

# A MANUAL OF THE DRAGONFLIES OF CHINA

## A MONOGRAPHIC STUDY OF THE CHINESE ODONATA

By

James G. Needham, Ph. D., Sc. D., Litt. D.

*Professor of Entomology and Limnology  
in Cornell University*

*Visiting Professor of the China Foundation  
for the Promotion of Education and Culture  
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# **A Manual of the Dragonflies of China**

## **A Monographic Study of the Chinese Odonata**

**By JAMES G. NEEDHAM**

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### INTRODUCTORY

The materials for this manual were obtained in part by my own collecting during a year of residence in China, but in a larger part by the generous cooperation of my scientific friends. Dr. C. Ping has for several years been sending me small lots of papered specimens for determination. To these he added some new material more recently collected near Amoy. The first considerable lot of new specimens I got on my arrival in Shanghai. Dr. Ping took me to the Shanghai Museum; there we found a considerable number of dragonflies that had been collected years before in Fukien Province by Tong Wong-wong. These the Curator of the Museum, Mr. A. de-C. Sowerby, kindly allowed me to take with me to Peking for study. Next, from the same province, came a large and important consignment of specimens from Professor C. R. Kellogg, and this he supplemented by two shipments later in the year. Some of the most valuable finds were in this material from Professor Kellogg.

Another very valuable lot of material was supplied by Dr. C. F. Wu, who had diligently collected the dragonflies about Yenching University Campus during the preceding season and had saved the material for me. Dr. Wu supplied me also with additional material collected earlier at Soochow.

At Tsing Hua University some additional dragonflies were supplied me by Dr. C.L. Liu, these having been collected by him about the college grounds.

In February when I visited Tientsin, Dr. Tsi-tung Li gave me a few specimens from the biological laboratory collection of Nankai University and took me to the Huang-ho and Pei-ho Museum, where we found important collections from the four northern provinces, Kansu, Shensi, Shansi and Hopei. This material Father Licent kindly loaned me for study.

Prof. A.P. Jacot of Shantung Christian University sent me a small collection from Tsinan and vicinity, in which I found some valuable and useful specimens. Later, in April, I had the pleasure of visiting Tsinan, and of going collecting with Professor and Mrs. Jacot, and of finding for the first time the immature stages of some of these species.

In Peking I found little in the way of dragonfly collections. There were a few specimens at the National Normal University, and a few more at the Zoological Park. I saw also specimens (all of common species) in several private collections, the best of which was that of Mr. Y.Y. Shia, mostly from the Western Hills. But in Peking I found the greatest aid of all toward the completion of my task, due to the presence there of my good friend and collaborator, Professor N. Gist Gee. Professor Gee shared with me his own laboratory facilities in Lockhart Hall, Peking Union Medical College. There we worked together, happily and profitably, during the hours that we could spare from other duties, he on fresh-water sponges and I on dragonflies, through the winter. There a long start was made on the preparation of this Manual.

There also were the best library facilities that I found in China. There Prof. E. C. Faust helped me with the preparation of my apparatus for spring collecting; and there the friendly interest in my undertaking that was manifested by all the members of the Peking Society of Natural History was great encouragement.

Professor Gee also helped me to find collaborators in parts of China that I was unable to visit in person; such as Dr. H.D. Brown in Chengtu and Dr. J. G. Endicott in Chungking, whose collections will have frequent mention in subsequent pages. He went with me in April to Soochow, where the large collections of Soochow University were placed at my disposal. Here, with the kindly cooperation of Dean J. W. Dyson and Professor R.C. Tasker and a number of advanced students from the university, we made a collecting trip by canal westward to Seven Sons Hill, where I enjoyed one of the best collecting days of my life.

At Nanking, where I spent a good part of April and May, I found in the Bureau of Entomology the largest collection of dragonflies in China. This was placed at my disposal for study by the Director, Dr. G. P. Jung. Besides local material, it contained specimens from the southeastern provinces of Chekiang, Fukien and Kwangtung.

In Nanking I was again favored with laboratory facilities at the University of Nanking, where Deans Reisner and Kuo, and Prof. J. L. Buck, generously provided for the needs of my work in the laboratories of the College of Agriculture.

In May I had the pleasure of a few days' stay in and about Hangchow. At Zakow, the picturesque seat of Hangchow College, several most interesting and profitable collecting trips were made under the guidance of Professor Yuanting T. Chu. This was the only place in China where I collected from swift streams. The materials obtained from them were unique, and very valuable. Professor Chu supplied me with considerable additional material of his own earlier collecting, some of it from Ningpo.

There were two sendings of alcoholic material collected near Chengtu by Dr. H. D. Brown, another from Dr. J. G. Endicott collected near Chungking. Dr. G. H. Tsou sent me two boxes of beautifully prepared material from the collection of the recently established Bureau of Entomology at Hangchow. Lastly in the summer of 1928 in the province of Kwangsi Dr. C. L. Chien sent me an exceedingly valuable collection of papered specimens that were obtained especially for use in this manual. They belong to the Metropolitan Museum of the National Research Institute, Nanking. For their collection I am indebted to Dr. Ping and others of the Science Society of China who very kindly arranged to have the material gathered for my use.

Dean J. W. Dyson of Soochow University sent me a small collection of reared specimens obtained by the collecting and rearing of nymphs. This material is especially valuable. A large and very important collection of reared material obtained by Mr. T. W. Liu in the course of his investigations as a graduate student in Yenching University was sent me by Dr. C. F. Wu. This included 20 life histories, a number of which I had not been able to obtain myself at Nanking. I have had the benefit of all this good work and am now able to describe herein the nymphs of a goodly proportion of the genera of the Chinese Odonate fauna.

Mr. Hugo Kahl of the Carnegie Museum of Pittsburg loaned me some material from his private collection derived from several localities near Canton. Mr. Rufus H. Lefevre loaned me some specimens of his own collecting in the province of Shantung, mostly from Weihsien. Dr. C.C. Adams, director of the State Museum at Albany, New York, also loaned me a few specimens from Formosa from his private collection. Dr. R. Takahashi kindly furnished me additional material from that island.

After I returned to America I received from Dr. Stuart P. Seaton a jar of alcoholic specimens collected at Hoi How in the Island of Hainan. This contained some interesting material, as will be noted in subsequent pages.

In America since returning I have searched the museums for additional Chinese material, and I found a good bit of it in four of them. Returning through San Francisco I found in the collections of the California Academy of Sciences a large number of dragonflies brought back by Dr. E. C. VanDyke from his year of residence in China in 1922-3. This collection was especially rich in species of *Sympetrum* from Manchuria.

Dr. P. P. Calvert, of the University of Pennsylvania who has himself been a keen student of the Chinese dragonfly fauna, assisted me to obtain a loan of materials from the Academy of Natural Sciences of Philadelphia, and loaned me specimens from his own private collection besides.

Mr. E. B. Williamson of Bluffton, Indiana loaned me specimens from his own extensive private collection. These were mostly from Soochow, sent him by Mr. M. L. J. Higgins; from Ningpo, sent by Mr. Y. S. Tsao; and from Pei Tai Ho sent by Dr. Chester N. Frazier.

The largest single collection of Chinese dragonflies that I have found anywhere is in the United States National Museum at Washington. For the privileges I have had in the study of this I am deeply indebted to Dr. J. M. Aldrich, the Curator, to Mr. Harold Morrison, and to Dr. Adams Böving. In Dr. Böving's office I was given laboratory facilities.

The National Museum material is principally derived from five sources.

1. Collections made by Dr. David C. Graham in the mountainous regions of western Szechuan. These are very rich in the larger Agrionine dragonflies and singularly lacking in Gomphines. This indicates that there was not much streamside collecting.
2. Collections made by Professor N. Gist Gee mainly around Soochow.
3. Collections made by Mr. A. deC. Sowerby in Kansu and Shensi.
4. Collections made by Professor C. R. Kellogg in Fukien.
5. Collections made by Mr. F.S. Light in Hainan.

From the foregoing it will appear that the materials furnished me for study have come from all the principal areas of China except the southwestern provinces of Kweichow and Yunnan.

My own collecting was very limited: for the academic year during which only I was in China, covers the lesser part of the collecting season. I arrived too late in the fall for good collecting. The late-flying species were however obtained: and I shall always remember with pleasure two good collecting trips that were made in the company of Drs. C.F. Wu and C. L. Liu to the brook that flows down out of the Western Hills back of the temple of Wo-fu-Ssu, and another made with Dr. H. C. Zen and his family to the Hot Springs 30 miles north of Peking.

In the Spring I had five weeks of wonderful collecting: flying trips, as above mentioned, with friends at Tsinan, Soochow and Hangchow; but a stay of a month and a chance for some real work at Nanking. Here under the leadership of Dr. Ping, my Chinese friends became my collaborators and helpers. We collected and reared dragonflies together, and obtained life histories in practically all the genera that fly at Nanking during the early part of the summer season. This work enabled me to describe in the following pages the nymphs of a goodly proportion of the genera of Chinese dragonflies.

The only published record that I have found of observations on good collecting grounds for dragonflies in China are those of Mr. A. deC. Sowerby, published in "Through Shen-kan" (London, 1912). On page 187 he says:

"In northern Shensi where the climate is dry and the vegetation scarce, butterflies and dragonflies are comparatively rare, while scarcely any were seen west of Chin-miy Chou in Kansu. In the mountains of Shansi butterflies are plentiful, and the marshes and rivers of the plains of the same province support many species of dragonflies. Nowhere, however, on the line of march, were either of these orders seen in such quantities as in the loess valleys of eastern Kansu and central Shensi."

On page 75 he says: "Over these watercourses, too, hung countless dragonflies of every description. Big pale fellows with translucent eyes, hovered high in the air, darting down, ever and anon, to devour one of their smaller relations. Skimming over the rippling surface of the water were others of a slaty blue color. Here a streak of vivid crimson marked the passage of the beautiful male of yet another species; and there, settled upon a rock—her wings outspread to get the full benefit of the sun's warm rays—sat his little brown mate. There was in addition, another most striking variety (*Matrona*), with shining body, broad wings, and long tapering tail, all ordinarily jet black, but now scintillating with a thousand shades of blue green and gold, as they caught and reflected the sunlight at various angles. Of this species there was a decided predominance; and at times they collected in swarms over the reeds and rushes on which they sought to settle. Their flight resembled that of the butterfly in its uncertain fluttering course, rather than the graceful evolutions, lightening dashes, and motionless poisons of other dragonflies. Amongst them were pale brown specimens which lacked the iridescent colors of the darker forms."

## HISTORICAL

The first Chinese dragonfly to find a place in the descriptive records of modern science was the beautiful Green-wing, now known as *Neurobasis chinensis*.

Linnaeus, who included all dragonflies in a single genus *Libellula*, described it in the first volume of his *Systema Naturae* in 1758. It is one of the most beautiful insects in the world, having hind wings of a wonderful metallic green whose shimmering surfaces reflect every tint of the rainbow. It was sure to be collected as soon as discovered and to be taken to Europe by those who gather things curious and beautiful.

Specimens of other strikingly colored species strayed into the hands of European collectors and were described here and there, singly and by twos, until in 1798 Donovan was able, in his *Natural History of the Insects of China*, to publish the first list of Chinese

dragonflies. This list contained six species, with illustrations on two beautiful colored plates. Besides the one named above there was the huge, stout, clear-winged *Ictinus clavatus*, its black body striped and ringed with yellow, and with two big black lappets flaring outward beside the end of the abdomen. There was the slender fluttering butterfly-like *Rhyothemis variegata* with its broad yellow wings traversed by sinuate lines and spots and blotches of rich brown. There was the little *Palpopleura sexmaculata* with the sexes unlike in color, the male abdomen pruinose blue, the female abdomen striped with yellow and brown: the hind wings tinted with gold in both sexes and both wings spotted with brown. There was the "red pepper" dragonfly, *Crocothemis servilia*, its body in mature coloration a fiery red, and its wings washed with gold across their bases. And there was the gauze-wing, *Neurothemis fulvia*, all over of varying tints of rich amber brown, and with an extraordinary richness of venational network in its wings. This was a bevy of beauties. Surely they were the sort of insects to be collected first.

Doubtless these were all well known locally, for, as Donovan remarks, "The Chinese are well acquainted with the natural productions of their empire, and zoology and botany in particular are favorite studies amongst them." Doubtless these six were selected by collectors for the trade because of their beauty; for Westwood remarked concerning the boxes of insects coming to London from China (chiefly purchased in the shops of Canton): "There is such an absolute monotony in these arrivals that it is almost impossible to discover in a quantity of these boxes a single species that is not contained in all the rest."

Thus early were commercial packages standardized in accordance with the supposed demands of the trade. But the demands of curiosity ran further; and other species were sent home by travellers, missionaries and collectors, and fell into the hands of systematic entomologists who described them in many places and in half a dozen different languages.

Since Donovan the number of described species has grown greatly, and eight local lists covering portions of China have been published, as follows:

- 1894. McLachlan, R. On two small collections of Neuroptera from Ta-Chien-lu in the Province of Szechuen, West China, on the frontier of Thibet.  
Ann. Mag. Nat. Hist. (6) 13: 421-436.
- 1896. McLachlan, R. On Odonata from the Province of Szechuen in Western China, and from Moupin in eastern Thibet.  
Ann. Mag. Nat. Hist. (6) 17: 365-374.



1900. Kirby, W. F. On a small collection of Odonata from Hainan.  
Ann. Mag. Nat. Hist. (7) 5:530-539. 1 pl.
1912. Ris, Fr. Neue Libellen von Formosa, Sudchina, Tonkin und den Philippinen.  
Suppl. Ent. 1:44-85. 3 pls.
1916. Ris, Fr. H. Sauter's Formosa-Ausbeute. Odonata. Mit Notizen über andere  
Ostasiatische Odonaten.  
Suppl. Ent. 5:1-80. 3 pls. 47 ff.
1922. Report of an Entomological Exhibition at the Agricultural Experiment Station,  
Peking.
1923. Fraser, F. C. Zoological results of the Percy Sladen Trust Expedition to Yunnan  
under the leadership of Prof. J. W. Gregory. Odonata. Jour. and Proc. Asiatic  
Soc. Bengal (n.s.) 19:447-464, 1923.
1925. Sjostedt, Y. Odonaten aus China. Arkiv für Zoologi. Band 17 A. No. 14. pp. 1-5.

Kirby's *Catalogue of the Neuroptera Odonata* published in 1890 listed 64 Chinese species.

The progress of systematic knowledge of the dragonfly fauna of China, up to the close of the year 1928, is set forth in the following table.

#### DESCRIBERS OF CHINESE DRAGONFLIES

AUTHOR	YEAR	NUMBER OF CHINESE SPECIES	COUNTRY WHERE PUBLISHED
Allard	1766	1	Italy
Barteneff	1910-1915	6	Russia
Brauer	1865, 1867, 1868	11	Austria
Brullé	1862	1	France
Burmeister	1839, 1878	7	Germany
Campion	1924	1	England
Charpentier	1840	1	Germany
Donovan	1811	1	England
Drury	1773	5	England
Eversman	1839	1	Russia
Fabricius	1798	7	Denmark
Förster	1897, 1899	2	Germany
Fraser	1924	7	India

de Geer	1773	1	Sweden
Guerin	1831	1	France
Harris	1782	1	England
Johanssen.	1764	1	Sweden
Karsch	1891, 1900	2	Germany
Kirby	1886, 1900	3	England
Kruger	1898	1	Germany
Laidlaw	1919	1	India
Linneus	1758	2	Sweden
Martin	1904, 1909	3	France
Matsumura	1911	1	Japan
McMachlan	1870, 1873, 1884, 1894	8	England
Needham	1928	1	China
Oguma	1922, 1926	6	Japan
Percheron	1835	1	France
Rambur	1842	15	France
Ris	1900	20	Germany, Belgium, France, Switzerland
Selys	1840-1895	65	Belgium
Sjostedt	1925	2	Sweden
Sulzer	1776	1	Germany
Van der Linden	1823	1	Belgium
Williamson	1904	2	U. S. of America

From this table it appears that there were many describers of single species, others of just a few, and that the largest number were described by the veteran Odonatologist, Baron Edmond de Selys Longchamps of Brussels, who laid the foundations of our knowledge of the order by his life-long studies of the world fauna. The table shows also how widely the publication of new species was dispersed over the Occident. Only one description was published in China. The bibliography at the end of this Manual will bear further testimony to the diversity of publications in which the descriptions have appeared. It is the purpose of this Manual to bring together in one place the descriptions of all the known species, in order that Chinese students may more easily take up the study of their own fauna. Our present knowledge is very incomplete. Many new species will be discovered; only one sex is known for many others; and the immature stages are known as yet for very few. Here is an inviting field for further pioneering.

A SUMMARY BY GENERA OF PRESENT KNOWLEDGE  
OF THE CHINESE FAUNA

GENUS	ADULTS			NYMPHS		WORLD DISTRIBUTION
	TOTAL	OLD	NEW	OLD <sup>1</sup>	NEW <sup>2</sup>	
Ictinus (11) <sup>3</sup>	3	3	0	C H U <sup>4</sup>	excl	East Asia, Afr., Aust
Gomphidia (11)	3	2	1		reared	East Asia
Sieboldius (7)	3	2	1	U	excl	East Asia
Davidius (10)	4	3	1			East Asia
Allogomphus (6)	2	2	0			Southeast Asia
Ophiogomphus (20)	1	1	0	C H N		Holarctic
Onychogomphus (61)	7	2	5	F		Eur., Asia, Afric.
Macrogomphus (11)	2	2	0	F		Southeast Asia
Leptogomphus (17)	2	2	0			Southeast Asia
Gomphus (110) <sup>5</sup>	21	5	16		reared	N.A., Eur., Asia
Merogomphus (2)	1	0	1			South China, Tonkin
Anisogomphus (8)	1	1	0			East Asia
Anax (31)	7	7	0	C H Ri	reared	Cosmopolitan
Hemianax (2)	1	1	0	F (?)		Old World
Anaciaeschna (4)	1	1	0			East Asia
Aeschnophlebia (4)	2	2	0		reared	Japan, China
Cephalaeschna (9)	4	3	1		ven	East Asia
Aeschna (71)	4	2	2			Cosmopolitan
Gynacantha (65)	5	5	0	N		Cosmopolitan
Planaeschna (7)	1	1	0		ven.	Japan, China, Aust.
Anotogaster (9)	5	4	1	U L	excl.	East Asia

<sup>1</sup> Nymphs known for exotic species

<sup>2</sup> Determined by rearing (*reared*), by comparison of venation of developing wing (*ven*), by exclusion (*excl*) other possible forms being known; this last is often open to doubt.

<sup>3</sup> Numbers in parenthesis indicate roughly the number of known species in the world fauna.

<sup>4</sup> These are the initials of describers of nymphs of Chinese species, species that occur also in other lands (none have hitherto been described from China): C, Cabot; F, Fraser; H, Hagen; L, Laidlaw; N, Needham; Ri, Ris; Ro, Rousseau; T, Tillyard; U, Uchida.

<sup>5</sup> Including *Platygomphus* and *Burmagomphus*.

Since this manuscript was completed there has appeared an excellent paper by Mr. Ting-wei Liu of Yenching University, who described the nymphs of thirty Chinese species from the vicinity of Peping (see Liu 1929 in Bibliography). References to his descriptions have been added under each of the species that he treated.

Cordulegaster (17)	2	2	0			Holarctic
Chlorogomphus* (14)	7	4	3	F		East Asia
Azuma (8)	1	1	0		reared	East Asia
Macromia	1	1	0		excl.	N. A., Eur., Asia
Epitheca (2)	1	1	0		reared	Paleartic
Idionyx (16)	2	2	0			Southeast Asia
Somatochlora (50)	1	0	1			Holarctic
Nannophya (1)	1	1	0			Southeast Asia
Nannodiplax (2)	1	0	1			China, Aust.
Diplacodes (6)	2	2	0	N		Asia, Aust.
Libellula (28)	4	4	0	C Ro	reared	Amer., Eur., Asia
Cratilla (2)	1	1	0			Southeast Asia
Orthetrum (25)	10	9	1		reared	Old World
Potamarcha (2)	2	1	1			Southeast Asia
Palpopleura (5)	1	1	0			Asia, Afric.
Rhyothemis (15)	2	2	0		reared	East Asia, Aust. Africa.
Neurothemis (10)	3	3	0			Southeast Asia, Aust.
Deielia (1)	1	1	0		reared	East Asia
Urothemis (3)	1	1	0			Eur., Asia, Afric.
Brachythemis (3)	1	1	0		reared	East Asia
Crocothemis (5)	2	2	0		reared	East Asia, Aust. Afric.
Lyriothemis (9)	4	4	0		reared	East Asia
Pseudothemis (1)	1	1	0		reared	China, Japan
Trithemis (16)	3	3	0	N		Afric., Aust., Asia.
Rhodothemis (1)	1	1	0			Southeast Asia
Acisoma (2)	1	1	0		reared	Asia, Afric.
Brachydiplax (5)	2	2	0		ven	Southeast Asia, Aust.
Sympetrum (38)	20	16	4	Ro N	excl	Cosmopolitan
Leucorrhinia (18)	1	1	0			Palaeartic
Hydrobasileus (3)	1	1	0	F (?)		Southeast Asia
Tramea (10)	1	1	0	F		Amer., Asia, Afric., Aust.
Tholymis (2)	1	1	0	F		Southeast Asia, Afric.
Pantala (2)	1	1	0	C N		Cosmopolitan
Agrion (26)	6	5	1		reared	Holarctic
Vestalis (10)	3	2	1			Southeast Asia
Matrona (5)	2	2	0		ven.	East Asia

\*Including Orogomphus

Neurobasis (3)	2	2	0	N		Southeast Asia
Echo (4)	1	1	0			Southeast Asia
Mnais (12)	8	7	1		ven.	East Asia
Psolodesmus (2)	2	2	0			China
Philoganga (2)	1	1	0			Southeast Asia
Caliphaea (2)	1	1	0			West China, Nepal
Pseudophaea (28)	4	4	0	T		Southeast Asia, Aust.
Anisopleura (3)	1	1	0	N		West China, No. Ind.
Bayadera (5)	4	2	2	N		Southeast Asia
Rhinocypha (49)	4	2	2	F		Southeast Asia
Micromerus (20)	1	1	0	F		Southeast Asia
Taolestes (1)	1	1	0		reared	Chekiang
Pseudolestes (1)	1	1	0			Hainan
Megalestes (4)	4	1	3			Southeast Asia
Lestes (93)	7	6	1			Cosmopolitan
Mesopodagrion (1)	1	1	0			Moupin
Philosina (1)	1	1	0			China
Rhipidolestes (1)	1	1	0			Formosa
Sinolestes (3)	3	0	3			China
Coeliccia (20)	4	4	0			Southeast Asia
Platycnemis* (28)	3	3	0	F	reared	
Pyrrhosoma (3)	1	1	0			Oriental, Palearctic
Agriocnemis (38)	5	4	1		reared	East Asia
Nehalennia (9)	1	1	0			Holarctic
Aciagrion (10)	1	1	0			East Asia, West Africa
Pseudagrion (41)	3	2	1	F		Southeast Asia, West Africa
Ceriagrion (14)	4	4	0		reared	East Asia, West Africa
Enallagma (41)	2	2	0	Ro		Holarctic, Neotropical
Ischnura (56)	7	6	1		reared	Cosmopolitan
Coenagrion (60)	10	6	4		reared	Holarctic, Neotropical, Oriental
Indoneura (3)	1	0	1			South China, India
Disparoneura (42)	1	1	0			Southeast Asia, Africa
Total	266	209	58			

At the conclusion of this work I find myself most indebted to my Research Assistant, Mrs. Elsie Broughton Klots, for efficient long continued and essential aid.

\*Including Copera

She assembled the literature, compiled the bibliography, made a large proportion of the drawings and participated in other phases of the work, doing everything possible to facilitate its completion.

### ABBREVIATIONS AND EXPLANATORY NOTES

Two sets of abbreviations are used in the manual which follows: those representing authors' names and those of collections containing the types of new species.

1. I have endeavored to supply a fairly complete bibliography under each species\*; and in order to save space, have abbreviated the author's name and have indicated the paper treating of the species, by the year of its publication. The full title of the paper will be found by looking for author and year of publication in the bibliography at the end of manual. The abbreviations used for authors' names are as follows:

### ABBREVIATIONS

<i>Alb.</i> , Albarda	<i>Linne.</i> , Linnaeus
<i>Bart.</i> , Bartenef,	<i>McLach.</i> , McLachlan
<i>Beauv.</i> , Beauvaise	<i>Mart.</i> , Martin
<i>Burm.</i> , Burmeister	<i>Mats.</i> , Matsumura
<i>Calv.</i> , Calvert	<i>Mort.</i> , Morton
<i>Camp.</i> , Campion	<i>Mtk.</i> , Muttkowski
<i>Charp.</i> , Charpentier	<i>Ndm.</i> , Needham
<i>Don.</i> , Donovan	<i>Oliv.</i> , Olivier
<i>Eversm.</i> , Eversman	<i>Perch.</i> , Percheron
<i>Fabr.</i> , Fabricius	<i>Plot.</i> , Plotnükow
<i>Foerst.</i> , Foerster	<i>Pusch.</i> , Puschnig
<i>Fras.</i> , Fraser	<i>Ramb.</i> , Rambur
<i>Guer.</i> , Guerin	<i>Rouss.</i> , Rousseau
<i>Hag.</i> , Hagen	<i>Schneid.</i> , Schneider
<i>Joh.</i> , Johannsen	<i>Sjos.</i> , Sjöstedt
<i>Kndy.</i> , Kennedy	<i>Tilly.</i> , Tillyard
<i>Krug.</i> , Krüger	<i>Van der W.</i> , Van der Weele
<i>Laid.</i> , Laidlaw	<i>Walk.</i> , Walker
<i>Lind.</i> , Van der Linden	<i>Wmsn.</i> , Williamson

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\*Except for a few of the wide-ranging palearctic species, for which the European literature is excessively extended: a selected bibliography suffices for these.

2. The abbreviations used for the collections in which types of new species are deposited are as follows:

Ac. N.S. Phila., Academy of Natural Sciences of Philadelphia.

Amer. Mus. N.H., American Museum of Natural History, New York City.

Bur. Ent. H., Bureau of Entomology, Hangchow.

Bur. Ent. N., Bureau of Entomology, Nanking.

C.U. Coll., Cornell University Collection, Ithaca, N.Y.

Calif. Ac. Sci., California Academy of Sciences, San Francisco.

Hoang H. Mus., Hoang ho and Pei ho Museum, Tientsin.

Sh. Mus., Shanghai Museum of the North China Branch of the Royal Asiatic Society.

When Arabic numerals are used in descriptions of species to designate segments without mention of body region, it is always abdominal sequents that are intended.

In the following pages there are described 266 nominal species of which 58 are believed to be new to science. These are included in 89 genera, of which one only (*Sinolestes*) is new. The classification used, and the numerical representation by subfamilies is as follows:

### Order **ODONATA**

#### Suborder **ANISOPTERA**

##### Family **Aeschnidae**

<i>Subfamilies</i>	Genera	Species
Gomphinae	12	50
Aeschninae	8	25
Cordulegasterinae	3	14

##### Family **Epiophlebiidae**

##### Family **Libellulidae**

Macromiinae	2	2
Corduliinae	3	4
Libellulinae	26	69

#### Suborder **ZYGOPTERA**

##### Family **Agrionidae**

Agrioninae	7	24
Epallaginae	7	16

##### Family **Coenagrionidae**

Lestinae	4	13
Coenagrioninae	15	47
Protoneurinae	2	2
	—	—
	89	266



**THE DRAGONFLIES OF CHINA**Order **ODONATA**

Dragonflies are large insects of predatory habits, and very peculiar structure. The head is freely movable on a slender neck, and is overspread at the sides by the huge compound eyes. The prothorax is small and the synthorax is very large and strongly askew. The wings are far back on its dorsal side, and the legs are far forward below, and the side plates of the body between wings and legs are strongly aslant. The forward position of the legs favors perching on vertical stems. The spiny legs are not adapted for walking, but for perching and for capturing prey.

The veiny wings have a semiflexible notch called the *nodus* in the middle of their front border and a heavy thickening called the *stigma* farther out at the point of their heaviest impact against the air. The long abdomen of ten segments is rather loosely attached at its base. On the ventral side of the second and third segments in the male there is developed an unique type of copulatory apparatus, the prominence of which renders the sexes easily distinguishable.

The insects that are most often mistaken for dragonflies are the Ascalaphids and Myrmeleonids, with a somewhat similar form of body and manner of flight, but which lack the skewness in the thorax, and the *nodus* in the wings, and which will be at once distinguished if these characters are noted.

The immature stages, *nymphs*, *naids*, or *larvae*, (called nymphs in this manual) are all aquatic. They are of very diverse appearance, but are all instantly recognizable as members of this order by the possession of a great grasping lower lip or labium of very remarkable form. It is hinged and folded beneath the head, the hinge when closed extending back between the fore legs. When extended it is almost as long as the leg. At the tip it is divided into one median and two lateral lobes, all armed with teeth and spines for grasping and holding prey.

It is my purpose in the following pages to provide the means for recognition of the species of dragonflies of the Chinese fauna. Some knowledge of insect structure and development (such as may be gained from the use of my *Elementary Lessons on Insects* or other textbooks of entomology) is assumed; but a careful study of the labelled figures that are herewith provided (Plates I and II) should enable even the beginner to use this manual without other aid. Keys and descriptions are provided for all the known species of adults, and figures are added where deemed necessary. The figures provide the ultimate criteria for species.

The little that is as yet known concerning the *nymphs*, or immature stages is presented in tables that show structural characters comparatively.