The Effect of Light on the Dispersal of 'Yellow' Melanin Pigments in the Integument of the Grasshopper *Poecilocerus hieroglyphicus* (Klug.)

Records of melanin in the integument of acridoids are few. Some vestiges of melanin are present in the blackish tegminal spots, mandibles, leg-joints and spines of *Schistocerca* and *Locusta* adults[1], and the black areas of the integument of the gregarious hoppers of these 2 locusts are definitely due to melanin deposited in the cuticle[2]. There are indications that some stage in the formation or deposition of melanin is affected by external factors; the amount of melanin deposited in the integument of the gregarious hoppers of *Schistocerca* is reduced with a rise of temperature[3].

The pale yellow or cream coloured specimens of *Poecilocerus hieroglyphicus* (Klug.) collected from along the river Nile where the vegetation is denser, could almost be mistaken for a different species from the deep yellow coloured insects found in the semi-desert areas of Khartoum District. A comparative study of the colour of the 2 types indicates that in the 'wing-bud' stage (fourth instar), the difference is mainly in the intensity of the yellow colour of the integument and in the number of the black spots.

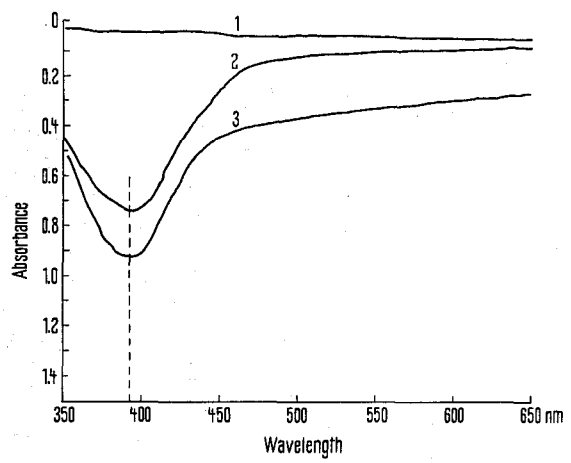
The fourth instar nymphs of the deep-yellow type were observed to reach the sixth instar stage in 6 weeks when reared under laboratory conditions (temperature 25 ± 1 °C and light intensity 460 Lux). These insects were normally fed on fresh leaves of the asclepiadaceous plant *Calotropis procera*. During this period their colour changed from deep-yellow to pale-yellow or cream. In a Gallenkamp incubator in complete darkness at a constant low temperature of 17 °C, however, the deep-yellow coloured fourth instar nymphs did not develop much during 6 weeks and most of them remained at the same stage of growth. Their colour, at the same time, did not significantly change during this period. When this experiment was repeated at a higher constant temperature of 30 °C which is about average temperature in the field, fourth instar nymphs reached the sixth instar stage in about 2 weeks and their deep-yellow colour changed completely into cream. But when the temperature was high (30 °C) and there was a light of 1200 Lux intensity during the hours of daylight (06.00–18.00 local time), fourth instar nymphs reached the sixth instar and adult stages in less than 3 weeks without any change in colour. In this experiment light from a 60 W bulb was controlled by a time switch.

These observations demonstrate that a change in colour from deep-yellow to cream in insects kept at normal temperatures (25–30 °C) is affected by the intensity of the light. At lower temperature (17 °C), however, the nymphs almost stopped growing and moulting. Their colour did not change even when they were left for 6 weeks in complete darkness. This may indicate that, at different light intensities, the colour can only change if the insects were growing and moulting normally at normal temperatures. It is most probable that 'tanning' takes place soon after ecdysis if the insects are exposed to normal light intensity during the day. This may also explain what happens in nature: *P. hieroglyphicus* from denser vegetation along the river aquire a pale yellow or cream colour as they are shaded more during the hours of the day than are the deep-yellow insects from open semi-desert areas.

The solubility of the yellow pigments in the abdominal terga and pronota of adult insects was tested in petroleum ether, butyl alcohol, 70% ethyl alcohol, acetone, 25% hydrochloric acid, conc. hydrochloric acid and 10% potassium hydroxide. The pigments were soluble only in 10% potassium hydroxide and conc. hydrochloric acid, in which they gave clear yellow solutions.

Chemical properties of the yellow pigments extracted in 500 cm³ of 10% KOH from the pronotum of a deep-yellow adult were compared with the chemical properties of melanin extracted from 0.25 g of black human hair by means of the same solvent. Each of the 2 pigments was readily bleached with hydrogen peroxide and, when a little amount of each was mixed with ammoniacal silver nitrate and heated, the latter was reduced to give metallic silver. The absorbance of the 2 pigments was tested in a Perkin Elmer 137 spectrophotometer. The results plotted in the Figure show that the 2 substances have identical maximum absorbance at 392 nm wavelength. This proves that the yellow pigments from *P. hieroglyphicus* integument are melanins.

Transverse sections of the abdominal terga of the 2 colour varieties, stained in haematoxylin, show that the endocuticle of the deep-yellow variety contains diffuse melanin pigments which are almost absent from the cuticle of the cream insects.



Absorbance of yellow pigments extracted from *P. hieroglyphicus* integument (2) and melanin pigments from black human hair (3) at different wavelengths (1) is the base-line.

Zusammenfassung. Nachweis, dass bei der sudanesischen Heuschrecke *Poecilocerus hieroglyphicus* (Klug.) die Körperfärbung von der Belichtung abhängt; starke Belichtung ergibt tiefgelbe, schwaches Licht dagegen hellcreme Farbe. Löslichkeit, chemische Eigenschaften und Absorption sprechen dafür, dass es sich bei diesem Pigment um ein Melanin handelt.

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[1] T. W. Goodwin, Biol. Rev. *27*, 439 (1952).
[2] B. Uvarov, *Grasshoppers and Locusts* (Cambridge University Press 1966).
[3] M. A. Hussain and T. Ahmed, Indian J. agric. Sci. *6*, 624 (1936).