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by G.M. ROSS

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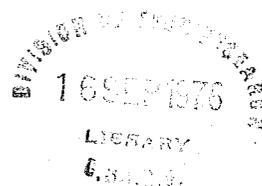

Division of Food Research

P.O. Box 52,
North Ryde,
N.S.W. 2113.

Commonwealth Scientific and Industrial Research Organization, Australia

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WHITE SPOT IN PRAWNS

by G.M. Ross

During the 1974 banana prawn season in the Gulf of Carpentaria, the incidence of a condition termed "white spot" was of concern to prawn processors in that area. Affected prawns were not acceptable for export because of their defective appearance. There are several possible causes of "white spot" which are discussed below.

The white spot problem appeared suddenly during the 1974 banana prawn season in Northern Australia, and had a much lower incidence during the following season. The exact nature of white spot and the reasons for its sudden appearance and disappearance still remain a mystery. Reports of the condition from sources in the Gulf of Carpentaria were sketchy and contradictory. There appeared to be several distinctly different symptoms which were all reported as white spot. Preliminary investigations into white spot began in 1974, and a research program supported by a grant from the Fishing Industry Research Trust Account was begun in July 1975.

There are possibly three different conditions which could be described as white spot:

- (i) White discoloration of the skin and surface layers of flesh only, most probably due to biochemical breakdown of the flesh due to spoilage. This discoloration may also be due to the overuse of chemical preservatives which can have a bleaching effect. Normal post-mortem changes in prawns cause the flesh to change from translucent to slightly whitish-opaque, becoming more pronounced as spoilage takes place.
- (ii) White discoloration of the shell in the form of encrusted patches. The cause remains unknown but may be of a bacterial or fungal nature or due to some other external parasite (see fig. 1).
- (iii) White discoloration throughout the flesh with the shell of normal appearance. The cause remains unknown but may be the result of infections by microsporidians and/or spontaneous muscle necrosis. The characteristics of this form of white spot are consistent with 'milk' or 'cotton' prawns which are known to be caused by microsporidial infection (see fig. 2.). Further descriptions of microsporidiosis and muscle necrosis are given below.

Microsporidiosis (see fig. 2)

Most investigations into microsporidial infections of prawns have taken place overseas, and have centred on species of prawns (shrimp) of commercial importance to the Southern Atlantic States of North America and the Gulf of Mexico. Microsporidians are typically parasites of arthropods and fish but may be found in several other major animal groups. Crustacea are particularly susceptible hosts.

In prawns, microsporidial infections cause the tissue to take on a chalky white appearance and have a 'cottony' texture lacking the firmness of normal muscle. Infected prawns are known as 'milk' or 'cotton' prawns. The infection may occur in the musculature or in particular organs or tissues, depending on the species of microsporidian involved. Microsporidians

occur in the tissue in the form of microscopic spores. These spores may occur individually or distinctly grouped, each group being surrounded by a membrane to form a sporant. Different species of microsporidian can be identified by the number of spores per sporant, size and shape of the spores and length of the polar filament of each spore.

Four different species of microsporidian have been described from prawns in studies overseas (see references); one from each of the genera Nosema (spores individual) and Pleistophora (more than eight spores per sporant), and two from the genus Thelohania (eight spores per sporant).

Three of these species, Nosema nelsoni, Pleistophora sp. and Thelohania duorara infect the striated muscles, and infections are usually found in the tail of the prawn. In N. nelsoni and T. duorara infections, the spores surround the muscle fibres and may eventually replace them. With Pleistophora sp. infections the spores usually replace the striated muscle fibre completely rather than surrounding it. Infections of these three species have the typical 'cotton' prawn characteristics and may be grossly indistinguishable from each other.

Pleistophora sp. infections sometimes result in a blue-black pigmentation of the chromatophores in the host prawn. N. nelsoni infections may also show this pigmentation but it is most common with Pleistophora sp. infections, which may also be found in the heart, hepatopancreas, gills and stomach. T. duorara may sometimes infect the heart, gonads and nerve tissues.

A fourth species, Thelohania penaei causes an infection which is easily distinguished from those resulting from the above three species. The infection has the same cottony appearance but always occurs in the head and along the dorsal midline (back) of the infected prawn. This species infects the smooth muscles of the blood vessels, gut and the germinal tissue of the gonads, resulting in castration.

Prawns can be infected with more than one species of microsporidian. There are no known treatments for prawns infected with any of the micro-

sporidians. The complete life cycle of microsporidians in prawns is not yet known but it is most probable that transmission results from ingestion of spores or of intermediate hosts which have fed on the spores. The effect of the disease is to weaken and gradually debilitate the host. Severely affected prawns are more likely to be taken by predators and are much less resistant to stress.

In overseas studies, microsporidians have been identified from Pink shrimp (Penaeus duorarum), White shrimp (P. setiferus) and Brown shrimp (P. aztecus). Reported infection rates range from 1.9 percent for P. duorarum to 16 per cent for P. aztecus. However, as stated in the literature, these figures do not represent the true incidence of infection because the early and light infections cannot be detected with the unaided eye and may only be detected during dissection under a microscope or during examination of histological sections.

Commercially, cotton prawns are unacceptable for appearance reasons alone. The disease is thought to be harmless to humans, although no studies into its effect on the edibility of prawns has been carried out. Although no surveys into microsporidial infections of prawns have been carried out in Australia, the disease has been known to occur in those species of prawns which are found in Australian waters.

Muscle Necrosis (see fig. 3).

This condition occurs when prawns are subjected to stressful conditions such as overcrowding, decreased oxygen content of water, high water temperatures and sudden salinity changes. White opaque patches develop in the flesh in the abdominal segments, rapidly expanding all along the abdomen. Death usually results in about twenty-four hours. This white discoloration is very similar to that caused by microsporidiosis, the two conditions being easily confused. Necrosis can occur if prawns are subjected to excessive stress during trawling; for example if catch rates are very high and trawling is continued for a long period. Prawns which are actually killed in the nets

during trawling may appear slightly white due to normal post-mortem changes in the flesh, but these changes are distinct from those of necrosis or microsporidiosis.

White Spot in Australian Prawns

A high incidence of white spot in Australian prawns occurred during the 1974 banana prawn season, during which landings of banana prawns were exceptionally large. Under such conditions the chance of spoilage is increased, and possibly the use of chemical preservatives is also greater, with prawns being held longer before processing. Increased population density in schools of banana prawns may increase the rate of infection by parasites, and possibly even result in the onset of necrosis, leading to a "white spot" condition in some of the prawns caught. Investigations by officers of the Australian Department of Agriculture suggested that microsporidiosis was responsible for the 1974 outbreak of white spot, but some doubts were expressed by others engaged in the prawn industry that microsporidiosis was the sole cause of the problem.

In 1975 the author undertook a field trip to prawn fishing areas in Northern Australia to investigate the white spot problem. No evidence of white spot was found in prawns during this trip, which included visits to a number of prawn processing companies, scientific and governmental installations. A number of conflicting reports of the 1974 white spot problem were obtained from those concerned with the prawn processing industry.

As there are several conditions which can give rise to a "white spot" condition in prawns, it is evident that in the event of any future outbreak of white spot, detailed laboratory and pathological examinations of affected prawns from a number of centres should be undertaken to ascertain the exact nature of the condition.

Acknowledgments.

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- Figure 1. White spot on a banana prawn showing discolouration of the shell in the form of encrusted patches.
- Figure 2. Uncooked banana prawn tails showing normal translucent flesh on left and the opaque appearance due to microsporidial disease in the two other samples.
- Figure 3. Muscle necrosis in live prawns is evident in the prawn on the right.



FIGURE 1.



FIGURE 2.

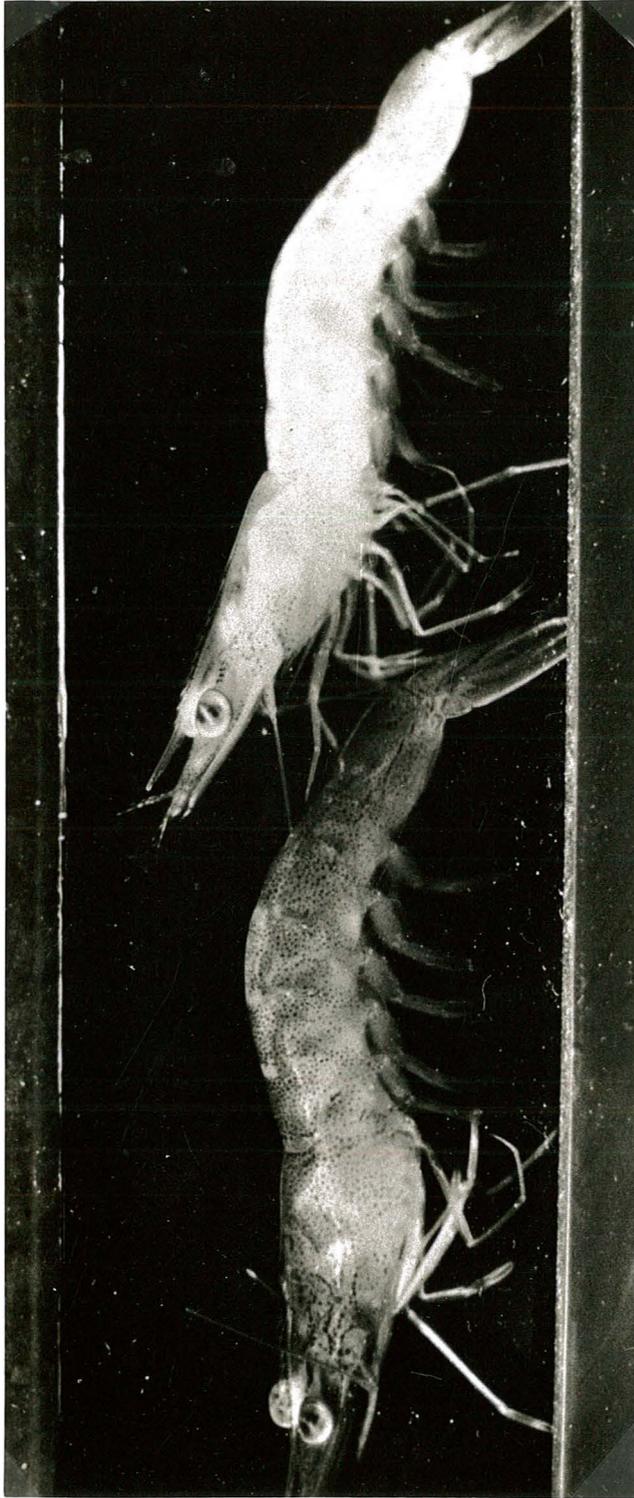


FIGURE 3.