Revison of *Capparis spinosa* and its African, Asiatic, and Pacific Relatives

Harold St. John

B. P. Bishop Museum, Honolulu, Hawaii 96819, U. S. A.

An investigation of the native Hawaiian species *Capparis sandwichiana* DC. led the writer into the broader problem of the Eurasian *C. spinosa* L. and its relatives. They form section *Capparis*, part 1, *Pedicellares* DC., are those species with single, axillary, perfect flowers, with asymmetric calyx, and thorn-like stipules. Many early botanists have published upon this group, in whole or in part, but it has not yet been satisfactorily classified. From one view, the group was considered, as by J. D. Hooker, to be but a single species, occurring from Europe to Australia and the Sandwich Islands. Other botanists have split the group into a large number of species and varieties. Another view, taking a median position, is here presented and defended.

According to the author's classification here presented, this plant group in the Pacific consists of endemic species and varieties, two of them very local but the others of broad ranges on the Pacific islands and Australia.

An opposing view was recently presented by Jacobs (1960: 89–92) who classed them all as *C. spinosa* L. var. *mariana* (Jacq.) K. Schum., and in his discussion implies that they are all merely the cultivated European, Mediterranean, and west Asian species *C. spinosa*, the source of a flavor or condiment, though he admits that they are not used as a flavoring plant by the Pacific islanders. He considers that they had been introduced and cultivated, first in Guam, previous to 1774, probably via the Spanish galleons from Mexico (where the caper was then unknown). For Australia Jacobs postulates a separate introduction of the European species via shipwreck or a lifeboat landing. One cannot definitely disprove such a theory, but pickled capers or even caper seeds are not a regular part of the food stores of a lifeboat. Then, too, the Australian aborigines would not be effective in spreading and cultivating the *Capparis* species up and down the west coast of Australia and over a broad range in the interior of the Northern Territory, since they never cultivated any plant species and had no agriculture whatever.

Part of Jacobs' argument rests upon the date of the first collection of the *Capparis* on the various Pacific islands. On the Hawaiian group it was collected by Menzies in 1792; on the Marianne Islands, comm. Sonnerat, 1774–1781; on the Society Islands by Beechey's Voyage, 1826, etc. Jacobs argues that on the earlier exploring expenditions the botanists, such as Banks, Solander, the Forsters, Commerson, et al., would have collected the plant had it existed then in the indigenous flora of the Pacific islands. As to Hawaii, Menzies was the second botanist to land there, and he collected it. Previous to him there was only David Nelson of Capt. Cook's third voyage, and he was allowed to land and botanize only once, making a trip up the slopes of Mauna Loa. He hurried through the

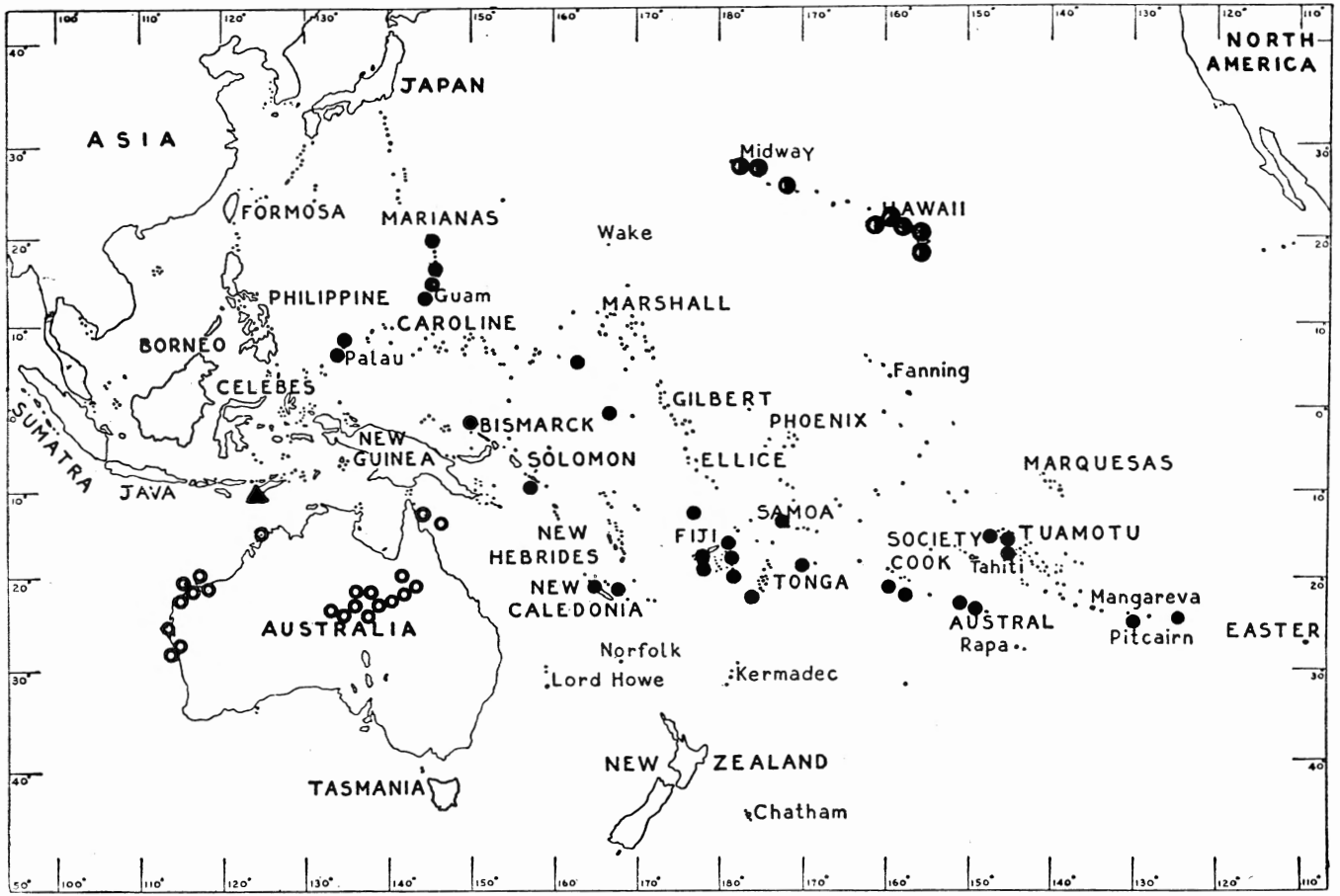

Fig. 1. Map of the distribution of certain *Capparis* species in the Pacific Ocean.
Triangle, *C. subcordata* Spanoghe. Circle. *C. Nummularia* DC.
Disc. *C. cordifolia* Lam. Half filled circle. *C. sandwichiana* DC.

lowland and collected very few plants there, saving his energies for collecting in the mountain forests, but he did bring back a single branch of *Capparis* from the dry lower slopes above Kealakekua Bay.

None of this group of plants grow in the Society Islands where Banks, Solander, and the Forsters spent so much of their time. The Forsters did land in the first row boat to reach Niue and had time to snatch four plants (not including *Capparis*) as they fled from the shower of spears thrown by the hostile natives.

Jacobs seems to cite Henderson I. as one of the Society Is. Usually this is classed as an isolated island, but by some as one of the Tuamotu Archipelago. Henderson is a virgin island that has always been uninhabited. Its flora was recently described by St. John and Philipson (1962). *C. cordifolia* occurs there, on the face of the raised coral cliffs, though Lay and Collie failed to collect it on the Beechey Voyage (Hooker & Arnott, 1832: 59).

Aside from Guam and the Marianas, where the *Capparis* was early collected, Banks, Solander, and the Forsters did not land and make collections on the other islands where *Capparis* grows. To this there is one exception, for on Cook's first voyage, they landed in the Tuamotu Archipelago on Anaa (Chain I.) and made collections. *Capparis* occurs there, but is limited to one small patch of "makatea" or raised dissected coral rock, which occurs on only one islet. Since they failed to collect it, it is probable that their landing was at another part of the perimeter of the atoll. The argument that the plants are recent cultivated ones, based on the failure of these few early collectors to find it, is not convincing. More important than this theorizing are the differences in morphology of flowers and herbage. To the writer these reveal that there are are four species and a variety in the Pacific islands and Australia.

KEY

A. Flower buds globose, but outer sepal slightly gibbous; young shoots lanate; flowers diurnal, opening in the morning, fading before noon; stamens 40–71. 1. *C. spinosa.*

A. Flower buds very asymmetric; outer sepal strongly galeate,

B. Nodes with a pair of conspicuous, stout, straight or curved stipular spines; midrib projecting from apex of blade as a recurved prickle,

C. Young shoots minutely pilosulous, but the hairs caducous and the shoots early glabrate; stipular spines strongly recurved; outer galeate sepals 3.8–4.2 cm. long; stamens 85–122. 2. *C. cartilaginea.*

C. Young shoots closely lightly tomentose, later glabrate; stipular spines straight or curved, 0.3–5 mm. long; outer galeate sepal 2 cm. long; stamens 79–100; flowers white, nocturnal, opening after dark, withering in about 16–17 hours and turning pink-purple. 4. *C. Nummularia.*

B. Nodes unarmed or with straight stipular spines less than 1 mm. in length; midrib not forming a projecting prickle,

D. Stamens 80–108; buds white tomentose or arachnoid; petals glabrous; anthers 3 mm. long; seeds 2–4 mm. long; shoots and petioles white tomentose, glabrate; blades 30–82 mm. long, 26–67 mm. wide, suborbicular to rounded ovate or oval; flowers white, noctural, by day

turning pink and withering by early or late morning, lasting $10\frac{1}{2}$–$16\frac{1}{2}$ hours. 5. *C. cordifolia*

D. Stamens 100–181,

E. Stamens 123–181; anthers 3.5–4.3 mm. long; stipular spines 0.5–1 mm. long, caducous; seeds 4–5 mm. long; blades 24–53 mm. long, 22–45 mm. wide, oval; flowers white, nocturnal, opening 1–3 hours after dark, turning pink during the following day and withering in 38–40 hours,

F. Young shoots, petioles, buds and other parts glabrous. 6a. *C. sandwichiana* var. *sandwichiana.*

F. Young shoots, young petioles, and buds cinereous puberulent. 6b. var. *Zoharyi.*

E. Stamens 100–130; buds sparsely appressed lanate; anthers 3–3.5 mm. long; stipular prickles wanting; seeds 2–2.7 mm. long; young shoots closely white lanate; blades 30–58 mm. long, 27–56 mm. wide, oval to suborbicular. 3. *C. subcordata.*

SYNOPSIS

1. **Capparis spinosa** L., Sp. Pl. 1: 503, 1753.

Illustrations: Curtis's Bot. Mag. 9: pl. 291, 1795; Loudon, J. C., Arbor. Frutic. Brit. 1: 314, 1838; Le Maout, E. & Decaisne, J., Traité Gén. Bot. 422, 1868; Baillon, H. E., Hist. Pl. 3: 150–152, figs. 174–179, 1872; Garden 12: 181, 1877, and 19: 22, 1881; Baillon, H. E., Dict. Bot. 1: 618, 1878; Nicholson, G., Ill. Dict. Gard. 1: 264, 1884–85; Gard. Chron. 26: 557, 1886; and III, 30: 319, 1901; Rev. Hort. pp. 16–17, 1889; Post, G. E., Fl. Palest. Sinai 109, 1896; Schneider, C., Ill. Handb. Laubholzk. 1: 354–355, 1905; Engler, A. & Drude, Veg. Erde 9(1): 20, 1910; Marret, L., Fl. Côte d'Azur 246, 377, 1926; Penzig, O., Fl. Lit. Medit. 12, 1902; Coste, H., Fl. France 1: 142, 1901; Strassberger, E., ed. Lang, W. H., Text-book Bot., ed. 6, fig. 687, 1930; Sargent, F. L., Pl. and their Uses, fig. 145, I, II, III, 1913; Wettstein, R., Handb. Syst. Botanik, ed. 4, 2: 720, fig. 476, 1935; Engler, A. & Prantl, K., Nat. Pflanzenfam. 3(2): 226, fig. 136 A-D, 1894, and ed. 2, 17b: 174, fig. 85 A-D, 1936; Smith, J. E., Spic. Bot. 2: pl. 20, 1792.

Trailing or pendent shrub, or erect and up to 1 m. tall; young shoots lanate; nodes with a pair of retrorse, stipular spines 3–5 mm. long; leaves deciduous; petioles 1–4 cm. long; blades 2–4 cm. long, elliptic to ovate, the midrib excurrent at tip as a curved spine: flowers axillary, solitary; pedicel 2.5–5 cm. long; buds globose and symmetrical, though at anthesis the outermost sepal is 13–15 mm. long, and is the largest and is slightly gibbous; petals 20–37 mm. long, obovate, wavy, white on opening in the morning, later turning red and fading before noon, free or the two upper shortly connate; stamens 40–71; filaments 2.5–4 cm. long, white below, but of a rich purple above; anthers 1.9–2.1 mm. long, red to yellowish; gynophore about twice as long as the corolla; in fruit 4–8 cm. long; style none; stigma minute; berry 3–5 cm. long, ellipsoid, straight; pedicel in fruit 2.5–5 cm. long; seeds 3–3.5 mm. long, 2–3 m. wide, reddish brown, ovoid-cochleate with a strong rhaphe.

Distribution: From Portugal, across the European and African Mediterranean

countries, the Balkans, and in Africa in Algeria, and in Asia from the Caucasus, Turkey, Israel, Iraq, and Sind, Pakistan.

Within this broad range there is some variation in the leaves, spines, flowers, etc., and to contain these extremes numerous species and varieties have been proposed. The writer has observed *C. spinosa* in the field in Italy and Egypt, and has examined many herbarium specimens. His first opinion was that it was a single species with numerous variations not worth recognizing. Now there comes to hand a recent, detailed study by M. Zohary (1960) of the *Capparis* species of the regions of the Mediterranean and the Near East. He includes *C. spinosa* and its relatives, accepting as members of this group *C. spinosa* L. with 7 varieties, *C. ovata* Desf. with 6 varieties, *C. leucophylla* DC. with 2 varieties, as well as *C. cartilaginea* Dcne., *C. mucronifolia* Boiss., and *C. decidua* (Forsk.) Edgew. He has a total of six species and 15 varieties, which he lists, describes briefly, and cites specimens and ranges. He does not, however, include a key with their diagnostic differences. The characters that he used are principally in the size, shape, and pubescence of the leaves, and the glandular pit in the petals. He makes no mention of the phenology of the flowers or the number of the stamens. Since the writer's studies of these species centering in the Mediterranean have been brief and since *C. spinosa* and its local relatives are only incidental to the present study, they will be but briefly treated here.

There are numerous recorded observations establishing that the flowers of *C. spinosa* are diurnal, lasting but a single morning.

The plant is economic, providing a flavoring element. The young flower buds are picked, then pickled. These, when prepared in a sauce, are the capers, often eaten as a condiment with meats.

C. spinosa is the generic lectotype, selected by A. S. Hitchcock and M. L. Green (1929: 140).

2. **Capparis cartilaginea** Decaisne, Ann. Sci. Nat. Bot. II, 3: 273, 1835.
   T: "le désert du Sinaï, N. Bové n. 143." [=148], holotype (P), and isotype (GH), both examined.
   C. galeata Fresen., Mus. Senckenb. 2: 111, 1837.
   C. spinosa L. var. *galeata* (Fresen.) Hook. f., Fl. Brit. Ind. 1: 173, 1872.
   Illustrations: Engler, A., ed. Harms, H., Nat. Pflanzenfam. 17b: fig. 86, 1936.

Shrub, 2–3 m. tall, erect; young shoots glabrous; branches whitish; stipular spines 3–4 mm. long, recurved, broad based, strong, yellowish brown; petioles 5–20 mm. long; blades 2–6.5 cm. long, ovate-elliptic or oval to suborbicular, fleshy, glaucous, when dried thick and rigid, the surface pustulate, the midrib at apex often protruding as a salient prickle; flowers solitary, axillary; pedicel 4–7 cm. long, erect; buds strongly asymmetric, due to the strongly galeate and much larger outer sepal which is 4 cm. long, and reflexed in flower; upper petals 2–2.3 cm. long, broad elliptic; lower petals 3.3–4 cm. long, narrowly elliptic, sometimes emarginate; stamens 85–87 in number; anthers 2–3 mm. long, creamy white to yellow, sometimes with a pinkish blush; berry 5–9 cm. long, clavate pyriform or obovoidoblong, on a recurved gynophore of about the same length.

Distribution: In Africa from Egypt, Sudan, Abyssinia, Somalia, Kenya, and Zanzibar; on Sokotra I.; in Asia from Israel, Sinai, Arabia and Aden, Afghanistan,

and Baluchistan. It is frequently found on maritime shores.

This species was observed by the writer on shore cliffs at Mombasa, Kenya, on Nov. 18–19, 1961. The odorless flowers opened at sunset, 18:15. The petals and filaments were white. In the next morning at 07:30 these same flowers were open and slightly pinkish, but by late afternoon there were no open flowers, so it is inferred that the flowers turn pink and wither by noon. They are essentially nocturnal, and appear to be open for about 18 hours.

Decaisne in the original publication of *C. cartilaginea* cited the holotype as Bové n. 143, but this was in error. The collector's number, actually, was 148. This holotype is still preserved in the Paris herbarium. This specimen is really as complete as most herbarium specimens, and showed more flower details than Decaisne bothered to notice or mention. It is a full sheet with several branches, many leaves, several young shoots, numerous small and large buds, and one opened but damaged flower.

The oldest name for this species, *C. cartilaginea* Decaisne, has until recently usually been rejected as being inadequately described. However, adequacy of description is not stipulated as a requisite of a valed name. This name was effectively published, and its description was sufficient to establish the identity of the species. It is undoubtedly the same as the species later called *C. galeata* Fresen.

3. **Capparis subcordata** Spanoghe, Linnaea 15: 166, 1841; also in Miq., Ill. Fl. de l'Archipel Indien 34, 1871.

T: Timor, *Spanoghe* (L), holotype examined.

Blumea grandiflora Zipp. ex Spanoghe, Linnaea 15: 165, 1841, an invalid name, published in synonymy, non *Blumea* DC. (1833).

Illustrations: Trop. Natuur 25: Jubilaeum-Uitgave, fig. 9, 1936.

Shrub, trailing; young shoots closely white or reddish lanate; nodes unarmed, or rarely the youngest with minute conic spines; internodes 15–35 mm. long; petioles 6–15 mm. long; blades 30–80 mm. long, 27–56 mm. wide, oval and acute to suborbicular, thick, firm when dried, above quickly glabrate, shining yellowish green, below retaining a little of the lanate coating and glaucous or yellowish, the midrib not excurrent; peduncles in anthesis 4.5–7 cm. long, axillary, solitary; buds sparsely appressed brownish lanate, later subglabrate; sepals reflexing in anthesis; outer sepal much enlarged and strongly galeate, 26–45 mm. long, 15–25 mm. wide; petals 30–54 mm. long, 23–43 mm. wide, broad elliptic, white; stamens 100–130, the filaments white, 36–50 mm. long; anthers 2.5 mm. long, apparently yellow; gynophore 5–6 cm. long; style none; stigma minute; berry 22–32 mm. long, 9–21 mm. wide, ellipsoid, glabrous; seeds 2–2.7 mm. long, ovoid to subspherical, brown, shining, the fruiting pedicel 7–8.2 cm. long.

Distribution: Known only from Timor Island, Indonesia, where it grows near sea level on coral limestone or sand. Timor: voyage de *Baudin* (L); East Timor, limestone plateau of Baucau, 350 m. alt., very common, low shrub not over 1 m. tall, flowers enormous, pure white, calyx green, anthers brownish, 15 Dec. 1953, *van Steenis 18,024* (L); *Teysmann 8,735* (BO, L); *Teysmann 8,736* (BO); Poelau Semaoe, 0 m. alt., 17-11-1935, *de Voogt 2,328* (BO, L, GH); *M. G. Walsh 365* (BO); *Zippelius* (G); in 1827, ex Herb. mus. Paris (G, NY).

This species has long been known on Timor, but customarily has been de-

termined as *C. mariana* Jacq. [=*C. cordifolia*], as by Zippelius (see Miquel 1871: 36), a species occurring from the Marianas and Peleliu I. to Henderson I. in eastern Polynesia. and the Bismarck Archipelago and Bellona I. in the Solomon Is. The plants of Timor seem amply distinct species, and the gap between Peleliu and Timor is a wide one. On Australia and on the islands fringing its western shore occurs another species of this group, *C. Nummularia* DC. The nearest locality for the latter species is at the Dampier Archipelago, distant oversea 860 miles.

Notes on the flower color and the habitat of *C. subcordata* on Poelau Semaoe, a small island off the west point of Timor I., are given by de Voogt.

4. **Capparis Nummularia** DC., Prodr. 1: 246, 1824; F. von Mueller, Fragm. Phytogr. Austral. 1(6): 143–144, 1859. Pl. I, b.

T: "in Novae-Hollandiae insulis sterilibus. (v. s. sine fl. et fr.).", not examined.

C. spinosa L. var. *nummularia* (DC.?) F. M. Bailey, Syn. Queensl. Fl. 15, 1883.

C. Nummularia DC. var. *typica* Domin, Bibliotheca Bot. 89(2): 685, 1925.

C. Nummularia DC. var. *minor* Domin, Bibliotheca Bot. 89(2): 686, 1925.

Illustrations: Bailey, F. M., Comprehens. Cat. Queensl. Pl. fig. 18, 1913.

Shrub 0.6–2.7 m. tall; young shoots closely light tomentose; older branches glabrate; nodes with a pair of stipular spines 0.3–5 mm. long, and straight or curved; internodes 6–20 mm. long; petioles 5–13 mm. long; blades 10–42 mm. long, 6–30 mm. wide, glaucous, somewhat fleshy, broadly ovate to orbicular, subacute, or obtuse, or emarginate, firm, the midrib projecting at apex as a strong, recurved mucro 0.8–1.5 mm. long; flowers axillary, solitary, nocturnal, white, turning pink-purple and withering in about 16–17 hours; pedicels 3–3.5 cm. long; buds very asymmetric; sepals in anthesis reflexed, the outer one 18–20 mm. long, 11–17 mm. wide, deeply galeate, glabrous; petals 4, the two upper petals 25 mm. long, erect, obovate, denticulate, fimbriate, the two lower larger, deflexed together, saccate, convolute and cucullate, the base with a longitudinal thickening; filaments creamy white, turning pink, then pink-purple, and drying brown; anthers 4 mm. long, white or creamy, turning pale yellow; stamens 79–100 in number and 1.5–2 cm. long; gynophore 4–4.5 cm. long; style none; young fruit dark glossy green, viscid; berry 3.2–4 cm. long, 1.8–2.4 cm. in diameter, ovoid, when ripe bursting irregularly, seeds 4–4.2 mm. long, 3–3.5 mm. wide, 2 mm. thick, obliquely ovoid, dull reddish brown, asymmetric from the strong rhaphe, imbedded in a saffron yellow pulp.

Distribution: Australia.

Queensland: Howick Group, Nr. 6 I., *Walter* (MEL); Great Barrier Reef Exped., Three Isles, *Stephenson* 648 (BM); Hughenden, *White 1,102* (A); ditto, *Domin* (GH); Flinders R., *Sutherland 54* (MEL); ditto, *White* (BRI); ditto, *von Mueller 54* (MEL); ditto, s. n. (AD); Cloncurry, *Pearson 137* (BRI); Oban Station, Mt. Isa, *Everist 3,348* (BRI); Devoncourt Station, Cloncurry, *Grant* (BRI); Georgina R., *Bick* (BRI); Glen Ormiston, Boulia, nom. vern. "yantarry", *Coghlan* (BRI); western Queensland, *Mac Gillivray 2,215* (BRI); northeast Australia, *Curdie* (MEL); Queensland, *Bowman* (MEL).

Northern Territory: Alice Sprs., *Chippendale 5,592* (BISH); Alice Sprs., Horn Exped., [*Tate*] (AD); ditto, Emily Gap, *Everist 4,154* (BRI); Illara Water, Horn Exped., [*Tate*], (AD); Henbury Station, Fink R., *Hill* (MEL); central Australia,

Stuart (MEL).

Western Australia: Depuck I., Voyage of Beagle, *Bynoe* (BM); Dampier Archipelago, *Walcott* (MEL); between Ashburton and de Gray Rivers, *Clement* (L); Ashburton R., *von Mueller* (GH); Port Walcott, *Harper 14* (MEL); Point Larry, *Hughan* (MEL); Roeburn, *Pritzel 284* (BM, GH); Dirk Hartog I., *Clifton* (MEL); ditto, Voyage of Bathurst, *Cunningham* (BM); Murchison R., *Olof* (MEL); Houtmans Abrothos Is., *Gilbert 68* (BM); Abrothos I., Voyage of Beagle, *Bynoe* (BM); E. Wallaby Sound, Abrothos I., Voyage of Beagle, *Bynoe* (BM); South Is., *Gilbert 68* (BM), holotype of var. *minor* Domin; tropical W. Australia, *Hughan* (MEL); Camden Harbor, *von Mueller* (MEL).

It has been recorded by collectors that this shrub is avoided by grazing animals, and that on flowering it is heavily infested by ants.

As usual, the data given on the herbarium specimens lacked the details of the flowering time. One of the writer's numerous letters of inquiry was referred to George Chippendale of the Animal Industry Branch, Alice Springs, Northern Territory, Australia. He then observed the shrub, day and night, and reported as follows, on March 31, 1959.

March 24, 1959.

14:00 hrs. Bud measured at widest point 3.3 cms.
16:30 hrs. Same bud 3.8 cm. wide; petals visible.
18:30 hrs. Same bud 4.3 cm. wide; petals visible.
20:00 hrs. Filaments erect; petals unfolding; anthers white or creamy.

March 25, 1959.

07:00 hrs. Petals and filaments creamy white, still erect; anthers pale yellow.
09:30 hrs. Petals and filaments creamy white, erect.
10:30 hrs. Petals and filaments creamy white, erect.
11:15 hrs. Petals and filaments collapsed, creamy white.
13:30 hrs. Petals and filaments curling and shrivelling, mostly creamy white, but tinges of pink evident low on filaments.
15:00 hrs. Pale pink purple extended up filaments.
16:30 hrs. Pink purple colour deepened on filaments: petals mostly pink-purple.
20:00 hrs. Pink-purple colour deepened.

March 26, 1959.

10:00 hrs. Colour slightly deeper.

"This seems general for all flowers on the bush, so that the flowers appear to open between 7 p. m. and 8 a. m., and collapse the next day about 11 a. m., with a pink-purple colour developing through the day, and perhaps deepening at night."

C. Nummularia was described by De Candolle from an incomplete specimen, lacking both flowers and fruit. The essential characters of these parts were added by von Mueller in 1859, from a collection from Dirk Hartog I., collected by Cunningham.

There is a noteworthy gap of 750 miles in the range of *C. Nummularia* between the coast of Western Australia and the Alice Springs region in the dry interior.

This *Capparis* is a shub of arid regions and it occurs in regions of rainfall of 10-20 inches. In Western Australia along the coast and on the fringing islands it occurs on raised coral limestone. In the interior from Alice Springs, Northern Territory, to Hughenden, Queensland, it is found at from 1,000 to 3,000 feet altitude on various fine grained, arid soils, not on limestone. The broad gap of intervening region seems to be unsuitable for the plant, as it is either formed of desert sand hills or is a stony desert with probably less than 5 inches rainfall (see C. S. I. R. O., 1950: figs. 10, 21). This is a statement of the writer's impression, and that of J. H. Willis of Melbourne who wrote (in litt., Feb. 25, 1959), "I think the curious gap in the distribution.....might be attributable to the extremely arid belt of country which intervenes—it has a low, unreliable rainfall and consists largely of *Triodia* steppe (spiny tussock-grasses covering thousands of square miles, to the exclusion of shrub vegetation)." However, S. T. Blake of the Brisbane Herbarium wrote on Dec. 23, 1958, "The gap could be more apparent than real. Most of the area has been scarcely explored botanically and I have seen very few specimens of any plants from the area."

This Australian species has been reduced by Jacobs (1960: 91) to *C. spinosa* L. var. *mariana* (Jacq.) K. Schum., and he considered it an independent introduction of the cultivated Mediterranean *C. spinosa*.

5. **Capparis cordifolia** Lam., Encyc. Méth. Bot. 1: 609, 1783 (=1789).
Pl. I, a; fig. 2.
T: "Isles Mariannes. M. Sonnerat." (Hb. Paris), holotype examined.

Fig. 2. *Capparis cordifolia* Lam., at Mochom, Guam, photo in 1964, at 17:00, by B. C. Stone.

C. mariana Jacq., Pl. Rar. Hort. Schoenbrunn. Descr. Icon. 1: 57, pl. 109, 1797.

C. spinosa L. var. *mariana* (Jacq.) K. Schum., Engler's Bot. Jahrb. 9: 201, 1888.

Illustrations: see Jacquin, cited above; Blanco, Fl. Filip. pl. 179, 1878–80.

Shrub; branches 1–2 m. long, erect or sprawling; young shoots white tomentose, later glabrate; nodes unarmed or rarely the nodes on a few plants with the stipules developing as minute dark umbos or as minute prickles up to 0.5 mm. in length; internodes 1–3 cm. long; petioles 10–23 mm. long, early tomentose, then glabrate; blades 30–82 mm. long, 26–67 mm. wide, suborbicular to rounded ovate or oval, glabrate, fleshy, firm, the midrib not excurrent; flowers axillary, solitary, nocturnal, white, by early morning or midmorning turning pink, and withering brown by the afternoon of the first day; pedicels 3–4 cm. long, white floccose at first, then glabrate; buds asymmetric, white tomentose or arachnoid at base; sepals in anthesis reflexed, glabrous except at base and margin, the outer one 20–22 mm. long, 12–15 mm. wide, deeply galeate; petals 18–22 mm. long, obovate-suborbicular, glabrous; stamens 80–108, white, turning pinkish or even purplish, 3–4 cm. long; anthers 3 mm. long, purple; gynophore 5 cm. long; style none; berry 4.3 cm. long, cylindric-ellipsoid; seeds 2–4 mm. long, brownish black, reniform.

Distribution: Maritime littoral species, at sea level or on shore cliffs, almost always on coral rock or limestone, from the Palau Is. to Henderson I.

Marianne Is.: *Gaudichaud* (G); Rota, *Kanehira 1,812* (NY); Saipan, *Fosberg 31,294* (L); ditto, *Kanehira 1,920* (NY); Tinian, *Fosberg 24,818*, and *24,918* (L); ditto, *Kanehira 1,050*, and *1,070* (NY); and *2,277* (K, NY); Guam, *Bryan 1,215* (BISH); and *Safford & Seale 1,108* (GH); *Stone*, several collections (GUAM); *Thompson 280* (BM, BO, NY, US), and *Nelson 517* (BO, NY), nom. vern. "alcaparra", fide Jacquin; "atcarparas".

Palau Is.: coral island, *Kanehira 1,994* (BISH, NY, US); Angaur, *St. John 21,500* (BISH), nom. vern. "i il lel lameng ngernger"; Peleliu, *St. John* (BISH).

Nauru I.: *Burges K17* (K), nom. vern. "ekobobwija".

Solomon Is.: Bellona I., T [empleton] C [rocker Exped.], (BISH).

Loyalty Is.: Lifou, *Balansa 1,679* (BM, US).

Rotuma I.: *St. John 19,366*; *19,702* (BISH).

Fiji Is.: *Tothill & Payne* (K); Aiwa, *Bryan 494A* (BISH); Kandavu, *Smith 319* (BISH, BO, UC, GH, US); Komondriti, *Bryan 494* (BISH); Vanua Masi, *Bryan 537* (BISH); Viti Levu, *Bryan 1,215* (BISH), and *Greenwood 917* (K).

Tonga Is.: Tonga Tabu, *Setchell & Parks 15,629* (BISH).

Samoa Is.: *Vaupel 630* (US); Savaii, *Christophersen 2,782* (BISH), and *3,342* (BISH, BO), and *Christophersen & Stehlin 2,662* (BISH, US).

Niue I.: *Yuncker 10,112*, and *10,212* (BISH).

Cook Is.: Rarotonga, *Cheeseman 506* (K); and *Wilder 840* (BISH); Mangaia, *Graham* (BISH).

Austral Is.: Rimatara, *Chapin 84* (BISH); and *St. John & Fosberg 16,850* (BISH); Rurutu, *St. John & Fosberg 16,555* and *16,726*, and *16,763* (BISH); nom. vern. "tiari teina mato."

Tuamotu Archipelago: Anaa (Chain), *Cuming* (K), and *St. John 14,291* (BISH); Niau, *Jones 818*, nom vern. "tufirofiro."

Pitcairn I.: *Whitney Exped.* (BISH).

Henderson I.: *Lintott* (BISH); *St. John & Fosberg 15,062* (BISH). This species was unintentionally omitted in the recent account of the flora of Henderson I. (St. John & Philipson, 1962.).

Without Locality: Wilkes Expedition, sheet no. *6,787* (US), (mixed with *C. sandwichiana*).

Cultivated Plants: Philippines, Luzon, Malabon, *Merrill 516*, introduced from Guam (BO, NY).

On Guam the plant is used as a relish, due to Spanish influence.

Many of the collections of this species from Polynesia have been misdetermined as *C. sandwichiana*, a species restricted to the Hawaiian Islands. The duration of the flower is not as well documented for this species as for the others. It occurs over a broad range, and many botanists have collected it. The writer has seen it and collected it on seven different islands. Several of the earlier collectors have noted the flower color or changing colors, but none have timed the anthesis. Now Dr. B. C. Stone (in lit. IV. 9. 1964) has watched the flowering of the species on Guam, and he reports: "The flowers open about 7:30 P. M. and are quite wilted by 6:00 A. M. The opening itself appears to be fully accomplished in about 1½–2 hours. The open flowers have a light, sweet odor. I think that an approximate 12 hour cycle is involved. Most of the flowers I have recorded faded to a pinkish or even a purplish color. They are pure white to begin with."

W. Greenwood with his no. 917 from Viti Levu gives the data: "Petals pure white. Stamens pure white, with purple anthers. By 10 o'clock the petals and stamens have turned pinkish. In the late afernoon the flowers have withered up to a reddish brown color." F. R. Fosberg said in 1946, "in sun the flowers wither at 9, those in shade at 9:30, none open in the afternoon." From these observations it is clear that the flowers last less than one day, being nocturnal, opening after dark, and remaining white till the next morning, then turning pink and withering by the strong light of morning.

C. cordifolia was described by Lamarck in his Encyclopédie, based solely upon a specimen from "Isles Mariannes. M. Sonnerat." In the Lamarck Herbarium at the Museum d'Histoire Naturelle, Paris, there is a single collection so labeled. For the specimen there are three labels, but the original one is a tiny slip, 18 by 25 mm., bearing in Sonnerat's hand, "capriee des îles Marianes." A second sheet has a life sized drawing of a branch, leaves, flower, and buds, obviously made in the field. On it is a fair description of the plant in the same hand. As the handwriting has been matched with that in his letters, it is thus established that this specimen is the *Capparis* collected in the Marianas by Sonnerat, and is the holotype of *C. cordifolia* Lam. Its leaves are cordate-ovate, 4–5 cm. long, 3.3–3.9 cm. wide; the shoots, galeate buds, and young petioles are tomentose; and the anthers are 3.2 mm. long. Only a fragment of the flower is preserved and the pencil drawing merely shows many stamens, but not a definite and accurate number of them. Thus, it is clear that the holotype agrees with the more recent and complete collections from the Marianas that are here classed as *C. cordifolia*.

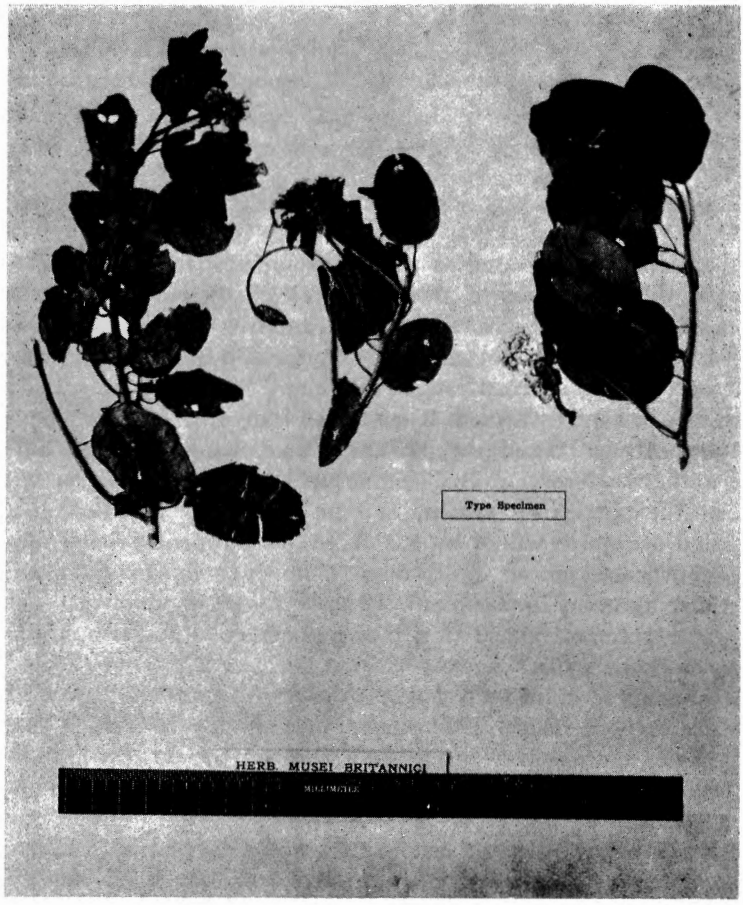

Fig. 3. *Capparis sandwichiana* DC. var. *sandwichiana*, holotype (the central and the right hand specimens), collected by Menzies (British Museum). The left hand specimen, collected by David Nelson, is of var. *Zoharyi* Degener.

6. **Capparis sandwichiana** DC., Prodr. 1: 245, 1820.

Pl. I, c-d; Figs. 3-4.

Flowers with 123-181 stamens; blades 3-6 cm. long, ovate to elliptic.

An Hawaiian species, consisting of the two following varieties:

6a. **C. sandwichiana** DC. var. **sandwichiana,** the species published by DC., Prodr. 1: 245, 1820.

T: "in ins. Sandwich. Menzies. (v. s. in h. Banks.)", holotype examined (BM).

Illustrations: Degener, Fl. Haw., fam. 142: 9/27/37.

Shrub; branches 1-2 m. long, ascending, arching or sprawling; young shoots glabrous; stipular prickles 0.5-1 mm. long, caducous; petioles 1-1.5 cm. long; blades 3-6 cm. long, 2.5-5 cm. wide, ovate to elliptic, fleshy, somewhat glaucous, obtuse or emarginate; flowers opening after dark, white, turning pink the next morning and fading the subsequent day; sepals green, glabrous; outer sepal strongly galeate, 2.5-3 cm. long, 9-13 mm. wide, the other sepals 2.4-2.6 cm. long, 1.4-1.9 cm.

HAWAIIAN ISLANDS ASSEMBLED

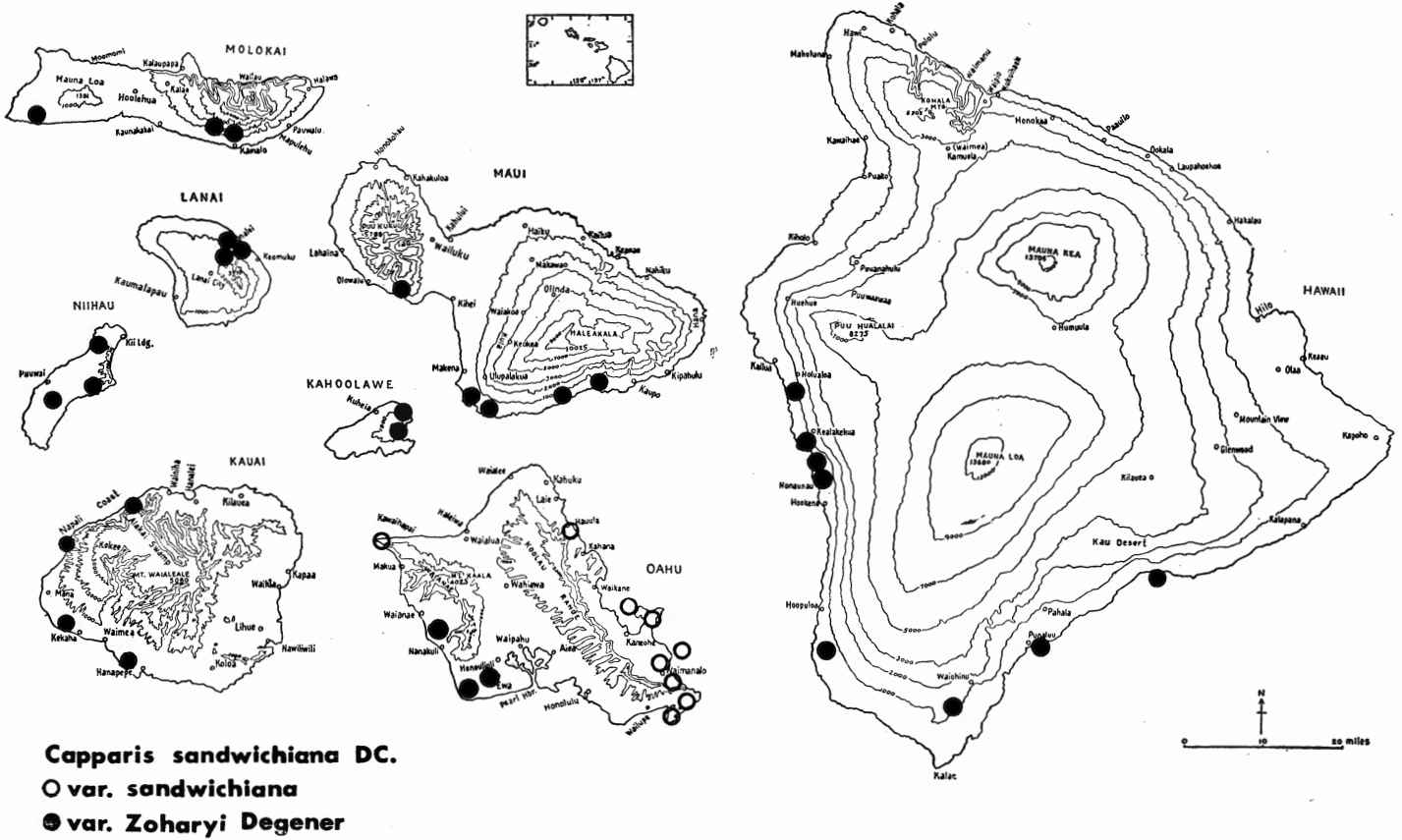

Fig. 4. Map of the distribution in the Hawaiian Is. of *Capparis sandwichiana* DC. and its varieties.

wide; upper petals 4 cm. long, 2.5–3.5 cm. wide, connate on adjacent margins for 25 mm., this united part firm, thick, forming a grooved ridge, deflexed into the reflexed outer sepal, and along the line of union densely white pilose; other petals 4–4.5 cm. long, 4–6 cm. wide, broadly obovate cuneate to suborbicular; stamens 119–128, white, wilting pink, 3–7 cm., but mostly 6 cm. long; anthers 3 mm. long, yellow; gynophore in flower 10–15 mm. long, in fruit 5–6 cm. long; pedicel in fruit 6–7 cm. long; berry 4–5 cm. long, 1.7–2.5 cm. wide, elliptic-cylindric, 5–7-ribbed, green, but when ripe orange; seeds 2.5–4 mm. long, 2–2.5 mm. wide, 2 mm. thick, oblique reniform, brownish gray.

Holotype: "in ins. Sandwich. Menzies. (v. s. in h. Banks.)", now in the British Museum of Natural History. (Specimen examined.) It is deduced that the upper central and the upper right specimens constitute the holotype, (while the upper left hand specimen, collected by D. Nelson, are of var. *Zoharyi*).

Specimens Examined, all from Oahu: Kaena Pt., *Degener & Park 9,952* (BISH, G, K, NY, US); Hauula, *Degener 2,081* (K, US); Kekepa Islet, *Fosberg 14,255* (BISH); Mokapu Pt., *Degener H217* (NY); also *Forbes 1,408* (BISH); Popoia Islet, *Stokes* (BISH); also *Fosberg 8,891* (BISH); Waimanalo, *Degener & Park 9,951* (BISH); also *Setchell 15,671*, and *15,691* (UC); Waimanalo near Makapuu Pt., *Bryan 620* (BISH); Maunalua, *V. Fosberq 13* (BISH); also *St. John & Rogers 21,570* (BISH); Blow Hole, *Rogers* (BISH); Koko Head, *Shaw 12,931* (BISH); nom. vern: "maiapilo".

Oahu: *Larsen* (BISH); *Mann & Brigham 108* (G, NY); *Remy* (NY).

Sandwich Is.: *Gaudichaud 262* (G); *Menzies* (BM); U. S. Expl. Exped. (NY).

Without Locality: U. S. Expl. Exped., in part, i. e. the two left hand specimens (US).

Note: The collection, *Remy 529* (GH), is labeled as from Hawaii Island. It seems to be the glabrous variety, known only on Oahu. Perhaps there is on this label a confusion in the data.

Distribution: mostly on coral rocks, rarely on basalt, from sea level up to about 75 ft. altitude.

Discussion: Since there are here recognized two varieties, it is necessary to discuss the typification of *C. sandwichiana* DC. It was described as follows: "inermis, foliis ellipticis glabriusculis, limbo petiolo vix triplo longiore, pedicellis solitariis 1-floris foliorum longitudine. *5* in ins. Sandwich. Menzies. (v. s. in h. Banks.)." In this the significant phrase is, leaves elliptic, essentially glabrous. Since the two varieties differ most clearly in pubescence, that character would seem to settle the question. However, the pubescence is close and minute, and pubescence of this kind was usually overlooked or unmentioned by botanists of the early 19th Century.

The single collection listed by De Candolle, and hence his holotye, was in the herbarium of Sir Joseph Banks. It is now in that of the British Museum of Natural History, London. The specimen is mounted on an old, original mounting sheet. On its front side is written in pencil in an old hand, "Capparis Sandwichiana DC. prodr. 1. p. 245." On the reverse side is written, "Sandwich Island. Messrs. Menzies & Dav. Nelson—Capparis Sandwichiana Decand. Prodr. I, p. 245." Now, the sheet bears three leafy twigs (fig. 1). The one at the upper left is the larger, and has one broken flower, showing two sepals, no

petals, but a few stamens. It was more poorly dried, and the leaves are shrivelled and somewhat broken. It is significant that the young, newly grown shoots are canescent puberulent, and so, this represents the pubescent variety.

The other two shoots, at the top center and upper right of the sheet, are smaller, 9 and 13 cm. long, similar, better pressed and preserved. Both have old flowers with sepals, petals, and many stamens, and there is also a young fruit. Their young shoots and petioles are completely glabrous, and thus they represent the glabrous variety.

Nothing on the sheet or in the museum records indicates which specimens were collected by Nelson and which by Menzies. Still, it has been possible to settle this point. David Nelson was a gunner, but also designated botanist, on Capt. Cook's third world voyage, the one which discovered the Sandwich Islands. In 1778 they made a landfall at Waimea, Kauai Island, but there is no indication that Nelson was allowed on shore. There is no plant collection from there attributed to him. Returning in 1779 they made a long stay at Kealakekua Bay, Hawaii Island, and had long, friendly contacts with the natives. When proposed by Corpl. Ledyard, Capt. Cook ordered Ledyard, and Nelson to lead a small party in the ascent of Mauna Loa, the massive volcano rising above the bay. They spent five days on the trip and penetrated the rainforest on the lower middle slopes. They returned to the ship, Nelson bearing a sizeable plant collection, the only one he was able to make during the many weeks in these island waters.

Archibald Menzies was assistant surgeon, then surgeon, and botanist on the voyage of Capt. George Vancouver which reached the Sandwich Islands in 1792. They landed on, and Menzies made collections on, the islands of Kauai, Niihau, Oahu, Maui, and Hawaii.

The glabrous variety occurs only on Oahu, hence, Nelson could not have encountered it, and must have collected the pubescent variety which still occurs on the western side of Hawaii, and even on the bay at Kealakekua near the Cook landing, but also occurs on all the other large islands of the group and on some of the Leeward Islands, out as far as Midway I.

Menzies visited Honolulu on Oahu Island, and from there could easily have tramped to the nearby localities for the glabrous twigged *Capparis*. Hence, it is deduced that the two smaller specimens, towards the right on the sheet, were collected by Menzies on Oahu, These then are the holotype of *C. sandwichiana* DC.

6b. **C. sandwichiana** DC. var. **Zoharyi** O. & I. Degener, Phytologia 7(7): 369, 1961. Pl. I, e; Figs. 3–4.

Illustrations: Sinclair, Indigenous Flowers of the Hawaiian Islands, pl. 42, 1885.

Description of All Specimens Examined: Shrub; branches arched divergent or in exposed or very arid places prostrate, 1–5 m. long; young shoots buds young blades and petioles cinereous puberulent, later glabrate; petioles 1–4 cm. long; blades 2.4–5.8 cm. long, 1.9–4.5 cm. wide, ovate to broadly elliptic, subacute to rarely obtuse or emarginate; flowers beginning to expand 1–2 hours after dark, the petals and filaments white, both turning pink by afternoon of the first day, and brownish by the morning of the second day; sepals glabrate or at base a

sparse puberulence persisting; outer sepal 2–4 cm. long, 1.4–2 cm. wide; upper petals 2–4 cm. long; stamens 123–181; anthers 3.5–4.3 mm. long, berry 1.7–3 cm. wide; seeds 4–5 mm. long, 2.5–3 mm. wide, 2–2.5 mm. thick, broad ovoid-suborbicular, cochleate, dark reddish brown.

Lectotype: Hawaiian Islands, Kauai, Polihale, rocky shore subject to ocean spray during storms, Nov. 27, 1960, *O. & I. Degener 27,254* (NY). The lectotype is selected herein.

Specimens Examined: Leeward Islands,

Midway I.: *Bartsch* (US); *Bryan* (BISH, BO, NY); *Caum 23* (BISH, UC, US).

Pearl and Hermes Reef: *Caum 54* (BISH, BO, NY); *Wilder 2* (BISH).

Laysan I.: *Bryan no. X* (BISH); *Schauinsland* (BISH); *Wilder 478* (BISH); *Snyder* (US).

Hawaiian Islands, main group.

Kaula I.: *Caum 1* (BISH).

Kauai: Hanakoa, *St. John, Britten & Cowan 23,210* (BISH). Also reported at Waiawa by *Wawra*; and on Kauai by *Hillebrand*, nom. vern. "puapilo."

Niihau: Halalii Lake, *St. John 22,733* (BISH); Kawaihoa Pt., *St. John 23,614* (BISH); ditto, *Stokes* (BISH, NY, UC)).

Oahu: Lualualei, *Forbes & Cook 1,928.0* (BISH); Sisal, *Forbes & Cook 1759.0* (BISH); Ewa Coral Plains, *Skottsberg* (BISH); Barbers Pt., *Egler 37–277* (BISH).

Molokai: Kawela, *Degener 17,208* (GH, NY); and *18,207* (GH); Kamalo Gulch, *Degener 17,206* (NY); ditto, *Forbes 588.Mo* (BISH, BO, UC); Haleana, *Nightingale* (BISH); Moomomi, *Rock* (BISH).

Maui: Manawainue Gulch, *Degener 17,209* (NY); La Perouse Bay, *Korte* (BISH); Keoneoio, *St. John & Catto 17,723* (BISH); Kahikinui, *Rock 8,694* (BISH); Nuu, *Forbes 1,914.M* (BISH).

Lanai: Maunalei, *Hosaka 1,964* (BISH); Limestone Pt., *Munro s. n.*; *49*; *117*; and *474* (BISH); Mauna Lei Gulch, *Rock 8,095* (BISH, BO, GH, NY, UC).

Kahoolawe: Kanapou Bay, *Bryan 723* (BISH); ditto, *Stokes* (BISH).

Hawaii I.: Kahului, *Alexander & Kellogg 5,364* (BISH); Kealakekua, *Greenwell & Hatheway 7* (BISH); Honaunau, *Hitchcock 14,588* (US); Kapua, *Forbes 352.H* (BISH); between Kaalualu and Waiohinu, *Degener 17,207* (GH, NY); Punaluu, *St. John 11,320* (BISH); Keauhou, 30–300 ft. alt., *St. John 22,463* (BISH); along road 40 miles w. of Kilauea, *Degener 2,091* (NY); Keaoi I., *Fagerlund & Mitchell 885* (BISH).

Oahu: without other locality, *Mann & Brigham 108* (CU, GH).

Sandwich or Hawaiian Is.: *Gaudichaud 262* (F); *Hillebrand* (K); *Mann & Brigham 108* (GH); and 108(430) (BISH); and *430* (GH).

Distribution: on coral or basaltic rocks or soils near the sea, at from 5 to 300 feet above sea level.

Discussion: Though the only difference between the two varieties is one of pubescence of the young shoots, it is clearly of some significance. No intermediates have been found, and each variety has a distinct range. The variety *sandwicensis* occurs only on windward Oahu. The only locality in western Oahu is at Kaena Pt., the northwestern point which projects well out and receives the full force of the northeast trade-winds, as it is not in the lee of the Koolau Range. All the other localities are on the northeastern or windward shore, except

that the range continues around Makapuu, the southeast point, to Koko Head, just as the wind and currents also eddy around this corner.

The range of var. *Zoharyi* is more extensive and notable because it extends from Midway I. to Hawaii I. The variety occurs, without relation to wind or current direction, on the atolls of Midway, Pearl & Hermes, and Laysan, and on the small and rather low islands of Niihau, Lanai, and Kahoolawe. It also occurs on all of the high islands of the main group of the Hawaiian Is., but only on their leeward sides. Since the species is essentially littoral, it is curious that one variety is strictly on the windward habitats, while the other is on mostly leeward ones, and that the two never occur together.

The collections by Mann and Brigham were given field collection numbers, and some of these were kept as permanent numbers, but in other cases the collections were renumbered with a "species number." This new number was given by Mann to all collections of that species, even those from different islands. The set in the Bishop Museum, which was the one retained by Brigham, is peculiar in that many labels bear two or even three numbers. Under their number 108 were distributed as from Oahu, both var. *sandwichiana* and var. *Zoharyi*. Since both occur on Oahu, these data may well be correct. A specimen of no. 108 in the Gray Herbarium bears only the locality, Hawaiian Islands. Another in the Bishop Museum has on the label the nos. 108(430). In the fragment of Mann's field number list preserved in the Gray Herbarium library, no. 430 is *Vac* [*cinium*] *penduli* [*florum*] var. *berberi* [*difolium*] Haleakala, E. Maui, so, in this case, Mann did a renumbering, and the final number, 108, was a species number, under which several collections were assembled. Hence, it is comprehensible how collections of two varieties from several islands were issued under a single number.

Since the periodicity of anthesis is significant, it seems worthwile to put on record field observations made on var. *Zoharyi* by the writer at Keauhou on one of several flowers observed.

Flower 2. Dec. 30, 1946.

20:30 hrs. Bud large; sepals pale green, but near tip tinged with pink; petals showing, still circinate, but with an apical opening 1 cm. in diameter, the petals white, but on the outside with a green band 3 mm. wide or with green splotches beginnin 6 mm. below the tip; stamens included except for 3 already exserted and erect; filaments white; anthers pale yellowish.

21:02 hrs. Corolla aperture 15 × 10 mm., the greatest width perpedicular to the saccate sepal; 14 stamens exserted.

21:18 hrs. Corolla aperture 16 × 11 mm. and the hole clear right down to the base; the exserted stamens in two groups lateral, one on each side, the inflexed, unexpanded stamens making an arch between the groups.

21:20 hrs. 11 stamens exserted.

21:25 hrs. 12 stamens exserted; the sepal opposite the saccate one standing free of the petals.

21:35 hrs. 13 long stamens and 12 short ones exserted through the corolla aper-

ture which is 18 × 14 mm. The stamens are not snapped out, but each one unbends and comes out through the aperture with a gentle motion, then stands erect.

22:00 hrs. Flower only slightly more open.

Dec. 31, 1946.

06:00 hrs. and half light. Flower still not fully opened; sepal opposite the saccate one reflexed slightly below the horizontal, the others still ascending and appressed; corolla aperture 30 × 25 mm., and the large central part in use by a bee; petals white, still tinged with green without; filaments white; anthers yellowish; 29 stamens fully exserted; fragrance strong. Honey bees visiting flower, crawling over the anthers and forcing their way down into the center of the flower.

06:20 hrs. Full dawn, but sun still behind Mauna Loa. Flower unchanged.

09:30 hrs. Flower in same state, still white and fragrant. Small beetles and small (native?) bees visiting the flower.

Jan. 1, 1947.

09:00 hrs. Petals and filaments pink; flower withering, the fragrance gone.

Medical use of this *Capparis* by the Hawaiians have been reported previously, but it was possible to get a first hand account from William H. Meinecke, long on the administrative staff of the University of Hawaii. After a long discussion on it, he complied with the writer's request, and on Jan. 21, 1947, wrote the following memorandum, which is here quoted in part.

"Out in the open one does notice any particular odor of the flowers, but if left in a closed room over night one soon realizes why it was named "pilo" or "maiapilo", = maia (banana), and pilo (having a putrid or vile odor. The odor of pilo is definitely putrid and suggestive of that of very rotten bananas well past the "sour" stage.

"The roots are comparatively shallow and radiate outward from the central stem. The medical properties of these roots is what makes pilo a very valuable plant. Hawaiians and other people of Kau still use it,—particularly for sprains, bruises, broken bones, old "football-knees" and even for fresh blending cuts.

"When I was a good sized boy, a friend stepped on a broken bottle and cut an artery near his ankle. There being no available doctor, an old Hawaiian applied pilo with very satisfactory results.

"Another friend had injured his knee playing football. For many years after, it would get stiff and sore whenever he sat still for about a half hour. Various treatments recommended by regular physicians did no good. At last he tried pilo. Just one treatment, and he has not been bothered since. I know of other similar instances.

"I have had occasion to use it myself. I had sprained my ankle and had immediate treatment by a regular doctor, but after a few days my ankle was so sore that I could not even bear my weight on it. One of my Hawaiian friends then recommended that I try pilo. So he got some pilo roots for me, told me how to prepare them and cautioned me against the tendency to leave the medicine on too long. He said "Aia hoomaka wela, wehe",—When it (hoomaka)

begins to (wela) hot or warm, remove it (wehe). The next day the soreness was practically all gone and on the second day I was able to run. But the skin around my ankle was "cooked" almost to the point of blistering, because I had misinterpreted the warning against leaving the medicine on too long at a time. It should have been removed as soon as it began to feel slightly warm,—not hot.

"First the thin outer skin of the root-bark is scraped off (to remove dirt). Then the root is pounded with a hammer and the bark itself is separated from the woody center. (Some people prefer scraping instead of pounding.) The bark is then pounded to a pulp like fine sawdust, some common Hawaiian sea-salt is added and mixed in, then the mass is put into a cheese-cloth bag or thin handkertief and it is ready for use. It is cool and slightly moist to the touch, but when placed on the "sore spot" the skin soon begins to feel *slightly warm*. It should then be removed and placed on another spot, or left off for a while and then replaced, only to be removed again as the skin again begins to feel slightly warm. Treat thus about a half hour or longer five or six times a day,—being sure to remove the medicine *before* going to sleep. Failure to remove the medicine will cause the skin to blister.

"The remedy for blistering is *the same used pilo* that caused it,—except that it is first baked or roasted in a pan over an open fire till it is reduced to ashes and then, when cool, the powder is sprinkled over the blistered parts, the same as in the use of ordinary drying powders for athletic "strawberries" etc. The relief is rapid and permanent."

The present writer has pursued the investigation of *C. sandwichiana* for many years. He has located the type of the species and determined that only the collections from windward Oahu are of the type variety. The other collections from the Hawaiian islands differ in pubescence, and are to be recognized as a variety. The writer has long had it named in manuscript and this unpublished varietal name is to be found in numerous herbaria. This epithet will not be mentioned here, because in 1961 the Doctors Degener published it as var. *Zoharyi*, a valid name. They based it only upon their collections from Polihale, Kauai. Their implication is that the Polihale collections represent a variety that occurs there only, and that it is different from all other Hawaiian *Capparis*. The present writer considers it of the same variety as the other pubescent ones of the islands, and adopts the epithet, var. *Zoharyi* O. & I. Degener, for all of these.

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Explanation of Plate

Plate I. a. (Upper left). *Capparis cordifolia* Lam., from Mochom, Guam. Photo by B. C. Stone, 8 p. m.

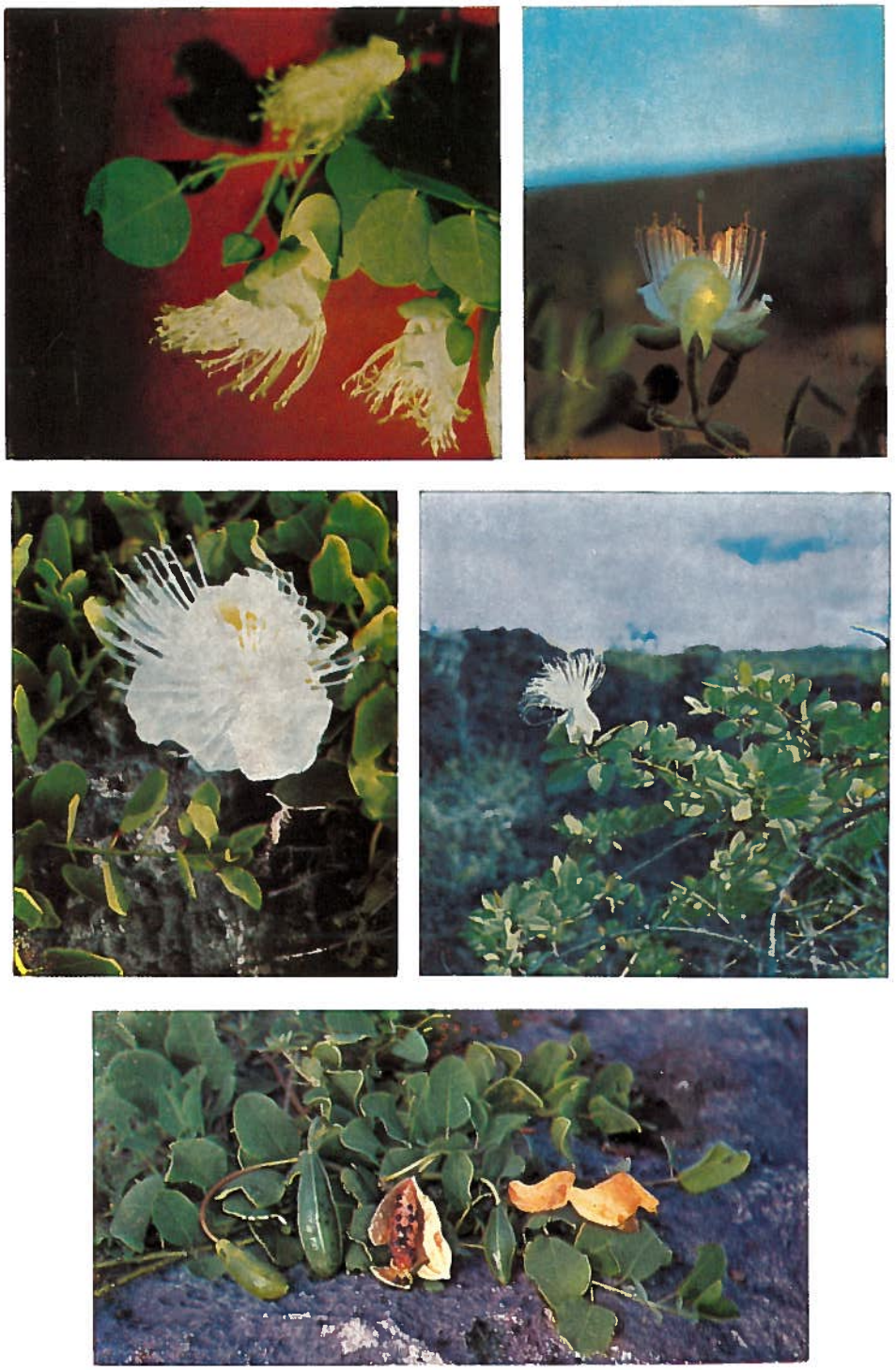
b. (Upper right). *Capparis Nummularia* DC., Alice Springs, Australia, 25 March 1959. Photo by G. Chippendale, 7 a. m.

c. (Middle left). *Capparis sandwichiana* DC. var. *sandwichiana*, Kahuku, Hawaiian Islands. Photo by G. Pearsall.

d. (Bottom). The same variety, Kahuku, Oahu, with fruit.

e. (Middle right). *Capparis sandwichiana* DC. var. *Zoharyi* Degeners, Keauhou, Hawaii, Jan. 2, 1947. Photo by H. St. John.

Plate I. Flowers of Capparis species



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