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WAX FILAMENTS ON COCCOID EGGS*

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ABSTRACT

Scanning electron microscopy of eggs deposited fay members of six coccoid families (Margarodidae, Pseudococcidae, Eriococcidae, Asterolecaniidae, Coccidae and Diaspididae) showed that all eggs were densely covered by rounded filaments. Similar structures were reported from the Kermesidae and the Apiomorphidae, and thus it is assumed that they occur throughout the Coccoidea. The filaments are secreted from diverse ventral orifices, including the diaspidid perispiracular pores. Filaments of *Pianonoccus* and *Saissetia* became disorganized and shapeless after a 5-second dip in chloroform, thereby indicating their waxy nature. Although the significance of the filaments is obscure, their persistence throughout the superfamily Coccoidea, whose members have evolved various wax glands and orifices, indicates that there has been strong selection pressure to preserve them.

It is now generally accepted that type, number and distribution of glands and pores on the coccoid body constitute some of the best characters for distinguishing taxons between and within groups. Some pores are rather characteristic, like the 8-shaped orifices of the Asterolecaniidae or the oral rim ducts of the Pseudococcidae. The great variety of wax-producing glands and their openings indicate strong pressures towards evolving diverse means to the same end: the protective covering. Consequently species of dissimilar groups, like the Margarodidae, Pseudococcidae and Diaspididae produce their characteristic scales by different glands and secrete them through diverse ducts.

On the other hand, there is a rather surprising consistency in the shape of wax flakes or filaments deposited on the scale insect egg. The egg of the soft scale *Saissetia* will serve as an example. It is uniformly covered with a large number of filaments (Fig. 1), which have a regular, well-defined structure, being curled, spaghetti-like and open

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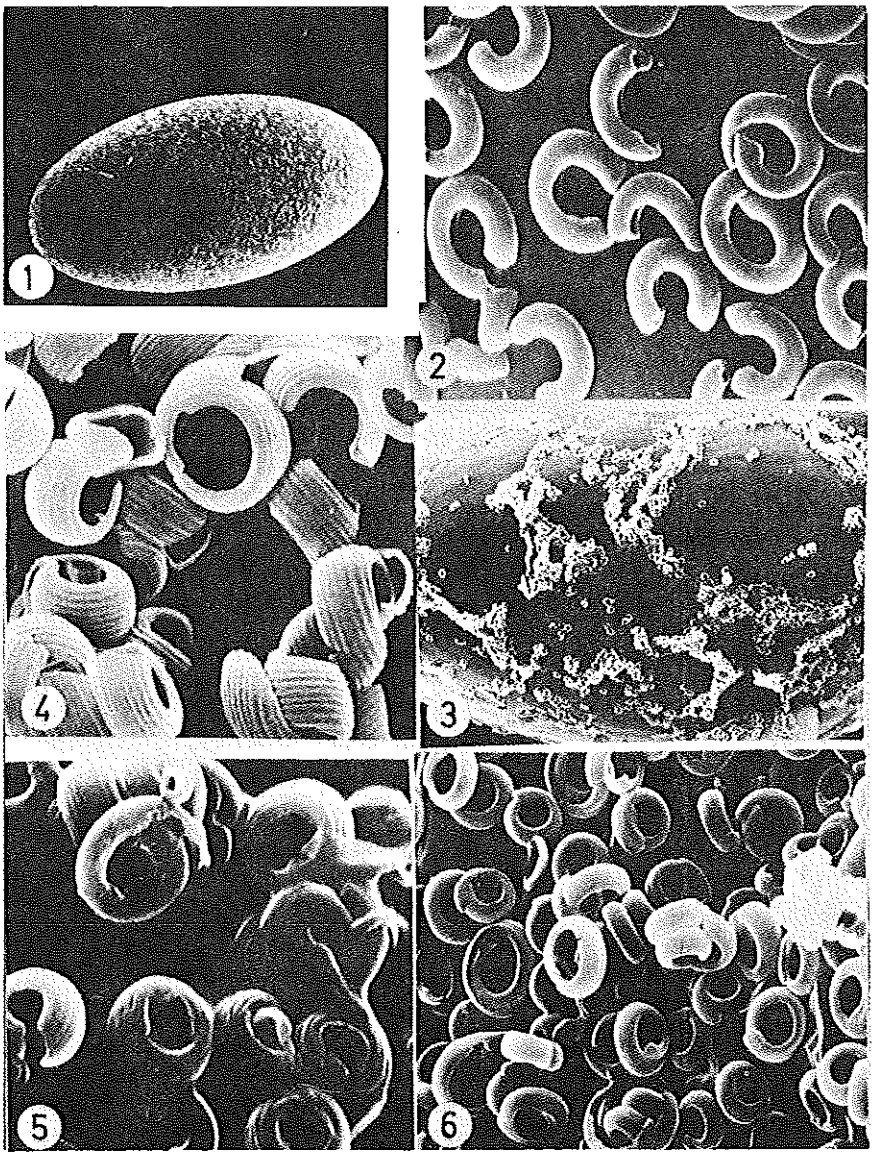
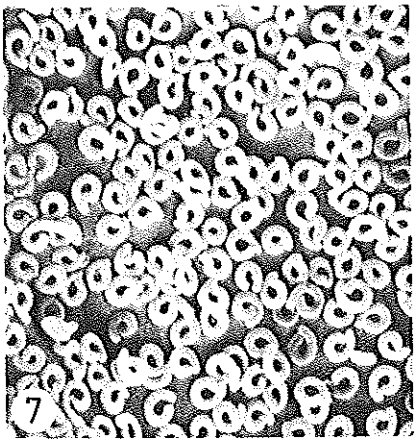
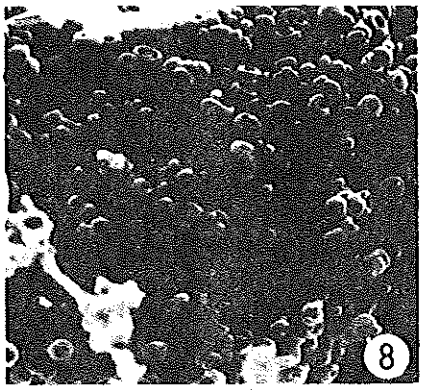
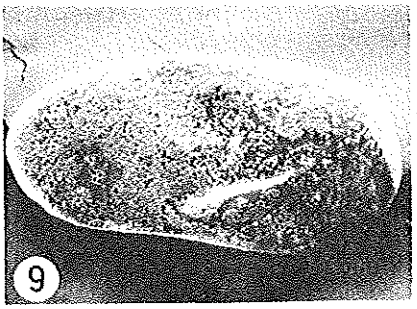
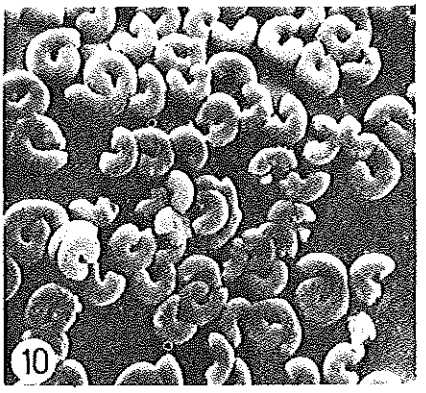


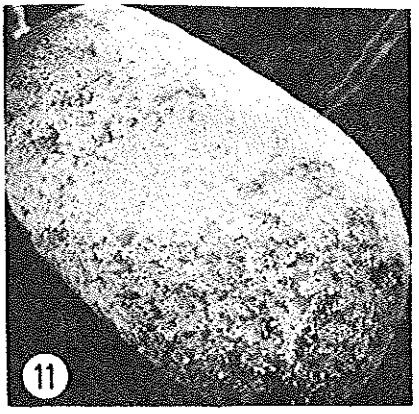
Figs. 1-6. Micrographs of coccoid eggs. 1. *Saissetia* (x336). 2. *Saissetia,* detail (x10,500). 3. *Saissetia,* following a 5-seconds dip in chloroform (x670). 4. *Planococcus,* detail (x10,500). 5. *Planococcus,* following a 5-seconds dip in chloroform (x10,500). 6. *Icerya,* detail (x5,100).

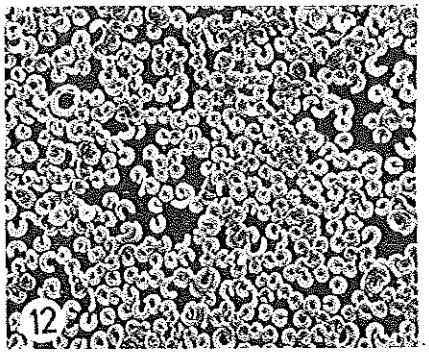




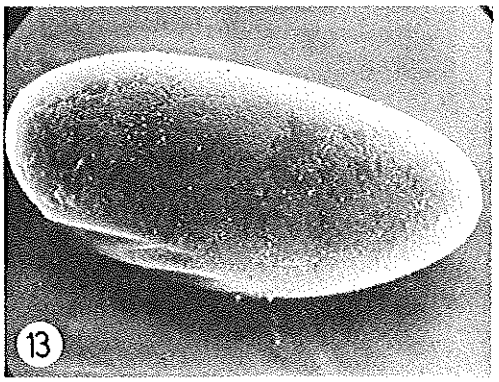


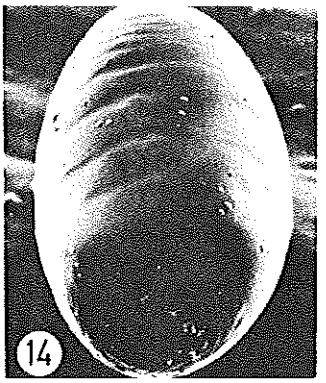


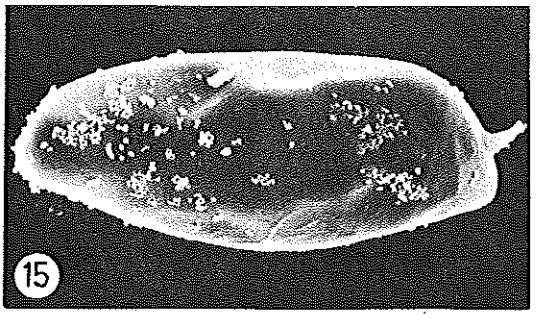


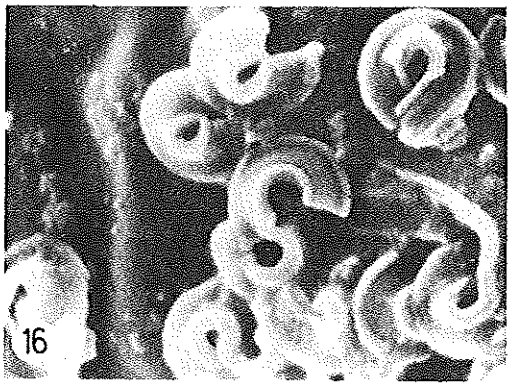


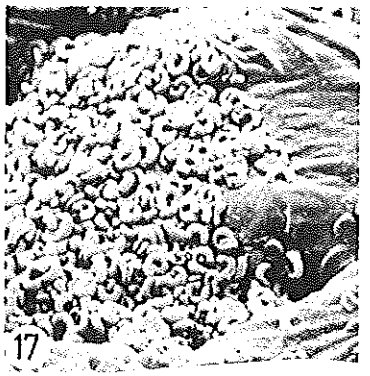
Figs. 7-12. Micrographs of coccoid eggs. 7. *Asterolecanium,* detail (x5,000). 8. *Eriococcus,* detail (x2,900). 9. *Lepidosaphes* (x340). 10. *Lepidosaphes,* detail (x6,500). 11. *Parlatoria* (x500). 12. *Parlatoria,* detail (x2,000).











Figs. 13-14. Micrographs of coccoid eggs. 13. *Odonaspis* (x318). 14. *Hemiberlesia* (x520). *Figs. 15-16.* Micrographs of whitefly eggs. 15. *Bemisia* (x430). 16. *Bemisia,* detail (x10,000). 17. Micrograph of the anterior spiracle of the coccoid *Lepidosaphes* (x2,700).

in the concave inner side (Fig. 2). Upon being briefly (5 seconds) dipped in chloroform, the filaments lose their regular distribution on the egg, aggregating in clumps (Fig. 3). Similar filaments, with a rather more pronounced longitudinal structure, occur on eggs of the mealybug *Planococcus* (Fig. 4). As these eggs are dipped in chloroform, the filaments lose their regular outline (Fig. 5), thereby confirming their waxy nature. Similar filaments occur on the eggs of *Icerya* in the Margarodidae (Fig. 6), of *Asterolecanium* (Fig. 7) and of *Eriococcus* (Fig. 8). Hamon, Lambdin and Kosztarab (1975, Fig. 4) found such filaments on eggs of *Kermes*, and according to Gullan (1979, Figs. 2, 4) they are also produced by *Apiomorpha*.

Eggs of genera representing three of the major tribes of the Diaspididae are densely covered with filaments. These include *Lepidosaphes* (Figs. 9 and 10) and *Pseudaulacaspis*, as shown by Hashimoto and Kitaoka (1971, Fig. 6) (Diaspidini), *Parlatoria* (Parlatorini) (Figs. 11 and 12) and *Odonaspis* (Odonaspidini) (Fig. 13). *Hemiberlesia*, representing the Aspidiotini, has an egg almost devoid of filaments (Fig. 14). Altogether seven scale insect families are thus known to have filament-covered eggs. Data on eggs of two closely-related superfamilies are also available. Retnakaran, Ennis, Jobin and Granett (1971) presented a micrograph of an aphid egg (Figure 2E in their paper) which appears to be covered with similar filaments. Eggs of the whitefly (Aleyrodidae) *Bemisia* (Figs. 15 and 16) are likewise covered, albeit not so densely.

Hamon *et al.* (1975) and Gullan (1979) stated that the filaments were produced by the multilocular pores of *Kermes* and *Apiomorpha*, respectively. Many observations indicate that the perivulvar pores of the Diaspididae secrete these filaments, as do the perispiracular pores (shown for *Lepidosaphes* in Fig. 17).

Hamon *et al.* (1975), following Tamaki, Yushima and Kawai (1969), postulated that the wax filaments may serve to prevent the eggs from sticking together, or protect them from dessication. No experimental data are available concerning these or other possible functions of the filaments.

The evidence presented shows the wax filaments to occur on eggs of three out of four superfamilies of the Sternorrhyncha; this clearly attests to the antiquity of the filaments. The persistence of the filaments in the Coccoidea, from the primitive Margarodidae to the advanced Diaspididae, during all diverse changes in gland and pore structure, suggests that the filaments have conferred some important advantage upon the eggs. The nature of this advantage is not known.

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