SCIENTIFIC BOOKS

A Handbook of the Dragon-flies of North America. By JAMES G. NEEDHAM and HORTENSE B. HEYWOOD. 378 pages, with about 650 figures. Published by C. C. Thomas, Springfield, Ill., 1929. Price $7.00.

THE long-looked-for volume by James G. Needham and students on North American dragon-flies has finally appeared and will undoubtedly stimulate interest in this fascinating group of insects. It is almost a prophetic voice crying in the wilderness, as work on the Odonata has ebbed in recent years and few young students have taken up work on the order. The older workers are gradually becoming less productive as their time becomes absorbed by increased duties of other kinds. New students are not being developed, as the study of dragon-flies has been crowded to the wall by the ever-insistent call for men trained in applied entomology. C. Francis Byers, B. Elwood Montgomery, Theresa M. Seemann and Elsie Broughton comprise the whole of the younger generation working on this group. The main difficulty for beginners has been the matter of literature. The beginners who have been able to work had access to the library of some one of the older workers. Without a good library work on North American Odonata has been impossible. Muttkowski cited the literature up to the year 1910 in his "Catalogue of North American Odonata." The present handbook of Needham and Heywood lists the literature down to date. It gives a new impulse and a new starting-point for students.

As early as the year 1900 Professor Needham announced to the systematists interested in Odonata that he was working on a volume on North American dragon-flies. The specialists shrugged their shoulders. It appeared to lesser minds to be a colossal task. However, Dr. Needham's usual sound judgment came to his rescue as he sensed the great amount of preliminary work involved, and the book was deferred from year to year until twenty-nine years later it has appeared in creditable form. Odonatists shudder when they think what the volume might have been if published before the great amount of revisional work of the present century had been completed.

The "Dragon-flies of Indiana" by E. B. Williamson appeared in 1900, the year of Dr. Needham's announcement. Between 1901 and 1908 appeared Calvert's volume on Central American and Mexican dragon-flies in the Biologia Centrali-Americana which represented ten years of unremitting toil. This cleared up the genus Argia and blocked out the species of the southwestern United States. Next appeared Muttkowski's "Catalogue of the Odonata of North America,"[1] which was accomplished by the loan of E. B. Williamson's nearly complete private library and a wide correspondence with specialists as to the exact status of doubtful species. This catalogue is still cited by writers and students as a model in entomological work and was the first painstaking sorting of the material for monographic work on North American Odonata. It has been the bible of all American workers. In the years 1909 to 1913 appeared Dr. F. Ris's monumental work in 1,278 quarto pages, "Die Libellulinen,"[2] which monographed the libelluline dragon-flies of the world and which straightened out the American genera Sympetrum, Libellula, etc. This is the largest and one of the most perfectly done pieces of work ever published on Odonata. Later appeared E. M. Walker's two monographs, "The North American Dragon-flies of the Genus Aeshna" and "The North American Dragonflies of the Genus Somatochlora."[3] This work covered a period of over fifteen years in which practically all American material was examined and numerous collecting trips were made in eastern and western Canada. These are monographs that are as nearly perfect as such can be made and which straightened out two large genera that were unbelievably scrambled. Besides these Walker published "The Odonata of the Prairie Provinces of Canada"[4] and "The Odonata of the Canadian Cordillera,"[5] with numerous shorter papers. During this period appeared Howe's "Manual of the Odonata of New England,"[6] which compiled all distributional data of New England dragon-flies, while during the same time appeared various papers by the present writer on the Odonata of the Pacific states. Such is the mass of preliminary and critical work that was necessary before a sound monographic work on North American Odonata could be undertaken. As work stands now there remains only one large genus that needs critical revision, this is the genus Gomphus with its seventy-five species. Plans are now on foot to get this cleared up in the next few years. With this done the pioneer work on North American Odonata will have been practically completed. This outlines the problem that Professor Needham faced in 1900 when he first announced his decision to write a book on North American dragonflies. It was a daring project, a magnificent vision and has finally been accomplished.

The volume is a beautiful example of the printer's art and is illustrated with six hundred and fifty line drawings, mostly of genitalia, which have the safest characters for species determination.

It is arranged in two parts. Part I—General—pages 3 to 46, is written by the senior author and

[1] Bull. I, Public Mus. Milwaukee, 1910.

[2] Coll. Zoo. de Selys.

[3] Univ. of Toronto Studies, 1912 and 1925.

[4] *Can. Ent.*, 1912.

[5] Brit. Col. Special Publ., 1927.

[6] Mem. Thoreau Mus., 1917–23.

covers the general biology of dragon-flies in a broad and delightfully written manner. The subheads are "Life of a Dragon-fly," "The Adult Dragon-fly," "Immature Stages," "The Eggs" and "Dragon-flies and Fish Culture." Naturally each is very briefly sketched. It is interesting that the one part of the structure of dragon-flies that is now making Odonata specialists lie awake nights and defer publishing until it has been settled, namely, the correct terms for the veins of the wings, is referred to in a short foot-note only. This is Tillyard's criticism of the present Needham system of terms for the veins of the wings. The situation of vein terminology is similar to the recent situation in physics concerning corpuscles and ether waves. Each side has what appears to be good evidence. While a discussion of terms for wing veins would have satisfied a great yearning among specialists, Dr. Needham undoubtedly used good taste in omitting such controversial subjects.

Part II—Systematic—covers pages 51 to 357 and is the body of the book, Part I being introductory to it. It contains short descriptions with brief keys, tables of characters of the known nymphs and illustrations of male and female genitalia. Each description is preceded by one or more selected references and a statement of distribution by states, and is frequently followed by a quotation on the habits of the species. As stated in the preface the systematic work is the combined product of Professor Needham and a group of graduate students. Except C. Francis Byers, the student authors appear to have had little experience to guide them past the pitfalls of taxonomic writing and no comprehension of the vast amount of toil involved in finished work of this type. In the rush of work before Dr. Needham left for his year in China, Mr. Byers bore the brunt of the effort to get the volume finished. His treatment of the genus Enallagma is the only comprehensive work we have on this group. Because of the difficulty of figuring Argia appendages in simple line drawings his treatment of this genus is not as satisfactory. With its thirty-six United States species it is the most difficult genus included in the handbook.

The reviewer can locate no statement of the area covered by the systematic treatment. Apparently it is North America north of Mexico and the West Indies. When the distribution of a species extends south of this area the fact is seldom stated. A tropical species with a United States distribution in Arizona would have its distribution indicated as "Ariz." The new student would be interested in knowing when he picked up such tropical or Mexican forms so far north.

The treatment of distribution could have been much more thoroughly done. It is merely a matter of hard work and lots of it. Apparently the recent literature was very casually covered for the more recent records. Professor E. M. Walker complains:

> The weakest portion of the work is that dealing with the distribution of the various species, although to judge by the introduction, it is supposed to be one of the prominent features of the volume. From the standpoint of our Canadian species the records are woefully inadequate and it would appear as if our Canadian literature of the past fifteen or twenty years dealing with the Odonata had been almost intentionally neglected. One of the most flagrant examples is found in the genus Ophiogomphus where only a single Canadian species is recorded, *viz.*, *O. occidentis* Hagen from British Columbia: at least seven species of this genus have been reported as occurring in the dominion.[7]

The reviewer has checked but a few species for distribution and has immediately run into equal omissions. *Argia emma* Kennedy is recorded in the handbook as from Washington only. The present writer has published (1917) eleven records of this species for Nevada and California where it is found as far south as Fresno. Walker has published (1927) two records of it for British Columbia. It is probably an exceptional case. However *Macromia magnifica* McL. is recorded from "Calif. and Ariz." Nine lines below Needham quotes the present writer's description of its habits as observed on Satus Creek, which is in the Yakima Valley, Washington, but which Needham in his reference places on the "Umatilla flats, Oregon." The record of *Macromio pacifica* Hagen for California is still included though no authentic specimen of this species has ever been taken west of Kansas or Waco, Texas. The original type is in the Museum of Comparative Zoology and bears the label, "Pacific Railroad Survey, lat. 38°." Apparently the specific name referred only to the Pacific Railroad Survey which started in Kansas and had no biological connection with California. This record was questioned by the writer in his paper "The Dragon-flies of Kansas" in 1917. These are samples that bear out Professor Walker's impression of the insufficiency of the distributional feature of the book, which is one phase of the work that a painstaking stenographer could have done. All these recent papers are listed in the bibliography at the back of the book and so were available to the authors.

Why *Brachymesia furcata* Hagen should be placed in the genus Sympetrum puzzles the reviewer, if for nothing more than that the illustration of the male genitalia (p. 235), because of their conspicuous differences from those of the parallel species of Sympetrum, spoil the regularity of the illustration. However, the writer did the same thing by mistake once and nearly described *furcata* as a new and very distinct species of Sympetrum from Phoenix, Arizona. The mistake

[7] *Can. Ent.*, May, 1929.

was caught just before mailing the description to the *Canadian Entomologist*. It was very disconcerting because *furcata* does not look like a Sympetrum. Neither does the writer understand Needham's treatment of the three species, *Ophiogomphus phaleratus* Needham, *O. occidentis* Hagen and *O. severus* Hagen. The description states that the superior appendage of the male *occidentis* is less pointed than that in *severus*, but the illustration shows the reverse. Also to which of three species do the female genitalia in the figures on pages 74 and 76 belong, presumably to the top and bottom species.

Walker has already pointed out[8] that the illustrations for *Gomphus furcifer* Hagen and *G. villosipes* Selys are interchanged as are those of *Somatochlora whitehousei* Walker and *S. septentrionalis* Hagen. To these can be added the transposition of the figures of *Lestes vidua* Hagen and *L. forcipatus* Rambur. A half dozen critical mistakes have already been discovered in the keys in spite of the fact that catching such errors is the real work of taxonomic writing. Dr. Needham has been frank about these errors and has already circulated a mimeograph sheet to specialists for the listing of such mistakes. These will be published as an extra folder to go with each volume sold. After we have written these corrections into the beautifully printed volume and forever marred its craftsmanship one rather wishes that the authors would give a slight rebate on the price to offset this injury to a seven dollar book.

The handbook will be useful in that it will stir up interest in the Odonata, but before publishing the student will still have to review and check up the literature that has appeared since Muttkowski's catalogue came out in 1910. This can be done by the use of the bibliography at the end of the book which lists the literature since 1910 and appears to be well done. Thus, as stated in the preface, "The Handbook of the Dragon-flies of North America" is "a book for collectors," but it is a book of doubtful value to specialists.

CLARENCE HAMILTON KENNEDY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF RECORDING MAXIMUM AND MINIMUM TEMPERATURES OF FOREST SOILS

INVESTIGATORS who have had occasion to use maximum and minimum soil temperatures have found that present methods are cumbersome even if technically adequate. Bates and Zon[1] state that "the use of registering maximum and minimum thermometers in soil temperature work is not very satisfactory." To secure accurate readings it is essential that the bulb of the thermometer be in direct contact with the soil. Furthermore, the instrument should receive a minimum of exposure to the atmosphere while the readings are being taken. Because of the differences in diathermic properties of air and soil, thermometers placed in wells are subject to considerable error, while the sudden temperature changes necessary to reset the instruments produce strains which may affect the accuracy of such instruments.

Various means have been suggested for the elimination of the difficulties mentioned above. Bates and Zon[1] proposed a bent tube minimum thermometer and a superrefined maximum thermometer with a constriction fine enough to prevent absolutely the return of mercury to the bulb even when in an upright position. Toumey and Stickel[2] used a system whereby the thermometers are placed in a small hole in the side of a pit and at a distance of several feet from the pit.

Thermographs are suitable for accurately recording soil temperatures but necessitate great care in the installation of the instruments, besides requiring frequent checking by standard thermometers. The price of thermographs also tends to make general use of them prohibitive.

In seeking to develop an improved technique for soil measurements, the writer found that there is on the market[3] a modified Six's maximum and minimum thermometer well adapted to recording soil temperatures in the forest.

The instrument, originally designed for incubator use, consists of the usual maximum and minimum features of the Six system, incased in a glass tube. The upper portion of the tube contains the scale, while the lower end is constricted and elongated to hold the bulb, which is some seven inches below the recording scale. The greater diameter of the casing is .7 inches and the smaller .3 inches; the entire thermometer is fifteen inches long. The scale reads from minus 20° to plus 50° C. The Six type of thermometer is generally considered somewhat less precise than standard recording thermometers, but apparently the instrument here described is constructed with sufficient accuracy to warrant its use in forest investigations. Table I shows the differences in reading between such an instrument and a standard soil thermometer read each day at 8:00 A. M. from January to June, 1929, at the one-foot soil depth.

[8] *Can. Ent.*, May, 1929.

[1] C. G. Bates and Raphael Zon, "Research Methods in the Study of Forest Environment," U. S. D. A. Bul. No. 1059, May, 1922.

[2] J. W. Toumey and P. W. Stickel, "A New Device for Taking Maximum and Minimum Soil Temperatures in Forest Investigations," *Ecology*, vol. vi, No. 171, 1925.

[3] Arthur H. Thomas Co., distributor, Philadelphia, Pa.