Preliminary Note on the Comparative Anatomy of Cucurbitaceæ, wild and cultivated in Japan.

by

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LOTAR¹⁾, PENZIG²⁾, FISCHER³⁾, FICKEL⁴⁾, HÖHNEL⁵⁾, BISCHOFF⁶⁾, HARZ⁷⁾, FRÉMONT⁸⁾, and others have early investigated the anatomical characters of *Cucurbitaceæ*, bringing to light the special structures of various organs. I undertook, for my part, to study comparatively some differences existing in the inner structures of *Cucurbitaceæ* found wild and cultivated in our country. In Japan the number of genera contained in this family is nowadays known to be fifteen: *Actinostemma*, *Benincasa*, *Bryonopsis*⁹⁾, *Citrullus*, *Cucumis*, *Cucurbita*, *Gymnostemma*, *Lagenaria*, *Luffa*, *Melothria*, *Momordica*, *Mukia*¹⁰⁾, *Schizopepon*, *Trichosanthes*, and *Zehneria*¹¹⁾, of which I examined twelve genera, *Bryonopsis*, *Mukia*, and *Zehneria* having been inaccessible to me.

I investigated the anatomical structures of the stems, hypocotyls, blades,

¹⁾ HENRI-AIMÉ LOTAR. Essai sur l'Anatomie comparée des organes végétatifs et des téguments séminaux des Cucurbitacées. Lille 1881.

²⁾ O. PENZIG. Zur Verbreitung der Cystolithen im Pflanzenreich. Bot. Centralbl. 1881. Bd. VIII, No. 13.

³⁾ A. FISCHER. Untersuchungen über das Siebröhrensystem der Cucurbitaceen. Bot. Centralbl. 1885. Bd. XXI, No. 4.

⁴⁾ J. F. FICKEL. Ueber die Anatomie und Entwicklungsgeschichte der Samenschalen einiger Cucurbitaceen. Bot. Ztg. 1876. Bd. XXXIV, Nr. 47-50.

⁵⁾ F. v. HÖHNEL. Morphologische Untersuchungen über die Samenschale der Cucurbitaceen. Wien 1876.

⁶⁾ G. W. BISCHOFF. Handbuch der botanischen Terminologie und Systemkunde. Nürnberg 1833. Bd. I.

⁷⁾ C. D. HARZ. Landwirthschaftliche Samenkunde. 1885. Bd. II.

⁸⁾ A. FRÉMONT. Sur les tubes criblés extra-libériens dans la racine des Oenothéracées. Journ. de Botanique. 1891. T. 5.

⁹⁾ H. KUROIWA. A List of Phanerogams collected in the Southern Part of Okinawa, an Island of the Loochoo Chain. Botanical Magazine. Tokyo. 1900. Vol. XIV, No. 163. p. 123.

¹⁰⁾ H. KUROIWA. *loc. cit.* p. 123.

¹¹⁾ H. KUROIWA. *loc. cit.* p. 123.

petioles, cotyledons, tendrils, roots, fruits, and seeds of the above plants, and when necessary old as well as young specimens were examined and compared. Here, however, instead of entering into detailed descriptions, I will give the chief results of my investigation piece by piece as a preliminary note.

(1) The old stems of *Luffa* and *Momordica* are very characteristic. They have a sharp keel along the angled portions. The microscopical examination shows that the ridges of *Luffa* consist only of the outgrowth of the collenchyma, while those of *Momordica* are formed by newly developed secondary fibro-vascular bundles.

(2) There are four types¹⁾ of the distribution of the sieve-tubes in the stems: *a*) the vascular-bundle sieve-tubes, *b*) the ectocyclic sieve-tubes, *c*) the entocyclic sieve-tubes, and *d*) the commissural sieve-tubes. *Luffa*, *Momordica*, *Gymnostemma*, and *Actinostemma* have those of the first and third types; *Lagenaria*, *Benincasa*, *Cucumis*, *Trichosanthes*, *Citrullus*, *Schizopepon*, and *Melothria* those of the first, third, and fourth types; and *Cucurbita* all kinds of them.

(3) Rhizomes occur in *Melothria* and *Gymnostemma*. They are long and thick, having scales at several nodes and are full of starch-grains, of which those of *Gymnostemma* are the largest (0.06 mm. in diameter) among the starch-grains contained in any organs of *Cucurbitaceae*.

(4) The number of the fibro-vascular bundles in the hypocotyls is generally six,²⁾ except in *Citrullus* and *Cucurbita*, the former of which has twelve, and the latter ten.

(5) The epidermal cells on the upper surface of the blades of *Trichosanthes cucumeroïdes* are elongated into conical papillae.

(6) The epidermis of the blades may be many-layered as in *Cucurbita*, a character which is limited to this genus. *Momordica* contains globular cystoliths³⁾ in the greatly enlarged epidermal cells on the lower surface of the blade. They are united into groups.

(7) Stomata on the upper surface of the blades are rarely found in *Momordica charantia* and *Trichosanthes japonica*, while they are entirely wanting in *Schizopepon* and *Gymnostemma*.

(8) The mesophyll of *Actinostemma* is very rich in intercellular spaces, so that it reminds us of the leaf-tissue of water plants.

¹⁾ Compare the work of A. FISCHER. *loc. cit.* p. 104-108.

²⁾ HENRI-AIMÉ LOTAR. *loc. cit.* p. 14.

³⁾ O. PENZIG. *loc. cit.* p. 393.

(9) Pallisade parenchyma mostly occupies four-tenths of the thickness of the blades, sometimes exceeding six-tenths in *Cucurbita Pepo*, where the pallisade cells may be arranged in double rows.

(10) The petioles are solid in general, excepting in *Cucurbita* and *Benincasa*, in which they are hollow. The number of fibro-vascular bundles varies from 5 (*Actinostemma*, *Melotlaria*, and *Gymnostemma*) to 13 (*Cucurbita*).

(11) Stomata on the cotyledons are in many cases present on both the upper and lower surfaces. *Momordica charantia*, *Trichosanthes japonica*, and *Gymnostemma cissoides* form an exception to this rule, the former two having the stomata on the lower surface and very rarely on the upper surface, while the last one has them exclusively on the under side.

(12) The number of stomata found on the tendrils is nearly the same in all species. The number of fibro-vascular bundles varies from 4 (*Actinostemma*, *Gymnostemma*) to 9 (*Citrullus*).

(13) Tubers are confined to the genus *Trichosanthes*. The largest starch-grains contained in the roots are those from the tubers of *Trichosanthes multiloba* (0.04 mm. in diameter).

(14) In the old roots of *Momordica* the fibro-vascular bundles have a double arrangement at the angled portions as in the old stems.

(15) The young roots of *Actinostemma* have remarkably wide inter-cellular spaces.

(16) The epidermal cells of the fruits may be radially flattened, cubical, and radially elongated. *Cucumis sativus* is characterized by having the epidermal cells four times longer radially than tangentially, and *Benincasa hispida* by having a tangential septum in many cells.

(17) In the fruit-tissue a sclerenchymatous ring, either complete or incomplete, is generally formed. In *Cucurbita*, *Schizopepon*, *Cucumis sativus*, and *C. Melo*, however, it is entirely absent.

(18) The anatomical structure of the fibro-vascular bundles of the *Luffa*-fruit deserves notice by the fact that the well-developed sclerenchyma surrounds the remaining weakly-developed portion of the bundle, the whole forming a spongy tissue.

(19) Into the tubercles on the surface of the fruit of *Momordica charantia* a branch of the fibro-vascular bundles enters. Nothing of this kind can be observed in other genera.

(20) The sieve-tubes have a characteristic distribution in the fruits. Besides those found in the phloem there are isolated sieve-tubes in the

cortex. These extra-phloem sieve-tubes occur in the hypoderma outside of the stiffening ring. And when no stiffening ring is present they are found in the outer part of the cortex.

(21) We may distinguish three kinds of the epidermal cells of the seeds: *a*) flattened cells, *b*) prismatic cells, *c*) prismatic cells with ridges on their walls. To the first type belong *Actinostemma*, *Gymnostemma*, and *Trichosanthes japonica*; to the second *Benincasa*, *Luffa*, *Momordica*, and *Trichosanthes cucumeroides*; to the third *Citrullus*, *Cucumis*, *Cucurbita*, *Lagenaria*, *Melothria*, and *Schizopepon*.

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Observations on the Flora of Japan.

(Continued from p. 84.)

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Gilibertia trifida (Thunb.) Makino nom. nov.

Acer trifidum Thunb. Fl. Jap. p. 163; Pers. Syn. Pl. II. p. 418; Willd. Sp. Pl. IV. p. 991; Spreng. Syst. Veg. II. p. 224; DC. Prodr. I. p. 595.

Dendropanax trifidus Makino in Herb. Sc. Coll. Imp. Univ. Tokyo.

Hedera japonica Jungh. 1840; Walp. Repert. II. p. 431.

Textoria japonica Miq. Araliaceæ in Ann. Mus. Bat. Lugd.-Batav. I. p. 12; Id. Prol. Fl. Jap. p. 90; Id. Cat. Mus. Bot. Lugd.-Bat., Fl. Jap. p. 43.

Dendropanax japonicus Seem. Journ. Bot. II. p. 301, et Revis. Heder. p. 27; Benth. et Hook. fil. Gen. Pl. I. p. 944; Franch. et Sav. Enum. Pl. Jap. I. p. 194; Kanitz Anthoph. Jap. p. 28; Clarke in Hook. fil. Fl. Brit. Ind. II. p. 733; Engl. in Engl. Bot. Jahrb. VI. p. 61; Forbes et Hemsl. in Journ. Linn. Soc. XXIII. p. 342.