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THE paper of mine referred to pointed out that it was not yet possible to say whether the two effects discussed would account for the whole of the differences between the slopes of probit–log-dose lines for houseflies resistant and susceptible to DDT. Additional genetic heterogeneity in strains of resistant flies could, it seems, operate side by side with the other two effects in reducing the slopes of the lines; it might also intensify the second of the other two effects. When applied to resistant flies with DDT, *bis*(*p*-chlorophenyl) methyl carbinol synergizes the action of the DDT by depressing its enzymatic detoxification[1,2], and at the same time increases the slope of the line relating probit mortality to the log-dose of DDT[2]; this strongly suggests that the detoxification mechanism is directly concerned in depressing the slope of the line for DDT without synergist, as discussed in my paper.

P. S. HEWLETT

Pest Infestation Laboratory,
Slough. June 2.

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Ecology of the Louse *Lepidophthirus macrorhini* Enderlein 1904 on the Elephant Seal *Mirounga leonina* (L.)

THE Australian National Antarctic Research Expeditions have maintained a station since 1948 on Macquarie Island, which is situated in the South Pacific, 54° 30′ S., 159° E. Through the courtesy of the director, Mr. P. G. Law, a visit was paid to the island in December 1957. This afforded an opportunity to obtain some information on the ecology of the louse *Lepidophthirus macrorhini* Enderlein 1904 which infests the elephant seal, *Mirounga leonina* (L.). Living lice were brought back to the laboratory for study by keeping infested hind flippers in a refrigerator.

Unlike other species of lice, *L. macrorhini* forces its way into the skin and creates a burrow under the stratum corneum of the epidermis. Single nymphs or adults were found in these burrows, usually with the posterior tip of the abdomen visible. Occasionally the burrows were half an inch in length. In addition, a copulating male and female were found in one burrow, and in two others, each inhabited by a single female, an egg was found. When the elephant seal moults the stratum corneum of the epidermis is shed intact with hairs attached. Although some lice are lost at this time many remain, since only the roof of the burrow which they inhabit is removed.

Pup seals were found to be the most heavily infested and the region of densest infestation was the hind flippers. From examinations made while the pups slept on the beach, it appeared that all were infested with lice.

The skin temperature of elephant seal pups and bulls (2–7 years old) resting on the beach was found to be between 27° C. and 34° C. Two pups were driven into the sea, after their skin temperatures had been taken, and restrained in 3 ft. of water by a lassoo around the neck. On entering the water their skin temperatures dropped to between 10° C. and 12·5° C., that is, a few degrees above the temperature of the sea, 8·5° C. These observations agree with those of Irving and Hart[1] on the harbour seal *Phoca vitulina* and the harp seal *Phoca groenlandica*.

In the laboratory it was found that the lice became inactive either in air or water at 10° C. When placed in moist air at 29° C., after an exposure to low temperatures for several days, normal activity did not return until after a few hours. Their oxygen consumption in air at 10° C., measured by a Warburg apparatus, dropped to at least a fifteenth of that at 33° C., and they survived a five-day immersion in sea-water at 10° C. which was only about 7 per cent saturated with oxygen (0·53 ml. oxygen per litre). Thus, at low temperature their metabolic rate was considerably reduced. It therefore appears likely that the skin temperature of the host is the primary factor which influences the growth of a population of these lice and that the main increase occurs when the skin temperature is highest, namely, when the elephant seal is on land. As a consequence, the age group which spends the longest continuous period ashore might be expected to become the most heavily infested. Pups comprised this group at Macquarie Island in December 1957.

It has been suggested that when the seal is at sea the lice obtain oxygen from a film of air trapped around the seal's body[2]. Examination of pups restrained in the sea showed that no film of air was trapped around the body, nor was one seen when the hind-flippers of pups, anæsthetized with chloral hydrate, were immersed in sea-water. Numerous small bubbles were held at the base of the hairs, in the orifice of the follicle, but were easily removed by gently running the fingers over the body. However, air bubbles which were sometimes retained in the burrows were not so easily removed.

Another suggestion has been that oxygen is obtained from air bubbles or from a film of air trapped between the characteristic setæ and scales found on this type of louse[3]. When lice were immersed in sea-water, a small bubble of air was occasionally attached to a seta but not necessarily to one of those surrounding the spiracles. More frequently, no bubbles were present and, as the cuticle of the louse was easily wetted, a film of air was not held around the insect. When completely wetted and immersed in fresh sea-water at about 10° C. the lice remained alive for more than two weeks.

As the cuticle is thin and transparent a microscopical examination of living lice in sea-water was made with transmitted light. Only abdominal spiracles were seen, with trachea leading from the anterior of the abdominal tracheal trunks to each of the limbs and the head. It was found that when a spiracular opening was surrounded by an air bubble regular contractions of the atrium commenced. When the bubble was removed these contractions ceased within a few hours. During this period no water was seen to enter the atrium, which was filled with a bubble of gas, some of which was occasionally expelled. As no other structure was seen which could have a respiratory function, it would appear that oxygen is obtained from sea-water by diffusion through the cuticle.

There appears to be no reason to doubt that sufficient oxygen can be absorbed through the cuticle. At the greatly reduced metabolic rate associated with the lowered temperature in sea-water, little oxygen would be required and the surface waters in the sub-Antarctic are usually more than 80 per cent saturated with it[4]. Moreover, the surface area of the cuticle of these lice is greatly increased by deep clefts in the intersegmental regions of the thorax and abdomen.

One function of the setæ, which in the living insect stand erect from the cuticle, is probably to maintain a space between the cuticle of the louse and the walls of the burrow in the seal's skin. This would enable a film of water to be maintained around the insect through which gaseous diffusion can take place. Also, any air bubble trapped in the burrow around the louse would be maintained and act as a gill.

It is hoped to continue these investigations and the co-operation of any biologist who intends to visit the sub-Antarctic would be most welcome.

M. D. Murray

Division of Animal Health and Production,
Commonwealth Scientific and
Industrial Research Organization,
McMaster Laboratory,
Parramatta Road,
Glebe, New South Wales.
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