

INDIAN INSECT PESTS.

Agents for the Sale of Books

PUBLISHED BY

THE SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA, CALCUTTA.

IN ENGLAND.

E. A. ARNOLD, 41 & 43, Maddox Street, Bond Street, London, W.	P. S. KING & SON, 2 & 4, Great Smith Street, Westminster, S.W.
CONSTABLE & Co., 16, James Street, Haymarket, London, W.	GRINDLAY & Co., 54, Parliament Street, London, S.W.
BERNARD QUARITCH, 15, Piccadilly, W.	KEGAN PAUL, TRENCH, TRÜBNER & Co., 43, Gerrard Street, Soho, London, W.
DEIGHTON, BELL & Co., Cambridge.	B. H. BLACKWELL, 50 & 51, Broad Street, Oxford.
II. S. KING & Co., 65, Cornhill, & 9, Pall Mall, London.	

ON THE CONTINENT.

R. FRIEDLÄNDER & SOHN, 11, Carlstrasse, Berlin, N.W.	KARL W. HIERSEMANN, Leipzig.
OTTO HARRASSOWITZ, Leipzig.	ERNEST LEROUX, 28, Rue Bonaparte, Paris.
	MARTINUS NIJHOFF, The Hague.
	RUDOLF HAUPT, Halle, A. S., Germany.

IN INDIA.

THACKER, SPINK & Co., Calcutta & Simla.	THACKER & Co., Ltd., Bombay.
NEWMAN & Co., Calcutta.	D. B. TARATOREVALA, Sons & Co., Bombay.
S. K. LAHIKI & Co., Calcutta.	A. J. COMBRIDGE & Co., Bombay.
R. CAMBRAY & Co., Calcutta.	RADHABAI ATMARAM SAGOON, Bombay.
V. KALYANARAMA AYYAR & Co., Madras.	SUNDER PANDURANG, Bombay.
G. A. NATESAN & Co., Madras.	N. B. MATHUR, SUPERINTENDENT, NAZAIR KANUN HIND PRESS, Allahabad.
HIGGINBOTHAM & Co., Madras.	RAI SAHIB M. GULAB SINGH & SONS, MUFID-I-AM PRESS, Lahore.
THOMPSON & Co., Madras.	SUPERINTENDENT, AMERICAN BAPTIST MISSION PRESS, Rangoon.
S. MURTHY & Co., Madras.	A. M. & J. FERGUSON, Ceylon.
TEMPLE & Co., Madras.	
COMBRIDGE & Co., Madras.	
A. R. PILLAI & Co., Trivandrum.	

INDIAN INSECT PESTS.

BY

H. MAXWELL-LEFROY, M.A., F.E.S., F.Z.S.,
#

Imperial Entomologist.



CALCUTTA:

OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.

1906.

Price Rs. 1-8 or 2s.

St. Albans,
25th September 1885.

‘But, meanwhile, I may most truly say that, if the crop or timber or fruit growers of India were furnished with plain and comprehensive accounts of history and habits of the common insect pests, accompanied by wood-cut figures, so as to convey the appearance of pests without wearisome description of details, all this would be a national benefit, repaying the outlay a hundred times.’

ELEANOR A. ORMEROD.

INTRODUCTION.

AS Mr. Lefroy has written this book largely at my instance, I wish to attach a few words in order to explain its scope. It is not a scientific treatise on Entomology, written for the use and training of Entomologists, but is intended to serve the more humble but useful purpose of a manual of practical information for the use of the intelligent agriculturist in the protection of his crops from insect pests. It is also hoped that it will be suitable as a text-book for use in Agricultural Schools and Colleges, all of whose students should acquire a working knowledge of insect pests and of the practical measures possible for the protection of crops. With these objects in view, the author has avoided, wherever possible, scientific terminology, using simple English equivalents which can easily be understood by persons with no scientific training in Entomology.

The information available for a book of even this limited scope is very far from complete. A good deal of work has been done in the past for Systematic Entomology in the collection and classification of some groups of Indian insects, more particularly the Butterflies, but it is only within the past few years that any real inquiry has been made into Economic Entomology, dealing with insect pests and their treatment. For this reason Mr. Lefroy would prefer to postpone publication until the material at his disposal is more complete, but I think first, that the information available is already of sufficient importance to give to the public, and second, that the best way of collecting additional information is to interest persons in that already acquired and to show

clearly the need for further help. For this purpose the many blanks in this book have designedly been given prominence by the author in the hope that many workers will endeavour to fill them up by careful and intelligent study of insect life. The field for future investigation is unlimited. This book is a testimony to the strenuous efforts made during the past three years in this field by Mr. Lefroy, who is the only Entomologist in the Department of Agriculture. It is hoped that in the near future an entomologist may be employed by each important province for the investigation, prevention and cure of crop pests, but this will not lessen the need for other workers, whose assistance will be warmly welcomed by the Government Entomologist. If this help is freely given, I look forward within a few years to the issue of a revised edition of this book, in which still more useful information about insect pests may be given.

F. G. SLY,

*Officiating Inspector-General
of Agriculture in India.*

The 1st May 1906.

PREFACE.

THE study of pests in India dates back twenty years to the formation of the Entomological section of the Indian Museum, the commencement of Indian Museum Notes, and the publication of Surgeon-General Balfour's little volume, "The Agricultural Pests of India." During this time a continuous effort has been made to classify insects injurious to crops, terminating with the work of the late Mr. L. deNiceville, the first Entomologist to the Government of India. It has fallen to me to gather up these records, to supplement them by observation in the field, and to put together briefly what is known of Indian pests.

To any one familiar with the scattered records of Indian Museum Notes, such an undertaking was a necessary preliminary to further work and, above all, to the wider growth of the study of insect pests. Few observers have contributed to our knowledge of insect pests in India, which is deplorable in so vast a continent where so large a population is dependent on agriculture.

In the present volume I have tried to give a short account of the general features of the lives of insects, as well as the salient facts concerning our destructive pests. Those who wish for technical accounts of the anatomy and classification of insects will find abundance of excellent books. We are here more closely concerned with their living activities and the part played by them in the reduction of the yield of the staple crops of the country.

I trust that the book may be of service to many who are engaged in agriculture and horticulture. Insects are universal and quite interesting as soon as one ceases to regard them as mysteries. I cannot hope to emulate the living interest of

the insect world as presented by "Eha," but perhaps the necessary precision of thought and language in this volume may blend with his delightful pictures and help to give a true impression of our insect friends and foes.

Much of the local information in this volume has been obtained from the many reports sent in at the instance of the Directors of Agriculture. In a country where nothing is outside the scope of official enquiry, much may be learnt from enquiries pursued by the Mamlatdar or Tahsildar, and especially in regard to the attitude of the cultivator towards his pests. My acknowledgments are due to the many district officials who have sent in reports of injurious insects and carefully collected information as to the remedies in use among the ryots.

I am under a deep obligation to Mr. F. G. Sly, Officiating Inspector General of Agriculture, to whom the inception of the book is due, and who has endeavoured to bring the arrangement and text into the form most suitable for those for whom it is intended; without this encouragement and advice, the volume could not have been produced in its present form. I have also to thank Mr. C. A. Barber, Government Botanist, Madras, and Dr. H. H. Mann, Scientific Officer to the Indian Tea Association, for valuable help and suggestions in the final preparation of the text. The illustrations are largely the work of the late artist in the Indian Museum, Babu G. C. Chukraburty, and these have in many cases been published in another form in the pages of Indian Museum Notes. Others have been prepared under my supervision by H. H. Deboo, Chotalal Daulatram Shah and Rambhau Balajec, artists attached to the Department of Agriculture. The diagrams and photos are my own, and Mr. R. C. Wood very kindly prepared the design on the cover.

I am indebted to the work of my staff for many observations; the Entomological Assistants attached to the Departments of Agriculture in the Punjab, Central Provinces and

Baroda have added information concerning injurious pests, and I have incorporated their observations in some cases. I trust that many will be found to follow in their footsteps, to take up the study of insect life in relation to agriculture in India, and to devote themselves to this branch of research. It is certain that India should not be behind other nations in scientific knowledge, and that men can be found who will devote themselves to this form of learning, not for the sake of the pay or position, but at the bidding of that intense organised curiosity which lies at the root of modern science. I venture to hope that this volume may draw others into this work and open a new field for research.

H. MAXWELL-LEFROY,

Imperial Entomologist.

CONTENTS.



Part I.—INSECTS IN GENERAL.		<i>Page</i>
CHAPTER	I.—Insects : their structure and food	1
" "	II.—Life history and habits	15
" "	III.—Form and colour	34
" "	IV.—Classification and nomenclature	52
Part II.—PREVENTIVE AND REMEDIAL MEASURES.		
CHAPTER	V.—Origin of insect pests	63
" "	VI.—Preventive and remedial measures	68
" "	VII.—Insecticides and spraying	75
Part III.—INSECTS INJURIOUS TO CROPS.		
CHAPTER	VIII.—Pests of the cotton plant	89
" "	IX.—Pests of rice and wheat	114
" "	X.—Pests of cane, maize, and sorghum	125
" "	XI.—Pests of leguminous crops	140
" "	XII.—Pests of miscellaneous field crops	151
" "	XIII.—Pests of vegetable crops	163
" "	XIV.—Pests of fruit	170
" "	XV.—Caterpillar pests	181
" "	XVI.—Beetle pests	196
" "	XVII.—Locusts, grasshoppers, surface beetles, and burrowing insects	210
" "	XVIII.—Sucking insects	233
Part IV.—OTHER IMPORTANT INSECTS.		
CHAPTER	XIX.—Insects infesting grain	251
" "	XX.—Insects attacking cattle	261
" "	XXI.—Beneficial insects	268
APPENDIX		
" "	A.—Useful information	283
" "	B.—Collecting, pinning, setting	290
GENERAL INDEX		
" "	305
LIST OF ILLUSTRATIONS		
" "	311
LIST OF PLANTS		
" "	315