hatchery-reared 1+ smolts. There are some grounds for believing that thyroid treatment could improve survival of smolts during the period of osmotic stress when they first enter tidal water[3,4]. This may apply more particularly to hatchery-reared smolts which necessarily have been subjected to some handling.

In this small experiment there was an increase of 80 per cent in the production of 1+ smolts for an increase of not more than 25 per cent in the feeding costs for the first year. However, had these 400 fish not become 1+ smolts, the cost of keeping them for a further full year would have been considerably more than the cost of thyroid material used in transforming them into 1+ smolts. The comparison in other districts may be even more favourable than in County Mayo, where the cost of thyroid material is high, relative to that of low-grade liver. Experimental work on lowered dosage-rates is planned for the coming season.

D. J. Piggins

Farran Laboratory, Newport,
Co. Mayo, Eire.

[1] Barrington, E. J. W., Barron, N., and Piggins, D. J., *Gen. and Comp. Endocrinol.*, **1**, 170 (1961).
[2] Piggins, D. J., Thesis, Univ. Nottingham (1958).
[3] Smith, D. C. W., *Mem. Soc. Endocrinol.*, **5**, 83 (1955).
[4] Fontaine, M., and Baraduc, M. M., *Bull. Franc. Pisc.*, **176**, 89 (1955).

Culture of *Spinellus*

Moulds of the genus *Spinellus* of the Mucorales are generally regarded as being obligate parasites of agarics, particularly those belonging to the genus *Mycena*. Recently, Ellis and Hesseltine[1] reported that they had grown a species of *Spinellus* in pure culture; they noted the difficulty of making the spores germinate, and demonstrated the necessity for a relatively low temperature (below 20° C.) for growth.

Last autumn, a culture of *Spinellus* sp. was obtained from a parasitized fruit-body of *Mycena galopus*. The isolation was made by placing spores on a medium, later referred to as the 'basal medium', containing glucose, salts and yeast extract. A rapidly growing mycelium developed, producing numerous sporangia resembling those on the parasitized agaric. The mould has since been maintained in culture, using mycelium for inoculation as it proved to be very difficult to make the spores germinate. Various natural media have been tried, as well as the basal medium, and 5 per cent corn-meal agar also gave good growth, although others seemed less suitable.

This isolate, like that obtained by Ellis and Hesseltine, was extremely sensitive to temperature. No growth was obtained with cultures kept above 23° C. and the optimum seemed to be about 20° C. At this and lower temperatures numerous sporangia were produced, with sporangiophores up to about 1·5 cm. tall. Cultures incubated at 22°–23° C. produced fewer sporangia, containing fewer spores, and with much shorter sporangiophores.

The spores from cultures grown at a low temperature (13° C. was used in these experiments) were elongated in form, with a ratio of length/breadth of about 3:1. Cultures grown at 22·5° C. produced relatively shorter and broader spores with a length/breadth ratio of about 2:1. The actual size of the spores varied somewhat according to the medium but the relative shapes were the same on different media and seemed to depend on the temperature at which the culture had been grown.

Various attempts have been made to determine the conditions necessary for spore germination and some relevant observations have been made. Spores germinate readily in contact with the fruit-body of a suitable agaric but only rarely on culture media. Some of the broader spores produced by cultures grown at 22·5° C. on corn-meal agar or basal medium germinated in water or nutrient solutions or on agar media, whereas spores produced by cultures grown at 13° C. did not germinate under these conditions.

Mycelium which developed from germinated spores produced, when grown at 13° C., the types of sporangia and spores characteristic for that temperature. There is thus no permanent change induced by growth at 22·5° C., but the spores produced differ in their shape and ability to germinate from those produced at lower temperatures. This presumably explains the successful initial isolation of *Spinellus*, as the spores used came from sporangia which had developed in the laboratory, at a temperature which was probably suitable for the production of the broader type of spore and the isolate could have resulted from the germination of one or more of these. Previous unsuccessful attempts had been made to isolate from sporangia developed in the field, and the spores, presumably of the narrower type, would not germinate on culture media.

Apart from bringing them into contact with a suitable agaric fruit-body, one other way has been found of obtaining some germination of spores at lower temperatures. This was to place them in association with various unidentified bacteria, which were first acquired as contaminants. The substance which stimulates germination appeared to diffuse through 'Cellophane' but has not so far been demonstrated in a Seitz filtrate of liquid cultures of the bacteria.

A more detailed account of these investigations will be published later and it is also hoped to study further the factors necessary for spore germination in *Spinellus* and other aspects of its relationship with its hosts.

Pauline Watson

Department of Botany,
Durham Colleges in the
University of Durham.

[1] Ellis, J. J., and Hesseltine, C. W., *Nature*, **193**, 699 (1962).

ENTOMOLOGY

Identification of Iso-Amyl Acetate as an Active Component in the Sting Pheromone of the Honey Bee

The sting of the honey bee (*Apis mellifera* L.) carries volatile substances which incite bees to aggression. This was first demonstrated by Huber[1], who elicited attacks by the guard bees when he placed freshly excised stings or the odour of stings near the hive entrance. Free[2] found that cotton balls containing stings were more frequently stung than control balls.

When not in action, the sting is retracted entirely within the sting chamber of the bee's abdomen. However, in the event of attack, the sting is quickly protruded and thrust into the enemy. The worker bee is usually unable to withdraw her barbed sting from the skin of vertebrates. Thus, the sting with its motor apparatus and glands is torn from the bee along anatomically predetermined breaking lines.