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Farming will never be a success unless the farmer had more voice in the disposal of his produce—P. Morrel.

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POLYEMBRYONY IN *ELEUSINE CORACANA*, Gaertn, (*Ragi*)[1]

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In the year 1929 in the course of a number of seed germinations of *Ragi*, odd instances occurred in which, two seedlings were found to arise from the same seed. The usual type was with two plumules and two radicles. Very rarely, two plumules in one coleoptile with a single radicle, or a single plumule with two radicles were met with. These seedlings with two plumules and radicles occurred in Family No. E. C. 663 in which out of 13 plants, 5 gave rise to these twins as follows:—

Plant	I.	1	seedling in	4,170	germinated.
,,	II.	2	,,	5,660	,,
,,	III.	4	,,	5,940	,,
,,	IV.	5	,,	11,140	,,
,,	V.	8	,,	8,830	,,

Subsequently 44 other pure lines were germinated and five of these, viz., E. C. 24, E. C. 103, E. C. 354, E. C. 363, and E. C. 593 gave each, one double seedling out of about 3,000 seeds germinated in each. It is curious that all these families belong to the Coimbatore area.

Six double seedlings from E. C. 663 were examined under the microscope and revealed the independent origin of each of these seedlings directly from the seed. One of these is figured in illustration 1. A later

[1] A paper read at a meeting of the Association of Economic Biologists, Agricultural College and Research Institute, Coimbatore on November 5, 1930.

sage of the growth showing the two plumules with the two radicles, all attached to the seed is shown in illustration 2. It will be noticed that one of these two seedlings is more vigorous than the other. This was the case in every one of these twins. In further growth in association, this difference in vigour is maintained (vide illustration 3). When twenty days old the seedlings were parted and potted separately and they are growing well, the weaker one having pulled up and appearing practically indistinguishable from the more vigorous one. It may be noted that the parted seedlings were absolutely individualistic showing no traces of earlier union. It is proposed to gather their seeds and pursue the occurrence of this phenomenon in their progeny.

Concurrently with this macroscopic experience, microscopic examination of a number of Ragi grains in the early stages of their development showed out one particular grain in which two embryos were found (vide illustration 4). These embryos are enlarged and their absolute doubleness will be apparent from illustration 5.

Eliminating instances of false or pseudo-polyembryony, true polyembryony is a comparatively exceptional occurrence in the flowering plants, and rare in cereals. In 1920 Hansen (1) records their occurrence in wheat, oats, and rye. In one strain of rye he noticed as many as 7 per cent of double germs. Komuro (1922) mentions the occurrence in Rice (2). Rodrigo (1925) found rare cases in the Philippine rices (3). In 1928 Jones (4) mentions an instance of this as a result of an artificial cross in Rice.

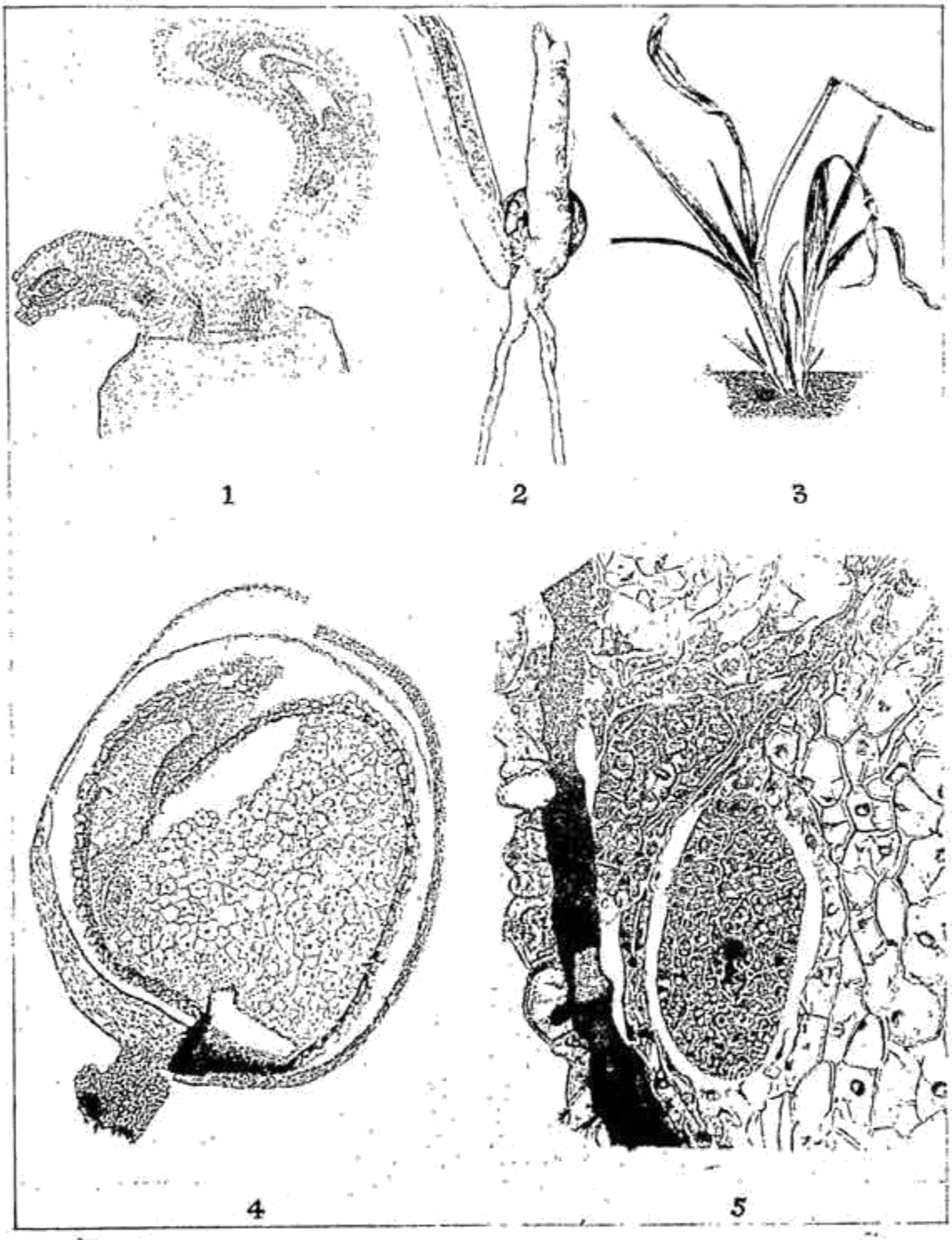
In other flowering plants the appearance of true polyembryony is not so rare. There are records of its occurrence in *Xanthoxylum* (5), *Citrus* (6), Mango (7), Soybeans (8), *Eugenia* (9), *Alnus* (10), *Erythronium* (6), and coconut (11).

It is difficult from the very nature of the material to determine the manner of the origin of the embryo from the anatomy of the seed. But examination of various other kinds show that this polyembryony may arise in one or other of the following ways :—(1) From the cells of the nucellus, (2) from the cells of the integument, (3) from the normal occurrence of two eggs, (4) from synergids, (5) from antipodal cells, (6) from endosperm cells, (7) from the suspensor. The projected intensive study in the pursuit of this phenomenon may reveal the nature of its origin in Ragi.

The question of the causes of the origin of this polyembryony is much discussed, many of the authorities attributing its occurrence to hybridity (Ernst, 12). Others put it to a weakening of sexuality (Strasburger, 13), a relic of some older condition now disappearing (Chauveaud, 14) or the early stages in the development of something new (Ganong, 15).

The development of a single embryo in preference to many seems to be the logical and natural outcome of the developmental tendencies manifest in the plant kingdom. To quote Bower " In the more specialized heterosporous forms and particularly in the seed plants with their more refined methods, individual precision supersedes mere numbers; and reduction of the propagative system has been its usual concomitant " (16).

Thus the presence of a single embryo is the progressed condition and the occurrence of polyembryony seems to be reminiscent of the similar and more cosmopolitan phenomenon in the gymnosperms—a view that accords with Chauveaud (14).



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The plant is more or less plastic and it is the inherent tendency of a plant, under certain circumstances to take, in a manner of speaking, a retrospective view, and give us the phenomenon called ' atavism '.

Hybridity may be said to have a causal connexion in this sense, that by the disturbing influence it introduces, it alters the normal tenor of the plant's life and calls out glimpses of ancestral features.

The last word has not been said on the subject and it still remains an unsolved biological problem. The view outlined above is here presented in the hope that if not acceptable, it is at least debatable.

Literature Cited

1. Hansen, W.—(Deut Landw. Presse, 47: No. 95; p. 647, 1920). *Exp. Stn. Record*, Vol. XLV, p. 532, 1921.

2. Komuro, H.—A polyembryonal plant of O. Sativa. L.; *Tokyo Bot. Mag.* 36: p. 23–24, 1922. (Quoted in 4).

3. Rodrigo. Pedro. A.—A case of polyembryony in Rice. *Philip. Agri.*, Vol. XIV, No. 10; p. 630, 1925.

4. Jones, J. W.—Polyembryony in Rice. *The Jour. Am. Soc. Agronomy*, Vol. XX, p. 774, 1928.

5. Longo, B.—Studies on polyembryony. (*Richerche sur la poliembrionia; Ann. Botanica Roma*, 14: 151–62) Bot. Abst., Vol. III, May 1920, Entry 1569.

6. Jeffrey, E. C.—Polyembryony in *Erythronium americanum*. *Ann. Bot.*, Vol. IX, No. 36; p. 537–41, 1895.

7. Young, W. J.—Potato ovules with two embryosacs. *Am. Jour. Bot.*, Vol. IX, No. 5, May 1922.

8. Owen, F. V.—Soybean seeds with two embryos. *The Jour. of Heredity*, Vol. XIX, p. 373–4; 1928.

9. Tiwary, N. K.—On the occurrence of polyembryony in the genus *Eugenia*. *Jour. Indian Bot. Soc.*, Vol. V, p. 124–34, 1926.

10. Woodworth, R.—Parthenogenesis and polyembryony in *Alnus rugosa* (Duroi) Spreng. *Science*, 70. No. 1808, 1929.

11. Smith, J. J.—New anomalies in coconuts (*Nieuwe misvormigen bij Kleppers Teysmania* 30; 291–7) *Bot. Abst.* Vol. IV, No. 1, July 1920. Entry 989.

12. Ernst, A.—(Bastardierung als ursache der Apogamie im Pflanzenreich, Jena, 1918, and other papers therein) quoted in 9.

13. Strasburger, E.—(Befruchtung and Zelltheilung Jena 1877) quoted in 9.

14. Chauveaud, G. L.—(Sur la fécondation dans les cas de polyembryonie: compt. Rend. 114: 504–6, 1892) quoted in Morphology of Angiosperms. Coulter and Chamberlain, p. 217, New York, 1909.

15. Ganong, W. F.—(Upon polyembryony and its morphology in *Opuntia Vulgaris*, *Bot. Gazette*, Vol. XXV, 221–8, 1898) quoted in 9.

16. Bower, F. O.—The origin of a Land Flora, p. 717, London, 1908.