Resistance to the Potato-Root Eelworm

SINCE 1941, I have been testing South American tuber-forming *Solanum* species for immunity and resistance to the potato-root eelworm. The material, kindly supplied by Dr. P. S. Hudson and Dr. J. G. Hawkes, of the Commonwealth Bureau of Plant Breeding and Genetics, Cambridge, forms part of the Commonwealth Potato Collection[1]. An interim report on this work was published in 1945[2], when about fifty forms had been examined. Since then, however, owing to a grant from the Commonwealth Agricultural Bureaux, it has been possible to increase the scale of the tests, and about seven hundred forms have now been examined.

The plants are grown in duplicate, in pots of infected soil sunk in the field. At the end of the season, the roots are examined in the field for eelworm cysts. Only in the case of a single type has this examination failed to reveal cysts; in 1945, no cysts were found on either of the extensive root systems of two well-grown specimens of *S. Ballsii*. The same result was obtained with two plants of the same species tested in 1946; however, while microscopic examination of roots stained with acid fuchsin had revealed no larvæ in the roots of the 1945 specimens, larvæ were found in 1946. More material was available in 1947 and tests were carried out on eleven plants. Again no cysts were found in the field; but on this occasion microscopic examination revealed the presence of a few very small cysts on the roots of some of the plants.

I have already referred to the difficulty of assessing relative resistance[2], and my subsequent work has emphasized this[3]. Nevertheless, the conclusion seems amply justified that, whereas *S. Ballsii* is not immune, it does appear to be exceptionally resistant. Mai and Lownsbery, of Cornell, have kindly allowed me to state that their preliminary trials with this form tend to support this finding.

C. ELLENBY

Department of Zoology,
King's College,
Newcastle-upon-Tyne.
June 4.

[1] Hawkes, J. G., Imp. Bur. Plant Breed. and Genetics Memorandum (Cambridge, 1944).
[2] Ellenby, C., *Emp. J. Exper. Agric.*, **13**, 158 (1945).
[3] Ellenby, C., *Ann. App. Biol.*, **33**, 433 (1946).

'Weeding' in Fish-Farming

THE papers by Dr. C. F. Hickling in *Nature* of May 15 and by Messrs. L. H. N. Cooper and G. A. Steven in *Nature* of April 24 are related. In particular is this so in the case of 'weeding'.

In the Far East, fish culture by the peasants is traditional, either in inland waters or in enclosed areas 'bunded off' from the sea. I will give two examples of how 'weeding' is dealt with, at the peasant level for these people have been faced for countless generations with the same problems that Messrs. Cooper and Steven discuss at some length in their article.

In the brackish water ponds of Java, where *Chanos chanos* (Forsk.) is cultivated, there are growths of *Zostera* and related genera, *Ruppia*, *Chondrocrispus* and other algæ which are not eaten by the fish. The fish are harvested by emptying the ponds and netting from a sump. I have seen the peasants at Soemenep in Madura digging the plants and algæ into the pond as green compost prior to refilling with water for the next crop of fish. In our small fish culture station at Tapah in Malaya we are carrying this a stage further, literally by composting the weeds, together with a considerable quantity of incidental molluscs, worms, crustaceans and the eggs of Amphibia. This compost is being permitted to rot on the sides of the ponds and is ultimately returned to the ponds as manure. Critical analyses of the results will be published elsewhere.

In the Chinese-type pond, where the main species cultivated are *Ctenopharyngodon idellus* (Cuv. and Val.), *Hypophthalmichthys molitrix* (Cuv. and Val.) and *Arristychthys nobilis* (Richardson), the 'weeding' and composting take a different form. The floral population of the ponds is normally a rich phytoplankton. On this, a varied crustacean plankton fauna and small cyprinid fish fauna thrive, thus perpetually reducing the essential productivity of the pond so far as the cultivated fish are concerned. The Chinese peasant realizes this, and in many ponds I have seen them seine-netting their pond with a fine-mesh net twice a week in order to catch these incidental organisms. These are then put into a 'mash' which is fed to ducks and pigs living in pens on the side of the pond. The phosphates and nitrates are then returned to the pond by sweeping the pig- and duck-droppings back. The Chinese peasant tests the nutrient salt concentration of the pond by judging the density of the phytoplankton in the water, into which he will throw a broken piece of white crockery, and by taking a mouthful of the water and gargling with it to ensure that the water is 'sweet and fat'.

An extension of this principle of 'weeding' as applied to the sea has come to light as the result of preliminary studies on the catches of the small-mesh nets used by the fishermen in the Straits of Malacca between peninsular Malaya and Sumatra. Here we have a constantly moving body of water which is almost totally surrounded by land on three sides. There is a perpetual run-off from the rich volcanic mountains of Sumatra and the less rich mountains of Malaya. The bulk of the food fish of Malaya are pelagic and pelagic feeders; but the fish population also contains a mass of small fish which never grows to more than three inches in length. They consist largely of Percomorphs. On the west coast of Malaya alone about twenty thousand tons per annum of these small fish are taken by specially designed fishing gear with small meshes, and are specifically fed to pigs and ducks or used as agricultural fertilizer. Throughout the year, only 7 per cent of the catch is the young of fish which when adult are used as human food. As the result of studies by this Department, it seems clear that the taking of this mass of small fish from the sea perpetually is a form of 'weeding' which permits those species which are of economic value as human food the more readily to grow and proliferate. Consequently, under these conditions, a rational employment of small-meshed nets is encouraged, as it promotes proper conservation of our fish resources and plays an important part in the ultimate production of protein food.

D. W. LE MARE

Fisheries Department,
Federation of Malaya and Singapore,
Penang.
July 21.