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NOTES ON THE TERATOLOGY OF CERTAIN ANGIOSPERMS [1]

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The present work was started and nearly finished at the Botany Department of the Lucknow University, but was brought out in the present completed form at the Cotton Research Laboratory, Lyallpur. The plants alluded to in this note were all found growing at Lucknow either wild or cultivated. They include members belonging to such diverse families as the Nyctaginaceae, Polemoniaceae, Solanaceae, Cucurbitaceae and Compositae. The observations recorded in this note are a result of casual observations made from time to time and an attempt has been made in the following pages to describe the abnormalities as they appear, avoiding any fanciful discussions which may lead to erroneous conclusions.

Boerhaavia repanda Willd.

This member of the family Nyctaginaceae is a perennial weed growing very extensively on waste land or barren fields, specially during the rainy season. It is particularly interesting, because it shows anomalous features in the anatomy of its root, stem and leaf.[2] That such a plant should show some external monstrosity also, is rather significant. An abnormal leaf has come to our notice which

[1] Singh, T. C. N. and Sinha, B. N.: (Abstract) A note on the teratology of certain Angiosperms. *Proc. Indian Sci. Congress*, Calcutta meeting, Jan. (1928).

[2] Mukerji, S. K. and Singh, T. C. N.: (Abstract) The study of five representative Lucknow plants of the hot season with a view to find out the nature of the adaptation of these plants to the marked periodic climate. *Ind. Bot. Soc.* Lucknow meeting, Jan. 1923 *Journ. Ind. Bot. Soc.* Vol. III, p. 262.

is fasciated. It is bilobed (Plate II, Fig. 8), each lobe having its own midrib and side veins but with a single common petiole possessed of a median groove. Thus, it is evident that this fasciated specimen, is a homologue of two leaves.

Phlox Drummondii [1]

The records of abnormalities in the species of the genus *Phlox*, other than *P. Drummondii* refer to the leaf enation in *P. paniculata* (*decussata*)[2] and to heteromery in *P. subulata*[3] and a few other cases.

Phlox Drummondii is a very common garden plant represented by several varieties. Over a thousand flowers of the said species were examined—from plants growing in the Botanic Garden of the Lucknow University—of which surprisingly enough, about one per cent showed a fairly wide variation in their floral parts, specially in the Calyx $K_{(4-6)}$, Corolla $C_{(3-6)}$ and Andrœcium $A_{(5-6)}$ (epipetalous), while the normal floral formula for the family Polemoniaceae [4] in which *Phlox* is included, is represented by $K_{(5)}\ \overset{\frown}{C_{(5)}}\ A_5\ G_{(2-5)}$

The occurrence of hexamery in the three outer whorls associated with the production of four carpels in *P. Drummondii* was shown by Wydler[5] about three-quarters of a century ago, but our hexamerous specimens differ from those of his, in their gynæcia which are composed in every case of only three carpels. For the sake of clearness the number of floral parts of the typical abnormal flowers is tabulated below (see also Plate 1, Figs. 1-4).

Type No.	Calyx	Corolla	Andrœcium	Gynæcium
1	5	3	3	(3)
2	4	4	4	(4)
3	5	5	4 or 5 or 6	(3) or (4)
4	6	6	6 or 5	(4)
5	6	6	6	(3)

[1] For figure of the plant see Nicholson, G. The Illustrated Dictionary of Gardening, Vol. III, p. 100, Fig. 112.

[2] Worsdell, W. C.: (1915) The Principles of Plant Teratology Vol. I, pp. 198, 201; Vol. II, pp. 162, 200.

[3] Vuillemin, Paul: (1909) L'hétéromerie normale du *Phlox subulata*. *Compt. Rend. Paris*, CXLXIII, p. 650.

[4] Willis, J. C.: (1919) Flowering Plants and Ferns, pp. 526, xlv.

[5] Wydler, Flora (1857) p. 29 and (1860), p. 657

The interest centres round the plasticity of the flowers in this species. That such a wide range of variation should occur is rather striking. It is perhaps due to chorosis or supression or both, resulting in an increase or decrease of the floral parts.

Datura Metel L.

Datura Metel L.—a member of the family Solanaceae—is quite a common plant growing throughout India, and flowers usually during the months from August to March. The floral parts are typical of the family[1] namely $K_{(5)}\ C_{(5)}\ A_5\ G_{(2)}$ but sometimes the number of the sepals, petals and stamens may be increased by one *i.e.* then the calyx, corolla and andrœcium consist of six members each instead of the usual five, the gynæcium being quite normal (Plate 1, Fig. 5). Jaeger[2] as early as 1814 observed in *Datura fastuosa* L., the occurrence of an anther with a forked apex, besides the four normal ones. His observation is of value in so far that it points to a possible explanation of the sporadic occurrence of an extra sixth stamen (in *Datura Metel*) which may very likely be due to a complete chorosis of one of the stamens, Jaeger's case perhaps representing the first stage in chorosis. At the same time it is interesting to note that all the stamens (including even the extra 6th) are so similar, both in the internal and external morphology of their anthers and their corresponding filaments that any discrimination between them is impossible. The increased number of calyx and corolla may also be explained similarly.

Increase in the number of parts in the calyx, corolla and andrœcium is known[3] in *Datura Stramonium* also, but in every such case it is curious that the gynæcia are either tri-carpellary or tetra-carpellary (but mostly tri-carpellary). However, this is not so in our specimens which are quite normal so far as the gynæcia (bi-carpellary) are concerned.

Trichosanthes dioica Roxb.

Trichosanthes dioica is the common Parwal, the fruit of which is eaten as a vegetable. The only case of abnormality known to us refers to the occurrence of fertile stamens in the female flowers[4] but no teratological observations are recorded at least in the case of fruits. Normally the fruits are spindle-shaped but sometimes two such fruits appear to have fused together with each other and all stages from partial to complete fusion may be noticeable (see Plate I, Figs. 6-7). Moreover it is interesting to find that sections through such a fasciated

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[1] Willis, J. C. *loc. cit.* pp. 611, xlv.

[2] Jaeger, G.F.: (1814) Ueber die Missbildungen der Gewächse, Stuttgart, p. 115.

[3] Blakeslee, A. F., Morrison, G. and Avery, A. G.: (1927) Mutations in a haploid Datura. *Journ. of Heredity* Vol. 18, No. 5, pp. 195-6.

[4] Baillon : (1922) Occurrence of fertile stamens in female flowers in Trichosanthes. *Bull. Period. de la Soc. Linn. de Paris*, p. 308.

fruit (a homologue of two) show that each part is composed of three carpels, being a complete homologue of a normal Cucurbitaceous gynœcium. Thus it seems quite clear that such a condition has resulted from fasciated double flowers which may be occurring in nature along with the normal ones.

Cosmos bipinnatus [1, 2]

The phenomenon of fasciation of capitula is extraordinarily common among the Compositae but no such record has so far been made for the genus *Cosmos*. The case in question (Plate II, Fig. 9) has its main peduncle very much flattened, looking as if it is due to the concrescence of a number of capitular peduncles. Right at its apex, the flattened structure is shortly forked into two, each being surmounted by a fasciated capitulum which is a homologue of at least two capitula. The two capitula are situated so close together that when cursorily examined they look like a single flattened capitulum. A little below the main fasciated peduncle occur about a dozen and a half normal peduncles (with the exception of one) arranged in a whorl each bearing a head at its apex. One of them (Plate II, Fig. 9 A) situated between the main flattened peduncle and the bundle of peduncles tied up together on the extreme left in the photograph, is also fasciated, as is evident from the flattened condition of its peduncle and the rather biggish head.

Helianthus annuus L.

In this plant the abnormalities are known in the vegetative organs [3] but recently an abnormal capitulum has come to our notice in which seven green 'leaf'-like structures looking like involucral bracts are seen jutting out of the central region of the disc (Plate II, Fig. 10) on which a number of disc and ray florets are set in the normal manner. On close examination it has been found that these "involucre"-like organs are altogether leafy except for a little thickening at the base and further, curiously enough, each of them is borne in the axil of a chaffy bract (Plate II, Fig. 11) like the other normal florets. Thus it is quite clear that the "leaf"-like structures are of shoot nature, hence homologus to the normal florets, the thickened portions at their base perhaps representing the vestige of an aborted flower. Therefore it is concluded that they are homologous to the habitually nearly abortive sepals (so common among the Compositae) which have—through some physiological circumstance—become leafy and the corresponding flowers bearing them have aborted.

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[1] We have very great pleasure in according our hearty thanks to Miss L. Baksh, M. Sc. for kindly providing us the specimen obtained from the Isabella Thoburn College Garden, Lucknow.

[2] For figure Nicholson, G. *loc. cit.* Vol. I, p. 386, fig. 534.

[3] Worsdell, W. C. *loc. cit.* Vol. I, pp. 82, 215.

Summary.

Descriptions are here given of abnormalities observed in half-a-dozen angiospermous plants.

(1) In *Boerhaavia repanda* Willd., a case of a fasciated leaf (a homologue of two leaves) is described.

(2) *Phlox Drummondii*: notes on the variation in its floral parts are made.

(3) In *Datura Metel L.* hexamery is recorded.

(4) Fasciation of fruits (a homologue of two) is described in *Trichosanthes dioica*. It is interesting to note that each part of the fasciated fruit is tri-carpellary, being a complete homologue of a normal Cucurbitaceous gynœcium.

(5) In *Cosmos bipinnatus* fasciation of capitula is noted.

(6) Very interesting is the case of an abnormal capitulum of *Helianthus annuus L.* in which seven "leaf"-like structures looking like involucral bracts (arising from the central region on the disc), are each borne in the axil of a chaffy bract. They have been regarded as homologous to the habitually nearly abortive sepals which have through some physiological circumstance become leafy and the corresponding flowers bearing them have aborted.

Acknowledgements.

Our sincere thanks are due to Dr. S. P. Agharkar for his kindly interest in informing us about the literature available at Calcutta; and to Prof. B. Sahni for his kindly reading through the manuscript and his criticisms.

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15*th May*, 1928.

Explanation of Plates.

PLATE I.

Figs. 1—4. Abnormal flowers of *Phlox Drummondii*. × 4/5.

Fig. 5. A flower of *Datura Metel L.* split open on one side to show the disposition of the six stamens. × 4/5.

Figs. 6—7. Fasciated fruits of *Trichosanthes dioica* Roxb. × 4/5. Fig. 6 shows the partial fusion of two fruits.

PLATE II.

Fig. 8. *Boerhaavia repanda* Willd.: A fasciated leaf. Nat. size

Fig. 9. *Cosmos bipinnatus*: Fasciated capitula. × 3/4.

Fig. 10. *Helianthus annuus L.*: An abnormal capitulum showing the seven "leaf"-like structures in the central region of the inflorescence. Nat. size.

Fig. 11. *Helianthus annuus L.*: One of the leaf-like structures borne in the axil of a chaffy bract. (br. = bract) × about 8.

B.N.S. del.

Plate I.

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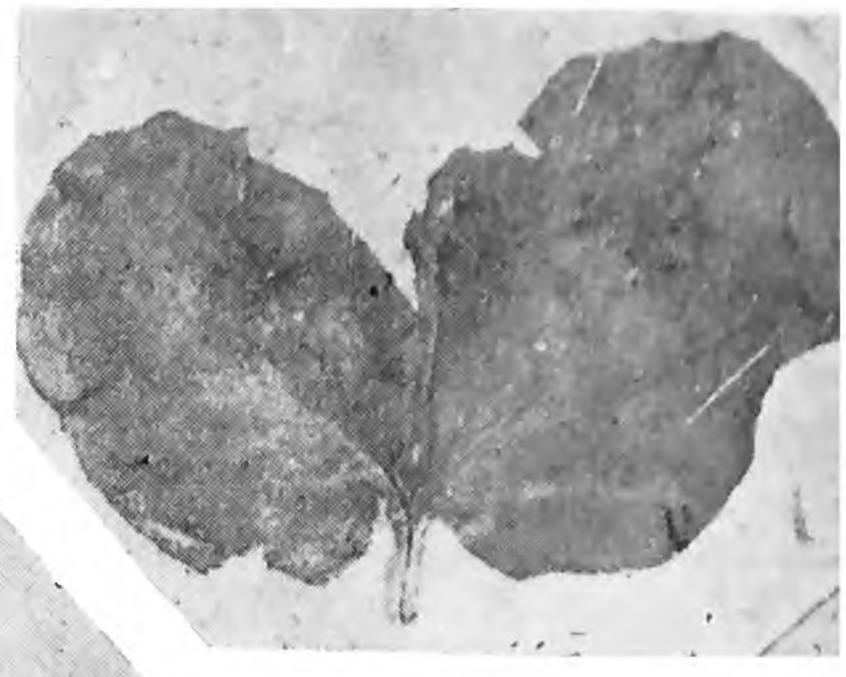

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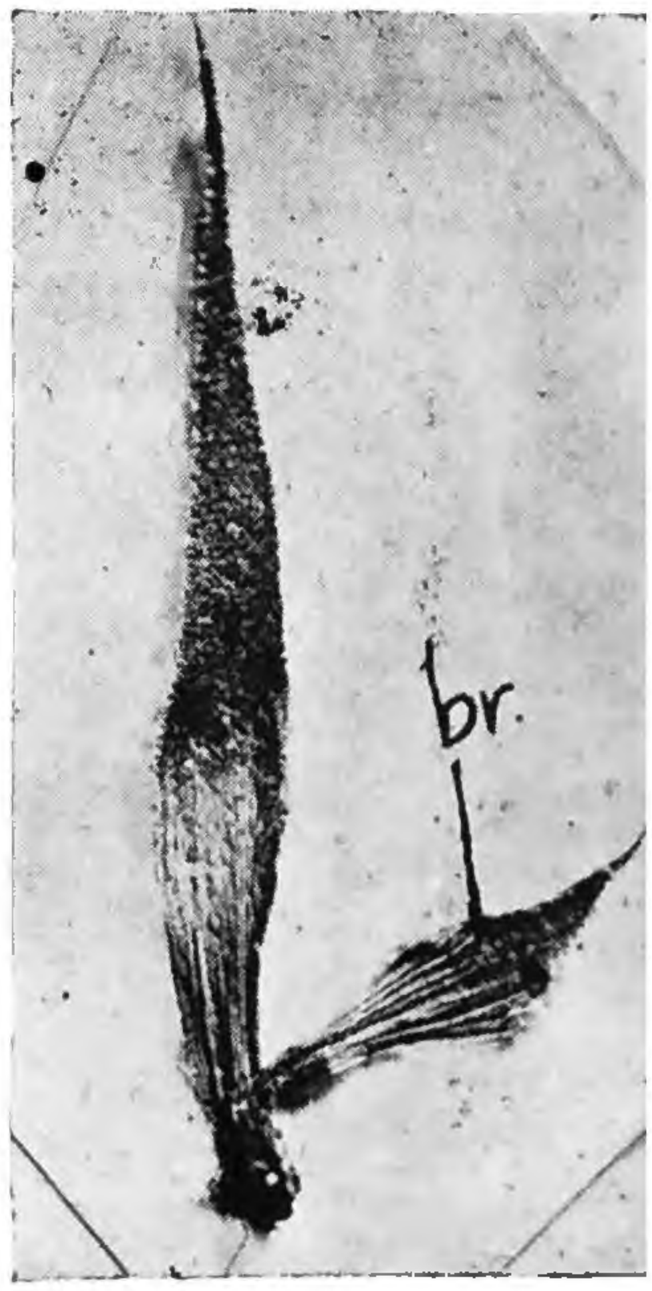

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T.C.N.S. phot.

Plate II.