# NOTES ON AGAVE IN ARUBA, CURAÇAO, BONAIRE AND SOME PARTS OF THE SOUTH AMERICAN CONTINENT.

by

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(With plates I—VIII).

*Introduction.*

This publication deals with some agaves which were collected by me participating as biologist in a geological excursion under Prof. Dr. L. M. R. Rutten and Mrs. Dr. C. J. Rutten-Pekelharing, in the beginning of 1930, to the West Indies. From 14 April to 4 May we camped in the western part of Curaçao, from 10 May to 10 June Bonaire was visited and from 16 June to 9 July we passed through Aruba.

In preference to the collection of a large number of different forms of Agave, an intensive investigation of the forms found on a few localities was made. I hoped thereby to acquire some information about the variability, and insight into the problem of the concept of species, not to be obtained by the study of herbarium material. — Other material was collected during an excursion to the mainland, following an invitation by the „Caribbean Petroleum Company".

I have been guided largely by the publication of W. Trelease on „Agave in the West Indies", in: Mem. Nat. Ac. Sc. Washington XI, 1913. Other more recent publications on the agaves of this area are: A. Berger, Die Agaven, 1915; I. Boldingh, The Flora of Curaçao, Aruba and Bonaire, 1914; id., Flora voor de Nederlandsch West-Indische Eilanden, 1913. They are based on Trelaese's monograph and do not produce any new facts [1]).

Trelease's descriptions of the characters of the species were

[1]) Boldingh in his floras mentions A. Cantula Roxb., A. fourcroydes Lemaire and A. sisalana Perrine, introduced as fibre plants; these are not discussed here.

of great assistance to my work and could be adopted generally. In some cases the limits of certain existing species have been extended further than Trelease probably would have admitted, but a subdivision into varieties has been introduced whereever this was considered justified by field observations and herbarium material.

## GENERAL PART.

### *Immigration.*

According to Trelease 1913, „There can scarcely be a doubt that the parent stock of the West Indian agaves, ...., was derived from North America rather than from South America". (p. 9) „It is hard to resist a belief that perhaps, though not probably, with exception of the Viviparae, the genus penetrated from Yucatan to and through what are now the West Indies at a time when they formed a continuation of the Central American mainland; [3]) (p. 9) „These forms, .... were undifferentiated, apart from local variation, until the filling by the sea of what is now the Anegada channel divided them into stocks from which have been derived the Antillanae.... to the north and the Caribaeae and probably the Viviparae to the south". (p. 10, 11) „The segregation of the Viviparae from the dominant Caribbean form appears to have been effected early under continental influences, if they be not of Central American origin"; (p. 11). Trelease considers it therefore probable, that the agaves of the Leeward Group[4]) found their way from Mexico, along a landconnection Central America - Antilles - South America. According to him, the immigration of agaves to South America over the isthmus must be of later date than that over the Antillean bridge, and he does not think it likely that

[2]) Other publications dealing with the delimitation of species in Agave are those of A. Berger, Die Agaven, 1915, W. Trelease, Species in Agave, in Proc. Am. Phil. Soc. IL, 1910 and G. Engelmann, Notes on Agave, in Trans. Ac. Sc. St. Louis III, 1878.

[3]) Trelease subdivides the West Indian agaves into different groups of which only the Viviparae, from the Leeward Group, Venezuela and Trinidad, and the Caribaeae, from the Caribbees (but to which also A. Trankeera from the Leewards belong) are of interest to us.

[4]) In this paper, the islands called „Leeward Group" are those, situated between Goajira and Trinidad (: Islas de Barloventa, Benedenwindsche Eilanden, Eilanden onder den Wind, Inseln unter dem Winde); so they are by no means identical with the „Leeward Isles" of British politics (Antigua, Montserrat, St. Kitts, Dominica, Virgin Islands).

the agaves reached the islands of the Leeward Group along this Central American landconnection.

By a careful and critical use of geological, biogeographical and also of a few topographical arguments, L. Rutten (in: Tijdschr. Kon. Ned. Aardr. Gen. (2) LI 1934 and in: Geol. Rundschau XXVI, 1935) has given us a summary of our present knowledge of ancient land and sea connections in Central America and the West Indies. It may be of interest, to follow some of his conclusions in relation to our subject.

According to Rutten, there existed, probably in the Lower Oligocene, a landconnection between Central America and the Greater Antilles; a connection between South America and the Lesser Antilles, and between these and the Greater Antilles existed possibly in the Oligo-Miocene. — In this way it was possible for the agaves to spread out of Mexico, over an Antillean bridge to South America, during the Oligocene and the Oligo-Miocene. — During the Pliocene the antillean landmass begins to disintegrate through the formation of the Bartlett Deep, the Mona- and Anegada Passage.

According to Rutten, the two Americas were separate almost continuously during the Cretaceous until the Pliocene; there may have been a connection via Central America in the Lowest Eocene, and possibly for a short time, also in a later period; the permanent junction of the two Americas only came to pass in the Pliocene. — In this way the immigration of agaves from Central America to South America was thus made possible, 1. from the Pliocene to the present time, 2. during the Eocene.

As regards this last possibility, there is, as far as I can judge, not a single argument, which makes an immigration of Agave to South America as early as the Eocene acceptable, but rather arguments which make it doubtful!, such as our absence of knowledge of forms which would point to a lengthy independent development of Agave on the South American continent.

So far, we can note a pleasing agreement, with the idea which Trelease had formed about ancient landconnections in the West Indies, chiefly based on his study of the agaves, and that which Rutten gives us, and which is grounded on numerous considerations of geological and biogeographical nature; — but the way in which Trelease supposes that these alterations in the earthcrust took place (Spencer's theory!), and his dating of the landconnection Yucatan - Antilles - South America (Pleistocene!) are totally different.

Trelease seems to find no difficulty in accepting an

immigration of Agave from South America to the Leeward Group; he considers these islands as belonging to the continental shelf, and therefore joined to the adjacent mainland until recently. — This supposition however is clearly erroneous. Bonaire and Curaçao, as well as the Aves Islands and Los Roques are surrounded on all sides by a sea, which has a depth of 800 meters or more, only near Aruba, the depth of the sea might agree with a position of Aruba as a shelf-island. There are also distinct differences, which point to the existence of a geological borderline since the Middle-Cretaceous, which runs directly South of the Leeward Group. — What is for us of greater importance, is the fact, that the connection of the islands Bonaire and Curaçao with a large stretch of land to the South, which connection can be considered to be proved by geological facts (chiefly according to L. Rutten and Pijpers) to be Upper Cretaceous, had very probably already ceased to exist during the Upper Eocene; and that there is not a single geological fact which points to a landconnection of Bonaire, Curaçao and Aruba at a later period. There is also nothing known of a possible connection of the islands with each other or with the other islands of the Leeward Group. — In the Upper Eocene Bonaire and Curaçao, and possibly Aruba, were completely or partially submerged; a slight upwarping followed probably in the Lower Oligocene. The geological history of these islands in late tertiary time is absolutely unknown; possibly they were above sea level. During the Pleistocene (limestones of the highest terraces!) the islands, certainly the far greater part of them, sank below the sea level; later a more or less complicated emergence followed until sub-recent times.

The occurrence of Agave on the islands of the Leeward Group indication about the period when, or the direction from which an eventual immigration of Agave to the islands Aruba, Curaçao and Bonaire, in post-eocene time, can have taken place. — Neither do the relations of the plants themselves, as far as I can judge, give us any clue.

*Occurrence.*

The occurrence of Agave on the islands of the Leeward Group is very local, but they possess mostly a rather high sociability [5]).

[5]) An exception is formed by the sorts which are cultivated as hedge-plant; especially A. Trankeera, but sometimes also A. Cocui and A. Boldinghiana. In the taxonomical part of this paper, the sociability has been indicated by grades in the five-part scale of Braun-Blanquet, in Pflanzensociologie, p. 31, 1928.

It is noticable, that different groups often show distinct characteristics, whereby they can be distinguished immediately from all other, for the rest similar groups of plants. This is especially clear, when the areals of such groups touch each other or mingle (cf Coll. Nr. 4-7!, 8-9, 13-14), which shows that in this case plants always keep the characteristic appearance of their group [6]). — The great similarity within these groups and the constancy of the small differences between the different groups, can probably be explained by the prominence of the vegetative manner of reproduction above the generative. Probably all species belonging to the Viviparae and native to the islands, can reproduce themselves with suckers, they also are abundantly bulbiferous and have a very small fruit production; — moreover I suspect that the sexual reproduction is rare, though always a, Agave, we shall always have to take the possibility of such an embryo. It is thus possible that the small differences which occur in one such homogenous group of plants, can be taken as the variation in one single individual, which has reproduced itself exclusively vegetatively (whereby such a group can be compared to a cloon). — By our appreciation of species and varieties in Agave, we shall always have to take the possibility of such an occurrence into consideration.

Each collection number always consist of only one single plant or several plants out of a single homogenous group of high sociability. In the latter case, the different specimens are often distinguished by letters.

The locality has always been given according to the topographical map 1:20.000 which has been issued by the Netherland Government.

*Material.*

In many cases the vegetative part of the plant has already suffered such change during the flowering, that flower- (or fruit-) and leaf-material of the same specimen which has been gathered simultaneously, is not sufficient, to form a correct impression of this plant. To obtain a proper species-description we must have in many cases material from two specimens, one not flowering specimen and one flowering, in which case it is naturally of primary importance that the taxonomical equality

[6]) No notice has been taken of the possibility of bastardy, although in some cases material was gathered (not described here!) which might point to this possibility.

of these two specimens is irrefutable. Further it is necessary to be careful when collecting, that all information is taken from fully grown plants, which have been able to develope freely and normally. Flowers which have developed in the axils of the lower bracts on the peduncle (mostly only after damaging or cutting off the inflorescence) or out of the bulbils, are usually of no value for the diagnosis.

The collected material, preserved in formaline, may be seen in the Botanical Museum at Utrecht. This paper deals with part of this material only, the remainder, for the greater part vegetative organs, does not justify a discussion at this place.

The „Herbarium Missouri Botanical Garden" (abbreviated: Miss.) send me nearly all the material, which Trelease 1913 used for the description of his species which have been discussed here. Other material I received from the „New York Botanical Garden" (abbrev.: N.Y.) and the Botanical Museum and Herbarium at Utrecht (abbrev.: Mus. Utr., Herb. Utr.).

*Methods.*

Instead of describing the marginal arming of the leaf by a large number of different measurements, which would necessarily be greatly arbitrary, the relative grades of development of the prickles and the marginal prominences are described as: not, weakly, well and strongly developed. The value of these terms can be judged by comparison with the illustrations which Trelease 1913 gave, and also with pl. IVb and Vb in this paper. From the same practical consideration the number of leaves per rosette, the number of branches per panicle and the number of bracts on the peduncle are not expressed in numbers, but by the words: few, rather few, rather many and many; in the first case the numeric value of these terms must be considered as respectively 20—25, 25—40, 40—60, 60 or more, in the last two cases as 5—15, 15—20, 20—30 and 30—40.

The length of the leafblade was measured over the middle of the leaf, from its base to the end of the spine. The circumference was determined by tracing it on a sheet of paper immediately after cutting. — The base of the spine was located by determing the limit of the hard tissue (: no impression could be made in the hard tissue with the thumb'nail). At the base the breadth and height of the spine were measured. — The description of the prickles and their density applies exclusively to a region of 10 cm at the middle of the leafmargin. The base

of the prickles was determined in a similar way as that of the spines and this determination could still be made on hardened, dry or dried material. — The number of bracts could be determined in an arbitrary manner only: Only those leaves are considered as bracts which may be found on the peduncle above the point that can be reached upwards by the tip of the longest rosette-leaf when placed, in fully extended, normal form, in an upright position. — The length of the ovarium was measured to the insertion of the style; the length of the tube from the insertion of the style to the throat, that is the point where the segments unite. The breadth of the segments was determined at the base. The length of the filaments and style has naturally always been measured on fullgrown organs.

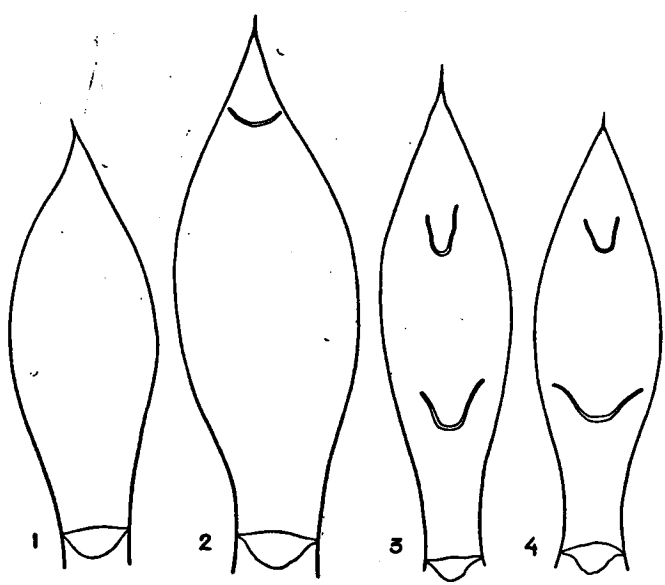



Fig. 1-4. Leaves, with cross-sections, of *Agave vivipara* (1/8). 1-2: Curaçao (1, Miss. 138500, type-leaf; 2, No 1a). 3-4: Aruba (3, No 6; 4, No 8a).

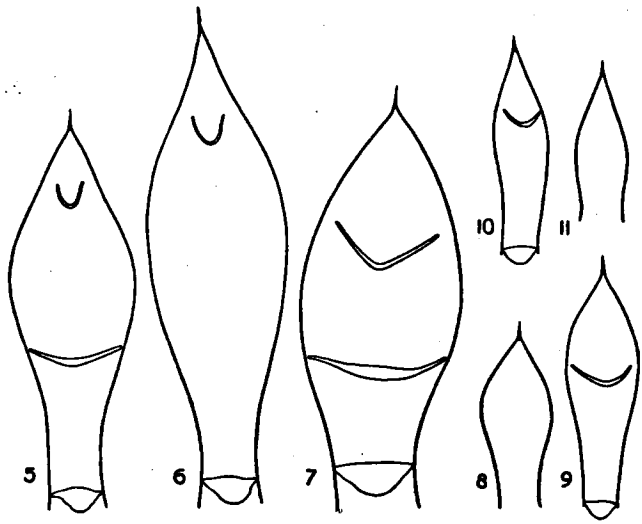



Fig. 5-7. Leaves of *A. vivipara* (1/8). 5: Aruba (No 9). 6-7: Bonaire (6, No 10a; 7, No 11b). — Fig. 8-11. *A. vivipara* var. *cabaiensis* (1/8): Curaçao (No 13).

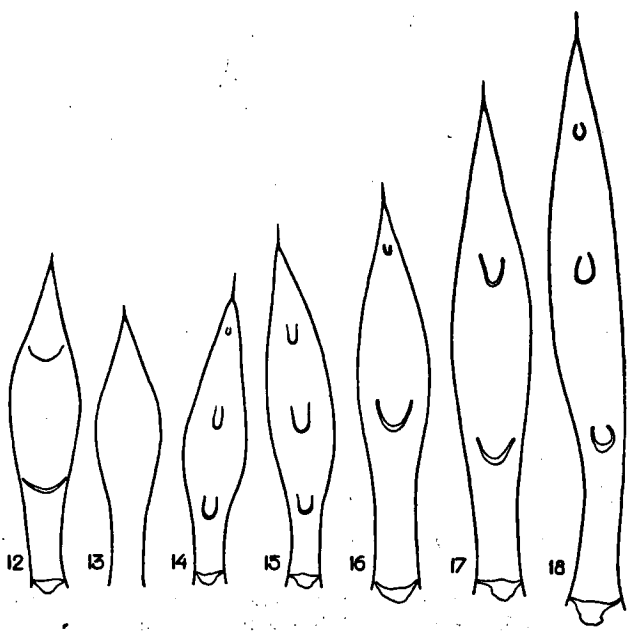



Fig. 12-13. Leaves of *A. vivipara* var. *cuebensis* (1/16): Curaçao (12, No 15a; 13, No 16a). — Fig. 14-15. *A. arubensis* (1/16): Aruba (No 17a, type-leaves). — Fig. 16-18. *A. Rutteniae* (1/8). Aruba (No 19a, type-leaves).

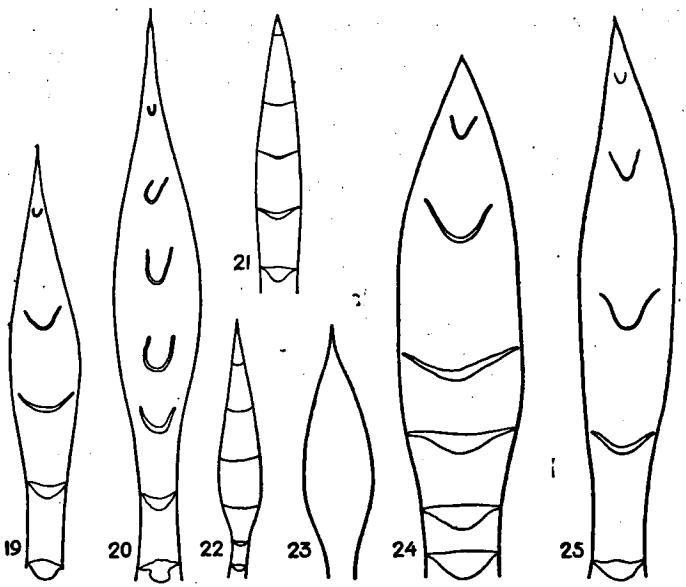



Fig. 19-20. Leaves of *A. Boldingiana* (1/16): Bonaire (19, No 20a; 20, No 21a). — Fig. 21. *A. Trankeera* (1/32): Curaçao (Miss. 138472, type-leaf). — Fig. 22. *A. petiolata* (1/32): Curaçao (Miss. 138458, type-leaf). — Fig. 23. *A. Cocui* (1/32): Venezuela (Miss. 138452-138455). — Fig. 24. *A. Cocui* var. *laguayrensis* (1/16): Bonaire (No 26). — Fig. 25. *A. Cocui* var. *cucutensis* (1/16): Colombia (No 27a).

## TAXONOMICAL PART.

**Agave vivipara** L. Sp. Plant. 1753, I p. 323.

Trelease 1913 p. 18, literature; Boldingh 1913 p. 151; id. 1914 p. 18; Berger 1915 p. 223.

Plants nearly acaulescent, suckering. Rosette about 100-120 cm diam., with rather few or rather many leaves. Leaves about 3-4 times as long as broad, 40-60 cm by 12-20 cm, elliptical, acuminate, widest in or a little above the middle, with short neck, slightly S-curved, round conduplicate, glaucous, at length rather glossy green. Spines acicular, straight or slightly curved, usually upcurved at the top, often somewhat flexuous, smooth, narrowly to very broadly round-grooved up to or beyond the middle, involute or slightly involute at the base, with margin rather blunt, smooth or with very few small prickles, shortly or not decurrent, dorsally intruding or slightly intruding into the

green tissue, 17-24 mm by 2½-4 mm by 2½-4 mm, red-brown. Prickles usually upcurved near the leaftop and recurved somewhat below the middle of the leaf, 7-14 per 10 cm, 3-4 mm in length, slender or rather slender aciculate to a well or rather weakly developed base, on well or rather well developed green prominences. Inflorescence about 300 cm high, capsuliferous, freely bulbiferous. Panicle ½ total length or more, narrowly oblong, with ascending branches. Pedicels about 5 mm. Peduncle with broadly triangular, imbricated bracts. Flowers 40-45 mm long, yellow. Ovary oblong, 20-25 mm long. Tube about 4 mm. Segments 15 mm by 4 mm. Filaments inserted a little below the throat, 30 mm long; anthers 16-20 mm. Style about 40 mm long, surpassing the filaments. Capsules broadly oblong, 30 mm or more by 25 mm (?!), shortly stipitate, beaked. Seeds unknown. Bulbils present.

The description given above is based on the vegetative material collected by Boldingh (No. A 3) and seen by Trelease (Miss. 138500-138503, fig. 1), amplified by notes given by Trelease in his description of 1913. Some supplementary leafmaterial from Ecker (1909; Miss. 138505) and Boldingh (A 3, Herb. Utr.) which I studied, was in complete agreement with this description.

Trelease used for his description the material collected on Curaçao by Boldingh in 1909 (No. A 3, both vegetative and generative) and Ecker in 1909, 1910.

The type-diagnosis of this species is as follows: „foliis dentatis, staminibus corollam aequantibus". — As neither the diagnosis of Linnaeus, nor the illustration of Commelin (in Praelud., pl. 15, 1703) to which he refers make any approach to our present demands for an even approximatively secure definition of species, I entirely agree to the interpretation and conception of these species, as given by Trelease in his monograph of 1913.

*Curaçao.* N. slope of the Seroe Domi, near Willemstad, 12. IV. 1930, on coral rock and débris of coral rock, 10-60 m, soc. 1-2, flor. (No 1a, fig. 2; No 1b, flowers; No 2; No 3).

These specimens differ from the description given above in: Leaves 2½-3½ times as long as broad. Spine usually slightly intruding into the green tissue. Prickles 7-17 per 10 cm, 3-5 mm in length, slender or rather slender aciculate to a weakly to rather strongly developed base, on weakly to strongly developed green prominences. Flowers 44-51 mm long. Ovary narrowly oblong, 23-25 mm by 5½-6 mm, yellowgreen. Tube 4-5½ mm, yellowgreen. Segments 19-22 mm by 5½-6 mm, greenish yellow. Filaments inserted 0-½, exceptionally 1 mm below the throat, 32-36 mm long, yellow;

anthers 16-19 mm, usually 18-19 mm, orange. Style 40-43 mm, yellow, surpassing the filaments.

The leafmaterial and the flowers of A. vivipara, collected by Britton & Shafer, in March 1913, on a „dry slope near Willemstad" Curaçao (N.Y. 3060, dupl. Herb. Utr.), agree very well with the description of the Seroe Domi plants.

*Aruba.* N.N.E. slope of the Hooiberg, 7. VII. 1930, on débris of hooibergite (igneous rock), 80-110 m, soc. 1-2, deflor. (No 4a; No 4b, capsules; No 5a; No 5b, caps. and flowerrests; No 6, fig. 3; No 7).

Differ from the specimens of the Seroe Domi, Curaçao, in: Leaves narrow elliptical to broadly oblanceolate, acute or slightly acuminate. Spines 23-28 mm by 3-4 mm by 3-4 mm, involute or not involute. Prickles 4-8 mm in length. Inflorescence 200-350 cm high. Panicle 1/5-1/2 total length, 2½-4 times as long as broad, with usually few ascending branches. Pedicels 4-6 mm. Peduncle 2-3½ cm broad, with usually 10-18 bracts, the highest bract 2½-4 cm long, the lowest bract about 10 cm long. Capsules oblong, about 2 times as long as broad, 28-35 mm by 14-18 mm, rather shortly stipitate, not or nearly not beaked. Seeds 6-6½ by 4½-5 mm. The flower does not appear different, excepting the style which is probably shorter.

*Aruba.* S. slope of the Hooiberg, 21. VI. 1930, on débris of hooibergite, 80-110 m, soc. 1-3 (pl. Ia), deflor. (No 8a, fig. 4; No 8b, caps.).

The numerous plants of this locality make a very homogenous impression and vary only in a few unimportant characteristics from those found in aforenamed locality: Leaves widest usually above the middle, with rather slender neck, dark greyish seagreen. Spines 21-27 mm by 3½-4½ mm by 3½-4½ mm. Prickles 12-17 per 10 cm, 6-9 mm in length, on strongly or very strongly developed hardening or partly green prominences. Capsule 27 mm by 19 mm. Seeds 7½ mm by 5 mm.

11 Inflorescences were measured: average total length 380 cm, max. 440 cm, min. 320 cm; av. length of panicle 160 cm, max. 200 cm, min. 125 cm; av. breadth of panicle 42 cm, max. 50 cm, min. 30 cm; av. length of largest branch 25 cm, max. 27 cm, min. 19 cm; av. number of branches exceeding 5 cm 18, max. 22, min. 16; av. diam. of peduncle 4½ cm, max. 5 cm, min. 3½ cm; av. number of bracts 22, max. 29, min. 16; av. length of highest bract 4 cm, max. 5½ cm, min. 3 cm; av. length of lowest bract 11 cm, max. 16 cm, min. 9 cm. — Only 2 inflorescences bore capsules, one each.

*Aruba.* S.E. slope of the Hooiberg, 22. VI. 1930, on débris of hooibergite, 110-130 m, soc. 2-4, deflor. (No 9, fig. 5).

The plants of this locality are also very similar to each other. They vary from the former ones in having the leaves with more slender neck, more slender spines (: 14-23 mm by 3-4½ mm by 2½-4½ mm), smaller and closer prickles (: 16-22 per 10 cm, 4-6 mm in length, with rather weakly developed base) and more capsules.

29 Inflorescences were measured: average total length 221 cm, max. 350 cm, min. 130 cm; av. length of panicle 78 cm, max. 150 cm, min 28 cm; av. breadth of panicle 22 cm, max. 30 cm, min. 13 cm; av. length of largest branch 12½ cm, max. 17 cm, min. 8 cm; av. number of branches exceeding 5 cm 10-11, max. 17, min. 6; av. diam. of peduncle 3 cm, max. 4 cm., min. 2 cm; av. number of bracts 14, max. 21, min. 12; av. length of highest bract 3

cm, max. 5½, min. 2 cm; av. length of lowest bract 9 cm, max. 15 cm, min. 5 cm.

*Bonaire.* 350 m S.W. of Fontein, 22. V. 1930, on coral rock, 80-85 m, soc. 3-5, deflor. (No 10a, fig. 6; No 10b, pl. Ib; No 10c with bulbils).

The numerous plants from this locality differ slightly from the specimens from the Seroe Domi, Curaçao: Leaves 2½-4 times as long as broad. Spines 23-24 mm by 2½-3½ mm by 2½-3½ mm, not or nearly not involute. Prickles 10-17 per 10 cm, 4-6 mm in length, on strongly developed green prominences. — Only 1 inflorescence was present, without flowers or fruit, resembling exactly that of A vivipara.

*Bonaire.* N. top of the Seroe Palmit, 30. V. 1930, on débris of porfirite, 110-115 m, soc. 2-4, deflor. (No 11a; No 11b, fig. 7, 3 specim.; No 11c, with bulb.). — Dochila, 5. VI. 1930, on débris of coral rock, about 50 m, soc. 3, deflor. (No 12).

The specimens from these localities differ appreciably from the plants from the Seroe Domi, Curaçao: (for the specimens from the Seroe Palmit) Leaves 2¹/₂-3 times as long as broad, broadly elliptical, widest in the middle, with short neck (more crowded specimens: 3-3½ times their width). Spines broadly or very broadly roundgrooved beyond the middle, not or nearly not involute towards the base with margin smooth, dorsally intruding into the green tissue. Prickles 6-14 per 10 cm, 3-7 mm in length, on very strongly to rather weakly developed green prominences. Inflorescence about 400-500 cm high. Panicle 2/5-3/5 total length, about 4-5 times as long as broad, somewhat decurrent, with rather few, more or less ascending branches. Pedicels 4-8 mm long.

## Agave vivipara L. var. cabaiensis Hummelinck nov. var. [7]).

*Curaçao.* N. slope of the Seroe Cabajé, Porto Marie, 19. IV. 1930, on débris of coral rock, 30-35 m (pl. IIb), soc. 2-4, deflor. (No 13, fig. 8-11, 3 specim.; No 14a, pl. IIa, 3 specim.; No 14b, with flowerrest).

The vegetative parts of these plants differ principally from those from the Seroe Domi in size and form of leaves: 17-30 cm by 5-10 cm, widest somewhat above the middle. Spines 16-21 mm by 2½-4 mm by 3-4 mm, grooved below or to the middle, not or slightly involute towards the base. Prickles 10-14 per 10 cm, 4-6 mm in length, slender aciculate to a weakly or well developed base, on weakly to well developed hardening or partly green prominences. In addition nearly all plants have a broad violet stripe, running along the center of the upperside of the leaf. — The form of the only inflorescence found, resembled exactly that of A. vivipara from the Seroe Domi (Pedicels 4-7 mm); the only flower which could be studied showed some peculiar differences with those of that locality: Segments 12-13 mm long. Filaments inserted ½-1 mm below the throat, 20-23

[7]) *A. vivipara* L. var. *cabaiensis* Hummelinck nov. var.
Folia 2½-4 partibus longiora quam lata, elliptica, 17-30 cm longa, 5-10 cm lata.

mm long; anthers 12-13 mm. — The numerous specimens may be divided in two groups which vary from each other in a greater or lesser development of the arming and, in addition, a more or less pronounced violet colouring of the leaves.

On account of the smaller size and the form of the leaves, probably in conjunction with shorter segments, filaments and anthers, I consider this form to be varietally separable from A. vivipara (typica).

**Agave vivipara L. var. cuebensis Hummelinck nov. var.** [8]).

*Curaçao.* N. slope of the Seroe Cabajé, Porto Marie, 19. IV. 1930, on débris of coral rock, 30-40 m, soc. 1-3, flor. (No 15a, fig. 12; No 15b, with flow.).

Plants acaulescent or nearly acaulescent, suckering. Rosette 120—160 cm diam., with rather many leaves. Leaves 4—5 times as long as broad, 60—75 cm by 12—17 cm, oblanceolate to narrowly elliptical, rather slender acuminate, widest somewhat above the middle, with slender neck, usually slightly S-curved with top often slightly curved upwards, usually round conduplicate, glaucous. Spines acicular, straight or very slightly curved at the top, sometimes slightly flexuous, smooth, rather broadly to narrowly grooved to or below the middle, involute towards the base, with margin sharp or rather sharp with few or very few small prickles, decurrent, dorsally intruding or slightly intruding into the green tissue, 20-23 mm by 3-4 mm by 3-4 mm. Prickles recurved in and somewhat below the middle of the leaf, 10-12 per 10 cm (below the middle 5-8 per 10 cm), 3-4 mm (below the middle 4-5 mm) in length, acuminate triangular or slender aciculate to a rather well or well developed base, on very weakly to rather well developed green prominences. Inflorescence about 300 cm high, poorly capsuliferous, bulbiferous. Panicle 1/3-2/5 total length, narrowly oblong, 5 times as long as broad, not er slightly decurrent, with rather few slightly S-curved, ascending branches. Pedicels 3-6 mm. Peduncle about 4 cm diam., with rather few bracts, the lowest bract 15-20 cm long. Flowers 40-46 mm long. Ovary oblong, 20-23 mm by 6½-7 mm, yellowish green. Tube 5-6 mm, greenish yellow. Segments 15-17 mm by about 6 mm, greenish yellow. Filaments inserted 0-2 mm, usually about 1 mm below

[8]) *A. vivipara* L. var. *cuebensis* Hummelinck nov. var.
Folia 4-5 partibus longiora quam lata, oblanceolata vel anguste elliptica, 60-75 cm longa, 12-17 cm lata. Florum tubi 5-6 mm longi. Filamenta 0-2 mm sub fauce inserta, antheris 14-15½ mm longis.

the throat, 29-34 mm long, greenish yellow; anthers 14-15½ mm, yellow. Style 38-41 mm long, surpassing the filaments. Capsules unknown, probably stipitate. Bulbils distributed over the panicle and in the axils of the bracts, downwards to or beyond the middle of the peduncle.

*Curaçao.* 600 m W. of the Seroe Semingil, near the Seroe di Cueba, St. Hyronimus, 30. IV. 1930, on débris of coral rock, about 40 m, soc. 2-4, flor. (No 16a, fig. 13; No 16b, flow.).

These plants are slightly different from the specimens from the Seroe Cabajé: Spines 20-23 mm by 2½-3 mm by 2¾-3 mm, dorsally not or nearly not intruding. Ovary 23-26 mm by 6½-7 mm. Tube 5-7 mm, usually 6 mm. Anthers 15-17 mm. Style about 35 mm. Inflorescence 350-400 cm.

Principally on account of the larger and more slender leaves, probably in conjunction with a longer tube and shorter segments, I consider this form to be varietally separable from A. vivipara (typica).

**Agave arubensis** Hummelinck nov. spec. [9]).

Plants acaulescent, suckering (?). Rosette 130-160 cm diam., with rather few leaves. Leaves 5-6 times as long as broad, 65-80 cm by 13-14 cm, broadly lanceolate, usually slightly acuminate, widest somewhat below or in the middle, with rather slender neck, 6-7 cm broad, slightly S-curved, usually round conduplicate. Spines acicular, straight or very slightly upcurved at the top, sometimes slightly flexuous, usually rough, covered with very many minute tubercles, narrowly or broadly grooved below or to the middle, involute or nearly not involute towards the base, with margin blunt or rather sharp, smooth or with few small or very small prickles, shortly decurrent, dorsally rather slightly intruding or not intruding into the green tissue, 27-32 mm by 2½-4 mm by 2½-4 mm. Prickles usually pointing downwards somewhat below the middle of the leaf, often

[9]) *A. arubensis* Hummelinck, nov. spec.

Folia lanceolata, 5-6 partibus longiora quam lata, 65-80 cm longa, 13-14 cm lata. Spinae terminales aciculares, rectae, vel apice parum curvatae, interdum subflexuosae, plerumque rugosae, basi vel ad medium anguste vel late sulcatae, basi involutae vel vix involutae, breviter decurrentes, dorso in textum viride paululum vel vix ingredientes, 27-32 mm longae, 2½-4 mm diametro. Aculei marginales 8-12 in 10 cm, 4-7 mm longi, aciculati, basi dilatati. Inflorescentia 350-500 cm alta, bulbifera. Panicula 2/3-1/2 partem inflorescentiae metiens, anguste oblonga, pedicellis 4-7 mm longis. Pedunculus 7-14 bracteatus. Florum tubi 7-8 mm longi, segmentis 19-21 mm longis. Filamenta 2-4 mm sub fauce inserta, 30-35 mm longa, antheris 14-19 mm longis. Stylus 35-40 mm longus. Capsulae anguste oblongae, 2½—3 partibus longiores quam latae, 35-40 mm longae, 12-15 mm latae, stipitatae, rostratae. Semina 4½-5 mm longa, 4-4½ mm lata.

The species has been named after the island on which it occurs.

upcurved at the leaftop, 8-12 per 10 cm, 4-6 mm, exceptionally 7 mm in length, slender aciculate to a well or rather well developed base, on rather weakly to strongly developed green or hardening prominences, usually rough at the base. Inflorescence 350-500 cm high, rather poorly capsuliferous, freely bulbiferous. Panicle 2/3-½ total length, narrowly oblong, 4-5 times as long as broad, somewhat decurrent, with rather many, slightly S-curved, more or less ascending branches. Pedicels 4-7 mm. Peduncle 4-5 cm broad, with few bracts, the highest bract 7-11 cm, the lowest 11-17 cm long. Flowers with tube 7-8 mm. Segments 19-21 mm long. Filaments inserted 2-4 mm below the throat, 30-35 mm long. Anthers 14-19 mm. Style 35-40 mm, equaling the filaments. Capsules narrowly oblong, 2½-2⅔ times as long as broad if green, nearly 3 times as long as broad if dried, 33-40 mm by 12-15 mm, stipitated if green, long stipitated if dried, long beaked. Seeds 4½-5 mm by 4-4½ mm. Bulbils distributed over the whole panicle, especially in the lowest parts, in the top and in the axils of the highest bracts on the peduncle, downwards to or beyond the middle of the peduncle.

*Aruba.* 550 m S. of Fontein (type locality), 5. VII. 1930, on débris of coral rock, 30 m, soc. 2, deflor. (No 17a, fig. 14-15, 2 specim., pl. IVb; No 17b, pl. IVa, flowerrests and capsules).

5 Inflorescences were measured: average length 440 cm, max. 510 cm, min. 365 cm; av. length of panicle 270 cm, max. 335 cm, min. 210 cm; av. breadth of panicle 60 cm, max. 73 cm, min. 52 cm; av. length of largest branch 33 cm, max. 40 cm, min. 25 cm; av. number of branches exceeding 10 cm 28, max. 34, min. 24; av. diam. of peduncle 4½ cm, max. 5 cm, min. 4 cm; av. number of bracts 9, max. 14, min. 7; av. length of highest bract 9 cm, max. 11½ cm, min. 7 cm; av. length of lowest bract 13½ cm, max. 17½ cm, min. 10 cm.

The vegetative parts of these plants show no differences which would justify a separation of species or even of variety from the form of A. vivipara (not discussed here!) which grow in their immediate neighbourhood. But the generative parts show such a number of remarkable differences, per example the long tube with low inserted filaments, the form of capsules and the small number of bracts, that I consider this new species to be well defined.

*Aruba,* Droemidera, 1550 m S. of Kasioenti and 1750 m S. W. of Fontein, 5. VII. 1930, on débris of coral rock, ca 40 m, soc. 1-2, deflor. (No 18, pl. IIIa, sev. specim.).

These specimens agree well with the description given above, but: Leaves 4½-4½ times as long as broad, 60-70 cm by 15-16 cm. Spines 23-27 mm by 3-3½ mm by 3-3½ mm. — 2 Inflorescences were measured: total length 445-525 cm; length of panicle 300-425 cm; breadth of panicle 80-105 cm; length of largest branch 43-60 cm; number of branches exceeding 10 cm 28-35; diam. of peduncle 5-5¾ cm; number of bracts 4-7; length of highest bract 13-20 cm; length of lowest bract 16-24 cm.

**Agave Rutteniae** Hummelinck nov. spec. [10]).

Plants acaulescent, suckering. Rosette about 90-150 cm diam., with few leaves. Leaves 5½-9 times as long as broad, 44-68 cm by 7½-9 cm, narrowly elliptical or lanceolate, acute, widest in or somewhat above the middle, with long and slender neck, 4-5 cm broad, straight or very slightly S-curved, usually with top slightly curved upwards, round to rather sharp conduplicate. Spines acicular, straight, often somewhat flexuous, smooth, narrowly and usually shallowly grooved below or beyond the middle, involute or slightly involute towards the base, with margin smooth or with some very small prickles, decurrent, dorsally not intruding into the green tissue, 22-28 mm by 2-3 mm by 2-3 mm. Prickles usually recurved somewhat below the middle of the leaf, 9-17 per 10 cm, 4-5 mm in length (5-7 mm below the middle!), slender aciculate to a rather weakly developed base, on weakly or rather well developed hardening or partly green prominences. Inflorescence usually 200-350 cm high, capsuliferous, freely bulbiferous. Panicle usually 1/3-1/4 total length, oblong or oboval, usually 3-4 times as long as broad, usually somewhat decurrent, with few, slightly S-curved, more or less ascending branches. Pedicels 5-6 mm long. Axis distinctly swollen under the insertion of the branches. Peduncle 2-3 cm broad, with rather few, toothed, not shriveled bracts, the highest bract usually 2½-4 cm, the lowest 9-15 cm long. Flowers of unknown length. Tube conical, 7½ mm. Segments 14-16 mm long. Filaments inserted 1-2 mm below the throat, 25-30 mm long; anthers 14-17 mm. Style 28-32 mm long, slightly surpassing or equaling the filaments. Capsules shortly oblong, 1½-1⅝ times as long as broad, 24-28 mm by 15-18 mm, stipi-

[10]) *A. Rutteniae* Hummelinck nov. spec.

Folia anguste elliptica vel lanceolata, 5½-9 partibus longiora quam lata, 44-68 cm longa, 7½-9 cm lata. Spinae terminales aciculares, rectae, saepe subflexuosae, laeves, basi vel ultra medium anguste sulcatae, basi involutae vel subinvolutae, decurrentes, dorso haud in textum viride ingredientes, 22-28 mm longae, 2-3 mm diametro. Aculei laterales 9-17 in 10 cm, 4-5 mm longi, aciculati, basi vix dilatati. Inflorescentia plerumque 200-350 cm alta, bulbifera. Panicula 1/3-1/4 partem inflorescentiae metiens, oblonga vel obovata, pedicellis 5-6 mm longis rhachi sub insertione ramorum distincte inflata. Pedunculus 10-20 bracteatus. Florum tubi 7½ mm longi, segmentis 14-16 mm longis. Filamenta 1-2 mm sub fauce inserta, 25-30 mm longa, antheris 14-17 mm longis. Stylus 28-32 mm longus. Capsulae breviter oblongae, 1½-1¾ partibus longiores quam latae, 24-28 mm longae, 15-18 mm latae, stipitatae, haud vel vix rostratae. Semina 5½-6½ mm longa, 4-5 mm lata.

The species has been named in honour of Mrs. Dr. C. J. Rutten-Pekelharing.

tate, not or nearly not beaked. Seeds 5½-6½ mm by 4-5 mm. Bulbils distributed over the whole panicle and in the axils of the bracts, downwards to beyond the middle of the peduncle.

*Aruba.* S. S. W. slope of the Hooiberg (type locality), 20. VI. 1930, on débris of hooibergite (igneous rock), 60-90 m, soc. 1-3, deflor. (No 19a, pl. Vb, IIIb, fig. 16-18, 3 specim.; No 19b, tab. Va, with flowerrests and capsules)

38 Inflorescences were measured: average total length 220 cm, max. 360 cm, min. 140 cm; av. length of panicle 63 cm, max. 145 cm, min. 16 cm; av. breadth of panicle 18 cm, max. 30 cm, min. 8 cm; av. length of largest branch 13 cm, max. 21 cm, min. 6 cm; av. number of branches exceeding 5 cm 9, max. 15, min. 3; av. diam. of peduncle 2 cm, max. 3 cm, min. 1 cm; av. number of bracts 17, max. 23, min. 9; av. length of highest bract 3¼ cm, max. 4¾ cm, min. 2 cm; av. length of lowest bract 11½ cm, max. 17¾ cm, min. 5 cm. — The flowering causes no remarkable differences as regards form or colour of the leaves. — Only 18 out of 38 inflorescences bore one or more capsules. — Were the rosettes grow very close together, the leaves can attain a length of more than 9 times their width.

Leafmaterial, very probably belonging to this species, has been collected by Boldingh 1910 on Aruba (No 5, Miss. 138493-138495).

## Agave Boldinghiana Trelease 1913 p. 21.

Boldingh 1913 p. 150; id. 1914 p. 17; Berger 1915 p. 225.

Plants nearly acaulescent, suckering. Rosette about 200 cm diam., with rather many or rather few leaves. Leaves nearly 7 times as long as broad, 100 cm by 15 cm, narrowly sublanceolate, subacuminate, rather slightly S-curved with top slightly curved upwards, round conduplicate, green, somewhat glaucous. Spines acicular, slightly or very slightly upcurved at top, smooth, shallowly grooved or not grooved below the middle, usually involute towards the base, with margin blunt and smooth if present, shortly or not decurrent, dorsally rather slightly intruding into the green tissue, 15—20 mm by 2—2¼ mm by 1½—2 mm, red brown. Prickles often irregularly upcurved near the leaftop and recurved somewhat below the middle of the leaf, 7—11 per 10 cm, 4—5 mm, exceptionally 7 mm in length, acuminate triangular or rather slender to slender aciculate to a well or rather well developed base, on rather well to strongly developed hardening or partly green prominences, from scarlet becoming chesnut. Inflorescence about 500 cm high, freely bulbiferous. Panicle (not fully expanded!) about 2/5 total length, oblong, tapering towards the top, about 3—4 times as long as broad, not or slightly decurrent, with rather few, S-curved, horizontal branches. Pedicels 4—7 mm. Peduncle with rather many, narrowly

triangular, appressed bracts. Flowers 45—46 mm long, golden. Ovary broadly fusiform or oblong, 20—25 mm long. Tube 5—5½ mm. Segments 18—20 mm by about 5 mm. Filaments inserted 0—1 mm below the throat, 34—35 mm long; anthers 18—21 mm. Style of unknown length. Capsules and seeds unknown. Bulbils present.

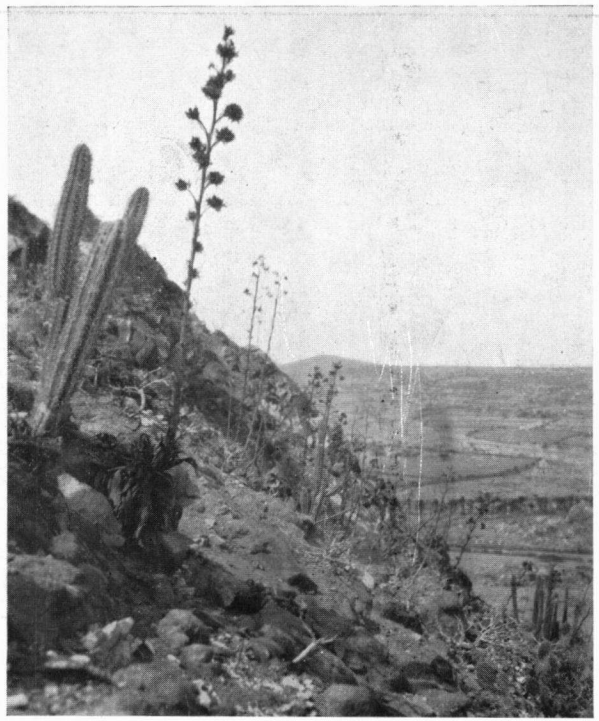
This description is based on the type-material coll. by Boldingh in 1909 (A 2; Miss. 138410—138415) and the flowers coll. by Ecker in 1910 (Miss. 138417, 138420), amplified by notes given by Trelease in his type-diagnosis (pl. 11, 12, 13 fig. 1).

As type Trelease has designated the (exclusively vegetative) material of Bolding (A 2) from Curaçao. He does not say which material provided him with the data for the description of the flower; but from the material used by him for comparison it appears that only that which Ecker gathered in Curaçao 1909, 1910, is taken into consideration.

The leafmaterial of Ecker (Miss. 138417) differs only unappreciably from the description of the type given above: Spine 20—22 mm by 3—3½ mm by 3 mm. Other leafmaterial examined, agreeing with this description: Herb. Utr. 12799 A, Boldingh A 2; Miss. 138418, 138419, 138421, Ecker, 1910.

*Bonaire*. S. of Dos Pos, 27. V. 1930, on débris of coral rock, abt 50 m, soc. 1-2, possibly semi-cultivated, flor. (No 20a, fig. 19; No 20b, flow., pl. VI a, b, unmat. caps., pl. VIII c, bulb.). — N. slope of the Seroe Dochila, near Dos Pos, 5. VI. 1930, on decomposing débris of coral rock, 50 m, soc. 1, possibly semi-cultiv., flor. (No 21a, fig. 20; No 21b, with flowerrests).

The specimens from these localities differ slightly from the type: Leaves 5-7¼ times as long as broad, 90-125 cm by 15-20 cm, widest in the middle, with slender neck, greyish green, glaucescent. Spines straight or very slightly upcurved at the top, not or very shallowly grooved at the base, not or very slightly involute, not decurrent, 14-25 mm by 2-3 mm by 2-3 mm. Prickles 7-12 in 10 cm, 4-6 mm in length, acuminate triangular or rather slender to slender aciculate to a rather well to very strongly developed base, on nearly not to strongly developed green or partly hardening prominences. Inflorescence 650-700 cm high, poorly capsuliferous. Panicle 3/5 total length or less, somewhat tapering towards the top, about 5 times as long as broad, with rather many S-curved, horizontal branches. Pedicels 4-9 mm, usually 5-6 mm. Peduncle with rather many bracts, the highest about 10 cm, the lowest about 20 cm long. Flowers 50-54 mm long. Ovary oblong, 26-28 mm by 6-7 mm. Tube 4-4½ mm. Segments 20-23 mm long. Filaments inserted ½-2 mm, usually about 1 mm below the throat, 35-38 mm long. Style 40-45 mm long, slightly surpassing the filaments. Capsules oblong, 2-2⅛ times as long as broad, 33-42 mm by 15-18 mm, stipitate, beaked. Seeds 6-6½ mm by 4½-5 mm. Bulbils distributed over the whole panicle and in the axils of the bracts, downwards to beyond the middle of the peduncle.



a *Agave vivipara L.* Aruba, Hooiberg (cf No 8).

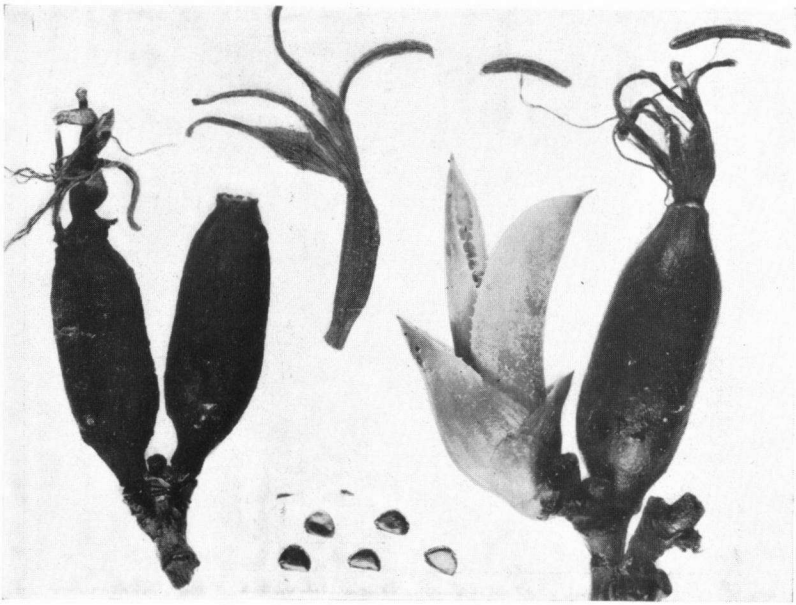
b *A. vivipara* L. Bonaire, near Fontein (No 10a).

a *A. vivipara* var. *cabaiensis* Humm. Curaçao, Porto Marie (No 13).

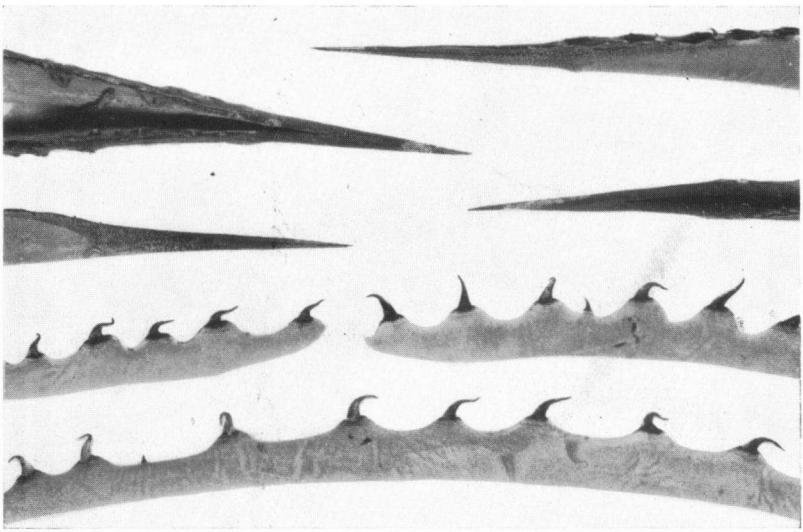
b *A. vivipara* var. *cabaiensis* Humm. Curaçao, Porto Marie (cf No 13, 14), showing one distinctly caulescent specimen.

a *A. arubensis* Humm. Aruba, near Fontein (No. 18).

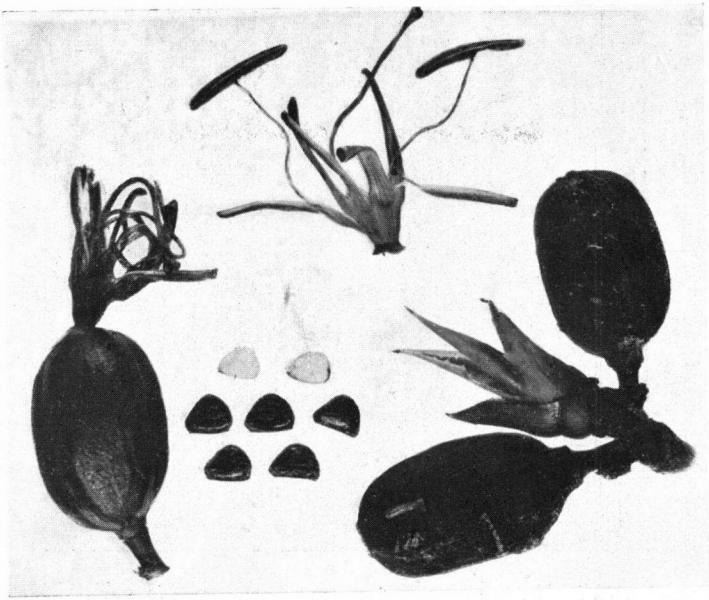
b *A. Rutteniae* Humm. Aruba, Hooiberg (No 19a, type).



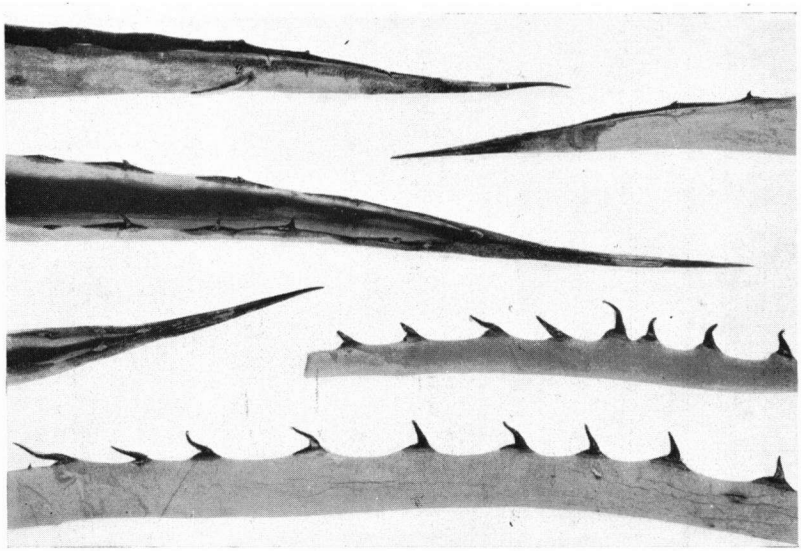
a *A. arubensis* Humm. Aruba (No 17b, type), showing green and drying fruit with flowerrests, bulbil, seeds and part of withered flower (nat. size).



b *A. arubensis* Humm. Aruba (No 17a, type), showing leaftips and pieces of leafmargin (nat. size).



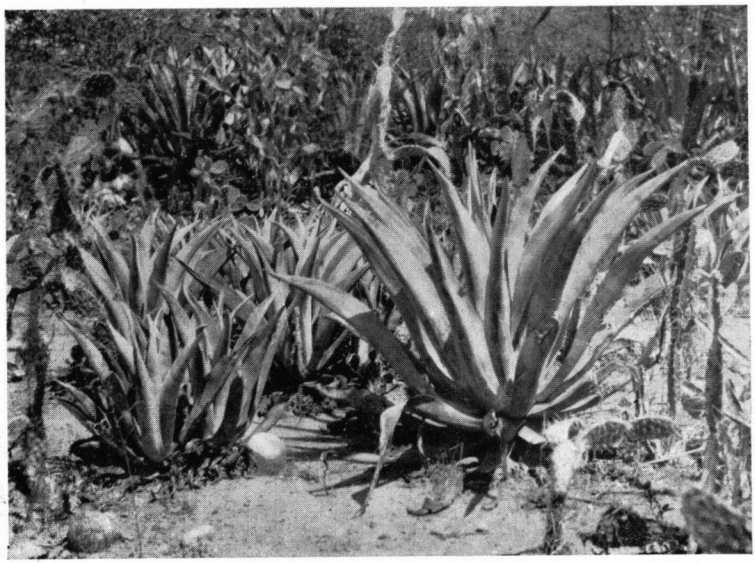
a *A. Rutteniae* Humm. Aruba (No 19b, type), showing green and drying fruit with flowerrest, bulbil, seeds and withered perianth with style and two stamens (nat. size).



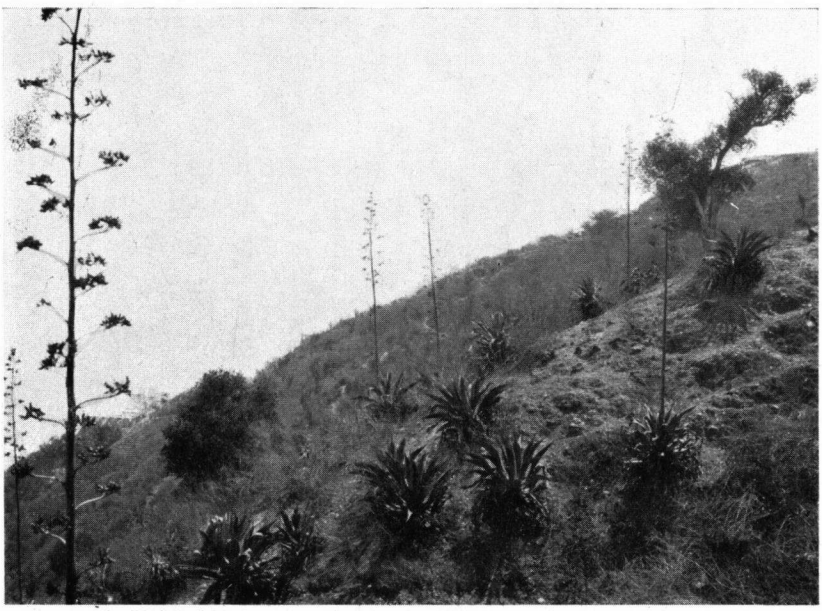
b *A. Rutteniae* Humm. Aruba (No 19a, type), showing leaftips and pieces of leafmargin (nat. size).

a *A. Boldinghiana* Trel. Bonaire, near Dos Pos (No 20b), flowers showing protandry: Style streches not until thecae burst and filaments begin to fade (reduced, from life).

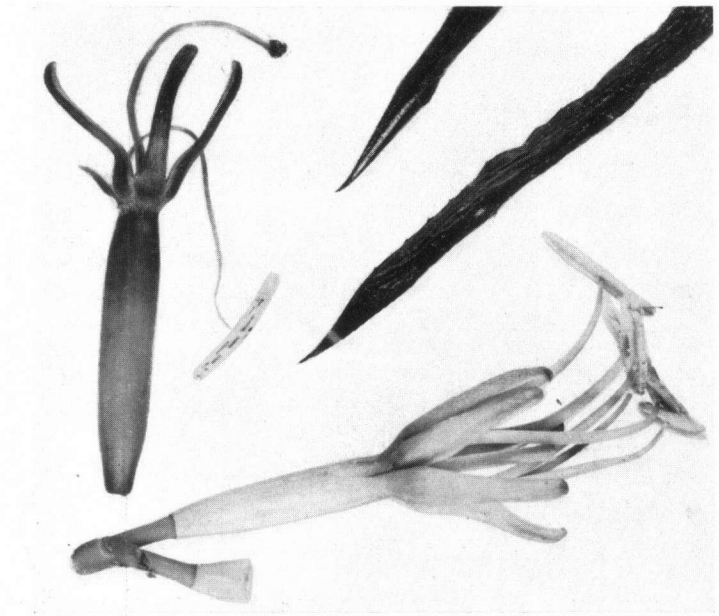
b *A. Boldinghiana* Trel. As before, later stade.



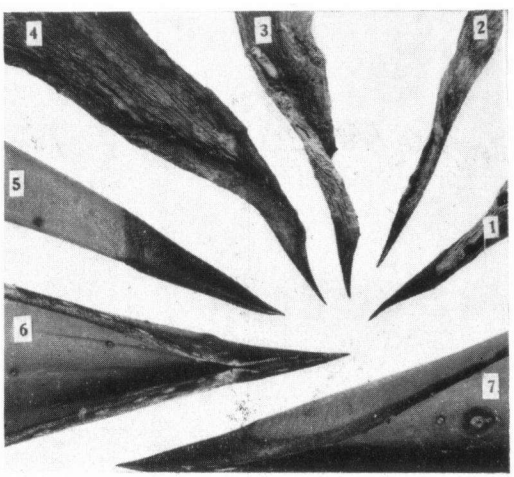
a *A. Cocui* var. *cucutensis* Humm. Colombia, near Cúcuta (No 27a).



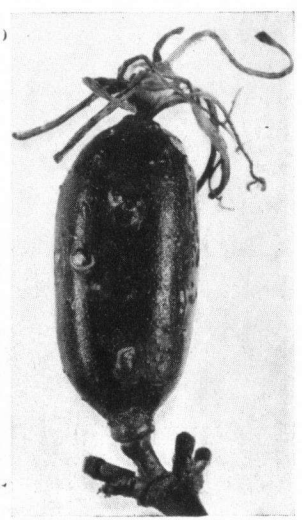
b *A. Cocui* var. *laguayrensis* Humm. Venezuela, La Guayra (cf No 23, 24).



a *A. Cocui* var. *cucutensis* Humm. Colombia (No. 27a, 27b), showing dried leaftips and flowers in different stades of development (nat. size).




b 1-4 *A. Cocui* Trel. Venezuela (1-3, Miss. 138447; 4, Miss. 138449, part of type-material). 5-7 *A. Cocui* var. *laguayrensis* Humm. Venezuela (No 23). All showing leaftips, 2 and 5 at sideview (nat. size).



c *A. Boldinghiana* Trel. Bonaire (No 20b), showing green fruit with flowerrest (nat. size).

*Bonaire*. Kralendijk, 16. V. 1930, on coral rock, 2 m, cultiv., flor. (No 22a; No 22b, flow. and caps.).

These specimens differ from those described above in: Prickles about 19 per 10 cm. Flowers 45-52 mm long. Ovary 22-28 mm by 5½-6½ mm. Capsules 40-46 mm by 17-19 mm.

Trelease 1913 p. 21 (not pl. 13 fig. 2!) considers the material which Boldingh collected on Bonaire („7456, etc., 1910, with more crowded and smaller prickles") as „perhaps varietally separable". A piece of marginal arming (Boldingh, 1910, 7456; Herb. Utr. 12800 A) falls within the variety width of the specimens described from Dos Pos. Another piece of marginal arming from Bonaire (Boldingh, 1910, Herb. Utr. 12801 A) has 10—16 prickles per 10 cm, the same has Miss. 138406 (—138405); thus this also corresponds to the variety width of A. Boldinghiana. This number 7456 contains, in addition to the afore named, other specifically different material: Miss. 138409 is probably A. vivipara (typica) and Miss. 138407—138408 (considered by Trelease 1913, pl. 13 fig. 2, to be a A. Boldinghiana with „aberrant leaf-margins with reduced papery-confluent prickles") is possibly related to A. Cocui.

Agave Trankeera Trelease 1913 p. 26.

Boldingh 1913 p. 151; id. 1914 p. 18; Berger 1915 p. 218.

Plants acaulescent or subacaulescent, not caespitose. Rosette about 250—300 cm diam., with many leaves. Leaves about 7—9 times as long as broad, 150 cm or more by 18—20 cm, lanceolate, gradually acute, widest somewhat below the middle, straight or very slightly S-curved with top slightly curved upwards, round conduplicate, sometimes plicate, dark green, dull, slightly glaucous when young. Spines conical but distinctly laterally flattened, somewhat mucronate, recurved or very slightly recurved at top, smooth, narrowly to rather broadly and deeply slit to beyond the middle, not involute or involute towards the base with margin smooth and rather sharp, decurrent, dorsally intruding into the green tissue, 8—10 mm by about 3 mm by 4—5 mm, blackish brown or gray, dull. Prickles often recurved somewhat below the middle, 5—8 per 10 cm, 1—2½ mm in length, acuminate triangular or rather slender aciculate to a well or rather well developed base, on no or rather weakly developed green or hardening prominences. Inflorescence 600—700 cm high, capsuliferous, freely bulbiferous. Panicle about ½ total length, oblong, about 3 times as long as broad, not or nearly not decurrent, with rather many,

slightly S-curved more or less ascending branches. Pedicels about 10 mm long. Peduncle with rather few, broadly triangular, often recurved bracts. Flowers about 60 mm long, orange. Ovary oblong, 30—33 mm long. Tube 5—8 mm. Segments about 25 mm by 9 mm. Filaments inserted 2—4 mm below the throat, 47—55 mm long; anthers 26—28 mm. Style of unknown length. Capsules broadly oblong, 40 mm by 25 mm, shortly stipitate, beaked. Seeds unknown. Bulbils distributed over the whole panicle, not in the axils of the bracts on the peduncle.

This description is based on the type-material collected by Boldingh (Dec. 1909, A 15; Miss. 138472, 138477—138485; fig. 21) and the flowers collected by Ecker (1910; Miss. 138486), amplified by data from the type-diagnosis of Trelease (p. 26, pl. 28 fig. 1).

As type Trelease has designated the (exclusively vegetative) material of Boldingh (A 15) from Curaçao. He does not say from which material he gained the information for the description of the flower; but from the material he used for comparison it is clear that only that which Ecker gathered in Curaçao in 1910 is taken into consideration.

The leafmaterial of Ecker (1910; Miss. 138487—138488) differs slightly from the description of the type given above: Spine conical, not flattened. A photograph of the inflorescence (Miss. 138486) shows full resemblance with the type (cf Trel. 1913 pl. 26 fig. 1). — Other leafmaterial from Boldingh (A 15; Herb. Utr.) fully agree with the description of the type. — A branch with dried capsules, gathered by Boldingh in 1909 at Valentijn, near Willemstad, Curaçao (Mus. Utr.) shows full resemblance with the picture given by Trelease 1913 pl. 27 fig. 2, but does not agree with the description given by this author: Capsules (old) oblong, about 2½ times as long as broad, 41—45 mm by 17 mm, stipitated, beaked. The pedicels are 7—13, usually 10 mm long. — Material from a flowering specimen of A. Trankeera, collected by Britton and Shafer on „rocky hillsides near Willemstad" (N. Y. 2922, dupl. Herb. Utr.), agree well with the description given above: Spine conical, laterally flattened, rather straight, 18 mm by 3 mm by 5 mm. Prickles 10—12 per 10 cm. Flowers 55—60 cm long, yellow. Ovary 28—34 mm by about 5—6 mm. Filaments inserted 2—3 mm below the throat, 48—56 mm long; anthers 20—26 mm. Style 55—63 mm long, surpassing the filaments.

Trelease examined also material from Aruba and Bonaire. According to him (1913 p. 26), these specimens „may prove distinct

from the Curaçao plant, if not from one another, when better known". Having no data at my disposal to solve this question I think it better to let the matter rest there for the present.

**Agave vicina** Trelease 1913 p. 19.

Boldingh 1913 p. 151; id. 1914 p. 18; Berger 1915 p. 224.

As type Trelease indicates the leafmaterial collected by Boldingh in 1910 (3,5). Mature flowers and fruit are unknown! In studying this material it appeared to me, that the illustrations given by Trelease (pl. 4, pl. 10 fig. 2) relate only to the material collected by Boldingh under Nr 3 (Miss. 13896, 13897) which however is probably A. vivipara; the description is also better applicable to this material only. The material under Nr 5 (Miss. 138493—138495), very probably A. Rutteniae!, is quite different.

**Agave petiolata** Trelease 1913 p. 20.

Boldingh 1913 p. 150; id. 1914 p. 18; Berger 1915 p. 225.

Plant caulescent, the trunk under 100 cm high, suckering? Rosette about 200—250 cm diam. Leaves about 6 times as long as broad, about 110 cm by 18 cm, lanceolate, gradually acute, widest below the middle, rather abrubtly contracted into a slender neck, blue-glaucous. Spines acicular, straight or somewhat curved, more or less flexuous, rough, covered with very many minute tubercles, smooth towards the top, broadly round-grooved below or to the middle, not or nearly not involute towards the base, with margin blunt and smooth, shortly decurrent, dorsally not or slightly intruding into the green tissue, 18—35 mm by 3½ mm by 4—4½ mm, chestnut. Prickles pointing downwards somewhat below the middle of the leaf, 3 per 10 cm, 6—7 mm in length (below and above the middle of the leaf up to 11 mm), granular roughened, rather slender aciculate to a well to very strongly developed base, on rather well to rather strongly developed hardening or partly green prominences, purplish chestnut. Inflorescence paniculate. Pedicels scarcely 5 mm. Flowers 35—40 mm long. Ovary fusiform, 15 mm long. Tube 5 mm. Segments 15 mm by 3 mm. Filaments inserted nearly in the throat, 30 mm long. Capsules and Bulbils unknown.

This description is based on the vegetative type-material collected by Boldingh (7. XII. 1909, A 8; Miss. 138456—138460, fig. 22, „cultivated; only on two plantations and in small num-

bers"), amplified by data given by Trelease in his type-diagnosis (pl. 8 fig. 2).

As type Trelease has designated the material collected by Boldingh (A 8) in Curaçao. For comparison he made use of material of Ecker (1909) and Boldingh (1910; 5624) from the same island. It is not clear which material gave him the data for the description of the flower.

The leafmaterial collected by Ecker on Curaçao (28. VIII 1909; Miss. 138463) differs slightly from the description given above: Spine 58 mm by 4 mm by 4 mm. Prickles 5—6 per 10 cm, 5 mm in length, on very strongly developed, abrubt, green prominences.

Although this „curious plant, in arming suggesting some of the Mexican species grown for pulque" (Trel. 1913 p. 20) is known only from Curaçao, it gives me the strong impression of not belonging to the native flora of that island.

**Agave Cocui** Trelease 1913 p. 19.

Literature; Berger 1915 p. 224.

In studying the type, collected by Zuolaga in 1910 near Caracas, Venezuela, it appeared to me that the type-diagnosis embraces only a part of the vegetative material. On plate IXb 1—4 I have figured some spines (Miss. 138447) not admitted to the type-diagnosis, which however, according to a pencil annotation of Trelease himself, belongs to the only flowering specimen seen by this author. In addition the circumference of a leaf (from Miss. 138452—138455), just as well collected by Zuolaga, is given. Though I doubt te uniformity of the type-material, I think it better to let the matter rest for the present, as I have not visited the type-locality myself and because the material is not ample enough to justify any decision in this matter.

**Agave Cocui** Trel. var. **laguayrensis** Hummelinck nov. var. [11])
Plant acaulescent or subacaulescent. Rosette with rather many leaves. Leaves lanceolate or suboblong, acute or slightly acuminate, large, often slightly S-curved, usually plicate, often with top slightly curved upwards. Spines conical, slightly or very slightly

[11]) *A. Cocui* Trel. var. *laguayrensis* Hummelinck nov. var.
Folia lanceolata vel suboblonga. Spinae terminales conicae paulo vel paululo recurvae apice saepe sursum curvatae laeves vel basi subrugulosae, late vel latissime longe ultra medium sulcatae, basi involutae vel valde involutae, decurrentes, dorso in textum viride ingredientes, 13-17 mm longae, 4-5 mm diametro. Aculei marginales, fere 10 in 10 cm, 2½-4 mm longi, acuminato-triangulares. Inflorescentia bulbifera. Panicula anguste oblonga, ½-⅔ partem

recurved and often again upcurved at the top, smooth or somewhat granular roughened below, broadly or very broadly and shallowly grooved to far beyond the middle, involute or strongly involute at the base, with margin blunt and smooth or with a row of minute confluent tubercles (reduced prickles), decurrent, dorsally intruding into the green tissue, 13—17 mm by 4—4½ mm by 4—5 mm. Prickles not upcurved near the top, 8—12 per 10 cm, 2½—4 mm in length, acuminate triangular or rather slender aciculate to a rather well to rather strongly developed base, on rather well or rather weakly developed hardening prominences. Inflorescence several metres high, freely capsuliferous, bulbiferous. Panicle ½—⅔ total length, narrowly oblong, 5—10 times as long as broad, not or slightly decurrent, with many S-curved, horizontal or more or less ascending branches. Pedicels 3—7 mm, usually 5 mm. Flowers 54—62 mm long. Ovary oblong, 25—32 mm by 7—8 mm, usually about 30 mm long. Tube 4—6 mm. Segments about 22 mm by 6—7 mm. Filaments inserted ½ mm below to ½ mm above the throat, 40—45 mm long; anthers 20—25 mm. Style 48—52 mm long, equaling or slightly surpassing the filaments. Capsules (green) oblong, about 2 times as long as broad, 42—50 mm by 22—25 mm, usually 48 mm by 24 mm, slightly or nearly not stipitate and not or nearly not beaked, stipitate and very slightly beaked when drying. Seeds 7—8½ mm by 5—6 mm. Bulbils especially in the lower parts, sometimes also in the axils of the bracts on the peduncle.

*Venezuela.* La Guayra, 7. IV. 1930, on débris of cristallyne sherts, 150-200 m, soc. 1 (pl. VIIIb), flor. (No 23, pl. IXb 5-7; No 24, flow. and caps.).
Probably varietally separable on account of the different structure of the spine.

*Bonaire.* Savaneta, E. of Dos Pos, 5. VI. 1930, on decomposed diabase, 40 m, cultiv., flor. (No 25, with flow. and caps.), 45 m, semi-cultiv., (No 26. fig. 24).
These plants agree well with the specimens described from La Guayra, from where they have probably been imported: Spines 15-16 mm by 4-5 mm by 5-6 mm. Prickles 5-7 mm in length. Inflorescence 850-1000 cm high. Flowers 60-68 mm long. Ovary 36-41 mm by 7-8 mm. Segments 23-25 mm by 6½-7½ mm. Filaments inserted usually ½-1 mm below the throat, 38-43 mm long.

inflorescentiae metiens, pedicellis 3-7 mm longis. Flores 54-62 mm longi, ovario 25-32 mm longo, tubo 4-6 mm longo, segmentis fere 22 mm longis, filamentis ½ mm sub fauce usque ad ½ mm supra faucem insertis, stylo 48-52 mm longo. Capsulae oblongae, fere 2 partibus longiores quam latae, 42-50 mm longae, 22-25 mm latae, vix stipitatae et rostratae. Semina 7-8½ mm longa, 5-6 mm lata.

**Agave Cocui Trel. var. cucutensis Hummelinck nov. var.** [12]).

Plants acaulescent, suckering. Rosette 200—250 cm diam., with rather many leaves. Leaves 5—6 times as long as broad, about 120 by 20 cm, narrowly elliptical, acuminate or slightly acuminate, widest about the middle, gradually narrowing towards the neck, more or less S-curved, usually with top slightly curved upwards, round to rather sharp conduplicate, glaucouscent. Spines conical with upcurved top, very rough, covered with many minute tubercles which are diminishing in size towaards the base and the top, narrowly and deeply grooved up to beyond the middle, involute, with margin slightly toothed and with few small prickles, decurrent, dorsally intruding into the green tissue, 10—17 mm by 3—4 mm by 4 mm. Prickles often recurved in the middle of the leaf, 6—7 per 10 cm, 3½—4½ mm in length, acuminate triangular or rather slender aciculate to a rather well or well developed base, on rather well or well developed green prominences. Inflorescence 500—600 cm high, freely bulbiferous. Panicle ½—⅔ total length narrowly oblong, tapering towards the top, 5—7 times as long as broad, not or nearly not decurrent, with many, slightly S-curved, horizontal or ascending branches. Pedicels 8—11 mm. Peduncle with rather few bracts, the highest bractea about 7—8 cm, the lowest about 18—20 cm long. Flowers 48—65 mm, usually 56—60 mm long. Ovary 30—37 mm by 6½—8 mm, oblong, yellowish green. Tube 4—5 mm. Segments 20—22 mm by 6—7 mm, greenish yellow. Filaments inserted 1 mm below to 1 mm above the throat, 38—43 mm long, yellow; anthers 17—20 mm, violent yellow. Style 44—46 mm, equaling the filaments. Capsules unknown. Bulbils distributed over the whole panicle, especially in the lower parts, and in the axils of the highest bracts on the peduncle.

*Colombia.* 4700 m N. of Cúcuta, 1500 m S. of Salado, near railway, 19. VII. 1930, on sandy shales with pebbles, abt 300 m, between shrubs with cactaceae, soc. 2-3, flor. (No 27a, pl. VIIa, fig. 25; No 27b, flow., pl. VIIIa). Material, collected by W. E. Broadway in the vicinity of Christobal

[12]) *A. Cocui* Trel. var. *cucutensis* Hummelinck nov. var.
Folia anguste elliptica, 5-6 partibus longiora quam lata, 120 cm longa, 20 cm lata. Spinae terminales conicae rugosissimae, sursum curvatae, anguste ac profunde ultra medium sulcatae, involutae, decurrentes, dorso in textum viride ingredientes, 10-17 mm longae, 3-4 mm diametro. Aculei marginales 6-7 in 10 cm, 3½-4½ mm longi, acuminato-triangulares. Inflorescentia 500-600 cm alta, bulbifera. Panicula ½-2/3 partem inflorescentiae metiens, anguste oblonga, pedicellis 8-11 mm longis. Pedunculus ca 18 bracteatus. Flores 48-65 mm longi, ovario 30-37 mm longo, tubo 4-5 mm longo, segmentis 20-22 mm longis, filamentis 1 mm sub fauce usque ad 1 mm supra faucem insertis, 38-43 mm longis, antheris 17-20 mm longis, stylo 44-26 mm longo.

Colon (= San Christobal, Táchira?), Venezuela, Febr. 1923 (N.Y. 472), is also characterized by long pedicels (8-12 mm) and differ otherwise only slightly from the specimens from Salado: Only spine present granular roughened, rather broadly grooved to the middle, shortly decurrent, 11 mm by 2½ mm by 2½ mm. Prickles 2-2½ mm in length, on weakly or very weakly developed green prominences. Flowers 46-50 mm long. Ovary 24-28 mm long. Filaments 32-36 mm long; anthers 15-19 mm. Style about 40 mm long.

## SHORT DIFFERENTIAL DIAGNOSES

(some conspicious characteristics are printed in italics)

It is certain, that with further study, the relation of species and varieties will prove to be very much more complicated, than this synopsis leads us to suppose.

**Agave vivipara L. 1753.**

*Leaves elliptical-oblanceolate, 2.3—4 times as long as broad, 40—60 cm in length. Spines* acicular, grooved, wether or not involute, *slightly or not decurrent,* wether or not intruding, smooth, 17—28 by 2.5—4.5 by 2.5—4.5 mm. Prickles 6—22 per 10 cm, 3—9 mm in length. Inflorescence 200—500 cm high; panicle 0.2—0.5 total length; pedicels 4—8 mm; bracts 12—30. Flowers 40—50 mm in length; ovary 20—25 mm; tube 4—5.5 mm; segments 15—20 mm; filaments inserted 0—0.8 mm below the throat, 30—36 mm in length; anthers 16—20 mm; style 40—43 mm. Capsules 2 times as long as broad, 28—37 by 14—19 mm, *stipitate, nearly not beaked.* Seeds 6—7.5 by 4.5—5 mm. — Curaçao, Aruba, Bonaire, on coral rock, porfirite and hooibergite.

**Agave vivipara L. 1753 var. cabaiensis Humm. nov. var.**

*Leaves elliptical, 2.5—4 times as long as broad, 17—35 cm in length.* Spines acicular, grooved, involute, slightly decurrent, slightly intruding, smooth, 16—21 by 2.5—4 by 3—4 mm. Prickles 10—14 in 10 cm, 4—6 mm in length. Inflorescence 300 cm high; pedicels 4—7 mm; bracts (about) 14. Flowers with tube 4—5 mm: *segments 12—13 mm; filaments* inserted 0.5—1 mm below the throat, *20—23 mm in length;* anthers 12—13 mm. — Curaçao, on coral rock.

**Agave vivipara L. 1753 var. cuebensis Humm. nov. var.**

*Leaves elliptical-oblanceolate, 4—5 times as long as broad, 60—80 cm in length.* Spines acicular, grooved, involute, decurrent, intruding or slightly intruding, smooth, 20—23 by 3—4 by 3—4 mm. Prickles 10—12 in 10 cm, 3—4 mm in length. Inflorescence 300 cm high; panicle 0.3—0.4 total length; pedicels 3—6 mm.

Flowers 40—46 mm in length; ovary 20—26 mm; *tube 5—7 mm;* segments 15—17 mm; filaments inserted 0—2 mm below the throat, 29—34 mm in length; anthers 14—17 mm; style 25—41 mm. — Curaçao, on coral rock.

**Agave arubensis** Humm. nov. spec.

*Leaves lanceolate, 4.3—6 times as long as broad, 60—80 cm in length.* Spines acicular, grooved, involute or nearly not involute, slightly decurrent, slightly or not intruding, *rough*, 27—32 by 2.5—4 by 2.5 by 4 mm. Prickles 8—12 in 10 cm, 4—6 mm in length. Inflorescence 350—500 cm high; panicle 0.5—0.7 total length; pedicels 4—7 mm; *bracts 5—14.* Flowers with *tube 7—8 mm;* segments 19—21 mm; *filaments inserted 2—4 mm below the throat,* 30—35 mm in length; anthers 14—19 mm; style 35—40 mm. *Capsules 2.5—3 times as long as broad,* 33—40 by 12—15 mm, *distinctly stipitate, distinctly beaked.* Seeds 4.5—5 by 4—4.5 mm. — Aruba, on coral rock.

**Agave Rutteniae** Humm. nov. spec.

*Leaves* elliptical, *5.5—9 times as long as broad, 44—70 cm in length. Spines slender acicular*, grooved, involute, decurrent, not intruding, smooth, *22—28 by 2—3 by 2—3 mm.* Prickles 9—17 per 10 cm, 4—5 mm in length. Inflorescence 200—350 cm high, panicle 0.3—0.4 total length, axis swollen under the insertion of the branches; pedicels 5—6 mm; bracts 10—20. Flowers with *tube 7.5 mm;* segments 14—16 mm; *filaments inserted 1—2 mm below the throat,* 25—30 mm in length; anthers 14—17 mm; style 28—32 mm. *Capsules 1.5—1.8 times as long as broad,* 24—28 by 15—18 mm, *shortly stipitate, not beaked.* Seeds 5.5—6.5 by 4—5 mm. — Aruba, on hooibergite.

**Agave Boldinghiana** Trel. 1913.

*Leaves* elliptical, *5—7.3 times as long as broad, 90—125 cm in length. Spines* acicular, *shallowly or not grooved,* slightly or not involute, *not or slightly decurrent,* intruding, smooth, 14—25 by 2—3 by 1.5—3 mm. Prickles 7—19 per 10 cm, 4—6 mm in length. *Inflorescence 500—700 cm high;* panicle 0.4—0.6 total length; pedicels 4—9 mm; bracts about 25. Flowers 45—55 mm in length; ovary 20—28 mm; tube 4—5.5 mm; segments 18—23 mm; filaments inserted 0—2 mm below the throat, 34—38 mm in length; anthers 18—21 mm; style 40—45 mm. *Capsules* 2—2.4 times as long as broad, 33—46 by 15—19 mm, *stipitate, beaked.*

Seeds 6—6.5 by 4.5—5 mm. — Curaçao, Bonaire, on coral rock (cultiv.! and semi-cultiv.!).

**Agave Trankeera** Trel. 1913.

*Leaves* lanceolate, *7—9 times as long as broad, 120—150 cm in length. Spines conical, laterally flattened, deeply slit,* slightly or not involute, decurrent, intruding, smooth, 8—18 by 3 by 4—5 mm. *Prickles* 5—12 per 10 cm, *1—2.5 mm in length. Inflorescence 600—700 cm high;* panicle 0.5 total length; *pedicels 10 mm;* bracts about 15—20. *Flowers 60—65 mm in length;* ovary 28—34 mm; tube 5—8 mm; segments 25 mm; *filaments inserted 2—4 mm below the throat, 47—56 mm in length;* anthers 22—28 mm; *style 55—63 mm. Capsules* 2—2.5 times as long as broad, 40—45 by 17—20(?) mm, *stipitate, slightly beaked.* — Curaçao, on coral rock (cultiv.! and semi-cultiv.!).

**Agave Cocui** Trel. 1913 var. **laguayrensis** Humm. nov. var.

Leaves lanceolate-suboblong. *Spines conical,* grooved, involute, decurrent, intruding, smooth or roughened, *13—17 by 4—5 by 4—6 mm.* Prickles 8—10 per 10 cm, 2.5—7 mm in length. *Inflorescence 700—1000 cm high;* panicle 0.6—0.7 total length; pedicels 3—7 mm; bracts about 20. Flowers 54—62 mm in length; ovary 25—41 mm; tube 4—6 mm; segments 22—25 mm; filaments inserted 0.5 mm above — 0.5 mm below the throat, 40—45 mm in length; anthers 20—25 mm; style 48—52 mm. *Capsules* 2 times as long as broad, 42—50 by 22—25 mm, *slightly stipitate, nearly not beaked.* Seeds 7—8.5 by 5—6 mm. — Venezuela, La Guayra, on sherts; Bonaire, on diabase (cultiv.!).

**Agave Cocui** Trel. 1913 var. **cucutensis** Humm. nov. var.

Leaves elliptical-suboblong, 5—6 times as long as broad, 100—130 cm in length. *Spines conical, upcurved,* grooved, involute, decurrent, intruding, *rough, 10—17 by 3—4 by 4 mm.* Prickles 6—7 per 10 cm, 3.5—4.5 mm in length. Inflorescence 500—600 cm high; panicle 0.5—0.7 total length; *pedicels 8—12 mm;* bracts about 15—20. Flowers 46—65 mm in length; ovary 25—37 mm; tube 4—5 mm; segments 20—22 mm; filaments inserted 1 mm above — 1 mm below the throat, 33—43 mm in length; anthers 15—20 mm; style 40—46 mm. — Colombia, near Cúcuta, on sandy shales; Venezuela, near Christobal.

## ERRATA

P. Wagenaar Hummelinck (Utrecht). Notes on Agave in Aruba, Curaçao, Bonaire and some parts of the South American continent. (Recueil des Travaux botaniques néerlandais, Vol. XXXIII, 1936; Mededeelingen van het Botanisch Museum en Herbarium van de Rijksuniversiteit te Utrecht no. 29).

p. 226, line 30 *read:*
Thus the known geological facts do not give us the slightest

p. 227, line 15 *read:*
generally rather small number of seeds prooved to contain an

Tab. VIII b, *read:* All showing leaftips, 1, 3, 4 and 5 at sideview (nat. size).