The functions of the council, which should be exercised in full co-operation with the specialist bureaux and other inter-territorial organisations, would be to encourage research workers and establish contacts between them, and to study what research projects of common interest could be usefully suggested to governments, research agencies or universities. Other aims of the council would be: to endeavour to facilitate the exchange and movement of scientific workers between different territories and to promote liaison between inter-government scientific bureaux or other bodies; to arrange for the compilation and distribution of information of general value concerning the locations of scientific workers, scientific equipment and specialist libraries; to foster, in respect of each of the major scientific subjects, the creation, in Africa, of centres of specialist documentation; to convene, with the consent of the Governments concerned, periodic conferences of a general scientific character and facilitate meetings of groups of specialists; and to submit recommendations to the Metropolitan Governments concerned in order to secure joint administrative action through a proposed inter-government committee for technical collaboration.

It is not intended that the proposed scientific council for Africa would itself establish any institutions or laboratories, or would itself actively direct research programmes; its main function would be to obtain a broad view of what research is being undertaken in Africa in order to minimize unnecessary overlap of effort and co-ordinate the work. Such an organisation would draw its strength from periodic conferences and meetings between scientific workers, but at the same time would ensure that such conferences are arranged on a rational plan with due regard to the expense involved. It is not anticipated that a large staff would be required, and the moving force of the council should be provided by a chairman able to give his whole time to the new organisation and direct a small personal secretariat.

The Conference suggested that the first chairman should be nominated for two years by agreement between the Metropolitan Governments, and stated that it would be happy to see Dr. P. J. du Toit nominated to this post. It also recommended that the governments concerned should establish, as soon as possible, a commission which might consist largely of members of the steering committee of the Conference to give shape to the proposal now put forward and to ensure its realization. It is felt that, should this council come into being, it will mark a major step in the progress of scientific research in Africa south of the Sahara.

H. B. S. COOKE

INSECT FLIGHT AND DISTRIBUTION

THE pattern of the geographical distribution of insects is very varied; but among the widely distributed species we can recognize easily two types. First, the species which develops many local or geographical races, such as the swallow-tail butterfly (*Papilio machaon*) and the apollo butterfly (*Parnassius apollo*) in Europe; and secondly, the species which has little or no geographical variation over very large areas, such as certain locusts or the painted-lady butterfly (*Pyrameis cardui*). This latter type of distribution indicates a population within the area of which there are few natural barriers, and within which there is a continual mixing of individuals. It is associated with species which have great powers of movement; and this movement can be either active and deliberate, as in the migration of locusts, or passive, due to distribution by air currents, as in the Aphidæ and other small insects. By either of these methods, large numbers of individuals can move hundreds of miles.

At the recent British Association meeting at Newcastle upon Tyne, Section D (Zoology) held an afternoon session devoted to these problems of insect flight and distribution. Dr. C. B. Williams opened the discussion with an account of the deliberate migrations of insects. This type of movement is found chiefly in the larger insects, and particularly in locusts, moths and butterflies, and in dragonflies and beetles (especially the Coccinellidæ). As a result of these movements, many millions of individuals belonging to hundreds of species regularly move hundreds of miles, and occasionally more than a thousand miles. Inland seas like the Mediterranean are regularly crossed by millions of insects. In the British butterfly fauna of sixty-eight species, about one-quarter is known to cross the Channel or the North Sea each year or at more irregular intervals.

One of the greatest migrants known in the Lepidoptera is the monarch butterfly (*Danaus plexippus*) of North America, which flies from southern Canada to the Gulf States and to southern California every autumn, and then, after a period of semi-hibernation in the south, flies north again in the spring. This double flight of this species may well cover more than two thousand miles. Another great migrant, the painted-lady butterfly (*Pyrameis cardui*), flies from North Africa through Europe each spring, and sometimes reaches Iceland, a distance of nearly 1,500 miles. At the other side of the Atlantic, the same species, indistinguishable even as a race, flies in a similar way in the spring from western Mexico northward and eastward to cover in some years most of the United States and southern Canada.

Students of insect distribution must thus recognize that many species of insects may, by their own deliberate movements, be spread regularly over distances of more than a thousand miles, and may reach oceanic islands and other isolated localities; so that in such circumstances the setting up of a local race or a special gene-complex is almost impossible. Only in the Australian and New Zealand area is the local race of the painted-lady butterfly (*P. cardui kershawi*) distinguishable from those of the rest of its almost world-wide range. From an economic point of view, the control of insect pests which are capable of long-distance migration in great numbers brings quite different problems from those of the comparatively sedentary species.

In the next paper, Prof. A. C. Hardy gave an account of his early work in trapping insects in the upper air by means of nets hanging from kites and towers on land, and from the mast-heads of ships crossing the North Sea. The insects thus caught are nearly all small, such as Aphidæ, Chalcidæ, and other small Hymenoptera, beetles (especially Staphylinidæ) and occasionally small moths and lace-wings (Chrysopidæ). The number of insects over land is greatest near the ground and falls off at first rapidly as the level of trapping is raised; but small numbers were caught at heights above a thousand feet.

Most of the trapping over the North Sea was done by nets flown at mast-head when the ships were more than a hundred miles from land. Under these conditions many hundreds of insects were captured, both by day and at night, indicating an enormous population of floating and drifting insects in the air at least a hundred miles away from any locality where they could have been carried up by air currents. More insects were found when the easterly winds were blowing from the Continent of Europe than with westerly winds from Britain. Attempts were made to obtain from air trajectories the possible origin and routes taken by the insects captured on particularly good and particularly bad days. These indicated that many insects had drifted for more than twenty-four hours and had come several hundred miles in their involuntary flight. Since the Second World War, Prof. Hardy has made experiments with nets trailing behind a helicopter flying over the English Channel at heights of 500–1,000 ft.; but the results were disappointing, and work from the masts of ships has been resumed instead. It appears possible that insects over the sea are at a lower level than those over the land.

Dr. C. G. Johnson described his recent studies of the insect drift in the upper and lower air by means of net-traps hung from the cables of barrage balloons at Cardington Airfield in Bedfordshire, with the excellent co-operation of the staff. Nearly every day in the summer, and also on many nights, balloons were flown with a series of traps at intervals up to 2,000 ft., or occasionally to 4,000 ft. The numbers of small insects caught were surprisingly great; on some hot summer days as many as twenty Aphidæ per hour were caught in a single net about three feet across and about 2,000 ft. above the ground. Since only a microscopic proportion of the air passes through the nets, the number of small insects at about this level must be enormous. All the insects were alive and apparently uninjured, and when they again fall to the ground, they could continue to lay eggs and start colonies or outbreaks of pests.

The nets hanging from the cables suffer from the disadvantage that the amount of air sampled varies with the wind velocity, and when the air is calm, as is often the case during the night, few or no insects are caught; but this is no proof of the absence of insects from the air. To overcome this difficulty, Dr. Johnson has developed a suction trap in which a fixed amount of air is blown through a vertical net by an electric fan. The volume of air thus sampled is independent of the wind velocity, at least up to wind speeds of about fifteen miles per hour, and so the results can be expressed as numbers of insects per 1,000 cubic feet of air, and become capable of mathematical treatment and comparison. Using these traps at ground-level, a very definite diurnal periodicity in the number of Aphidæ in the air has been shown to exist. There are one or two peaks during the day and very small numbers at night. It is hoped next year to have these traps attached to the barrage balloons, and so to get a correct estimate of the relative numbers of insects during day and night at the higher levels. This work is being carried out at Rothamsted with special reference to the long-distance distribution of injurious Aphidæ and particularly the black fly of beans (*Aphis fabæ*).

The last paper of the series was a description by Mr. P. S. B. Digby of a wind tunnel constructed recently for the experimental study of flight behaviour of insects. In this instrument wind speed, light, temperature and humidity can all be independently controlled, and the insects can be kept under direct observation during the tests. The criterion used is the rate of wing-beat of the insects as measured by a stroboscopic technique.

In the discussion which followed, the effects of turbulence and convection currents, and the difference between them over land and over sea, were considered by various speakers; the general conclusion was that insects are likely to gain height during the day-time over the land, and to fall steadily both by night over the land, and by day and night over the sea. There might, however, be a cushioning turbulence effect near the surface of the sea, which would prevent the majority falling into the sea under normal conditions. Heavy rain at sea, however, would bring down a large proportion of the aerial population.

C. B. Williams

NEWS and VIEWS

Nobel Prize for Physics for 1949: Prof. H. Yukawa

Prof. H. Yukawa, who has been awarded the Nobel Prize for Physics for 1949, is best known for his theory of nuclear forces which, in 1935, first postulated the existence of a particle a few hundred times heavier than the electron. The nuclear forces would then bear the same relation to the possible emission and absorption of such a particle as the electromagnetic forces in an atom bear to the emission and absorption of light. The discovery of the meson in cosmic rays appeared to be a confirmation of Yukawa's prediction, but the study of its properties gradually led to the conviction that it could not be identical with the particle required for Yukawa's theory. It was not until 1947 that Powell and his collaborators demonstrated the existence of a second short-lived particle, the π-meson, which is known to be the parent of the cosmic-ray meson, and which is strongly linked to protons and neutrons. This provided a brilliant vindication of Yukawa's idea. The detailed theory of the relation between this particle and the nuclear forces is still in its infancy; but, whatever the outcome, all thought about nuclear forces for the past decade and for many years to come is entirely dominated by the ideas of Yukawa. Since this first pioneer work, Yukawa has contributed much to other problems in fundamental theory and has built up an important school of theoretical physicists. As the editor of the new journal, *Progress of Theoretical Physics*, he has helped to provide an outlet for the great wealth of important contributions from his own school, as well as that of his colleagues. This new journal has already found a prominent place in literature on modern fundamental quantum theory

Aeronautics at the University of Glasgow: Prof. W. J. Duncan, F.R.S.

Prof. W. J. Duncan, who has been appointed to the new Mechan chair of aeronautics and fluid mechanics in the University of Glasgow, is the son of a Glasgow shipbuilder, and, after completing his education at Dulwich College and University College, London, he spent seven years in his father's firm. He then joined