INTERNATIONAL EXPERIMENTATION AND CONTROL OF THE LOCUST PLAGUE

Africa in the First Half of the 20th Century

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Locust plagues are still a calamitous event for the continent of Africa (1). In June 1993 this insect was devouring the harvests of Ethiopia, Sudan, Eritrea, Somalia and Djibouti. Between 1986 and 1989 the locust affected some thirty African countries. In October 1987 a plague was present in the majority of the populated areas of Niger and Mali, and was also invading the north of Mauritania, the Western Sahara, Morocco and Algeria (2). In 1988 international aid almost reached 250 million dollars and more than 3 million litres of insecticide were used between January and July of that year (3).

It goes without saying that throughout this present century, and of course the previous ones, numerous plagues have occurred on this continent. With regard to this century, we should perhaps recall one of the most significant, in the Sahel zone, in the thirties, still spoken of today as the "Doa-Hiire", *the year of the locust*, which, as a result of a combination of the locust plagues, a drought and a lack of resources on the part of the colonial administrations, 100,000 people were killed between 1931 and 1932 (4).

It was precisely in the 1930s that the process of formation of a scientific community concerning Acridoidea and the institutionalisation of the international scientific fight against the locust took place, by means of five locust conferences, held in Rome, Paris, London, Cairo and Brussels. The first was held in 1931 and the last in 1938. These meetings dealt basically with the locust problem in Africa. The existence of these conferences was facilitated by the fact that since the beginning of the century applied entomology had begun to take part in what was known in Britain as "constructive imperialism" and in France as "mission civilisatrice" or "mise en valeur" of the colonies (5). Boris P. Uvarov, author of *Locusts and Grasshoppers* (London, 1928), the reference work for all those interested in the discipline, baptised in those days as "acridology", played an outstanding role throughout these conferences. The work developed by Paul Vayssière, of the *Station Entomologique* in Paris, was also very important. Vayssière worked together with Auguste Chevalier, another scientist who contributed to the study of locusts, in the creation of the *Académie des Sciences Coloniales* (1922) and the *Association Colonies-Sciences* (1926).

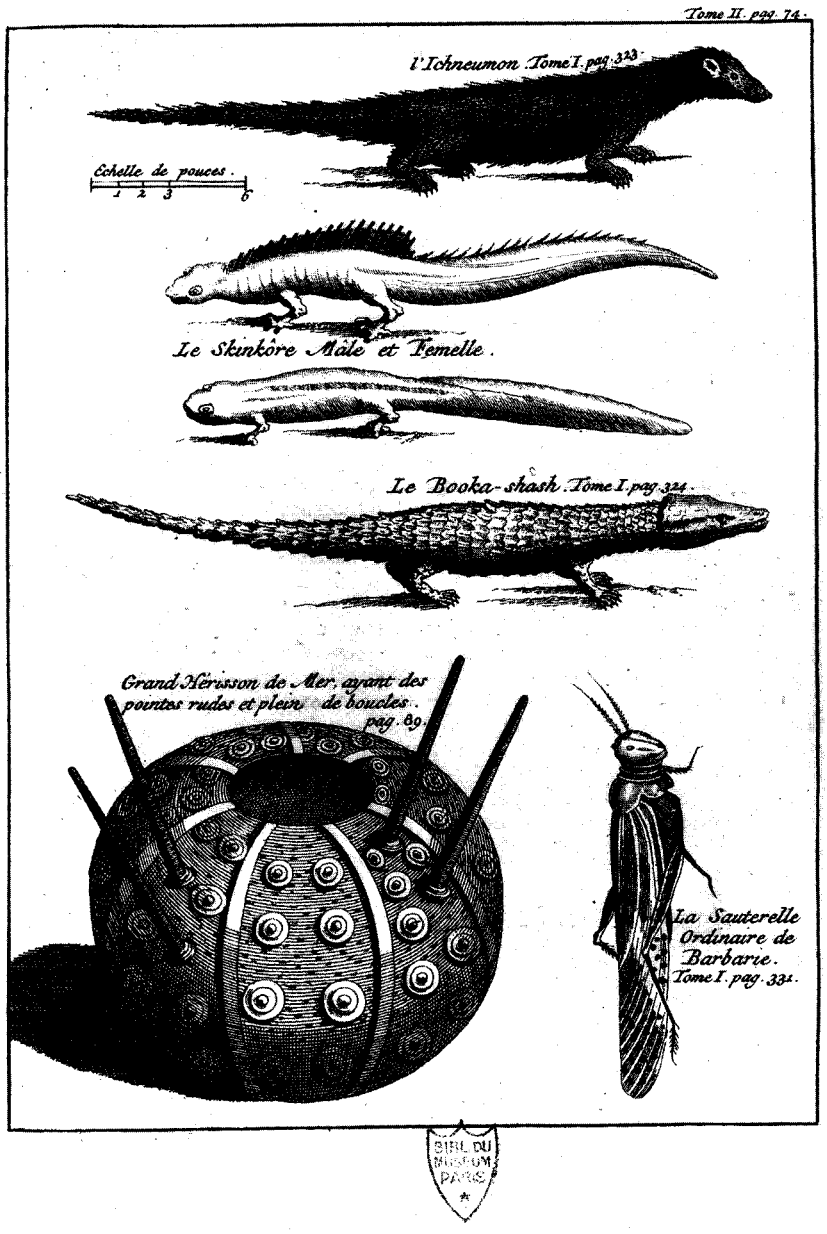


Figure 1.

As well as bringing news about the fauna of the places they visited, the travellers of the XVIIIth century, often accompanied their writings with drawings of the animals they had found. This illustration is taken from the French edition of Thomas Shaw: *Voyages de Monsr. Shaw, M.D. dans plusieurs provinces de la Barbarie et du Levant: contenant des observations géographiques, physiques, philologiques et mêlees sur les royaumes d'Alger et de Tunis, sur la Syrie, l'Égypte et l'Arabie Petrée, avec des cartes et des figures,* La Haye, Jean Neaulme, 1743, MDCCXLIII.

Other important events related to the fight against the locust were happening from the beginning of the century. On the initiative of the International Institute of Agriculture, the first report on the problem on a world scale was published in 1916 and the first international meeting on the locust was held in Rome in 1920. Both events, with serious colonial implications, meant the beginning of the institutionalisation of the international fight against the plagues. In previous centuries, it had been a recurrent theme for travellers, missionaries, naturalists and colonials.

The African Locust in the Ancient Chronicles

The locust has historically been catastrophic in Africa. The evidence brought back by travellers and naturalists, throughout the centuries has testified to this. Through their chronicles of the severity of the plagues, linked with famines, of the existence of locust-eating peoples, and the methods used to combat them, they broadened the extent of the universal awareness of the problem. Their role as scientific agents should not be scorned, especially that of the naturalist at the end of the century of Enlightenment, relating the habits of the different species, or drawing and sending examples of the insects to natural history museums and botanical gardens (see Figure 1).

With regard to the north of Africa, the region richest in evidence, the fact that until well into this century the majority of the texts dealing with this subject always started with a reference to the eighth biblical plague, the plague of locusts in Egypt, is an indication of the incidence of the locust in that territory (6). Some historical authors documented the problem in the region, among them Herodotus, Strabo, Pliny the Elder, Titus Livius and Saint Augustine. For example, Pliny the Elder, in his encyclopedia, *Historia Naturalis*, noted that the locust that was infesting Italy in the first century a.d. came from Africa, in particular from the district of Cyrene (7). Concerning Mauritania, we have a later but equally interesting witness, the Spaniard Leon Africano. A traveller from the beginning of the XVI century, he gave us a vivid description of the disaster in the region. He wrote that at times the number of the insects was so great that when they flew in a swarm it seemed to be a cloud so dense that it obscured the light from the sun (8).

In later centuries, other testimonies documented the problem in the African Mediterranean. The terrible plague that hit a great part of the region, especially Algeria, during 1724 and 1725, had various chroniclers. Among these were the English chaplain and member of the *Royal Society*, Thomas Shaw, and the doctor Jean André Peyssonnel, member of the *Académie de Sciences* (9). In the second half of the XVIII century, the Magreb suffered other great plagues, which were documented by the Dane George Höst (10) and the diplomat and French writer Louis de Chénier. Chénier wrote that, in Rabat in 1779, he had seen a multitude of peasants who had died of starvation, parents who were selling their children and, "women and children running behind camels, to look in their excrement for a grain of barley that had not been digested and eat it greedily". The arrival of grain from Cadiz and Lisbon relieved the situation, but inflated the prices: "poor quality oil and rancid butter cost 180 pounds a quintal; peas, beans and lentils that were abundant in those parts became luxuries" (11). In the following century Jacopo Gråbeg di Hemsö told of the Moroccan Plagues of 1813-1815, calling the locust the most terrible scourge for Moroccan agriculture (12).

In short, this type of documentation brought to light the existence of a problem that was practically universal. This was the situation until the last decades of the previous century, when entomology began to acquire more scientific parameters. The fight against the locust in French Algeria and the United States of America figured among the most interesting experiments. Both were widely published and helped to sensitise the scientific community to the problem. It is also necessary to point out the organisational and scientific level reached by other countries such as Russia, Italy, Argentina and Spain (13).

The Algerian experience gives us the first organised European intervention against the locust in an African colony. The French occupation of this territory generated a series of interesting studies. Among those that stand out are the works of the entomologist Hippolyte Lucas, of the *Commission scientifique de l'Algérie* in the middle of the eighteen hundreds (14), and overall those of Jules Künckel d'Herculais, assistant to the Zoological chair of the Paris *Muséum national d'histoire naturelle*, and delegate in Algeria for the fight against the locust from 1888 (15).

In 1864 an invasion of locusts began in Algeria which lasted until 1875. There were plagues of greater and lesser intensity every year. The worst was in 1866. Its indirect consequences were extremely grave, being heightened by a serious drought. Moreover, on the 2nd of January 1867 Algeria was hit by a strong earthquake and from August to October it suffered a cholera epidemic. As if that were not enough, there was also an appalling famine. Relating the situation in the interior of the country, especially the streets of Ténès and Miliana in 1869, Bellarmin-Vincent Burzet, a priest from Chebli and member of the *Association Scientifique*, wrote that the natives, "arrived from all directions to the European centres, emaciated, almost naked, shadows of their former selves: they were not men, nor women, nor children, they were skeletons!" (16). Burzet also described the sight of mothers supporting dying children in their laps, natives fighting over the roots of dwarf palm trees or wrestling with dogs for the bones and scraps thrown out of houses. Neither was it rare, he said, to find bodies, eaten by hyenas and jackels on the paths, or to come across acts of cannibalism. As a result of locusts or other disasters, the dead numbered 245,494 in the three militarily controlled provinces. Almost all of them were natives (17).

The Beginnings of the International Control of Locusts

The plague in Algeria helped to sensitise the international community to fight against the locust plague. However, the first attempt to find an international answer to the problem, which came from the International Institute of Agriculture, did not take place until 1905. With its headquarters in Rome, this organisation was dedicated, since its founding, to all aspects of plant diseases and plagues. With reference to the locust, the Institute drew up and published the first report on the world situation, with the title *La lutte contre les sauterelles dans les divers pays*, in 1916 (18). A little later, in October 1920, the holding of an international conference marked the beginning of the institutionalisation of the international fight against the plagues (19). The participating states numbered twenty five, although ten were in actual fact colonies of France, Italy and Great Britain. During the inaugural ceremony, on the 28th of October, the president of

the Rome institute, an Italian called Pantano, alluded to the origin of the convention, confirming that the government of the French Protectorate of Morocco had requested its celebration in 1916 (20).

At that time, while some countries suffering from plagues had provided themselves with the material and organisational means to confront the insect, Africa, which endured the most damaging species, had not developed them. Significantly, on a world scale, the African locust began to be the subject of most research from the 1930s onward. The reason for this contrast has to do with the economic exploitation of the colonies by the mother countries. In that process the applied entomology took an active part.

As we know, at the beginning of this century came recognition of the very important role science had in the development of colonies. In France, this appraisal happened during the 1st World War because of the shortage of raw materials in this period. In Great Britain, the Imperial Institute, which began to work in the last decade of the 19th century in order to join science and colonial economy, did not obtain a clear recognition of its aim until 1914 (21). In the first of the above-mentioned countries, war led to a change of attitude about the colonies. The course of war helped to accept the idea, both at the military and economic levels, that colonies could reinforce instead of weaken France.

How was the new science to be? The Colonial Agriculture Congress of Paris, March 1918, pointed at the way (22). It had to take into account specialist training; to develop a real agronomical research in botanical gardens, experimental farms and laboratories, to create the necessary structures to popularise the information for the landowners and to coordinate studies on colonial products from the mother countries (23).

A bibliometric analysis of the subject of locusts, from 1850 to the middle of the twentieth century, will give us some clues as to the role played by the contemporary entomological science in the control of these plagues. To help us in this we have the exceptional work of M.L. Roonwall, "Bibliographia Acrididiorum" (24), which gathers together the greatest number of references to locusts up to 1957. The main contribution of Roonwall's work was to show the quantitative change that occurred in this field of knowledge between 1850 and 1950. In the first half of this period the production of both scientific and popular literature on the subject of locusts numbered 714 titles, with an average of 14.2 per year (see Figure 2).

The turn of the century, especially from the 1920s, brought with it a genuine revolution in scientific production. From 1900 to 1949 production was multiplied 6.3 times, reaching 4,541 titles. Between 1900 and 1909 the average annual production was a little greater than that of the last half of the previous century. However, in spite of the First World War, between 1910 and 1919 it doubled compared to the previous decade. The same increase occurred in the following decade. The increase was even more marked in the period from 1930 to 1939, when production more than doubled as compared to the previous decade. The years between 1940 and 1949 are anomalies because the effect, of course, of the Second World War reduced the scientific output. Lastly, the production of literature after 1950 reflected the final consolidation of this discipline.

A more than quantitative analysis of Roonwall's work gives us a clearer background to the above statements. One of the important characteristics of applied entomology

Figure 2. The World Production of Literature on the Locust during the Period 1800-1955.

Period in Years	Publications	Average per year
1800-1849	77	1,5
1850-1899	714	14,2
1900-1909	172	17,2
1910-1919	354	35,4
1920-1929	843	84,3
1930-1939	1.992	199,2
1940-1949	1.180	118
1950	268	268
1951	375	375
1952	279	279
1953	289	289
1954	294	294
1955	172	172

during this period was its marked eurocentrism. With few exceptions, the centres of scientific production were European. Also themes tackled referred increasingly to the locust in Africa. By the end of this period almost all the scientific production dealt with that continent. Africa became a vast laboratory, especially after the 1930s. The scientific activity benefited from external elements that were clearly linked to the colonial phenomenon, which had previously been backed by science in trying to take advantage of the wealth of the newly conquered continent.

The beginnings of the international fight against locust plagues led to the Rome meeting of 1920. Its final institutionalisation did not take place, however, until almost two decades later. Its culminating moment was the Fifth International Locust Conference, held in Brussels in 1938. This frenetic scientific and organisational activity was not unrelated to the fact that a plague of very grave consequences affected Africa from 1928 onwards. And so, some countries with African possessions such as Italy, Portugal, Belgium, Spain, France and Great Britain carried out noteworthy scientific and organisational work. In the two latter countries the work of entomologists Paul Vayssière and Boris P. Uvarov was exceptional.

Paul Vayssière and Boris P. Uvarov. The Final Internationalisation of the Fight against the Locust.

Paul Vayssière (1889-1984) played a fundamental role in the internationalisation of work against locusts in France and its territories. In 1924 he published "Le problème acridien et sa solution internationale" (25) in the geographical magazine *Matériaux pour l'étude des calamités*, possibly his most outstanding work on locusts. According to Vayssière, one fundamental requisite for the fight against the problem was an appro-

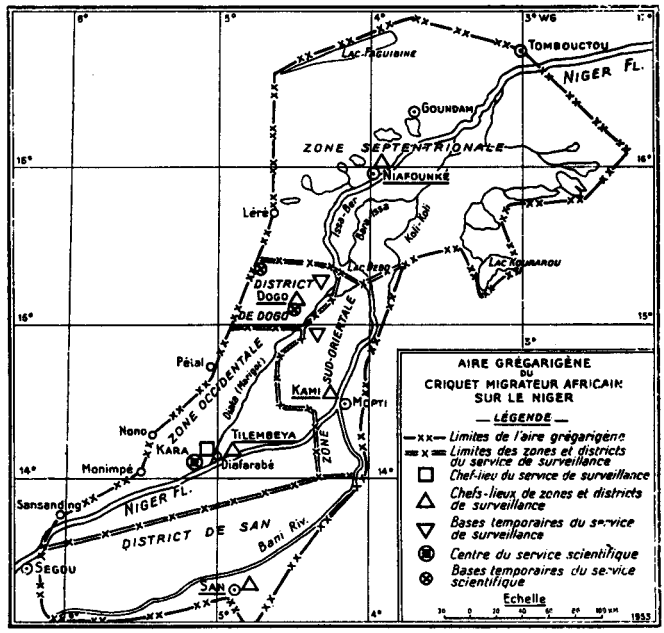
priate international organization. The plagues went beyond national frontiers and only an organization indiffererent to regional limitations, he argued, could attack them in all their complexity.

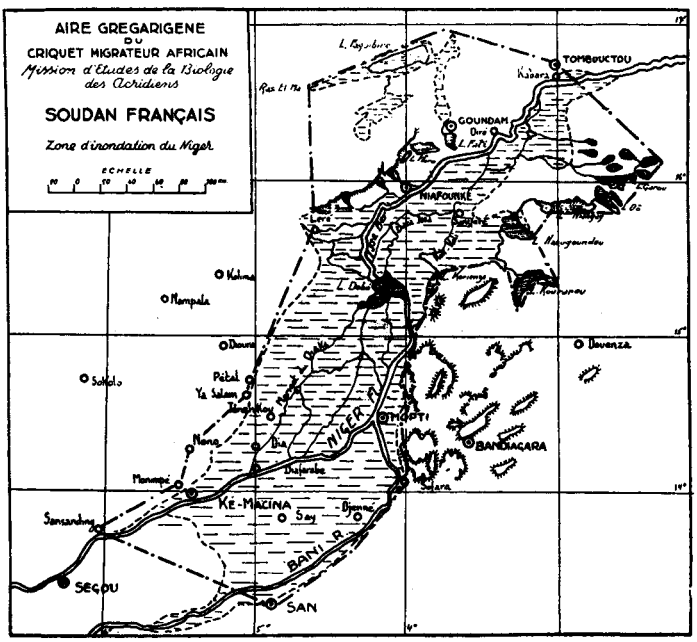
In January 1932 Vayssière participated in the creation of the *Comité d'études de la biologie des acridiens* in Algiers, a body similar to the British *Committee on Locust Control* formed three years earlier. Its first results led him to conclude that the locust problem was about to enter a period of "practical realisations"; it was, however, necessary to persevere with the scientific action, which meant it was vital to obtain the appropriate financial means (26). The exiled Russian Boris N. Zolotarevsky played an outstanding role on the Algerian committee. Before his accession to the committee, Zolotarevsky had been working in Madagascar from 1926 to 1932. This apprenticeship helped him to lead its first expedition, made in Middle Niger. This first mission started its work in November 1932 and returned to Algiers in April 1934. In the words of Zolotarevsky, the colonial authorities supported the work of the mission unreservedly (27). To maintain the group's safety in the desert regions of the north west of French Sudan they were assigned a military detachment. The fundamental objective of the expedition was to find out about the permanent habitation sites and the migration routes of the *Locusta migratoria migratorioides* and the *Schistocerca gregaria*, two of the most harmful species of locusts in the region.

The most significant scientific result was to verify the breeding areas of the *Locusta* around the flood plains of the Niger, between KeMacina and Lake Debo. The knowledge of these breeding areas should imply a policy of control of the *Locusta*, using insecticide, when the plague was forming. However, the practical results were limited and the plague reached the highest intensity in 1934.

A few years later, in spite of the war, a centre of control was set up in Tilembeya-Diafarabé, in Niger. The centre owned vehicles to move across the zone both insecticide to carry on the preventive tasks and specialized staff. Five years later, there were 9 technical agents, 41 watchmen and 4 policemen. In 1947, there were 4 jeeps, two Dodge 3/4 trucks, and ten 4-ton trucks to undertake tasks and 10 tons of insecticide. All these materials were used to control the 50000 km² breeding areas of *Locusta* in the region (see Figures 3 and 4) (28).

While Boris Zolotaresky was working for France, another exiled Russian, Boris P. Uvarov (1888-1970), was working for Great Britain. He began developing his work in 1920 in the *Imperial Bureau of Entomology* in London. This institution, renamed the *Commonwealth Institute of Entomology* not long after, became the *Anti-Locust Research Centre* in 1945. In the scientific field Uvarov made an early impression in 1921 by proposing his so-called theory of locust phases to explain the phenomenon of locust plagues (29). This theory revolutionalised the explanations given for these plagues. According to Uvarov, locust can suffer a very surprising reversible transformation when the density of the locust reached a certain number, individuals change shape, colour, physiology and behaviour. In this way, in the so-called breeding areas, a solitary and harmless locust, unable to undertake any migration, became in 1 or 2 generations a terrible devastating animal. So the finding of these areas should allow control of that transformation with the aid of insecticide.





Figures 3 and 4.

Watch and control services in the Locusta migratoria area in Niger about 1950.

Source: B.N. Zolotarevsky: "Historique de l'organisation internationale de lutte préventive contre le criquet migrateur africain", 1954.

The following decade was one of intense activity for Uvarov, who was creating an outstanding role for himself in the International Locust Conferences. He exercised true leadership in them and inspired much of the practical work on the African continent. As well as his vital role in these events he attended other international meetings, including the 1937 International Conference on Natural Disasters (30). In his report he reviewed the state of the problem of harmful species worldwide, and stressed the importance of the African problem. Given that their breeding areas were now beginning to be discovered, Uvarov pointed out, now was the moment to develop a new anti-locust policy on the continent based on the control of these areas.

During the Second World War Uvarov never stopped organising; creating, among other things, the *East African Anti-Locust Directorate* to resist the *Schistocerca*. When this fight ended, his working party became the aforementioned *Anti-Locust Research Centre*. His written work, totalling more than 400 titles, in the fields of taxonomy, biology and ecology of Orthoptera, was decisive in the development of the discipline. His role as disseminator of the two scientifically accepted principles for the control of locusts, based on a wide ecological knowledge of every species, and in the international co-ordination and co-operation to fight the plagues, was also fundamental. With the first one it should be possible to localize the places where the different species changed from a solitary locust into a gregarious one in order to apply a preventive policy. With the second, the idea was to start a cooperation among the different countries.

The International Locust Conferences. From Rome, 1931, to Brussels, 1938.

Alongside such outstanding personalities as Vayssière, Zolotarevsky and Uvarov, the International Locust Conferences of the thirties should also be acknowledged as landmarks in the fight against locusts during the first half of this century. The first conference took place in Rome between 28th September and 1st October 1931 at the request of the Italian Colonial Minister, although it was apparently due to pressure from the British government (31). The event brought together representatives from the British Empire, France, Italy and their respective colonies and protectorates. Among the resolutions that were adopted was that annual meetings of specialists should be held and that the *Imperial Institute of Entomology* in London should be designated the international centre for anti-locust investigations. Apart from depriving the International Institute of Agriculture of one of its responsibilities, this decision slanted international anti-locust activity still more towards the interests of certain European countries with African colonies.

The next conference took place in Paris between the 15th and the 23rd of July 1932, coinciding with the Vth International Congress of Entomology held in the same city (32). The papers and the resolutions demonstrated both the interest of applied European entomology in the locust in Africa and the precarious situation of the science. The third conference was held in London between the 11th and the 18th of September 1934 (33). The papers given at the conference, a total of 24, were mainly the work of Anglo-Saxon entomologists. The objectives of the conference were, however, no different to those in Paris. The conclusions of the conference did, however, reflect the progress that had been made, in little more than two years, on the formulation of a scientific programme

to combat locusts. In London, the clear statement was that the identification of the African breeding areas should be the principal end of the international studies.

The Locust Conference in Cairo, from the 14th to the 22nd of April 1936, represented an important qualitative step in the internationalisation of the problem (34). Taking note of the stated desire of the London conference that the international meetings should not only concentrate on the locust in Africa, 60 delegates representing 23 countries from all the continents gathered in the Egyptian capital. During the working sessions more than fifty papers relating to the scientific questions, the economic importance, and the organisation of locust control were presented. The last of the series of International Locust Conferences, which was initiated in Rome in 1931, was held in Brussels between the 25th of August and the 1st of September 1938 (35). A total of 58 representatives from every continent attended. It must be said, however, that more than 50% of the papers presented were still dealing with the locust in Africa. But, for the first time, the conference had a clear international character, involving delegates from countries such as China, the Philippines, Argentina and Canada, that were not European colonies or their mother countries.

In general conclusion, we must first point out the definitive scientific institutionalisation of the fight against the locust, from an international perspective, which began in the 1930s. By institutionalisation, we mean here the existence of an organised scientific institution about Acridoidea and a group of explanatory theories for its scientific problems. The process took place basically as a result of five international conferences held during that decade; the first of these in Rome, in 1931, with the presence of three countries and ten delegates; the last in Brussels, in 1938, in which some twenty countries and more than fifty delegates took part. Although the majority of the meetings centred upon the problem of the locust in the African colonies, both the countries and the themes dealt with became progressively more universal.

The emergence of a scientific community dealing with Acridoidea means the professionalisation of a great number of researchers, generally members of general entomological organizations. Most investigations on locust were published in colonial magazines (*Revue de Botanique appliquée et d'Agriculture tropicale, L'Agronomie Coloniale, Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord, Bulletin of Entomological Research*). Also, new magazines on locust were created like *Locusta* or *Anti-Locust Bulletin*.

On the other hand, the celebration of the last meeting in Brussels meant the end of a model. The Second World War imposed a brusque change in the whole programme of entomological science at the service of the European powers. The world conflict meant a new political and scientific framework. Nevertheless, this has also failed to eradicate locust plagues. The explanation for this surpasses a purely scientific understanding of the problem and enters into the realm of sociopolitical organisation.

NOTES

1) The writing of this paper has benefited from the support of the *Commissionat per a Universitats i Recerca. Direcció General de Recerca. CIRIT BE92. Departament de la Presidència. Generalitat de Catalunya*, and the investigation programme CICYT PB-92-0247.

2) Joyce Magor: "Joining battle with the desert locust", *Shell Agriculture*, 3, 1989, pp. 12-15.

3) Véronique Lorelle: "Casques verts contre criquets pélerins", *Phytoma*, No. 404, January 1989, pp. 22-30.

4) Boureina Alpha Gado: *Une histoire des famines au Sahel. Étude des grandes crises alimentaires (XIXe-XXe siècles)*, Paris, L'Harmattan, 1993, pp. 107-133. More information about the Sahelian crisis in F. Fuglestad: "La Grande Famine de 1931 dans l'Ouest nigérien: réflexion autour d'une catastrophe naturelle", Revue française d'histoire d'outre-mer, LXI, No. 222, Paris, 1974, pp. 18-33. An analysis of the problem in the north of Nigeria during the same period, accusing European colonialism of dislocating the adaption processes of the traditional societies faced with natural dangers, in Michel Watts: *Silent Violence. Food, famine and peasantry in Northern Nigeria*, Berkeley, University of California Press, 1983, XXXI, 687 pages.

5) The importance of science in colonial European context in the first half of 20th century has been studied by Michael Worboys: *Science and British colonial imperialism 1895-1940*, PhD thesis, University of Sussex, 1979; Lewis Pyenson: "Cultural imperialism and exact sciences. German expansion overseas 1900-1930", *History of science*, 20, No. 47, March 1982, pp. 1-43; Christophe Bonneuil: *Des savants pour l'empire. La structuration des recherches scientifiques coloniales au temps de "la mise en valeur des colonies françaises" 1917-1945*, Paris, Éditions de l'Orstom, 1991, 125 pages.

6) From other parts of the continent the testimonies of Michel Adanson, Anders Sparrman, Robert Moffat and R.P. Camboué are noted, although the list is more extensive. See Michel Adanson: *Histoire naturelle du Sénégal. Coquillages. Avec une relation d'un voyage fait en ce pays*, Paris, C.J.B. Barche, 1757; Anders Sparrman: *A Voyage to the Cape of Good Hope, towards the antarctic polar circle, and round the world, but chiefly into the country of the Hottentots and Caffres, from the year 1772 to 1776 by –*, Translated from the Swedish original, London, G.G.J. and J. Robinson, 1785, 2 vols.; Robert Moffat: *Missionary labours and scenes in Southern Africa*, London, John Snow, 1842, XVI, 624 pages.; R.P. Camboué: "Les sauterelles à Madagascar", *Bulletin bimensuel de la Société Nationale d'Acclimatation*, Paris, 1888, 4 pages. Two years earlier Camboué had published in the same journal: "Les sauterelles à Madagascar sur le riz malgache", Paris, 1886, 5 pages.

7) Pliny: *Natural History*, Cambridge, Massachusetts-London, Havard University Press-William Heinemann Ltd., Loeb Classical Library, Vol. III, Books VIII-XI, pp. 495 ff.

8) Leon Africano: *De l'Afrique, contenant la description de ce pays*, Paris, De l'Imprimerie de L. Cordier, 1830, 4 vols. The quote is in Vol. 2, page 315. The first edition of the work, *Descrizione dell'Africa*, is from 1526.

9) Thomas Shaw: *Travels or Observations relating to several parts of Barbary and the Levant*, Oxford, Printed at the theatre, 1738, XV-442-60 pages. The information on the plague appears on page 187. Shaw's work was translated into French with the title: *Voyages de Monsr. Shaw, M.D. dans plusieurs provinces de la Barbarie et du Levant: contenant des observations géographiques, physiques, philologiques et mêlées sur les royaumes d'Alger et de Tunis, sur la Syrie, l'Égypte et l'Arabie Petrée, avec des cartes et des figures*, A La Haye, Chez Jean Neaulme, MDCCXLIII, 2 Vols., XLIV-414 pages + 172 pages. The information on the locust in Vol. 1, page 331 ff.; Jean André Peyssonnel: *Relation d'un voyage sur les cotes de Barbarie, fait par ordre du roi, en 1724 et 1725*, in Peyssonnel et Desfontaines: *Voyages dans les Régences de Tunis et d'Alger, publiés par M. Dureau de la Malle*, Paris, Librairie de Gide, Éditeur des annales des voyages, 1838, Vol. 1, XXXVII-485 pages. The quote on page 331.

10) George Höst: *Narichten von Marokos und Fes, in Lande selbt gesammlet, in den Jahren 1760 bis 1768*, Copenhague, C.G. Gottlob, 1781, XVI-312 pages. The reference about the Moroccan locust is on page 300.

11) M. de Chénier: *Recherches historiques sur les Maures et Histoire de l'Empire du Maroc*, Paris, Imprimerie Polytype, 1787, Vol. III, page 498.

12) Jacopo Gråbeg di Hemsö: *Specchio geografico, e statistico dell'imperio di Marocco*, Genoa, Tipograpia Pellas, 1834, 364 pages.

13) The control of the locust in contemporary Spain is being studied by Antonio Buj. The first results can be found in: "Control de las plagas de langosta y modernización agrícola en la España de la segunda mitad del siglo XIX", *Geo Crítica*, No. 95, Barcelona, July 1992, 67 pages; and "Control of locust plague in Spain in the first half of the XXth century. The agronomist José Cruz Lapazarán and the plague in Aragón", *XIXth International Congress of History of Science 1993 (Zaragoza)*, held 22nd-29th of August 1993 (published in *CEHOPU*, Madrid, Ministerio de Obras Publicas).

14) Hippolyte Lucas: "Insectes", in *Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842*, Paris, Impr. nationale, 1849, Vol. III; "Quelques remarques géographiques sur les Acridites qui habitent les possessions françaises du nord de l'Afrique et de deux nouvelles espèces appartenant à cette famille", in *Annales de la Société Entomologique de France*, Paris, 1851, Vol. IX, pp. 349-383.

15) Jules Künckel d'Herculais: *Invasions des acridiens vulgo sauterelles en Algérie*, Algiers, Imprimerie Administrative et Commerciale Giralt, 1893-1905, 3 Vols.

16) L'Abbé Burzet: *Histoire des désastres de l'Algérie. 1866-1867-1868. Sauterelles. Tremblement de terre. Choléra. Famine*, Algiers, Impr. de E. Garaudel, 1869, page 71.

17) Jules Künckel d'Herculais: *op. cit.*, 1893-1905, Vol. I, page 226.

18) Institut international d'Agriculture: *La lutte contre les sauterelles dans les divers pays*, Rome, Imprimerie de l'Institut international d'Agriculture, 1916, XVI-187 pages.

19) Institut international d'Agriculture: *Actes de la Conférence internationale pour l'organisation de la lutte contre les sauterelles (Rome, 28-31 octobre 1920)*, Imprimerie de l'Institut international d'Agriculture, 1921, 171 pages.

20) *Ibid.*, pp. 125-126.

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