THE SCENT AND COLOUR OF FLOWERS IN RELATION TO BIRD-POLLINATION

BY

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The recognition of the importance of scent in relation to bird-pollination has been neglected in such a measure that in recent years the opinion has been expressed that birds make no use of their sense of smell and so none of the flowers habitually fertilized by them are fragrant [1]. During the course of his observations on pollination by birds in Indian flowering plants, the author has come across certain interesting facts with regard to scent and colour which call for some critical remarks.

The flowers of the Rubiaceous tree *Morinda tinctoria* Roxb. are cream coloured and when in bloom (*April* to middle of *June*), these emit a very strong pleasing sweet fragrance which spreads in a radius of at least one furlong. It is interesting to record that the mature flower is about one-fourth full of a sugary juice which is secreted by the nectary at the base of the corolla-tube. In the cool hours of morning between five and eight o'clock, this tree is visited almost exclusively by sun-birds (*Cinnyris asiaticus*), both male (steel-black: this is the colour which it acquires during the mating season) and female. The sugary juice is heartily feasted upon by these birds which in Indian vernacular are called *shakar-khorá* (or the sugar-eaters). This name may very fitly be extended even to other such birds. However, in this act of drinking the sugary juice from flower to flower, the sun-birds unconsciously effect pollination [2].

Thus we see that the flowers of *Morinda tinctoria* Roxb. are not only not scarlet but are at the same time sweet scented and are pollinated by sun-birds. The absence of scarlet colour and presence of scent and yet the occurrence of pollination by birds in a single species does really appear to be antagonistic to the prevailing idea of ornithophily. Scarlet colour, as is well known, is supposed to

[1] Hampton: *The scent of flowers and leaves*, 1925.

[2] The fuller paper, on the pollination of *Morinda tinctoria* Roxb. by sun-birds, will subsequently be published.

be common in ornithophilous flowers e.g. *Erythrina indica* Lam.[1], *caffra* Thunb.[2], *Christa-galli* Linn., *herbecea* Linn. and *speciosa* Andr.[3], several species of *Lobelia*, *Begonia fuchsioides* Hook., *Amherstia nobilis* Wall. and *Brownea coccinea* Jacq. [4], *Bombax malabaricum* DC. and several others; but on the other hand quite a number of plants e.g. *Butea frondosa* Roxb., *Euphorbia pulcherrima* Willd., *E. splendens* Boj. ex Hook., *Hibiscus rosa-sinensis* Linn, varieties of *Canna indica* Linn., American species of *Aechmea* and *Vriesea* [5], Malay Zingiberaceae [6] and many more may be enumerated, in which the scarlet colour of their bracts or corolla, does not exert any influence in attracting birds to perform the function of pollination; while there are others e.g. *Feijoa Schenckiana* Kiaersk, with snow-white flowers, *Marcgravia umbellata* Linn. with dull brown flowers, *Courouptia guianensis* Aubl. and *Weigela* sp. with deep carmine flowers and *Strelitzia Reginae* Banks with bright orange perianth and a large azure labellum [7], possessed of flower-colours, other than scarlet, which are regularly pollinated by birds.

So it is clear that we should relinquish the view, which of late has been gaining ground, of seeing the scarlet coloured flowers with an eye of suspicion and regarding most of them to be ornithophilous[8]. It is, therefore, proposed to examine and discuss in brief the characters which appear to be of most importance with regard to bird pollination.

The tree *(Morinda)* in bloom is leafy and is not in the least so conspicuous as the leafless *Bombax malabaricum* DC., *Erythrina indica*, Lam. and several other ornithophilous members with their scarlet flowers. In the latter, certainly colour does act as a guide which purpose in *Morinda tinctoria* Roxb. is presumably effected through the agency of the sweet fragrance of its flowers. And the author has also himself seen in the early hours of morning, sun-birds flying to this tree from distant places.

Already several investigators [9] have recognised and the fact is now fairly well established that scent plays an important rôle in the courtship of moths, butterflies, beetles and fruit-flies. Likewise, in *Morinda*, besides serving as guide, the scent perhaps plays a similar

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[1] Singh: *Jour. Bomb. Nat. Hist. Soc.* XXXIII, 1929.

[2] Galpin: *Gard. Chronicle*, IX, 1819; Knuth: *Hand-Book of Flower Pollination*, I, 1908.

[3–4] Kerner: *The Natural History of Plants*, II, 1904.

[5–7] Schimper: *Plant Geography*, 1904.

[8] Hampton: (1925) *ibid.*

[9] Carpenter: *Proc. Eng. Entom. Soc.* 1914; Hampton: *loc. cit.*; Longstaffe: *Butterfly Hunting in Many Lands*, 1912; Knuth: *loc. cit.*

part in the way of fulfilment of the most important biological end-the courtship-of the sun-birds. Because, these during the period of the year intervening between April and June, are, so to say, at the height of their mating fervour. This is evidenced by their sweet but short pretty chirpings which they give out as they hop from bough to bough and also by the steel-black colour of the males.

From a rather rapid survey related in the preceding paragraphs, the following important details are at once apparent in the case of certain Indian types:—

Name of Plant	Flower Colour	Scent	Nectary	Name of Bird
Morinda tinctoria Roxb.	Cream White	Strong pleasing fragrance.	Sugary juice produced in great abundance.	*Cinnyris asiaticus.*
Erythrina indica Lam.	Scarlet	None	Ditto	*Acridotheres tristis tristis*
Bombax malabaricum DC.	Scarlet	None	Ditto	Several birds.

Although the species briefly described here are far removed from each other in the natural scheme of classification, yet the most important fact that stands out prominently is the character of the sugary juice which is secreted in great abundance by the nectary apparatus in each case. This condition is not only characteristic of the species referred to but it is so also of other ornithophilous species e.g. *Marcgravia* [1], *Manettia* [2], *Protea* [3], *Erythrina caffra* Thunb. and *Tecoma capensis* Linde. [4], *Ravenala madagascariensis* Gmel. and *Strelitzia Reginæ* Banks [5] and several others [6].

Thus, from a perusal of facts presented, it is clear that the relation between bird-pollination and scarlet colour of a flower cannot be upheld in the same terms as is often stressed and in the light of the

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[1] Knuth: *loc. cit.* Vol. I; Willis: *A Dictionary of Flowering Plants and Ferns*, 1919.

[2] Knuth: *loc. cit.* Vol. II: Müller: *The Fertilization of Flowers*, 1883: Rendle: *The Classification of Flowering Plants*, Vol. II, 1925; Schimper; *Plant Geography*, 1925.

[3] Schimper: *loc. cit.*; [4] Galpin: *loc. cit.*; Knuth: *loc. cit.*

[5] Schimper: *loc. cit.*; [6] Knuth: *loc. cit.*; Scott-Elliot: *Ann. Bot.* IV and V, 1889–91; Thomson: *Transc. & Proc. N. Z. Institute*, VIII, 1880; Kerner; *The Natural History of Plants*, II, 1904.

observations on pollination in *Morinda tinctoria* Roxb. the view with regard to scent (or fragrance), like that of colour, will also need have to be modified. In fact, these characters-scent and colour-which when present appear to be of secondary importance and help chiefly as guides to the pollinators. But, as shown above, the character of most importance and constant occurrence in relation to ornithophily, is the production of sugary juice in great profusion. This (sugary juice) by itself when stored up in petals (e.g. in *Feijoa Schenckiana* Kiaersk.) themselves or in some sort of a receptacle (due allowance, however, being made of the size of the bird and flower) formed by the close fitting or otherwise of the sepals or petals or both (as found in known ornithophilous flowering plants), is almost sure to attract birds as pollinators. The birds are, after all, gluttons and so they are naturally lured by those plants which offer them plenty of food rather than flaring colour or pleasing scent.

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It is with the deepest regret that we have to record the sudden and sad death of Dr. Winfield Dudgeon. The news came to us as a great shock. His connection with the Indian Botanical Society is well-known. He was not only its first President but also its founder. We have lost in him not only an able botanist but a kind and generous friend. We offer our most heartfelt sympathy to Mrs. Dudgeon in her bereavement.