and amount of oscillations in the tropics must be linked to those of higher latitudes. Changes of sea level must be separated from local changes in the level of the crust. Multiple working hypotheses must be tested by the application of new and significant facts.

BOTANY.—Merope angulata, *a salt-tolerant plant related to Citrus, from the Malay Archipelago.* WALTER T. SWINGLE, Bureau of Plant Industry.

In the course of a survey of the wild relatives of the commonly cultivated citrous fruits, in the hope of finding new material for use in breeding, the writer was struck by accounts of a curious thick-leaved plant said to grow in tidal swamps in the Malay Archipelago at Noessa Kambangan, in southern Java, where it is called "kigerukkan." A search for descriptions has revealed a curious and involved nomenclatorial history, and a surprising lack of information as to the occurrence, nature, and possible economic value of this curious salt-tolerant plant. As early as 1801 it was described by Willdenow as *Citrus angulata*, with a citation of Rumphius' illustration of *Limonellus angulosus* in the Herbarium Amboinense (1741). In 1834 Wight and Arnott noted that the *Citrus angulata* of Willdenow was undoubtedly a Limonia, and Miquel later (1859) made the transfer as *Limonia angulosa*. In 1872 Kurz described this same plant as a new species under the name *Atalantia longispina*. Two years later he decided to create a genus, Gonocitrus, for the *Citrus angulata* of Willdenow, making his *Atalantia longispina* a synonym. In 1875 Hooker described the plant as *Paramignya longispina;* and in 1876 Kurz abandoned his genus Gonocitrus and transferred the *Citrus angulata* of Willdenow to Paramignya as *P. angulata.*

The nomenclatorial vicissitudes outlined above, however, tell only half the story!

In 1825 Blume created a new genus, Sclerostylis, to receive five species, regarded by him as new. Among them was the kigerukkan, which received the name *S. spinosa*. Although it is the first species listed by Blume, it cannot properly be con-

sidered the type of the genus. The name *Sclerostylis*, meaning hard style, must of course have applied to some species the styles of which were seen, whereas the type specimen of *Sclerostylis spinosa* has no flowers,[1] and the original description does not describe the flowers. Very probably Blume had only a single specimen of this plant from which to draw his description of the species. He had, however, flowering specimens of some, if not all, of his other species of Sclerostylis, now considered as belonging to Glycosmis, which have very short, thick styles that might easily have given occasion for the generic name. Material of *S. trifoliata* and *S. lanceolata* in the herbarium of the Muséum in Paris, labeled in Blume's hand, shows styles characteristic of Glycosmis and suggestive of the name Sclerostylis.

Finally, characteristically spiny material from the type locality (it should be noted that the other four species of Blume's Sclerostylis are inermous) shows the plant in question to be very different from Blume's genus in flower and especially in style characters.

Sprengel, in 1827, referred the *Sclerostylis spinosa* of Blume to the genus Limonia, and Dietrich in 1840 referred it to Glycosmis. In 1846 Roemer created a new monotypic genus, Merope, based on Blume's *Sclerostylis spinosa*. There is every reason to believe that Roemer did not see actual specimens of the plant, but drew the characters of his new genus exclusively from Blume's description. In 1912 Koorders[2] records this plant from Noessa Kambangan under the name *Atalantia spinosa*, giving "Hook., Index Kew. II. 849" as authority.[3]

A photograph of Blume's original type specimen at Leiden, obtained through the kindness of Dr. Th. Valeton, and a subsequent study of the specimen itself show beyond question that the *Sclerostylis spinosa* of Blume is the same as Willdenow's

[1] "Comme vous voyez le spec'men (l'original de *Sclerostylis spinosa* de Blume) n'a ni fleurs ni fruits." Valeton, Th. Letter dated Leiden, 10 October, 1910. In February, 1912, I had an opportunity of seeing the specimen myself in the Rijks Herbarium at Leiden.

[2] Exkursionsfl. Jav. **2**: 427.

[3] The reference in Kew Index under Sc'erostylis is as follows: "*spinosa* Blume, Bijdr. 134 (Atlantiae sp.)"

Citrus angulata. Under the name *Paramignya angulata* Kurz, Valeton in 1912[4] published a Latin description of this plant, accompanied by an excellent figure, giving fruits and flowers. Here, as a result of a suggestion made by the writer to Dr. Valeton in 1909, attention is first called to the identity of *Sclerostylis spinosa* and *Citrus angulata*. At the request of the writer a native collector was sent by Dr. Valeton to Noessa Kambangan on the south side of Java in 1910 and he succeeded in securing specimens of the kigerukkan and later on a considerable quantity of viable seeds.

Fig. 1. *Merope angulata*. Flowering branch. Scale one-half.

A study of these specimens and of living plants growing in the greenhouses of the U. S. Department of Agriculture at Washington, D. C., has convinced the writer that this plant cannot be referred to Paramignya but constitutes a distinct genus (figs. 1 and 2). Since Sclerostylis must be considered a synonym of Glycosmis, as shown above, the oldest available name for this plant is Roemer's Merope. This genus differs rather widely from any other plant in the subfamily Citratae, but is doubtless most nearly related to Paramignya and Lavanga, which also have fruits lacking in pulp vesicles. It differs from Paramignya in the character of the seeds, which are very long and flattened, in the triquetrous fruit (see fig. 2), the paired spines, the simple, short petiole (not long and twisted), and the thick, leathery leaves. It differs from Lavanga in the simple (not trifoliate) leaves, the simple, short petiole, and the straight (not curved) spines.

[4] Icones Bogorienses, **4**: 159–161. *pl. 348*. 1912.

The name of the kigerukkan, the only species known in this genus, becomes:

Merope angulata (Willd.) Swingle, comb. nov.[5]
Citrus angulata Willd. Sp. Pl., ed. 4, **3**[2]: 1426. 1801.
Sclerostylis spinosa Blume, Bijdr. Fl. Ned. Ind. **1**: 134. 1825.
Limonia spinosa Spreng. Syst. Veg., ed. 16, **4**[2]: 162. 1827.
Glycosmis spinosa Dietr. Syn. Pl. **2**: 1409. 1840.
Merope spinosa Roem. Syn. Mon. Hesp. **1**: 44. 1846.
Limonia angulosa Wight & Arnott; Miq. Fl. Ind. Bat. **1**[2]: 521. 1859.
Atalantia longispina Kurz, Journ. As. Soc. Bengal, **41**[2]: 295. 1872.
Gonocitrus angulatus Kurz, Journ. As. Soc. Bengal, **42**[2]: 228, *pl. 18.* 1874.
Paramignya longispina Hook. f. Fl. Brit. Ind. **1**: 511. 1875.
Paramignya angulata Kurz, Journ. As. Soc. Bengal, **44**[2]: 135. 1876.
Atalantia spinosa Hook. f. Index Kew. **4**: 849. 1895. (vide Koorders, Exkursionsfl. Jav. **2**: 427. 1912.)

Leaves coriaceous, inconspicuously veined, alternate; petioles simple. Twigs with very strong spines, often in pairs. Flowers borne singly or in pairs (rarely in few-flowered clusters) in the axils of the leaves; ovary stalked on a rather tall disk, 3–5-celled, with 2–4 pendulous ovules in each cell; stamens 10, free; anthers linear oblong. Fruits strongly angled, triangular in cross section; cells filled with a sticky mucilaginous fluid (without true pulp vesicles); seeds very large, flattened, reniform, caudate at the tip where attached. Cotyledons in germination aerial, not increasing in size; first foliage leaves alternate, broadly ovate.

A large shrub or small tree (not a climbing shrub), growing on the seashore in tidal forests or mangrove swamps from the mouth of the Ganges to the Moluccas.

MEROPE RESISTANT TO SOIL SALINITY

This plant, which has not received the attention it merits, either from botanists or horticulturists, was discovered in the Moluccas and has since been found in Java, at Malacca, in upper Tenasserim and lower Pegu (Burma), and in the Sunderbuns (the mouth of the Ganges in India). These regions represent a range of nearly 3000 miles, and it will doubtless be found to be widely distributed throughout the Malay Archipelago. It is likely to have escaped most collectors, however, because of its restriction to inaccessible coastal swamps.

The fact that *Merope angulata* grows only along the seashore

[5] The following pre-Linnaean name is referable to this species: *Limonellus angulosus* Rumph. Herb. Amboin. **2**: 110. *pl. 32.* 1741.

in mangrove swamps and tidal forests would naturally lead us to expect that it possesses high powers of "alkali resistance," since sea water contains over 3 per cent of dissolved salts and the mangrove and other plants growing in the mangrove swamps are able to withstand large quantities of dissolved salts in the

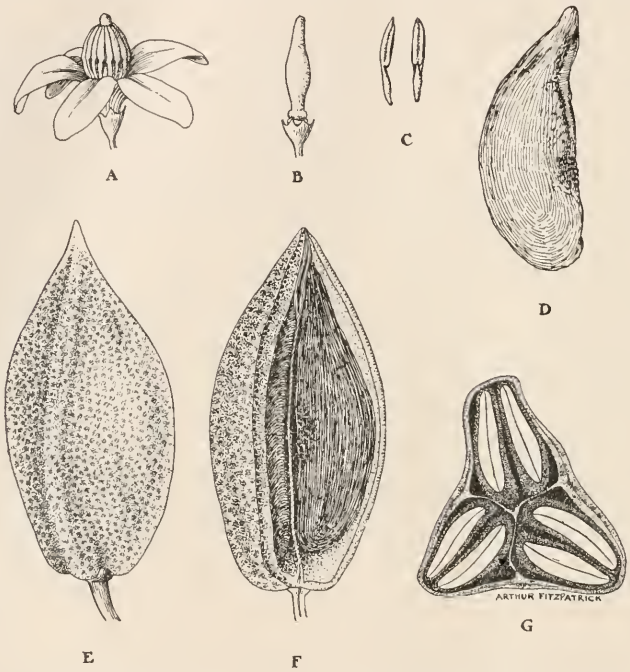

Fig. 2. *Merope angulata*. *A*, flower; *B*, pistil; *C*, stamens; *D*, seed; *E*, fruit; *F*, longitudinal section of fruit; *G*, cross section of fruit. *A–C*, scale 1.5 ; *D–G* natural size.

substratum. Experiments carried on with seedling plants in the greenhouses of the Department of Agriculture at Washington have shown that it is indeed very resistant to salt. One plant which was watered exclusively with a normal salt solution showed no ill effects for two months. The treatment was continued and the plant finally died, the soil containing at the time of its death 1.34 per cent salt (computed from readings by electrolytic bridge). Another plant was given 1.5 oz. normal

salt solution every fourth day (ordinary water being used in addition for any further moisture needed by the plant) from August 31, 1914, to January 20, 1915. At this latter date the foliage was yellowing and the roots were beginning to decay. Other plants of this species, however, which were given small amounts of normal salt solution from time to time, actually made better growth than those not receiving any salt.

POSSIBLE UTILIZATION OF KIGERUKKAN FOR STOCKS

When we remember that the orange is one of the most sensitive to alkali among the fruit trees, it can readily be seen that *Merope angulata* is a plant of decided interest for trial as a stock for other citrous plants, and experiments are now being carried on under greenhouse and field conditions to determine whether it can be so used. So far Citrus has not been grafted successfully on this stock; but a seedling kigerukkan grafted on a seedling grapefruit grew rapidly and after some months flowered, having developed a strong swelling at the point of union of the stock and scion in the meantime. It is therefore hoped that reciprocal grafting of the kigerukkan and the cultivated species of Citrus will ultimately be successful.

ZOOLOGY.—*The relationship between phylogenetic specialization and temperature in the recent crinoids.*[1] AUSTIN H. CLARK, National Museum.

In a previous paper[2] I discussed the relationship between phylogenetic specialization and bathymetrical distribution in the recent crinoids. In the present paper I shall consider in the same way the relationship between phylogenetic specialization and the temperature of the habitat.

Unfortunately temperature records for the crinoids are comparatively few, and for many of the families very unsatisfactory; yet, incomplete as they are, they bring out certain features which are not without interest.

[1] Published by permission of the Secretary of the Smithsonian Institution.
[2] Journ. Wash. Acad. Sci. **5**: 309–317, May 4, 1915.