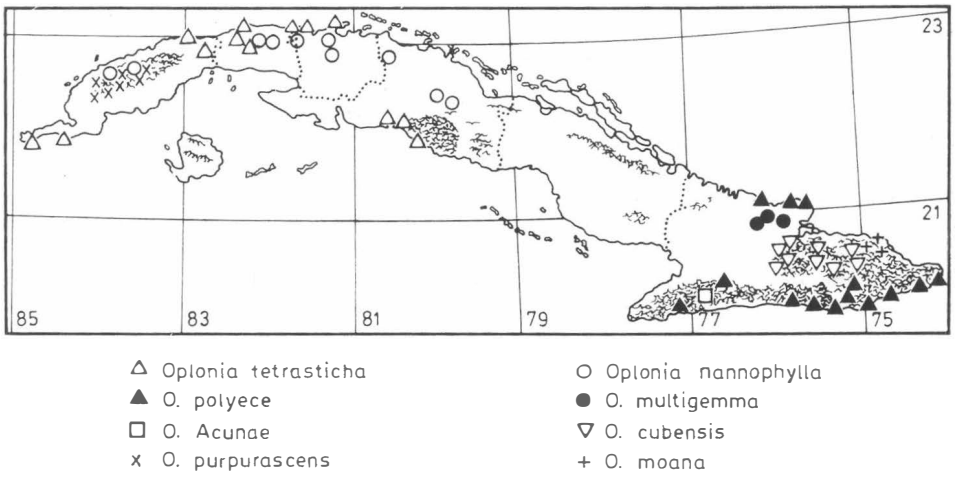


*Fig. 39.* Geographical distribution of some species of the genus *Oplonia* (Acanthaceae) (after Borhidi et Muñiz 1979)

## District B.1.2.: Seashore of the Bahia Honda-Hicacos zone (Havanense)

**a. Geography:** The coast ranging from Bahia-Honda to Varadero consists mainly of Pliocene limestone which is seldom broken by muddy or sandy beaches. Flat karsts and cliffs (Seboruco) are most usual but rocky hills may also be seen. Mainly shallow, rocky, humic-carbonated soils cover the area.
**b. Climate:** Seasonal with dry winter, the annual precipitation is 1000–1400 mm with a distribution similar to that in the preceding district. The dry season gets longer eastward, reaching a duration up to 5–6 months.
**c. Flora:** The area abounds in drought-tolerant endemic species. *Coccothrinax borhidiana* (Fig. 34), *Piper cojimaranum*, *Gochnatia sagraeana*, *Croton litoralis* ssp. *rugelianus*, *Pilosocereus robinii*, *Leptocereus wrightii*, *Eugenia mollifolia*, *Rhytidophyllum crenulatum*, *Borrichia cubana*, *Rondeletia rugelii* and *Guettarda undulata* are worth mentioning.
**d. Vegetation:** Coastal thickets, dry evergreen forests and shrubwoods, fragments of semi-deciduous forests on the slopes, small stands of mangrove.

## District B.1.3.: The plain Artemisa—Colón (Güinense)

**a. Geography:** Gently rolling denudated plain. Fertile, calcareous red ferrallitic soils predominate.
**b. Climate:** Seasonal with dry winter. Usually 5–6 dry months. 1200–1800 mm annual precipitation.
**c. Flora:** Monotonous, no local endemics occur. The influence of the human impact of centuries is obvious.
**d. Vegetation:** Originally, this is the zone of seasonal evergreen and semi-deciduous forests which have been replaced by culture savannas and agricultural fields. ative vegetation occurs only in the mangrove and gallery forest belt on the seashore.

## District B.1.4.: Yaguaramas—Cascajal plain (Cascajalense)

**a. Geography:** On the border of Matanzas and the old Las Villas province is this completely flat area at an altitude of about 100 m. The soil is mocarrero having an impermeable layer close to the surface.
**b. Climate:** Seasonal with 5–6 dry months in the winter. The annual precipitation is 1200–1400 mm.
**c. Flora:** A single endemic monospecific genus (*Rhodogeron coronopifolius*) and nearly 10 endemic species (e.g., *Bucida subinermis*, *Brunfelsia clarensis*, *Eriocaulon echinospermum*, *Lachnocaulon cubense* and three *Cheilophyllum* species) characterize the flora. The eastern limit of the distribution of western "savanna" plants may be drawn here. Eastward the flora becomes completely different: on the mocarrero soil shrublands and secundary savannas with *Copernicia* palms exist.
**d. Vegetation:** Thorny shrublands and savannas with *Sabal* palms on poorly drained hardpan soils. This is one of the largest edaphic savanna area in Cuba. It may have turned to marshes several times during the Quaternary, and then dried up.

## District B.1.5.: Coastal area between Cienfuegos—Casilda (Casildense)

**a. Geography:** This zone begins at Juragua, east of Playa Giron and extends to the Casilda peninsula. Flat karsts consisting mainly of coastal coral limestone alternate occasionally with sand beaches. It is the ecological equivalent of floristic district II.1.2. on the southern coast, with shallow, humic-carbonated soils.

**b. Climate:** In the western part seasonal with dry winter of 5–6 months duration. In the east two arid seasons occur and the annual precipitation is 1000–1200 mm.
**c. Flora:** Strongly xerotherm flora containing large succulents, for example, *Dendrocereus nudiflorus*, *Leptocereus silvestris*, *Rhodocactus cubensis*, and *Pilosocereus brooksianus*. Widespread endemics are *Pavonia calcicola*, *Acalypha hutchinsoni*, *Rondeletia pedicellaris*, *Pectis ritlandi* and *Cassia clarensis*. A local endemic at Cienfuegos (*Acacia polypyrogenes*) and nearly ten further ones at Casilda (e.g., *Cordia intricata*, *Ipomoea flavopurpurea*, *Hyptis rivularis*, *Myrtus crenulata*, *Chrysophyllum clarense*, *Casearia formosa*, *Rhacoma ekmanii*, etc.).
**d. Vegetation:** Rocky and sandy coastal communities, evergreen scrubs on the flat karsts, dry evergreen forests and semideciduous forests on deeper soils.

## *Sector B.2.: The Guamuhaya Massif or Escambray (Trinidadicum)* (Fig. 37)

Isolated mountains above the southern coastal zone of central Cuba, divided into two smaller mountains: the more elevated Trinidad Mountains and the lower Sancti Spiritus and Banao Heights. A peculiarity of the flora is its double origin. The montane elements came from the mountains of Oriente, the plants of karsts are partly originated from Pinar del Rio. An endemic monospecific genus (*Euleria*) and approximately 20 regional endemics [e.g., *Miconia ancistrophora*, *M. wilsonii*, *Pachyanthus lunanus*, *Rondeletia leonis*, *R. pedicellaris*, *Tabebuia arimaoensis*, *T. glaucescens*, *Neobracea howardii* (Fig. 9), *Lunania elongata*, three *Calyptranthes* species, *Pithecellobium trinitense*, *Guettarda urbaniana* and *Gesneria clarensis* ssp. *clarensis*] characterize the area. Noted endemics in common with the mountains of Oriente are *Magnolia cubensis* s. l., *Hedyosmum grisebachii* (Fig. 7), *Coccoloba wrightii*, *Ossaea ottoschmidtii*, *Clidemia wrightii*, *C. capituliflora*, *Meliosma oppositifolia*, *Ocotea ekmanii*, etc. Also, many Caribbean — Neotropical elements of montane rainforests occur, e.g., *Ocotea cuneata*, *O. wrightii*, *Guatteria blainii*, *Oxandra laurifolia*, *Garrya fadyeni*, etc. Some elements of the limestone forest communities of western Cuba reaching eastward this sector are *Tabebuia sauvallei*, *Sapium leucogyum*, *Rhytidophyllum wrightianum*, *Karwinskia rocana*, *Rondeletia odorata*, and *Miconia cubensis*.

### District B.2.1.: Trinidad Heights (Trinidadense)

**a. Geography:** Steeply inclined mountains with the highest point at 1156 m and a central plateau at 700 m. The parental rocks are mainly limestone or crystalline slate. Extensive limestone and dolomite karsts in the central and south-eastern part, and a granodiorite zone with scattered serpentine outcrops (San Blas) in the west. Humic carbonated soils on the southern slopes, tropical brown soils on the northern sides, acidic yellowish-red soils in the montane zone.
**b. Climate:** Seasonal with dry winter of 3–4 months duration up to an altitude about 400 m. One or two dry months up to 700 m and moist rainforest climate further up. The annual precipitation is 1200–2300 mm.
**c. Flora:** In addition to the regional endemics mentioned above, a number of local endemics occur, particularly in the montane rainforests, e.g., *Calyptronoma microcarpa*, *Pilea clarana*, *P. cacuminum*, *Rhytidophyllum lomense*, *Calyptranthes lomensis*, and *Spaniopappus iodostylus*. The montane karsts of Pico Potrerillo — the contact area of montane rainforests, semideciduous forests and karstic forests — is especially rich in local endemics (*Vernonia potrerilloana*, *Rondeletia potrerilloana*, *Karwinskia potrerilloana*, *Daphnopsis alainii*, *Banara glaberrima*, *Psychotria martii*, etc.). The Hanabanilla area (*Psidium celastroides*, *Erigeron capillipes*, *Cardamine porphyrophylla*) and the karsts of Buenos Aires (*Pinguicula jackii*) (Fig. 40) may also be mentioned. On the dry southern slopes several endemics with point-like geogra-

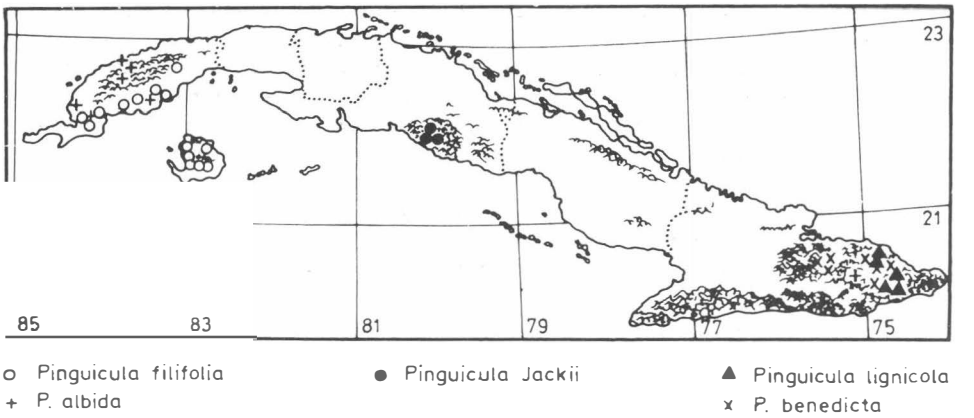


*Fig. 40.* Geographical distribution of the Cuban taxa of the genus *Pinguicula* (Lentibulariaceae) (after BISSE, LIPPOLD and CASPER 1975)

phical distribution occur, for instance, *Machaonia pubescens* (Fig. 38) and *Guettarda nervosa*.

**d. Vegetation:** Dry evergreen shrubwoods on the southern slopes up to 200 m, dry evergreen forests up to 550 m. In Pico Potrerillo occurs the semi-deciduous forest at the highest altitude in Cuba (900 m). In the interior of the mountains and on the northern slopes the seasonal evergreen forest belt occurs at an elevation as low as 400 m. At about 800 m the vegetation turns into montane rainforests. In the high parts of the valleys montane rainforests may occur downwards to 5–600 m some montane elements may descend along the watercourses even to the plains (e.g., *Calyptronoma dulcis*). In many valleys secondary forests of the introduced *Syzygium jambos* predominate.

## District B.2.2.: Sancti Spiritus Heights (Spirituense)

**a. Geography:** Mountainous area east of the Agabama river, similar to the preceding district in geology, although much less karstic formations occur. The highest point is 843 m at the Banao Peak. Humic-carbonated soils predominate.

**b. Climate:** Seasonal with dry winter; 3–4, or at the higher altitude 1–2 dry months. The annual precipitation is 1600–1800 mm.

**c. Flora:** Due to the drier climate and lower altitude the montane rainforest belt is lacking although some montane elements occur, as *Meriania leucantha* ssp. *nana*, *Torralbasia cuneifolia*. Yet, this area possesses about ten local endemics, such as *Tetrazygia aurea*, *Pachyanthus clementis*, *Rondeletia bicolor*, *R. convoluta*, *Hyperbaena acutifolia*, *Pilea clementis*, *Dorstenia rocana*, and *Psychotria banaoana*.

**d. Vegetation:** Less diverse than the vegetation of the preceding district. Semi-deciduous forests and, at a higher altitude, seasonal evergreen forests represent the dominant types.

## *Sector B.3.: Eastern central Cuba (Camagüeyicum)* (Fig. 41)

Mainly young plains formed at the end of the Tertiary and in the Quaternary. Emergent, strongly eroded Cretaceous block mountains (Cubitas, Chorrillo, Jatibonico) and denuded serpentine ridges make the geology of this area more diverse. The limestone flora is originated mainly from the southern slopes of the Baracoa Mountains via the karsts of Sierra Maestra

and Sierra de Nipe. The serpentine elements came directly from Nipe and reached the serpentine hills around Holguin. An evidence of this is the recent distribution of three endemic genera in common with Oriente (*Hemithrinax*, *Doerpfeldia* and *Henoonia*). The colonization of the plains by plants was influenced by the relatively early rise of the northern coast in central Cuba: in the north the Oriente flora migrated to the farthest whereas on the southern coasts the most intensive migration was exhibited by the western elements. This discrepancy is expressed by the well-marked recent boundary of the two sectors.

The descent of plants to the lowlands resulted in a significant change of both the serpentine flora and the xerotherm forest flora. In this regard, the secondary speciation within two young palm genera of high genetic plasticity, *Copernicia* (Figs 36, 42) and *Coccothrinax*, was particularly intensive producing several taxa of hybrid origin (*Copernicia*×*textilis*, *C.*× *sueroana*, *C.*×*verpertilionum*, *C.*×*burretiana*, *C.*×*shaferi*). In addition, *Copernicia gigas*, *C. hospita*, *C. rigida*, *C. yarey*, *C. molineti*, *C. curbeloi*, *Coccothrinax salvatoris* and *C. clarensis* may be mentioned. Typical are the endemic species in common with southern Oriente, e.g., *Doerpfeldia cubensis*, *Henoonia brittonii*, *Eriochloa ekmanii*, *Mimosa fagaracantha*, *Jatropha tupifolia*, *Sarcomphalus acutifolius*, *Croton myricifolius*, *Ravenia clementiana*, *Pictetia marginata*, *Tabebuia trachycarpa*, *Brya chrysogonii*, *Polygala guantanamana*, and *Antirhea aristata*.


*Fig. 41.* The phytogeographical subdivision of the eastern part of the Central Cuban subprovince

B.2. Sector: Guamuhaya Massif (*Trinidadicum*)
B.2.1. District: Trinidad Heights (*Trinidadense*)
B.2.2. District: Sancti Spiritus Heights (*Spirituënse*)

B.3. Sector: Eastern Central Cuba (*Camagüeyicum*)
B.3.1. District: *Claraënse*
B.3.2. District: *Camagüeyense*
B.3.3. District: *Holguinense*
B.3.4. District: *Sagüense*
B.3.5. District: *Guaimarense*
B.3.6. District: *Cautoënse*
B.3.7. District: *Gibarense*

### *Sub-sector B.3.a.: Isolated serpentine areas of Motembo — Holguin (Eu-Camagüeyicum)* (Fig. 41)

Four serpentine outcrops of different area 100–200 kilometers apart from one another. The smallest one is Motembo having an area of about 50 km², the others are of 500–800 km² area each. Despite the isolation, the flora is unexpectedly uniform. The presence of Pan-Cuban endemics and the absence of *Moacroton* and the *Anemia coriacea* aggregate (Figs 11 and 12) characterize all areas. Some exclusively local endemics also occur, e.g., *Jacaranda cowellii*, *Zanthoxylum nannophyllum*, *Myrtus anomala*, and *Coccoloba geniculata* (Fig. 22).

Numerous serpentinophilous species occur only in two neighbouring areas. For instance, common endemics of the Las Villas and Camagüey serpentines are: *Croton nephrophyllus*, *C. camagüeyensis*, *C. heteropleurus*, *Daphnopsis oblongifolia*, *Machaonia subinermis* (Fig. 38), *Gochnatia cowellii*, *Thymopsis thymoides*. The number of Camagüey—Holguin endemics is much larger, e.g., *Platygyne parvifolia* (Fig. 14), *Jacquinia shaferi*, *Stenandrium crenatum*, *Cordia grisebachii*, *Myrtus cabanasensis*, *Karwinskia orbiculata*, *Ginoria microphylla*, *Polygala ambigens*, *Notodon savannarum*, and *Coccoloba cowellii*.

### District B.3.1.: The serpentine of Santa Clara (Claraënse)

**a. Geography:** Hilly serpentine area with emergent ridges, in Sierra de Agabama up to 450 m, with gabbro and limesone outcrops. Red ferralitic soils, occasionally with pseudoglei character, and brown soils cover the first, humic carbonated soils the second. The isolated serpentine area around Motembo also belongs to this district.

**b. Climate:** Seasonal with 5–6 (or 3–4 in the north) dry months in the winter. The annual precipitation is 1100–1600 mm.

**c. Flora:** In addition to those mentioned above, about 15 local endemics occur. For example, *Eugenia clarensis*, *E. subdisticha*, *Guettarda clarensis*, *G. roigiana*, *Xylosma acunae*, *Karwinskia oblongifolia*, *Hypericum ophiticola*, *Xylosma claraense*, *Melocactus actinacanthus*, *Dorstenia lanei*, *Harpalyce macrocarpa*. To the Motembo area *Paspalum edmondi*, *P. motemboense*, *Cheilophyllum sphaerocarpum* and *Scleria motemboensis* are endemic.

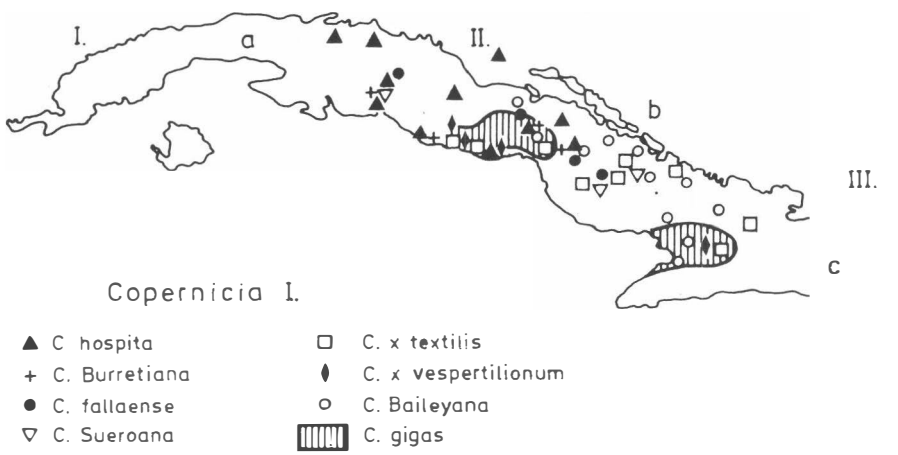


*Fig. 42.* Geographical distribution of some Central and East-Cuban taxa of the genus *Copernicia* (after DAHLGREN and GLASSMAN 1963, modified)

**d. Vegetation:** Dry evergreen thorny shrublands. Evergreen shrubwoods and forests on the brown soils. In many places forests and shrubwoods are replaced by secondary dwarf grass savannas and secondary *Brya* and *Dichrostachys* scrubs.

### District B.3.2.: The serpentine of northern Camagüey (Camagüeyense)

**a. Geography:** Low, gently rolling flatland. Different allite-ferritic soils derived from serpentine, magnesium humic-carbonate soils, in the northwest ferritic latosols. Here and there granite, porphyrite and diorite intrusions occur.
**b. Climate:** Seasonal with dry winter of 5–6 months duration and 1200–1400 mm annual precipitation.
**c. Flora:** In addition to the common serpentinophilous endemics listed above, this district has 15 local endemic species. In particular, the palms (*Copernicia cowellii*, *Coccothrinax camagüeyana*, *C. pseudorigida* (Fig. 42) are famous. Further endemics are *Reynosia camagüeyensis*, *Randia acunae*, *Waltheria ovalifolia*, *Eugenia shaferi*, *E. malanadenia* ssp. *santayana*, *Cameraria microphylla*, *Nashia variifolia*, *Cheilophyllum macranthum*, *Justicia stenophylla*, *Rondeletia insularis*, *Guettarda camagüeyensis*, and *Wedelia urbanii*.
**d. Vegetation:** The primary vegetation of this district is evergreen thorny shrubwoods with dwarf palms and shrublands with small grassy clearings. The latter type became gradually predominant due to burning and grazing. The formerly widespread view that the "serpentine savannas" are original is not supported by the comparative taxonomic-phytogeographic-phytosociologic studies of the author (see BORHIDI and HERRERA 1977, BORHIDI 1973, 1974, 1976).

### District B.3.3.: The serpentine of Holguin (Holguinense)

**a. Geography:** A diversified hilly landscape with wide ridges and inclined conical serpentine hills with isolated limestone terraces and cliffs. On the SW and NE border of the area there are red allitic-ferritic soils. Elsewhere tropical brown soils derived from serpentine predominate.
**b. Climate:** Seasonal with two dry seasons. 5–6 dry months, 800–1200 mm annual precipitation.
**c. Flora:** Rich in endemics. The flora, especially in Cerro Galano, is closely related to that of Sierra de Nipe and Sierra del Cristal with several endemics in common, for example, *Spirothecoma holguinensis*, *Piper holguinianum*, *Ateramnus revolutus*, *Moacroton lanceolatus*, *Jacquinia robusta*, *Brya hirsuta*, *Leucocroton saxicola*, *Salacia nipensis*, *Antirhea ophiticola*, *Euphorbia podocarpifolia*, *Antirhea minutifolia*, *Coccoloba nipensis*, *Guettarda shaferi*. Approximately 20 local endemics have been indicated, e.g., *Agave anomala*, *Coccothrinax garciana*, *Acacia belairioides*, *Pithecellobium savannarum*, *Caesalpinia hermeliae*, *Acidocroton trichophyllus*, *Chamaesyce filicaulis*, *Buxus heterophylla*, *Neobesseya cubensis*, *Justicia tomentulosa*, *Rondeletia savannarum*, *R. shaferi*, *Gochnatia parvifolia*, *Cassia holguinensis*, *Croton acunae*, *C. holguinensis*, *Melocactus holguinensis* (Fig. 45), *Machaonia urbinoi* (Fig. 38), *Oplonia multigemma* (Fig. 40).
**d. Vegetation:** The conical serpentine mountains, the rocky ridges and the plains were formerly covered by thorny solerophyllous evergreen shrubwoods containing dwarf palms. These have been replaced by secondary savannas with short grasses and palms. The microphyllous semideciduous forests in the valleys were cleared and then turned to agricultural lands.

### *Sub-sector B.3.b.: The lowlands, limestone hills, south-coastal zones and keys of eastern central Cuba* (*Guaimaricum*) (Fig. 41)

Mainly farmland with unvaried vegetation. The points made in B.1 and B.3 are relevant here, too. The flora is characterized by relatively few endemics, in particular, *Copernicia*

*hospita, C. gigas, C. vespertilionum, C. textilis, C. sueroana, C. baileyana* (Fig. 42) and *Hildegaardia cubensis* (reaching to the northern coasts and keys too and the xerotherm endemics in common with southern arid zone of Oriente. Its phytogeographic division is based primarily on the characteristics of lands because the phytogeographical boundaries have been obscured as a result of human impact. Many important elements of the Neotropical xerotherm flora, such as *Phyllostylon brasiliensis* and *Prosopis juliflora* have reached this sub-sector from the east.

## District B.3.4.: The hilly and flat areas and the northern coastal zone in Las Villas (Saguënse)

**a. Geography:** Diversified landscape. The coastal zone is covered by peaty and meadow soils developed on Quaternary sediments. On the Jurassic limestone of the northwestern heights and the Cretaceous limestone of the northeastern heights (including Sierra de Jatibonico) there are humic-carbonated soils. In the valleys ferralitic soils are predominant. In the lowlands and hills of the west and southwest the tropical brown soils derived from young Tertiary sediments cover extensive areas.
**b. Climate:** Seasonal bixeric with two dry season (3–4 months) on the northern coast. Elsewhere monoxeric seasonal with dry winter (5–6 months). At the northeastern heights only 3–4 dry months. Annual precipitation is 1200–1600 mm on the average.
**c. Flora:** It is characterized by the forest elements of limestone rocks, these are in fact typical of the whole country. The Caguaguas mogotes at Sagua la Grande possess a special flora, including the representatives of two rare endemic genera [*Hemithrinax ekmaniana* (Fig. 13), *Megalopanax rex*]. Endemic palms of the savannas are *Copernicia burretiana, C. textilis, C. molineti* (Fig. 42). *Caesalpinia savannarum* and *C. glaucophylla* are also endemic species of the savannas.
**d. Vegetation:** The coastal zone is lined with a broad mangrove belt. On the meadow soils moist and treeless secondary savannas predominate taking the place of the former woodlands. In the hills some fragments of semi-deciduous forests represent the natural climax vegetation. Most part of this area is agricultural land, all the tropical brown and red ferrallitic soils are utilized for agricultural purposes. On the mocarrero soils in the southeast semiculture savannas with *Copernicia* palms occur, probably in the place of microphyllous semideciduous forests.

## District B.3.5.: The Ciego de Avila—Alto Cedro—La Maya plains (Guaimarense)

The central and southern parts of Camagüey and the western lowlands in Oriente, except the northern coastal zone and the low Cauto Basin are included.
**a. Geography:** Mainly denuded plains with a gentle inclination towards the southern coast. Along the shore a wide swamp belt occurs. In western Camagüey, on the plain of Ciego de Avila-Morón, mainly calcareous and fertile red ferrallitic soils are found. In the Camagüey-Tunas-Holguin denuded plains in the interior of the island except the area of districts B.3.3.–B.3.4. tropical brown soils predominate. The karstic limestone mountains (Sierra de Najasa) are covered with humid-carbonated soils. In the lowlands parallel to the coast alluvial soils are the most common. Tropical brown soils with mocarrero mosaics are also found here. The only sandy area of central Cuba is located south of Victoria de las Tunas with a peculiar flora and fauna.
**b. Climate:** Seasonal tropical which is dry in the winter. 5–6 dry months occur per year. In southern Camagüey persists a more humid climate with 3–4 dry months in the winter. East of Holguin and in the northern foothills of Sierra Maestra there are two dry seasons of 5–6

months duration. The annual precipitation is 1800 mm in the west and gradually decreases eastward to a level of 800 mm/year.

**c. Flora:** Similar to that of the preceding district. Strongly affected by human impact and quite uniform. Some local endemics occurring in certain places, e.g., *Cleome tenuifolia* (Galbis), *Caesalpinia hornei* (Ciego de Avila). *Rondeletia gamboana*, *Catesbaea gamboana*, *Cleome gamboensis* and *Copernicia longiglossa* is found on the sands at Victoria de las Tunas, the latter also at Dumañuecos (!). At the edge of the Cauto valley *Ateleia parvifoliola* (Mir), *Crotalaria urbaniana* and *Bergia sessiliflora* (Bayamo), *Coccothrinax savannarum* and *C. pauciflora* (Miranda) occur.

**d. Vegetation:** The natural vegetation of the ferrallitic soils in the central Cuban denuded plains are seasonal evergreen forests, semi-deciduous forests and gallery forests along the rivers on alluvial soils and black tropical soils. In the brown soil zone of the Camagüey Tunas–Holguin plains extensive semi-deciduous forests with *Swietenia mahagoni* were found even at the turn of this century. This species is still present as a standard tree in the recent deciduous tree-savannas. On sand and mocarrero microphyllous semi-deciduous forests with *Copernicia* palms, remnants of open forests with loose canopy layer (foret claire) and their derived savannas are found. The shoreline is covered by broad mangrove vegetation. On the rocks of Sierra de Najasa the eastern versions of karstic forests occur in which *Coccothrinax* palms and cacti are typical.

## District B.3.6.: The Cauto Basin (Cautoënse)

**a. Geography:** The alluvial area and the delta of Rio Cauto are among the youngest areas on the surface of Cuba. The delta is covered by peaty soils containing brackish water. On the alluvium tropical black soils and alluvial soils are found. These tend to become alkaline soils in some places.

**b. Climate:** Seasonal with dry winter in the west. Two dry seasons in the eastern part of the area with a total of 5–6 dry months. The annual precipitation is about 700–1200 mm.

**c. Flora:** Depauperated upon human influence, monotonous, species poor. *Chamaesyce biramensis* is an endemic of the marshes in the delta area.

**d. Vegetation:** Only a few degraded stands of the extensive rainforest-like gallery forests remained. The natural vegetation is replaced by treeless marshy meadows and moist savannas. As a result of deforestation, erosion is intensive.

## District B.3.7.: Littoral terraces and islands of the northern coastal area; the Cayo Francés—Turiguanó—Cebolla zone (Gibarense)

**a. Geography:** The flat coastal area and the archipelago are composed of young Tertiary and Quaternary limestone sediments and subfossil peat layers. There are, too, some small limestone outcrops (Turiguanó, Cayo Romano). For phytogeographic reasons, the higher limestone hills and karstic mountains, Loma Cunagua, the upper Cretaceous-Eocene blocks of the Sierra de Cubitas and the limestone mountains of the Mariabón group at Gibara and Banes are also assigned to this district. Salt marshes and flat karsts covered by shallow humic-carbonated soils alternate in this area. Occasionally, smaller serpentine, gabbro and diabase outcrops increase the geological variability (Puerto Padre, Bahia de Naranjo). The hills and mountains are covered by tropical brown soils and brown carbonated soils. In the valleys of Sierra de Cubitas red ferralitic soils occur.

**b. Climate:** Seasonal bixeric climate with two dry seasons. In general, 5–6 dry months occur, 7–8 in the islands and only 3–4 in the east at Banes. The annual precipitation is 700–1100 mm on the average. The precipitation is low in the Puerto Padre–Gibara area where climate is

similar to that of South-Oriente and sometimes years of extreme drought may also occur.

**c. Flora:** Local xerotherm endemics. The close relationship to the flora of Bahamas is indicated by many species shared by the two regions, e.g., *Guapira bracei*, *Pithecellobium millspaughii*, *Eugenia lucayana*, *Cordia bahamensis*, *Auerodendron northropianum* and *Phialanthus myrtilloides*. Relatively few indigenous species are typical of the whole district, for example, *Coccothrinax salvatoris*, *Trichilia pungens*, *Sarcomphalus obovatus*. On the contrary, many local endemics are found in the islands and peninsulas e.g., *Chamaesyce paredonensis*, *Heliotropium myriophyllum* (Cayo Paredon Grande), *Selenicereus brevispinus*, *Nashia cayensis*, *Isocarpha glabrata*, *Notodon cayensis* (Cayo Guayaba), *Crescentia mirabilis* (Cayo Sabinal). *Guettarda lanuginosa* and *Argythamnia microphylla* are in common with Sierra de Cubitas and the coast. *Coccothrinax muricata* is an endemic palm species of the Cubitas and Najasa mountains. A local endemic of Sierra de Cubitas is *Guettarda munizii*. *Copernicia oxycalyx* occurs in the savannas of Manati. The Puerto Padre-Playa Herradura area is the richest in endemics, e.g., *Ximenia roigii*, *Acacia cupeyensis*, *A. curbeloi*, *A. roigii*, *Zanthoxylum curbeloi*, *Banara wilsoni*, *Tabebuia truncata*, *Xylosma roigii*, *Randia costata*, *Baccharis orientalis* ssp. *orientalis*, *Galactia rotundata* and *Casasia clusiifolia* var. *hirsuta* are endemic to Gibara and surroundings, whereas *Pictetia arborescens* is endemic to Playa Pesquero Nuevo. *Eugenia pteroclada* is an endemic species of Banes. In the very dry coastal area between Puerto Padre and Banes some elements of the southern Oriente semi-desert zone also occur, for instance, *Lemairocereus hystrix*, *Bonania microphylla*, *Amyris diatrypa*, *Samyda ramosissima*, *Cordia curbeloi*, *Eupatorium littorale*, *Thouinia pseudopunctata*, *Pseudocarpidium avicennioides*, *Oplonia polyece*, and *Doerpfeldia cubensis*.

**d. Vegetation:** Besides the extensive mangroves, the most attractive types are the dry evergreen forests and xerotherm evergreen scrubs of flat karsts. The former gallery forests grown on alluvial soils have been replaced by secondary savannas. The natural vegetation on brown soils is the semi-deciduous forest as seen in Loma Cunagua and the valleys of Sierra de Cubitas. The eastern Cuban karstic mogotes with *Coccothrinax* palms have been even less intensively studied.

## SUB-PROVINCE C: EASTERN CUBA (ORIENTO-CUBANICUM) (Fig. 43)

This phytogeographic unit includes two big massifs in Oriente, the Sierra Maestra and the Nipe-Baracoa range, the basin in between and the adjacent coastal lowlands. This area is considered to be the cradle of the Cuban flora and, together with western Hispaniola, the most prominent centre of speciation in the Antilles. In addition to the 13 Pan-Cuban and 5 central-eastern Cuban endemic genera, there are 24 genera and more than 1500 species exclusively endemic to this sub-province. Approximately 1950 endemic taxa, including western and Pan-Cuban elements, occur in this area of about 18 000 km$^2$. The close relationship to Hispaniola is indicated by ten other endemic genera (*Plethadenia*, *Spirotecoma*, *Bellonia*, *Barleriola*, *Picardaea*, *Isidorea Margaritopsis*, *Peratanthe*, *Fuertesiella*, and *Victorinia*) and 103 species present in both islands. Furthermore, this sub-province is the evolutionary centre of 22 Caribbean genera, such as *Roystonea*, *Spathelia*, *Leucocroton*, *Bonania*, *Reynosia*, *Auerodendron*, *Neobracea*, *Pseudocarpidium*, *Gesneria*, *Rhytidophyllum* and *Acrosynanthus*, and the largest or one of the largest evolutionary centres for additional 32 Neotropical and Pantropical flowering plant genera, e.g., *Coccothrinax*, *Lepanthes*, *Metopium*, *Buxus*, *Purdiaea*, *Calyptranthes*, *Pimenta*, *Eugenia*, *Pachyanthus*, *Ossaea*, *Lyonia*, *Tabebuia*, *Dorstenia*, *Coccoloba*, *Schoepfia Pilea* (shared with Hispaniola), *Harpalyce*, *Amyris*, *Rondeletia* and *Gochnatia*. It may be concluded from this list that this area is in fact one of the richest gene reserves of the world. Its exploration, however, is by no means complete.

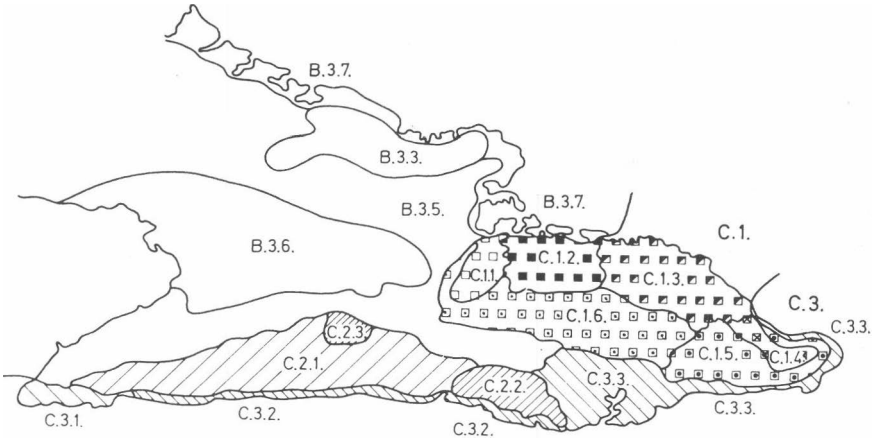


*Fig. 43.* The phytogeographical subdivision of the East-Cuban sub-province

C.1. Sector: Sagua-Baracoa massif (*Moanicum*)
- C.1.1. District: Nipe Mountains (*Nipense*)
- C.1.2. District: Cristal Mountains (*Cristalense*)
- C.1.3. District: Moa and Toa Mountains (*Moaënse*)
- C.1.4. District: Serpentines of Baracoa (*Baracoënse*)
- C.1.5 .District: *Purialense*
- C.1.6. District: *Yaterense*

C.2. Sector: Sierra Maestra (*Maestricum*)
- C.2.1. District: Western Maestra (*Turquinense*)
- C.2.2. District: Eastern Maestra (*Piedraënse*)
- C.2.3. District: Mogotes of the Maestra (*Bairense*)

C.3. Sector: South-eastern coasts (*Santiagicum*)
- C.3.1. District: *Pilonense*
- C.3.2. District: *Uveroënse*
- C.3.3. District: *Guantanamense*

Two humid mountainous areas (Sierra Maestra and Nipe-Baracoa) and an arid coastal plain is included in this phytogeographical category. The mountains have three endemic genera (*Synapsis*, *Zonanthus*, *Triscenia*) and more than 325 endemic species, mainly orchids (e.g., *Pleurothallis*, *Lepanthes*, *Epidendrum*, *Maxillaria* species). Furthermore, many species of *Lyonia*, *Coccoloba*, *Clusia*, *Pilea*, *Peperomia*, *Ossaea*, *Miconia*, *Calycogonium*, *Eupatorium* and *Vernonia*; and several montane species, such as *Clethra cubensis*, *Magnolia cubensis*, *Purdiaea nipensis*, *Euphorbia helenae*, *Calyptronoma clementis*, *Ilex macfadyenii*, *Myrica punctata*, *M. shaferi*, *Cleyera nimanimae*, *Guatteria moralesi*, *Illicium cubense*, *Laplacea ekmanii*, *L. wrightii*, *Dalbergaria cubensis* and *Bumelia jubilla* may be mentioned. Contrarywise, the arid coastal plain has many species in common primarily with the limestone karsts of mountains, e.g., *Hyperbaena cubensis*, *Calliandra orientalis*, *C. colletioides*, *Alvaradoa arborescens*, *Bursera glauca*, *Stigmaphyllon lineare*, *S. sericeum*, *Plumeria stenophylla*, *Rochefortia stellata*, *Tabebuia arenicola*, *T. hypoleuca*, *T. libanensis*, *T. simplicifolia*, *Gesneria gibberosa*, *Rhytidophyllum intermedium*, *Agave underwoodi*, *Rondeletia lomensis*, *R. baracoensis*, *Eupatorium* (Grisebachianthus) *carsticola*, *Aristida laevigata*, *A. pradana*, *Rajania baracoensis*, *Pitcairnia cubensis*, *Aristolochia lindeniana*, *Coccothrinax gundlachii* and *Gochnatia maisiana*. Particular attention should be paid to two isolated ancient relicts of this area, namely *Dracaena cubensis*, which has its closest relatives in the Canaries and Honduras, and *Cneorum trimerum*, the only Neotropical species of the Cneoraceae which includes merely 3 species, the other two being native to the Canaries and the European Mediterranean.

## *Sector C.1.: The Nipe—Baracoa Massif (Moanicum)* (Fig. 43)

Extensive serpentine ranges and large, bordering limestone karsts. The flora development of this area has been continuous since the upper Eocene. This region is characterized by high relief energy and diversified edaphic, macro- and microclimatic conditions. The richest flora of the Caribbean, and one of the richest floras of the World is found here and, too, this area is the most significant evolutionary centre of the Cuban flora and a starting point for the dispersal of species groups with different ecological requirements (serpentinophilous, montane and karstic elements). Eighteen endemic genera occur, five confined to this sector, namely *Tetralix*, *Phidiasia* (Fig. 44), *Schmidtottia* (16 species!), *Ariadne* and *Ekmanochloa*. The majority of species belonging to highly polymorphic genera, such as *Podocarpus*, *Gochnatia*, *Vernonia*, *Guettarda*, *Rondeletia*, *Purdiaea*, *Phyllanthus*, *Moacroton* (Fig. 12), *Coccoloba*, *Casearia*, *Spathelia* (Fig. 6), *Siphocampylus* and *Hemithrinax* (Fig. 13), etc., have a limited geographical range restricted to this sector. The number of regional endemic species is about 200. However, if the local endemics are also considered this number reaches 725. Some typical species are *Podocarpus ekmanii*, *Pinus cubensis*, *Dracaena cubensis*, *Guettarda ferruginea*, *Phyllanthus myrtilloides*, *Cyrilla cubensis*, *Rauvolfia salicifolia* and *Clerodendron nipense*.

## *Sub-sector C.1.a.: The serpentine mountains of the Nipe—Baracoa Massif (Eu-Moanicum)*

Four mountains or mountain groups have been distinguished from a phytogeographic point of view. These are the Nipe, Cristal, Moa and the Baracoa-Jauco zone. The first two, just as the second two, represent more closely related units. Nipe and Cristal are separated only by a narrow limestone strip, the valley of Rio Mayari. The boundary between Moa and Baracoa is a narrow gabbro zone. However, Cristal and Moa fall far apart, there is in between the wide Sagua de Tanamo depression lined with Tertiary limestones. This area, with its mesophilous tropical forest, must have acted as an important barrier of migration for the serpentine floras. Within the East-Cuban sub-province this area has the richest flora. Of its eighteen endemic genera sixteen are confined to this sub-sector, including all regional endemic

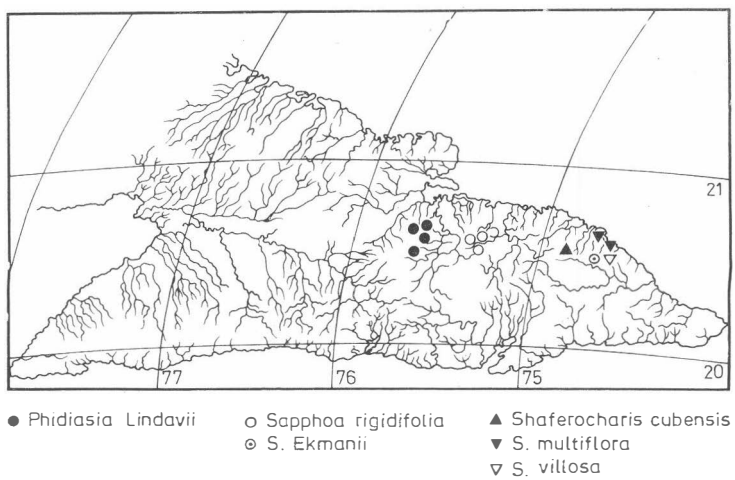


*Fig. 44.* Geographical distribution of the endemic genera *Phidiasia*, *Sapphoa* and *Shaferocharis* (after BORHIDI 1981, modified and original)

genera and the majority of the 725 endemic species. The number of vicarious species in the mountains is large. Also, many vicarious subspecies occur providing evidence for speciation in more recent times. The *Calycogonium rosmarinifolium* (Fig. 18), *Casasia nigrescens* (Fig. 17), *Moacroton lanceolatus* (Fig. 12), *Anemia coriacea* (Fig. 11) and *Phyllanthus myrtilloides* aggregates are examples. All developmental stages of serpentine soils are found in this area and, as a result of the different ecological conditions of serpentine habitats, the floristic and vegetational variability ranges from the arid evergreen shrublands to the submontane rainforests.

## District C.1.1.: Sierra de Nipe (Nipense)

**a. Geography:** A serpentine plateau at 600 m elevation, relieved by narrow and deep canyons and covered by old fossil ferrallitic and ferritic soils. The eroded forms of these soils are mixed with more recent serpentine rendzina on the ridges and covered by the humic drift of slopes in the valleys.
**b. Climate:** Seasonal with dry winter, 3–4 dry months in the south and 1–2 dry months in the interior. Two dry seasons of 3–4 months duration on the northern slopes. Montane rainforest climate at Loma Mensura. The annual precipitation is between 1200 and 2300 mm.
**c. Flora:** The relatively wide climatic conditions of this small area account partly for the uniqueness of the flora. Four monospecific endemic genera, *Dasytropis*, *Koehneola*, *Harnackia* (Fig. 10) and *Ciceronia*, and about 140 local endemic species, especially from the genera of *Tabebuia*, *Leucocroton*, *Chaptalia*, *Brunfelsia*, *Callicarpa*, *Eugenia*, *Calyptranthes*, *Phyllanthus* and *Rhynchospora* occur. Further 21 species are common to this district and the Cristal Mountains, examples are *Euphorbia podocarpifolia*, *Eugenia piedraensis*, *Schmidtottia cubensis*, *Suberanthus canellaefolius*, *Senecio subsquarrosus*, *Vernonia desiliens*, and *Gochnatia cubensis*, etc. Some species are exclusively found here and in Moa, being absent from the Cristal Mountains in between. These are *Pithecellobium nipense*, *Ravenia simplicifolia*, *Phyllanthus phlebocarpus*, *Ph. estrellensis*, *Buxus aneura*, *Phidiasia lindavii* (Fig. 44), *Matelea nipensis*, *Exostema stenophyllum*, and *Psychotria lopezii*. The richness of certain valleys (e.g., Rio Piloto) or peaks and ridges (Loma Mensura, Loma Bandera, Loma Winche) in local endemics is also of particular interest.
**d. Vegetation:** Semi-arid evergreen shrubwoods on the sharp ridges. Various natural and secondary *Pinus cubensis* forest communities on the slopes and the plateau. Semi-arid montane rainforests predominate along the watercourses. Semi-arid montane shrubwoods occur on the western and eastern slopes of Loma Mensura. The "montane serpentine savannas" of CARABIA (1945) have been resulted from the deforestation of relict pinewoods.

## District C.1.2.: Sierras del Cristal and Micara (Cristalense)

**a. Geography:** Massif consisting of deeply inclined conical hills and sharp ridges. The lower sections are covered by ferrallitic soils. Over 700 m these are replaced by yellowish-red montane clays.
**b. Climate:** More uniform than the climate of the preceding district. The dry season is in the winter with 1–2 dry months at the margin of the mountains. Humid rainforest climate in the interior. Annual precipitation between 1600–2300 mm.
**c. Flora:** Strikingly poor and monotonous when compared to the flora of the neighbouring Nipe and Moa Mountains. This is indicated by breaks in the distribution of numerous species mentioned in the discussion of the preceding district. This situation may be partially accounted for by the deficiency of these mountains in extreme, dry rocky habitats. Another reason is that this area is not thoroughly explored. Thus, only one (!) endemic monospecific genus

(*Eosanthe cubensis*) and about 50 endemic species are known. Most of these species are markedly different from their relatives, for example, *Lagenocarpus cubensis*, *Freziera conocarpa*, *Moacroton cristalensis* (Fig. 12), *Buxus imbricata*, *B. olivacea*, *Croton pachyrrhachis*, *Ilex cristalensis*, *I. eoa*, *I. paucinervis*, *I. subavenia*, *Chaetocarpus cordifolius*, *Leucocroton obovatus*, *Pachyanthus monocephalus*, *Jacquinia sessiliflora*, *J. oligantha*, *Senecio ekmanii*, *Sapphoa rigidifolia* (Fig. 44), *Acrosynanthus ovatus*, *Gesneria pachyclada*, *Dendropanax nervosus*, *Ossaea cristalensis*, etc. Whereas the Cristal Mountains are poor only in comparison with the neighbouring districts, the coniferous forests of Sierra de Micara are monotonous by any standard with an only exception of the dry rocky ridge of Saca La Lengua: as few as 6–8 endemics, such as *Annona cristalensis*, *Erythroxylum flavicans*, *Rondeletia bissei*, *Ossaea micarensis*, *O. pinetorum*, *Myrtus micarensis* and *M. del-riscoi* have been known.

**d. Vegetation:** The coniferous zone is much narrower than in Nipe, Seasonal evergreen forests run up to an altitude of 600 m with moist rainforest mosaics. Between 600 and 1100 m pine forests of *Pinus cubensis* are dominant. From 1100 to 1230 m semi-dry montane shrubwood, variant of cloud forest on serpentine, is found. On the southern serpentine cliffs of Pico del Cristal the existence of a peculiar vegetation, namely dry montane evergreen shrubwoods, may be assumed.

## District C.1.3.: Sierras de Moa and Toa (Moaense)

The most extensive floristic district on serpentine. Its flora probably has the longest history in Cuba, as this area is considered to be the evolutionary centre of the vegetation in these mountains.

**a. Geography:** In general, wide and flat ridges and plateaux are typical (Cupeyal, El Toldo, Altos de Iberia) although the Cuchillas de Toa range between the Jaguani and Toa rivers consists of conical and pyramidal mounts. Very old, red ferritic soils predominate. In zones close to the coast (Cerro Miraflores, Yamanigüey) younger ferrallitic serpentine soils are found. The middle and upper section of the Toa valley is mainly covered by yellowish-red montane soils derived from serpentine.

**b. Climate:** The most humid area in Cuba. At the northern, western and southern boundary there are two dry seasons of 1–2 dry months duration. In the interior the climate is warm and moist throughout the year. At about 7–800 m altitude it is replaced by moist montane rainforest climate. Annual precipitation between 1400–3000 mm, occasionally near to 5000 mm in certain localities.

**c. Flora:** Very rich and diverse. Four endemic genera, *Kodalyodendron*, *Schaferocharis*, *Shafera* and *Feddea*, and nearly 200 local endemic species, e.g., *Hemithrinax rivularis* and var. *savannarum* (Fig. 13), *Moacroton leonis*, *M. tetramerus*, *Phyllanthus chryseus*, *Callicarpa oblanceolata*, *Bonnetia cubensis*, *Laplacea moaensis*, *Talauma minor* ssp. *oblongifolia*, *Shafera platyphylla*, *Schaferocharis cubensis*, *S. multiflora*, *S. villosa*, *Cassia bucherae*, *Byrsonima bucherae*, *Acacia bucheri*, *Brya subinermis*, *Casearia ophiticola*, and 7 *Buxus*, 4 *Coccoloba*, 5 *Leucocroton*, 4 *Ilex*, 5 *Calyptranthes*, 4 *Myrcia*, 6 *Eugenia*, 6 *Miconia*, 5 *Calycogonium*, 6 *Ossaea*, 4 *Clusia*, 8 *Cordia*, 3 *Callicarpa*, 6 *Tabebuia*, 6 *Schmidtottia* and 6 *Senecio* species, etc. occur. Numerous endemics are in common with the Nipe Mountains (see above), with Sierra del Cristal (e.g., the endemic genus *Sapphoa*, *Neobracea ekmanii*) (Fig. 9), the Baracoa-Jauco district discussed below (e.g., *Moacroton ekmanii* (Fig. 12), *Cordia duartei*, *Platygyne obovata*, *Suberanthus stellatus*, *Casearia bissei*, *Feddea cubensis*, *Dracaena cubensis*, etc.) and even with the Monte Libano group (e.g., *Gesneria cubensis*, and *Columnea tincta*). Several minor developmental centres may be recognized within the mountains (Cerro Miraflores—Playa la Vaca, Yamanigüey, Alto de Iberia El Toldo, Pico Galán, and the surroundings of old nickel mines: Mina Iberia, Mina Potosi, Mina Franklyn, Mina Cayo Guam, Mina Delta), although it has been shown (BORHIDI and

MUÑIZ 1972b) that many species had been thought to be local endemics turned to be in fact only regional endemics of wider distribution.

**d. Vegetation:** In the northern foothills, the Cupeyal Plateau and the upper Toa valley various forest communities of *Pinus cubensis* predominate. Along the coast these forests alternate with microphyllous evergreen shrubwoods very rich in species, including strongly isolated endemics such as *Kodalyodendron cubensis*, *Shaferocharis multiflora*, *Tabebuia linearis*, *Acrosynanthus minor*, *Miconia javorkaeana*, *Forchammeria emarginata*, *Coccoloba acuna*, *Phyllanthus comosus*, *Eupatorium minutifolium*. Over 400 m and up to 6–700 m semi-arid montane rainforests occur. At higher altitude semi-arid montane shrubwoods correspond to the climax vegetation type. On the dry tops of some serpentine plateaux (e.g. El Todo) a dwarf pine-woodland of *Pinus cubensis* is developed (PÓCS, ex verb.). In the valleys of the Jaguani and Toa rivers are found the *Carapa guianensis* forests, representing the only submontane tropical rainforest zone in Cuba.

## District C.1.4.: The serpentine areas of Baracoa and Jauco (Baracoënse)

**a. Geography:** This area, situated east of the Quibiján and Toa rivers, is younger, lower and, too, poorer in species than the preceding districts. Yellowish red montane soils and latosols occur in the west, latosolic red serpentine soils in the east.

**b. Climate:** Humid rainforest climate with no seasons. Annual precipitation between 1600 and 2900 mm.

**c. Flora:** Most species are in common with Moa. Approximately fifty local endemic species are found here, for example: *Melocactus radoczii* (Fig. 45), *Buxus baracoensis*, *Cordia baracoensis*, *Siphocampylus baracoensis*, *Schmidtottia multiflora*, *Ossaea elliptica*, *Henriettea cuabae*, *Exostema shaferi*, *Xylopia ekmanii*, *Spathelia leonis* (Fig. 6), *Leucocroton ekmanii*, *Rhamnidium pruinosum*, *Ternstroemia baracoensis*, etc.

**d. Vegetation:** Submontane rainforests in the west, pinewoods on ferritic soils, and mainly microphyllous evergreen shrubwoods in the Peladeros de Jauco zone in the east.

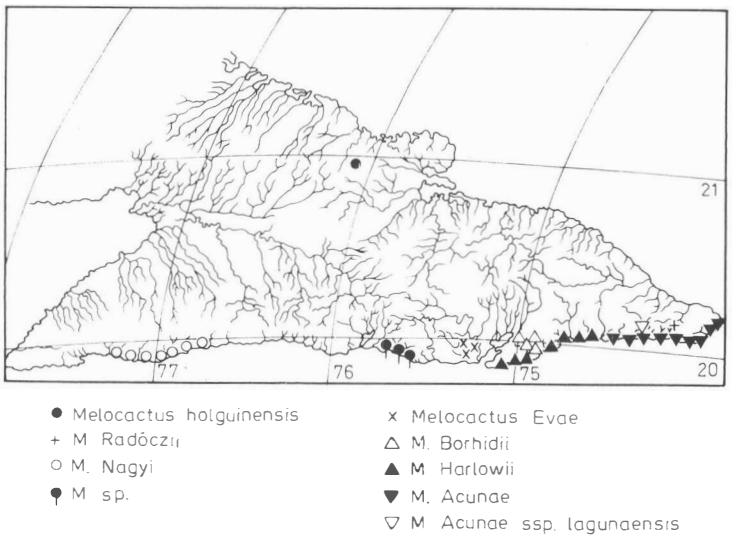


*Fig. 45.* Geographical distribution of the East-Cuban taxa of the genus *Melocactus* (after MÉSZÁROS 1977)

### *Sub-sector C.1.b.: The limestone karsts and other not serpentine ranges of the Nipe—Baracoa Massif (Yatericum)*

This sub-sector includes the mogates of the southwestern Sierra de Nipe, the partially eroded limestone blocks folded at the margin of serpentine mountains, in the Monte Libano–Monte Cristo–Monte Verde group, the sandstone hills mingled with the limestone blocks, and the Sierra del Purial range with the Sierra de Imias which continues as a limestone plateau towards the end of the island. The endemics are not evenly distributed over the area. The deciduous forests occurring on sandstone have very few floristic specialities, whereas the limestone cliffs are very rich in endemics due to geographical isolation. In spite of this heterogeneity, the sub-sector played a significant role in the flora evolution of Cuba for two fundamental reasons: 1. Via this area migrated the montane flora from the north (Moa, Cristal) southward (Sierra Maestra). 2. The limestone cliffs are considered to be the cradle of the southern Oriente xerotherm flora which, in the Quaternary, moved both to the west and towards the terraced coastal area. The existence of these floristic relationship is best shown by the distribution of the vicarious species of *Gesneria*, *Eupatorium* and *Siphocampylus*.

### District C.1.5.: Sierra del Purial, Yunque de Baracoa and the Gran Tierra Plateau (Purialense)

**a. Geography:** Diversified mountainous area. Sierra del Purial is a deeply inclined range up to 1100 m altitude, Gran Tierra is a "meseta" area. Quite different are the mogotes west of the Yumuri valley and the anvil-shaped Yunque de Baracoa monadnock consisting of limestone and dolomite. Tropical brown soils predominate in the Sierra del Purial and Yunque. In some elevated places yellowish-red montane soils occur. In the limestone area of Gran Tierra and Yumuri humic-carbonated soils are the most common.
**b. Climate:** Characterized by sudden changes along a gradient. There is hardly any transition between the bixeric climate of two dry seasons (3–4 dry months), the wet tropical and the montane rainforest climate. In the northeast a particular tropical seasonal climate occurs which is dry in the summer. Annual precipitation 1000–2200 mm.
**c. Flora:** The flora of Sierra del Purial and Sierra de Imias is little investigated so that only few endemics have been known (*Senecio saugetii*, *Croton tropidophyllus*, *Scolosanthus wrightianus*, *Phialanthus parvifolius*, *Ph. macrostemon*, *Ardisia baracoensis*, and *Platygyne leonis*) but the discovery of others is expected. A single endemic genus, *Bembicidium*, and several endemic species, e.g., *Callicarpa areolata*, *Gesneria gibberosa*, *G. yumuriensis*, *G. purpurascens*, *Victorinia regina*, *Siphocampylus yumuriensis*, *Spathelia yumuriensis* (Fig. 6), *Heptanthus yumuriensis* (Fig. 5), and *Ossaea yumuriensis*, etc. occur in the Gran Tierra and Yumuri area. The richest evolutionary centre is the Yunque de Baracoa monadnock from the Pliocene, which has one endemic genus (*Ekmania*) and about 25 endemic species, for instance, *Spaniopappus ekmanii*, *Vernonia yunquensis*, *Jacquinia yunquensis*, *Ossaea heterotricha*, *Calycogonium plicatum*, *Ilex wrightii*, *Croton yunquensis*, *Erythroxylum baracoense*, *Coccothrinax yunquensis* (Fig. 46), three *Gesneria* and 5 *Pilea* species, *Siphocampylus manettiaefolius*, *Arthrostylidium angustifolium*, etc.
**d. Vegetation:** This is the zone of seasonal evergreen forests, although over 7–800 m montane rainforests and, in the Sierra de Imias, even mossy forests may occur. The mogote zone is covered by karstic forests whose floristic composition is still unknown.

### District C.1.6.: The mogotes of the Nipe—Yateras area (Yaterense)

**a. Geography:** Inclined conical karsts and, too, wide and terraced limestone plateaux with serpentine intrusions often reaching the surface. The limestone formations alternate with