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Semi-deciduous forests syntaxa from Sierra Maestra, Eastern Cuba

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Abstract: Reyes, O.J. & Acosta Cantillo, F. *Semi-deciduous forests sintaxa from Sierra Maestra, Eastern Cuba. Lazaroa 35: 37-53 (2014).*

Five associations from two classis, three orders and four alliances are described in low Sierra Maestra semideciduous forests. Two of microphill semideciduous forests are in soils from calcareous rocks, while the three from mesophill semideciduos forests grow up in soils developed over volcanic rocks from El Cobre group. In this work we have used the Zurich – Montpellier school methodology, which is easily used in the Cuban archipelago.

Keywords: Caribean forests, sintaxonomy, Sierra Maestra, Cuba.

Resumen: Reyes, O.J. & Acosta Cantillo, F. *Sintáxones en los bosques semideciduos de la Sierra Maestra, Cuba Oriental. Lazaroa 35: 37-53 (2014).*

Se describen cinco asociaciones correspondientes a dos clases, tres órdenes y cuatro alianzas pertenecientes a los bosques semideciduos de la parte baja de la Sierra Maestra. Las dos que concuerdan con el bosque semideciduo micrófilo se desarrollan sobre suelos de origen calcáreo y las tres que corresponden al bosque semideciduo mesófilo crecen en suelos provenientes del Grupo indiferenciado El Cobre. Para este trabajo se empleó la metodología de la Escuela Zurich Montpellier ampliamente utilizada en el archipiélago cubano.

Palabras clave: Bosques caribeños, sintaxonomía, Sierra Maestra, Cuba.

INTRODUCTION

Semi-deciduous forests (Capoate & Berazaín, 1984; Reyes, 2006, 2011-2012), also known as seasonal evergreen forests (Del Risco, 1995), were the most extensive in the flat and hilly areas of the Cuban archipelago (Borhidi, 1996) where they formed mature communities in relative equilibrium.

Degrading human intervention occurred due to deforestation and fire; the latter played a major role in the driest areas. When exploitation in altered oecotopes corresponding to this type of forest is excluded, a syngenetic evolution by enrichment and competition among species is also developed, up to reach a stage of secondary tree shrubwood, in which few species dominate the coverage. Then, they constitute an Early secondary community or Homeostasis I (sensu Budowski, 1985; Capoate & *al*., 1988; Reyes & Acosta, 2004a, b), and establish at the same time, a stage of relative equilibrium (Reyes & *al*., 2004b). Later, other species come to gradually replace the existing ones, creating new Late secondary communities (Fiera II and Homeostasis II), which are different regarding degradation and ecological conditions. The number of tree species, the degree of cenotic complexity and the dominance of species of advanced stages change with the successional stage.

Low areas from Sierra Maestra have been heavily exploited (crop and / or pasture), thus offering variations on existing plant communities. León (1946) and Samek (1974) established an altitudinal zonation and named those low areas as "Yayales" and "Planar floor" respectively. Like-

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wise, REYES (2006) said semi-deciduous forests were developed there, so they will be treated as "floor of semi-deciduous forest and scrubs". The aim of this paper is to describe the main currently existing forest syntaxa on the vegetation floor before mentioned.

MATERIALS AND METHODS

DESCRIPTION OF THE STUDY AREA

The "floor of semi-deciduous forest and scrubs" from Sierra Maestra - where this kind of forest evolves - presents typically tropical ecological conditions; the weather is warm and the mean temperature is about 24ºC. The relative humidity varies from 80 to 85%, whereas the evaporation averaging from 1500 to 1900 mm. The annual rainfall for this area is from 800 to 1200 mm per year. It has two different seasons: one with a sharp little rainy season (November to April), ranging from 300 to 400 mm and the other, the rainy season (May to October), in which precipitation goes from 800 to 1 000 mm (VILAMAJÓ & *al*., 1989; MONTENEGRO, 1991a, b, c, d).

Geologically the study area is generally located in El Cobre Group (MENDEZ & *al*., 1994.) and in sialIitic brown soils or reddish brown fersiallitic soils (sensu RENDA, 1989; HERNÁNDEZ & *al*., 1994). The areas corresponding to the Coastal Terraces in Southern Sierra Maestra (NÚÑEZ & VIÑA BAYÉS, 1989) are mainly composed by highly percolating Pliocene marl from La Cruz Formation (Cuban - Hungarian Commission, 1976), and by shallow to very shallow soils.

METHODOLOGY

In a minimum area of 400 m², vegetation inventories (stands, samples) were made by means of the BRAUN-BLANQUET (1921, 1951, 1964) method; using the SAMEK (1973) experiences, they were numbered and marked on the map 1:50 000 (Figure 1). There were also performed some observations of the sample's surroundings and ecological conditions: altitude, exposure, slope and soil (type, depth, texture, structure, stoniness, humidity, etc). Organization of vegetation inventories and syntaxa separation were performed by means of phytocoenological methods (SCAMONI & PASSARGE, 1959, 1963). Homogeneity according to the law of RAUNKIAER (1934) was then confirmed. Species with grades of presence IV and V were considered for characteristic combination, and for subassociations and variants the

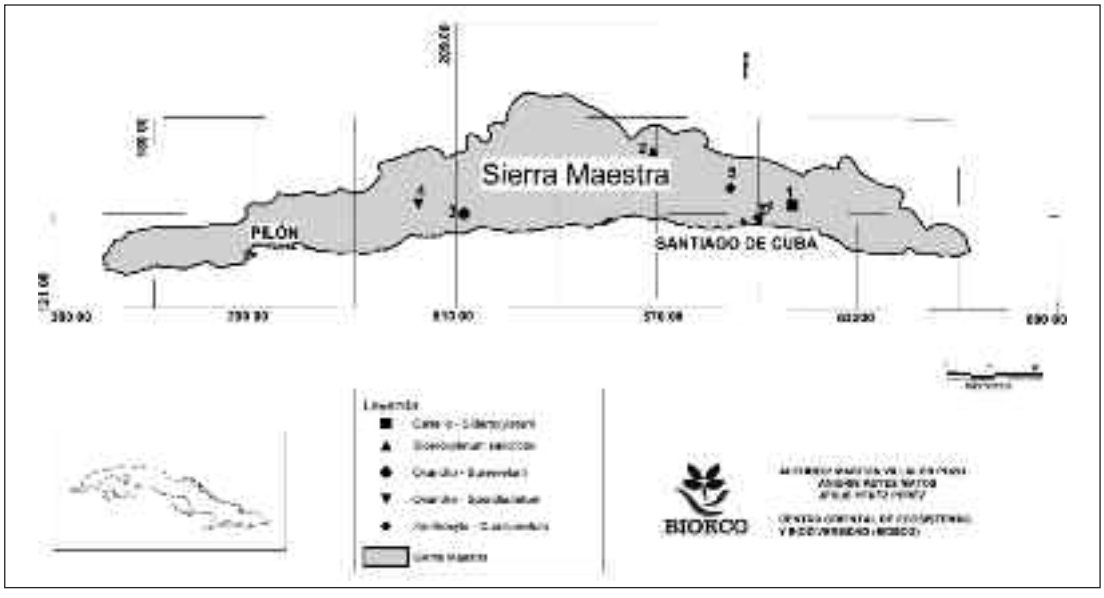

Figure 1. – Semideciduous sampled forest in Sierra Maestra range (Cuba).

differential combinations (SAMEK, 1973; MUELLER-DOMBOIS & ELLEMBERG, 1974).

Generally, in the description of layers (E_1 – herbaceous, E_2 – shrub and E_3 – canopy layers) and synusiae (Li – lianas, Ep – epiphytes) the following categories of species presence were established: *constants*, present in 80 % or more of the inventories; *frequently*, present in 60 to 79 %; *less frequent*, present in 30 to 59 %; *casual*, present from 15 to 29 %. Species with values lower than 15 % were not named in the description. REYES & FORNARIS (2011) agreement that vegetable earth layers are: L withered leaves, F incompleted decomposition (leaching) and H humus.

Categorization and naming of syntaxa was performed according to the International Code of Phytosociological Nomenclature (WEBER & *al*., 2000). Flora de Cuba vols. 1-5 (LEÓN, 1946; LEÓN & ALAIN, 1951, 1953, 1957; ALAIN, 1964) was used to name species and corrections were made following modern publications (GUTIERREZ, 2000; HAGEN, 2007; ACEVEDO-RODRÍGUEZ & STRONG, 2012). Collected specimen are in Herbarium BSC.

RESULTS

A large ecosystem diversity can be found, even at the classes, orders and alliances levels due to the great range of ecological conditions on the "floor of semi-deciduous forests and scrub" from the Sierra Maestra, where these syntaxa developed. Hence it is considered a complex phytosociological arrangement, which is observed at the end of work.

EUGENIO MALEOLENTIS-DIPHOLIDETALIA SALICIFOLIAE (Reyes 2005) Reyes stat. nov.
(*Holotypus: Eugenio-Dipholidion salicifoliae* Reyes 2005).

Composition & characteristic species. *Sideroxylon salicifolium, Gymnanthes lucida, Eugenia maleolens, E. axillaris, Bursera simaruba, Exostema caribaeum, Colubrina elliptica, Erythroxylum havanense, E. rotundifolium, Maytenus buxifolia, Amyris elemifera, Chiococca alba, Stigmaphyllon sagreanum*, etc.

Physiognomy. Microphyll semi-deciduous forest, low, the arboreal layer (canopy layer) reaches between 7 to 12 m in high and covers from 30 to 100 %.

Ecology and distribution. It occupies sialIitic brown soils from calcareous marl in the Coastal Terraces from Sierra Maestra and brown soils on the limestones from the north side of such mountain group. The rainfall range between 700 and 1 200 mm with a distinct dry season. It takes place on the "floor of semi-deciduous forest and scrubs" from Sierra Maestra.

Syntaxonomy. REYES & MARTÍNEZ (2005) placed the alliance *Eugenio-Dipholidion salicifoliae* Reyes 2005 in the class *Gerascantho-Burseretea simarubae* Borhidi 1996 and in the order *Gerascantho-Burseretalia simarubae* Borhidi 1996. Due to a better correspondence such alliance was transferred to the class *Thrinaceto-Plumerietea obtusae* Borhidi 1996, which raises its rank (Article 27 a) to the order *Eugenio maleolentis-Dipholidetalia salicifoliae* (REYES, 2005) Reyes stat. nov. (Recommendation 46H) and equally maintains the alliance *Eugenio-Dipholidion salicifoliae* Reyes 2005 with their associations, original diagnosis and unaltered types.

Eugenio-Dipholidion salicifoliae Reyes 2005.

Canello winteranae-Sideroxyletum salicifolii
Reyes & Acosta *ass. nova hoc loco*
(Table 1, *holotypus* rel. 2)

Physiognomy & floristic composition. This syntaxon constitutes a phase of syngenetic development, which corresponds to a Late successional community, i.e., the stage known as Fiera II, when arboreal species surpass the layer seen in Homeostasis I and begin interacting with one another, whereas the pioneers diminish their vitality. The canopy layer generally covers from 70 to 90 % and ranges between 9 and 12 m tall. Floristically, it is quite heterogeneous as it has averaged about 11 species by inventory (occasionally 15). It was found a total of 41 species that reach this layer. The most common species are: *Sideroxylon salicifolium, Canella winterana, Acacia macracantha* and *Senna atomaria*. With less coverage is also

found *Bursera simaruba*. The most abundant species in the shrub layer are *Eugenia axillaris, Coccothrinax fragans* and *Randia aculeata* are also observed. While *Scleria lithosperma, Chiococca alba, Zapoteca gracilis, Paspalum breve, Lasiacis divaricata, Lantana montevidensis, Zanthoxylum fagara* and *Croton lucidus* were the most abundant species in the herbaceous layer. The characteristic combination is shown in Tables 1-3 and consists of 21 species.

Table 1
Canello winteranae-Sideroxyletum salicifolii ass. nova
var. *typicum* (1-3), var. *Caesalpinia vesicaria* (4-6)
(*Eugenio-Dipholidion salicifoliae, Eugenio maleolentis-Dipholidetalia salicifoliae, Thrinaceto-Plumerietea obtusae*)

Inclination (º)	40	20	20	30	20	25
Exposition	WSW	SSW	N	NNW	SSW	NNE
Canopy layer- E_3 (%)	70	60	70	70	80	70
Shrub layer- E_2 (%)	70	80	80	80	50	60
Herbaceous layer- E_1 (%)	60	70	50	50	40	30
N. species	30	27	22	37	37	30
Relevé N.	1	2	3	4	5	6
Characteristics						
E_3- *Sideroxylon salicifolium*	1	3	3	2	2	3
Canella winterana	.	+	+	+	r	+
Acacia macracantha	4	r	+	+	r	r
Senna atomaria	2	r	+	r	1	.
Bursera simaruba	r	+	r	+	+	+
E_2- *Eugenia axillaris*	r	2	2	2	2	2
Randia aculeata	1	+	1	+	+	2
Lantana montevidensis	1	.	+	+	r	r
Comocladia dentata	.	.	.	+	r	+
Bourreria virgata	+	.	.	.	.	r
E_1- *Coccothrinax fragans*	1	+	+	+	.	1
Croton lucidus	3	3	1	1	1	1
Zapoteca gracilis	+	r	r	r	1	.
Zanthoxylum fagara	.	+	+	r	r	r
Scleria lithosperma	r	2	1	2	.	2
Paspalum breve	.	2	.	1	1	1
Lasiacis divaricata	r	+	.	+	+	.
Li- *Tragia hexandra*	.	+	+	r	r	+
L- S*tigmaphyllon sagreanum*	+	r	.	r	+	+
Chiococca alba	r	1	.	1	1	+
Smilax havanensis	r	+	.	+	r	+
Differentials of typicum						
E_3- *Simarouba laevis*	.	1	1	+	r	+
E_2- *Amyris elemifera*	r	2	1	.	+	1
Li- *Tragia volubilis*	.	+	.	r	r	+
Differentials of *trichilietosum hirtae* and *diospyretosum grisebachii*						
Li- *Salacia nipensis*	1	.	.	.	r	r
Differentials of *trichilietosum hirtae*						
E_1- *Erythroxylum havanense*	.	.	.	r	+	.
Commelina erecta	.	.	.	r	+	.
Differentials of diospyretosum grisebachii						
E_3- *Exostema caribaeum*	r	1	.	1	+	1
Colubrina elliptica	1	.	.	2	2	r
Thouinia patentinervis	.	.	.	.	r	r
E_1- *Lantana camara*	+	.	.	.	.	r
Spermacoce laevis	.	.	.	r	r	.
Li- *Passiflora suberosa*	+	.	.	r	r	r

Relevé N.	1	2	3	4	5	6
Differentials of variants						
E_2- *Caesalpinia vesicaria*	.	.	.	3	3	+
Capparis flexuosa	.	.	.	r	r	.
Companions						
E_1- *Oplonia tetrasticha*	.	1	.	.	r	1
Varronia globosa subsp. *humilis*	.	r	.	r	.	.
Melochia nodiflora	r	.	.	+	.	.
Li- *Passiflora foetida*	r	.	.	.	r	.
Distictis rhynchocarpa	.	+	.	1	+	.
Ep- *Tillandsia fasciculata*	r	r	.	.	.	.

Other species: *Euphorbia heterophylla, Tillandsia recurvata* and *Casearia hirsuta* r, *Callicarpa resinosa* +, *Bothriochloa pertusa* 4 in 1; *Erithalis fruticosa* + in 2; *Diospyrus grisebachii, Sideroxylon foetidissimum* subsp. *foetidissimum, Ehretia tinifolia* and *Piper richardianum* r, *Ocotea coriacea* and *Cupania glabra* 1 in 3; *Triopteris rigida* +, *Urochloa humidicola* 1, *Turnera ulmifolia* and *Citharexylum ternatum* r in 4; *Erytrhroxylum rotundifolium* +, *Desmodium incanum* and *Pisonia aculeata* r in 5; *Rochefortia acanthophora* + in 6.
Localities: all relevés were collected in the hills at the north side of the Coastal Terraces of the South of Sierra Maestra, between 20 and 100 m asl. (x: 610.708, y: 151.079); *holotypus* rel. 2.

Ecology and distribution. The studied areas are hills between 20 and 100 m asl. Most are located at the north side of the Coastal Terraces of the South of Sierra Maestra (x- 610.708, y- 151.079), so their secondary watershed and dell preferably have north-northwest direction and Northwest´s to a lesser degree. Geologically these hills are composed by Pliocene marl from La Cruz Formation. Soils are brown (carbonate), from shallow to very shallow and even react with saliva. They are usually clay loam, sandy clay or sandy, stony in greater or lesser level, with small and medium stones. The most frequent inclination is between 20 and 40 degrees, the micro-relief on the slope is generally flat. Regarding the litter, the L layer reaches about 2 cm; the F layer is generally absent and the humus is missing. The earthworm activity (which is higher in more developed successional stages) is very important in the incorporation of humus to the soil. Where such activity is greater, a mixed layer of soil (1 to 1.5 cm) and half-decomposed litter is formed, thus affecting the ecosystem nutrient recycling. The annual mean temperature is around 26° C and the average maximum is in the order of 32° C. The annual precipitation is about 800 mm and the yearly evaporation is between 1 700 and 1 900 mm.

It has three sub-associations: *typicum* (= *simaroubetosum laevis*), *trichilietosum hirtae* and *diospyretosum grisebachii*. Differences are caused by the degree of successional development and the ecological conditions, mainly the exposure and position on the slope.

typicum

It is the most advanced community in Fiera II. The main tree pioneers generally show diminished vitality and poor or very poor regeneration. However, the thickness of *Sideroxylon salicifolium* and *Eugenia axillaris* is very high in the arboreal layer. The proportion of trees seedlings in shrub and herbaceous layers is high. It covers 50 to 80 % and 40 to 70 % respectively, which also confirm the advanced successional stage. It is generally observed in exposures to the West and in the mid to upper hillside, so the relative height is greater than 20 m. The soil is very shallow, sometimes gravelly and with some stones on the surface. Earthworm, great activity is also considerable. Due to its inclination, position on the slope and exposure, it can be considered as a dry oecotope.

Two variants are found: *typicum* and *Caesalpinia vesicaria* (Table 1).

trichilietosum hirtae Reyes *subass. nova hoc loco* (Table 2, *holotypus* rel. 1)

This subassociation is an early stage of Late successional community; where *Acacia macracantha* and *Senna atomaria* still play an important role in the canopy layer; and the thickness of *Sideroxylon salicifolium* and *Eugenia axillaris* is still very low. The microphanerophytes and nanophanerophytes number is important in the shrub and herbaceous layers. The first covers bet-

ween 25 and 70 % and the second from 10 to 90 %. Preferentially they occupy the slope bottom and are directed towards the North (NE-NW). Therefore, the water balance is more favourable here than in other sub-associations. Three variants with weak floristic differences are presented: *typicum*, with *Tournefortia volubilis* and with *Trema micrantha* (Table 2).

Table 2
Canello winteranae-Sideroxyletum salicifolii trichilietosum hirtae subass. nova var. *typicum* (1), var. *Tournefortia volubilis* (2, 3), var. *Trema micrantha* (4-6), (*Eugenio-Dipholidion salicifoliae, Eugenio maleolentis-Dipholidetalia salicifoliae, Thrinaceto-Plumerietea obtusae*)

Inclination (º)	30	10	30	35	30	45
Exposure	NW	ENE	NE	NW	NE	NNW
Canopy layer- E_3 (%)	90	90	90	80	70	80
Shrub layer- E_2 (%)	30	25	50	60	70	60
Herbaceous layer- E_1 (%)	70	90	60	40	15	10
N. species	31	40	47	42	36	35
Relevé N.	1	2	3	4	5	6
Characteristics						
E_3- *Sideroxylon salicifolium*	+	+	+	2	1	.
Canella winterana	r	r	r	+	1	r
Acacia macracantha	4	3	4	1	+	2
Senna atomaria	+	2	3	1	1	+
Bursera simaruba	+	r	.	r	+	1
E_2- *Eugenia axillaris*	+	.	1	3	3	2
Comocladia dentata	r	2	r	1	r	.
Bourreria virgata	+	r	+	+	r	r
Lantana montevidensis	.	.	+	r	.	.
Randia aculeata	.	r	r	r	.	+
E_1- *Coccothrinax fragans*	.	r	r	r	r	2
Scleria lithosperma	1	2	1	1	2	+
Lasiacis divaricata	1	1	2	r	.	+
Paspalum breve	+	3	r	1	+	.
Zapoteca gracilis	+	1	.	.	1	+
Croton lucidus	.	.	.	3	.	1
Zanthoxylum fagara	.	r	.	r	.	.
L- *Stigmaphyllon sagreanum*	+	r	+	r	.	1
Chiococca alba	2	1	+	1	1	1
Smilax havanensis	+	r	+	.	.	+
Tragia hexandra	.	.	.	+	+	.
Differentials of *Trichilietosum hirtae*						
E_3- *Trichilia hirta*	+	3	r	3	1	r
Sideroxylon foetidissimum subsp. *foetidissimum*	+	r	1	+	+	+
Cordia alba	+	r	2	2	.	+
E_2- *Ehretia tinifolia*	+	2	+	1	+	+
Turnera ulmifolia	1	r	1	r	.	+
E_1- *Erythroxylum havanense*	+	r	+	1	1	+
Chrysophyllum oliviforme	r	r	r	r	1	.
Casearia hirsuta	.	r	+	r	1	r
Urochloa humidicola	1	2	2	r	+	1
Heliotropium indicum	.	r	+	r	.	+
Commelina erecta	+	r	+	.	.	r
Desmanthus virgatus	.	1	r	r	1	.
Li- *Gouania lupuloides*	2	1	r	1	1	+
Serjania diversifolia	+	.	+	r	r	+
Salacia nipensis	+	.	+	r	r	.
Ep- *Tillandsia recurvata*	.	r	r	r	1	.

Relevé N.	1	2	3	4	5	6
Differentials of *Diospyretosum grisebachii* and *Simaroubetosum laevis*						
E_3- *Colubrina elliptica*	.	.	.	.	1	2
Li- *Passiflora suberosa*	.	.	r	.	.	r
Differentials of *Diospyretosum grisebachii*						
E_1- *Lantana camara*	.	r	+	.	.	r
Euphorbia heterophylla	r	.	r	.	.	.
Differentials of variants						
E_1- *Bourreria setoso-hispida*	.	+	1	.	.	.
Tournefortia volubilis	.	r	r	.	.	.
E_1- *Trema micrantha*	.	.	.	r	1	r
Cupania glabra	.	.	.	+	2	.
Li- *Pisonia aculeata*	.	r	r	.	.	.
Companions						
E_3- *Lonchocarpus domingensis*	.	.	+	1	.	+
E_2- *Adelia ricinella*	.	r	.	+	.	.
E_1- *Desmodium incanum*	.	.	+	.	r	.
Varronia globosa subsp. *humilis*	.	.	r	1	.	.
Li- *Cissampelos pareira*	.	.	r	1	1	.
Centrosema virginianum	r	.	2	.	.	.
Cissus verticillata	.	r	.	r	.	.

Other species: *Callicarpa resinosa* r in 1; *Passiflora foetida*, *Spermacoce laevis* and *Tillandsia fasciculata* r, *Zuelania guidonia* + in 2; *Bothriochloa pertusa* and *Rochefortia acanthophora* +, *Melochia nodiflora* and *Varronia lineata* r in 3; *Ocotea coriacea* r in 4; *Diospyrus grisebachii* and *Lonchocarpus longipes* +, *Caesalpinia vesicaria* 1, *Erytrhroxylum rotundifolium* and *Capparis flexuosa* r in 5; *Oplonia tetrasticha* +, *Citharexylum ternatum* and *Triopteris rigida* r in 6. Localities: all relevés were collected in the hills at the South of Sierra Maestra, between 20 and 100 m asl; *holotypus* rel. 1.

diospyretosum grisebachii Reyes *subass. nova hoc loco*
(Table 3, *holotypus* rel. 3)

This syntaxon has a more advanced successional stage than the previous. In its arboreal layer, pioneer species reach less thickness; whereas *Sideroxylon salicifolium* and *Eugenia axillaris* are important. In shrub and herbaceous layers, which typically cover from 50 to 80 % and from 40 to 70 % respectively, the number of tree seedlings increases compared to the previous syntaxon. It can be found in the lower slopes of the whole association, since only occasionally exceeds 20 degrees of inclination. The relative height is usually greater than 20 m. Two variants are presented: a *typicum* with a mean of 35.7 species and another variant of *Zapoteca gracilis* richer with 45.2 average, which preferentially occupies the lower parts of the slopes (Table 3).

Sideroxyletum salicifolio-foetidissimi Reyes & Acosta *ass. nova hoc loco*
(Table 4, *holotypus* rel. 1)

Physiognomy & floristic composition. This microphyll semi-deciduous forest was altered by intense selective logging, which has changed its structure, yet maintains its floristic composition. The canopy layer is 7 to 10 m high, so it is considered a low forest. Its cover varies from 30 to 50 % and it has also emerging trees (emergents) of about 15 m. *Sideroxylon foetidissimum* subsp. *foetidissimum* distinguishes for being constant and abundant. *Bursera simaruba* is also constant and locally abundant. *Ocotea coriacea* (sometimes abundant), *Chrysophyllum oliviforme, Sideroxylon salicifolium* and *Exostema caribaeum* (locally abundant) are frequent. Shrub layer is dense and has from 80 to 90 % coverage. They are constant and abundant: *Eugenia* sp. and *Comocladia dentata, Exostema caribaeum, Adelia ricinella, Casearia hirsuta* and *Erythroxylum havanense* (locally abundant) are equally constant. *Ocotea coriacea* (abundant), *Alvaradoa amorphoides, Erythroxylum rotundifolium, Zanthoxylum fagara, Bursera simaruba* and *Chrysophyllum oliviforme* are frequent. The herbaceous layer is sparse and has coverage of 20 to 30 %. S*ideroxylon foetidissimum* subsp. f*oetidissimum, S. salicifolium, Picramnia pentandra, Eugenia* sp., *Varronia globosa, Zapoteca gracilis, Desmodium incanum, Scleria lithosperma* and

Table 3
Canello winteranae - Sideroxyletum salicifolii diospyretosum grisebachii subass. nova var. *typicum* (1-4), var. *Zapoteca gracilis* (5-8)
(*Eugenio-Dipholidion salicifoliae, Eugenio maleolentis-Dipholidetalia salicifoliae, Thrinaceto-Plumerietea obtusae*)

Inclination (º)	.	20	5	35	.	30	20	5
Exposition	NE	NNW	NE	NNE	.	NNE	NW	NNE
Canopy layer- E_3 (%)	50	80	80	80	80	70	80	70
Shrub layer- E_2 (%)	80	50	50	60	70	80	80	60
Herbaceous layer- E_1 (%)	30	40	70	40	90	50	50	40
N. species	38	41	31	33	51	38	51	41
Relevé N.	1	2	3	4	5	6	7	8
Characteristics								
E_3- *Sideroxylon salicifolium*	3	2	3	4	1	4	2	4
Canella winterana	r	r	.	1	r	r	r	+
Acacia macracantha	1	+	+	+	3	+	4	.
Senna atomaria	r	+	+	.	2	+	3	r
Bursera simaruba	+	+	r	+	r	+	+	r
E_2- *Eugenia axillaris*	4	4	3	1	3	4	+	1
Comocladia dentata	1	1	.	1	3	1	r	+
Randia aculeata	+	+	+	+	+	r	+	+
Lantana montevidensis	+	r	r	+	2	1	.	.
Zanthoxylum fagara	+	r	r	.	r	+	r	.
Bourreria virgata	r	.	+	.	+	.	+	1
E_1- *Coccothrinax fragans*	+	+	.	+	1	r	r	+
Croton lucidus	3	2	3	2	.	2	4	1
Lasiacis divaricata	1	1	.	+	+	.	r	+
Paspalum breve	.	1	1	r	3	.	2	1
Scleria lithosperma	2	2	2	1	4	.	.	.
Li- *Tragia hexandra*	+	+	+	+	+	r	.	+
Chiococca alba	1	1	1	1	1	1	+	1
Smilax havanensis	r	r	r	r	1	.	r	+
Stigmaphyllon sagreanum	r	r	r	.	+	r	r	.
Differentials of *trichilietosum hirtae* and *diospyretosum grisebachii*								
E_3- *Sideroxylon foetidissimum* subsp. *foetidissimum*	.	.	r	.	r	r	r	+
Li- *Salacia nipensis*	.	r	.	+	+	r	.	r
Gouania lupuloides	.	1	.	.	.	1	+	1
Differentials of *diospyretosum grisebachii* and *simaroubetosum laevis*								
E_3- *Exostema caribaeum*	+	r	+	2	+	.	r	r
Colubrina elliptica	r	1	2	2	+	.	.	2
Li- *Passiflora suberosa*	r	r	.	r	.	r	r	.
Differentials of *diospyretosum grisebachii*								
E_3- *Diospyrus grisebachii*	r	+	+	r	r	.	+	2
Thouinia patentinervis	.	r	.	r	r	.	r	r
E_2- *Trema micrantha*	.	r	+	.	.	r	r	r
Erithalis fruticosa	1	1	r	+	+	.	.	2
Lantana camara	r	.	.	.	r	r	r	r
E_1- *Spermacoce laevis*	r	r	.	.	+	.	r	+
Bourreria setoso-hispida	.	r	r	r	r	r	.	r
Varronia lineata	+	r	.	.	3	r	+	r
Euphorbia heterophylla	r	r	.	.	r	r	r	r
Li- *Cissus verticillata*	1	+	1	.	+	1	.	.
Differentials of *trichilietosum hirtae*								
E_2- *Erythroxylum havanense*	.	.	.	.	r	+	1	.
Chrysophyllum oliviforme	.	.	.	.	r	1	+	.
E_1- *Urochloa humidicola*	.	1	.	.	1	.	+	.
Casearia hirsuta	.	.	.	+	.	.	+	.
Li- *Serjania diversifolia*	.	.	r	.	.	r	r	.

Relevé N.	1	2	3	4	5	6	7	8
Differential of *simaroubetosum laevis*								
E_3- *Amyris elemifera*	.	.	+	1	.	.	r	.
Differentials of variants								
E_1- *Zapoteca gracilis*	.	.	.	.	+	1	3	2
Varronia globosa subsp. *humilis*	.	.	.	.	+	r	r	.
Heliotropium indicum	.	.	.	.	r	.	r	.
Desmodium incanum	.	.	.	.	r	.	.	r
Desmanthus virgatus	.	.	.	.	r	.	r	.
Melochia nodiflora	.	.	.	.	.	r	r	.
Commelina erecta	.	.	.	.	.	r	r	.
Li- *Distictis rhynchocarpa*	.	.	.	.	+	r	.	1
Triopteris rigida	.	.	.	.	r	r	+	r
Companions								
E_3- *Zuelania guidonia*	.	.	.	r	.	.	.	+
Lonchocarpus longipes	.	.	.	r	+	.	.	+
Cupania glabra	.	r	.	.	.	.	1	.
Ocotea coriacea	.	r	.	.	.	1	.	.
Citharexylum ternatum	+	.	.	.	.	r	r	.
E_2- *Rochefortia acanthophora*	r	.	r	.	.	.	.	r
Caesalpinia vesicaria	r	.	.	.	.	.	1	r
Adelia ricinella	.	r	.	.	.	.	r	.
E_1- *Morinda royoc*	.	r	r	r	r	.	.	.
Erytrhroxylum rotundifolium	r	.	+	+	.	.	.	r
Tournefortia volubilis	.	.	.	r	r	r	.	.
Wissadula amplissima	.	.	r	.	.	r	r	.
Piper richardianum	.	.	.	r	.	.	+	.
Callicarpa resinosa	.	.	.	r	+	.	.	.
Oplonia tetrasticha	1	.	+	.	.	.	r	.
Li- *Centrosema virginianum*	.	r	.	.	+	.	.	r
Pisonia aculeata	+	.	.	.	.	.	+	.
Passiflora foetida	r	.	.	.	.	.	.	r
Ep- *Tillandsia fasciculata*	r	.	.	.	+	.	.	r
Tillandsia recurvata	r	r	.	.	.	.	r	.

Other species: *Cissampelos pareira* and *Turnera ulmifolia* r, *Bothriochloa pertusa* 2 in 1; *Ehretia tinifolia* + in 3; *Lonchocarpus domingensis* r in 6.
Localities: all relevés were collected in the hills at the South of Sierra Maestra, between 20 and 100 m asl; *holotypus* rel. 3.

Commelina elegans are constant. Concerning lianas, *Stigmaphyllon sagreanum, Pisonia aculeata, Gouania lupuloides, Smilax havanensis, Serjania diversifolia* and *Chiococca alba* (locally abundant) are constant. *Selenicereus grandiflorus* and *Tragia hexandra* are frequent. Regarding the epiphytes, only *Tillandsia fasciculata* is frequent. Litter has an L layer of 2 to 2.5 cm, and an F of 0.5 to 1 cm. The H layer is thin and forms a root mat of about a centimetre in some places. The strata and synusiae composition is shown in Table 4.

Ecology and distribution. It shows in "Charco Redondo" geological formation. The soil is brown, very shallow and sometimes rocky up to 80 %. The slope of the surface is small (5 %) and exposure is varied. Altitude varies from 230 to 240 m a.s.l.

Climatically, it is in the area where the influence of Sierra Maestra ends. The mean annual temperature ranges from 24 to 26ºC, with an average maximum of 32 to 34ºC and an average minimum of 18 to 20ºC. Rains in the area are between 1 000 and 1 200 mm, distributed in a rainy season from May to October and a less rainy season from November to April. It rains 40 to 60 days a year. The middling relative humidity is 75 to 80 % and the evaporation varies from 2 000 to 2 200 mm. The study was conducted at the place known as "El Granizo" (x: 565.474, y: 175.766), between Jiguaní and Baire, in the hills of Northern edge of Sierra Maestra.

Table 4
Sideroxyletum salicifolio-foetidissimi ass. nova (*Eugenio-Dipholidion salicifoliae, Eugenio maleolentis-Dipholidetalia salicifoliae, Thrinaceto-Plumerietea obtusae*)

Altitude (m a.s.l.)	230	240	230
Exposure	E	NE	W
Canopy layer- E_3 (%)	30	40	50
Shrub layer- E_2 (%)	80	90	80
Herbaceous layer- E_1 (%)	20	30	20
N. species	54	45	39
Relevé N.	1	2	3
Characteristics			
E_3,1- *Sideroxylon foetidissimum*	2	2	3
Bursera simaruba	1	1	+
$E_{3,2}$- *Sideroxylon salicifolium*	1	1	+
Ocotea coriacea	1	2	1
Exostema caribaeum	1	+	1
Exothea paniculata	.	2	1
$E_{3,2,1}$- *Comocladia dentata*	2	2	1
Cupania glabra	r	+	+
Adelia ricinella	1	+	1
Alvaradoa amorphoides	r	r	+
E_2- *Eugenia* sp.	3	2	4
Guettarda sp.	1	+	.
Senna atomaria	r	.	+
Zanthoxylum fagara	r	.	r
$E_{2,1}$- *Picramnia pentandra*	r	+	+
Casearia hirsuta	+	+	+
Erythtroxylum havanense	2	1	1
E. *rotundifolium*	+	+	+
Varronia globosa	r	r	r
Capparis flexuosa	r	r	.
Coccoloba diversifolia	r	+	.
Erithalis fruticosa	r	r	.
Chrysophylum oliviforme	1	.	+
E_1- *Zapoteca gracilis*	r	+	+
Desmodium incanum	1	+	+
Scleria lithosperma	+	r	1
Commelina elegans	+	r	r
Rivina humilis	.	r	r
Oeceoclades maculata	.	1	+
Lasiacis divaricata	r	r	.
Selenicereus grandiflorus	+	r	.
Agave underwoodi	r	.	r
Urochloa humidicola	r_0	.	$+_0$
Li- *Pisonia aculeata*	1	+	+
Smilax havanensis	1	1	+
Stigmaphyllon sagreanum	1	+	+
Gouania lupuloides	1	r	r
Serjania diversifolia	+	+	r
Chiococca alba	1	1	+
Turbina corymbosa	1	r	.
Tragia hexandra	+	r	.
Lantana camara	r	.	r
Ep- *Tillandsia fasciculata*	r	.	r

Other species: *Cedrela odorata, Clusia rosea, Lonchocarpus domingensis, Colubrina elliptica, Citharexylum caudatum, Waltheria indica, Eupatorium* sp., *Tabebuia* sp., *Melicoccus bijugatus* and *Distictis rhynchocarpa* r, *Colubrina ferruginosa, Hyperbaena longiuscula* and *Morinda royoc* +, *Bothriochloa pertusa* 2 in 1; *Swietenia mahagoni* 2, *Gymnanthes lucida, Drypetes alba* and *Hyperbaena longiuscula* +, *Palicourea* sp., *Canella alba, Vitis tiliaefolia* and *Abrus precatorius* r in 2; *Thouinia* sp. 1, *Rhamnaceae, Zamia* sp. and *Rutaceae* r in 3.
Localities: All relevés collected at the hills of northern Sierra Maestra ('El Granizo'; x: 565.474, y: 175.766), between Jiguaní and Baire; *holotypus* ass. rel. 1.

Oxandro lanceolatae-Burseretum simarubae

Reyes & Acosta *ass. nova hoc loco*
(Table 5, *holotypus* rel. 4)

Physiognomy & floristic composition. Although this vegetation type (mesophyll semideciduous forest) has been exploited for livestock development, the analyzed area has a high degree of naturalness. The canopy layer has a coverage ranging from 50 to 90 % and a height between 7 and 15 m. *Bursera simaruba, Oxandra lanceolada, Cordia gerascanthus* and *Piscidia piscipula* are constant. As frequent: *Sideroxylon foetidissimum* subsp. *foetidissimum, Cupania americana, Guazuma ulmifolia, Spondias mombin, Phyllostylon brasiliensis* and *Lysiloma sabicu*. As less frequent: *Drypetes alba, Gymnanthes lucida, Cupania glabra, Zuelania guidonia, Poeppigia procera, Roystonea regia, Trophis racemosa, Sideroxylon salicifolium* and *Carpodiptera cubensis*. The shrub layer has a coverage ranging from 40 to 90 %. Constant species are: *Erythroxylum havanense* and *Picramnia pentandra*. Are frequent species *Coccothrinax gundlachii* and *Trichilia hirta*. As less frequent *Capparis flexuosa, Casearia sylvestris* var. *myricoides* and *Zapoteca gracilis*. The herbaceous layer is relatively poor. It covers between 30 and 50 % of the surface, and only has *Olyra latifolia* as constant. There are in the category of less frequent: *Oeceoclades maculata, Pharus glaber, Urochloa humidicola* and *Rivina humilis*. Lianas in turn occur as follows: *Serjania diversifolia, Gouania lupuloides, Pisonia aculeata* and *Stigmaphyllon sagreanum* are constant. Epiphytics are underrepresented, showing *Tillandsia recurvata* as constant and *T. usneoides* as oc-

Table 5
Oxandro lanceolatae-Burseretum simarubae ass. nova
var. *typicum* (1-4), var. *Poeppigia procera* (5-9)
(*Guazumo-Cupanion glabrae, Lonchocarpo sericeo-Ceibetalia pentandrae, Guazumo-Ceibetea pentandrae*)

Altitude (m a.s.l.)	160	155	150	145	120	150	195	185	200
Inclination (º)	35	40	30	35	25	30	40	20	32
Exposition	NE	SW	S	NE	SW	NE	ENE	ESE	SE
Canopy layer - E_3 (%)	90	70	50	80	70	75	60	70	80
Shrub layer- E_2 (%)	50	50	80	40	80	90	70	80	60
N. species	27	27	29	25	38	43	32	35	35
Relevé N.	1	2	3	4	5	6	7	8	9
Characteristics									
E_3- *Bursera simaruba*	3	3	2	1	3	2	2	2	2
Oxandra lanceolata	3	2	3	+	3	3	3	2	2
Cordia gerascanthus	2	1	r	.	r	1	+	+	r
Piscidia piscipula	r	r	+	+	1	1	r	.	r
Sideroxylon foetidissimum	1	r	.	.	1	1	1	1	r
Cupania americana	r	.	.	r	r	1	+	1	1
Guazuma ulmifolia	.	.	+	+	r	r	1	1	1
Spondias mombin	r	1	r	r	.	r	.	1	.
Phyllostylon brasiliensis	+	.	2	+	2	1	1	.	.
Lysyloma sabicu	r	r	.	.	r	r	.	+	r
E_2-*Erythroxylum havanense*	r	r	+	r	1	1	r	+	r
Picramnia pentandra	2	r	r	.	1	1	1	r	r
Coccothrinax gundlachii	r	2	r	3	1	+	r	.	.
Trichilia hirta	r	.	r	.	r	r	.	r	r
E_1- *Olyra latifolia*	2	1	1	1	r	2	+	1	+
Oeceoclades maculata	+	.	r	.	r	r	.	r	r
Li- *Serjania diversifolia*	r	r	+	r	r	r	r	r	r
Gouania lupuloides var *lupuloides*	r	+	+	+	+	r	.	1	+
Pisonia aculeata	r	r	+	+	+	r	+	+	.
Stigmaphyllon sagreanum	r	r	r	r	r	r	r	r	r
Ep- *Tillandsia recurvata*	.	r	r	r	r	+	r	r	r
Differentials									
E_3- *Drypetes alba*	1	.	.	.	.	+	2	1	3
Gymnanthes lucida	.	.	.	.	.	2	1	+	1
Cupania glabra var. *glabra*	.	.	.	.	.	1	r	+	r
Zuelania guidonia	.	.	.	.	.	+	+	+	1
Poeppigia procera	.	.	.	.	.	r	r	r	r
Roystonea regia	r	.	.	.	.	r	r	r	r
Trophis racemosa	.	.	.	.	.	r	r	r	r
Sideroxylon salicifolium	.	.	.	.	r	r	r	r	r
Carpodiptera cubensis	.	r	.	.	.	+	r	r	.
Exothea paniculata	.	.	.	.	.	1	1	.	+
Geoffroea inermis	.	.	.	.	.	r	.	1	+
E_1- *Pharus glaber*	.	.	.	.	.	2	2	2	r
Li- *Trichostigma octandrum*	.	.	.	.	.	r	.	r	r
E_3- *Calycophyllum candidissimun*	.	.	r	1	+	.	.	.	.
Collubrina reclinata	.	.	r	1	r	.	.	.	.
E_2- *Capparis flexuosa*	.	r	r	r	r	.	.	.	r
E_1- *Urochloa humidicola*	1	1	2	r	.	.	.	.	.
Chlorophora tinctoria	.	r	+	.	1	.	.	.	.
Eugenia sp.	.	.	+	2	+	.	.	.	.
Commelina elegans	.	.	+	r	r	.	.	.	.
Accompaniers									
E_3- *Prunus myrtifolia*	.	.	.	.	.	.	.	r	r

Relevé N.	1	2	3	4	5	6	7	8	9
Ficus membranacea	.	.	.	.	r	.	.	.	r
E_2- *Casearia sylvestris* var. *myricoides*	r	.	r	.	.	r	r	.	r
Senna atomaria	.	.	r	.	r	.	.	.	.
E_1- *Rivina humilis*	r	.	.	.	r	r	.	r	.
Zapoteca gracilis	.	2	+	.	.	+	+	.	.
Hyperbaena paucinervis	r	.	.	.	.	.	r	.	.
Malpighia suberosa	.	.	.	r	.	.	r	.	.
Croton lucidus	.	1	.	2	.	.	.	.	.
Desmodium incanum	.	.	r	.	r	.	.	.	.
Varronia leptoclada	.	.	.	+	.	.	.	r	.
Petiveria alliacea	.	r	.	.	r	.	.	.	.
Li- *Triopteris rigida*	.	.	.	.	r	r	.	.	.
Passiflora suberosa var. *pallida*	.	.	.	.	r	r	.	.	.
Cissus verticillata	.	.	.	.	r	r	.	.	.
Chiococca alba	.	+	.	.	.	.	.	r	.
Pithecoctenium echinatum	.	.	.	.	r	r	.	.	.
Ep- *Tillandsia usneoides*	r	.	.	.	.	r	.	.	.

Other species: Zanthoxylum martinicensis r in 1; Polypodium polipodiodes and Castela spinosa r and Belairia spinosa + in 2; Selenicereus grandiflorus r in 3; Commelina diffusa + and Ceiba pentandra r in 4; Oplismenus setarius 1 in 5; Hyperbaena sp. r in 6; Chrysophyllum oliviforme r in 7; Palicourea sp. and Tabebuia angustata r in 8.
Localities: All relevés were collected on the southern slope of Sierra Maestra mountain range near the mouth of Turquino River (x: 508.527, y:144.674) in altitude between 120 and 200 m asl; holotypus ass. rel. 4.

casional. The composition of life forms in this syntaxon is as follows: 40.5 % of the species are trees, 24.3 % are shrubs, 13.5 % make up the herbaceous layer, 2.7 % are ferns, 16.2 % are lianas and 4.1 % are epiphytes. Litter is unevenly distributed. The L layer ranges between 1.5 and 3 cm; occasionally more, but in isolated nano-depressions it can reach 15 cm. F and H layers are almost imperceptible, and only the last is observed mixed with the horizon A.

Two variants are presented: *typicum* and *Poeppigia procera*.

typicum variant. It tends to be in greater soil depth. It does not have a well defined differential combination, but there are missing many species observed in the other variant.

Poeppigia procera variant. This syntaxon is preferably found in very shallow soils. The differential combination is very well defined (see Table 5).

Ecology and distribution. The micro-relief is generally flat. It locally presents rocky outcrops on the surface. The slope is also very variable, ranging between 20 and 40 degrees. The exposure has two main trends: one towards east and the other to the south. The most important soil is the reddish brown fersiallitic, whose depth varies from very shallow to moderately deep; well drained, both internal and external. The annual rainfall in this area is 1000 to 1200 mm per year, having two distinct seasons: the less rainy season (November to April) with an average of 300 to 400 mm and the rainy (May to October) with ranges from 800 to 1000 mm. Altitude varies between 120 and 200 m asl. This syntaxon occurs on the southern slope of Sierra Maestra mountain range. At present, the most extensive relicts are located near the mouth of Turquino River (x: 508.527, y:144.674).

Zanthoxylo fagarae - Guazumetum ulmifoliae
Reyes & Acosta *ass. nova hoc loco*
(Table 6, *holotypus* rel. 1)

Physiognomy & floristic composition. This secondary syntaxon is a late successional community known as 'Fiera II'. The canopy layer increases in size along with the development of the forest, from 6-8 m to 10-12 m and 100 % of cover. A real stratification between arboreal and shrub layers is missing in the lower parts. The most abundant species are *Guazuma ulmifolia, Zanthoxylum fagara* and *Senna atomaria; sometimes, Casearia sylvestris* var. *sylvestris* and *Cupania americana*.

Table 6
Zanthoxylo fagarae-Guazumetum ulmifoliae ass. nova (Trichilio-Guazumion ulmifoliae, Oxandro-Burseretalia, Guazumo-Ceibetea pentandrae)

Altitude (m a.s.l.)	225	220	240
Exposition	SE	NE	N
Inclination (º)	20	30	15
$E_3 + E_2$ (%)	100	100	.
E_3- Canopy layer (%)	.	.	100
E_2– Shrub layer (%)	.	.	20
E_1– Herbaceous layer (%)	30	50	60
N. species	38	53	48
Relevé N.	1	2	3
Characteristics			
$E_{3,2}$- *Guazuma ulmifolia*	2	3	4
Zanthoxylum fagara	2	1	+
Senna atomaria	3	3	3
Acacia macracantha	1	r	+
Samanea saman	3	+	1
Casearia hirsuta	+	r	2
Chrysophyllum oliviforme	r	1	r
Cupania americana	r	2	+
Cupania glabra	r	+	+
Chromolaena odorata	r	r	r
Phyllostylon brasiliensis	1	1	.
Leucaena leucocephala	r	r	.
E_2- *Eugenia floribunda*	.	+	+
Picramnia pentandra	.	1	1
Lonchocarpus blainii	.	+	r
Casearia sylvestris var. *sylvestris*	.	3	1
Psidium guajava	.	r	+
E_1- *Erythroxylum havanense*	+	2	3
Rivina humilis	+	r	+
Commelina elegans	r	r	+
Petiveria alliacea	+	r	r
Abutilon sp.	r	r	r
Pavonia typhalea	r	r	+
Trichilia hirta	r	.	1
Spermacoce laevis	+	.	3
Desmanthus virgatus	r	.	+
Phyla nodiflora	r	.	+
Turnera ulmifolia	+	.	r
Rauvolfia tetraphylla	r	.	+
Desmodium incanum	.	r	+
Adiantum trapeciforme	.	2	+
Varronia globosa ssp. *humilis*	r	r	.
Oeceoclades maculata	r	r	.
Li- *Gouania lupuloides*	1	2	+
Pisonia aculeata	1	1	2
Serjania diversifolia	+	2	3
Turbina corymbosa	r	+	1
Trichostigma octandrum	+	.	2
Smilax havanense	r	.	r
Lasiasis divaricata	.	r	+
Cissampelos pareira	.	1	+
Chiococca alba	.	+	r
Tournefortia hyrsutissima	.	1	+
Centrosema sp.	.	r	r
Stigmaphyllum lineare	.	r	r
Stigmaphyllum sagreanum	r	+	.

Other species: *Sterculia apetala* 3, *Harrisia eriophora* +, *Commelina* sp. 1, *Malpighia* sp. and *Passiflora* sp. r in 1; *Guarea guidonia* 2, *Zanthoxylum martinicense* and *Faramea occidentalis* 1, *Cecropia peltata, Citharexylum* sp., *Spondias mombin, Ocotea coriacea, Desmodium* sp., *Roystonea regia, Zyzygium jambos, Urena lobata, Lantana camara, Genipa americana, Abrus precatorius, Hippocratea volubilis* r in 2; *Cedrela odorata* 1, *Poeppigia procera, Spigelia anthelmia, Gastrococos crispa, Melochia nodiflora, Sideroxylon foetidissimum* subsp. *foetidissimum* and *Tragia volubilis* r in 3.
Localities: All relevés were collected in Santiago de Cuba: El Cobre (x: 592.474, y: 156.371); *holotypus ass.* rel. 1.

The herbaceous layer covers between 30 and 60 %. The most abundant species vary locally and they are: *Erythroxylon havanense, Samanea saman* and *Spermacoce laevis*. They are also accompanied by a large number of species with low constancy. This community has a rich characteristic combination, which can be seen in Table 6. Litter is often presented in a dispersed way. Layers L and F are mixed in the structurally less evolved parts, and they are no more than a centimetre. On the contrary, in the more developed parts, the L layer is about 1.5 cm and F, 0.5 cm. H layer is missing.

Ecology and distribution. It lies on rocks from the undifferentiated El Cobre Group. The soils are yellowish brown, very shallow, with sharp sheet erosion and about 5 % of stones on the surface. Such surface is somewhat irregular and preferably occupies the middle and lower basins. It was studied in the environs of the town El Cobre (Santiago de Cuba, x: 592.474, y: 156.371).

Oxandro lanceolatae-Spondiadetum mombin
Reyes & Acosta *ass. nova hoc loco*
(Table 7, *holotypus* rel. 1)

Physiognomy & floristic composition. The canopy layer has two sub-strata: the upper is about 20 m, with emergents of 25 m (sometimes this layer reaches the latter height); and the lower, which contrary is between 8 and 10 m, occasionally 12 to 15 m. Both cover 100% of the surface.

Table 7
Oxandro lanceolatae-Spondiadetum mombin ass. nova (Picramnio-Ocoteion coriaceae, Oxandro-Burseretalia, Guazumo-Ceibetea pentandrae)

Altitude (m a.s.l.)	200	190
Inclination (º)	8	35
Exposition	E	N
Canopy layer- E_3 (%)	100	100
Shrub layer- E_2 (%)	30	20
Herbaceous layer- E_1 (%)	10	10
N. species	62	48
Relevé N.	1	2
Characteristics		
E_3- *Spondias mombin*	3	1
Oxandra lanceolata	3	2
Cecropia peltata	2	1
Ocotea coriacea	2	+
Guazuma ulmifolia	2	1
Guarea guidonia	2	1
Cupania americana	+	+
Cupania glabra	r	1
Roystonia regia	r	r
Sideroxylon foetidissimum subsp. *foetidissimum*	r	r
Ficus membranacea	1	+
Trichilia hirta	+	r
Trophis racemosa	1	r
Zanthoxylum martinicense	2	+
Pseudolmedia spuria	+	3
Dendropanax arboreus	+	3
Zuelania guidonia	+	r
Bursera simaruba	+	r
Geoffroea inermis	r	r
Casearia hirsuta	r	r
E_2- *Calophyllum antillanum*	1	r
Cordia gerascanthus	+	r
Picramnia pentandra	+	r
E_1- *Erythroxylum havanense*	+	r
Chrysophyllum oliviforme	r	r
Psychotria sp.	+	r
Oplismenus setarius	r	r
Lithacne pauciflora	+	+
Pharus glaber	+	r
Oeceoclades maculata	r	r
Adiantum trapeziforme	r	+
Li- *Abrus precatorius*	r	r
Serjania diversifolia	r	+
Pisonia aculeata	r	r
Cissus verticillata	r	r
Trichostigma octandrum	r	r
Gouania lupuloides	r	r
Hyperbaena sp.	r	+
Ep- *Tillandsia fasciculata*	r	r
Tillandsia usneoides	r	2

Other species: *Cojoba arborea, Calycophyllum candidissimum, Thouinia* sp., *Piscidia piscipula, Ficus suffucans, Eugenia* sp, *Casearia sylvestris* var. *sylvestris, Erythroxylum areolatum, Poeppigia procera, Eugenia floribunda, Pavonia spinifex, Petiveria alliacea, Capparis flexuosa, Philodendron lacerum, Pithecoctenium echinatum, Guzmania monostachya, Trichocentrum undulatum, Olyra latifolia* and *Tillandsia recurvata* r, *Clusia rosea, Licaria jamaicensis* and *Anthurium cubense* + in 1; *Drypetes alba* 3, *Buchenavia capitata* (*tetraphylla*) 2, *Prunus occidentalis, P. myrtifolia, Urera baccifera* and *Vitis tiliaefolia* r, *Sapium jamaicense* and *Eugenia axillaris* + in 2.
Localities: All relevés were collected in the middle of Turquino River (x: 506.532, y: 148.853); *holotypus ass.* rel. 1.

This layer is very prolific, its arrangement is shown in Table 7. Coverage of shrub layer range from 20 to 30% and is composed almost entirely of tree species. The herbaceous layer is poor and extends over 10% of the surface. Nearly half of its species are also trees. The humus layers are not well developed. The L layer is between 3.5 and 5 cm thick, covering about 80 % of the surface. F layer is almost imperceptible, scattered among the rocks and gravel, while H layer is missing.

Ecology and distribution. This association is relatively scarce and was studied in the middle of Turquino River (x: 506.532, y: 148.853). It comes near the river, at the bottom of the slope and therefore receives the contribution of its runoff. Besides, being in that landscape position, it is influenced by the night gravitational winds; therefore the water balance is favourable. The weather is warm. The mean annual temperature is around 24ºC. The relative humidity varies between 80 and 85 %. The annual rainfall is between 1400 and 1600 mm, while evaporation ranges from 1500 to 1700 mm. The study area corresponds to rocks from El Cobre Group. The soil is siallitic brown, deep, with gravel in the profile (20 %). It also has 40 to 100 % of rocks on the surface.

DISCUSSION

The Sierra Maestra is the mountain range with the highest peaks of the Cuban archipelago (Pico Turquino with 1972 m a.s.l). That's why it shows

a vegetation altitudinal zonation from the cloud forests in the upper parts up to the semi-deciduous forests and shrubs in the lowest (REYES, 2006, 2011-2012). Interestingly, a zonation with similar altitudes (up to 2000 m a.s.l) was described in the Venezuelan Guayana (HUBER, 1995). The difference in altitudinal floors (zones) is produced by the diversity of ecological conditions caused by altitude, mainly due to moisture dissimilarities and its interrelation with temperature. The semi-deciduous forests that develop in Sierra Maestra below 500 m asl, i.e., in flat, hilly and premontane areas ("floor of semi-deciduous forest and scrub") change in mesophyllous and microphyllous, according to the ecological conditions. Mesophyllou's develop in the most favourable oecotopes (mainly due to moisture), while microphyllous, in drier and oligotrophic areas. They likewise form a syntaxa complex in correspondence with the oecotopes properties (REYES & *al*., 2004a, b). Since the mesophyll semi-deciduous forests - the most anthropised vegetation type of Sierra Maestra - the relicts where it maintains an acceptable structural and floristic composition are scattered. In turn, middle zones are occupied by economic areas and different successional stages. A microphyll semi-deciduous forest with many sclerophyllous species locally presents in stressful environmental conditions, caused by a poor soil development and / or a marked water deficit, often with accentuated wind affection (BORHIDI, 1996).

CONCLUSIONS

According to the wide range of ecological conditions, both geological and / or soil and climatic; variation occurs in mesophyll and microphyll semi-deciduous forests (the last under the most stressful conditions). These forests are different classes. This fact and the syngenetic evolution stages produce great syntaxonomical diversity, since two classes, four orders, five alliances, 11 associations, 12 subassociations and 11 variants are observed.

SYNTAXONOMICAL SCHEME

THRINACETO-PLUMERIETEA OBTUSAE Borhidi 1996
Eugenio-Dipholidetalia salicifoliae (Reyes 2005) Reyes stat. nov.
Eugenio-Dipholidion salicifoliae Reyes 2005
Sideroxyletum salicifolio-foetidissimi Reyes & Acosta ass. nov.
Canello winteranae-Sideroxyletum salicifolii Reyes & Acosta ass. nov.
trichilietosum hirtae Reyes subass. nov.
var. *typicum*
var. *Tournefortia volubilis*
var. *Trema micrantha*
diospyretosum grisebachii Reyes subass. nov.
var. *typicum*
var. *Zapoteca gracilis*
GUAZUMO-CEIBETEA PENTANDRAE Borhidi 1996
Lonchocarpo sericeo-Ceibetalia pentandrae Borhidi & Muñiz 1996
Guazumo-Cupanion glabrae Borhidi & Del Risco in Borhidi 1991
Oxandro lanceolatae-Burseretum simarubae Reyes & Acosta ass. nov.
var. *typicum*
var. *Poeppigia procera*
Oxandro-Burseretalia Borhidi & Muñiz in Borhidi 1991
Trichilio-Guazumion ulmifoliae Reyes 2004
Zanthoxylo fagarae-Guazumetum ulmifoliae Reyes & Acosta ass. nov.

Picramnio-Ocoteion coriaceae Reyes 2004
Oxandro lanceolatae-Spondiadetum mombin Reyes & Acosta ass. nov.

Clarification. Reyes & Acosta (2012) exposed in Lazaroa 33 (pp. 114) the alliance *Bactri cubensis-Pinion cubensis* Reyes 2012, whose spelling must be corrected (Article 41b) to *Bactrio cubensis-Pinion cubensis* Reyes 2012, due to the incorrect vocal union.

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