FLORAL COLOURS AND THEIR ORIGINS

BY SIR C. V. RAMAN* 

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ABSTRACT

A new orientation is given to the subject of floral colours by the author's discovery that these colours may be placed into two distinct spectral categories, which have been designated by him respectively as the spectrum of florachrome A and of florachrome B. Typical of these two categories are the colours of Delphinium ajacis (larkspur) in the blue and pink varieties respectively, the former showing the spectrum of florachrome A and the latter that of florachrome B. As a general rule, all blue flowers exhibit the spectrum of florachrome A which consists of three distinct and clearly separated bands of absorption appearing respectively in the red at 630 mμ, in the yellow at 580 mμ and in the green at 540 mμ. The spectrum of florachrome B also consists of three distinct bands of absorption, but these now appear in the orange-yellow at 590 mμ, in the green at 545 mμ and in the blue-green at 505 mμ. Spectra exhibiting these features are reproduced with the paper. Their explanation is discussed and it is shown that they owe their origin to an electronic absorption frequency located at the first of the three bands combining with vibrational transitions, the oscillator being the CO group present in the structure of the florachrome.

1. INTRODUCTION

The colours which flowers exhibit when held in bright sunlight represent the physiological perception of the radiation which emerges from their petals after suffering diffusion and absorption within their substance. The spectral characters of the light emerging from the petals and the physiological characteristics of human vision which determine the sensation produced by the composite radiation have alike to be taken into consideration. Any discussion of floral colours which ignores either of those determining factors, would not only be futile but may also lead one to erroneous conclusions.

The processes of absorption and diffusion suffered by light in its passage through the petals and its emergence therefrom are determined by the nature

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and condition of the materials present within the living substance of the flower. It follows that no inference regarding these materials can be valid or sustainable unless it is based on their optical and spectroscopic behaviours observed in vivo. If one attempts to extract from the flowers the materials responsible for the observed colours, it is necessary to use processes which do not fundamentally alter their nature. In particular, if a solvent is used for the extraction, it should be such that it does not produce an observable change in the optical properties or spectroscopic behaviour of the pigment.

When one examines the voluminous literature in which the subject of floral colours and their origin has been dealt with, one fails to find any recognition of the fundamental considerations set forth in the two preceding paragraphs. The identification of the materials responsible for the colours of flowers as “anthocyanins” and the explanations put forward for the great differences in colour exhibited by various flowers are thereby rendered highly dubious. In treatises on plant biochemistry, the anthocyanins are placed in the general category of “flavonoids”. The parent substance which gives the name to this group of organic compounds is flavone and it is a significant fact that this substance is itself a colourless solid which melts at 97°C. How such a substance can be transformed into the brilliantly coloured floral pigments merely by hydroxylation and combination with glucose or other sugar residues is a mystery which one seeks in vain for an elucidation in the chemical literature.

From what has been stated above, it is evident that the origin of the vivid colours exhibited by many flowers in vivo has so far remained an unsolved problem. The present investigation addresses itself to finding an answer to the highly interesting questions arising in this field.

2. FLORACHROME A

A new orientation is given to the subject of floral colours by the author’s discovery that the spectral character of the light emerging from the petals of flowers is related to the observable hue of the flowers in a highly characteristic fashion. We may illustrate this finding by a reference to some cases studied by him in earlier years.

The well-known avenue tree known botanically as *Jacaranda mimosifolia* bears numerous clusters of bluish-purple bell-shaped flowers. The climbing plant *Thunbergia grandiflora* bears large and widely expanded flowers of a pale blue colour. The well-known shrub *Plumbago capensis* commonly used as a hedge plant bears clusters of small flowers which are azure-blue