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A TYPICAL CASE OF BACTERIAL ORIGIN OF INSECT COLOURATION (IN *CICADELLA VIRIDIS*)

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In the present communication there is an excellent reproduction of a coloured insect and of the colours idoures of its two symboitic bacteria which produce the pigments of the wing and of the main body. A fact worthy of mention is that the bacteria isolated easily showed mutations.

Key words: Insect colours; Bacteria; *Cicadella viridis.*

INTRODUCTION

On the role, more than on the origin of insect colours, there is Sir E. B. Poulton's classical work on Colours of Insects. Supplementing it is O. Prochnow's Die Faerburg der Insekten in C. Schroeder's *Handbuck der Entomologie,* vol. 2, p. 430. Fischer, Jena (1925).

Now P. Puchner has published a monograph of symbiosis among Homoptera in Zeit f. Morph u. Oekol 4, 149 1925, and later a book on symbiosis which has also been translated into English. With all this vast literature there is no statement to the effect that many homoptera and even some hemiptera can owe this colour directly to the existence of symbiotic organisms they harbour. A typical case revealing this phenomenon has been *Cicadella viridis* on which a paper was read at the meeting of the German Zoological Society and later published in its proceedings of 1939 (p. 420). It needed the coloured illustrations of the insect and of the corresponding pigments producting by the bacteria. This has been done rather late in the article entitled "Bacterial origin of some insect pigments and the origin of species through symbiosis, published in the Pakistan J. Sci. Ind. Res., 13 (4) 1970: pp. 410-413 with 35 coloured illustrations.

The picture reproduced there was photographed at the Zeiss laboratory Jena, in the expectation that it would give the desired result. Unfortunately this did not prove to be the case. Thus the illustrations published there are badly wanted to show the colours of the insects are due to the bacteria which produce the corresponding pigments.

In 1974 I happened to visit my son Dr. Mohsinali Hassan at Baltimore. He had a good library including the book, Frank Wagnalls: Wild Life Encyclopedia, 1974. In Vol. 9, p. 1071 there appeared a coloured illustration of

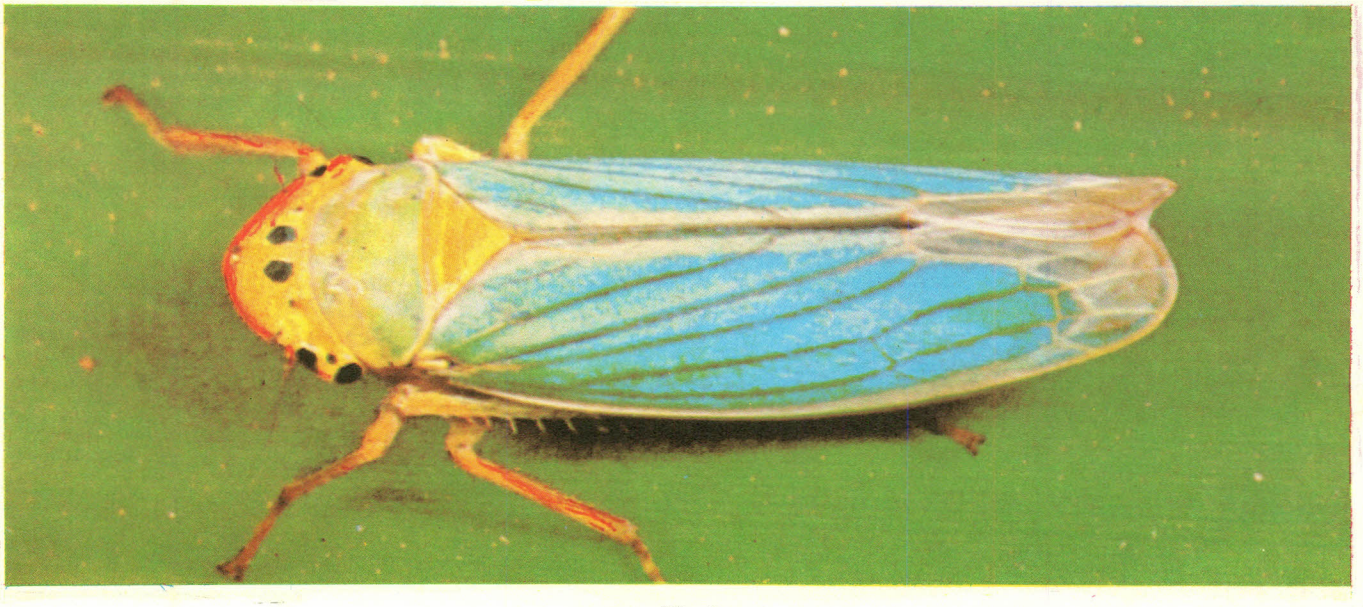

Fig. 1

Cicadella viridis in which I was most interested. Realizing this my son Mohsinali, out of love for the work of his father tore away the page 1071 which permits its being reproduced in Fig. 1.

There are two main colours. Dorsally the wings are green which makes the insect cryptic as a plant feeder. Ventrally it is orange coloured because of carotine B. From the two tumours within the insect I could isolate one as mycobarterium producing carotin B. A portion of its colony which was coloured is shown enlarged in Fig. 2. The other tumour – associated with the former was smaller. Its bacteria produced a greenish to olive – green pigment, illustrated in Fig. 4. I took both cultures of Prof. R. Kuhn the Nobel leureate at the Heidelberg who easily diagnosed the pigment of bacterium (Fig. 2) as Carotin B, while on the olive-green pigment he made the following comment E. Chargaff had obtained a new chemical, sarcinin, from a bacterial colony. When the olive-green colour is extracted with pyridine it gives a lemon – yellow colour spectroscopically identical with Sarcinin. At any rate the pigment of Fig. 4 can account for the green colour of insect wings and the pigment of Fig. 2 that of the main yellow colour of the body particularly of its underside. I continued to cultivate the original red and green bacterial colonies for some three years on my return to India early in 1940.

Both bacteria were capable of mutations. Fig. 2 produced a more yellow or less orange coloured colony seen in Fig. 3, while the same further produced a green coloured mutation (Fig. 5). There have been many mutations most of which have been illustrated before in the Pakistan J. Sci. Ind., Res. (Dec. 1970). Returning to Fig. 2, there is no doubt that Carotin B being the precursor of Vit A. is useful and does not allow any further discussion. The green pigment of Fig. 4 though chemically not analysed appears to be a pterin. Prof. Hopkins of Cambridge University isolated from the wings of the cabbage – white butterfly a white pigment which was a pterin. It appears likewise that the green pigment of *Cicadella visidio* wing is also a pterin.

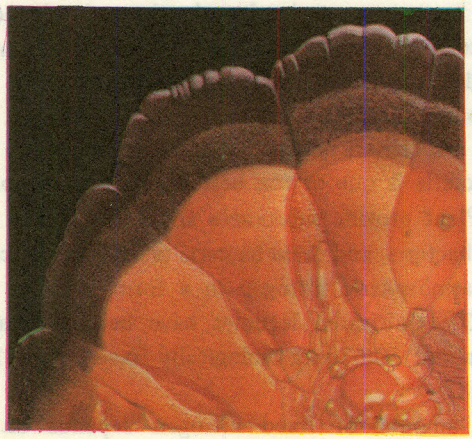

Fig. 2

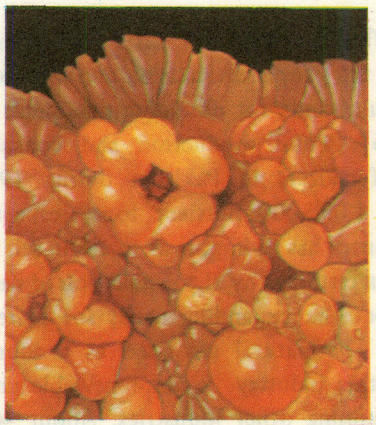

Fig. 3

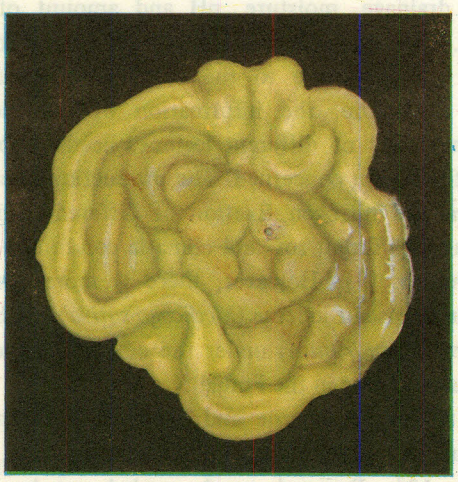

Fig. 4

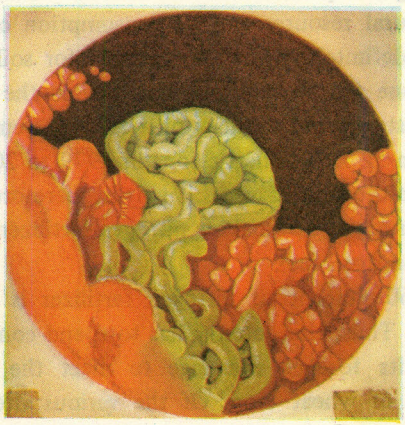

Fig. 5