The Biological Method of Pest Control.

By Dr. A. D. IMMS, F.R.S.

PHYSICO-CHEMICAL methods of controlling noxious insects present the advantage that they generally check their activities sufficiently to enable the grower to produce a reasonably satisfactory crop. They are, however, at the best only palliatives the application of which entails an increase in costs of crop production. Furthermore, they usually need to be repeated year after year, because they fail to reduce a given pest population to a low enough level, in any one season, to prevent its subsequent recurrence or increase. For the most part, however, they are the best general control measures so far devised. Notwithstanding this fact, there are many insect pests that are not amenable to any method of artificial control. In attempting repression in such cases other means have to be sought, and a possible method often presents itself in the utilisation of the natural parasitic (and predaceous) enemies of specific pests. This procedure has come to be known as biological control, and it has produced the most encouraging results where pests have become accidentally introduced into lands they did not previously inhabit. Their natural enemies being left behind, such pests, unchecked by biological agents of this kind, quickly gain the ascendancy.

Biological control aims at restoring, so far as possible, the missing parasite factor. It has to be remembered that some of these introduced pests are numbered among the worst of the world's enemies of food supplies. Artificial control measures have, in many cases, proved impracticable and their application has involved vast expenditure of money to no real advantage. Biological control has consequently been resorted to as a sounder and, in the end, a less expensive measure. In a number of cases highly satisfactory results have been achieved, but the method is too immature to forecast its ultimate possibilities and its limitations with any certainty. Every year, however, brings fresh records of promising results, but it cannot be regarded as a universal panacea as the misinformed are too prone to view it.

The first essential for success is technical knowledge of the behaviour of specific parasites in relation to their hosts, from every point of view. Such knowledge forms the guiding principle in biological control work: it enables the most suitable parasites to be selected and the chances of failure or mistakes to be reduced. The collection of biological data of this kind is the work of highly trained entomologists, who must have the use of the equipment and technique pertaining to a subject which has its special requirements. They must also be field naturalists, capable of studying the ecology of parasites in different countries in relation to different conditions. A further necessity is experience in the transportation of delicate insects over many thousands of miles of land and sea, where drastic climatic changes may be encountered *en route*. At the destinations of these

living cargoes fully trained specialists are likewise necessary. Familiarity with the handling, breeding, and liberation of parasites under favourable conditions can alone prevent loss of valuable material and wasted effort.

The more trade is fostered within the British Empire, the greater are the chances of the spread of pests from one land to another. The most efficient quarantine has so far failed to preclude this transfer taking place at one time or another. As already mentioned, it is largely against such introduced enemies that biological control offers promise of success. The basic food plants of Europe are grown in most of the Empire, and, consequently, parasites of the enemies of such plants have mainly to be sought out in Europe. These facts, taken in conjunction with the growing importance and demand for biological measures, have received timely recognition from the Empire Marketing Board. By providing financial aid it has enabled the Imperial Institute of Entomology to establish a special laboratory for the furtherance of the method at Farnham Royal, Bucks. A grant of £15,000 for capital expenditure led to the foundation, in 1927, of what is certainly the most adequate laboratory of its kind in the world. An annual maintenance grant for five years has led to its rapid development. That the creation of this laboratory has met a real need in Empire entomology is borne out by the number of requests for assistance that have already come in from various dominions and colonies. Its establishment renders the British Empire no longer so dependent upon the good-will of the United States for assistance in this direction. The Federal Government at Washington has fully realised the value of biological control and now expends more than £100,000 per annum on work of this character.

A general account of the aims and underlying principles of biological control has been recently published by the Empire Marketing Board in a *Bulletin*,* under the authorship of Dr. W. R. Thompson, the superintendent of the Farnham Royal Laboratory. In the same publication he gives a full and most interesting description of the organisation, facilities, and progress of the work of the Laboratory. During the brief existence of the latter more than 73 consignments of beneficial insects, containing over 285,000 living individuals, have been sent out to where demands came. These consignments represent about 24 species attacking about 17 different kinds of hosts. Also about 29,000 examples of Chrysomelid beetles have been shipped to Australia with the view of attempting to control St. John's wort by the aid of their phytophagous propensities.

This *Bulletin* is to be commended to all entomologists and to anyone interested in the practical applications of biology. In one respect it is unique,

* "The Biological Control of Insect and Plant Pests. A Report on the Organisation and Progress of the Work of the Farnham House Laboratory." Pp. 124+7 pl. E.M.B. 29. By Dr. W. R. Thompson. (London: His Majesty's Stationery Office, 1930.) 1s. net.

in that it explains the whole procedure of biological control and its underlying principles. It will obviously prove most helpful to have such information gathered together in so convenient and authoritative a form. There may be differences of opinion here and there on the theoretical side of the subject, but only one criticism of any

importance need be raised. On page 25 an erroneous impression is conveyed with reference to the outstanding work of the Hawaiian entomologists and their methods. Probably in no part of the world has greater skill or care been exercised in biological control than in these Pacific Islands, and the successes achieved have been truly remarkable.

Radio Telephony at the Rugby Station.

PROGRESS is being made rapidly in the development of the Post Office radio transmitting station at Rugby. On the invitation of Sir Thomas Purves, Engineer-in-Chief to the Post Office, who is also president of the Institution of Electrical Engineers, many of the members of the Council of the Institution visited this station on Sept. 30 and were much impressed by the new developments.

In 1927, the first international telephone service designed for connexion with the ordinary telephone subscribers' system was started with one channel between the United States and England. There are now four channels and preparations are nearing completion for a fifth channel. Two of these channels use long waves and three short waves. The short wave systems are cheaper to erect, but they are not so trustworthy as the long waves. For the latter system, there are twelve masts, each 820 feet high, supporting the antennæ. The single side band telephone transmitter G.B.T. is the most powerful radio telephone transmitter in the world. Its wave-length is 5000 metres (60 kilocycles) and its output is equivalent to a broadcast transmitter of 1000 kilowatts. It is wonderful to notice how a current of several hundred amperes is apparently transmitted directly into the ether.

There are now a large number of smaller towers arranged in groups called 'arrays', the heights of which vary from 120 to 180 feet. These towers are used to support the antennæ for the short wave beam telephone services. The arrays are so arranged that the beam is projected in the direction of the great circle joining the transmitting to the receiving station. Three different frequencies are used, depending on the time of day the message is sent, and the message sometimes travels one way round this great circle and sometimes the other way.

The G.B.R. telegraph transmitter is the most powerful one in the world and works at 600 kilowatts and 16 kilocycles. The ninth harmonic of a tuning fork which oscillates at 1777.7 cycles is used to tune the circuit. In the final amplifier stages of G.B.R. each panel contains eighteen cooled anode valves.

By combining both short wave and long wave

systems, the Post Office can now provide an effective service to America over the full twenty-four hours. It is not considered possible to operate long wave systems to greater distances than from England to North America. The solution of the problem of providing communication with the Dominions has been obtained by the use of short wave transmission.

In order to prevent unauthorised persons from 'listening in' to the private telephone messages which are now being sent almost continuously, a method has been devised of making the speech as transmitted quite incoherent to the would-be listener. The component parts of the speech are 'scrambled', that is, they are split up into portions by an electrical device and transmitted in this state, being finally rearranged in their correct form at the distant end. Demonstrations were given to the visitors, through the medium of a loud speaker, of the London side of conversations with New York through the long wave channel. The scrambled speech sounded absolutely meaningless. A somewhat different system of scrambling is adopted in the short wave system. In this case the frequencies of the various sounds are inverted, the high frequency sounds becoming low frequency and vice versa. The sounds produced by the waves in the intermediate stages remind one of barking dogs or crowing cocks.

The Rugby station is used for the ship and shore telephone service. The messages to the *Majestic*, the *Olympic*, the *Leviathan*, and other vessels, are sent out from here.

The electric power required to work the station is obtained from the system of the Leicestershire and Warwickshire Power Company by means of two underground cables, each capable of taking the full load of the station. The cables can be connected to either the Warwick or Hinckley power stations, so that the risk of a failure of the power supply is almost negligible. Short wave services to Australia, South Africa, Canada, India, and the Argentine are either complete or nearing completion. As the site covers 900 acres, there is plenty of room for extension.

Obituary.

PROF. W. D. MATTHEW, F.R.S.

PALÆONTOLOGISTS, zoologists, and geologists mourn the loss of Dr. William Diller Matthew, professor of palæontology in the University of California, who died on Sept. 24, aged fifty-nine years. For thirty years he shared the charge of the fossil vertebrates in the American Museum of Natural

History, New York, and added greatly to the collection by his own discoveries in the western States. In 1927 he was appointed to the professorship at Berkeley, where he looked forward to extending the palæontological museum of the University of California by renewed activity in collecting fossils on the Pacific border of the American continent.