

NOTES ON AGAVE IN THE NETHERLANDS WEST INDIES AND NORTH VENEZUELA

by

P. WAGENAAR HUMMELINCK (Utrecht).

(With plates I—IV).

This paper deals with some species of *Agave* of which material was collected in 1936 and the beginning of 1937, on a trip to Aruba, Curaçao, Bonaire, the Venezuelan Islands and the adjacent continental coast. It may be considered as a continuation of my "Notes on Agave in Aruba, Curaçao, Bonaire and some parts of the South American Continent" in Vol. 33 (1936) of this periodical. The material was preserved in formaline and has been deposited in the Botanical Museum at Utrecht.

TRELEASE, in his monograph on "Agave in the West Indies", in Mem. Nat. Ac. Sc. Washington 11, 1913, distinguished no less than 47 species and he stated that, at any rate in the Lesser Antilles, each species was, as a rule, confined to a single island or to islands arising from a common bank; — on Curaçao, Aruba and Bonaire, however, where several species are found, some are common to all three islands. Furthermore he suggested that the large flowered agaves are in each main division of the archipelago represented by a distinctive group of species, — again with the exception of Curaçao, Aruba and Bonaire which possess a common species (*A. Trankeera*) belonging to the Section *Caribaeae*, which is characteristic of the Lesser Antilles from Grenada to St. Croix. For the continent of Venezuela he only mentioned one species (*A. Cocui*), which he united with the remaining species from Curaçao, Aruba and Bonaire (*A. vivipara*, *A. Boldinghiana*, *A. vicina*, *A. petiolata*) and with the agave from Trinidad (*A. evadens*) in the Section *Viviparae*. From the Venezuelan Islands only scanty material, consisting of some isolated flowers from Margarita, was known.

In result of my studies I distinguish in the Section *Viviparae*

6 species: *A. vivipara* (Aruba, Curaçao, Bonaire, Venezuelan Islands), *A. arubensis* (Aruba), *A. Rutteniae* (Aruba), *A. Boldinghiana* (Aruba, Curaçao, Bonaire), *A. Cocui* (South American Continent, Venezuelan Islands) and *A. evadens* (Trinidad). These species are nearly related and, in certain regions, even not always clearly differentiated. For the present, however, I would not recommend a further reduction of the number of species. The reduction to a single species, *A. vivipara* L., with a suitable subdivision in subspecies, varieties or forms would certainly have some advantages, — but only if, at the same time, all West Indian and South American species were dealt with according to this principle.

In my previous paper I have shortly dealt with TRELEASE's phytogeographical conclusions, in so far as they relate to the countries in question. I had to confess, however, that the geological facts did not give us the slightest indication when, in post-eocene times, the species of *Agave* could have immigrated to the islands Aruba, Curaçao and Bonaire, nor about the direction from where they came; the relations between the plants themselves did give us no clue either. — Here too we cannot give much more information. The greater number of species in Aruba, Curaçao and Bonaire suggests that these islands were separated from the continent at an earlier date than Margarita. This would be in accordance with geological and zoogeographical facts, which point to a connection of Margarita with the mainland in pliocene or pleistocene times. — The occurrence, on Aruba, Curaçao and Bonaire, of a species belonging to the Section *Caribaeae*, however, is probably due to human influences.

Key to the species of *Agave* occurring in Curaçao, Aruba and Bonaire.

(The species, printed in italics, are introduced plants which are not discussed in this paper.)

Agave: Rosette, consisting of succulent, elongated, $\frac{1}{4}$ –2 m long leaves, ending in a spine; inflorescence terminal, paniculate, 2–10 m high; flowers erect, yellow; filaments much longer than the segments.

- 1a Leaves straight, 12–25 times as long as broad 2
- b Leaves curved, $2\frac{1}{2}$ –9 times as long as broad 4
- 2a Prickles usually entirely suppressed *A. sisalana* Ferr.
- b Prickles 2–5 mm long 3
- 3a Plant caulescent; leaves grey-green *A. fourcroydes* Lem.
- b Plant acaulescent or subacaulescent; leaves green *A. Cantala* Roxb.
- 4a Plant caulescent; leaves lanceolate, abruptly contracted at the base, longer than 1 m; spines acicular *A. petiolata* Trel.

- b Plant acaulescent or subacaulescent; leaves lanceolate, elliptical or oblanceolate, not abruptly contracted at the base, longer or shorter than 1 m; spines acicular to conical 5
- 5a Plant not producing suckers; leaves lanceolate, 7—9 times as long as broad, 120—170 cm long; spines usually conical; prickles $\frac{1}{4}$ — $2\frac{1}{2}$ mm long A. Karatto Mill.
- b Plant producing suckers; leaves lanceolate, elliptical or oblanceolate, $2\frac{1}{2}$ — $7\frac{1}{2}$ times as long as broad, 30—125 cm long; spines acicular to conical; prickles 2—9 mm long 6
- 6a Leaves elliptical to broadly lanceolate, 90—125 cm long; inflorescence 5—10 m high 7
- b Leaves elliptical to oblanceolate, 30—80 cm long; inflorescence 2—5 m high 8
- 7a Leaves elliptical, distinctly acuminate, 5— $7\frac{1}{2}$ times as long as broad; spines acicular A. Boldinghiana Trel.
- b Leaves elliptical to lanceolate, slightly acuminate or acute, $3\frac{1}{2}$ —4 times as long as broad; spines conical A. Cocui Trel.
- 8a Number of bracts 6—13; tube 7—8 mm; capsules $2\frac{1}{2}$ —3 times as long as broad, distinctly stipitate, distinctly beaked. A. arubensis Humlnk.
- b Number of bracts 15—28; tube 3—8 mm; capsules $1\frac{1}{2}$ — $2\frac{1}{4}$ times as long as broad, shortly stipitate, not or indistinctly beaked 9
- 9a Axis distinctly swollen below the insertion of the branches; tube 7—8 mm; capsules $1\frac{1}{2}$ — $1\frac{3}{4}$ times as long as broad. A. Rutteniae Humlnk.
- b Axis indistinctly swollen below the insertion of the branches; tube 3—6 mm; capsules $1\frac{3}{4}$ — $2\frac{1}{4}$ times as long as broad A. vivipara L.

Agave vivipara L., Sp. Plant. 1753, I p. 323. TRELEASE 1913 p. 18; HUMMELINCK 1936 p. 231. — *A. vivipara* L. var. *cabaiensis* HUMMELINCK 1936 p. 234. — *A. vivipara* L. var. *cuebensis* HUMMELINCK 1936 p. 235. — *A. americana* L., apud ERNST 1886, Nederl. Kruidk. Arch. (2) 4 p. 362; JOHNSTON 1909, Contr. Gray Herb. (N.S.) No 37 p. 197, 274. — *A. vicina* TRELEASE 1913 p. 19 (cf HUMMELINCK 1936 p. 243).

"Koeki indiaan" (Cur., Ar., Bon.); "Cocú" (Marg.).

Aruba; Curaçao (type-locality!); Bonaire, Klein Bonaire; Blanquilla; Morro Fondadero, Morro Pando (Los Hermanos); Margarita.

Very locally but nevertheless the most common agave of the Leeward Group.

Leaves oblanceolate or, sometimes, elliptical or oblong, rarely lanceolate, ($2\frac{1}{2}$ —) 3—5 (—7) times as long as broad, (20—) 40—80 (—100) cm long. Spines acicular or, rarely, conical, sometimes triquetrous, often flexuous, rarely recurved near the top, usually involute at the base, sometimes rough, slightly or not decurrent, dorsally, as a rule, very slightly intruding, (12—) 15—25 (—36) \times (2—) $2\frac{1}{2}$ — $4\frac{1}{2}$ (—6) \times (2—) $2\frac{1}{2}$ — $4\frac{1}{2}$ (—6) mm. Prickles (6—) 8—18 (—24) per 10 cm, (2—) 4—8

(—12) mm long. Inflorescence (2—) $2\frac{1}{2}$ —4 (— $6\frac{1}{2}$) m high; pedicels (3—) 4—7 (—8) mm; bracts (12—) 16—25 (—30), serrate towards the top, usually with more or less hardened spine. Flower 40—60 mm; ovary (20—) 23—27 (—37) mm; tube (3—) $3\frac{1}{2}$ — $5\frac{1}{2}$ (— $6\frac{1}{2}$) mm; segments (15—) 18—20 (—22) mm; filaments inserted (1 mm above to) $0-\frac{3}{4}$ (—1) mm below the throat, (27—) 30—35 (—37) mm long; anthers (14—) 16—19 (—21) mm; style 40—45 (—48) mm. Capsules $1\frac{3}{4}$ —2 (— $2\frac{1}{2}$) times as long as broad, (25—) 30—38 (—45) mm long, usually shortly stipitate, slightly or not beaked.

Var. *cabaiensis* and var. *cuebensis* must be considered as extreme forms in the range of variability shown by *A. vivipara*. No importance must be attached to the values given for the flower of var. *cabaiensis*, as the scanty material was probably abnormal. The measurements for the spine and prickles of var. *cuebensis* were partly obtained from leaf fragments which might prove to belong to another species.

Curaçao. S. slope of the Oost Seinpost, 9. IX. 1936, diabase, 40—50 m, soc. 1—3 (No 28, flower rests, capsules). S. rooi of the Oost Seinpost, id. (No 29, caps.). N.E. of Fort Beekenburg, 16. X. 1936, diabase with coral rock, 1—10 m, soc. 1—2 (No 30). N. slope of the Seroe Cabajé, Porto Marie, 20. IV. 1930, as No 13—14 (No 31). Id., 9. XI. 1936 (No 32). N. slope of the Seroe di Cueba, St. Hyronimus, 29. X. 1936, as No 16, soc. 1—3 (No 33, flow. r., caps.). Id. 30. IV. 1930, about 44 m, soc. 1—2 (No 34, flow.). Id. 29. X. 1936 (No 35, flow. r., caps.). S.E. of the Tafelberg, St. Hyronimus, 10. XI. 1936, diabase with some coral rock, about 110 m (No 36).

Klein Bonaire. Near the Salinja, 23. III. 1937, barren coral rock, 1 m, soc. 1—2 (No 37, sev. spec., flow.).

Bonaire. 200 m E. of Pos Nobo, S. of the Brandaris, 22. X. 1930, diabase, 25—35 m (No 38—40).

Aruba. S. slope of the Hooiberg, 5. XII. 1936, as No 8, inflor. juv. (No 41, sev. spec.). Solito, near Oranjestad, 16. XII. 1936, dioritesand, 12 m (No 42, three spec.). 400 m N.W. of the Seroe Pretoe, near the Hooiberg, 10. II. 1937, 20 m, quartzdiorite, inflor. juv. (No 43, sev. spec.). Top of the Jamanota, 3. I. 1937, diabase, 186 m (No 44, old caps.). E. of the Shidaharaka, near Rooi Lamoenchi, 29. XII. 1936, coral rock, 50—60 m, inflor. juv., soc. 1—3 (No 45, four spec.). Seroe Canashito, 7. XII. 1936, coral rock, 55 m, soc. 1—2 (No 46, sev. spec.). 600 m W. of the Hooiberg, 7. XII. 1930, diabase, 32 m (No 47). 400 m W. of the Jaburibari, 24. VI. 1930, quartzdiorite, 50 m, soc. 1, deflor. (No 48, 48a, flow. r., caps.). Droemidera, 1550 m S. of Kasioenti, 5. VII. 1930, coral rock, 40 m, soc. 1—3, deflor. (No 49, three spec., flow. r., caps.). Droemidera, 40 m E. of aforementioned locality, 5. VII. 1930 (No 50, three spec., flow. r., caps., 50a). Droemidera, 100 m S. of aforementioned locality, 5. VII. 1930 (No 51). Kasioenti, S. rooi, 5. VII. 1930, diabase, 65 m, deflor. (No 52).

Blanquilla. Playa Valuchu, 21. VII. 1936, sandy shore, 1 m, soc. 1—3, deflor. (No 53, sev. spec., flow. r., caps.; tab. IIa, IIIb). N.W. of Playa Valuchu, 21. VII. 1936, biotite-granite with coral rock, about 10 m., soc. 1—2, deflor. (No 54, flow. r., caps.).

Morro Fondeadero (Los Hermanos), 20. VII. 1936, W. slope near sea, hornblende-diorite, 5–10 m, soc. 1–2, deflor. (No 55).

Morro Pando (or Orquilla, Los Hermanos), 20. VII. 1936, S. slope, quartzdiorite, 20–40 m, soc. 1–2, deflor. (No 56).

Margarita, Punta Ausente, N. of Juan Griego, 14. V. 1936, hornblende-albite rock, 10–100 m, soc. 1–2 (No 57, five spec., flow., caps.; tab. Ia 3–4, IIIa, cf. IIb). Puerto Manzanillo, 11. V. 1936, hornblende-gneiss, 5–15 m, near sea, soc. 1–3, flor. (No 58, four spec., flow.). N.E. of El Piache, near El Valle, 10. VII. 1936, marble, soc. 1–2, deflor. (No 59, flow. r., caps.). E. of La Asunción, near Cerrito, 27. V. 1936, marble, about 80 m, soc. 1–2 (No 60, flow. r., caps.; tab. Ia 1–2).

At the Oost Seinpost (No. 28, 29) we see the differences between plants growing in an exposed situation and those growing in the shade and protected against the East trade-wind. In the first instance we usually find compact rosettes with many leaves and a strong armature (the typical *vivipara*-form of Trelease and other authors); in the second instance we have looser rosettes with much longer and narrower leaves and a weaker developed armature. — The plants of Pos Nobo (No 38–40), partly growing between high shrubs, have inflorescences of 4–6 m high! while the leaves are 3–7 times as long as broad.

Some plants from Aruba (No 45, 47, 48) have rough and very strong spines, $20-36 \times 3-6 \times 3\frac{1}{2}-6$ mm. Those from the Seroe Canashito (No 46) show two extremes of spine variation, but no transitional forms; some have rough, very strong, conical spines, $23-30 \times 4\frac{1}{2}-5 \times 4\frac{1}{2}-5$ mm and other smooth, very weak, acicular spines, $20-25 \times 2-2\frac{1}{2} \times 2\frac{1}{2}-3$ mm. This fact, once more, calls to our mind that the characters whereby a group of *Agave* as we find it in the field, is distinguished from other, for the rest similar, plants, often must be taken as the characteristics of a single individual, which has reproduced itself vegetatively.

The plants of Droemidera (No 49, 50) clearly show some affinity to *A. arubensis* which grows in the immediate neighbourhood. The leaves look very similar and the capsules are more slender, more stipitate and more beaked than in other forms of *A. vivipara*. Of these plants 26 inflorescences were measured: length (230—) 300 (—410) cm, length of panicle (90—) 125 (—180) cm, breadth of panicle (25—) 30 (—40) cm, length of largest branch (14—) 17 (—22) cm, number of branches exceeding 10 cm (14—) 19 (—29), diam. of the peduncle ($2\frac{1}{2}$ —) $3\frac{1}{2}$ (— $4\frac{1}{2}$) cm, number of bracts (19—) 24 (—30), length of highest bract (3—) $4\frac{1}{2}$ (—6) cm, length of lowest bract (7—) 9 (—12) cm.

The specimens from Blanquilla (No 53, 54) resemble the typical *A. vivipara* from the Dutch Islands; the capsules are as in *A. Rutteniae*; the spine is dorsally intruding! Those of Los Hermanos (No 55, 56) look quite the same.

The plants from Punta Ausente, Margarita (No 57) too have to be considered as *A. vivipara*; the measurements show but little difference from the average in the general description given above: Leaves elliptical; spines broadly acicular to conical, mostly slightly incurved at the top, dorsally intruding or slightly intruding; inflorescence $4-6\frac{1}{2}$ m high; flower 55–60 mm long; tube (4—) 6 (— $6\frac{1}{2}$) mm; ovary 29–37 mm; anthers 18–21 mm; capsules about $2\frac{1}{3}$ as long as broad, 40–45 mm long, stipitate. The specimens from Puerto Manzanillo (No 58) resemble the typical *A. vivipara* still more closely.

The limestone hills of El Piache (No. 59) are rich in agaves; some are

placed very favourably in fissures filled with weathered soil; others in very exposed spots on the unweathered rock. The rainfall is greater here than in any of the other island localities. Sometimes narrow, more than 1 m long leaves are found, they are somewhat plicate but always more or less oblanceolate; the spines are acicular or conical, sometimes slightly recurved at the top, $10-20 \times 2-4 \times 2-4\frac{1}{2}$ mm. There are inflorescences of 6 and of $2\frac{1}{2}$ m; the filaments are inserted 1 mm above to 1 mm below the throat and are 27-30 mm long; the anthers about 14 mm. — Sometimes we find irregularly plicate or oddly twisted, very juicy plants, which remind one of similar abnormalities observed in *A. Cocui* from Puerto Santo (No 80, 80a). As a rule, however, all these plants have the appearance of *A. vivipara* and have no resemblance to the *A. Cocui* which I studied in similar circumstances on the continent.

Some small, caespitose specimens, found on a dry limestone hill near El Cerrito (No 60), show the typical habit of *A. vivipara*. The spines are conical, acuminate, usually more or less flexuous, $14-22 \times 2-4 \times 2\frac{1}{2}-4$ mm; the capsules are as in *A. Cocui* of La Sabana (No. 85).

Agave arubensis Hummelinck 1936 p. 236.

Aruba, rooi Fontein (type-locality!).

Only found in the type-locality and in its neighbourhood.

Leaves lanceolate, $4\frac{1}{4}-6$ times as long as broad, 60-80 cm long. Spines acicular, sometimes slightly flexuous, rarely recurved near the top, involute at the base, usually rough, slightly decurrent, dorsally as a rule very slightly intruding, $27-32 \times 2\frac{1}{2}-4 \times 2\frac{1}{2}-4$ mm. Prickles 6-12 per 10 cm, 3-7 mm long. Inflorescence $3\frac{1}{2}-5$ m high; pedicels 4-7 mm; bracts (4-) 6-12 (-14), sharply serrate towards the top, usually with a weakly developed spine. Tube 7-8 mm; segments 19-21 mm; filaments inserted 2-4 mm below the throat, 30-35 mm long; anthers 14-19 mm; style 35-40 mm. Capsules $2\frac{1}{2}-3$ times as long as broad, 33-40 mm long, distinctly stipitate, distinctly beaked.

Aruba. Rooi Fontein, 28. II. 1937, as No 17, inflor. juv. (No 61).

The plants of *A. vivipara* growing in the immediate neighbourhood (No 49, 50) clearly show in form of the leaves and capsules some resemblance to this species; but there are also sharp differences, for instance in the length of the tube, the insertion of the filaments and the number of bracts. Moreover the form of the capsules differs widely from that of all other forms of *A. vivipara* so that there is every reason for maintaining *A. arubensis*.

Agave Rutteniae Hummelinck 1936 p. 238.

Aruba, S. slope of the Hooiberg (type-locality!).

Only found in the type-locality, but here abundantly.

Leaves elliptical, 4-9 times as long as broad, 40-70 cm long. Spines acicular, often slightly flexuous, involute at the base,

slightly decurrent, dorsally as a rule not intruding, 20—28 \times 2—3 \times 2—3 mm. Prickles 9—17 per 10 cm, 4—5 mm long. Inflorescence 2—3½ m high; pedicels (4—) 5—6 (—7) mm; axis usually distinctly swollen below the insertion of the branches; bracts (10—) 15—20 (—23), distinctly serrate towards the top, usually with a well hardened, slender spine. Tube about 7½ mm; segments 14—16 mm; filaments inserted 1—2 mm below the throat, 25—30 mm long; anthers 14—17 mm; style 28—32 mm. Capsules 1½—1¾ times as long as broad, 24—28 mm long, shortly stipitate, very slightly or not beaked.

Aruba. S.S.W. slope of the Hooiberg, 5. XII. 1936, as No 19, inflor. juv. (No. 62). Id., 26. II. 1937 (No 63, flow. buds).

The narrow leaves appear to be less characteristic than at first was supposed and the shape of the capsules is sometimes very similar to that of *A. vivipara*. It is mainly because of the characteristics of the flower that I wish to maintain *A. Rutteniae* as a distinct species. — The soil on which *A. Rutteniae* occurs, weathered hooibergite, has a pH varying between 4 and 5½, it is more acid than the soils on these islands usually are. The same values, however, have been found for a similar soil in the immediate neighbourhood on which typical *A. vivipara* (No 8, 41) occurs.

Agave Boldinghiana Trelease 1913 p. 21. HUMMELINCK 1936 p. 239.

“Koeki indiaan”, “Koeki spanjool” (Cur., Ar., Bon.). “Pieta” (Bon.).

Curaçao (type-locality!); Bonaire; Aruba.

Fairly common, found here and there in small quantities, often cultivated.

Leaves elliptical, distinctly acuminate, 5—7½ times as long as broad, 90—125 cm long. Spines acicular, usually involute at the base, slightly or not decurrent, dorsally usually very slightly intruding, 10—27 \times 2—3½ \times 1½—3¾ mm. Prickles 7—22 (—28) per 10 cm, (1—) 2—5 (—6) mm long. Inflorescence 5—7 m high; pedicels 4—9 mm; bracts 20—30, distinctly serrate towards the top, usually with a well hardened, slender spine. Flower 45—55 mm; ovary 20—28 mm; tube 4—5½ mm; segments 18—23 mm; filaments inserted 0—2 mm below the throat, 34—38 mm long; anthers 18—21 mm; style 40—45 mm. Capsules 2—2½ times as long as broad, 33—46 mm long, stipitate, beaked.

Curaçao. N.E. of Fort Beekenburg, 16. X. 1936, as No 30, soc. 1 (No 64). Aruba. Seroe Blanco, N. of St. Nicolaas, 26. II. 1937, quartzdiorite with coral rock nearby, cult., inflor. juv. (No 65).

Bonaire. 600 m E. of Tanki Hoeba, N. of Goto, 16. X. 1930, diabase, 40 m, soc. 2—3 (No 66, sev. spec., flow. r., caps.).

On Curaçao, Bonaire and Aruba *A. Boldinghiana* is always recognizable from all other species; compared with certain forms of *A. Cocui* and *A. vivipara* found in other regions, it appears less well defined.

Agave Cocui Trelease 1913 p. 19. PITTIER 1926, Plantas usuales Venez., p. 186; HUMMELINCK 1936 p. 244. — *A. Cocui* Trel. var. *laguayrensis* HUMMELINCK 1936 p. 244. — *A. Cocui* Trel. var. *cucutensis* HUMMELINCK 1936 p. 246.

"Cocui", "Pite" (Venez.) or "Pieta" (Cur., Bon.).

Venezuela (Caracas, type-locality!), going inland as far as Lara, Táchira and Santander del Norte (Colombia); Margarita; Los Frailes; Los Testigos.

Common on the N. Coast of E. Venezuela, near La Guaira, in S. Falcón and N. Lara; more locally in Santander del Norte, Táchira, N. Falcón, Paraguaná, Margarita, Los Frailes and Los Testigos; also to be found on Bonaire and Curaçao, but probably introduced; often cultivated.

Leaves lanceolate to elliptical, sometimes suboblong, rarely oblanceolate, ($3\frac{1}{2}$ —) 4—5 (—6) times as long as broad, (80—) 100—120 (—140) cm long. Spines conical or, rarely, acicular, rather often distinctly laterally flattened or, sometimes, triquetrous, very rarely flexuous, often recurved near the top, usually involute at the base, often rough, more or less decurrent, dorsally as a rule intruding, (10—) 12—20 (—30) \times (2—) 3—5 (—6) \times (2—) 4—5 (—6) mm. Prickles (6—) 10—15 (—22) per 10 cm, (2—) $2\frac{1}{2}$ —6 (—7) mm long. Inflorescence (5—) 6—8 (—10) m high; pedicels (3—) 4—8 (—12) mm; bracts 15—25, serrate towards the top, usually with more or less hardened spine. Flower (40—) 45—55 (—65) mm; ovary 25—40 mm; tube (3—) 4—6 (—7) mm; segments (18—) 20—24 (—25) mm; filaments inserted (1 mm above to) 0—1 (— $1\frac{1}{2}$) mm below the throat, (30—) 35—45 (—55) mm long; anthers (15—) 18—23 (—25) mm; style (38—) 44—50 (—55) mm. Capsules $1\frac{3}{4}$ — $2\frac{1}{4}$ times as long as broad, (35—) 40—50 mm long, shortly stipitate, usually very slightly beaked.

Some localities on the continent show us that in *A. Cocui* the spines are so variable that, on account of this character, several species might be distinguished. As, however, the different forms often occur together and transitional forms are frequent, it is, in my opinion, impossible to delimitate even varieties. The value of this character has been greatly overrated.

The var. *laguayrensis* merely indicates a certain variation of

the terminal spine, whilst the var. *cucutensis* is only characterized by its long pedicels.

Falcón. Pereboro, 17 km N. of Siquisique, 31. VII. 1930, shales (No 67). Taparoy, 30 km N. of Siquisique, 31. VII. 1930, shales (No 68). Pecaya, between Siquisique and Coro, 30. VII. 1930, shales (No 69). Dabajuro, midway between Coro and Maracaibo, 29. VII. 1930, sandy soil (No 70). Paraguaná, 1500 m E. of Santa Ana, 16. II. 1937, sandy soil, soc. 1 (No 71, three spec.; tab. Ia 8). Id., Barunú, W. of Buena Vista, 18. II. 1937, maris, cult., soc. 1, (No 72, sev. spec.).

Curaçao. S. rooi of the Oost Seinpoot, as No 28—29, 9. IX. 1936, soc. 1 (No 73). Near Zoutpan Siberië, St. Marie, 8. XI. 1936, sandstone, 2 m., soc. 1 (No 74, three spec., old caps.).

Esmeralda, W. of Carúpano, 10. VI. 1936, cherts, 2—10 m, soc. 1, deflor. (No 75, flow., caps.; tab. Ia, IVa). Morro de Eemerarda, island, 10. VI. 1936, cherts, sand, 1—5 m, soc. 1, deflor. (No 76, flow., gr. caps.).

Guanta, near Barcelona, 15. VIII. 1936, limestone, 5—30 m, soc. 1 (No 77). Id., 7. IV. 1937, flor. (No 78, flow., gr. caps.).

Puerto Santo, E. of Carúpano, 12. VI. 1936, cherts, 10—15 m (cf tab. Ib), soc. 1 (No 79, caps.). Id., sand, 2 m, soc. 1 (No 80, 80a, flow. r., gr. caps.). Id., quartz-marble-cherts, 10 m, soc. 1—2 (No 81, four spec., old caps.; tab. Ia 6). Id., 10—60 m, soc. 1 (No 82, 82a—d).

Tamarindo (or Testigo Grande, Los Testigos), 16. VI. 1936, near Pozo Inglés, granodiorite, 20 m, cultiv.? (No 83, two spec.).

Puerto Real (Los Frailes), 18. VI. 1936, hornblende-diorite, 5—10 m, soc. 1—2 (No 84, sev. spec.).

Margarita. La Sabana, E. of La Asunción, 27. V. 1936, quartz-marble-cherts, with detritus, about 50 m, cult. (No 85, three spec., flow., caps.; tab. Ia 5).

The type-material (Miss. 138438—138440, 138447, 138449, 138450) may be described as follows: Acaulescent, suckering; leaves $3\frac{1}{2}$ —4 times as long as broad, about 110×30 cm, lanceolate, slightly acuminate, widest somewhat below the middle, usually plicate; spines narrowly conical, often somewhat triquetrous, straight, often slightly incurved at the top, smooth, broadly and shallowly grooved below the middle, or often not grooved but flattened, not or slightly involute at the base, not or shortly decurrent, dorsally rather slightly intruding, 12 — 18×2 — $3\frac{1}{2} \times 2$ — $3\frac{1}{2}$ mm. Prickles 10 — 12 per 10 cm, 2 — $3\frac{1}{2}$ mm in length, acuminate triangular or aciculate, on green prominences; inflorescence 9 m high; panicle about $\frac{1}{2}$ total length, oblong, tapering towards the top, 4 — $4\frac{1}{2}$ times as long as broad, not or slightly decurrent; pedicels (3—) 5 (—8) mm; flower 48—55 mm, yellow; tube $3\frac{1}{2}$ — $5\frac{1}{2}$ mm; segments 20—25 mm; filaments inserted (0—) $\frac{1}{2}$ (— $1\frac{1}{2}$) mm below the throat (35—) 40—46 mm long; anthers 20—23 mm; style about 42 mm; capsules about 2 times as long as broad, 40—50 mm long, shortly stipitate, very slightly beaked; seeds 7 — 9×5 — 6 mm.

Some spines of a very different appearance, belonging to the flowers of the type-material, were excluded from the original diagnosis; they are laterally flattened, smooth or rough, the margin often with a few small prickles, 7 — $9 \times 1\frac{1}{2}$ — $2 \times 2\frac{1}{2}$ mm (tab. VIII 4, 1936) (Miss. 138447, probably also 138449, 138450). The other material, cited by Trelease, varies widely, but may belong to the same species.

The leaf material from the mountain region of S. Falcón and N. Lara

(No 67—68) shows often a striking similarity with material which *Zuolaga* gathered near Caracas. Here the agaves sometimes cover the mountainsides in great profusion, on sedimentary as well as on igneous (gabbro) rock. The plants from the plains of N. Falcón are much smaller and often resemble one of *A. vivipara*. Those from central Paraguana (No 71, 72) have conical to acicular spines, incurved near the top, rough, strongly decurrent, $20-30 \times 4-6 \times 4-6$ mm; they do not show any similarity whatever with *A. vivipara*.

The plants from Esmeralda (No 75) show only very little differences from the material which was used for the type-diagnosis; the filaments are inserted $\frac{1}{2}$ mm above to $\frac{1}{2}$ mm below the throat, 30—38 mm long, anthers 17—19 mm. Those from the Morro de Esmeralda (No 76) look quite the same. The spines of the plants from Guanta (No 77, 78) are rather different, acicular to conical, incurved near the top, $12-23 \times 1\frac{3}{4}-4 \times 2\frac{3}{4}-5$ mm.

On the peninsula of Puerto Santo agaves grow in great profusion and luxuriance; the spine variation is enormous. — Sometimes we find a few peculiarly luxuriant plants of a striking, hard green colour, with thick, juicy, strongly plicate, more or less irregularly twisted leaves, provided with small, as a rule strongly laterally flattened spines. Some of these spines entirely resembled the flattened spines of the additional type-material of *A. Cocui*, which have been described above (tab. VIIIb 1—4, 1936). The inflorescence of such a plant (No 80) was only $5\frac{1}{2}$ m long, but it was branched from the base; the pedicels were fairly long, about 8 mm, but otherwise everything was in agreement with the material from Esmeralda, the flowers were even somewhat smaller. — Between the larger rosettes of *A. Cocui* there were without any transition some much smaller plants (No. 81) which reminded one strongly of *A. vivipara*: Leaves up to 70 cm, spines narrowly conical, smooth, dorsally not intruding, $12-14 \times 2\frac{1}{2}-2\frac{3}{4} \times 2-2\frac{3}{4}$ mm, prickles 10—22 per 10 cm, $\frac{1}{2}-3\frac{1}{2}$ mm long. The flower showed some peculiar differences: tube $2-2\frac{1}{2}$ mm, filaments inserted $0-\frac{1}{2}$ mm above the throat, about 30 mm long, segments 19—21 mm, style 38—40 mm.

The habit of the plants from La Sabana, Margarita (No 85) do not resemble that of *A. vivipara*; the leaves however are oblanceolate, the fruit is the same as that of *A. vivipara* from the other localities in the island and the flowers are small. The terminal spine reminds one of certain forms of *A. Cocui* which occur near Puerto Santo and on the other hand varies only slightly from that of *A. vivipara* from other localities in the island.

Although I am convinced that on Margarita, and perhaps also on the mainland in Sucre and in N.W. Falcón, *A. vivipara* and *A. Cocui* are not clearly separated, it seems to me advisable to maintain (at any rate for the present) these two species, which in other localities differ so greatly from each other.

Agave evadens Trelease 1913 p. 20.

Trinidad (type-locality!), Chacachacare.

Locally, fairly common.

Leaves oblanceolate, about 70—100 cm long. Spines conical, straight or somewhat recurved, slightly involute at the base,

slightly or not decurrent, dorsally very slightly or not intruding, 10—14 × 2—3 × 2—3 mm. Prickles 6—12 per 10 cm, $\frac{1}{2}$ —1 $\frac{1}{2}$ mm long. Pedicels (6—) 8—10 (—12) mm. Flower 47—55 mm; tube 2—3 $\frac{1}{2}$ mm; segments 19—25 mm; filaments inserted 0—1 $\frac{1}{2}$ mm below the throat, 35—42 mm long; anthers 17—25 mm; style about 40 mm. Capsules about 2 times as long as broad, about 40 mm long, distinctly stipitate, slightly beaked.

The description given above is based on the type (merely 9 flowers and some pedicels; Crueger, Miss. 145589) and other, more complete material from Trinidad (Kew, Trin. Bot. Gard. 1333) and the Boca Island Chacachacare (Britton March 1920, flow., Kew, N.Y. 519). The specimens are characterized by their small prickles, long pedicels, short tube and the conspicuously stipitate fruit. The characters which Trelease himself regarded as most important, however, he took from two photographs (reproduced in his monograph, pl. IX): shortly caulescent; leaves narrowly oblanceolate; inflorescence laxly paniced at the end only, with few ascending few-flowered branches. I have carefully studied these photographs but it seems to me that these characters have no value, as the bases of the caulescent specimens appear to be washed free and the lower, flowerless branches probably were not visible because of the great reduction of the picture; the very slender leaves might be due to the external circumstances.

In Puerto Santo I collected material (No 81, dealt with under *A. Cocui*) which only differs from the description given above in having more prickles, shorter pedicels, shorter filaments and only slightly stipitate fruits. It may possibly belong to *A. evadens*.

The few flowers from El Valle, Margarita (Miller and Johnston 241, 1901, Miss. 145590) which Trelease determined with all reserve as *A. evadens* (1913, p. 21 pl. X 1) have the short tube and long filaments of this species but could, nevertheless, belong to *A. Cocui* or perhaps *A. vivipara* as well.

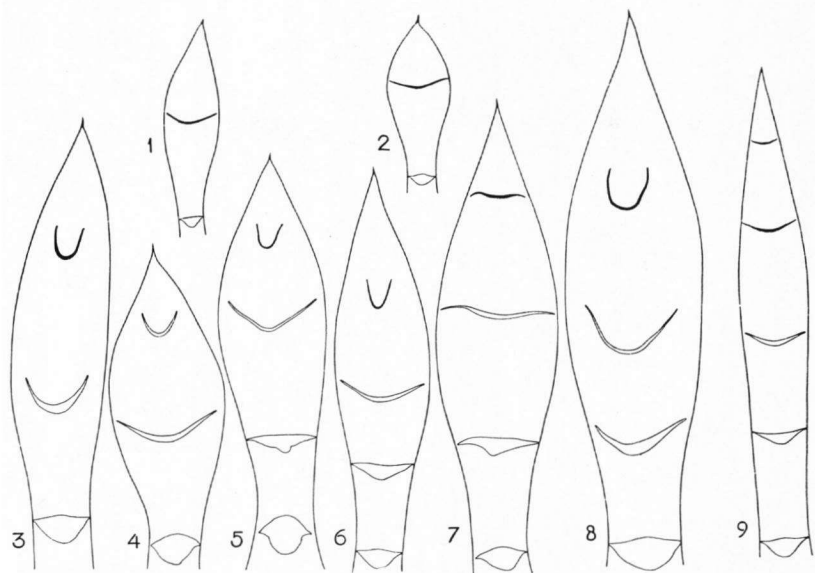
Agave Karatto Mill., Gard. Dict. 8 ed. 1768. TRELEASE 1913 p. 23. — *A. Van Grolae* TRELEASE 1913 p. 24. — *A. Trankeera* TRELEASE 1913 p. 26; HUMMELINCK 1936 p. 241. — *A. nevidis* TRELEASE 1913 p. 24. — *A. Scheuermaniana* TRELEASE 1913 p. 25.

"Karata" (St. Kitts, Nevis, St. Eustatius); "Karatto", "Corita" or "Coryata" (St. Kitts); "Pieta" (St. Eustatius) or "Pieta di trankeer" (Cur., Ar., Bon.).

St. Kitts (type-locality!), Nevis; St. Eustatius, Saba; St. Martin; Curaçao; Aruba; Bonaire.

Common; in Curaçao, Aruba and Bonaire cultivated only as a living hedge.

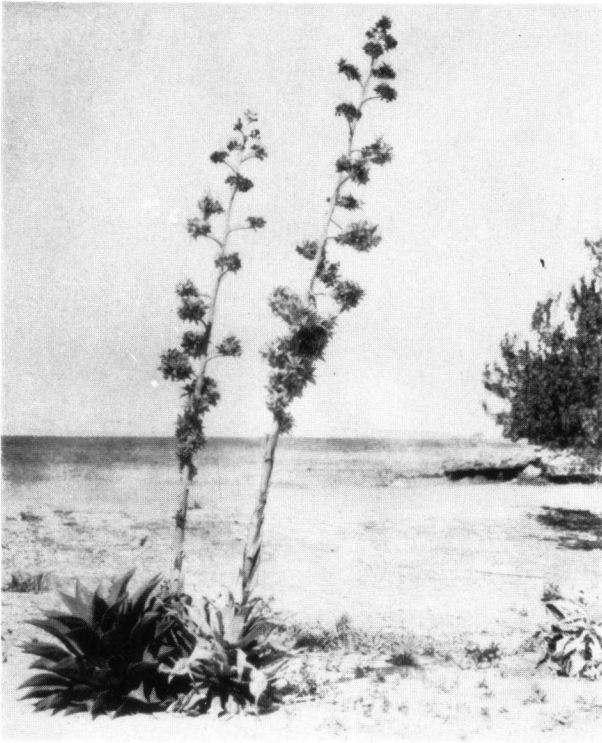
Leaves lanceolate to narrowly elliptical, 7—10 times as long as broad, 100—200 cm long. Spines conical, often laterally flattened, often acuminate, sometimes mucronate, very often recurved at the top, involute, sometimes sharply conduplicate,



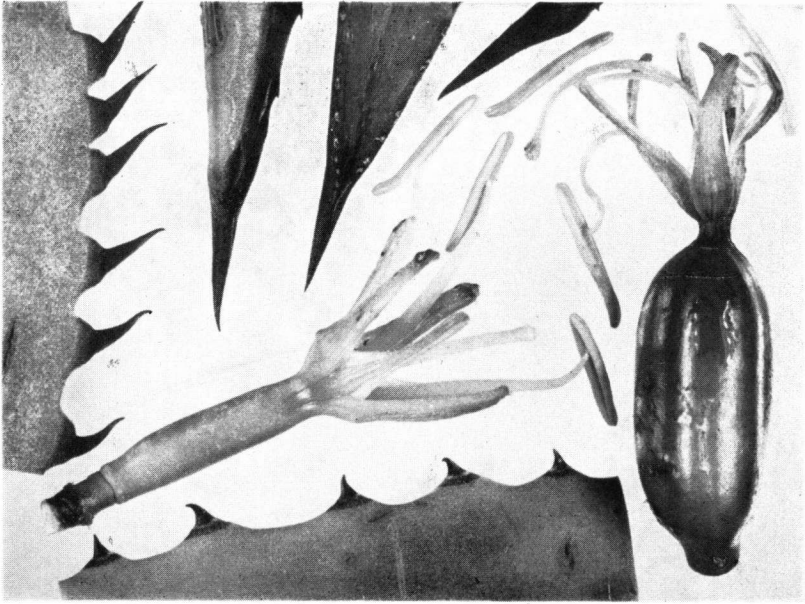
a Leaves, with cross sections of — 1—4 *A. vivipara* (1—2 Margarita, No 60; 3—4 Margarita, No 57). — 5—8 *A. Cocui* (5 Margarita, No 85; 6 Puerto Santo, No 81; 7 Esmerarda, No 75; 8 Paraguaná, No 71). — 9 *A. Karatto* (Curaçao, No 93). (1—8 1/12 nat. size, 9 1/24 nat. size).



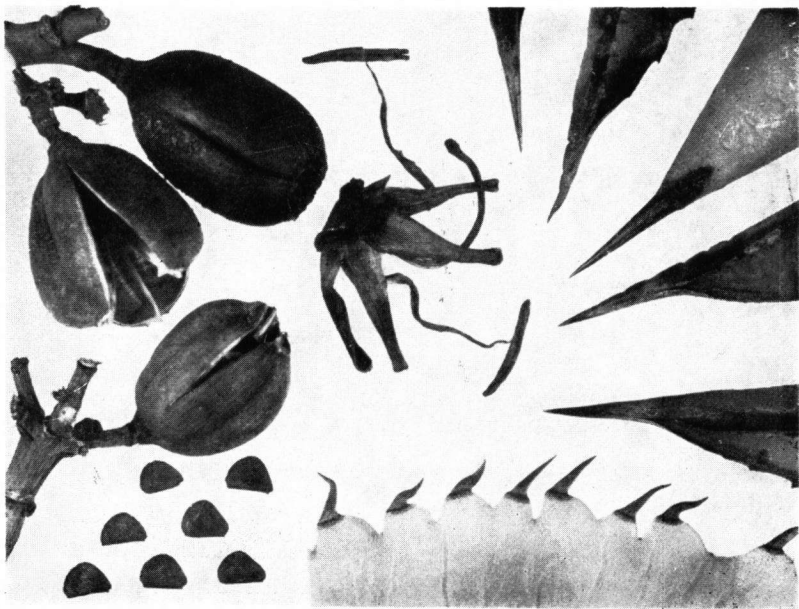
b Puerto Santo, where *A. Cocui* grows in great luxuriance, with the Morro de Puerto Santo on the background (cf No 79—82).



a *A. vivipara* on the beach in Blanquilla (cf No 53).
b *A. vivipara* at Punta Ausente, Margarita (cf No 57).



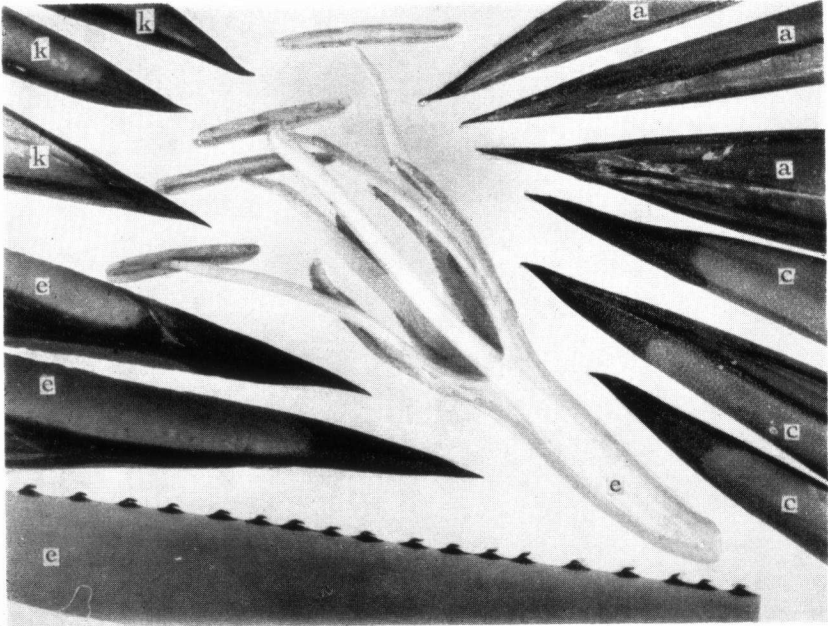
a *A. vivipara*, Margarita (No 57), showing prickles, spines, flower and green fruit with weathered perianth. (nat. size).



b *A. vivipara*, Blanquilla (No 53), showing prickles, spines, weathered perianth, dried capsules and seed. (nat. size).



a *A. Cocui*, Esmeralda (No 75), showing prickles, spines, flower, green fruit with weathered perianth and seed. (nat. size).



b *A. Karatto*, showing flower, prickles and spines from e St. Eustatius (No 89), k St. Kitts (No. 86), a Aruba (No 96), c Curaçao (No 93). (nat. size).

more or less decurrent, dorsally distinctly intruding, (8—) 10—20 (—26) \times (2—) 3—5½ (—7) \times (3—) 4—7 (—8) mm. Prickles 4—16 per 10 cm, (½—) 1—2½ (—3) mm long. Inflorescence 5—8 m high; pedicels (6—) 8—12 (—20) mm; bracts 10—20, distinctly serrated towards the top, with short, thick, usually well hardened spine. Flower (45—) 60—70 (—85) mm; ovary (25—) 30—40 (—46) mm; tube (3½—) 5—8 (—9) mm; segments (20—) 24—28 (—34) mm; filaments inserted (½ mm above to) 1—3 (—4) mm below the throat, (35—) 40—50 (—65) mm long; anthers (20—) 22—28 (—37) mm; style (45—) 50—62 (—68) mm. Capsules 1¾—2¼ times as long as broad, 40—55 mm long, usually stipitate, very slightly beaked.

St. Kitts (or St. Christopher). Hills E. of Basseterre, 19. III. 1937, 30—80 m, soc. 1 (No 86—88, flow., gr. fr.; tab. IVb).

St. Eustatius. 1 km E. of Oranjestad, 18. III. 1937, volcanic rock, cult. (No 89, 90, flow., gr. fr.; tab. IVb).

Saba. The Bottom, 18. III. 1937, volcanic rock, abt 350 m, soc. 1, inflor. juv. (No 91).

Curaçao. N. of Salinja St. Kruis, 6. XI. 1936, gravel, 1—2 m, cult. (No 92). Westpunt, 27. X. 1936, diabase, 20—30 m, cult. (No. 93, tab. Ia 9, IVb). Piscadera Baai, 19. XI. 1936, coral rock with mixed soil, 5 m, cult. (No 94).

Aruba. W. of the Hooiberg, 5. XII. 1936, quartz-diorite, 15 m, cult. (No 95). N. of Oranjestad, Solito, 16. XII. 1936, mixed soil, 20 m, cult. (No 96, 3 spec.; tab. IVb). Rooi Spoki, N. of St. Nicolaas, 26. II. 1937, coral limestone, 50—60 m, inflor. juv. (No 97).

Bonaire. Guatemala, 11. V. 1930, diabase, 25—30 m, cult. (No 98, flow., caps.).

Miller's type-diagnosis of *A. Karatto* is as follows: „foliis erectis laetè virentibus, marginibus fuscis minimè serratis. American Aloe with long deep green leaves, edged with brown, and very slightly sawed.”

The material which Trelease used for his description of *A. Karatto* from St. Kitts (Shepherd 1908, Miss. 145581, 145583; id. 5. X. 1910, Miss. 145582, flor.) has a strikingly mucronate spine; my own material (No 86—88), on the contrary, an acute or acuminate spine. Together, these specimens nearly cover the whole general description given above; the plants are acaulescent, not caespitose, the spines are deeply slit beyond the middle, often up to just below the top, with a sharp, smooth or slightly serrate margin; the panicle is oblong to elliptical, ⅓—⅔ of the total length, usually slightly decurrent; the seeds are 4½—6 \times 7—8 mm.

TRELAUSE's type-material of *A. Van Grolae* from St. Eustatius (VAN GROOL, Apr. 1910, Miss. 145552, 145553, flor.). the other specimens collected by Mrs VAN GROOL in 1909 and 1912 (Miss. 145549—145551, 145555, 145561) and the material which I collected myself (No 89, 90) differ only slightly from *A. Karatto* of St. Kitts: the spines are very often distinctly laterally flattened, not mucronate, sometimes sharply conduplicate, usually with several small prickles at the margin, 10—20

$\times 3-6 \times 4-8$ mm. I am, therefore, convinced that *A. Van Grolae* Trel. must be considered as identical with *A. Karatto* Mill.

On Saba I observed a few plants with a more strongly developed armature (No 91) which, as far as I could judge, also belong to *A. Karatto*.

The spines of *A. nevidis* Trel. from *Nevis* (MALONEY 1910, type, Miss. 145547—145548) are acute to slender acuminate, broadly roundgrooved to somewhat beyond the middle or just below the top, $8-16 \times 2\frac{1}{2}-5 \times 3-6$ mm. As far as I can see, this merely vegetative type-material does not justify a specifically separation from *A. Karatto* Mill.

The exclusively vegetative material of *A. Scheuermaniana* Trel. from *St. Martin* (SCHEUERMAN 1910, type, Miss. 145487) and *Anguilla* (OWEN 1910, Miss. 145485—145486, 145488—145490) may be considered as perfectly the same although the spines from the first island are smaller and imperfectly hardened. It differs from *A. Karatto* from *St. Kitts* in having acute to acuminate, sometimes nearly acicular spines, usually slightly recurved at the top, deeply roundgrooved to or beyond the middle, up to $9 \times 3 \times 3\frac{1}{2}$ mm. In my opinion, however, these differences fall within the range of variability of *A. Karatto* Mill.

TRELEASE thought that the *A. Trankeera* found in *Aruba* and *Bonaire*, when better known, might prove distinct from the *Curaçao* plant, if not from one another. In my previous paper I had no data at my disposal for solving this question, but now I am quite sure that this separation would not be justified.

In the field a striking resemblance of *A. Trankeera* Trel. with the native *Agave* of *St. Eustatius* and *St. Kitts* may be noted. A closer investigation emphasizes this conformity, especially with the plants of *St. Eustatius*: they show a panicle frequently drooping at the top and have often laterally flattened spines. It is obvious, therefore, that the species *A. Trankeera* Trel. has to be cancelled.

When we keep in mind that the "pita di trankeer" of *Curaçao*, *Aruba* and *Bonaire* is widely cultivated as a hedge-plant and has never been found wild, and that *St. Eustatius* in former times was a wealthy Dutch colony with a busy trade on *Curaçao*, we must admit the possibility that in *Curaçao* and the neighbouring islands *A. Karatto* is an introduced plant.

SUMMARY.

In Curaçao, Aruba and Bonaire the most common species of *Agave* is *A. vivipara*. Although the variability is rather great, this species is nearly always easily recognizable. In Aruba, however, in two localities agaves are found, namely *A. Rutteniae* and *A. arubensis*, which differ from *A. vivipara* in their generative parts only. The *A. Cocui*, which occasionally occurs in Curaçao and Bonaire, but which has probably been introduced from the coast of Venezuela, differs from these species, both in shape and size. *A. Boldinghiana*, which is found here and there on all three islands, is in herbarium material not always easily distinguished from the above named species, in the field it is always easily recognizable. *A. Karatto*, which is frequently cultivated as a living hedge in Aruba, Curaçao and Bonaire, has very little in common with the other agaves growing there; this species occurs also in St. Eustatius and the neighbouring islands and it seems probable that it was introduced from there in former times, when there was a more lively trade between these islands.

On the Venezuelan Continent there probably is only one species of *Agave*, *A. Cocui*, which, however, shows a wide range of variability in the form of the terminal spine.

In Trinidad and Chacachacare *A. evadens* occurs; possibly it may be found on the neighbouring part of the continent as well.

On the Venezuelan Islands, *A. vivipara* is known from Blanquilla and Los Hermanos, *A. Cocui* from Los Frailes and Los Testigos. The common agave of Margarita, which I determined as *A. vivipara*, resembles a special form of *A. Cocui* growing on the continental coast opposite. Although it seems not possible to differentiate them clearly, yet, for the time being, it does not seem advisable to unite these two species.

RESUMEN.

El Continente de Venezuela posee únicamente una especie de *Agave* muy variable, *A. Cocui*, común en todo el litoral y que se encuentra en el interior hasta los estados de Lara y Táchira.

Aruba, Curaçao y Bonaire en contra poseen, aparte de algunas especies introducidas por sus fibras, nada menos que 6 especies de *Agave*, de las cuales 4 muy probablemente son endémicas: *A. vivipara*, *A. Boldinghiana*, *A. Rutteniae*, *A. arubensis*, y 2 son probablemente importadas de otras partes: *A. Cocui* de Venezuela, *A. Karatto*, la planta de los setos, de St. Eustatius.

En cuanto a las Islas Venezolanas, *A. vivipara* se encuentra en Blanquilla y Los Hermanos, *A. Cocuí* en Los Frailes y Los Testigos. En Margarita encontramos ambos; en este lugar sin embargo muestran un parecido tan fuerte que su clasificación a veces es incierta.