Albinism in Coconut Seedlings

In an article on inducing chlorophyll in albino citrus seedlings, Minessy[1] has recently shown by suitable grafting methods that chlorophyll formation was not blocked in the normal plant and that no chlorophyll irregularities appeared when albinos were grafted on to green ones. He mentions that this result apparently seemed to contradict the somewhat accepted view that albinism is due to recessive genes as was claimed by Torres for the Szinkom mandarin. Several other workers, Patel[2] in the case of the coconut, Bull[3] in the case of the African oil palm, Posnette and Cropley[4] in the case of the strawberry, Rick *et al.*[5] in the case of the tomato, also believed that the cause of albinism was due to certain disturbed genetical factors brought together by cross-pollination. Some botanists have attributed the lack of chlorophyll to infection with an unknown disease. Pretreating citrus seeds with disinfectants such as 'Ceresan' and 'Agrosan' resulted in the production of seedlings which were nearly all green. Albino avocado seedlings were shown by Wallace and Drake[6] to result both from seeds originating from off bloom or late set fruit as well as from matured fruits. Tager and Cameron[7] on the other hand, found that albinism could be eliminated in citrus seedlings by the removal of seed-coats before sowing, indicating that the inhibitor of chlorophyll formation resided in the seed coats. Furtado[2] has mentioned coconut seedlings exhibiting complete shoot albinism, attributing this to some internal factor and chlorosis due to lack of ferrugenous products in the endosperm.

The logical inference from the above review is that there is yet some other factor which induces albinism in plants. Indeed, some of the evidence reported in the case of complete or partial lack of chlorophyll in leaves refers to inadequate functioning of some physiological mechanism essential for the development of plastid colour, a condition which is also brought about by the genetic composition of the plant. That this physiological mechanism appears to be the proper and optimum utilization of iron (and probably nitrogen and magnesium) is apparent from the results we have obtained in several attempts made to induce chlorophyll in albino coconut seedlings. Although calcium, phosphorus and iron do not enter into the composition of the chlorophyll, their variations in the soil are generally known to influence its production. This also appears to depend upon the general vigour and tone of the plant which in their turn are influenced by the optimum availability and/or utilizability of certain combinations and concentrations of these elements.

The albino coconut leaf tissue contained rather high iron and high phosphorus contents. The possibility of preventing the high phosphorus content hampering the availability of iron for the biosynthesis of the pigment, by side-tracking the iron as iron phosphate was, therefore, examined in three ways. Iron (and magnesium) were supplied to the soil every week in the form of chelates (iron green, 330 Fe, NaFe, as well as Na_2Mg) singly and in different combinations to pot-established albino coconut seedlings. Dilute aqueous solutions (2 per cent) were used. It was observed that the central shoots began to develop green colour from about the end of the second week and steadily progressed until the whole leaf appeared healthy and green. The green tint developed from the base of the leaf, proceeding to the tip, petiole and midrib portions almost simultaneously. Even from the time of appearance, the emerging inner shoot had developed chlorophyll just as the normal leaf. Although development of chlorophyll and health of the seedlings progressed with the chelate application, the plants gradually faded and eventually died.

In a second series of experiments the tip of one of the albino leaves was just cut and the cut end kept dipped in a 2 per cent cane sugar solution. On continuing the feeding of the leaf with sugar for a week, it was observed that the inner leaves which developed afterwards had green colour even as a normal leaf. This may be attributed to the organic matter suitably chelating the iron present in the leaf and rendering the nutrients in an available form thus paving the way for normal physiological processes to occur. In the third experiment the cane sugar was substituted by a 2 per cent solution of potassium chloride for the foliar feeding since it is known[8] that iron precipitation by phosphorus could be prevented by a possible conversion of inorganic to organic phosphorus in the leaf and/or by secondary effects on the organic acid status and cell sap *p*H. There was a remarkable response to the potassium treatment in that there was a progressive greening of the inner shoot and inner whorl of leaves.

These results show that inadequate availability iron due probably to the incapacity of the plant to utilize the iron already present in the leaf determines the albinic condition. The requisite mobilization of the iron appears to be the factor controlled by the recessive gene or genes, since albinism is an inherited character. Albinism in the coconut thus appears to follow the general biochemical pattern of nutrient maladjustment which when corrected could orientate the recessive genetical factors to re-adjust properly the physiological processes concerned in the biosynthesis of chlorophyll to their usual and normal courses. Planned experiments to elucidate further these aspects are in progress and will be reported elsewhere.

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[1] Minessy, F. A., *Nature*, **183**, 553 (1959).
[2] Menon, K. P. V., and Pandalai, K. M., "The Coconut Palm—A Monograph", 306 (Indian Central Coconut Committee, Ernakulam, India, 1958).
[3] Bull, R. A., *J. Waifor*, No. 2, 62 (1954).
[4] Posnette, A. F., and Cropley, R., *J. Roy. Hort. Sci.*, **30**, 56 (1955).
[5] Rick, M. C., Thompson, A. E., and Brauer, O., *Amer. J. Bot.*, **46**, 1 (1959).
[6] Wallace, J. M., and Drake, R. J: Year Book Calif. Avoc. Soc. for 1956, 156.
[7] Tager, J. M., and Cameron, S. H., *Physiol. Plantarum*, **10**, 302 (1957).
[8] Bolle-Jones, E. W., *Plant and Soil*, **6**, 129 (1955).

Capsicum Species of West Africa

There is still considerable confusion in the classification of the genus *Capsicum*. While some authorities disagree as to whether all the cultivated varieties should belong to a single variable species or to the two species, *C. annum* and *C. frutescens* recognized by Linnæus[1-6], others have recognized more species[7,8]. The number of pedicels per leaf axil has been one of the main characters used in the classification of the genus. Recently, Wilson[9], following Smith and Heiser[8], has used 3–5 pedicels at each node and the circular constriction at the base of the calyx in fruit