**Botany.** — "*Lindeniopsis. A new subgenus of the Rubiaceae*". By Dr. TH. VALETON (Buitenzorg).

During an official journey through the island of Billiton in March 1907 Mr. HAM, Inspector of Forests in the Dutch East Indies, gathered a small, but not unimportant herbarium collection, which he gave over to me for study.

The importance of this collection mainly depends on the fact, that it was formed on lands, which are extremely rare in the Indian Archipelago, and are as yet florally almost unknown. These are the socalled "*padang*" lands (compare VERBEEK in Jaarboek Mijnwezen 1897, p. 60 and 61). The soil of these lands consists of young, loose sediments of recent origin, namely quartz sand and clay, both often containing iron and manganese, the soil, however, owes its peculiar character to the presence of a mineral, which the Chinese call *fo sau kak* and which consists of quartz sand, which has been moulded together by organic acids into a pretty firm, dark brown sand-stone.

"These *padang* lands are characterized by a sparse and peculiar vegetation, in consequence of the small permeability to water of the "*fo sau kak*", so that level padang-lands are frequently inundated after heavy rains, and the roots of the plants, which can only penetrate with difficulty into the hard "*fo sau kak*", rot and die off." (VERBEEK l.c.).

Besides in Billiton, these padang soils are also found in Banka between Doeren and Boekit (VERBEEK l.c.). In other parts of the Archipelago they do not appear to be known. The most important of these lands are found in the north and north-east of the island, between Boeding and Manggar, and were studied botanically by Mr. HAM.

From verbal information and from the journal of the voyage, which Mr. HAM kindly lent me for perusal, I obtained the following data:

The appearance of the padang soils is not everywhere the same. Mr. HAM distinguishes: 1 *grass padang*, often rich in flint, where grasses and sedge-grasses predominate, 2 *fern padang* where ferns (*Pteris aquilina L.*, *Nephrolepis acuta* PRESL.), form almost the whole vegetation, being only mixed with *Xyris microcephala* HASSK, *Fimbristylis* spec., *Melastoma* spec., *Calophyllum pulcherrimum* WALL., *Psychotria viridiflora* BL. and 3 *sand padang*, where the soil consists of blinding white quartz sand. The white layer varies in thickness from $^1/_2$—5 centimetres; under this the soil is grey, obviously through humus, and sometimes it is grey immediately below the

surface, when fine, black humus or mosses occur at the bottom. The vegetation nowhere forms a compact mass or sod. Groups of low and high shrubs, generally with higher shrubs or small trees in the middle, alternate with a lower vegetation, which is also always limited to separate spots or clumps, so that the white sand can everywhere be seen through it, and in many places even has the upper hand. Of the plants which were collected here, the following are mentioned as characteristic:

*Drosera Burmanni* VAHL. in the dampest parts, forming dark-red areas, when seen from a distance, often placed on small columns of sand; *Fimbristylis* spec., *Rhynchospora* spec., *Xyris microcephala* HASSK. and *Xyris bancana* MIQ.; more rarely *Salomonia oblongifolia* D.C., *Lindernia stemodioides* MIQ., *Thuarea sarmentosa* PERS.

Of the shrubs the following are prominent: *Baeckea frutescens* L., which in low-lying padangs forms more than half of the vegetation, and reminds one very much of the *Calluna* of European heaths, *Jambosa buxifolia* MIQ., *Leptospermum flavescens* SM., *Leucopogon malayanus* JACK., *Vaccinium malaccense* WIGHT, *Cratoxylon glaucum* KORTH., *Calophyllum pulcherrimum* WALL., *Timonius* spec., *Garcinia bancana* MIQ., *Syzygium variifolium* MIQ., the last three arborescent.

On the lowest lying padangs south of Manggar and near Boeding, where *Baeckea frutescens* and *Fimbristylis* spec. formed the chief vegetation, *Ischaemum* spec., *Archytaea Vahlii* CHOISY, *Wormia suffruticosa* GRIFF., *Melaleuca minor* SM. and a non-determinable species of *Eugenia* were also noticed; in addition mosses and lichens. Further there were collected in these localities *Rhodomyrtus tomentosa* WIGHT, *Nepenthes* spec., *Tristania obovata* R. BR., *Dischidia* spec. *Bromheadia palustris* LINDL. [Orchidea], *Isachne australis* R. BR. *Burmannia bancana* MIQ., a species of *Lucinaea*, which is probably new, and finally a new Rubiacea, about which I wish to make a communication here.

The above-described formation has in consequence of the predominant occurrence of the Calluna-like *Baeckea frutescens* a superficial resemblance to the sandy and boggy heaths of Northern Europe. Already JUNGHUHN, in his description of the Battak countries I, p. 158, refers to an Erica, which above the forest zone characterizes the alpine flora in company of other woody Myrtaceae, and he doubtless means *Baeckea frutescens*. From Southern China and the Philippines to New-Guinea, where BECCARI found the plant at Goldfinck Bay (altitude?) and WICHMANN on the G. Siëp at about 800 Meters, the area of distribution of this species extends; it is wanting in Java and its nearest allies (numerous *Baeckea*-species) inhabit Australia.

Everywhere it is characteristic of physiologically dry plateaus and rarely descends to the low-lying plains, as in the present case. *Drosera* and the *Cyperaceae* also tend to emphasize the resemblance to heaths.

Through the other vegetation, of which the sclerophyllous and sclerocarpous Myrtaceae form an important constituent, this formation, however, approximates much more to that which was called by SCHIMPER (Pflanzengeogr. p. 538) "*Hartlaubformation*" and of which he describes a number of regions, occurring round the Mediterranean, in California, in Chili, in South-Africa and in South-Australia. These regions are all characterized by dry and hot summers, alternating with moist winters. Hence climatologically there is little resemblance between these and the padang-formation of Banka and Biliton, where it rains almost the whole year. As regards the condition of the soil, there is, on the other hand, a resemblance with the South-Australian "*scrublands*", described by SCHOMBURGK in his Flora of South-Australia 1875. (See SCHIMPER l. c. p. 559).

The dominant influence of the soil on the character of the formation cannot here be doubted, this influence, which according to SCHIMPER is relatively rare in the Tropics, has been but little investigated. (See SCHIMPER l. c. p. 405. Edaphische Wirkungen in den Tropen).

The padang-formation does not correspond even roughly with any of the vegetation-pictures and formations, mentioned in that chapter. As has been mentioned, it can only, to some extent, be compared with tropical alpine floras and with the "*Hartlaubformation*".

The plants, collected by Mr. HAM, probably do not represent a complete, but nevertheless give a very typical picture of this rather poor flora. As regards the distribution of these plants, it is at once noticeable, that not a single one of these occurs in Java, with the exception of two wide-spread grasses, which have crept in from the beach, namely *Thuarea sarmentosa* and *Isachne australis*, and with the exception of the two pantropic ferns and of *Psychotria viridiflora*, which plants were, moreover, not found in the typical sand padang. A wide distribution from Malacca to Australia through the northern part of the Archipelago, but excluding Java (probably up to and including Timor), is observed in the case of *Baeckea frutescens*, and also of *Leptospermum flavescens*, *Rhodomyrtus tomentosa*, *Melaleuca minor*, *Drosera Burmanni*, *Salomonia oblongifolia* and *Bromheadia palustris*. From Malacca and Borneo are known: *Calophyllum pulcherrimum*, *Garcinia bancana*, *Vaccinium malaccense*, *Leucopogon malayanus*, *Archytaea Vahlii*, *Wormia suffruticosa*. From Banka

and Billiton only the following are known: *Jambosa buxifolia, Syzygium variifolium, Tristania obovata, Schima bancana, Xyris bancana* and *Lindernia* (Vandellia) *stemodioides*; *Cratoxylum glaucum* and a *Lucinaea* spec. nova were only known from Borneo. The as yet undetermined *Eugenia, Nepenthes, Dischidia* and *Ischaemum*, and a few others, are doubtful in this respect.

Endemic, as far as our present knowledge extends, is only the new species, now to be described. Unfortunately data are wanting about the dimensions and habit of this plant, but it belongs to the suffructicose inhabitants of the low sand-padangs, referred to above; it is among the species, poor in individuals, and it reaches a height of $^3/_4$—2 metres. The rod-like erect branches which are often 60 centimetres long, and bear at their tops the crowded inflorescences with grey hairs, the small stiff, aciculate, erect leaves, all these characters indicate a strongly xerophytic nature.

At the first examination this species seemed to me to constitute a completely new genus. It belongs to the tribe *Cinchoneae* of the sub-order *Cinchonoideae* (K. SCHUMANN), and to the sub-tribe *Hillieae*. On applying the analytical key, prepared by K. SCHUMANN (Natürl. Pflanz. Fam. IV 4 p. 42) one does not arrive at any genus in particular, but in the immediate neighbourhood either of *Cosmibuena* RUIZ and PAVON, or of *Coptosapelta* KORTH., according as to whether one takes the style to be little or very much longer than the corolla-tube. A closer comparison with the genus *Cosmibuena*, to which a small number of Central- and South-American, epiphytic shrubs belong, at once, however, reveals considerable differences in the structure of the calyx, stamens, stigma and in the dehiscence of the fruit, so that there can be no question of a union with this genus, although in habit and in the shape of the flowers the agreement is closer than with *Coptosapelta*. As regards the latter genus, it is said in the above-mentioned key: "style quadrangular and hairy", so that, if one were to adhere strictly to this, one would be forced to set up a new genus for our species, in which the style is cylindrical and glabrous. On further comparison with the characters given in the generic diagnosis for *Coptosapelta*, the following differences are also found: C a l y x, small, saucer-shaped, five-toothed in *Coptosapelta*; in the new species much longer than the calyx-tube, divided to its base into five lanceolate, pointed, erect divisions. — C o r o l l a-t u b e very short, as long as or shorter than the lobes of the limb, and hairy at the tube-mouth, in *Coptosapelta*; in the new species 4—6 centimetres long, thin and straight, much longer than the lobes of the limb, and glabrous at its mouth. — A n t h e r s almost as

long as the lobes of the limb and hirsute on their dorsal side, with deeply cleft base, in *Coptosapelta*; here much longer than the lobes of the limb, glabrous, and with a two-lobed base. Seeds with a regularly fringed wing in *Coptosapelta*; here surrounded by an entire wing. Finally as regards the habit, the two known species of *Coptosapelta* are high-climbing shrubs with fairly large leaves and many-flowered pendulous panicles of small flowers, whereas the new species is a small erect shrub with erect cymes of few, prominent flowers.

Superficially there seems therefore abundant reason for setting up a new genus for this new species, and on account of the great resemblance in habit, leaves, inflorescence, calyx and corolla, to the American genus Lindenia, which belongs to the tribe of the *Rondeletieae,* I gave it the name *Lindeniopsis.*

A closer comparison with *Coptosapelta flavescens* KORTH, which occurs in Java, induced me, however, to withdraw this genus and to bring the new species under *Coptosapelta*. Some of the points of difference, deduced from the literature, proved to be the result of errors in the existing descriptions. For instance, the style in *C. flavescens* is not *quadrangular* and *hairy* as described by SCHUMANN, but, except at the top, cylindrical and glabrous, as in the new species, the calyx is not saucer-shaped, but deeply divided into five divisions, and resembles, except in size, that of the new species, and the mouth of the tube is not hairy, but quite glabrous. In this way a number of the enumerated points of difference already disappear.

There is further perfect similarity in the structure of the ovary and fruit of the two plants. The very peculiar stigma, which in contradistinction to the neighbouring genera, is not two-lobed, but quite entire, and receives pollen on the stigmatic papillae which cover the whole of its hairy surface. The anthers are identical in structure and in their mode of attachment. Finally, what is very important, the pollen of the new species has, like that of *C. flavescens,* an exine with net-shaped thickenings of wide mesh, and, as would appear from the figures in the Flora brasiliensis, the plant herein differs completely from the other genera of the *Hillieae.* Having regard to all these similarities, there can be no doubt, that our new species must be included in the genus *Coptosapelta,* but forms in it a special, monotypic sub-genus.

As a morphological peculiarity, which confirms the relationship to *C. flavescens,* I here draw attention to the glands, which alternate with the calyx divisions, and have, as far as I know, not yet been

described in any other of the *Rubiaceae* (with the possible exception of *Dichilanthe* HOOK.).

They have the same structure as the colleters, resembling intestinal glands, which in this genus, as in most Rubiaceae, are placed at the inside of the base of the stipules [1]) and are also found on the leaf base in *Apocynaceae* and in *Loganiaceae*. They are found in the new species, as in *C. flavescens*, alternating with the calyx divisions singly or two together; in the latter species they are however, only $^1/_5$ mm. long and have hitherto been overlooked by investigators; in the new species they are well over 1 to 1.5 m.m. in length.

Perhaps, on closer examination, they will also be found to exist in other *Rubiaceae*. Obviously they must be interpreted as rudimentary stipules of the sepals.

*Coptosapelta* KORTH. Descriptio nova: Calycis tubus ellipsoideus, limbus eo nunc brevior nunc duplo longior, persistens, dentatus vel ad basin usque 5-partitus, segmentis erectis imbricatis cum glandulis parvis stipularibus erectis teretibus singulis vel binis alternantibus. Corolla coriacea tomentosa, hypocraterimorpha, tubo brevi vel longo, gracili, tereti, intus glabro vel fauce hirta, limbi lobi obovato-lineares aestivatione contorti. Stamina 5 ori corollae inserta, filamentis brevibus subulatis; antherae oblongae vel lineares apice apiculatae, basi subbilobae vel bipartitae glabrae vel dorso hirsutissimae, dorso prope basin affixae, patentes demum saepe tortae. Pollinis granula subglobosa, poris 3?, insigniter reticulata. Discus carnosus cupularis. Ovarium biloculare. Stylus teres glaber elongatus corollae tubum aequans apice exsertus. Stigma magnum integrum, fusiforme velclavatum, in alabastro per longitudinem striatum, puberulum; ovula in loculis numerosa, placentis magnis septo affixis peltatis linearibus apice et basi liberis dense imbricatim affixa, peltata, marginata, ascendentia. Capsula obovoidea lateraliter compressa obsolete costata calyce longius persistente coronata, glabrescens ad medium versus loculicide bivalvis, vel demum saepe quadrivalvis. Semina placentae cylindricae, subcarnosae, loculum implenti extus affixa, peltata, imbricata, erecta, testa membranacea in alam hyalinam nunc insigniter fimbriatam nunc subintegram crenulatam radiatim striulatam expansa, albumine carnoso; embryo rectus parvus radicula tereti infera.

Frutices nunc alte scandentes nunc parvi erecti, canescenti-sericeo-villosi, ramulis tetragonis foliis coriaceis, subtus ± villosulis. Stipulae interpetiolares parvae ovato-trigonae.

[1]) Vide SOLEREDER, Anat. Charakt. der Rubiaceae 1893, p, 179.

Cymae terminales et in axillis superioribus trichotomae nunc densiflorae et ample paniculatae pendentes, nunc pauciflorae erectae. Flores brevissime pedicellati, bracteolis (prophyllis) 2, pedicello insertis calyce appressis eoque brevioribus instructi, nunc parvi nunc conspicui.

Subgenus I *Eucoptosapelta* VAL. Calycis limbus ovario brevior. Corollae tubus brevis, limbi lobos aequans vel illo brevior, faucis orificium glabrum vel hirsutum. Antherae lineares, basi bifidae, dorso dense villosae, demum tortae. Stigma elongato-fusiforme vel quadrangulare. Seminum ala fimbriata. Frutices alte scandentes ramulis subteretibus. Foliis majusculis patentibus subtus ad nervos villosis. Paniculae terminales foliatae multiflorae, densiflorae, pendentes.

**1.** *C. flavescens* KORTH., (*Stylocoryne racemosa* haud CAVANILLES, MIQ.; *St. tomentosa* BL.): Corollae tubus limbi lobos circiter aequans, faux glabra. Calycis tubus brevis.

Habitat: Malacca, Burma, Borneo, Java.

**2.** *C. Griffithii* HOOK.: Corollae tubus limbi lobis multo brevior. Faux dense hirsuta. Calycis tubus elongatus.

Habitat: Malacca, Singapore.

Subgenus II. *Lindeniopsis* VAL. Calycis limbus ovario plus duplo longior, ad basin usque partitus segmentis erectis lanceolatis acutis. Corollae tubus gracilis lobos pluries superans, faucis orificio glabro. Antherae oblongae basi bilobae, glabrae. Stigma magnum, clavatum. Seminum ala subintegra.

Frutices parvi erecti, ramulis acute tetragonis erectis elongatis, foliis parvis erectis rigide-coriaceis, spinuloso-apiculatis subtus appresse villosis. Cymae terminales et in axillis superioribus trichotomae, pauciflorae, erectae.

**3.** *C. Hammii* VAL. Characteres subgeneris.

Habitat: Biliton.

**Botany.** — "*Contribution N°. 1 to the knowledge of the Flora of Java.*" (Third Continuation)[1]). By Dr. S. H. KOORDERS.

### § 6. Further data concerning Oreiostachys Pullei Gamble.

#### §§ 1. Additions and corrections to p. 674—686 of the "Proceedings".

The proof-corrections, which Mr. GAMBLE sent me from England last April, were, nevertheless, much to my regret, received by the printers too late for incorporation in the number of the Proceedings

[1]) Continued from p. 773 of the Proceedings of the Royal Academy of Sciences, Amsterdam, ordinary meeting of the Math. and phys. section April 9th 1908.