

FLORISTIC AND ECOLOGICAL DATA ON THE LIANES OF THE BROKOPONDO DISTRICT, SURINAM

J. VAN DONSELAAR

Instituut voor Systematische Plantkunde, Utrecht.

SUMMARY

Lianes, defined as woody climbers and (facultatively) straggling shrubs, were collected in an area of about 1900 square kilometres of the Brokopondo District, in the interior of Surinam. Ten different habitats were distinguished only one of which was intensively sampled, viz. the so-called "high forest", the most luxuriant climax vegetation type in the area.

A total of 132 species were distinguished, 80 of which could be determined with certainty and 15 nearly so. Among the identified species one was new (described since as *Dicranostyles guianensis* A. Mennega, Conv.), and 5 were new records for Surinam, viz. *Sparattanthelium aruakorum* Tutin (Hern.), *Abuta obovata* Diels, *Abuta splendida* Kruk. et Mold., and *Sciadotenia sagotiana* (Eichl.) Diels (all Menisp.), and *Mimosa micracantha* Benth. (Mim.).

The distribution of the species over the 10 habitat types is shown, and the ecology of some of them is discussed more in detail.

1. INTRODUCTION

During his various sojourns in Surinam since 1963 the author, together with his Surinamian assistants, collected lianes in the Brokopondo District, in the interior of the country. This collecting was possible due to the Biological Brokopondo Research Project, but without forming part of it.

The collections were made primarily to provide Dr. A. W. M. Mennega of the Institute for Systematic Botany, Utrecht, with material for her systematic studies on the wood anatomy of tropical American lianes (most collections include a wood sample), secondarily also for general taxonomic and floristic purposes.

The collecting covered an area between the village Berg en Dal, the village Brownsweg, the former Mamadam rapids and Gran Creek basin (now flooded by the artificial Brokopondo Lake), and a point some kilometres to the East of the village of Brokopondo, altogether about 1900 square kilometres (*fig. 1*). Initially the whole of this area, consisting of undulating to hilly land (about 5 to 300 m above sea level) traversed by the Surinam River and its tributaries, was covered largely with several types of primary and secondary forest. However, from 1 February, 1964, when the construction of a barrage dam at Afobaka was completed, 1300 square kilometres of it were converted into the gradually expanding Brokopondo Lake.

The sampling of the area was rather intensive but certainly not exhaustive. Relatively it was concentrated on the "high forest" (see section 3), and, since in the long run the number of new finds in this vegetation gradually decreased,

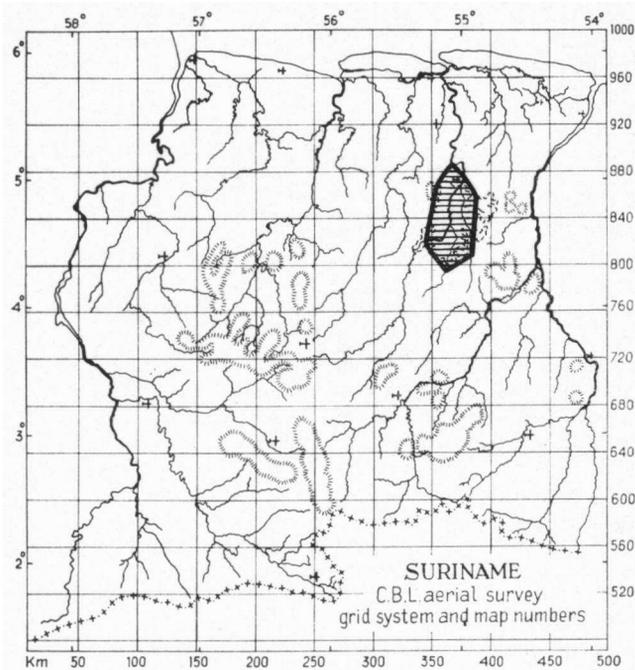


Fig. 1. Location of the sampled area.

Among the collected lianes there was one new *Convolvulacea*, described in the meantime as *Dicranostyles guianensis* A. Menega. For the description three more specimens were available from Cayenne (MENEGA 1968). It may be presumed that at least in this type of habitat the majority of the liane flora was seized.

Lianes are a relatively neglected group, especially from an ecological point of view. This holds for Surinam, too. LINDEMAN & MOOLENAAR (1959) distinguished a type of forest called "liane forest" but in their paper not a single liane species is mentioned; SCHULZ (1960) ignored the group completely. In some other papers dealing with the flora and vegetation of Surinam (see below) some lianes are mentioned only briefly. All this may justify the publication of the following data, which are new though far from detailed.

In this paper the term liane applies to woody climbers and to shrubs that in the present area always or occasionally occur as stragglers.

2. TAXONOMY AND FLORISTICS

Up to March, 1969, we brought together 230 specimens which could be assigned to 132 species. Of these 80 could be named to species with certainty, 15 nearly so; of 34 only the genus or the family could be determined, and 6 remained entirely unidentified. Most difficulties with the identification were due to the fact that many specimens were found only in a sterile state.

The following 6 species (one of slightly doubtful identity) are new records for Surinam:

- Doliocarpus* (cf.) *scandens* (Dill.)
- Sparattanthelium aruakorum* (Hern.)
- Abuta obovata* (Menisp.)
- Abuta splendida* (Menisp.)
- Sciadotenia sagotiana* (Menisp.)
- Mimosa micracantha* (Mim.)

Second and third records were made for *Petastoma patelliferum* (Bign.), *Bauhinia guianensis* (Caes.), *Davilla alata* (Dill.), and *Paullinia* (aff.) *novemalata* (Sapind.).

Beside these species, and those of families not yet treated in the "Flora of Suriname" (PULLE & LANJOUW, ed., 1928-) (*Celastraceae*, *Cucurbitaceae*, *Liliaceae*, *Moraceae*, *Solanaceae*, and *Violaceae*), 9 others were not reported in this flora.

Among the about 42 unidentified species there are very probably many first finds for Surinam.

3. THE SAMPLED HABITATS AND THEIR LIANE FLORA (see table 1)

(1) *High forest*: the most luxuriant type of vegetation in this area. In its most common form it consists of a story of widely scattered emergents and two to three closed stories the tallest of which attains a maximal height of about 40 m. Under the tree layers the saplings of the tree species are rather close-set but the undergrowth is scanty, consisting of ferns, small shrubs, saprophytes, small palms, juvenile specimens of taller species of palms, and other monocotyledons, with the grasses and the sedges evidently in the minority.

This type of forest occupies the optimal sites, like the slopes and the hill tops that are never subject to severe shortage or excess of water. The soil consists of a type of loam.

A subtype that might be called *wet high forest* shows about the same stratification but is more open, allowing more light to penetrate. Consequently the amount of tree saplings is often enormous and the undergrowth dense to very dense. Small shrubs are markedly less common than in normal high forest, but prickly and sharp-edged small palms, sedges, and bromeliads may be dominant.

Wet high forest occurs in flat valleys with poor drainage in which the ground water may reach close to or even exceed the surface for some time during the rainy seasons. The surface shows the beginning of a hogwallow structure. The granular composition of the soil is about the same as in normal high forest.

The high forest (in the following including the wet type) was intensively sampled. The most common liane species was an as yet unidentified *Machaerium* species (Papil.). Other abundant species were *Bauhinia guianensis* (Caes.), *Machaerium aculeatum* (Papil.), *Abuta obovata* (Menisp.), *Moutabea guianensis* (Polygal.), and *Coccoloba marginata* (Polygon.). The following five species were not only abundant but were not collected anywhere but in high forest:

Dolioscarpus surinamensis (Dill.), *Strychnos erichsonii* and *S. mitscherlichii* (Log.), *Dalbergia monetaria* (Papil.), and *Petrea bracteata* (Verb.).

(2) *Riverbank forest* has two to three layers, the tallest up to about 30 m, with scattered emergents (mainly *Ceiba pentandra* Gaertn., Bomb.), up to more than 40 m. It is not more open than normal high forest. The undergrowth is poor in species and may be dominated by the fern *Adiantum latifolium* Lam. No saprophytes were observed.

During the long rainy season this type of forest is periodically inundated by the river.

In the riverbank forest too, *Bauhinia guianensis* (Caes.) was a common species.

(3) *Creek forest* is two-storied. Along the larger creeks it resembles riverbank forest, with *Ceiba* as emergent tree, along the smaller creeks deeper in the forest it may resemble wet high forest. The undergrowth may be rich in *Adiantum latifolium* and in small palms; no saprophytes were observed here either. In the long rainy season creek forest is flooded.

This type of forest was poorly sampled. The new species *Dicranostyles guianensis* was collected in a narrow strip of creek forest resembling wet high forest.

(4) *Savanna forest* consists of two stories of trees (max. 30 and 20 m, respectively) the lower one of which is partly made up of treelets connecting savanna forest floristically with savanna wood (5). Savanna forest is thinner than high forest and may have a somewhat denser undergrowth, sometimes resembling that of wet high forest.

The habitat has in any case a period of water shortage, in some cases also a period of water excess. The soil is essentially a sandy loam.

Dolioscarpus calinea (Dill.), *Coccoloba marginata* (Polygon.), and *Moutabea guianensis* (Polygal.) were common in this type of forest.

(5) *Savanna wood* has one tree layer not exceeding a height of 20 m, usually much lower. The number of species is relatively small, the bulk of the vegetation being made up of thin and close-set treelets belonging to about five species. The undergrowth, also poor in species, may be locally dense in which case it consists largely of sedges.

This vegetation type occupies the most adverse sites where tree growth is still possible. It is subject to an annual period of more or less severe drought, in some instances also periods with waterlogged soil. In accordance with the latter condition the surface may have a hogwallow structure. The soil usually consists of sandy loam or loamy sand.

Savanna wood is poor in lianes. The most common species were the same as in savanna forest.

The nomenclature of the vegetation types 1-5 is derived from LINDEMAN & MOOLENAAR (1959); a more detailed description will be given van VAN DONSELAAR (in prep.).

(6) *Secondary vegetation types*, mostly representing stages in the regeneration to high forest of abandoned culture plots, have very diversified characteristics depending in the first place on their age.

DATA ON LIANES OF THE BROKOPONDO DISTRICT, SURINAM

Table 1. The species and their ecological range.

1-10: see section 3.

a: not in the "Flora of Suriname"

b: first record for Surinam

c: second or third record for Surinam

	1	2	3	4	5	6	7	8	9	10
ANNONACEAE										
<i>Annona haematantha</i> Miq.	x	.	.	.	.	.	.	.	.	.
<i>Guatteria scandens</i> Ducke	x	x	.	.	x	.	.	.	.	.
APOCYNACEAE										
<i>Prestonia surinamensis</i> Müll. Arg.	.	.	.	.	.	.	.	.	x	.
ARACEAE										
1 sp. indet.										
BIGNONIACEAE										
<i>Adenocalymma inundatum</i> Mart. ex DC.										
var. <i>surinamense</i> Bur. et K. Schum.	x	.	.	.	.	.	.	.	.	.
<i>Arrabidaea florida</i> DC.	x	.	.	.	.	.	.	.	.	.
<i>A. vs mollis</i> (Vahl) Bur. et K. Schum.	x	.	.	.	.	.	.	.	.	a
<i>Cydista aequinoctialis</i> (L.) Miers	.	.	.	.	.	.	.	.	x	.
<i>Distictella elongata</i> (Vahl) Urb.	x	.	.	.	.	.	.	.	.	.
<i>D. racemosa</i> (Bur. et K. Schum.) Urb.	.	.	.	.	.	.	x	x	.	.
<i>Memora flaviflora</i> (Miq.) Pulle	x	.	.	.	.	.	.	.	.	.
<i>M. schomburgkii</i> (DC.) Miers	.	x	.	.	.	.	.	.	.	.
<i>Petastoma patelliferum</i> (Schlecht.) Miers	.	.	.	.	.	x	.	.	.	c
<i>Pseudocalymma aliaceum</i> (L.) Sandw.	x	.	.	.	.	.	.	.	.	.
3 spp. indet.										
BORAGINACEAE										
<i>Tournefortia ulei</i> Vaupel	.	.	.	.	.	.	x	.	.	.
CAESALPINIACEAE										
<i>Bauhinia guianensis</i> Aubl.	x	x	.	.	.	x	.	.	.	c
<i>Cassia latifolia</i> G. F. W. Meyer	.	.	.	.	.	x	.	.	.	.
<i>C. quinquangulata</i> L. C. Rich.	.	.	.	.	.	.	x	.	.	.
5 spp. Caes. + Pabil. indet.										
CELASTRACEAE										
<i>Cheiloclinium cognatum</i> (Miers) A. C. Smith	x	.	.	.	.	.	.	.	.	a
<i>Hippocratea volubilis</i> L.	x	.	.	.	.	.	.	.	.	.
<i>Prionostemma aspera</i> (Lam.) Miers	x	.	.	.	.	.	.	.	.	.
<i>Salacia multiflora</i> (Lam.) DC.	x	.	.	.	.	.	.	.	.	.
5 spp. indet.										
COMBRETACEAE										
<i>Combretum laxum</i> Jacq.	.	x	.	.	.	.	.	.	.	.
<i>C. rotundifolium</i> L. C. Rich.	.	.	.	.	.	.	.	.	x	.
CONNARACEAE										
<i>Cnestidium guianense</i> Schellenb.	x	.	.	.	.	.	.	.	.	.
<i>Rourea</i> cf. <i>cuspidata</i> Benth.	x	.	.	.	.	.	.	.	.	a
<i>R. cf. rectinervia</i> A. C. Smith	x	.	.	.	.	.	.	.	.	a
<i>R. surinamensis</i> Miq.	.	.	.	.	.	.	.	.	x	.
3 spp. indet.										
CONVOLVULACEAE										
<i>Aniseia martinicensis</i> (Jacq.) Choisy	.	.	.	.	.	.	.	.	x	.
<i>Bonamia maripoides</i> Hall. f.	.	.	.	.	.	.	x	x	.	.
<i>Dicranostyles guianensis</i> A. Mennega	.	.	x	.	.	.	.	.	.	a b

	1	2	3	4	5	6	7	8	9	10
<i>Maripa</i> cf. <i>glabra</i> Choisy	x	.	.	.	.	.	.	.	.	.
<i>M. reticulata</i> Ducke	.	.	.	.	x	.	.	.	.	.
<i>M. scandens</i> Aubl.	.	.	.	.	.	.	x	.	.	.
<i>M. violacea</i> (Aubl.) v. Ooststr. ex Lanj. et Uitt.	x	.	.	.	.	.	.	.	.	a
3 spp. indet.										
CUCURBITACEAE										a
1 sp. indet.										
DICHAPETALACEAE										
<i>Dichapetalum glabrum</i> (Vahl) Prance	x	.	.	.	.	.	.	.	.	.
<i>D. rugosum</i> (Vahl) Prance	x	.	.	.	.	.	.	.	.	.
DILLENIAEAE										
<i>Davilla alata</i> (Vent.) Briq.	x	.	.	x	.	.	.	.	.	c
<i>D. aspera</i> (Aubl.) R. Ben.	.	.	.	.	.	.	x	x	.	x
<i>Doliocarpus calinea</i> J. F. Gmel.	.	.	.	x	x	.	x	.	.	.
<i>D. cf. dentatus</i> (Aubl.) Standley	x	.	.	.	.	.	.	.	.	.
<i>D. cf. guianensis</i> (Aubl.) Gilg	x	.	.	.	.	.	.	.	.	.
<i>D. macrocarpus</i> Mart.	.	.	.	.	x	.	.	.	.	.
<i>D. cf. scandens</i> (Aubl.) Gilg	x	.	.	.	.	.	.	.	.	a b
<i>D. surinamensis</i> Lanj.	x	.	.	.	.	.	.	.	.	.
<i>Tetracera asperula</i> Miq.	.	.	.	.	.	.	x	.	.	x
2 spp. indet.										
EUPHORBIACEAE										
<i>Acalypha diversifolia</i> Jacq.	x	.	.	.	.	.	.	.	.	.
<i>A. scandens</i> Benth.	x	.	.	.	.	.	.	.	.	.
2 spp. indet.										
GNETACEAE										
<i>Gnetum nodiflorum</i> Brongn.	x	.	.	.	.	.	.	.	.	.
HERNANDIACEAE										
<i>Sparattanthelium aruakorum</i> Tutin	x	.	.	.	.	.	.	.	.	a b
1 sp. indet.										
LILIACEAE										a
<i>Smilax schomburgkiana</i> Kunth	.	x	.	.	.	.	.	.	.	.
2 spp. indet.										
LOGANIACEAE										
<i>Strychnos erichsonii</i> Rich. Schomb.	x	.	.	.	.	.	x	.	.	.
<i>S. medeola</i> Sagot	x	.	.	.	.	.	.	.	.	a
<i>S. mitscherlichii</i> Rich. Schomb.	x	.	.	.	.	.	.	.	.	a
MALPIGHIACEAE										
<i>Heteropteris nervosa</i> Juss.	.	.	.	.	.	.	.	.	x	.
<i>Hiraea chrysophylla</i> Juss.	.	.	.	.	.	.	.	.	x	.
<i>Stigmaphyllon fulgens</i> (Lam.) Juss.	.	.	.	.	.	.	.	x	.	.
<i>Tetrapteris squarrosa</i> (Griseb.) Griseb.	x	.	.	.	.	.	.	.	.	x
MARCGRAVIACEAE										
<i>Norantea guianensis</i> Aubl.	x	.	.	x	.	.	x	.	.	.
2 spp. indet.										
MENISPERMACEAE										
<i>Abuta</i> cf. <i>barbata</i> Diels	x	.	.	.	.	.	.	.	.	.
<i>A. candollei</i> Tr. et Pl.	x	.	.	.	.	.	.	.	.	.
<i>A. grandifolia</i> (Mart.) Sandw.	x	.	.	.	.	x	.	.	.	a

DATA ON LIANES OF THE BROKOPONDO DISTRICT, SURINAM

	1	2	3	4	5	6	7	8	9	10
<i>A. obovata</i> Diels	x	.	.	x	x	.	.	.	.	a b
<i>A. splendida</i> Kruk. et Mold	x	.	.	.	.	.	.	.	.	a b
<i>Sciadotenia sagotiana</i> (Echl.) Diels	.	.	.	.	.	x	.	.	.	a b
1 sp. indet.										
MIMOSACEAE										
<i>Mimosa micracantha</i> Benth.	.	.	.	.	.	.	x	x	.	a b
<i>M. myriadena</i> Benth.	.	.	.	.	.	.	.	x	x	.
MORACEAE										a
<i>Ficus pertusa</i> L.f.	.	x	.	.	.	.	.	.	.	.
OLACACEAE										
<i>Heisteria scandens</i> Ducke	x	.	.	.	.	.	.	.	.	.
PAPILIONACEAE										
<i>Dalbergia monetaria</i> L.f. (= <i>D. volubilis</i> (L.) Urb. var. <i>cuspidigera</i> Hoejne)	x	.	.	.	.	.	.	.	.	.
<i>Lonchocarpus</i> cf. <i>spiciformis</i> Mart. ex Benth.	x	.	.	.	.	.	.	.	.	.
<i>Machaerium aculeatum</i> Raddi	x	.	.	.	.	x	.	.	.	a
<i>M. vs compressicaule</i> Ducke	x	.	.	.	.	.	.	.	.	a
<i>M. aff. ferox</i> (Benth.) Ducke	.	.	.	.	.	x	.	.	.	.
<i>M. leiophyllum</i> (DC.) Benth.	x	x	.	.	.	.	.	.	x	.
<i>M. quinatum</i> (Aubl.) Sandw. spp. indet.: see <i>Caes.</i>	.	.	.	.	.	.	.	.	x	.
PASSIFLORACEAE										
<i>Passiflora glandulosa</i> Cav.	x	.	.	.	.	x	.	x	.	.
<i>P. vespertilio</i> L.	.	.	.	.	.	.	.	.	x	.
POLYGALACEAE										
<i>Moutabea guianensis</i> Aubl.	x	.	.	x	x	.	.	.	.	.
<i>Securidaca paniculata</i> L. C. Rich.	.	.	.	.	.	.	.	.	x	.
POLYGONACEAE										
<i>Coccoloba excelsa</i> Benth.	.	.	.	.	.	.	.	.	x	.
<i>C. vs. gymnorrhachis</i> Sandw.	x	.	.	.	.	.	.	.	.	.
<i>C. marginata</i> Benth. 2 spp. indet.	x	.	.	x	x	.	.	.	.	.
RHAMNACEAE										
<i>Gouania blanchetiana</i> Miq.	.	.	.	.	.	.	x	.	.	.
RUBIACEAE										
<i>Malanea sarmentosa</i> Aubl. 1 sp. indet.	x	.	.	.	.	.	.	.	.	.
SAPINDACEAE										
<i>Paullinia dasygonia</i> Radlk.	.	.	.	.	.	.	.	.	x	.
<i>P. aff. novemalata</i> Uitt.	x	.	.	.	.	.	.	.	.	c
<i>P. vs. pinnata</i> L.	x	.	.	.	.	.	.	.	.	.
<i>P. cf. rufescens</i> L. C. Rich.	x	.	.	.	.	.	.	.	.	.
<i>P. spicata</i> Benth.	.	.	.	.	.	.	.	.	x	.
<i>Urvillea ulmacea</i> H.B.K.	.	.	.	.	.	.	x	.	.	.
SOLANACEAE										a
<i>Solanum coriaceum</i> Dunal	.	.	.	.	.	.	.	.	x	.
TRIGONIACEAE										
<i>Trigonia hypoleuca</i> Griseb.	.	.	.	.	.	.	.	.	x	.
<i>T. microcarpa</i> Sagot ex Warm.	.	.	.	.	.	x	.	.	x	.
VERBENACEAE										
<i>Petrea bracteata</i> Steud.	x	.	.	.	.	.	x	.	.	.

	1	2	3	4	5	6	7	8	9	10	
VIOLACEAE											a
<i>Corynostylis arborea</i> (L.) Blake	.	.	.	.	.	.	.	.	x	.	
INDET. 6 spp.											
Number of identified species	52	7	1	6	7	10	15	7	16	3	
Number of unidentified species	34	-	4	-	1	2	-	1	-	-	
Total number of species	86	7	5	6	8	12	15	8	16	3	

In a stretch of secondary forest ten years old the only liane species encountered were *Bauhinia guianensis* (Caes.), *Abuta grandifolia* (Menisp.), *Machaerium aculeatum*, and *M. aff. ferox* (Papil.).

The other species listed in *table 1* were collected from thickets in the village of Brokopondo where in some places they covered the whole vegetation, together with the herbaceous twiners *Odontadenia nitida* (Vahl) Müll. Arg. var. *oblonga* Müll. Arg. (Apoc.) and *Passiflora auriculata* H.B.K. (Pass.).

(7) *Margins of forest and wood.* As a rule high forest does not have a natural border. There is generally a gradual transition to another type of woody vegetation that borders upon a more or less open vegetation. In the area under consideration the series high forest – savanna forest – savanna wood – savanna with bushes was studied.

Common lianes on the margin of the savanna wood were *Davilla aspera*, *Doliocarpus calinea*, and *Tetracera asperula*, all *Dilleniaceae*.

The aspect of an artificial edge of high forest depends largely on its age. Along a newly formed border several species of the high forest itself may temporarily come to the fore, like *Strychnos erichsonii* (Log.), *Norantea guianensis* (Marcgr.), and *Petrea bracteata* (Verb.). In the beautifully closed older high forest border around the village of Brokopondo the following species were observed: *Distictella racemosa* (Bign.), *Tournefortia ulei* (Bor.), *Cassia quinquangulata* (Caes.), *Mimosa micracantha* (Mim.), *Gouania blanchetiana* (Rhamn.), and *Urvillea ulmacea* (Sapind.). Hardly any were encountered in other kinds of habitat.

(8) *Open roadsides.* Some species of secondary habitats and artificial forest borders were observed to extend as creepers onto the adjoining ground, e.g., *Distictella racemosa* (Bign.), *Bonamia maripoides* (Conv.), and *Passiflora glandulosa* (Pass.). In this habitat *Mimosa myriadena* (Mim.) locally showed optimal development, forming bushlike concentrations with long creeping stems all over the denuded roadside.

(9) *Riversides.* A habitat particularly rich in lianes is formed by forest borders on riverbanks. Here the most common species was *Cydista aequinoctialis* (Bign.), followed by *Aniseia martinicensis* (Conv.), none of which was found anywhere else in this area, just like most of the other riverside liane species.

Particularly in this habitat the lianes were accompanied by herbaceous twiners, forming together a closed curtain: e.g., *Mesechites trifida* (Jacq.) Müll. Arg. and *Odontadenia macrantha* (R. et S.) Mgf. (Apoc.), *Pleonotoma clematis* (H.B.K.) Miers (Bign.), *Ipomoea tiliacea* (Willd.) Choisy (Conv.), and *Cissus sicyoides* L. (Vit.).

(10) *Savanna bushes* varying in size from a few to more than 100 square metres were present in the natural savanna adjoining the savanna wood. Many of their shrubs belonged to species present as treelets in the savanna wood.

In savanna bushes some liane species may assume the form of shrubs. This, however, was not observed in this area. The most frequent species, *Tetracera asperula* (Dill.), kept trailing, as did the other two, *Davilla aspera* (Dill.) and *Tetrapteris squarrosa* (Malp.).

4. NOTES ON SOME OF THE SPECIES

Two of our riverside species, viz. *Cydistia aequinoctialis* (Bign.) and *Corynostylis arborea* (Viol.), were reported by LINDEMAN (1953) from swamps and swamp wood, respectively, in northern Surinam.

Rourea surinamensis (Conn.), another of our riverside species, was found elsewhere in several types of savanna bushes on loamy soil (VAN DONSELAAR 1965).

LINDEMAN (1953) reported three species collected by us in the Brokopondo area only in high forest from quite different habitats in the North of the country, viz. *Hippocratea volubilis* (Celastr.) on riverbanks and in strand scrub, *Dalbergia monetaria* (Papil.) on riverbanks, and *Paullinia pinnata* (Sapind) in scrub and low wood in swamps and on moist soil. According to TEUNISSEN & WILDSCHUT (1970) *Gnetum nodiflorum* (Gnet.) may also be found in savanna bushes on several types of soil.

Relatively much is known about the species belonging to or occurring in savanna and related habitats. First three *Dilleniaceae* should be mentioned; see HEYLIGERS (1963), VAN DONSELAAR (1965), KRAMER & VAN DONSELAAR (1968), and TEUNISSEN & WILDSCHUT (1970).

Davilla aspera is a species of borders, in particular on dry loamy soils. See *table 1*. Heyligers and van Donselaar reported it as locally abundant on forest borders around anthropogeneous savannas. In this connection a savanna vegetation-type was described, called *Trachypogon* vegetation – *Davilla* variant by the first author, *Mesoseto-Trachypogonetum davilletosum* by the second. This species had already been found in and around savanna bushes of several types on loamy soils. However, Teunissen & Wildschut found it in the savanna bushes on the white-sand caps of the hills in the loamy Sabanpasi savanna area.

Doliocarpus calinea, in the Brokopondo area only found in savanna forest, savanna wood, and along the border of the latter, was generally reported from the same habitats elsewhere in the country, and also from savanna scrub and bushes on white and coloured sand as well as on loamy soils. It was, however, not found on anthropogeneous savannas, in bushes that are mere remnants of the former forest, or forerunners its of regeneration.

In the Brokopondo area *Tetracera asperula* was found on the margin of savanna wood and in savanna bushes. Elsewhere in the country it is known from the latter habitat. Heyligers found it in fragments of savanna wood and in savanna scrub on white sand; according to LINDEMAN (1953) it may even be found in high forest.

Tetrapteris squarrosa (Malp.), found in high forest and in savanna bushes, was reported earlier only from savanna bushes in natural savannas on loamy soils (VAN DONSELAAR 1965, TEUNISSEN & WILDSCHUT 1970).

The straggling shrub *Coccoloba marginata* (Polygon.) was observed as one of the most common species in high forest, savanna forest, and savanna wood. From the Sabanpasi savanna area TEUNISSEN & WILDSCHUT (1970) described a type of savanna bushes which they called Community of Marlierea montana and Scleria cyperina – variant with *Coccoloba marginata* and *Rhynchospora cyperina*, in which *Coccoloba* was optimally developed. According to the authors this type, occurring on loamy soil, perhaps took the place of burned savanna wood or savanna forest.

ACKNOWLEDGMENTS

Thanks are due to Mr. E. M. C. Helstone for his essential part in the field work; to Dr. Alberta M. W. Mennega and several other staff members of the Institute for Systematic Botany, Utrecht, for identifying most of the species; to Dr. K. U. Kramer for correcting the English text.

REFERENCES

- DONSELAAR, J. VAN (1965): An ecological and phytogeographic study of northern Surinam savannas. *Wentia* 14: 1–163. Also *The Veg. of Sur. IV. Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 211.
- (in prep.): Botany. Ch. 5 in J. H. WESTERMANN (ed.): Biological Brokopondo Research Report 1963–1969. *Uitg. Natuurwetensch. Studiekring Sur. Ned. Antillen*. Also *Meded. Bot. Mus. Herb. Rijksuniv. Utrecht*.
- HEYLIGERS, P. C. (1963): Vegetation and soil of a white-sand savanna in Suriname. *Verhand. Kon. Ned. Akad. Wetensch. Amsterdam afd. Natuurk. ser. 2*, 54 (3): 1–148. Also *The Veg. of Sur. III. Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 191.
- KRAMER, K. U. & J. VAN DONSELAAR (1968): A sketch of the vegetation and flora of the Kappel savanna near Tafelberg, Suriname, I and II. *Proc. Kon. Ned. Akad. Wetensch. Amsterdam C*, 71: 495–524. Also *The Veg. of Sur. VI (2). Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 309.
- LINDEMAN, J. C. (1953): *The vegetation of the coastal region of Suriname*. (135 pp.) Utrecht, Kemink. Also *The Veg. of Sur. I (1). Meded. Bot. Mus. Herb. Rijksuniv. Utrecht*. 113.
- & S. P. MOOLENAAR (1959): *Preliminary survey of the vegetation types of northern Suriname*, (45 pp.) van Eedenfonds, Amsterdam. Also *The Veg. of Sur. I (2), Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 159.
- MENNEGA, A. M. W. (1968): On two new species and one new variety of *Dicranostyles* (Convolvulaceae) collected in the Guianas and Amazonia. *Proc. Kon. Ned. Akad. Wetensch. Amsterdam C*, 71: 550–556. Also *Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 310.
- PULLE, A. A. & J. LANJOUW (ed.) (1928–): *Flora of Suriname*. Amsterdam, Koninklijk Instituut voor de Tropen. Since 1964: Leiden, E. J. Brill.
- SCHULZ, J. P. (1960): Ecological studies on rain forest in Northern Suriname. *Verhand. Kon. Ned. Akad. Wetensch. Amsterdam afd. Natuurk. ser. 2*, 53 (1): 1–267. Also *The Veg. of Sur. II. Meded. Bot. Mus. Herb. Rijksuniv. Utrecht* 163.
- TEUNISSEN, P. A. & J. T. WILDSCHUT, (1970): Vegetation and flora of the savannas in the Brinckheuvel Nature Reserve, Northern Suriname. *Proc. Kon. Ned. Akad. Wetensch. Amsterdam C*. Also *The Veg. of Sur. VI (4). Meded. Bot. Mus. Herb. Rijksuniv. Utrecht*. in the press.