# Extreme Temperatures Reduce Encapsulation of Insect Parasitoids in their Insect Hosts[1]

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*Summary.* Low (0°–4 °C) and high (40°–48 °C) temperatures to which two scales insects: *Saissetia coffeae* (Walker) and *Coccus hesperidum* L. (Homoptera: Coccidae) were subjected, before exposure to the encyrtid *Metaphycus* aff. *stanleyi* (Compere), reduced egg encapsulation of the parasitoid in the two hosts. Consequently the mass rearing of *M.* aff. *stanleyi* was greatly improved.

Soft scale insects (Homoptera: Coccidae) are pests[3] against which many biological control projects have been directed. Complete, substantial or partial success in such projects was attained in many countries, mainly by parasitic Hymenoptera[4].

One of three criteria used in measuring the suitability of an insect parasitoid to its insect host is the incidence of parasitoid egg encapsulation[5]. The capability of an indigenous host to encapsulate eggs of an alien parasitoid may prevent or detain (according to the degree of encapsulation) establishment of an introduced parasitoid in a new region. Encapsulation may thus adversely affect the efficacy of a parasitoid as a biological control agent. High encapsulation rates may also cause difficulties in mass propagation of parasitoids (i.e., the brown soft scale *Coccus hesperidum* L. and its parasitoids[6,7]). Many habitual parasitoids of insects have evolved devices which enable them to avoid the haemocytic reactions of their usual hosts[8]. Information on reducing the haemocytic reaction of an aphid[9], of Noctuid caterpillars[10] and beetle larvae[11], by changing diet composition, selected chemicals or starvation, respectively, is available. No similar data on Coccids have hitherto been published.

I report herein that extreme temperatures reduce egg encapsulation of a Hymenopterous parasitoid in two of its Coccid hosts, resulting in the vastly improved mass rearing of an important natural enemy.

The endoparasitoid *Metaphycus* aff. *stanleyi* (Compere) (Hymenoptera: Encyrtidae) was introduced into Israel from Kenya in early 1973[12] to control the Mediterranean black scale *Saissetia oleae* (Olivier), a pest of citrus and olive in Israel[3]. The parasitoid was mass propagated in our laboratory on *S. oleae*. Very small breedings were obtained from the hemispherical scale *Saissetia coffeae* (Walker), but no parasitoids emerged from *C. hesperidum*. Encapsulation of the parasitoid eggs by these two Coccids appeared to be the cause of the unsuccessful breedings (Table).

Detached potato sprouts were used for mass rearing the hemispherical scale, while squash fruits and oleander plants served as hosts for the brown soft scale. *M. aff. stanleyi*, obtained from the laboratory breeding on *S. oleae*, was used for all experiments. Scale hosts were subjected to extreme temperatures (Table), immediately exposed to parasitization, and then kept at 28 °C. After 7 days, it became possible to observe the developing parasitoid larvae, encapsulated eggs, or both together within a parasitized scale. Only data pertaining to parasitized scales hosting encapsulated eggs (and therefore preventing normal parasitoid development) are presented in the Table.

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Effect of extreme temperatures on the egg encapsulation of *Metaphycus* aff. *stanleyi* in two of its Coccid hosts

| Plant host | Scale host | Treatment before subjecting scale host to parasitoid | Number of parasitized scales | Scales with encapsulated eggs and without developing parasitoid (%) |
|---|---|---|---|---|
| Squash | *Coccus hesperidum* | None | 115 | 100 |
| | *Coccus hesperidum* | 24 h, 4 °C | 40 | 100 |
| | *Coccus hesperidum* | 24 h, 0 °C | 50 | 84.0 |
| | *Coccus hesperidum* | 48 h, 4 °C | 50 | 76.0 |
| | *Coccus hesperidum* | 48 h, 0 °C | 50 | 74.0 |
| Oleander | *Coccus hesperidum* | None | 212 | 100 |
| | *Coccus hesperidum* | 1 h, 48 °C | 50 | 48.0 |
| | *Coccus hesperidum* | 2 h, 46 °C | 65 | 47.2 |
| Squash | *Coccus hesperidum* | 24 h, 40 °C | 70 | 12.8 |
| Potato sprouts | *Saissetia coffeae* | None | 442 | 83.6 |
| | *Saissetia coffeae* | 3 h, 46 °C | 380 | 18.9 |
| | *Saissetia coffeae* | 5 h, 46 °C | 196 | 10.2 |
| | *Saissetia coffeae* | 24 h, 40 °C | 100 | 6.0 |

Extreme low temperatures reduced encapsulation in *C. hesperidum* reared on squash; developing parasitoids were detected in 16 to 24% of the parasitized scales. High temperatures had a greater effect on the reduction of encapsulation; thus, in *C. hesperidum* kept on detached oleander leaves, heat reduced the incidence of parasitized scales having encapsulated eggs to less than 50%, consequent upon which adult parasitoids (males and females) emerged. Good results of using high temperatures were attained with *S. coffeae* reared on potato sprouts, and with *C. hesperidum* reared on squash, the overall best treatment being 40 °C for 24 h before exposure to parasitoids. No encapsulated eggs were found in either of the parasitized scale nymphs subjected to this treatment, while only 8.2% of the young *S. coffeae* females and 7.6% of the young *C. hesperidum* females contained encapsulated eggs together with developing parasitoid larvae. Only 28.5% of the 'rubber' stage females of *S. coffeae* and 5.5% of the ovipositing females of *C. hesperidum* escaped the parasitoid's effect by encapsulating all the latter's eggs.

The health and vigour of the host are among several factors which affect the occurrence of an encapsulation response[11,13]. The extreme temperatures, to which the brown soft scale and the hemispherical scale were subjected before exposure to parasitoids, probably reduced encapsulation by weakening the scale hosts by a yet unknown mechanism. We are presently rearing *C. hesperidum* and *S. coffeae* as hosts for various parasitoids employed in current biological control projects, and the findings herein reported are facilitating the mass rearing of these parasitoids. A full account of this and related work will be published elsewhere.

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## Stable Lipid Peroxidation Products in Human Skin: Detection, Ultraviolet Light-Induced Increase, Pathogenic Importance

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*Summary.* Products of lipid peroxidation (malonaldehyde, Schiff-bases) were detected in human skin. These products were increased after UV-light exposition, on chronically sun-exposed areas as well as with advancing age. Malonaldehyde cross linked epidermal glucose-6-phosphate-dehydrogenase and diminished their activity.

It is not clear whether the damage to human skin caused by irradiation with UV-light is effected mainly by changes in the nucleic acids, or via a labilization of the cell membranes, particularly the lysosomal membranes. As far as the latter aspect is concerned, lipid peroxidation provides a suggestive conception by means of which the sunburn, the aging of the skin and probably a number of pathological conditions, such as photosensitization and light provocation of skin diseases, can be explained. After irradiation with UV-light, free radicals appear in the skin[2] and lysosomal hydrolases are released[3]. We were able to demonstrate in human surface lipids and in the skin, the formation of lipid peroxides and also of substances which develop in the course of destructive free radical reactions and are positive in the thiobarbituric acid test (mainly malonaldehyde)[4–6]. Minimal concentrations of these products inhibit cell respiration[7]. But because of their high reactivity, these products are difficult to measure, and it could therefore only indirectly be inferred that physiological doses of UV-light may cause harmful lipid peroxidation in the skin[8].

The stable final products of lipid peroxidation to be found in the internal organs have been thoroughly characterized[9]. These are, above all, 1-amino-3-imino-propenes (Schiff base products) which are formed by a reaction of malonaldehyde with amino groups and can hardly be split by enzymes. These Schiff base products can be identified by means of their typical spectroscopic data.

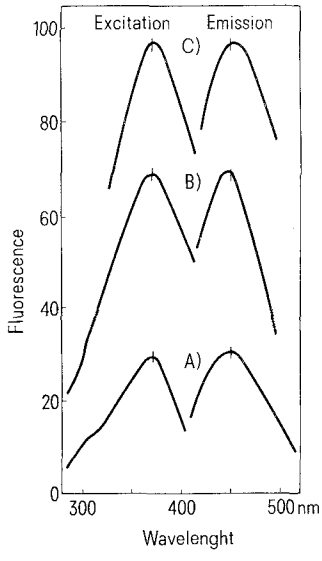


Fig. 1. Fluorescence spectrum of the chloroform/methanol extract of the human epidermis. A) non-irradiated abdominal epidermis; B) after irradiation with 10 MED of UV-light; C) after addition of malonaldehyde. 200 mg of epidermis were homogenized in the presence of 2 *mM* of EDTA by means of the TP 18/2 Ultra Turrax (Jahnke & Kunkel, Stauffen im Breisgau). Fluorescence in arbitrary units.

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