

sectional dinners, private parties and other social events.

It has become the rule of late for the host centre to use the occasion of the Association's visit to produce an up-to-date and authoritative survey of the scientific and natural and human history of its district. The local executive committee at Oxford has charged its publications sub-committee with this task, and the volume, which is being wholly financed in generous fashion by the Delegates of the Clarendon Press, is now well advanced and will provide members with a finely balanced survey which should greatly enhance their understanding and appreciation of what they see and hear during their time in Oxford.

The meeting takes place in Oxford itself, and most, if not all, of the visitors will be accommodated within or not far beyond the modern bounds of the city. But as the contents of the regional survey will emphasize, the real venue of the meeting is the Oxford district, that is, the country between Cotswolds, Chilterns and Berkshire Downs, and it is hoped that not only the excursions but also not a few of the lectures and addresses will enable members to get a picture of the natural and human history, both ancient and modern, of the upper Thames valley. Within that valley are other towns besides Oxford, and these towns, too, are to some, though necessarily to a lesser, extent hosts to the visitors from farther afield. Two of them in particular, Reading and Abingdon, are co-operating directly in one way or another with the University and civic authorities in Oxford in the arrangements for the meeting. It is the wish of all who are concerned in those arrangements that they shall lead to a meeting which will stand comparison with any one of the preceding five visits of the Association to Oxford. If the number of visitors equals or exceeds that of 1926, the success of the 1954 meeting can scarcely fail to be assured.

TOXIC CHEMICALS IN AGRICULTURE AND THEIR EFFECT ON FOODSTUFFS

DURING recent years a wide variety of chemicals has become available for the protection of growing crops or stored food. Thus insecticides, weed killers and fungicides are applied to agricultural crops, fruits and vegetables; chemicals known as 'sprout-depressants' are applied to stored potatoes; other stored foods, such as grain, are fumigated, sprayed or dusted with insecticides. To these must be added the bacterial and chemical preparations used against rats which infest food stores. Substances or preparations having the above functions may be conveniently grouped together as pesticides.

The older pesticides were largely inorganic compounds containing lead, arsenic, copper or other metallic salts; and over the course of time methods have been standardized for the accurate determination of metallic residues, and toxicity studies have led to the proposals (by the Metallic Contamination Sub-Committee of the Food Standards Committee of the Ministry of Food) for upper working-limits for such residues in foodstuffs. The precautions necessary in the use of these older pesticides are by now well established.

This is by no means true of the newer pesticides, which are usually organic chemicals highly effective

in small concentrations. They present three distinct, although allied, hazards: to agricultural and other workers responsible for their use on the farm or in the food warehouse; to the consumer of food contaminated by residues; and to domestic animals and wild life—birds and useful insects may be killed and the ecological pattern in an area may be modified. Because of these considerations, the Minister of Agriculture and Fisheries in 1950 took the initiative in establishing a working party, under the chairmanship of Prof. S. Zuckerman, to examine the safety of workers dealing with pesticides; many of the recommendations contained in its report published in 1951¹ were given statutory authority by the Agricultural (Poisonous Substances) Act of 1952.

The working party was re-established in 1951 jointly by the Minister of Agriculture and Fisheries, the Minister of Health, the Minister of Food and the Secretary of State for Scotland to examine the second phase of the problem, namely, the potential hazards arising from the contamination of food with pesticide residues. The report* now issued gives a concise and authoritative survey of existing knowledge. A third report is being prepared on matters affecting animal and plant life.

Many who have been concerned directly or indirectly with pesticides have commented on the lack of available publications concerning their use in the United Kingdom—in contrast, for example, to the United States, where the various public inquiries² have had the merit of providing information for both scientific workers and others interested. The working party affirms the fact that pesticides "can be marketed and used on food crops without any reference to official bodies" and that the many government departments concerned with the problem "have no means of obtaining adequate information about the introduction of new preparations except by the goodwill of the firm concerned". The emphasis placed on the necessity of reducing the "area of ignorance about crop-protecting chemicals" will therefore be warmly welcomed by those scientific workers who believe that the lack of information is one of the legitimate reasons for criticism and fear on the part of certain sections of the general public in Great Britain.

The report includes a valuable seven-page section listing the main compounds used as pesticides, classified according to their chemical constitution; an outline is given of their functions and modes of action. This list includes the rapidly growing numbers of the halogenated hydrocarbons (such as DDT and BHC) and the increasingly important organophosphorus compounds (including 'Parathion' and 'Schradan'). As the working party points out, there is a formidable problem facing the analyst concerned with the identification of many of the newer compounds and with their determination at the low concentrations at which they are likely to occur as residues³.

A further difficulty arises from the lack of knowledge regarding the mode of action of many of the newer substances. Although much research has been carried out on selective toxicity⁴, some of the most effective agents for the control of lower organisms are known to interfere with enzyme systems which form a biochemical pattern throughout a wide range of mammalian and other species. Thus, some of the

* Toxic Chemicals in Agriculture: Residues in Food. (Report to the Ministers of Agriculture and Fisheries, Health, and Food, and to the Secretary of State for Scotland, of the Working Party on Precautionary Measures against Toxic Chemicals used in Agriculture.) Pp. iii + 32. (London: H.M.S.O., 1953.)

organo-phosphorus compounds are able to inactivate the choline-esterase system present in motor nerve endings. Moreover, the pharmacologist is faced with the assessment of the chronic toxicity as distinct from the acute toxicity of the substances under investigation, in that their effects on man may be cumulative.

The working party found that there was no direct evidence of human illness arising from pesticide residues in food; but it expressed the opinion that the situation "is not one which allows of complacency . . . while the present lack of any system of notification makes it impossible to find out what proportion of the food we eat is being treated with these less familiar chemicals, the increasing rate of introduction of new and potentially dangerous compounds indicates that measures need to be taken to ensure that the situation does not get out of hand, and that new materials are not used on a commercial scale until at least a specified minimum of information is available concerning their toxicity, and concerning the residues they leave on foods".

The working party took full cognizance of the importance of restoring public confidence: "Public fears about the dangers of chronic illness from eating possibly contaminated food are hardly going to be allayed by statements that there have been no fatal accidents so far, or that chronic illness is not to be expected because none was observed in experimental rats which over a year or so ate food that had been dosed with the new chemicals used in crop protection. Disquiet will give way to confidence only if the public is satisfied that a constant watch is being kept over the problem, and that every reasonable precaution is being taken to obviate possible risks".

It therefore recommended that some permanent machinery be created in the form of an advisory committee to keep under review all aspects of the problem. This conclusion has been accepted by H.M. Government, which is establishing an advisory committee to include representatives of the various ministries and departments concerned, together with representatives of the Medical Research Council and the Agricultural Research Council. There will be general satisfaction that Prof. Zuckerman has agreed to serve as independent chairman of this new body.

In one section of the report is a detailed discussion of the special problem that has arisen in recent years following the introduction of bacterial rodenticides, which have proved highly effective in the destruction of rats. It is noted that "there is no official control of the varieties of organisms employed, or the methods used for culturing them, for checking their virulence or their use under practical conditions". The bacterial preparations introduce risks over and above those associated with chemicals, in that the cultures contain living organisms which may multiply rapidly under appropriate conditions. Following the recommendations of the working party, it is announced that special consideration will be given by the advisory committee to this problem and that the willing co-operation of the manufacturers is assured.

The working party discussed the importance of the training of the personnel handling pesticides; a part-time course of four years in duration has now been sponsored by the City and Guilds of London Institute⁶ and is receiving the full support of industry in London and elsewhere.

Other recommendations of the working party which have been accepted by the Ministries concerned include proposals for the active encouragement of

research and also for the encouragement of international co-operation—a matter of special importance in that 60 per cent of British food supplies (including a large proportion of staple foods) comes from abroad. The previous 'history' of such foods is largely dependent on the legislation and the vigilance of the authorities in the country of origin, and it is clear, therefore, that co-operation with such overseas scientific bodies as the Food Protection Committee of the National Research Council of the United States⁹ can be of great advantage.

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¹ Toxic Chemicals in Agriculture: Rep. Work. Party Min. Agric. Fish. (London: H.M.S.O., 1951.)

² See *Nature*, 168, 748 (1951).

³ Agricultural Control Chemicals, 1950 (Advances in Chemistry Series No. 1. American Chemical Society, Washington, D.C.).

⁴ Albert, A., "Selective Toxicity" (Methuen and Co., Ltd., London, 1951).

⁵ Syllabus No. 127, Pest Control Course, City and Guilds of London Institute.

⁶ *Nature*, 169, 658 (1952).

SPECIATION OF FISHES IN AFRICAN LAKES

By DR. E. B. WORTHINGTON

THE complex distribution of fishes and other fauna of the great lakes of Africa has attracted attention for more than half a century. Moore¹ paid particular attention to Lake Tanganyika and propounded his hypothesis of the marine origin of some elements of its fauna. Boulenger² straightened out the taxonomy of the fishes as then known. Cunningham³ assembled the data on distribution, discredited the marine origin for Lake Tanganyika and emphasized geographical isolation as a major factor in the evolution of the endemic forms. Regan, in papers too numerous to specify here, described large numbers of new fishes, especially of Cichlidae, and pointed to adaptive radiation towards different types of food and feeding methods as an important factor in their evolution.

These early investigations have been followed up extensively during the past twenty-five years or so by Trewavas, especially on the Cichlidae, Graham on the fishes of Lake Victoria, Worthington on non-Cichlid fishes of many of the lakes, and Poll on lakes lying wholly or partly in the Belgian Congo. Ricardo-Bertram filled in the picture for Lakes Rukwa and Bangweulu, and more recently new investigations have been published or are in preparation as a result of field-studies by Lowe on Lake Nyasa and the East African lakes and Greenwood on the Cichlidae of Lake Victoria. Brooks has recently reassembled the biological and geological evidence about many of the lakes.

Most of these workers and a number of others, in addition to describing new forms and studying the fishes either in the field or the museum or both, have been greatly interested in how these unique lake faunas came into being and have expressed opinions on the subject of speciation. Indeed, the evidence which these African fishes can give on evolution is so great that some of it is now finding its way into the text-books, and in repetition and summarizing, errors can creep in. For example, some of the results given by Worthington⁴ were re-tabulated by Mayr⁵ in directing attention to the size and age of the lakes as factors in evolution. In quoting Mayr's table,