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SCANNING ELECTRON MICROSCOPY OF PRUINOSITY IN ODONATA

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The structure of the supracuticular pigment of *Mnais pruinosa* (Calopterygidae), *Bayadera indica* (Euphaeidae), *Lestes sponsa* (Lestidae), *Libellula depressa, Orthetrum albistylum, O. anceps, O. cancellatum* and *O. triangulare* (Libellulidae) were examined using scanning electron microscopy. On the base of pruinescence micromorphology, 2 groups of families can be distinguished, viz. Lestidae+Libellulidae, with lamellar pruinosity, and Calopterygidae+Euphaeidae, with filamentous pruinosity. Differences in the microstructure of the pruinescent colouration result from some solid morphological (structure of porous canals of the cuticle) and/or biochemical (structure of cuticular waxes) differences between the odon. groups. The structures are interpreted both as sunlight reflectors and as colour patterns useful in intraspecific communication.

INTRODUCTION

Different types of colouring in Odonata have been described by TILLYARD (1917) as optical colours and pigmentation. Pigmentation has been divided into cuticular, hypodermal and pruinescent (or supracuticular) colouration (TILLYARD, 1917). Pruinescence is a special form of colouring, connected with maturation. Supracuticular pigments usually occur on the abdomen, rarely on the thorax, axillar sclerites. PAULSON (1983) has described pruinosity on the ventrolateral portion of the thorax, hind femora, upper part of the thorax and base of the abdomen for *Gomphus lynnae*. Sexual dimorphism is usually observed with males having a greater degree of pruinosity.

Substances that cause the pruinescence are produced by the hypodermis and excreted on the cuticular surface with the aid of fine porous canals. The pruinescence can reflect ultraviolet-light (UV) (ROBERTSON, 1984). Because the eyes of insects are sensitive to UV, UV structural colouration patterns may be important for intraspecific communication. Indeed, this has been shown for the structural colouration of the wings of lycaenid butterflies (MEYER-ROCHOW, 1991). This paper reports comparison of the microsculpture of the pruinescent colouration of the abdomen, thorax and axillary sclerites in eight species of Odonata.

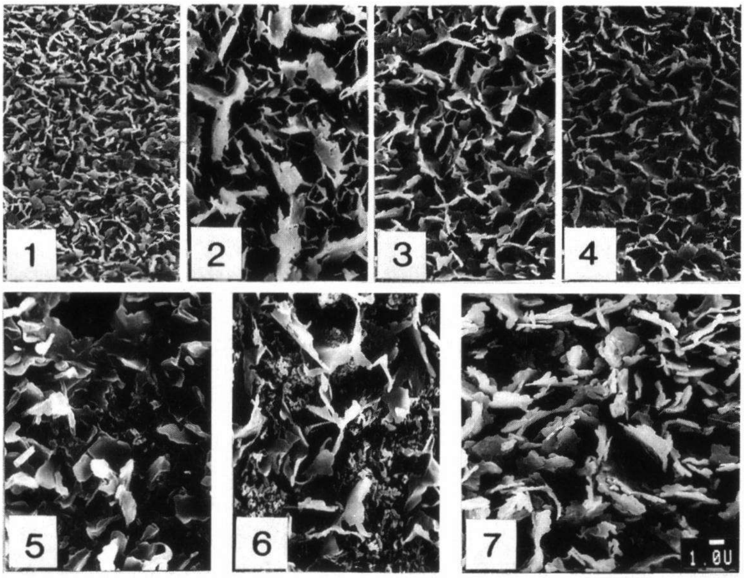
MATERIAL AND METHODS

Mature specimens of eight species from four families were studied, viz. Calopterygidae: *Mnais pruinosa* Sel.; Euphaeidae: *Bayadera indica* (Sel.); Lestidae: *Lestes sponsa* (Hans.); and Libellulidae: *Libellula depressa* L., *Orthetrum albistylum* (Sel.), *O. anceps* (Schneider), *O. cancellatum* (L.) and *O. triangulare* (Sel.).

Cuticular pieces of dry specimens from collection were mounted on holders, sputter-coated with gold and examined in a scanning electron microscope (JEOL JSM-35C).

RESULTS

The pruinosity of the species examined can be divided into lamellar and filamentous pruinosity; each of these is peculiar to different taxa.



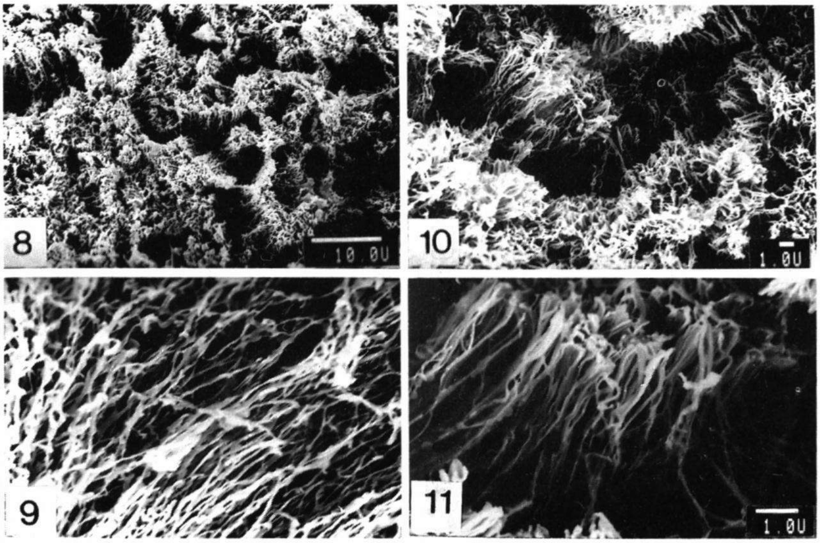
Figs 1-7. Lamellae, causing the pruinosity in Libellulidae (Figs 1-4, 6-7) and Lestidae (Fig. 5): (1) *Orthetrum triangulare* (Sel.), ♂, dorsal surface of 4th abdominal segment; – (2) *O. cancellatum* (L), ditto; – (3) *O. anceps* (Schneider), ditto; – (4) *Libellula depressa* L., ditto; – (5) *Lestes sponsa* (Hans.), ditto, of 9th abdominal segment; – (6) *Orthetrum albistylum* (Sel.) ♀, ventral surface of 4th abdominal segment; – (7) *O. albistylum* (Sel.), ♂, dorsal surface of 4th abdominal segment. – [× 4000. – Bar = 1 µm].

LAMELLAR PRUINOSITY

The lamellae of libellulids (Figs 1-7) are of different sizes in different species, e.g. 1,0-2,0 µm in *Orthetrum triangulare* (Fig. 1) and *Libellula depressa* (Fig. 4) and 4-6 µm in *O. cancellatum* (Fig. 2), and are orientated perpendicularly to the cuticular surface plane. The edges of the lamellae are uneven. The ventral part of the female abdomen of *O. albistylum* and the dorsal part of the male abdomen of *O. cancellatum* both have sparse large lamellae (3,0-6,0 µm) and dense small lamellae (0,3-1,0 µm), whereas the dorsal part of the male abdomen of *O. albistylum* has only large lamellae (3,0-6,0 µm) (Fig. 7). In *Lestes sponsa* the lamellae are small (1,0-2,0 µm) and occur sparsely on the cuticular surface (Fig. 5).

FILAMENTOUS PRUINOSITY

Bayadera indica branched and merged filaments are found on the axillar sclerites (Figs 8-9). *Mnais pruinosa* is characterized by a thread-like wax microsculpture on the pterothorax (Figs 10-11). The filaments (length = 6,0 µm, width = 0,4-0,8 µm) are somewhere coupled.



Figs 8-11. Branched and merged filaments, causing the pruinosity in Euphaeidae (Figs 8-9) and Calopterygidae (Figs 10-11): (8-9) *Bayadera indica* (Sel.), ♂, axillar sclerite, × 2000 and 10000, resp.; – (10-11): *Mnais pruinosa* Sel., ♂, dorsal surface of pterothorax, × 4000 and 12000, resp. – [Bar = 1 µm].

DISCUSSION

Some insects, such as Hemiptera, have well-developed pruinescent-like formations (SHVANVICH, 1949). The structure of these cuticular wax excretion differ among the Hemiptera (threads and lamellae) and correlate with the arrangement of the cuticular canals.

If the pruinescence microsculpture of Odonata is compared, it can be seen that there are two groups. The first group includes lestid and libellulid dragonflies, with lamellar microstructures, the second includes calopterygid and euphaeid species, with filamentous microstructures. The results may be taken to indicate a close relationship between the lestids and the libellulids, on the one hand and between the calopterygids and the euphaeids, on the other. These differences are probably due to differences in the structure of the pore canals in the cuticle and/or to differences in the chemical structure of the cuticular waxes.

SHVANVICH (1949) indicated the possible function of different types of wax pruinosity in Hemiptera as defence against predators. PAULSON (1983) suggested for Gomphidae that the function of pruinosity was to reflect sunlight, because specimens from more southern populations have a better developed pruinescent colouration. Well developed sexual dimorphism in pruinosity may be interpreted as a colour pattern used for intraspecific communication.

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