

A ZOOLOGICAL SURVEY OF MADAGASCAR

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THE survey of tropical faunas has, for nearly two centuries, been largely limited to the haphazard methods of the general collector or to the painstaking but limited efforts of individual specialists. The results, as could be predicted, were of very doubtful value when either ecological or biogeographical projects were considered. However, they were extraordinarily successful in so far as they brought to light a very large number of new forms and built up our present knowledge of taxonomy. It unfortunately proved impossible to compare, with any accuracy, the faunas of two neighbouring areas for any scientific purpose. This did not prevent ambitious workers from building biogeographical or ecological systems on a very large scale. Yet to the man working in the field these systems seemed always rather unsafe, even though they called in all the resources of the geological and statistical methods and very strict logical constructions.

As a tropical country, Madagascar had for some time the very rare distinction that a series of monographs in the *Histoire Physique, naturelle et politique de Madagascar* had been published by the combined efforts of A. and G. Grandidier. It could thus compare with Central America, Seychelles, Hawaii or British India. But even these monographs, mainly published during the second half of last century, are now considered out of date.

In the years following the Second World War, research work on tropical faunas has started on completely revolutionary lines. New research institutions and groups are either working permanently in tropical areas or covering these in terms of long-range work. They are thus enabled to collect intensively the whole year round, using breeding methods and many new collecting systems. Such teams are at work in the Belgian Congo, Micronesia, Melanesia, etc.

The Zoological Survey started in Madagascar in 1947 and is still at work. It would seem from published results¹ that it has been particularly successful. It is centred on the Zoology Department of the Institut Scientifique de Madagascar, an institution covering pure and applied research in most fields of

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human, animal and plant biology and in soil science, hydrology and geography. The Institute itself belongs to a chain of tropical institutes created after 1946 by the French Office de la Recherche Scientifique et Technique Outre-Mer in what was then the French Union and is now the French Community.

It may be of interest, considering the variety of results obtained in the short period 1947-59, to give some details on the practical organization of the Survey before describing the changes wrought in our knowledge of the local fauna.

Considering that only limited means could be brought to bear on the problem of such a survey, the following principles have been applied.

(a) The formation of a mobile team with one or two European scientists, a number (3-6) of native assistants, a 'Landrover', and all the basic collecting equipment. This team has the use of a small permanent workshop in the centre at Tananarive for the building of new gadgets, and the constant upkeep of the material used.

(b) A central office, with one to three European scientists and three or four native assistants, which receives the collections, prints the labels, mounts and sorts the material and makes a preliminary study of all collections. More breeding work is carried on in the insectarium of the Central Office.

(c) A very large team of honorary research workers, specialists of international reputation, from practically every country of the world. They have agreed to work out collections made in Madagascar from their special groups. They are responsible for describing any new or remarkable forms and preparing revisions of such families, tribes or genera which may be considered as fairly well known. More than a hundred specialists have been enlisted in this way.

(d) A practical organization enlisting the co-operation of well-known foreign specialists, giving them all possible help and practical local guidance, helping them with the necessary camping and collecting outfit, etc. This organization can help specialists who come to Madagascar on their own, arrange for joint expeditions, or even finance complete expeditions, to which they are invited. In this way, during the past ten years, no less than thirty-three zoologists have taken part in the survey and some of them have spent more than a year in Madagascar or have come several times. The 'geographical distribution' of these specialists is worth noting: two Mauritians, five South Africans, one Rhodesian, two East Africans, three Swiss, three Austrians, three Italians, one German, eight Americans, one Australian and five

French. In all cases the material collected or the observations made are embodied in the general publications of the Institute.

(e) Means for regular and so far as possible prompt publication of results. These have been obtained by the channel of two new scientific periodicals: papers on the local fauna make up the whole of the *Memoires de l'Institut Scientifique de Madagascar*, Series A (zoology) and E (entomology), and are the main topic in the *Naturaliste malgache*. Whenever a group seemed sufficiently well known, a revision is published in the series "Faune de Madagascar", on the plan of the well-known "Faune de France". Apart from the nine published volumes of this series, three other volumes are ready to be printed and half a dozen others (covering such groups as birds, Acridoidea, Vespidae, Tingidae) are being actively prepared.

It was planned at the start to limit the survey to Madagascar proper. However, it was soon found necessary to cover the insular environment, the Mascarenes, the Comoros and the small atolls or coral reefs (Tromelin, Europa, Glorioso). Although the knowledge we may gain of their fauna is completely independent of Madagascar proper, it is a great help towards an understanding of the malagasy fauna itself.

It is still too early to give a complete analysis of the results of the Survey. More than a million specimens have been collected, covering the whole animal kingdom from protozoa to mammals, and a very large part of this material is still undergoing systematic study.

From the purely taxonomical side more than 2,500 new forms (subfamilies, tribes, genera and species) have been described. Many orders have been discovered on Madagascar proper (for example, fresh-water Coelenterata, Porifera, Bryozoa; in Insecta: Zoraptera, Plecoptera, Diploura, Protoura; in Chelicerata: Palpigrada, Uropyga, Amblypyga; in Crustacea: Syncarida) and many more groups. No animal group has remained untouched, and often the known number of forms has risen by as much as 500 per cent.

The very great variety of new forms found in the island has completely changed its aspect and helped to build an entirely new system of biogeographical relations.

The Survey has opened up a number of new biota: many new groups of cave-dwelling forms have been detected, such as scorpions and Homoptera, that were not known previously from this habitat; a very large and highly specialized blind soil-fauna, probably

one of the richest in the world ; a series of crustaceans and worms inhabiting interstitial waters, both salt and fresh ; an original intertidal fauna of land arthropods ; a rich fauna living in the water found in leaf axils of palms, Musaceae, Aroideae and in bamboos. This last fauna is exceptionally large and its members range from frogs to insects and crustaceans ; mosquitoes play a very important part, with high speciation and remarkable morphological adaptations.

Less original, but quite as important results have been obtained by the systematic breeding of parasites (chalcidoids, tachinids, etc.) and of leaf-mining and gall-making insects. These researches have brought to light new biological facts for known groups, such for example as the existence of leaf-mining drosophilids.

In the extreme north of Madagascar, where recent volcanoes with rain forest co-exist with deciduous forest on limestone, sandstone or lateritic soils, a comparative study of the fauna has been most rewarding. Not only does it give many remarkable new forms but also helps in the understanding of factors underlying speciation, which is one of the most remarkable facts in the local fauna.

Some facts have been established on a firm basis and allow for biological discussion. For example, the remarkably active speciation referred to, with a high number of sympatric species, the numerous missing elements in the fauna as compared with continental Africa or the Indian subcontinent ; the place and significance of the austral element ; the wide plasticity of most new imported forms, etc. A number of principles underlying the building up of the fauna on small isolated islands have also been found. All these have shown that Madagascar was one of the most remarkable natural laboratories in the world for the study of species formation, adaptation and evolution. A considerable research effort should be started along such lines in the near future.

By necessity, the work until now has been mostly taxonomical ; ecology has only been considered in so far as it opened up new biota ; biological research has been limited to breeding work. But with the progress of the general catalogue of Madagascar's fauna research work on biology, ecology and physiology will soon be possible. If the method used has delayed a biological approach to Madagascar, it is believed that it has ensured a sure and efficient basis for such an approach and has saved many efforts and many errors due to an insufficient basic knowledge of the local fauna. It has in this way proved time-saving. The results of this Survey have shown also how completely misleading was the previous

knowledge of a tropical fauna which one considered usually as fairly well known.

Thus it is quite evident that the Zoological Survey will never be finished, just as it is not finished in Britain or in France, but it may be brought to such a stage that, for most practical purposes, it can be considered as sufficient.

¹ *Mémoires de l'Institut Scientifique de Madagascar*, série A, 1-12; série B, 1-12. *Naturaliste malgache*, 1-10. *Faune de Madagascar*, 1-9.