Observations on Some Plant Abnormalities in Bengal.

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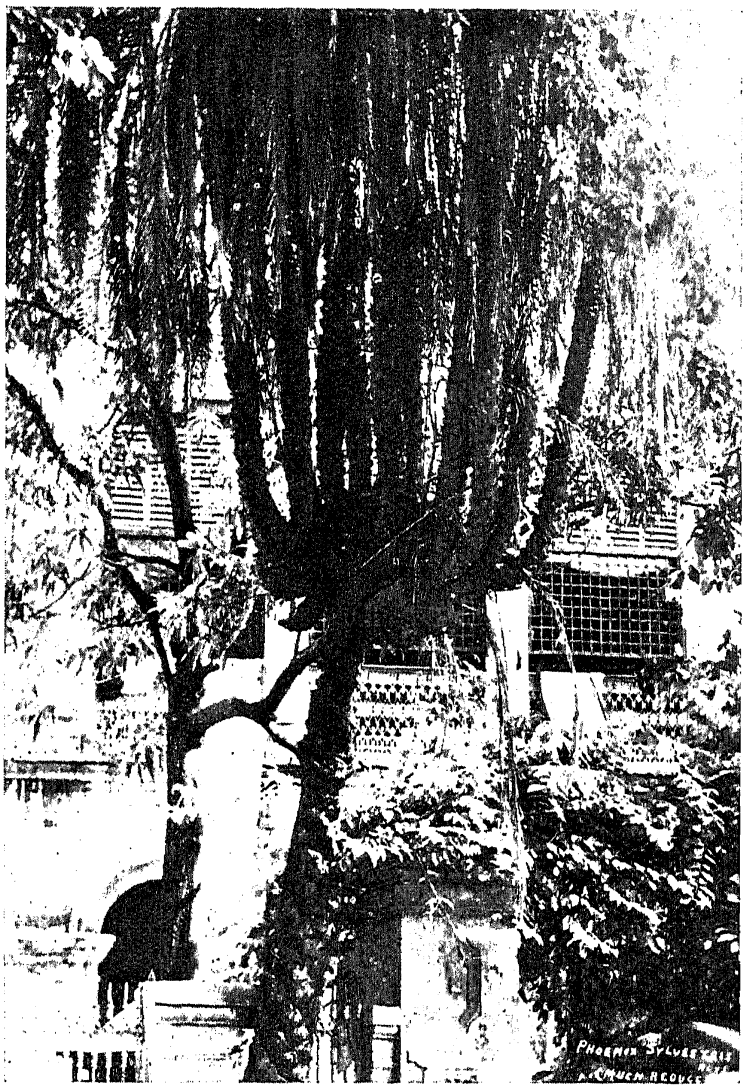
ABNORMALITIES of various types have been observed in a large number of wild and cultivated species of plants in Bengal. Of such may be mentioned fasciated flowering branch of *Achras Sapota* as shown in Fig. 1. Fasciation of *Tagetes patula*, *Mirabilis jalapa*, *Amaranthus* sp. and *Celosia* sp., and many other species are not of rare occurrence. A branched inflorescence of *Lagenaria vulgaris*, received recently, developing from the root stock is an interesting specimen for study. This abnormal branched inflorescence bears a large number of flowers in aggregation. Investigation is being carried on to trace the factors which led to such a peculiar abnormal basal inflorescence in Cucurbitaceæ. Sections of stems, flowers and fruits do not, however, show anything abnormal. Formation of fasciated structures and other similar monstrosities is often considered to be due to local damage or excess of nourishment at the growing organ either by attack of gall-insects or other agencies. Examples of abnormal flowers of *Hibiscus rosa-sinensis*, *Dianthus* sp. and other horticultural species are many. Flowers borne on the axil of the petals of a single flower and also sterile double flowers due to branching of the thalamus in *Hibiscus rosa-sinensis*[1] are not of rare occurrence. Viviparous seeds of non-mangroove species such as *Zea Mays*, *Mangifera indica*, *Artocarpus integrifolia* are also not uncommon. Double fruits of *Citrus decumana* and double and quadruple fruits of mangoes (*Mangifera indica*)[2] and brinjal (*Solanum melongena*) sometimes in the form of bifurcating horns are many. A syncarpous fruit of Cocoanut palm (*Cocos nucifera*) has been received of late years for an exhibit in the gallery of the Industrial Section of the Indian Museum. Polyembryony in the genus Eugenia has been recorded by Tiwary.[3]



Branched *Phœnix sylvestris*.

On rare occasions, evidently due to stimulus from local injury at the apices of the stem, crowds of branches develop forming a crown on palm stems. Such a specimen of *Phœnix sylvestris* exists in Southern Calcutta in the courtyards of a residential house. The tree which is still alive is about sixty years old and some of the branches are since dead. The branches come out mainly in two lateral directions and vary from 4 to 5 feet in length, each bearing the usual crown of leaves. Each of these heads in its turn bears also flowers and fruits in proper season, as shown in the photograph I.

[1] Banerjee, S. C., "Terretological branching of the thalamus of a species of Hibiscus," *Proc. Sixteenth Ind. Sci. Congress*, 1929, 228.

[2] Singha, B. N., "Notes on the Terretology of certain Indian Plants," *Jour. Ind. Bot. Soc.*, 1931, **10**, 160.

[3] Tiwary, N. K., "On the Occurrence of Polyembryony in the genus Eugenia," *Jour. Ind. Bot. Soc.*, 1927, **5**, 124.

An interesting specimen of a branched inflorescence of *Musa sapientum* var. *paradisiaca* has recently been observed in a plant growing in the village Gobardanga of 24 Pergunnahs. This plant, as illustrated in the photograph II, has a long inflorescence bearing a large number of spikes which are pedicelled. Thus the inflorescence appears like a branched panicle, each branch bearing a branch of three stalked spikes. The inflorescence carried a total number of about 22 spikes and some of them were bearing green fruits. Syncarpous fruits are also observed which is, as known to the plant terretologists,[4] due to mutual pressure in the position of the flowers in the inflorescence. A branched inflorescence in *Musa sapientum* was previously reported by Messrs. K. G. Banerjee and G. P. Mozumdar. They made a note in the abstract of papers of the *Proceedings of the Sixteenth Indian Science Congress*, 1929, "on the branching of the main axis and development of 105 perfect and semi-perfect inflorescences in the places of flowers in the axils of spathes on the main axis." Costerus and Smith[4] in their studies of tropical terretologist, 1915, recorded a branched inflorescence in *Musa paradisiaca*. The same authors have also reported that the branched inflorescence bears flowers and fruits in the following year, if the axis of the inflorescence remains on the plant. *Musa paradisiaca* and other Musa species such as *Musa ornata* are susceptible to various types of abnormal growths of the floral structure of the flowers as reported by H. Crüger.[4] Parthenocarpæ[4] is also common and has, more or less, been thoroughly studied by various authors together with their anatomical details. Monstrosities such as an inflorescence bursting out from the base of the crown of leaves is not of rare occurrence as once reported by Mr. S. C. Banerjee, Professor of Botany, Presidency College, Calcutta. Abnormalities of the flowers of *Musa superba* and *Musa paradisiaca* were also noted by Agharkar.[5] It is indeed a matter of some importance to note that such branched inflorescence in Musa can bear fruit. The question is the quality of the fruits borne. If by horticultural experiments such branched inflorescence in Musa may be allowed to bear fruits of good quality and of sufficient market value, it means a good headway in the study of horticulture. *Musa paradisiaca* Linn. was formerly considered as a separate species. It was subsequently included by Hooker in *Musa sapientum*

Branched inflorescence of *Musa sapientum*, var. *paradisiaca*.

Linn. which Prain,[6] agreeing with Hooker[7] has rightly considered *paradisiaca* Hook., a variety of *Musa sapientum* Linn. *Musa sapientum* Linn. var. *Paradisiaca* Hook. which is wildly cultivated in Bengal is commonly known in Bengali as Kanchkala. The systematic position of various types of cultivated bananas is not yet quite fixed although attempts are being made by a large number of systematists and horticulturists in this direction. Wild bananas have also been taken into account.

In 1929, one of the papaya (*Carica Papaya*) plants grown in the compounds of the writer inside the Royal Botanic Garden, Calcutta, exhibited, on one of its leaves, a peculiar superposed leaf-structure

[4] Penzig, O., *Pflanzen-teretologie*, 1922, **3**, 325.

[5] Agharkar, S. P., "On the abnormalities of the flowers of *Musa superba* and *Musa paradisiaca* sub sp. *sapientum*," *Jour. Ind. Bot. Soc.*, 1931, **4**, 18-20.

[6] Prain, D., *Bengal Plants*, 1903, **2**, 1050.

[7] Hooker, J. D., *Flora of British India*, 1894, **6**, 262.

with a stalk developing over the primary leaf-lamina appearing as an extension of the primary leaf-stalk (Fig. 2). Singh, who has recorded a large number of malformations from different provinces of India, mentioned in his note "On the terretology of certain Indian plants" VIII,[8] 'stalked funnel or spoon-like structures on the adaxial surface' of the leaf of *Carica Papaya*, 'just above the point of attachment of the petiole and the palmate lamina'. He evidently referred to a superposed leaf. Mozumdar in the *Proceedings of the Indian Science Congress*, 1929, considers similar superposed leaf formation as a case of enation, evidently, as his observation suggests, in want of a more suitable term. He, however, suggests a superficial nature of the growth of this superposed leaf

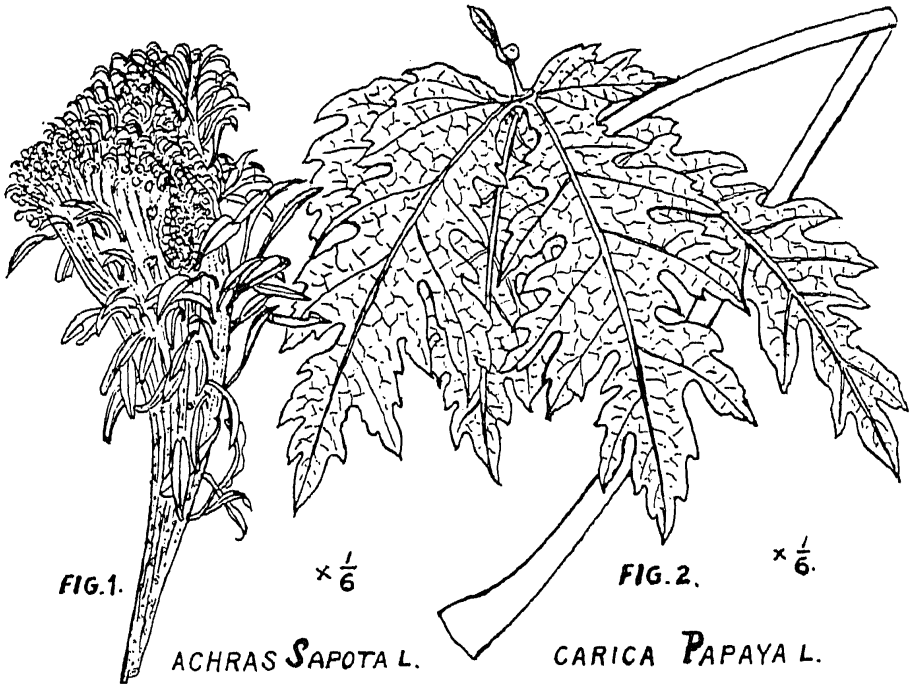


Fig. 1. Fasciated branch of *Achras Sapota*. **Fig. 2.** Superposed Leaf of *Carica Papaya*.

structure. This interesting variation in leaf structure of *Carica Papaya* has been discussed by Cook[9] very lately in his illuminating article entitled "Double-deck Papaya leaves—an example of leaf evolution". Cook rightly suggests a special term *superate* for such an overtopped, double deck leaf, with secondary leaf structure rising above the primary leaf-blade. Cook observes:—"A striking variation was found in 1932 in an experimental planting of papayas in the Colorado River Valley of Southern California. An otherwise normal leaf bore a secondary leaf-structure erected in double-deck fashion above the primary leaf-blade. The first sight of such a leaf gave a startling sense of novelty, though several plants in California were found to have such leaves, and many others in Southern Florida. A superposed leaf-structure should not be confused with twinning, fasciation, or other lateral modifications of leaf-blades, which have been reported from several families of plants. The Carica variation may be described as a vertical addition to the leaf, supported by a secondary petiole growing out of the callus of the primary leaf-blade (see Figs. 6 & 7). A special word seems necessary to characterise the overtopped, double-deck leaf, with a secondary leaf-structure rising above the primary leaf-blade. Such a word as *superate* may convey the idea of a leaf surmounted by another leaf, as representing the morphological principle of adding new elements of leaf-structure by superposition. Setting one leaf on another may be considered as a method of derivation of compound leaves from simple leaves. The Carica variation illustrates a constructive possibility in leaf evolution that apparently has not been recognised in the past, but may be worthy of observation and experimental study."

Palm-shaped and other curiously shaped

[8] Singh, T. C. N., *Proc. 18th Ind. Sci. Cong.*, 1931, 270.

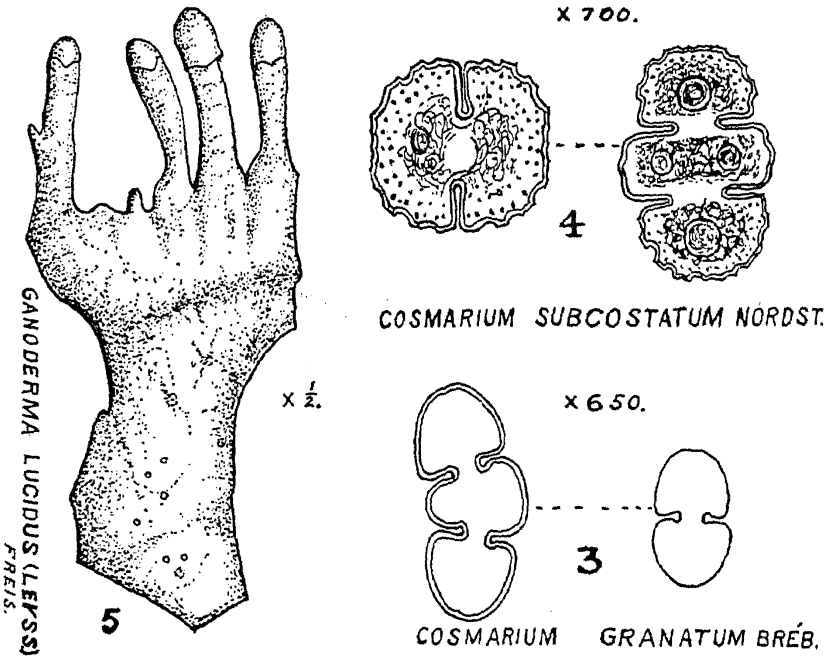
[9] Cook, C. F., "Double-deck Papaya leaves, an example of Leaf Evolution," *Jour. of Heredity*, 1934, **25**, 226.

fruits of *Carica Papaya* and fruits containing sometimes two or three or as many as seven[10] fruits inside one fruit or one inside the other are of frequent occurrence.

It is suggested by Botanists and Horticulturists that seeds or grafts from the abnormal structure sometimes result in the development of similar abnormal individuals. Such an instance is well established in *Ficus Krishnii*, a horticultural species grown in the Royal Botanic Garden. But reversion to the parent form of *F. Bengalensis*, which may be called a *bud mutation*,[11] has actually taken place in one of the branches of this *F. Krishnii* as reported by the author in *Nature*. Details of this will be published in a subsequent note.

Medical College, Calcutta, a specialist in hard Fungi, possesses in his herbarium specimens of *G. lucidus* of various phantastic shapes. Such curious development is very likely due to obstruction in the development of the thallus and need not be taken as anything extraordinary.

Monstrosities or malformations are but freaks of Nature and may be considered as marked aberrant variations appearing suddenly in a plant body. They are by no means less common and to a botanist does not appeal so much. "The relationship between plant deformities and living organisms (ranging from bacteria to insects) was fairly common knowledge in serious horticultural circles before the present



Figs. 3 & 4. Abnormal growth of sister cells of *Cosmarium granatum* and *C. subcostatum*.
Fig. 5. "Hand of a Ghost," abnormal growth of the thallus of *Ganoderma lucidus*.

Abnormalities in Algæ and Fungi are also not very infrequently met with. Conjugatæ among algæ are well known for such variations from normal development. Thus Cosmarium species sometimes exhibit peculiar monstrous growth of sister cells (Figs. 3-4). Abnormal conjugation is also reported. A peculiar finger-like form of *Ganoderma lucidus* (Fig. 5) has aptly been designated by the collector as "Hand of a Ghost". Dr. S. R. Bose, Professor of Botany, Carmichael

century dawned. Kerner, in his *Natural History of Plants*, gives a very full account of the matter, while recognition of the cause of fasciation has now become so much an item of popular information as to entitle its mention in Webster's Dictionary." But laymen sometimes ascribe all sorts of explanation to a structure like that of "Hand of a Ghost" and it has been heard that they even go so far as to worship such a structure. Occasionally luminous fungi or bacteria emanating light from a log of rotten wood in a forest during the rains at night create similar surprise among villagers who consider them as a supernatural phenomenon. The actual factors connected with

[10] Mozumdar, G. P., "A Note on some Abnormalities in *Carica Papaya* Linn.," *Proc. Ind. Sci. Cong.*, 1929, 240-241.

[11] Biswas, K., "Bud mutation in Ficus," *Nature*, 1932, **130**, 780.

the production of malformations such as fasciation, etc., have not so far been thoroughly investigated in spite of fair accumulation of literature on this subject. Stoker[12] rightly observes: "A simple gall, such as that appearing on the oak, is due to insect injury to a differentiated tissue. Fasciation, which may be looked upon as a compound bud, or cluster gall, ensues from an invasion of embryonic material. Thus the fasciation of Asparagus really extends upwards (with the growing tip), not downwards. Excess of nourishment, as Mr. Mulligan surmises, has no connection whatever with the malformation. Mechanical injury, whether accidental (as from the growth coming in contact with an obstruction), or due to voluntary trauma (such as pinching out a growth) cannot cause fasciation, or anything resembling it, unless the wounds become infected." Perhaps detailed physiological, ecological and horticultural investigations may solve the problem in future.

The Rôle of Silicon in Plant Nutrition.

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EVER since Liebig first propounded his "mineral theory" of plant nutrition (1840), it has been generally recognised that certain elements like phosphorus, potassium, calcium, magnesium and iron are essential to perfect plant growth. During recent years, there has been increasing evidence to show that minute quantities of certain other elements like boron, fluorine, iodine, silicon, aluminium, manganese and zinc are also necessary. The parts played by many of the above-mentioned elements in plant nutrition have been more or less defined: those of others, especially that of silicon, are still comparatively obscure.

That silicon is always present in plants and forms a considerable proportion of their ash constituents is well known (Wicke,[1] Hattensaur,[2] Wolff,[3] Crüger[4] and others). Though the silicon content of different parts, especially that of leaves, is extremely variable, from the merest traces to over 80 per cent. of the total ash, still complete absence of that element is never observed.

This very general presence of silicon led to the belief that it is an essential nutrient to most plants; that it contributes to the stiffness of the tissues while its absence is the cause for the laying of crops after heavy rains. Later observations showed, however, that it cannot be placed in the same category as phosphorus or potassium as essential elements of plant nutrition, for a number of investigators (Sachs,[5] Knop,[6] Jodin,[7] Honnel[8] and others) working with different plants succeeded in demonstrating that silica can be completely dispensed with and that successive generations of crops can be grown to maturity in culture solutions without any supply of silicon beyond that provided by the original seed.

It is hardly likely, however, that a material which constitutes such a large percentage of the mineral constituents can be wholly without any use in the economy of the plant. Experience has indeed taught agriculturists that silica-free plants are at a disadvantage compared with those grown with the normal supply of that element. The latter are able to withstand insect pests and fungus diseases to a greater extent than the former.

Wolff and Kreuzhage[9] were probably the first to bring to light an entirely new aspect of the rôle of silicon in plant economy. These authors grew oats in culture solutions, with and without silica, and noted that in the former case there was considerable

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[12] Stoker, F., "Fasciation," *Gardener's Chronicle*, 1934, **96**, 43-44.

[1] Wicke, W., *Bot. Zeit.*, 1862, **20**, 76.

[2] Hattensaur, G., *Ber. der Kais. Akad. der Wissenschaft, Wien*, 1890, **99**, IIB, 29.

[3] Wolff, E., *Aschen-analysen*, 1880.

[4] Crüger, H., *Bot. Zeit.*, 1857, **15**, 281, 297.

[5] Sachs, J. von., *Flora*, 1862, 52; *Exper. Physiol.*, 1865, 150.

[6] Knop, W., *Landw. Versuchs-Stat.*, 1862, **2**, 185; **3**, 176.

[7] Jodin, V., *Ann. Agron.*, 1883, **9**, 385; *Compt. rend.*, 1884, **97**, 344.

[8] Honnel, *Heberlandts wiss. prakt. Unters.*, 1877, **2**, 160.

[9] Wolff, E., and Kreuzhage, C., *Landw. Versuchs-Stat.*, 1884, **30**, 161.