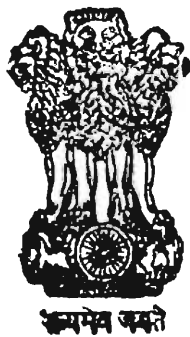


RECORDS
of the
INDIAN MUSEUM

(A Journal of Indian Zoology)

Vol. 56
(For the year 1958)

EDITED BY
THE DIRECTOR,
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BIBLIOGRAPHIA ACRIDIDIORUM.

A bibliography of the Orthopterous insects of the family Acrididae (comprising the short-horned grasshoppers and locusts) from the earliest times to the end of 1954 (with some additions for 1955-57).

By

M. L. ROONWAL



Edited by the Director, Zoological Survey of India

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ROONWAL, M. L.

BIBLIOGRAPHIA ACRIDIDIORUM. A bibliography of the Orthopterous insects of the family Acrididae (comprising the short-horned grasshoppers and locusts) from the earliest times to the end of 1954 (with some additions for 1955-57).

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A BIBLIOGRAPHY OF THE ORTHOPTEROUS INSECTS OF THE FAMILY ACRIDIDAE
(COMPRISING THE SHORT-HORNED GRASSHOPPERS AND LOCUSTS) FROM THE
EARLIEST TIMES TO THE END OF 1954 (WITH SOME ADDITIONS FOR 1955-57)

By

M. L. ROONWAL

*Director, Zoological Survey of India, Calcutta**

(With one Table, one Text-figure and one Plate)

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* Formerly, Chief Research Officer (Forest Entomologist), Forest Research Institute, Dhera Dun.

I—INTRODUCTION

1. *General*

The group of Orthopterous insects known as short-horned grasshoppers constitute the family Acrididae which, by certain authorities, is raised to superfamily rank. For convenience, for the purpose of this bibliography, we will refer the entire group to the "family Acrididae" (*vide* further discussion below under Classification, etc., p. 3).

The family Acrididae (which includes the locusts) is a group of primarily terrestrial insects distributed practically all over the land-surface of the earth except the extreme subpolar regions of the Arctic and the Antarctic Circles (Pl. 1). A few forms are semi-aquatic in freshwaters. Several members of the family periodically increase enormously in numbers so as to cause plagues (Pl. 1) during which the vegetation of the areas concerned suffers serious depredation, being eaten up by the hordes. The family has always formed a favourite subject for scientific observations and investigations both by the older naturalists (because of the spectacular locust swarms) and by modern zoologists. The insects are large, easy to procure and rear in moderate and even large numbers, and belong to a comparatively unspecialized order of the Pterygote group. They consequently provide favourite material for the study of varied biological problems in regard to morphology, ecology, embryology, cytology, physiology, zoogeography, taxonomy and evolution. The migratory members (locusts) of the family exhibit the curious and biologically very interesting phenomenon known as the "phases" in which populations living under crowded conditions show morphological, physiological, colour and behaviouristic differences from individuals living under relatively less crowded or solitary conditions. In addition, locusts and grasshoppers are of great economic importance as serious pests of crops, especially the family Gramineae (grasses), locusts being the classical dread of the agriculturist from ancient times. Recently damage by locusts throughout the world has been estimated at Rupees 400,000,000 each year. All these factors have combined to stimulate research on the family so that over 200 papers are now published every year, and the total number of references published so far (up to the end of 1954) is slightly over 7,300. It is clear that in the normal course it is difficult, even for favourably placed research workers, whether pure or economic zoologists, to get to know of the existence of even a fraction of these numerous references mainly because of the wide variety of places and periodicals where, and the languages in which, they are published. The need for a comprehensive bibliography has, therefore, been widely felt, and the present publication is designed to fulfil that need both for the economic zoologist and the pure researcher.

Since the completion of the Main Bibliography, some more references have come to my attention and have been included in two Supplementary Bibliographies at the end.

2. *Acknowledgements*

The compilation of this Bibliography was begun by me some twenty-five years ago and by about 1948, the bulk of it, complete up to the end of that year, was ready in manuscript form. During the years 1952-53,

Dr. Surendra Deo Misra, of the Zoology Department, Saugar University, Saugar (Madhya Pradesh), kindly volunteered assistance and helped in bringing the Bibliography up-to-date and also in typing out and re-arranging portions of the first few alphabets (A-H). In 1955, the Government of India sanctioned some staff under a "Co-ordinated Locust Research Scheme" to assist me in completing the Bibliography and in making it press-ready. The staff was to be administratively on the strength of the Plant Protection Adviser to the Government of India, Ministry of Agriculture, New Delhi, but was to work technically under me at the Forest Research Institute, Dehra Dun. Under this arrangement were appointed Shri Sanat Kumar Chatterjee, M. Sc., as Research Assistant, and Kumari Swaran Lata Chawla as Typist; they joined duty at Dehra Dun in the later part of 1955 and rendered considerable help. Kumari Chawla left the Scheme in July, 1956 and Shri Chatterjee in August, 1956. Shri R. K. Bhanotar, M. Sc., joined the Scheme as Research Assistant in May, 1956 at Dehra Dun, and helped in the preparation of a portion of the Subject Index and the Supplementary Bibliographies. In addition, much assistance has also been received from my Technical Assistant, Shri Kishori Lal. To all these Assistants I would like to record my thanks. On my transfer to Calcutta in July, 1956, the Scheme was transferred to me here in January, 1957.

During the long period of years while this Bibliography has been under preparation, many fellow zoologists all over the world have helped generously either by sending reprints, by clarifying crucial points regarding the various references, or in other ways, and it is a pleasure to acknowledge my sincere thanks to them.

3. *Classification of short-horned grasshoppers, and problems of nomenclature*

(a) *Classification of short-horned grasshoppers—*

The short-horned grasshoppers, which were formerly grouped under a single family Acrididae (with a number of subfamilies) of the order Orthoptera, are now classified into several families under a single superfamily, Acridoidea, thus :—

Superfamily *Acridoidea*.

Family 1. ACRIDIDAE.

(With subfamilies Acridinae, Batrachotetriginae, Crytanthacridinae, Oedipodinae, Ommexechinae, Pamphaginae, Pauliniinae, Pyrgomorphinae, Romaleinae and Thrincinae.)

Family 2. EUMASTICIDAE.

Family 3. PROSCOPIIDAE.

Family 4. TETRIGIDAE (= ACRYDIDAE).

Family 5. TRIDACTYLIDAE (including CYLINDRACHAETIDAE).

There exist, however, alternative classifications. Among the latest is that by Chopard (1949, in Grassé's *Traité de Zoologie*, 9, pp. 674-713, Paris), who has adopted the following classification of the short-horned grasshoppers, with 2 superfamilies and 12 families :—

Suborder CAELIFERA

Superfamily (i) *Tridactyloidea*.

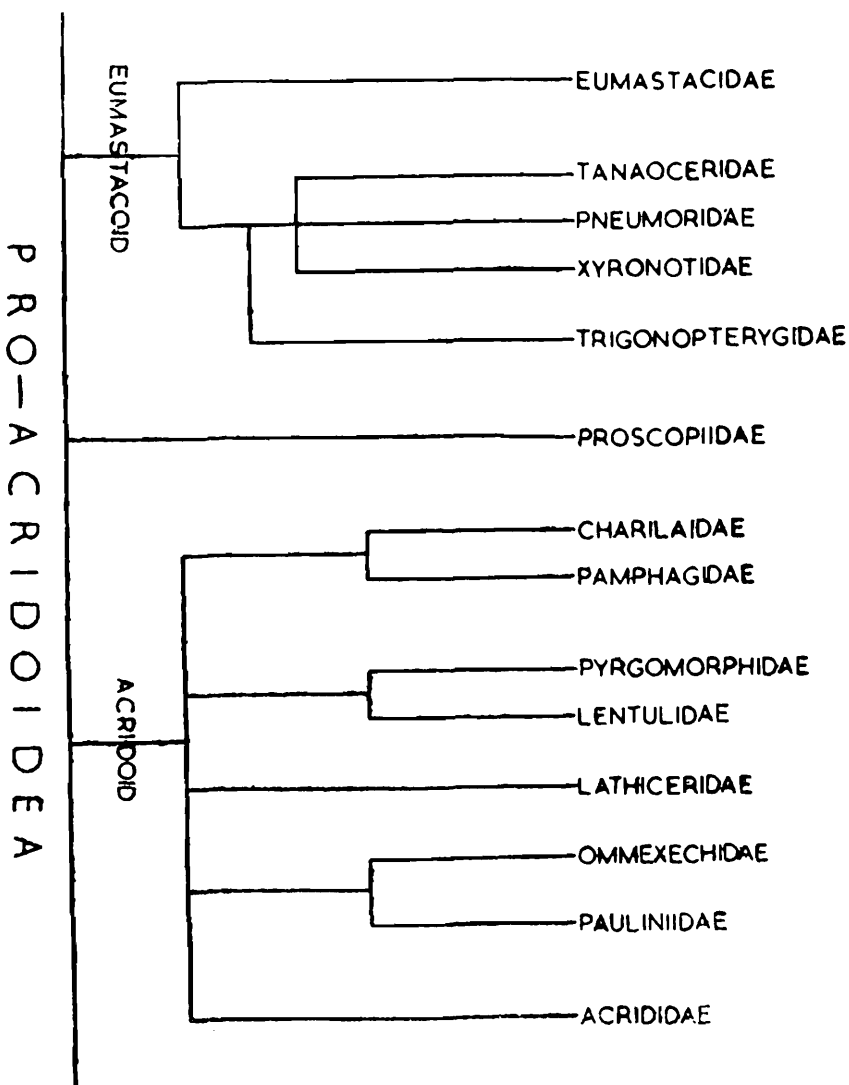
Family 1. TRIDACTYLIDAE.

„ 2. CYLINDRACHAETIDAE.

Superfamily (ii) *Acridoidea*.

- Family 1. TETRIGIDAE (= ACRYDIIDAE).
 „ 2. PNEUMORIDAE.
 „ 3. EUMASTICIDAE.
 „ 4. PROSCOPIIDAE.
 „ 5. PYRGOMORPHIDAE.
 „ 6. PAMPHAGIDAE.
 „ 7. OMMEXECHIDAE.
 „ 8. ROMALEIDAE.
 „ 9. CATANTOPIDAE.
 „ 10. ACRIDIDAE (with subfamilies Acridinae and Oedipodinae).

Dirsh (*Trans. R. ent. Soc. Lond.*, 108 (7), pp. 223-356, 1956) has, on the basis of the structure of the phallic complex, recognized 14 families of the suborder Acridoidea which are listed below ; the family Tetrigidae, formerly included in that suborder, has been raised by him to the rank of a distinct suborder, Tetrigoidea. Dirsh considers the ancestral group Pro-Acridoidea to have given rise to three independent branches, viz., the Eumastacoid (with 5 families), the Proscopiid (with a single family) and the Acridoid (with 8 families), as is illustrated in Text-fig. 1.



TEXT-FIG. 1.—A phylogenetic scheme of the Acridoidea. (After Dirsh, 1956.)

Suborder *ACRIDOIDEA*

- Fam. 1. EUMASTACIDAE.*
 Fam. 2. TANAOCERIDAE. (See foot-note under Eumastacidae).
 Fam. 3. PNEUMORIDAE.
 Fam. 4. XYRONOTIDAE.
 Fam. 5. TRIGONOPTERYGIDAE.
 Fam. 6. PROSCOPIIDAE.
 Fam. 7. CHARILAIIDAE.
 Fam. 8. PAMPHAGIDAE.
 Fam. 9. PYRGOMORPHIDAE.
 Fam. 10. LENTULIDAE fam. nov. (Dirsh, 1956).
 Fam. 11. LATHICERIDAE.
 Fam. 12. OMMEXECHIDAE.
 Fam. 13. PAULINIIDAE.
 Fam. 14. ACRIDIDAE.
 Subfam. (i) *Romaleinae*.
 ,, (ii) *Catantopinae*.
 ,, (iii) *Calliptaminae*.
 ,, (iv) *Euryphyminae*.
 ,, (v) *Hemiacridinae* subfam. nov. (Dirsh, 1956.)
 ,, (vi) *Acridinae*.
 ,, (vii) *Egnatiinae*.
 ,, (viii) *Eremogryllinae* subfam. nov. (Dirsh, 1956.)
 ,, (ix) *Truxalinae*.

(b) *Problems of nomenclature, etc.—*

One of the objects of this Bibliography is to assist the economic zoologists and the field workers on locusts and grasshoppers who have no access to large libraries. Frequent changes of the scientific names of the various economic species, especially the migratory and the widely spread species, present serious problems and cause confusion. To take an example : The Desert Locust, *Schistocerca gregaria* (Forsk.) has been variously known in the literature also as *Acridium peregrinum* Olive., *Acridium tatarica* (of various authors, not Linné), and *Gryllus gregarius* Forskal. The various common names adopted for this species in the scientific literature are : the Migratory Locust, the North-West Locust (India), criquet pelèrin, criquet migrateur (rarely), etc. Much of this confusion has been cleared up by Uvarov in his book *Locusts and Grasshoppers* (1928). To facilitate the task of the field worker, I give below the current and valid scientific names of the more important species of locusts and grasshoppers (*i.e.*, species on which there is considerable literature), together with the first name and the original reference ; the common names are also appended. For fuller synonymies, Kirby's (1910, *A Synonymic Catalogue of the Orthoptera*, Vol. III) and Uvarov (1923 and 1928) should be consulted for world forms ; for Indian species, Kirby's (1914) volume on the Orthoptera ; Acrididae (in the *Fauna of British India* series) though rather out of date,

*Rehn (1948, *Proc. Acad. nat. Sci., Philadelphia*, 100, pp. 77-139), recognised 17 subfamilies of the family Eumastacidae. Of these the subfamily Tanæocerinae was raised to family rank by Dirsh (1955, *Ann. Mag. nat. Hist.*, London, (12) 8, pp. 285-288)

will still be found useful. In several cases, the migratory and solitary phases (phases *gregaria* and *solitaria* respectively) have been known under different names.

List of names of some locusts and grasshoppers, with references and type-localities

1. *Anacridium aegyptium* (Linné 1764). Egyptian Grasshopper.
Gryllus (*Locusta*) *aegyptius*, Linné, *Mus. Lud. Ulr.*, p. 131 (Egypt). For additional synonymy, see Uvarov, *Ann. Mag. nat. Hist.*, London, (9) 11, p. 487.
2. *Anacridium moestum* (Servilié 1839). Tree Locust.
Anacridium moestum, Serville *Ins. Orth.*, p. 654 (Pays de Mossilikatse=Southern Rhodesia, Africa).
3. *Austroicetes cruciata* (Saussure, 1888). Small or Australian Plague Grasshopper.
Ditopternis cruciata, Saussure, *Mem. Soc. Phys. Genève*, 30, p. 45 (Australia).
4. *Chortoicetes terminifera* (Walker 1870). Australian Plague Locust. ("Wandering Grasshopper" of Uvarov).
Epacromia terminifera, Walker, *Cat. Derm. Salt. Brit. Mus.*, 4, p. 777 (Swan River Australia).
5. *Caliptamus italicus* (Linné 1758). Italian Locust.
Gryllus (*Locusta*) *italicus*, Linné *Syst. Nat.* (ed. 10), 1, p. 432 (Italy).
6. *Dociostaurus maroccanus* (Thunberg 1815). Moroccan Locust.
Gryllus maroccanus, Thunberg, *Mem. Acad. St. Petersb.*, 5, p. 244 (N. Africa).
Phase *gregaria*=*maroccanus* Thunb.
Phase *solitaria*=*degeneratus* Brnov.
7. *Locusta migratoria* (Linné 1758). Migratory Locust.
Gryllus (*Locusta*) *migratorius*, Linné, *Syst. Nat.* (ed. 10), 1, p. 432 (Europe).
Phase *gregaria*=*migratoria*. L.
Phase *solitaria*=*danic* ? L.
Several geographical subspecies occur as follows :—
 - 7a. *L. m. migratoria* Linné 1758.
As above.
 - 7b. *L. m. migratorioides* (Reiche & Fairmaire 1847).
Oedipoda migratorioides, Reiche & Fairmaire in : Ferrier & Galinier, *Voyage Abyss.*, 3, p. 430 (Abyssinia).
 - 7c. *L. m. capito* (Saussure 1884).
Pachytylus migratorioides var. *capito*, Saussure. *Mem. Soc. Phys. Genève*, 27, p. 119 (Madagascar).
 - 7d. *L. m. manilensis* (Meyen 1835).
Acrydium manilense, Meyen, *Reiseum die Erde*, 2, p. 197 (Manila). For synonymy, see Uvarov, *Bull. ent. Res.*, 27, 1936, p. 92.
 - 7e. *L. m. rossica* Uvarov & Zolotarevsky 1929.
Idem., *Bull. ent. Res.*, 20, 1929, p. 263 (Central Russia).
 - 7f. *L. m. gallica* Remaudière 1947.
Idem., *C. R. Acad. Sci. Paris*, 225, p. 1025 (W. France).
8. *Locustana pardalina* (Walker 1870). Brown Locust.
Pachytylus pardalinus, Walker, *Cat. Derm. Salt. Brit. Mus.*, 4, p. 725 (Interior of South Africa).
9. *Melanoplus differentialis* (Thomas 1865). Differential Grasshopper.
Acridium differentiale, Thomas, *Trans. Illin. State. Agric. Soc.*, 5, p. 450 (U.S.A.).
10. *Melanoplus femur-rubrum* (De Geer 1773). Red-legged Grasshopper.
Acrydium femur-rubrum, De Geer, *Mem. Ins.*, 3, p. 498 (N. America).

11. *Melanoplus mexicanus* (Saussure 1861). Rocky Mountain-Locust.
Pezoreux mexicana, Saussure, *Rev. Zool.*, (2) 13, p. 160 (Mexico).
 Synonyms :
Acridium spretus Thomas, 1865, *Trans. Illin. State Agric. Soc.*, 5,
 p. 450 (U.S.A.). (=phase gregaria.)
Caloptenus atlantis Riley, 1876, *Rep. Ins. Missouri*, 7, p. 169 (Missouri,
 U.S.A.). (=phase solitaria.)
12. *Nomadacris septemfasciata* (Serville 1839). Red Locust.
Acridium septemfasciata, Serville, *Ins. Orth.*, p. 661, (Cape de Bonne Esperance).
 For synonymy, see Uvarov, *Ann. Mag. nat. Hist.*, London, (9) 13, 1924, p. 7.
 Phase gregaria=*septemfasciata* Serv.
 Phase solitaria=*coangustata* Luc.
13. *Patanga succincta* (Linné 1763). Bombay Locust.
Gryllus (*Locusta*) *succinctus*, Linné, *Amoen. Acad.*, 6, p. 398 (India).
 For synonymy, see Uvarov, *Ann. Mag. nat. Hist.*, London, (9) 12, 1923,
 n. 365.
14. *Schistocerca gregaria* (Forsk. 1775).
Gryllus gregarius, Forskal, *Descr. anim. quae in itin. orient. observavit*, 1779,
 p. 81 (Cairo, Egypt, 23 Dec., 1761, swarms).
 For fuller synonymy, see Uvarov, *Bull. ent. Res.*, London, 14, p. 31.
 Phase gregaria=*gregaria* Forsk.
 Phase solitaria=*flaviventris* Burm.
15. *Schistocerca paranensis* (Burmeister 1861). South American Locust.
Acridium paranense, Burmeister, *Reise La Plata Staaten*, 1, p. 491 (La Plata,
 S. America).
 Phase gregaria=*paranensis* Burm.
 Phase solitaria=?*americana* F.

Those not familiar with modern classification often confuse the Orthopteran family name Locustidae (=Tettigonidae), containing the long-horned grasshoppers, and the suborder and superfamily names Locustoidea and Locustodea (containing the families Grylloblattidae, Locustidae, Gryllacridae, Stenopelmatidae, Schizodactylidae, Gryllidae and Gryllotalpidae) with the Acrididae, Acridodea, etc. (containing the short-horned grasshoppers). This confusion is accentuated by the fact that the generic name *Locusta* belongs to the family Acrididae and not to the Tettigonidae. The following names which often occur in the literature on grasshoppers belong to the family Tettigonidae :—*Decticus verrucivorus* Linn., *Locusta virridissima* Linn., *Meconema varium* Fabr., *Saga ephippigera* Fisch. and *Saga gracilipes* Uvar.

4. Some general remarks on the family Acrididae

The family Acrididae is practically world wide in distribution, ranging from the extremely cold Arctic and Antarctic regions to the temperate and tropical areas. Its members inhabit a wide variety of places such as snowfields, hot, humid, tropical forests, dry sandy deserts and high mountain slopes. A few species are semi-aquatic and are able to swim, though rather weakly. No species is domesticated (*i.e.*, occurs habitually in human dwellings). The family is of great importance to agriculture and forestry as its representatives are phytophagous and include the voracious locusts which, owing to their periodic epidemic mass-multi-

plication and migrations over enormous distances, constitute an international problem as regards their control. It is partly because of this great economic importance that a vast amount of scientific literature has been published on the family.

Locusts have figured, often prominently, in religious and literary works in the past and continue to do so at present. Thus, in the Bible—in both the *Old* and the *New Testaments*—there are many references to locusts in Egypt, Palestine and the adjoining countries. It is stated, for example, how they come in large numbers, eating everything and darkening the face of the earth ; and again, that Moses for a time fed exclusively on locusts and honey. The species, however, cannot be identified with certainty from the descriptions and might be either *Schistocerca gregaria* or *Doclostaurus maroccanus*, the two species now commonly occurring in those parts. The locusts in “Exodus” (in the *Old Testament*, 2nd century A.D.), however, were probably *Schistocerca gregaria* since they plagued Egypt and were subsequently driven into the Red Sea.

The following is a vivid description of locust swarms taken from “Exodus” :—

“4 Else, if thou refuse to let my people go, behold, to-morrow will I bring locusts into thy border :’ 5 And they shall cover the face of the earth, that one shall not be able to see the earth : and they... shall eat every tree which groweth for you out of the field : 6 And thy houses shall be filled, and the houses of all thy servants, and the houses of all the Egyptians

“...14 And the locusts went up all over the land of Egypt, and rested in all the borders of Egypt ;.. 15 For they covered the face of the earth, so that the land was darkened ; and they did eat every herb of the land, and all the fruit of the trees which the hail had left ; and there remained not any green thing, either tree or herb of the field, through all the land of Egypt... 19 And the Lord turned an exceeding strong west wind, which took up the locusts, and drove them into the Red Sea ; there remained not one locust in all the border of Egypt.”—*Exodus*, X.

Rádl (1930, p. 92), in his book *The History of Biological Theories*, mentions that “Napier, the discoverer of logarithms, discussed with equal earnestness those complicated properties of numbers and the question whether migratory locusts may have been Mohammedans by religion”.

In recent years in the Russian novel, *The Locusts*, by Sergey Budantsev (1927), the plot is woven around the struggle with locusts in Central Asia. The American novel, *The Good Earth*, by Pearl Buck contains vivid references to locusts in China, and, based on the book, there is also a cinema film in which locust swarms are shown.

It is chiefly because of the extraordinary feats of locusts that public interest in the family has been roused. Locust swarms are truly huge, sometimes 10 miles long and a mile wide, and contain millions of insects. When such swarms visit us periodically, the sun is hidden as if by clouds. Where the swarms alight, they make short work of all green vegetation, whether crops or trees or even bark, within a matter of a few hours, leaving a desolate scene behind. Where they alight, it is impossible to walk without crushing a handful of them under your feet. I once witnessed in Jodhpur (Rajasthan) that the wheels of a railway engine slipped back repeatedly due to the crush of the dense mass of locusts

on the rails, and the train could move forward only when sand was thrown on the rails in front of the puffing engine. Then there is the case of a locust swarm in Russia stripping a herd of sheep of its wool for food (*vide* Husain and Mathur, 1936a). In another case, a 10-month old human baby was eaten up by a swarm of locusts in the Osian village, Jodhpur District, Rajasthan (India) while the mother was working in another part of the field (*vide* "INDIA", 1952, *Hindustan Times*, Delhi, Nov. 20, 1952, p. 8, col. 4) ; the report stated : "when after a while the mother reached the spot, she found to her horror that her dear son had been completely finished by the pest"

While locust swarms cause famine and pestilence in agriculturally fertile areas, in the non-fertile and desert areas such as Baluchistan, locust swarms are welcomed as they form a valuable source of food. Children and womenfolk make it a holiday when swarms come, and have a busy time collecting locusts ; they then break their heads which are thrown away and dry the bodies in the sun. The dried locusts are stored in bags, to be made into curry when required.

Locust control is a problem which requires international cooperation. Not only that, but also in each country the control work is an emergency problem requiring quick action on as wide a public and official sector as possible. And so when swarms invade an area, all available manpower—army personnel, students and other members of the public—is harnessed to the task. But people may have their own objection to killing "life" This happened in 1950 in the Mehsana District in Gujrat (India) when thirty persons were jailed (*vide* "INDIA", 1950, *Hindustan Times*, Delhi, Nov. 21, 1950, p. 6, col. 5). The report stated that "the 30 persons who were arrested had raided a Government insecticide depot and attacked a locust-fighting squad." And further : "The same sentiment blinded others to throw a causeway of shrubbery across the river Banas near Dessa town to help locust swarms cross it. (Don't they have wings?) ; this 'sentimental causeway' was improvised to help hungry locusts across to fertile fields."

5. *Historical account of works on the Acrididae*

A history of the scientific attention, as judged by the number and variety of publications, devoted to the family Acrididae, is of some interest. In the ancient and mediaeval texts, the family came to be mentioned mainly because of the spectacular and devastating locust plagues. References to them occur here and there in the ancient Indian (Sanskrit), Egyptian and Chinese texts, but a systematic and critical study of these texts is a desideratum. In the ancient Greek texts, ARISTOTLE (4th century B. C.) referred in passing to locusts. In the *Bible* (the *Old Testament*, 2nd century A. D., and the *New Testament*, 4th century A. D.) fairly extensive references are made to the devastating habits of locust swarms, probably that of the Desert Locust, *Schistocerca gregaria* (Forsk.) but in a literary way only (*vide supra*). Following this, there was an almost complete absence of any worthwhile mention of locusts, etc., during the middle ages in Europe and elsewhere for about a 1000 years (400-1399 A. D.). In the 15th century, the Arab writer AD-DAMIRI (died 1430 A. D.) refers to locusts (probably the Desert Locust) in his work. This is the sole

reference from the year 1400 up to about 1656. From 1657-1695, about 13 scientific publications where locusts had been mentioned appeared in Europe, thus : The English book by S. PURCHAS (1657) entitled *A Theatre of Political Flying Insects* was published in London ; while dealing mainly with bees, it referred to locusts also. In 1690 was published in Uppsala the small eight-page dissertation on locusts by J. BILBERG and P. SALONIUS. In 1693, about seven publications (by EBERLIN, FICHTELBERGER, HEBENSTREIT, KIRCHMAJER, C. H. LÖBER, SCHRECK-RUTE, TREUNER and by WOLLENHAUPT); in 1694, three (by FLOYD, LUDOLF and by OWEN) ; and in 1695 one (by RAYGER), dealing with locusts plagues were published, mostly in Germany. Thus, in the entire 17th century only 13 references (average 0·13 per year) were published.

In the 18th century (1700-1799) about 43 references (average 0·43 per year) were published, all in Europe ; this excludes the purely taxonomic references of such authors as those of C. LINNÉ (1758), P. FORSKAL (1775), etc. In the first half of the 19th century (1800-1849) about 77 references (average 1·5 per year) were published, but the number rose sharply in the second half of the century (1850-1899) to 710 (or *ca.* 14 per year). From the beginning of the 20th century, the number has been steadily rising from about 17 per year in the first 10-year period (1900-1909) to nearly 270 in 1953, but there was a decline during the period of the Second World War (1939-45). Further details of distribution will be found in Table 1.

*TABLE 1.—*Distribution of publications on the Acrididae (short-horned grasshoppers, including locusts) through the centuries, up to the end of 1954. (From the Main List of References only.)*

Years (A.D.)	Total period (years)	Total number of references	Average number of references per year (Approximate)	Remarks
2nd century . . .	100	1	..	..
3rd century . . .	..	..	..	..
4th century . . .	100	1	..	..
400-1399 . . .	1000	<i>Nil</i>	..	..
1400-1499 . . .	100	1	..	..
1500-1599 . . .	100	<i>Nil</i>	..	..

*Subsequent to this tabulation about 50 references were added, and are accounted for in the subsequent tables.

TABLE 1—*contd.*

Years (A.D.)	Total period (years)	Total number of references	Average number of references per year (Approximate)	Remarks
1600-1699 . . .	100	13	0.13	1600-1656...0 1657-1699...13
1700-1799 . . .	100	43	0.43	..
1800-1849 . . .	50	77	1.5	..
1850-1899 . . .	50	710	14	..
1900-1909 . . .	10	170	17	..
1910-1919 . . .	10	350	35	..
1920-1929 . . .	10	840	84	..
1930-1939 . . .	10	1989	199	..
1940-1949 . . .	10	1172	117	..
1950	1	235	235	..
1951	1	239	239	..
1952	1	269	269	..
1953	1	263	263	..
1954	1	181	181	Somewhat incomplete ?
TOTAL :		6554	..	..

6. Arrangement of the Bibliography

The references in the bibliography are arranged alphabetically, according to authors' surnames, and for each author chronologically. Where it is not possible to assign a reference to a particular author owing to anonymity of publication, the reference is listed either under ANONYMOUS, or under a country or continent (*e.g.*, AFRICA, AUSTRALIA, EGYPT, etc.) to which it specifically refers or to some other specific heading such as INTERNATIONAL, etc. Such impersonal "author-names" are enclosed within square brackets : "[]".

Each reference consists of the following components in the order given below :—

(i) Author's surname, followed by his or her initials. In the case of joint authorship, the individual authors are listed in the order given in the original publication. Where there are more than one individual

author with the same surname and initials, they are differentiated by the prefixes (A), (B), etc., thus :

- (A) COLEMAN, L. C.
(B) COLEMAN, L. C.

(ii) The year of actual *publication*. In some references, there is a discrepancy between the actual year of publication of a reference and the date printed on the title page which might merely indicated the year to which a particular volume or part of a journal normally belonged and in which it was expected to be published. The actual date of publication is sometimes indicated on the title page itself, in addition to the expected date of issue, and in other cases this information is obtainable in a variety of other ways. Where the above-mentioned discrepancy exists, the "expected" year of publication is printed within square brackets after the volume or number.

(iii) The *full* title of the paper in the original language, if the language is one of the more common European languages adopting the Latin script, *viz.*, either English, French, German, Italian, Latin or Spanish, etc. In the case of other languages, the title is usually translated into English, and the name of the original language mentioned in square brackets at the end of the title.

The title is printed in Roman when the reference is published as a paper in a periodical, and in Italics when it is published as an independent book or pamphlet.

(iv) The name of the journal or periodical, abbreviated (with minor variations where considered necessary) according to the recommendations of the book *A World List of Scientific Periodicals* (3rd ed., London, 1952), followed, wherever possible, by the name of the town of publication.

(v) The volume number of the periodical, preceded, where necessary, by the series number within brackets, and followed, where necessary, by the number of the part, number, Heft, etc., within brackets.

(vi) In special cases, where there is a discrepancy between the actual date of publication and the expected date or date printed on the title page, the latter is mentioned in square brackets after the part or Heft number (*vide* No. (ii) above).

(vii) The first and last pages of the original reference, together with any additional pages if present. (Any text-figures, charts, etc., printed on these numbered text-pages are not, as a rule, mentioned separately.)

(viii) The total number of plates, charts, graphs, figures, tables, etc., which do not come on the text-pages already mentioned in No. (vii) above but are in addition to them.

(ix) Where an author (or a set of joint authors in identical order) have more than one reference under each year, the small letter *a, b, c*, etc., in Italics, is appended to the year following the name (s) of author(s).

Cross references are given, in the appropriate alphabetical place, to the alternative spellings of an author adopted in the literature, and to the authors other than the first one in the case of references with more than one author.

Each complete reference is serially numbered. Cross references do not bear any serial number but carry in its place a small dash.

At the end of the Bibliography there is an Author Index and a Subject Index.

A few fictitious examples of the mode of writing the references, as explained above, are given below for guidance :—

66. GOTWAL, R. K. 1923*a*. A study of the geographical distribution of some locusts. Part 2. The Asiatic species.—*Bull. comp. Anat.*, Bombay, (4) 6 (2) [Sept. 1922], pp. 14-94, 3 pls., 4 tables, 2 maps in pocket.
67. GOTWAL, R. K. 1923*b*. Studies on the anatomy of locusts.—*J. Zool. Anat.*, Washington, 6 (3), pp. 14-93, 5 pls.
- GUMBERG, L. P. 1944.—See BODINE, W. and GUMBERG, L. P. 1944.
69. GUNNER, P. A. 1864. *The Locust Plagues of the World*. xii+1+302+iv pp., 1 frontispiece, 23 pls.—Heidelberg (Günther & Co.).
70. GURTOVSKY, S. S. 1933. Aspects of locusts research in the Soviet Union. [In Russian.]—*Odessk. Vyatste*, Odessa, No. 173, pp. 8-63.

7. Scope and completeness of the Bibliography

An effort has been made here to compile as complete a list as possible of the published references on the family Acrididae, as understood in the first classification (not Chopard's, 1949) discussed above (p. 3) in the section on "Classification etc.", but the major references of the other allied though small families, viz., the Eumasticidae, the Proscopiidae the Tetrigidae (=Acrydiidae) and the Tridactylidae, are also included as guides to further search especially because in the older scientific literature (and even in some current literature) these families are not separated from the Acrididae. The bibliography covers the period from the earliest times to the end of the year 1954. Some readily available references published in 1955, 1956, and the early part of 1957 have also been included to enhance its utility, but these years are incomplete as it will be some considerable time before comprehensive information about them will become available. In this way a total of about 6,600 references has been assembled here in the main bibliography and about 700 in the supplementary ones.

No special effort was made to include the references to locusts and grasshoppers occurring in the ancient texts (see above under Historical Account, p. 9), as the labour involved in the task would not have been commensurate with the results—the main purpose of the present bibliography being scientific rather than historical. The earliest dated reference in historical times is that in the Arabic work of AD-DAMARI (died 1430 A.D.), and then from about 1657 onward works started appearing in Europe which steadily increased in number and improved in scientific quality as years rolled by.

The bulk of the references listed here have been examined by me, as opportunity occurred, in the various libraries of the world, especially in the following countries :—India, Great Britain, Germany, Sweden, Italy, France and the U.S.A. In India the libraries most profitable in this respect were those of the Zoological Survey of India,

Calcutta, the Indian Agricultural Research Institute, New Delhi, and the Forest Research Institute, Dehra Dun. References which could not be examined in the original were taken from other authoritative publications, particularly the following :—

- ACRIDOLOGICAL ABSTRACTS. 1950-1956. (For references from 1949 onwards.)—London (Anti-Locust Research Centre).
- AGASSIZ, L. and STRICKLAND, H. E. 1848-1859 (?). *Bibliographia Zoologie et Geologie*, 1-4 (1848-1859 ?)—London.
- BRITISH MUSEUM (NATURAL HISTORY), LONDON. 1903-1933. *Catalogue of Books, Manuscripts, Maps and Drawings in the British Museum (Natural History)*, 1-7 (1903-1933).—London.
- CARUS, J. V. and ENGLEMAN, W. 1861. *Bibliotheca Zoologica*. [1]. (For the years 1846-1860.) Bd. 1 (pp. x+1-950) ; Bd. 2 (pp. xxiv+951-2144).—Leipzig.
- ENGLEMAN, W. 1846. *Bibliotheca Historico-Naturalis*. 1. (For the years 1700-1846.) Pp. viii+2+786.—Leipzig.
- HORN, W. and SCHENKLING, S. 1928. *Index Literaturae Entomologicae*. Serie I. *Die Welt-Literatur über die gesamte Entomologie bis inklusive 1863*. 1-3 (1056 pp., 5 pls.).—Berlin.
- REVIEW OF APPLIED ENTOMOLOGY. 1913-1956. 1-44 (Series A and B).—London.
- ROONWAL, M. L. 1954. A brief review of the progress of entomology in India during the period 1938-50, together with a bibliography.—*Mem. ent. Soc. India*, New Delhi, No. 3, pp. 1-119.
- TASCHENBERG, O. 1887-1923. *Bibliotheca Zoologica*. 2 (Bds. 1-8, ca. 6620 pp.).—Leipzig.
- UVAROV, B. P. 1928. *Locusts and Grasshoppers*.—London.
- UVAROV, B. P. 1948. Recent advances in Acridology : Anatomy and physiology of Acrididae.—*Trans. R. ent. Soc. Lond.*, London, 99, pp. 1-75.
- ZOOLOGICAL RECORDS. 1864-1953. Annual volumes 1-90.—London.

In spite of all this effort it is possible, and indeed almost certain, that some references have been overlooked, although I hope and believe that their number is small. The publication of this Bibliography will highlight those omissions. I will be grateful if readers will be kind enough to bring any omissions and inaccuracies to my notice.

8. Some analyses of the Bibliography

Some general analyses of the about 6604 references included in the Main Bibliography will be of some interest. These analyses have been done in regard to the following aspects :—

- (a) Distribution under the various alphabets according to the authors, names.
- (b) Number of individual authors in the entire list, and under each alphabet.
- (c) Number of references by separate authors.
- (d) Distribution of references by countries of publication.
- (e) Distribution of references by languages of publication.

(a) Distribution of references under alphabets (authorwise)—

Out of a total of about 6604 separate references, their distribution under the various alphabets (with which the authors' names begin) varies from 0-655. At the lower end of the scale, the distribution is : X, 0 ; Q, 5 ; Y, 29 ; O, 55 ; and at the higher end : B, 655 ; S, 626 ; R, 510 ; M, 443 ; C, 433.

(b) Number of individual authors—

The total number of authors in the entire bibliography (excluding impersonal authorships, e.g., under countries, anonymous, etc.) is about 2858.

The number of separate authors (exclusive of impersonal authorships) under each alphabet varies from 0-321, the distribution towards the two extremes being as follows : X, 0 ; Q, 3 ; U, 13 ; Y, 20 ; Z, 29 ; O, 30 ; and S, 322 ; B, 282 ; M, 231 ; C, 202.

(c) Number of references by separate authors—

The total number of references, up to the end of the year 1954, attributable to individual authors (for joint papers, the first author alone is counted for this purpose) varies from 1 to about 202. About 118 authors have contributed 10 or more papers. The following authors have contributed more than 50 papers each :—

Y Ramachandra Rao (1920-54)	:	51 papers.
M. L. Roonwal (1933-55)	:	61 „
J. A. G. Rehn (1901-54)	:	64 „
J. Lieberman (1928-53)	:	82 „
J. H. Bodine (1921-54)	:	90 „
B. P. Uvarov (1911-54)	:	202 „

(d) Distribution of references by countries of publication—

The distribution of the 6604 references by continents or major regions is as follows :—Africa, 517 ; Asia, 725 ; Australia and New Zealand, 151 ; Europe (including U.S.S.R.), 3307 ; North and Central America, 1450 ; South America, 448 ; and doubtful or unaccounted, 6. The breakup by countries is given below ; the most prolific countries are the U.S.A. (1254) and Great Britain (840).

I—AFRICA		II—ASIA	
1. Algeria	73	1. China	42
2. Egypt	86	2. India	520
3. Morocco	26	3. Japan	71
4. Rhodesia	36	4. Philippines	29
5. South Africa	166	5. Others	63
6. Sudan	25		
7. Others	105		
	<hr/> 517 <hr/>		<hr/> 725 <hr/>

III—AUSTRALIA and NEW ZEALAND		V—NORTH and CENTRAL AMERICA	
1. Australia	148	1. Canada	148
2. New Zealand	3	2. Central America	6
	-----	3. Hawai IIs.	5
	151	4. Mexico	37
	-----	5. U. S. A.	1254
IV—EUROPE (including U.S.S.R.)			-----
1. Belgium	92		1450
2. France	571	VI—SOUTH AMERICA	
3. Germany	569	1. Argentina	382
4. Great Britain	840	2. Uruguay	23
5. Holland	46	3. Others	43
6. Italy	331		-----
7. Spain	89		448
8. Sweden	51	-----	
9. Switzerland	3	Total	6598
10. U. S. S. R.	580	Doubtful or unaccounted	6
11. Others	105		-----
	3307	GRAND TOTAL	6604
	-----		-----

(e) *Distribution of references by languages of publication—*

The distribution of the 6604 references by the language of publication shows that the vast majority of them (*ca.* 6524) have been published in the European languages among which English dominates (with *ca.* 3667 references); only about 70 have been published in the Asian languages. The approximate distribution in the major languages is as follows :—

I—EUROPEAN LANGUAGES		II—ASIAN LANGUAGES	
Dutch	23	Chinese	22
English	3667	Japanese	36
French	817	Other Asian languages	12
German	631		-----
Italian	255		70
Latin	23	-----	
Russian	502	III—MIXED OR UNCLASSIFIED	10
Spain	526		-----
Swedish	20	GRAND TOTAL	6604
Slav and allied languages, excluding Russian	37		-----
Other European languages	23		-----
	6524		-----
	-----		-----

II—SUMMARY

1. A comprehensive bibliography of the Orthopterous insects of the family Acrididae (comprising the short-horned grasshoppers and locusts) from the earliest times to the end of the year 1954 is given. Readily available references published during 1955, 1956, and the early part of 1957 are also included to enhance the utility of the bibliography.

2. The Main Bibliography contains about 6554 references which are arranged alphabetically according to the author's surnames. Under each author, the references are arranged chronologically.

3. Each reference consists of the following components in the order stated below ; The author's surname(s) and initials ; the year of publication ; the full title of the paper or book etc., in the original language if the language is one of the more common European languages, otherwise in the English translation ; the abbreviated name of the journal or periodical ; the volume number, preceded by the series number, if any, and followed by the number of part, Hefte, etc., if any ; the first and last pages ; and the number of plates, chart, etc. not included in regular text-pages.

4. Cross references are given in the appropriate alphabetical place to the alternative spellings of an author adopted in the literature, and to the authors other than the first one in the case of references with more than one author.

5. All references, except cross references, carry a serial number.

6. In a brief Introduction the following aspects of the bibliography etc., are discussed :—

(a) The classification of the short-horned grasshoppers into families, superfamilies, etc., is given. (b) The current names and synonyms of the more important economic species of the family Acrididae, especially the migratory ones, are listed. (c) Some general remarks on the family Acrididae with especial reference to the more spectacular doings of the locusts are given. (d) A brief historical account of the scientific writings on the family Acrididae is provided. (e) The arrangement, scope and completeness of the bibliography are discussed. (f) Some analyses of the references contained in the bibliography, with regard to such aspects as the number of individual authors, distribution by countries and languages of publication, etc., are given.

7. At the end of the Main Bibliography are given an Index to Authors and a Subject Index.

8. Two Supplementary Bibliographies of about 700 references have been added, followed by an Index to Authors and a Subject Index in each Supplement.

III—BIBLIOGRAPHY

References dealing either wholly or in part with the Desert Locust, *Schistocerca gregaria* (Forsk.), are marked with an asterisk (*).

A

1. AAMODT, T. L. 1934. Procedures responsible for Minnesota's successful grasshopper control campaign.—*J. econ. Ent.*, Menasha (Wis.), 27, pp. 694-702.

2. ABBE, C. 1880. A relation between meteorology and the grasshopper or locust pest.—*Amer. Nat.*, Salem (Mass.), **14**, pp. 735-738.
3. ABITOL, J. 1948. Los insecticidas en la lucha contra la langosta.—*Rev. Bolsa Com. Rosario*, **36** (880), pp. 5-6 ; and 8.
4. ACHARD, E. 1927. Note sur l'emploi de quatre insecticides.—*Syrie : Minist. Agric. etc.*, Damascus, 12 pp., typescript. Summary in *Rev. appl. Ent.*, London, (A) **15**, p. 574.
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7. ADAMOVICH, Z. H. R. 1950. Quelques analyses biométriques de l'*Oedipoda coerulescens* L. (Orthoptères). [In Serbian, with French summary.]—*Bull. Mus. Hist. nat. Pays serbe*, Belgrade, (B) **3-4**, pp. 333-342.
- . ADAMSON, D. M. 1950a.—See TAHMISIAN, T. N. and ADAMSON, D. M. 1950a.
- . ADAMSON, D. M. 1950b.—See TAHMISIAN, T. N. and ADAMSON, D. M. 1950b.
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4934, 4935, 4936, 4937, 4946, 4949, 4956, 4957, 4958, 4959, 4979, 5027,
5028, 5029, 5032, 5040, 5041, 5046, 5052, 5053, 5053a, 5055, 5060, 5062,
5063, 5069, 5078, 5098, 5101, 5102, 5113, 5124, 5125, 5126, 5143, 5144,
5145, 5150, 5151, 5185, 5186, 5187, 5190, 5191, 5192, 5193, 5194, 5195,
5201, 5202, 5231, 5258, 5262, 5263, 5268, 5269, 5270, 5271, 5272, 5273,
5274, 5275, 5276, 5282, 5283, 5284, 5286, 5288, 5291, 5295, 5297, 5298,
5299, 5300, 5322, 5350, 5351, 5352, 5353, 5354, 5355, 5356, 5358, 5359,
5360, 5361, 5362, 5363, 5364, 5365, 5366, 5367, 5368, 5373, 5374, 5375,
5378, 5389, 5393, 5429, 5431, 5434, 5443, 5444, 5454, 5455, 5456, 5471,
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5624, 5625, 5641, 5645, 5656, 5659, 5660, 5710, 5713, 5719, 5724, 5734,
5841, 5842, 5924, 5941, 5946, 5952, 5975, 5977, 5986, 5988, 5989, 5990,
5991, 5992, 5997, 6055, 6056, 6057, 6061, 6075, 6087, 6089, 6095, 6096,
6111, 6116, 6117, 6122, 6123, 6124, 6125, 6134, 6152, 6153, 6154, 6155,
6169, 6170, 6174, 6193, 6218, 6219, 6220, 6221, 6222, 6223, 6229, 6231,
6233, 6255, 6256, 6264, 6265, 6266, 6267, 6287, 6288, 6289, 6292, 6293,
6294, 6296, 6298, 6299, 6301, 6302, 6303, 6304, 6305, 6306, 6308, 6309,
6310, 6311, 6312, 6313, 6315, 6333, 6377, 6387, 6392, 6393, 6405, 6408,
6410, 6412, 6422, 6427, 6435, 6436, 6437, 6439, 6446, 6448, 6449, 6450,
6486, 6488, 6500, 6501.

4. DEVELOPMENT

(Embroynic and post-embroynic)

49, 70, 118, 120, 123, 325a, 381, 500, 502, 532, 535, 536, 537, 539, 592, 596, 601, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 617, 618, 619, 620, 621, 622, 624, 628, 629, 636, 638, 639, 640, 641, 642, 643, 644, 651 to 656, 657 to 666, 667 to 674, 675, 676, 677, 678, 680, 682, 683, 685, 686, 691, 692, 692a, 706, 707, 788, 802, 803, 807, 830, 831, 898, 899, 902, 908, 911, 912, 913, 1027, 1033, 1034, 1043, 1112, 1146, 1171, 1194, 1353, 1366, 1372, 1373, 1432, 1456, 1587, 1631, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1901, 1955, 2024, 2049, 2050, 2052, 2053, 2054, 2055 to 2071, 2073, 2074, 2076, 2077, 2219, 2222, 2258, 2270, 2349, 2362, 2377, 2385, 2490, 2537, 2550, 2586, 2701, 2733, 2735, 2762, 2816, 2875, 2913, 2926, 2934, 2986, 2988, 2999, 3001, 3037, 3041, 3043, 3047, 3087, 3109, 3171, 3172, 3173, 3264, 3381, 3536, 3537, 3546, 3547, 3548, 3740, 3806, 3821, 3828, 3846, 3921, 4051, 4052, 4080, 4129, 4164, 4245, 4259, 4309, 4310, 4343, 4455, 4537, 4538, 4539, 4540, 4541, 4542, 4648, 4663, 4723, 4724, 4766, 4789, 4791, 4793, 4794, 4802, 4803, 4806, 4807, 4808, 4809, 4817, 4822, 4831, 4836, 4837, 4841, 4897, 4926, 4946, 4955, 4960, 4961, 4963, 5011, 5012, 5046, 5064, 5085, 5161, 5162, 5183, 5184, 5189, 5223, 5257, 5258, 5259, 5260, 5261, 5262, 5264, 5267, 5268, 5278, 5280, 5281, 5282, 5294, 5296, 5309, 5370, 5372, 5432, 5433, 5434, 5437, 5454, 5455, 5464, 5479, 5493, 5513, 5539, 5557, 5560, 5561, 5562, 5563, 5567, 5571, 5624, 5625, 5628, 5629, 5630, 5631, 5633, 5654, 5655, 5702, 5735, 5841, 5842, 5968, 6019, 6092, 6099, 6165, 6166, 6222, 6230, 6235, 6237, 6287, 6324, 6326, 6329, 6413, 6414, 6415, 6416, 6446, 6447, 6448.

5. PHYSIOLOGY

(Including biochemistry)

11, 80, 83, 84, 85, 86, 87 to 90, 122, 177, 280, 287, 305, 308, 309, 310, 311, 373, 378a, 383, 387, 397, 408, 409, 458, 459, 511, 518, 532, 534, 535, 562, 567, 574, 575, 576, 577, 578, 579, 582, 585, 593, 594, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627 to 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 656, 657, 666, 667, 674, 675, 678, 679, 680, 681, 682, 683 to 686, 691, 692, 692a, 744, 746, 792, 795, 800, 817, 818, 819, 820, 821, 830, 831, 901, 905, 906, 908, 909, 910, 911, 912, 913, 931, 933, 934, 934a, 934b, 936, 939, 940, 942, 943, 944, 945, 946, 946a, 947, 949, 954, 957, 964,

974, 975, 1022, 1023, 1051, 1054, 1055, 1075, 1082, 1083, 1098, 1099,
1101, 1102, 1104, 1107, 1110, 1111, 1112, 1113, 1115, 1117, 1118, 1119,
1124, 1125, 1134, 1186, 1194, 1195, 1221, 1222, 1225, 1234, 1235, 1254,
1329, 1358, 1359, 1360, 1361, 1380, 1446, 1447, 1448, 1476, 1477, 1478,
1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1499, 1512, 1529,
1533, 1566, 1577, 1579, 1580, 1587, 1590, 1591, 1593, 1595, 1623,
1626, 1631, 1642, 1653, 1656, 1657, 1658, 1662, 1664, 1666, 1667, 1669,
1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1710,
1782, 1812, 1823, 1824, 1825, 1826, 1843, 1844, 1847, 1848, 1850, 1851,
1861, 1889, 1890, 1891, 1904_a, 1908, 1909, 1932, 1933_a, 1934, 1935, 1936,
1937, 1938, 1939, 1945, 1960, 1967, 1975, 1976, 1977, 1981, 1982, 1982_a,
1983, 1984, 1985, 1999, 2024, 2025, 2026, 2026_a, 2027, 2028, 2029, 2030,
2032, 2033, 2034, 2035, 2046, 2062, 2070, 2085, 2090, 2092, 2099, 2104,
2105, 2132, 2133, 2134, 2135, 2136, 2140, 2151, 2154, 2158, 2202, 2220,
2226, 2261, 2262, 2263, 2265, 2294, 2317, 2323, 2325, 2349, 2352, 2353,
2366, 2378, 2379, 2384_a, 2388, 2392, 2409, 2410, 2411, 2412, 2413, 2414,
2415, 2416, 2422, 2423, 2423_a, 2424, 2433, 2441, 2442, 2443, 2444, 2445,
2467, 2468, 2498, 2543, 2545, 2548, 2550, 2626, 2627, 2677, 2678, 2679,
2680, 2681, 2682, 2683, 2684, 2685, 2686, 2687, 2688, 2689, 2690, 2736,
2738, 2755, 2756, 2757, 2759, 2760, 2761, 2762, 2763, 2768, 2774, 2788,
2843, 2859, 2863, 2865, 2873, 2874, 2926, 2969, 2973, 2974, 2975, 2979,
2996, 3011, 3019, 3020, 3023, 3024, 3025, 3035_a, 3040, 3041, 3043, 3046_a,
3047, 3048, 3053, 3061, 3122, 3177, 3178, 3179, 3201, 3236, 3240, 3244,
3381, 3393, 3394, 3395, 3414, 3416, 3417, 3418, 3419, 3477, 3487, 3500,
3501, 3502, 3503, 3504, 3537, 3538, 3541, 3546, 3561, 3584, 3585, 3587,
3588, 3589, 3590, 3598, 3604, 3614, 3630, 3653, 3664, 3665, 3726, 3731,
3812, 3823, 3830, 3841, 3847, 3849, 3850, 3851, 3853, 3877, 3906, 3924,
3945, 3948, 3969, 4001, 4002, 4003, 4004, 4005, 4006, 4007, 4015, 4052,
4062, 4063, 4080, 4091, 4125, 4127, 4140, 4169, 4181, 4193, 4220, 4221,
4222, 4223, 4230, 4242, 4286, 4290, 4308, 4320, 4345, 4346, 4349, 4350,
4384, 4385, 4397, 4398, 4399, 4400, 4419, 4447, 4538, 4539, 4540, 4541,
4542, 4545, 4553, 4557, 4558, 4641, 4663, 4664, 4676, 4677, 4678, 4686,
4687, 4706, 4707, 4722, 4723, 4724, 4743, 4744, 4749, 4750, 4761, 4762,
4764, 4774, 4775, 4800, 4811, 4841, 4850_f, 4859, 4860, 4861, 4871, 4874,
4875, 4876, 4877, 4878, 4879, 4880, 4883, 4926, 4943, 4962, 4963, 4979,
4996, 5001, 5002, 5003, 5004, 5006, 5011, 5012, 5024, 5025, 5026, 5031,
5045, 5060, 5145, 5155, 5187, 5217, 5231, 5255, 5256, 5257, 5259, 5263,
5264, 5267, 5268, 5269, 5278, 5279, 5281, 5284, 5285, 5286, 5287, 528 8
5290, 5329, 5330, 5357, 5378, 5435, 5456, 5471, 5484, 5510, 5541, 5542,
5543, 5544, 5552, 5553, 5555, 5556, 5557, 5558, 5559 5560, 5561, 5562,

5563, 5564, 5565, 5566, 5567, 5568, 5572, 5573, 5594, 5600, 5603, 5614, 5628, 5629, 5630, 5631, 5632, 5633, 5636, 5643, 5644, 5646, 5654, 5655, 5656, 5685, 5702, 5709, 5841, 5842, 5849, 5946, 5978, 6059, 6060, 6071, 6076, 6077, 6078, 6087, 6089, 6099, 6114, 6120, 6121, 6138, 6144, 6165, 6166, 6168, 6215, 6223, 6231, 6232, 6233, 6234, 6236, 6237, 6255, 6256, 6257, 6258, 6259, 6263, 6281, 6288, 6320, 6321, 6322, 6323, 6324, 6325, 6326, 6327, 6367, 6368, 6376, 6408, 6411, 6412, 6417, 6484.

6. BIONOMICS AND ECOLOGY

(Including life-histories, ecology, parasites, predators, epidemics, etc.)

2, 5, 6, 10, 14, 15, 16, 17, 26, 27, 29, 31, 34, 35, 38, 43, 44, 45, 46, 49, 54, 55, 56, 57, 59, 62, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 76, 78, 81, 82, 93, 95, 98, 102a, 103, 104a, 107, 108, 110, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 126, 127, 128, 128a, 130, 133, 135, 136, 137, 138, 139, 140, 142, 144, 145, 146, 148, 149, 150, 152, 153, 154, 155, 156, 158, 160, 161, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 176, 178, 185, 193, 194, 200, 206, 214, 220, 224, 226, 228, 229, 230, 233, 234, 235, 237, 238, 239, 243, 261, 262, 264, 275, 277, 282, 283, 284, 294, 296, 297, 301, 302, 303, 304, 306, 312, 313, 314, 315, 316, 318, 320, 321, 322, 324, 325, 327, 328, 329, 331, 332, 333, 334, 335, 337, 338, 339, 340, 341, 342, 344, 346, 348, 350, 353, 354, 355, 356, 357, 358, 359, 362, 363, 364, 365, 366, 367, 375, 376, 380, 383, 392, 395, 396, 407, 410, 411, 412, 416, 417, 418, 420, 422, 424, 427, 429, 430, 440, 441, 443, 445, 446, 455, 456, 457, 460, 461, 462, 463, 464, 465, 466, 469, 470, 471, 475, 477, 479, 481, 482, 484, 489, 490, 493, 494, 496, 497, 498, 505, 506, 510, 512, 513, 514, 515, 519, 520, 521, 522, 529, 533, 534, 535, 536, 540, 541, 544, 546, 547, 549, 550, 551, 552, 554, 555, 560, 563, 465, 568, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 583, 584, 586, 587, 588, 589, 591, 593, 594, 687, 688, 690, 694, 695, 696, 697, 703, 719, 720, 721, 722, 723, 732, 732b, 732c, 733a, 733d, 733e, 734, 735, 736, 738, 740, 741, 747, 749, 755, 756, 759, 761, 762, 764, 765, 766, 767, 768, 771, 772, 774, 776, 778, 779, 780, 781, 782, 783, 784, 785, 787, 788, 796, 797, 798, 799, 801, 803, 804, 805, 806, 807, 808, 810, 811, 812, 825, 826, 827, 829, 832, 833, 834, 835, 836, 837, 839, 845a, 845b, 845c, 846, 867, 870, 872, 874, 875, 876, 877, 878, 882, 884, 885, 890, 891, 892, 893, 894, 895, 902, 903, 904, 907, 914, 918, 919, 920, 924, 927, 928, 929, 930, 935, 948, 951, 952, 955, 958, 959, 960, 961, 962, 966, 969, 970, 971, 973a, 977, 978, 979, 980, 981, 982, 983, 985, 990, 996, 997, 998, 999, 1000, 1027, 1039, 1042,

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1. INTRODUCTION

The First Supplement to the *Bibliographia Acrididiorum* contains about 501 references which are chronologically distributed as follows, but it should be borne in mind that, as mentioned above in the Introduction (p. 13) to the Main Bibliography, it is complete only up to the end of the year 1954, though the readily available references published in 1955, 1956, and 1957 have also been included :—

Year	Number of references	Year	Number of references
1884 .	1	1948	1
1893 .	1	1949	4
1894 .	1	1950	54
1895	1	1951	136
1902 .	1	1952	9
“ 1902-1905 ”	1	1953	23
1925	1	1954	99
1926	1	1955	137
1929	2	1956	21
1936	2	1957	1
1939	1		—————
1941	1	TOTAL	501
1946	1		—————
1947	1		

A total of 160 new authors are included, these not being found in the Main Bibliography ; they are listed in the Author Index at the end, along with the other authors occurring in this Supplement.

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1. INTRODUCTION

The Second Supplement to the *Bibliographia Acrididiorum* contains approximately 201 references which are chronologically distributed as follows. As already mentioned above (pp. 13 and 551), the scope of this Bibliography is only up to the end of the year 1954, but papers published during 1955-57 have also been included where readily available, but no effort has been made to make these years complete.

Year	Number of references
1949	1
1950	0
1951	0
1952	1
1953	3
1954	14
1955	35
1956	130
1957	17
TOTAL	201

A total of 93 *new* authors are included here, these not being found either in the Main Bibliography or in the First Supplement; they are listed in the Author Index at the end along with the other authors occurring in this Supplement.

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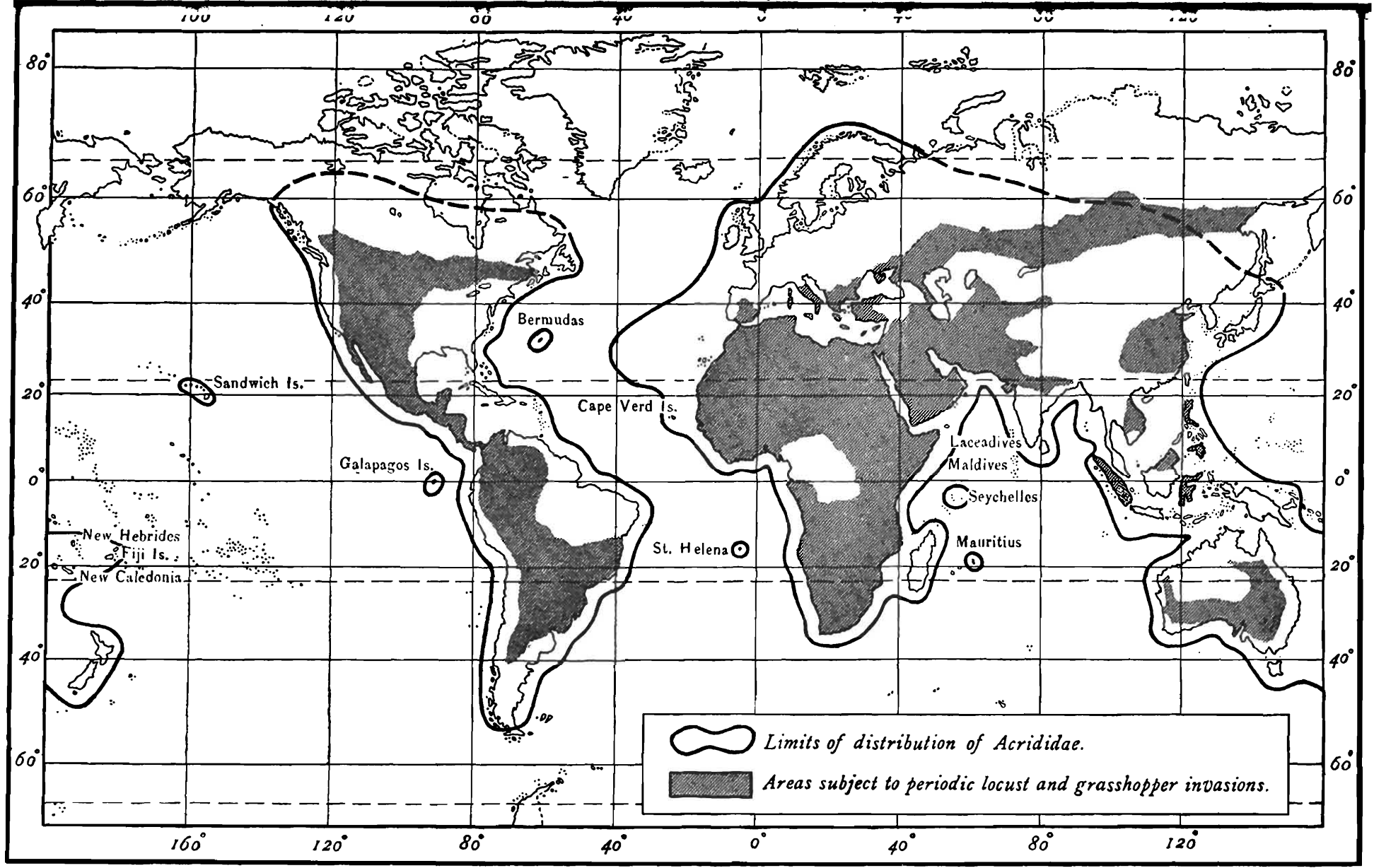
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PLATE 1

Map of the World to show : (i) The approximate geographic limits of distribution of the family Acrididae (in the wide sense, *i.e.*, to include all short-horned grasshoppers, including locusts). (ii) The areas (shaded) where periodical plagues of Acrididae, *e.g.*, locusts and/or grasshoppers occur. (Compiled from various sources.)



Map of the World, showing the geographical limits of distribution of *Acrididae* and the areas subject to periodical invasions by locusts and grasshoppers

ZOOLOGICAL SURVEY OF INDIA

34, Chittaranjan Avenue,
CALCUTTA-12.

Officers and Scientific & Technical Sections as on 31st December, 1958.

Director : Dr. M. L. Roonwal
Deputy Director : Dr. M. S. Mani
Administrative Officer : Vacant

Scientific Divisions and Sections

I. Invertebrate Division

(Superintending Zoologist : Vacant)

- | | |
|----------------------------------|--|
| 1. Protozoology Section : Vacant | } Dr. B. S. Chauhan
(Officer-in-Charge) |
| 2. Helminthology Section | |
| 3. General Non-Chordata Section | Shri K. S. Pradhan
(Officer-in-Charge) |
| 4. Crustacea Section | Dr. K. K. Tiwari
(Officer-in-Charge) |
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II. Entomology Division

(Superintending Zoologist : Dr. A. P. Kapur)

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| 6. Entomology Section : Vacant | } Dr. A. P. Kapur
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| 7. Arachnida Section : Shri B. K. Tikader
(Asstt. Zoologist) | |

III. Lower Chordata Division

(Superintending Zoologist : Vacant)

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| 8. Marine Fish Section | } Dr. K. S. Misra
(Officer-in-Charge) |
| 9. Freshwater Fish Section : Dr. A. G. K.
Menon (Asstt. Zoologist) | |
| 10. Protochordata & Amphibia Section | Shri M. N. Acharji
(Officer-in-Charge) |

IV Higher Chordata Division

(Superintending Zoologist : Vacant)

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| 12. Bird Section | } Dr. B. Biswas
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| 13. Mammal & Osteology Section : Shri H.
Khajuria (Asstt. Zoologist) | |

V. Other Scientific & Technical Branches

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| 14. Taxidermy and Museum Section | Shri B. S. Lamba
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| 15. Marine Survey Unit | Vacant |