Control of West Indian Insect Pests.

THE reduction of insect damage in all parts of the British Empire is a problem of primary importance. Adequate and reliable physico-chemical methods are available, yet in many parts of the world their cost, or the conditions governing their application, render them essentially unsuitable. Some other avenue of approach has to be opened up in these circumstances, and a method which shows evident promise is the practical utilisation of the parasitic and predaceous enemies of pests, or, in other words, biological control. In 1928, Dr. J. G. Myers, of the Imperial Institute of Entomology, was commissioned to devote two years' study to the possibilities afforded by biological methods of control in respect to the main insect pests of agriculture in the British colonies of tropical America. A preliminary report by Dr. Myers on his investigations has recently been published by the Empire Marketing Board.* In this report he discusses the main geographical, topographical, meteorological, biological, and agricultural conditions upon which the distribution and prevalence of insect pests presumably depend. At the same time there is reason to believe that such factors have a very direct bearing upon the prospects of applying biological control methods.

In carrying out his exploratory mission, Dr. Myers has visited most of the West Indian Islands and also parts of the mainland of South America. Notwithstanding the extensive area covered in these travels, he has been successful in assembling a large amount of practical information. Since sugar-cane is the most important crop in the British West Indies, the pests affecting it, naturally, received the most attention. The most important of these latter, in the region as a whole, is the small moth-borer (*Diatraea* sp.). While this insect has numerous parasites, only two appear to be reasonably efficient. The most valuable of these seems to be *Lixophaga*, which has accordingly been introduced into Barbados and Antigua. As regards the notorious cane-frog hopper of Trinidad, which still remains a pest of the first rank, no effective parasite has yet been discovered, though the possibility of its being found in the mainland remains for the future. The large moth-borer of cane (*Castnia licoides*) is now serious only in Trinidad; it is controlled by flooding the fields in British Guiana. Since it is increasing in Trinidad, an effective parasite is greatly needed. While no parasites are as yet known,

the discovery of the original plant-host of this insect by Mrs. Myers is held to render the search more likely to prove successful. The cane root-borer (*Diaprepes abbreviatus*) is likewise a very serious pest in Barbados. The discovery of an effective egg-parasite of two allied species in Haiti and Montserrat has rendered the problem more hopeful, and its introduction into Barbados is being arranged for.

In addition to sugar-cane, the insect pests and their parasites of cacao, cotton, mahogany, banana, coffee, and so on, also come under consideration. In these connexions it needs to be pointed out that, for several of the pests, little hope is expressed that suitable parasitic enemies will be found within the confines of the West Indies or the adjacent mainland. Certain of the injurious species of insects are Old World pests which have become accidentally introduced, without their natural parasites or predators, into the West Indies. There are other cases in which the same pest, or closely allied species, is much more effectively parasitised in Africa or the Orient than in tropical America. Taking facts of this kind into account, the possibility of introducing suitable parasites into the West Indies from the Old World tropics is one which requires fullest consideration, since it may lead the way to the permanent control of the pests concerned. With the cacao thrips, for example, Dr. Myers suggests that a species of parasite from the Gold Coast may prove to be a useful introduction. Against cotton-stainers (*Dysdercus*) certain tachinid flies from Queensland or Nigeria are suggested, and for the banana-borer (*Cosmopolites sordidus*) it is recommended that a search for possible parasites should be made in New Guinea.

If the suggestions made in this report be translated into practice, they will lead to experiments of the utmost value in testing the soundness of the biological principles and ideas that are involved. Difficulties are likely to be encountered in the transit of living material of this kind over vast tracts of land and water. With the increase of aerial communications such troubles will become greatly reduced. The aeroplane, it may be added, has already been adopted by Dr. Myers in the transmission of moth-borer parasites from Cuba to Antigua, whence they were sent on in cold storage to Barbados.

This report should be read by all interested in the subject, and due credit must be given to the Empire Marketing Board, through the financial provision of which the investigations recorded therein were rendered possible.

A. D. IMMS.

* Empire Marketing Board. A Preliminary Report on an Investigation into the Biological Control of West Indian Insect Pests. By Dr. J. G. Myers. (E.M.B. 42.) Pp. 173. (London: H.M. Stationery Office, 1931.) 1s. net.

Measurement of Pressure and Temperature in the Upper Atmosphere.

DR. A. K. DAS, B. B. Ray, and D. N. Dasgupta, of Alipore Observatory, Calcutta, have sent a description of apparatus designed to yield measurements of atmospheric pressure and temperature at various heights. The advantages claimed over the ordinary meteorograph are that the required information is available within a very short time and at small expense.

For determining pressure, a small glass bulb drawn out at one end into a narrow spiral tube is used. A small pellet of strong sulphuric acid is introduced into the tube; the apparatus is then placed in a chamber with glass windows, the air of which can be gradually removed by a pump. The pressure is shown by a suitable manometer. Exhaustion is carried to the point when the pellet of acid is just reaching the open

end of the tube, and the pressure at this moment is observed. The apparatus is then placed inside a light box packed with non-conducting material, the open end of the tube projecting beneath the box so as to overhang a small bowl containing a mixture of sugar and potassium chlorate. It is attached at some distance below a balloon, which carries it up until the pressure has fallen to that value which will allow the acid to emerge and explode the mixture in the bowl, the smoke of the explosion being observed from the ground in a theodolite. Measurement of the angle subtended by the line joining the balloon and the apparatus, and of the angular elevation of the latter, enables the height at which the explosion occurs to be measured.

A slight modification of the arrangement, illus-

trated by Fig. 1, allows temperature to be measured instead of pressure. As before, we start with air at surface temperature and pressure enclosed by the pellet of acid, but the explosive mixture is enclosed in a sealed copper vessel (*E*). The bulb is packed in non-conducting material, so that it is only the temperature

FIG. 1.

of the explosion chamber that changes when the apparatus is carried up beneath a balloon. The fall of pressure due to the fall of temperature allows the pellet of acid to emerge from the spiral tube at a temperature that is determined by a special experiment on the same lines as that made for calibration of the apparatus for pressure measurement, the temperature in this case being varied.

It will be seen that for every individual reading of pressure and temperature a special calibrating operation must be made in addition to the construction of a new apparatus. These drawbacks do not necessarily imply that the method is unworkable. A more serious objection is that the method of determining the

height of the explosion is obviously liable to serious error unless the altitude is small compared with the highest altitudes attained by the balloon meteorograph for which this apparatus is proposed as a substitute. Its possibilities could be estimated if practically simultaneous sets of values of pressure and temperature were obtained, for the values of pressure could be calculated by Laplace's equation from the observed values of height and temperature, and could be compared with those found experimentally. The apparatus when used for measuring temperature must necessarily ignore inversions of the ordinary fall of temperature with height, and so could never give the thermal structure of the atmosphere in great detail.

Since the above communications were received, Dr. A. K. Das has forwarded a description of a modified form or extension of the device which he has specially designed to supply the missing information. It is shown in Fig. 2.

Glass is used throughout, except for the cork *c*. The vessel *V* contains a small quantity of potassium chlorate and sugar. The shaded parts contain strong

sulphuric acid, the unshaded parts air. There is a constriction in the upper horizontal length of tube and a valve *v*, consisting of a glass tube drawn out at each end, which allows acid to travel from left to right only. The whole is packed in cotton-wool, except for the bulb *B* and a part of its stem, and is carried up by an ordinary pilot balloon. So long as temperature is decreasing, the valve is closed and acid is sucked up the stem of *B* owing to the fall of temperature and pressure in *B* through the capillary tube the open end of which is labelled *t*₁; but as soon as an inversion of temperature is encountered and the pressure in *B* is increased, the valve opens and a drop of acid emerges at *t*₂ so as to explode the mixture below it. The smoke of the explosion is observed through a theodolite, and its height, which is that of the inversion, is measured by the 'tail-method' described above. The partial filling of the apparatus with acid appears to offer no difficulty, the acid being sucked in through *t*₁; subsequently some acid is withdrawn from *t*₁.

Dr. Das does not say whether the apparatus has been tested. A difficulty that at once suggests itself

is that of ensuring that the charge shall not be exploded prematurely by a rise of temperature at ground level. Sensitive thermograms show that the air near the ground is constantly varying in temperature whenever a wind is blowing, the effect being due largely to turbulence of the air. It would appear that the bulb *B* would need to be insensitive to these if a premature explosion is to be avoided; at the same time, the balloon that carries the apparatus up must rise quickly if the former is to remain visible to high elevations, and, if the bulb is not very sensitive, inversions may fail to be recorded unless they extend through a considerable height. Ingenious though the device may be, it seems very doubtful whether it or those formerly described will prove to be practical substitutes for apparatus of the type already in use with registering balloons.

FIG. 2.

E. V. NEWNHAM.

Prehistoric Society of East Anglia.

IN his presidential address before the Prehistoric Society of East Anglia on Oct. 7, Mr. J. P. T. Burchell took as his subject the relation of Neanthropic man to the ice age. Mr. Burchell pointed out that a convenient datum line in the quest for the correct geological horizons of the successive cultural stages is provided by the deposits of the 100 ft. terrace of the Thames, and the fact that north of the Thames the Acheulean and Mousterian cultures overlay the lower Boulder Clay. Recent work on the upper glacial deposits of the Yorkshire coast and the estuary of the Humber was correlated by Mr. Burchell with the discoveries made in the Brown Boulder Clay of Hunstanton by J. Reid Moir, and advanced in evidence of a late Pleistocene, Aurignacian-Upper Mousterian stage having been succeeded by climatic conditions which resulted in the formation of the Brown Boulder Clay of the Hunstanton and Lincolnshire coast and of the Coombe deposits (? Boulder Clay) of Yorkshire. Examination of the Lower Estuarine Clay of Northern Ireland had revealed a palaeolithic industry of Magdalenian character which must predate the formation of that deposit.

At the same meeting, Mr. A. L. Armstrong described an open-air site at Scunthorpe, Lincolnshire, where an Azilian-Tardenoisian floor, covered by blown sand, was found to be superimposed upon a late Aurignacian deposit. This confirms the sequence already observed in the cave-floor deposits of Mother Grundy's Parlour, Cresswell Crag, Derbyshire, where excavations carried out by Mr. Armstrong in 1924 revealed the gradual development of Upper Aurignacian culture in England and established the fact that this development was of a distinctive character and practically free from Magdalenian influences, while it was found to be overlain by an Azilian-Tardenois culture—the microburin appearing in the last few inches.

Excavations in the Mendip caves and elsewhere have since confirmed these conclusions and it is now recognised that the latest phase of this developed Aurignacian culture is essentially an English one.

Hitherto, definite occupation sites have been confined to caves, but four years ago what appeared to be an open station was located on the North Lincolnshire Cliff Range, in the Scunthorpe district. This has since been consistently examined each year and