The Postman in White

The unusual flower whose ancestry is discussed here in the light of modern ideas of genetics was collected in Hobart by W. Baulch, and the photographs are by H. J. Read.

by
R. G. L. BRETT, B.Sc.,
Senior Science Master,
Hobart State High School

The pictures in the heading show the normal flowers of Kennedya, above, and the rare white form below. The flowers of the normal form are a brilliant pillar-box red.

MANY people dislike white flowers because they associate them with funerals and death. This is a pity, for some of the most beautiful flowers are white. The "little white gardenia" of our Victorian grandfathers is an exquisite gem. A long list could be made of shrubs and herbs that beautify our gardens with their pure white blossoms.

PLANT FREAKS ARE OFTEN GARDEN PRIZES

It is not surprising that much attention has been given to the study of color factors in flowers Especially has this been the case with those freak "color breaks" which have appeared as the result of intense cultivation of wild plants. Such freaks do occasionally turn up in Nature. Geneticists have been able in many instances to elucidate the mystery of their sudden appearance and almost immediate disappearance. One aspect of the art of horticulture is the perpetuation of abnormal plant types which, by the pleasing color of their flowers or their quaint growth habits, commend themselves to us.

The Running Postman *(Kennedya prostrata,* R.Br.) is a small prostrate perennial creeper often found on dry stony hillsides or sandy patches near the sea. Its slender stems with pale green clover-like leaves bear brilliant scarlet blossoms a distance of often many feet from the root-stock. The vernacular name is apt. The scarlet flowers (rarely pink) can be seen from a considerable distance, and are doubtless intended to attract insects whose eye-sight is somewhat limited. It is therefore of great interest that a single plant with white flowers was collected during last summer on the Queen's Domain, Hobart, where many of the normal red flowering plants are to be found. This freak form is such a rarity that it will repay further investigation. Our interest in the principles underlying the presence or absence of color in plants and animals is stimulated by such a find.

ALL DONE BY GENES

Most people nowadays have heard that the inherited characters of plant or animal are transmitted by minute bodies in the nucleus of each cell called chromosomes. These bodies, of which there are normally two sets in each of the body cells and only one set in each reproductive cell, are in turn divisible into still more minute bodies, the genes. The color of a flower or the shape of a leaf may be influenced by one gene or by a number of genes acting in conjunction. Color of flowers is frequently affected by several genes. We must imagine a chromosome of one set lying beside the equivalent member of the duplicate set, with the pairs of corresponding genes arranged together.

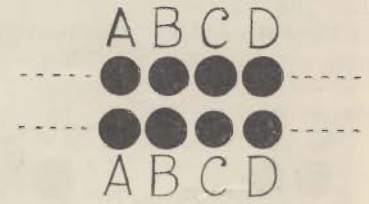


Fig. 1
Diagram of genes of a normal, completely dominant plant.

In fig. 1 the genes A.A., etc., are identical, and produce the same characters. But in the course of time one or more genes, say A. and B., may be altered to a. and b., in such a way that they now produce quite a different effect, as in fig. 2.

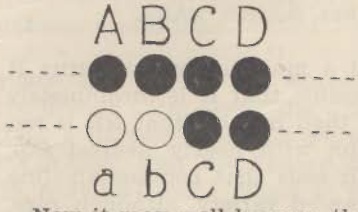


Fig. 2
Showing the introduction of a recessive element masked by dominants.

Now it may well happen that A. and B. are able to neutralise the effects of a. and b. They are then said to be dominant, while a. and b. are described as recessive. If a. and b. are to produce their effects the two chromosomes must be as in fig. 3; no A. or B. must be present.

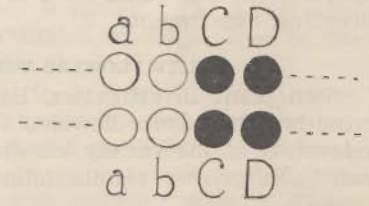
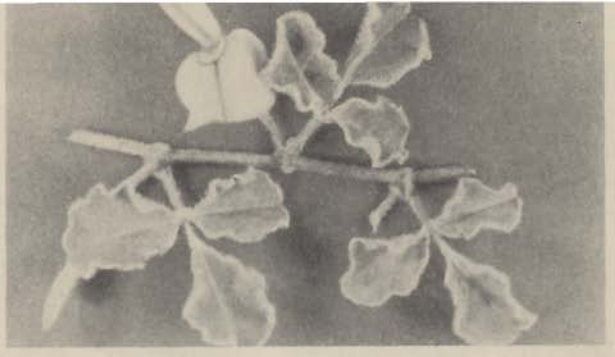


Fig. 3
Double recessives, which will be fully effective.

If the four genes illustrated above are the only ones concerned with the characters being considered we neglect all the others, including the



The white-flowered Kennedya has also a lighter stem and lighter leaves.

chromosomes to which they belong, and write the description of the plant by a simple formula. Thus AA, BB, CC, DD is the formula for fig. 1, and aa, bb, CC, DD that for fig. 3. Capital letters are used for "dominants" and small type for "recessives."

THE "ACID TEST"

In some cases the color of a flower is controlled by the acidity of the sap in the flower cells. In the Chinese primula *(Primula sinensis)*, a favorite greenhouse plant for table and indoor decoration, there are three principal genes affecting color, B, K, and R. Thus BB, KK, RR is magenta, while BB, kk, rr is pale pink to white, but bb, kk, rr and bb, KK, RR are white and red respectively. The gene R tends to turn the sap acid, while the corresponding r turns it alkaline.

Now it well may be found on investigation that the "Postman in White" has been produced by similar principles. We have only to imagine a gene R responsible for the normal red flowers, and

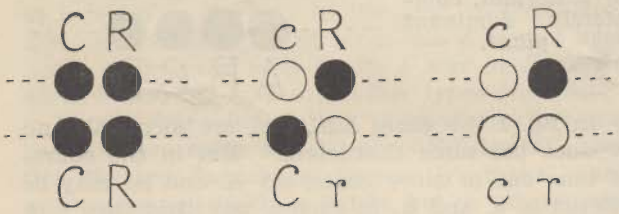


Fig. 4.—Color genes in Sweet-pea—left and centre, red flower type; right, dominant C absent makes flowers white.

a rare accident called a mutation which turns R into r. It is also possible that R is incompletely dominant to r. It is then possible that RR is red with acid sap, Rr pink with nearly neutral sap, while rr is white, with cells that contain alkaline liquid. The pink-flowered variety, although rare, would occasionally appear, and this is found to be the case in nature, while the white-flowered form would be exceedingly rare. The rr, if it exists, is doubtless unfavorable, and probably tends to die out quickly. Of course these suggestions are mere speculation, and would have to be tested by careful breeding experiments.

WHITE FLOWERS TURN RED

Two plant investigators, Bateson and Punnett, cross-bred two white-flowered sweet peas *(Lathyrus odoratus)* of the variety known as "Emily Henderson." Surprising results followed when the first generation of plants F_1 were found to be all colored red. The self-fertilised plants of the F_1 generation produced a second generation F_2, with approximately 56% reds and 44% whites. This remarkable result was explained by assuming the presence of two dominant genes, C and R, both of which were required to produce colored flowers. Some examples are shown in fig. 4. The genes C, R, belong to two different chromosomes of the single set.

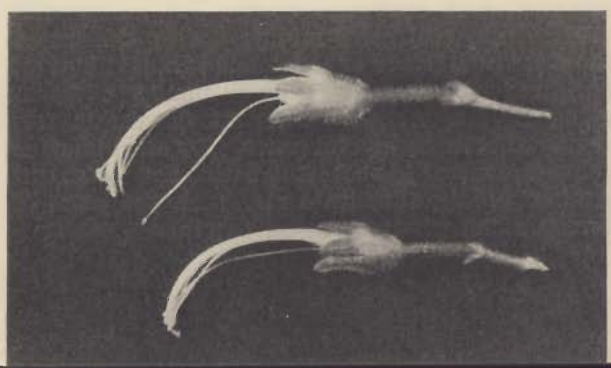
When a plant normally produces white flowers mutations might have the effect of producing a rare colored type. It is possible to see a hint of this in some wild flowers of the white type. *Leptospermum scoparium,* known in Tasmania as Tea-tree and in Victoria as Manuka Tea-tree, produces masses of small vivid white flowers. But an occasional shrub is found with flower petals showing distinct traces of pink. Intensive breeding and selection from seed gathered from such a plant might in the long run produce at least one crimson flowered type. Once this was achieved the plant could be propagated indefinitely from cuttings.

MUTATIONE CAUSE TOTAL CHANGE

A study of the photographs of the "White Postman" show that not only is the color of the flower changed, but the whole plant has been affected in some slight degree. The magnified view of the anthers clearly shows the difference between the red and the white. There is no difficulty in observing that the red pigmentation which affects to some extent the cells of leaf and stem in the normal plant is entirely absent in the white flowered form. Other changes are observable, not the least of which is the tendency of the white plant to produce fewer flowers, notwithstanding the fact that the situation of its growth was definitely a favorable one.

Thus an alteration of the factors of inheritance may affect one part of an animal or plant to a marked degree, but it is not without its effect on the whole organism. We are sometimes prone to overlook this important fact.

Kennedya prostrata is found in every State but Queensland. In Victoria it is known as the Scarlet Coral Pea. There appears to be no record of a white-flowered form in literature readily available in Hobart. But it is quite possible that it has been observed in other States, and some reader acquainted with it may be sufficiently interested to send a communication to the column, "Notes and Specimens."



Stigma and anthers of normal and white-flowered Kennedya compared; above, white-flowered type; below, normal scarlet flower.