

ENTOMOLOGICAL NOMENCLATURE
AND
LITERATURE



3rd Edition
Revised and Enlarged

By

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Oregon State College

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PREFACE

In attempting to teach courses dealing with various phases of entomology over a period of 30 years, there has been an increasing tendency to separate course work into more and more restricted fields.

Much of the material presented herewith is given by various instructors in connection with courses in historical entomology, taxonomy, etc., and, in such courses, it is usually treated only briefly and in an incidental manner.

Nomenclature is of sufficient importance that it should be treated directly and with considerable emphasis. Its importance, development and historical background should be understood by every student in entomology.

Literature is, of course, the basis from which all present-day workers get their inspiration, and the literature in the field of entomology is so extensive that one must handle it in a systematic manner.

It has been the hope of the writer that, by pointing out those works where bibliographies are obtainable, the task of obtaining information on any given phase of entomology would be made an easier one.

When late works are available which contain extensive bibliographies, such as Wigglesworth, Principles of Insect Physiology, or Snodgrass, Principles of Insect Morphology, the student is referred to those works, and from the bibliographies he will be able to select those applicable to the problem at hand.

Source works, such as bibliographical catalogues, monographs with selected bibliographies, indexes and similar works, have been included so that a bibliography upon almost any specialized field may be assembled with the least possible outlay of time.

Judging from comments made by alumni who have taken State and Federal Civil Service Examinations, much of the material here presented has proven extremely valuable in their examinations.

Two editions of this work have appeared in planigraph form. These have received very favorable reception and have been rather widely used for course work at various universities and colleges.

Oregon State College
Corvallis, Oregon
July 1952

W. J. Chamberlin

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Part I

ENTOMOLOGICAL NOMENCLATURE

It is at once apparent that in order to deal intelligently with objects we must apply names to them, and, were there only a few objects, the manner of naming these would be of small importance. The name might be a phrase or sentence: i.e., the small, black, oval object always found attached to the broad, green leaf. However, when the objects of which we wish to speak become numerous, this type of classification is not only cumbersome but useless. Imagine trying to describe a particular species of insect by saying, "the grayish creature about one inch long, with horns two inches long, often found about logs in the spring." It is true that anyone with entomological training would suspect at once that the author was referring to a cerambycid beetle, but to which particular species, it would be impossible to say, since there are perhaps twenty or more species which would correspond, in a measure, to that brief description. So it may be stated that objects in order to be talked about must have names, and in order to be identified they must be described. Briefly, then, this is the reason for nomenclature, the designation of all objects by name. We are not satisfied to stop at the mere naming of the object but wish to classify each particular species by placing it in its proper niche, which should, insofar as we are able to judge, show its relationship to others of its kind in the animal or plant world.

The biologist is interested in living organisms, and it was early apparent that a primary classification was obviously one for dividing all such organisms into one of two groups, which were designated kingdoms. Of these there were two: namely, the animal and the vegetable kingdoms. It would appear to the average person that there surely would be no difficulty in placing any given species of living thing in one or the other of these primary groups; even today certain living organisms are of such a character as to defy their being definitely placed.

In spite of the fact that to us it would appear that nomenclature is indispensable and

needs no supporting argument, we find those who attempt to belittle and even ridicule the work of the systematist. The latter admit that it is worth while to know that a fly is a fly or that the caterpillar is an immature butterfly; that the little spots on a grapefruit are scale insects, but question the vast amount of time and energy expended in separating all the various insects, such as mosquitoes, scales or other creatures, which look so much alike. Why bother to place each in a specific niche? Why not call all mosquitoes just mosquitoes, and let it go at that? A few examples of why this is impracticable may be in order. Ladybird beetles are numerous in species and individuals; broadly speaking, they are among the greatest friends of man, since they destroy countless injurious scales and other small insects. There is, however, one species¹ which is very injurious; like many other species, it must be controlled and therefore must be specifically known. Mosquitoes are annoyers of man, but of recent years we have found that certain species are carriers of the causative agent of deadly diseases. Mosquito control is expensive, but, when human life is at stake, great expense is justified. However, before steps are taken to expend large sums of money in mosquito control work, we should be sure that those species which carry disease are actually present.

It is a common occurrence for growers to submit insects for determination and, at the same time, to request instructions as to how these insects may be controlled. Very often the insect submitted is a perfectly harmless species or even a beneficial one and any action against it would do harm rather than good. To illustrate: A grower recently submitted a specimen of a beetle, saying that it was responsible for the destruction of a large percentage of his strawberry plants. The insect submitted was a perfectly harmless predacious staphylinid very likely doing some good in destroying noxious forms. Another example may be cited. The various fruit flies are quite similar in appearance yet many are

¹Epilachna corrupta Muls.

perfectly harmless. We have a rigid quarantine against the Mediterranean fruit fly, the Mexican fruit fly and others. Quarantine officials, in order to admit some and reject other materials, must be acquainted with the species if justice is to be done. In a similar manner, biological control is absolutely dependent upon the proper knowledge of the pests, the enemies, and the hyperparasites. The introduction of a few of the latter may completely nullify the hard work of foreign field agents and large sums of money may be wasted. We must, therefore, come to the conclusion that the naming of species is the very foundation of biology and is a praiseworthy and laudable part of our system.

The naming of living forms (from this point on we will have insects in mind) may be very beneficial or it may be of little or no value. We may go further and say that it may even be quite detrimental to science. If the descriptions are carefully drawn up and there is no question as to the validity of the insect under observation, there has actually been something added to our knowledge and a beneficial piece of work results. If some additional information concerning the biology, distribution, hosts, etc., be added, the work is even more valuable. The describing of specimens of questionable validity, and poorly-drawn descriptions without notes or other information are of questionable value. When descriptions, regardless of how well done, result in synonymy it is a detriment to our already overcrowded catalogue of names.

Historical Development. Among the ancient writings we find many references to insects. One of the earliest and better known Greek writers was Aristotle (348 B.C.-322 B.C.) He was born at Stagira on the Mace-

donian coast, the son of the physician to the king of Macedonia. Aristotle is known as a philosopher, but he was greatly interested in zoology and actually created a definite zoological system. He collected and recorded the observations of his precursors. After opening his Lyceum in Athens (about 334 B. C.), the king put at his command several thousand men to collect animals of all varieties in order that Aristotle might write his "History of Animals." Aristotle made many mistakes. Most of them were due, in a large measure, to the fact that he was forced to rely in many cases upon the observations of others. He apparently believed in spontaneous generation in the cases of flowerless plants, gastropods and some insects. He states that these resembled each other in that they were "engendered from inanimate matter." This was a common belief and it remained for Redi (1626-1697) to prove that creeping things engendered their own kind in the same manner as did higher animals.

Aristotle erected the category of Entomos, which included insects, spiders, scorpions, centipedes and millipeds. He believed that insects had a sense of smell but did not breathe. He mentions about 60 species, but few can be identified from his writings. He knew locusts oviposited in the ground. He thought cicadas fed only upon dew and knew that only males sing. He also pointed out that the Ephemeron lived but a day and that geometrid moths came from caterpillars which "form waves when they walk."

He used such terms as Kouleoptera, Kleras, Karabas and Melolonthe. He named the invertebrates, Anaima (without blood). His work had great influence on all writers up to the latter part of the 14th century.

A SHORT BIOGRAPHY OF ARISTOTLE²

Aristotle was born at Stagira, in Thrace, 384 B.C., and died at Chalcis 62 years later (322 B.C.). His father, a physician to the Macedonian king, took great care with his early education and encouraged him in the pursuit of scientific studies for which he had a natural taste. At the age of 18 he became a student in the Academy of Plato at Athens and for 29 years lived in the intellectual atmosphere of Athens and the academy. He was charged with the task of educating the Heir to the throne, Alexander, the future conqueror of the world, and he held this post for three years (342-340 B.C.). He traveled in Greece and Macedonia, made important

seaside studies in Mitylene, and returned to Athens where he set up a school of his own known as the Lyceum.

Although Aristotle was primarily a philosopher, he created the first definite zoological system. "Animals may be characterized according to their way of living, their actions, their habits and their bodily parts. According to the first three-named principles, they are divided into land animals and aquatic animals; certain of the latter live entirely in the water--the fishes; others live most of their time there but breathe and breed outside it--otters, beavers and crocodiles. The most

²1912 Lones, T. E. Aristotle's Researches in Natural Science. London
1929 Weiss, H. B. The Entomology of Aristotle. Journ. N. Y. Ent. Soc. 37: 101-109.

important basis of classification are the parts of the animals' bodies both external and internal, namely; motive organs, respiration, organs of sense and blood circulation. By combining various qualities the groups are defined and characterized." Aristotle classified about 520 species which present-day zoologists have identified. It seems that the marine fauna interested him more than the land fauna.

With Aristotle, classification was incidental and an outgrowth of his studies of structure and development. Since he does not mention some very well-known forms, like the badger, the dragonfly, etc., we can assume that he knew others but did not regard it as necessary to give a catalogue of all the forms known to him. He mentions them only when he wishes to refer to habits and certain structural conditions found among them.

His simple direct statement of the metamorphosis of insects is as follows:

"The so-called psyche or butterfly is generated from caterpillars, which grow on green leaves, chiefly leaves of the raphanus, which some call crambe, or cabbage. At first it is less than a grain of millet; it then grows into a small grub and in three days it is a tiny caterpillar. After this it grows on and on, and becomes quiescent and changes its shape, and it is now called a chrysalis. The outer shell is hard, and the chrysalis moves if you touch it. It attaches itself by cobweb-like filaments and is unfurnished with mouth or any other apparent organ. After a little while, the outer covering bursts asunder, and out flies the winged creature that we call the psyche or butterfly. At first, when it is a caterpillar, it feeds and ejects excrement; but when it turns into a chrysalis it neither feeds nor ejects excrement."

Aristotle founded zoology on broad lines as a universal science, since anatomy and embryology, physiology and classification find equal consideration. He subordinated classification to the more important features of structure, development and physiology, which he was discerning enough to recognize as of greater worth.

The claims of Aristotle to consideration in the history of science rest chiefly on the fact that he was the greatest investigator of antiquity. A careful reading of his *Historia Animalium* will show that he was no compiler but an investigating naturalist, perusing his subject by personal observation and by

broad comparison, together with the use of reason.

All that was best in the natural history of that time is to be found in the writings of Aristotle and his successor, Theophrastus. The beginnings of zoology and botany are lost in the past, but most of the previous accumulations of knowledge regarding animals and plants, clarified and reduced to system, are preserved by these two great naturalists.

The works of Aristotle, and those which were produced by his co-workers under his direction, represent the most prodigious intellectual achievements ever connected with a single man.

Included in his writings are: "The History of Animals," "On the Parts of Animals," "On the Movements of Animals," "On the Generation of Animals," "On Respiration" and "On the Phenomena Chiefly Connected with Natural History."

In Book IV of the "History of Animals," Aristotle divided the bloodless creatures into four genera or families, as follows: 1) Those animals with flesh-like substance outside and any hard skeleton that may be present on the inside--Mamals. 2) Those with flesh-like substance on the inside and a hard skeleton on the outside, which cannot be shattered but must be crushed--Malacostraca. 3) Animals with flesh on the inside, which can be shattered but not crushed--Testraceans, (snails and oyster). 4) Those with nicks either on the belly or on the back, or on both, and with no part distinctly osseous and no part distinctly fleshy, but rather intermediate between bone and flesh--Insects.³

Following are a few random extracts quoted from "The Works of Aristotle Translated in English" by D'Arcy Wentworth Thompson, which give an insight into the thought of the times.

"Some insects are wingless, such as the *iulus* and the centipede; some are winged, as the bee, the cockchafer and the wasp; and the same kind is in some cases both winged and wingless, as the ant and the glow-worm.

"Insects have three parts common to all; the head, the trunk containing the stomach, and a third part in betwixt these two, corresponding to what in other creatures embraces chest and back.

"All insects when cut in two continue to live, excepting such as are naturally cold

³D. W. Thompson, The Works of Aristotle Translated into English, Oxford Press, 1910.

by nature, or such as from their minute size chill rapidly.

"All insects have eyes, but no other organ of sense discernible, except that some insects have a kind of tongue. In some insects this organ is soft; in other insects it is firm. In the horse fly and gad fly it is hard. Such insects as have no sting in the rear use this organ as a weapon. Thy fly can draw blood, and the gnat can prick or sting with it.

"Some insects are dipterous or double-winged, as the fly; others are tetrapterous or furnished with four wings, as the bee; and no insect with only two wings has a sting in the rear. Some winged insects have a sheath or shard for their wings, as the cockchafer; but in the case of all, alike, flight is in no way modified by tail-steering, and the wing is devoid of quill-structure or division of any kind.

"Some insects have antennae in front of their eyes, as the butterfly and the horned-bettle. All insects have the belly different from the back.

"The cicada alone is unprovided with a mouth, but it is provided with the tongue-like formation found in insects furnished with frontward stings; and by the aid of this, the creature feeds on dew, and on dew only, and in its stomach no excretion is ever found.

"Insects can make sounds by internal air or wind, though not by the emission of air or wind; for no insects are capable of respiration. Some make a humming noise, like the bee and the other winged insects, and others are said to sing, as the cicada. And all these latter insects make their special noises by means of the membrane under the hypozoma. The noise made by grasshoppers is produced by rubbing or reverberating with their long hind-legs.

"In the bee, the fact of its being asleep is very obvious; for at night-time bees are at rest and cease to hum.

"When spontaneously generated insects mate, they give birth to a something--a something imperfect. For instance, the issue of copulation in lice is nits; in flies, grubs; in fleas, grubs.

"Some insects are generated spontaneously of dew, others out of mud or dung, others in timber, some in the hair of animals, some in the flesh, some in the excrement after it has been voided, and some before it is voided, as in the intestinal worm.

"The so-called butterfly is generated from caterpillars which grow on green leaves, chiefly leaves of cabbage.

"In the summer there are brought down toward the sea by the stream what look like little sacks rather bigger than grapes, out of which at their bursting issues a winged quadruped. The insect lives and flies about until the evening, but as the sun goes down it pines away and dies, having lived just one day, from which circumstance it is called the ephemeron."

Following Aristotle, very little progress was made for nearly 1800 years. Early in the 16th century Edward Watson (Wotton) attempted to classify Aristotle's animals and did considerable compilation and some original writing on natural history.

Due largely to the very definite lack of a system of naming organisms, these early writings were of little practical use. It must also be remembered that the art of printing was not introduced until about 1445⁴, and, even then, the dissemination of printed material was very expensive and exceedingly slow.

John Ray made some contributions worthy of note, and it is likely that Linnaeus knew of Ray's writings. In fact, it may be that Ray's observations were in a large measure responsible for some of Linnaeus' contributions in the field of classification.

BIOGRAPHY OF JOHN RAY

John Ray was born at Black Notley, Essex, England, in 1628, the son of a blacksmith. Ray was educated at Catherine Hall and Trinity College, Cambridge. Francis Willughby was a famous pupil of his. Ray and Willughby went on a collecting tour throughout Europe. They planned to use

their collections as a basis for a complete systematic description of the plant and animal kingdom. Willughby was to write the animal part, but he died after completing only ornithology and ichthyology. Ray edited these after Willughby's death.

⁴See brief notes on printing in Part III.

In his early work he classified plants alphabetically, but later used the number of cotyledons as a basis. In 1682, Ray published his first independent systematic work on plants, "Methodus Plantarum Nova." In this work he was the first to show the true nature of buds, and employed the division of flowering plants into dicotyledons and monocotyledons. He based his system mainly upon the fruit and, in part, upon the flower, leaf and other characteristics. Unfortunately, he retained the primary division of plants into shrubs and trees, and denied the existence of buds on herbaceous plants.

He wrote a history of plants, the first volume of which was issued in 1686 and the second in 1688. A third volume was published in 1794. A comprehensive summary of vegetable histology and physiology, including the researches of Columna, Jungius, Grew and Malpighi, is prefixed to the first volume. The two first volumes describe about 6,900 plants.

He⁵ published the first truly systematic arrangement of animals, since the days of Aristotle, in 1693. Ray's classification was based upon the digits and the teeth.

From about 1690, Ray's attention was largely given to the study of insects. When Lady Granville at Exeter was judged insane because she collected insects, Ray was called as a witness to her sanity.

He died before publishing a completed classification of insects. This was published by Derham, Kirby remarks that Ray's work⁵ combined the system of Aristotle with

that of Swammerdam, and cleared the way for Linnaeus." He practically adopted the modern division of insects into the Metabola and Ametabola. Cuvier, speaking of his zoological works as a whole, terms it "yet more important than his botanical achievement, it being the basis of all modern zoology."

Ray's fame as a systematic botanist depends mostly on his third volume of "Historia Plantarum" for its completeness and critical value. It was published in 1704, contained 11,700 species in all.

Ray died at the Dewlands in 1705. His collections went to his helper, Samuel Dale, and his herbarium to the botanical department of the British Museum, where many of his works are to be found. For his varied and useful labors, he is regarded as the "Father of Natural History of England."

Hallam says that he is "the first zoologist who made use of comparative anatomy."

He was elected a Fellow of the Royal Society in 1667-

In 1844 the Ray Society was established for the publication of works dealing with natural history. Among the first volumes was "Memorials of John Ray."

Ray wrote some 25 books, in addition to several papers on sap, spontaneous generation and other subjects.

REFERENCE

1942 Raven, C. E. John Ray Naturalist, His Life and Works. Cambridge Press Cambridge, England. 502 pages.

FRANCESCO REDI

Francesco Redi, the Italian poet, physician and naturalist, was born February 18, 1626, at Arezzo and died March 1, 1698, at Pisa. After studying medicine in Pisa and taking his degree, he entered the service of Colonna family in Rome as a tutor. He held this position for five years, then traveled for five years and worked in the Vatican libraries as a bibliophile and linguist. In 1654, he went to Florence where he acted as physician to the Grand Dukes Ferdinand II and Cosimo III.

He was constantly engaged in experiments intended to improve the practice of medicine and surgery, yet found time for much literary work. He was an active member of the academies of the time, including the Academia del Cimento. As an associate of the Crusca, he aided in preparing its important "Vocabolario." He taught

in the Studio at Florence in 1666 as lettore pubblico di lingua toscana and was one of the first members of the Arcadia.

In his famous book, "Esperienze intorno alla generazione degli insetti," which was published in 1688, he controverted the doctrines of spontaneous generation of maggots in putrid flesh. Although Redi did not believe in the spontaneous generation of maggots from decaying flesh, he did believe in the spontaneous generation of intestinal worms and gall flies.

Redi could not accept the view that "worms" are produced in dead animals or plants, but thought they were all generated by insemination and that the putrefying matter merely served as a suitable nest in which animals deposited their eggs at the breeding season and in which they also found nourishment. To test this view, Redi made

⁵Some credit for work along systematic lines must be given to Aldrovandus (1602) and to Edward Watson (Wooten).

a very large number of experiments. He placed many kinds of flesh in open boxes and left them to decay. Maggots appeared and he watched them become insects. He also found the ova which he thought had been dropped on the flesh by flies. He was confirmed in his belief by finding that hovering over the flesh before it grew wormy were flies of the same kind as those that later bred in it. "Belief," says Redi, "would be in vain without the confirmation of experiment." He, therefore, put a snake, some fish, some eels and a slice of milk-fed veal into four wide-mouthed vessels, and, having closed them with paper, prepared similar open vessels. In the latter series the flesh rapidly teemed with maggots, but he could find none in the closed series, although here and there on the paper cover he saw maggots eagerly seeking any crevice through which they could penetrate to find food. As the experiments had been made with closed vessels which might have hindered the circulation of air, he made other experiments in which the air might freely enter but flies could not. He placed meat and fish in large vessels closed with the finest Naples gauze, and, for further protection against flies, placed the vessels in a frame covered with the same gauze. Many flies were found moving about on the frame, but no maggots appeared in the meat. On occasions, he saw flies deposit their ova on the net, or even in the air before they reached the net.

By such experiments, Redi destroyed forever the myth that maggots are bred spontaneously from meat. In other experiments, he traced the development of the ova through maggots to fully-formed flies of diverse sorts. Redi described himself as the most incredulous man in the world with regard to natural phenomena, and admitted that in bygone days when blinded with inexperience he believed in things "which I am now ashamed to remember." He studied worms in all sorts of vegetation, and, strangely enough, he ultimately concluded that fruits, vegetables, trees and leaves show grubs in two ways: 1) they come from without and gnaw a path inward, and 2) the soul or principle which creates the flower and fruits is the same as that which produces grubs in plants. In spite of his accurate work on the development of maggots in flesh, Redi was led astray when he came to investigate the grubs in galls. Originally he believed that oak-galls resulted from the bite of a fly which deposited its ova in the wound, but, for various reasons, he

altered his view and maintained that grubs in trees do not originate from ova, and he consoled himself by saying that such a view was "not a great sin against philosophy."

Redi's observations on the development of flies from maggots were supported by other investigators. However, it took the experiments of Spallanzani in 1769, Schulze in 1836, Schroder and Von Durch in 1854, and Pasteur in 1860, to put the finishing touches to Redi's theories.

REFERENCE

1915 Locy, W.A. *Biology and its Makers*. 3rd. Ed. Henry Holt Co., New York.

At the time Linnaeus became interested in natural science and presented a plan of nomenclature, it was only natural that it was received with enthusiasm.

Linnaeus' plan was to bring order out of chaos; to make it a relatively simple matter to refer to any known organism by using two words. This would obviate the old order of using a descriptive phrase, sentence or paragraph, and it would naturally stimulate the naming of those organisms which hitherto had not been referred to because of the lack of a simple method. The new system was to use one name to refer the organism to its proper group or kind, the genus; a second to designate its particular niche within the genus, the species. He established his system in a series of books on both botany and zoology in which he listed all those species known at the time, whether or not he had actually seen them. One of these books was *Systema Naturae Regnum Animale* in which the various animals known to him, or of which he could find accounts, received names and a brief description. This work passed through a number of editions and zoologists have, by mutual consent, adopted the tenth edition, published in 1758, as the starting point for our present system of binomial nomenclature. Anything appearing previous to 1758 has no status in our system.⁶ All names in the tenth edition are accepted and Linnaeus is given credit for them, although many of them were actually described by earlier authors.

There have been changes in thought and conception during the nearly 200 years since the work of Linnaeus, but these have not affected the fundamental principle upon which the binomial system rests. Rules and regulations have been adopted and we now use trinomial names for sub-species, but the principle still remains.

⁶See code, Article 26, p. 25.

Linnaeus employed the terms class, order, genus, subgenus and species. He knew but 72 genera of insects and less than 10,000 species of all kinds of animals. Today there are families containing more than 72 genera, and we have more than twice as many described beetles in North America as Linnaeus had of all animals.

Professor Clarence Hamilton Kennedy, Ohio State University, Columbus, says:⁷

"The binomial system of nomenclature in its establishment by Linnaeus appears to have been a discovery and not a well-thought-out invention. The system of Linnaeus divides readily into main features. First is his generic and supergeneric classification built up in succeeding order of size of genera, orders, classes, phyla and kingdoms. This part of the system appears to have been thought out carefully by him by a reevaluation and recombination of ideas already developed by John Ray and successors and from the generic classification of ideas worked out in Greek logic. It is an astonishingly sound piece of thinking. Second is his binomial method of designating individual species; but this accidental discovery had no basic theory in its inception.

"In the first nine editions of the *Systema Naturae*, no binomial system of nomenclature was used. Each species was given a generic or group name, an idea coming from Greek logic. This generic name was followed by a short description of from one to three or four lines in Latin. Linnaeus considered the generic name plus the condensed Latin description, the name of the species. This obviously was a very lengthy and unwieldy designation.

"By the time of the publication of the ninth edition of the *Systema Naturae* other naturalists were describing new species; so, in order to make the ninth edition complete, the descriptions published by these other workers were quoted in this edition quite numerously. However, to condense the work, Linnaeus, in quoting these descriptions, used merely the generic name followed by the first adjective of the specific description, which was usually the most descriptive adjective. This procedure gave a description condensed to a generic name and one specific name or character. Linnaeus at once saw the value of such a condensed description, and, in the tenth edition set out in special type the generic name and the first descriptive term of the specific description as the binomial name of the species. Thus arose the binomial system of

nomenclature. It came about by the chance of clerical compulsion and the usual high cost of printing.

"Except for the beginnings of a systematic philosophy of the natural world devised by Aristotle about 300 B.C., the objects in nature still remained in the philosophies of man as a heterogenous hodge-podge. Linnaeus was the first man to give the world a system that worked. When he started work, he found the major groups roughly blocked out by Aristotle and more recently by John Ray and the botanist Tournefort. He had access also to the system for the classification of ideas as worked out by Greek logicians. By a recombination of these ideas he built the framework of his general classification. In Greek logic, individual ideas or conceptions were specific or rated as species. These were organized into groups of similar ideas or conceptions called by the group name genus. Genera were then organized again as groups of similar genera into a genus of a higher order. Thus, in the Greek conception of the world of thought, this was organized into a pyramid of genera of ever-increasing orders of comprehension, each higher genus being composed of a group of genera of the next lower order, each genus of the lower order being a species of the genus of the next higher order. This was an ingenious and flexible system characteristic of the subtleties of the Greek mind.

"Linnaeus used this generic system of the Greeks, but, in using it, made certain changes. First, he applied the system to natural objects for the first time. Second, he gave specific terms to his genera of the higher levels. Linnaeus grouped species into Genera, then grouped genera into a genus of the next higher rank, which he termed an Order. Orders were grouped into a genus of the next higher order, which he termed a Class. Classes were grouped into Phyla and these into Kingdoms, of which he recognized three: Animal, Vegetable and Mineral."

The many groups, which may be recognized under the animal kingdom today, are as follows:

Kingdom
 Phylum
 Class - sub-class
 Super order - order - sub-order
 Super family - family - sub-family
 Super tribe - tribe - sub-tribe
 Super genus - genus - sub-genus
 Group
 Species - sub-species - variety

⁷1929 Trans. IV. International Congress of Ent., Ithaca, N. Y.

Linnaeus is considered one of the outstanding scientists of all times, so it is well that we know something of this man and his work.

A brief biography of Carolus Linnaeus follows.

CAROLUS LINNAEUS (CARL VON LINNÉ)

Only the story of Charles Darwin can approach the fairy-tale life of Carolus Linnaeus. Sweden, after a brief meteoric military ascension under Charles, had subsided into a handful of impoverished provinces with no institutions of learning worthy of the name. No one expected that the greatest naturalist of the age would come from this geographical icicle in the North.

Carolus Linnaeus was born in a little red farmhouse near Roeshult, Sweden, on May 23, 1707. Little is known of the family. Presumably, the boy learned his letters under the village pastor by sitting on a varnished bench in a dismal Lutheran Church on cold "school" days. From this same man he learned the Latin Orchis, Rosia and Lilium. It was decided at a solemn conclave in the family kitchen that Carolus would pursue his naturalistic bent in the pursuit of medicine--the only profession open to those so inclined at the time and generally considered but one step removed from blacksmithing.

After a brief period at Lund, where he was given little but divine lectures, Linnaeus enrolled at Upsala, near Stockholm. With little money and wearing only ragged clothes and paper-soled shoes, he began to wonder if he might not starve in his pursuit of knowledge. He came under the attention of old Olaf Rudbeck, who was attracted to this boy whose thin, red wrists projected from tattered, too-short jacket sleeves and who protested being ejected from the library at closing hour. He recommended him to Dean Celsius as "the only student who preferred to study flowers instead of Job." Under these patrons Linnaeus' fortunes waxed. He was given a grant to make a scientific reconnaissance of Lapland and brought back much valuable material. As a result, he was sent out by the government to survey Dalecarlia. Linnaeus' diary, however, speaks more of the maidens than of scientific discoveries, for, in the midst of all this, he fell tumultuously in love with Sara Lisa Moraea.

His diary records that on January 2, 1735, he called upon her in Lapp costume, and that on the following day, finding her parents from home, he stayed all day. He was back on the 10th and 15th, and, by the 19th, all of his friends were wagering that

there would be a christening before another year.

Dr. Moraea guaranteed not to betroth the girl for two years. Accordingly, Linnaeus set sail with a light heart for continental Europe. The Dutch universities made a specialty of routing Swedes through the diploma mills. It took only a few weeks and not much money was involved. Linnaeus cheerfully paid his last few florins at Leyden and prepared to starve learnedly for a while. He need have had no fears, for his lovable personality saved him again. In a short time he had more patrons than he could easily handle.

Europe at that time was still ransacking ancient knowledge, particularly that of Aristotle. The young Linné merely used that venerable head as a stepping stone, and his early manuscripts of *Systema Naturae* were making all scientific Europe take notice. Linnaeus was inducted into a large number of European societies, including the French Academy--quite an honor for a barbarian!

Having had his fill of Europe, he hurried back to Sweden lest Moraea give his daughter in marriage to another. The shrewd old gentleman agreed that Linnaeus was famous, but--did he have any money? Linnaeus had to confess his utter lack of this commodity. Accordingly he hung out his shingle as a practicing physician and built up a trade in the slums and among the petty bourgeoisie class. He won the favor of a court lady by a cure and in a short time was physician to the Admiralty, physician to the Court, Assayer of Metals to the Government, President of the Academy--and the husband of Sara Lisa Moraea.

Tiring of medicine, he accepted the position of professor at Upsala. At this time, explorations were at a peak and green waves of foreign plants and fauna were rolling in on Europe. Linnaeus was foremost in sorting much of this material. His fame drew native and foreign students of such caliber as DeGeer, Fabricius, Zoega, Kuhn, Sparmann, Rolander, Rotheram, Hasselquist and others. (Note: Dr. Adam Kuhn of Philadelphia was Linnaeus' only American student.)

Linnaeus lived a rich full life, was enobled, and fathered two daughters and one son. He died January 10, 1778 of

complications following a December sleigh ride, against his physician's orders.

On the following pages may be found chronological and other material relating to Linnaeus.

It should be noted that Linnaeus was primarily a botanist, but the amount of his descriptions in other fields is staggering. He is credited with binomial nomenclature and the insistence upon the use of Latin as a medium of scientific intellectual exchange.

His collection is in two parts: the early and more valuable one was purchased by the Linnaean Society of London; the later collections are at Upsala University in Sweden.

His most important works include: "Systema Naturae," (Ed. 1, 1735) and "Systema Naturae," (Ed. 10, 1758).⁸

Although Linnaeus traveled and collected extensively, his American types were furnished by his friends, pupils, associates, etc. Even his American lists run into hundreds of species. A few are included here because of local interest.

Silver Fish Moth, Lepisma sacharina L.
European Earwig, Forficula auricularia L.
Oriental Cockroach, Blatta orientalis L.
Rose aphid, Macrosiphum rosae L.
Oyster Shell Scale, Lepidosaphes ulmi L.

Golden Buprestid, Buprestis aurulenta L.
Pea Weevil, Mylabris pisarum L.
Strawberry Root Weevil, Brachyrhinus ovatus L.
Sheep Bot, Oestrus ovis L.
Cabbage Butterfly, Pieris rapae L.

Linnaean Chronology

- 1707 Born - Roeskild, Sweden.
1732 Journey to Lapland.
1735 Systema Naturae, First Edition. Established class insecta, gave generic characters for first time.
1741 Accepted a professorship at Upsala University.
1744 Systema Naturae, 4th Edition. Settled on the orders of insects.
1753 Species plantarum.
1758 Systema Naturae, 10th Edition. Beginning of modern nomenclature.
1778 Death at Upsala.

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1928 Nordenskiöld, E., "History of Biology," Knopf, London
1931 Essig, E. O., "History of Entomology," Macmillan, N. Y.
1936 Peattie, D. C., "Green Laurels," Simon and Schuster, N. Y.

THE SPECIES

The basis of all nomenclature is the species, and it is essential that we fix our conceptions of just what a species is.

The question, What is a species?, is one which is still opinionative. No hard and fast rules can be made to define this category. Among older writers, we find that species was defined as an organism which was non-fertile with another species. If this were true hybridization would be impossible. On the other hand, this view has a value, for we might consider two insects very similar in external structure and appearance, yet differing so greatly in the male genitalia as to make it physically impossible for the male of one to mate with the female of the others. In such a case there would be no question as to their being of different species. In insects, as a rule, we must deal with preserved specimens and mainly with very small numbers. Basing of species on breeding is out of the question. Then, too, we must consider individual variation within the

species. As an example of this we might cite the domestic dog, considered a single species, yet made up of nearly 100 races, each readily separated from the other. The various races of man are also considered a single species. So we must not lose sight of the fact that, especially in insects, extreme caution must be used before passing upon the validity of a species. Two individual specimens of a widely-distributed species, selected from widely-separated localities, may appear quite distinct, but, when compared with a series representing the entire distribution, it may be seen at once that there is a gradation from one extreme to another, with all belonging to a single species. Hence, there is a danger in erecting species upon unique specimens unless the author is very familiar with the group throughout its entire range. Always remember that it is axiomatic in biology that no two individuals are exactly alike. Just where to draw the line between species and individual

⁸This work serves as a starting point in the names of insects. All names antedating it are considered invalid.

variation becomes exceedingly difficult at times, especially in dealing with insects, and with very limited numbers. We may also encounter great difficulties in dealing with certain forms which vary with hosts. An outstanding example of this is a scale belonging to the genus Lecanium which has a wide range of hosts. Its shape may vary according to the surface upon which it settles, be it convex or flat or a very small twig or a large trunk. It may be small, large, shiny, light-colored, dark-colored or covered with a powdery substance. These variations are more or less constant, depending upon the host, yet, morphologically, the forms are all the same and are called Lecanium corni.

Nuttall⁹ proved by experiment that the lice found on man, long considered two species, (the head louse and the body louse) are one. The extent to which the specialist may work is further illustrated by the same insect, for there have been described sub-species of each of these varieties, or so-called species.

We have references in literature to so-called biological species--physiological species--that may be considered forms which, by life history, hosts or habits, differ radically from other forms, but are essentially the same in structural detail. The lecanium scale cited previously is an example; Ellopiia somniaria, a geometrid moth found in the North Pacific coast region, is another good example of this phenomenon. One race feeds on western hemlock and other coniferous trees; while another feeds upon the oak. Specialists have not only applied separate names to these, but have created varietal names, or sub-species of each. Yet, unless one knows the host and locality from which a specimen comes, he cannot separate them.

Among insects there are certain phenomena which must be considered, as alternation of generations, heterogenous species and dimorphism, as found in cynipids, aphids, adelgids, etc. There do not ordinarily enter into the question of species in the higher classes.

Different kinds of animals are different species, but it is no simple matter, in all cases, to separate these different species. In fact, it is a question which sometimes becomes exceedingly complicated. The basing of species on gametic purity has been suggested. This would be impractical in

entomology where one must deal largely with mounted specimens; again, the question of hybridized species would enter. McLeod¹⁰ suggests specific standing based upon chemical composition; to this, there are serious objections and it would be impractical for insects.

Although not entirely satisfactory and certainly opinionative, the following may serve as a working definition (keeping in mind that there are bound to be exceptions in such things as dimorphic and similar forms):

In similar individuals, those units which, by virtue of structural characters, which do not intergrade with others and which can be separated from other similar units, may be considered species.

Where the individuals of one group intergrade with those of another in a different locality, they may be termed sub-species. Sub-species has come to imply geographical race.

Color variation, albinism, xanthism or melanism are not sufficient ground for sub-specific standing. The systematist must also beware of aberrations and mutations. Even structural differences are at times of little or no value in differentiating species, for example, the difference in length of wings in certain species of Orthoptera and Hemiptera. In the case of the chinch bug, the long-winged individuals of the east and the short-winged individuals of the west are but races of the same species. In certain Plecoptera it may be noted that an individual may so lack uniformity that the wings of the right side are quite different from those of the left. In Kermes, where species were once based on relative size of the various segments of the antennae, it is now known that the variation within the species is often much greater than the difference between related species.

Some specialists regard the designation of sub-species, varieties, races, etc., to be of questionable value and insist that a specimen is a certain species or it is not. This erecting of a sub-species for each county or each ecological area within a county is carrying the matter to an extreme which is unjustifiable in the eyes of the average entomologist. On the other hand, there are times, places, and circumstances when to recognize biological species, sub-species, races, varieties, etc., may serve a practical purpose. Unless the designation of

⁹1919, Parasitology, XI, p. 201.

¹⁰1919 McLeod. The Quantative method--Biological Publications of the University of Manchester, Biological Series No. 2, p. 201.

something less than a species actually serves a practical purpose, it is difficult to see any need for such a designation.

Concerning the naming of species Ferris (1928,p.22) has the following to say:

"Coincident with the matter of naming species, it has always been considered necessary for the systematist to give some sort of a description of them. In fact, it has been accepted as a general rule that no name is really valid until the object to which it applies has been in some way described. So closely have the two things been linked that they are frequently regarded as synonymous, and to say that a species is named is to say that it is described; to say that it is described is to say that it is named. Or even a further step has been taken and the word 'known' has been employed as a synonym of both these other terms.

"As a matter of fact, one cannot deal very long with any very extensive part of our systematic literature without coming to the conviction that actually this interchangeability of terms is merely a conventional fiction. Yet the fact that this fiction has existed is undeniable as is also the fact that it has been extremely harmful to the proper progress of systematic work. Through its working, the describing of species - whether they be named or not - has too frequently been subordinated to the naming of them. It follows that of our named species, in entomology at least, a very large proportion are actually not described at all, at least within any real and practical meaning of the word. Furthermore, of those which are described but a very small percentage can be regarded as known, within any such meaning."

As an example of what Ferris has reference to, the following so-called description of a new species may be cited:

Conophthorus radiatae n. sp. "Length 2.4 to 2.6 mm., shining black with a broad front, otherwise very much like *C. coniperda*. T. L. Pacific Grove, California. Host: Cones of *Pinus radiata*." or:

Conophthorus resinosae n.sp. "Length 2.75 to 3.25 mm., color: dull black, otherwise like *Virginiana*", followed by type locality distribution and host. It might also be noted that *Conophthorus virginiana*, with which *C. resinosae* is compared, was described by the same author in less than four lines.

The point might be further emphasized by comparing the above descriptions of species belonging to the same family with those drawn up by Blackman or Swaine.

Following are some suggestions to authors of new species:

1. Study some good descriptions of related species.
2. Never attempt to describe a new species unless you are reasonably familiar with the other species of the same group.
3. Examine type material if at all possible.
4. Always remember that it is quite probable that other (now unknown) species of the same group will eventually be described.
5. Always give the location of the type, allotype, paratypes, etc., if such exist.
6. Give all that is known of the type locality, hosts, distribution, ecology and habits. Dates of capture are important.
7. Place the species in relation to its nearest relative. Explain its similarity and its differences.
8. Describe the specimen systematically, starting with a general statement as to size, color and over-all appearance. Describe the head and all its appendages, then the thorax, then the abdomen. Describe all parts visible from the dorsal side first, then proceed to the ventral side. This prevents one from having to continually turn the specimen.
9. A key to the group, with the new species fitted into its proper place, may be desirable to show its relationship. It may not be necessary to construct an entirely new key. The new species may be fitted into an existing key by re-writing and rearranging one or two couplets.
10. Describe the sexes separately in detail if there is evident dimorphism. If they are very similar except for certain areas such as legs or terminal abdominal segments, such should be noted and the area carefully described.
11. It is well to give the order and family of new species. These are well known to the author but readers not familiar with the group may have to go to considerable trouble to locate the species in its correct place. In addition to the above the editor of the Proceedings of the Entomological Society of Washington (Vol XX,p.1, 1918) gives the following rules and suggestions which govern publication in that journal:
 - Rule 1. No description of a new genus, or sub-genus, will be published unless there is cited as a genotype a species which is established in accordance with current practice of zoological nomenclature.

- Rule 2. In all cases a new genus, or sub-genus must be characterized and if it is based on an undescribed species the two must be characterized separately.
- Rule 3. No description of a species, subspecies, variety or form will be published unless it is accompanied by a statement which includes the following information, where known (1) the type-locality; (2) of what the type material consists--with statement of sex, full data on localities, dates, collectors, etc.; and (3) present location of type material.
- Rule 4. No unsigned articles or articles signed by pseudonyms or initials will be published.
- Rule 5. The ordinal position of the group treated in any paper must be clearly given in the title or in parentheses following the title.
- Suggestion 1. An illustration accompanying an article should be mentioned in the text and preferably in places where the object illustrated is discussed.
- Suggestion 2. It is desirable in describing new genera and species that their taxonomic relationship be discussed and that distinguishing characters be pointed out.
- Suggestion 3. In discussion of type material, modern terms indicating its precise nature will be found useful. Examples of these terms are: Type (or holotype), allotype, paratype, cotype, lectotype, neotype, etc.
- Suggestion 4. In all cases in the serial treatment of genera and species and where first used in general articles the

authority for the species, or genus, should be given and the name of the authority should not be abbreviated.

Suggestion 5. Where the title of any publication referred to is not written in full, standard abbreviations should be used.

Suggestion 6. When a species discussed has been determined by someone other than the author, it is important that reference be made to the worker making the identification.

Regarding Illustrations.

There is an excellent dissertation on Entomological Drafting and the advantages of illustrating insects, particularly new species, in Ferris' "Principles of Systematic Entomology." This should be studied by every embryo author of new species.

Unfortunately, very few entomologists are artists and it is seldom indeed that one is able to obtain the services of an artist, who is capable of turning out illustrations which will even remotely compare with those which Ferris uses to illustrate his new species. (See Atlas of Scale Insects by Ferris referred to on P. 106) If the author is an artist or can obtain the services of a first-class scientific illustrator, by all means include significant illustrations. However, it should be borne in mind that a poor illustration is worse than no illustration. Unfortunately photography is of little help since it is only in rare instances that a reproduction from a photograph of an insect or part of an insect brings out the desired results.

KEYS

Keys are very important in entomological work and a brief discussion of them may not be out of place at this point.

A key is simply a system through which, by using outstanding characters, the species may be easily identified. Those who have made careful and extensive studies in any group; those who have now, or have had in the past, access to all or nearly all of the known species and who have had the opportunity of studying the types, have become specialists in the group. They certainly know more about the group than the average reader, and it is up to them to make keys which are as simple as possible, so that the average worker may be able to identify the various species.

Numerous kinds of keys have been used. The majority have advantages and disadvantages. Short keys, when there are few species, may be of any kind. In long, complicated keys, the couplet system seems the most desirable. Note the fact that a key to even a very large genus (more than 100 species), such as *Agrilus* (Coleoptera, Buprestidae), can be easily used when it is constructed on the couplet plan (See Fishes' "A Revision of N.A. *Agrilus*", U.S. Nat. Mus. Bul. 145). In the genus *Pityphthorus* with about the same number (110) of species which Blackman divided into seven groups¹¹, a key other than the couplet

¹¹N. Y. State College of Forestry Tech. Bul. No. 25.

type issued, and one often has to turn several pages to find the compliment letters. For instance, starting on page 88 one finds:

- A. Pronotum narrowly to broadly rounded, etc.
- B. Pronotum rather narrowly rounded, etc.
- C. Female frons smooth, etc.

One must turn to page 91 to find:

- AA. Pronotum broadly rounded, etc.

This key also presents examples of more or less general comparisons, which are exceedingly difficult to deal with:

- A. Pronotum narrowly to broadly rounded--asperities not usually fused to form concentric ridges, etc.
- AA. Pronotum broadly rounded--asperities usually fused, etc.

Even with the additional characters given, it is questionable whether some species should go under A or AA. The key in question constantly refers to sexes; in some places only the male is mentioned, while in others only the female is referred to. Distribution and hosts enter into the keys. Such keys are useless to the average reader.

Some keys that have appeared are based very largely on distribution and hosts. Their value for determining species, which fall into ones hands without specific data, is very questionable. For example, the following key from U.S.D.A. Office of Sect. Report 99 p. 33 is of little value:

- I. Pronotum with apex slightly produced, with posterior margin of rugose space rounded; fine scales of elytra not dense.
 - AA. Elytra with longer interspatial scales and smaller stria scales.
 - Veta Pass, Colo. (*Cryphalus*) mucronatus Lec.
 - Western Oregon, in *Acer* sp. aceris.
 - Alta, Utah. utahensis.
 - Kenai, Alaska (*Cryphalus*) striatulus Mann.
 - B. Elytra brown, scales yellowish red, longer scales in rows.
 - Black Hills, S. Dak., in *Salix* sp. salicis.
- II. Pronotum with apex rather strongly produced; fine scales of elytra densely placed; posterior margin of rugose space nearly straight.
 - Beaver Canyon, Idaho. idahoensis, page 34.
 - Tercio, Colo., in *Populus tremuloides* populi, page 34.

An example of the couplet key from U.S. National Museum Bul. No. 145 clearly shows the advantage of such a key.

KEY TO SPECIES OF AGRILUS

- 1. Tips of the elytra prolonged. 2.
- Tips of the elytra not prolonged 5.
- 2. Elytra with pubescent markings 3.
- Elytra without pubescent markings, (1) ferrisi Dury.
- 3. Scutellum transversely carinate; pubescence on elytra forming designs; elytral tips arcuately emarginate on inside and forming an acute tooth near outer margin. 4
- Scutellum not carinate; pubescence on elytra not forming designs; elytral tips produced into an acute tooth at middle (2) nevadensis Horn.
- 4. Posterior and anterior median depressions on pronotum equal in width; pubescence on elytra yellowish white. (3) subtropicus Schaeffer.
- Posterior median depression on pronotum distinctly wider than anterior depression; pubescence on elytra brownish yellow (4) lucanus Fall.
- 5. Antennae serrate, beginning at fourth joint. 6.
- Antennae serrate, beginning at fifth joint. 84.

- | | |
|--|-----|
| 6. Tarsal claws cleft in such a manner that the inner portion is turned inward, nearly or quite touching that of the opposite side | 7. |
| Tarsal claws simply cleft, the inner portion not, or only feebly turned inward, and the tips distant | 30. |
| 7. Pygidium with a projecting carina | 8. |
| Pygidium without a projecting carina | 10. |

In constructing keys keep in mind the fact that the user of the key:

1. Will not usually have your extensive knowledge of the group.
2. Will not possess many of the species other than those he is trying to determine.
3. May not know the host plant; may even be ignorant of the original locality from which the insect came. (Insects are frequently mislabeled as to locality when collected. They may be brought in by the butcher or the baker or the storekeeper who collected them from a bunch of bananas, a box of hams so that the place of origin is entirely unknown.)
4. May not have access to books which give full descriptions. Place yourself in the position of the potential user. Have someone inexperienced in the group use the key to determine specimens which you give him for that purpose. If he is successful, it is fair to assume that the average reader will be able to use the key.

RULES

Although the system devised and set up by Linnaeus was comparatively simple and workable, it was by its very nature bound to give rise to many and varied questions. In fact, Linnaeus foresaw some of these and proposed some simple rules.

Any system is merely a suggestion; no worker is compelled to accept any particular rules. Public opinion alone can force their acceptance.

As the various branches of science progressed and passed from the category of avocations to professions, societies and organizations were formed. These have undertaken to establish rules of conduct for their respective professions. In most cases, the work has been well done and widely accepted by the professions.

The larger international organizations meet at frequent intervals and have standing committees to work on the more important subjects.

Following Linnaeus, Fabricius, in Philosophia Entomologica, 1778, attempted to formulate a code or set of rules on nomenclature for entomologists. In 1801, Rudolphi, a parasitologist, suggested a set of rules which he failed to follow himself.

Following these personal ideas on rules, the British Association for the Advancement of Science appointed a committee to consider the feasibility of formulating a code. Since a man by the name of Stickland¹² was chairman of the Committee, the code, published

in June, 1843, became known as the Stricklandian Code. This same code was adopted by the American Society of Geologists in 1845. The British Association amended and republished the Code in 1863 and 1865. Followed for a number of years by both American and British zoologists, it formed the basis for other codes which have since appeared.

In 1876, W. H. Dall, a conchologist, was appointed by the American Association for the Advancement of Science as a committee of one "to obtain an expression from the working naturalists of America in regard to the nature of a set of rules for facilitating the decision of questions relating to nomenclature." His report was published in 1878 but was never adopted.

The Zoological Society of France adopted a code in 1881, and the same year the International Congress of Zoology adopted what is known as the Douville Code, to govern naming.

The American Ornithologist's Union in 1885 prepared a code based partly on the Stricklandian Code known as the A.O.U. Code.

At the First International Zoological Congress was held in Paris in 1889, R. Blanchard, a French zoologist, submitted the present International Code which was adopted by the Congress and readopted by the second Congress at Moscow in 1892. In 1894, the Germans brought forth certain objections to

¹²Hugh E. Stickland Published "Rules for Zoological Nomenclature" in Magazine of Natural History Vol. I, Pg. 127-131, 1837.

the code; proposed a new one. Stiles¹³ in his bulletin states that in 1895 the English were largely following the Stricklandian Code; the French the International of Blanchard; the Germans the German Code; while, in America, some followed the Stricklandian, others the A.O.U., the Dall, or the International Code. There were many workers in the various countries who followed their own codes or none at all.

The Third International Zoological Congress met in Leyden in 1895 and appointed an international committee of five members to study all existing codes. At the Fourth Congress held in Cambridge in 1898, the committee was increased to 15 members who made their report to the Fifth Congress in Berlin in 1901. The code submitted was adopted and the committee was made a permanent body to have charge of matters relating to the present code. This committee is known as the Permanent Commission.

Any proposed changes in the code must be submitted to the executive committee of the International Congress of Zoology at least one year before they can be presented to the Congress. The committee studies the proposed change or changes and submits same to the Permanent Commission. This body studies the proposed change and reports it to the Congress with recommendations. Thus the code is protected from hasty or ill-advised changes, but can be altered where deemed advisable after due and deliberate study.

There is, of course, no power to force any individual to accept the International or any code. There is however almost a unanimous backing of the code among zoologists, and it is so uniformly accepted that if one does not adhere to its rules, such writings are not accepted by most publications, or, if published, are very likely to be ignored.

The more important codes proposed up to the adoption of the International Code are as follows:

1751 Linnaeus Suggested a few simple rules

1778 Fabricius Added a few to the above
 1801 Rudolphi Made suggestions which were not followed.
 1843 Strickland¹⁴ Stricklandian Code (B.A.A.S.)
 1863 British Association Amended Stricklandian Code
 1865 Further amendments
 1876 Dall¹⁵ Code never formally adopted
 1881 Douville¹⁶ Douville Code
 1885 Committee A.O.U. Code (American Ornithologist's Union)
 1889 Blanchard International Code started
 1894 Committee German Code¹⁷
 1901 Committee International Code adopted.

Since the International Congress of Zoology has been accepted as the governing body so far as nomenclatorial matters are concerned, it is well to note the time and place of meetings which have been held.

| | | |
|------|------|--------------------|
| 1st | 1889 | Paris, France |
| 2nd | 1892 | Moscow, Russia |
| 3rd | 1895 | Leyden, Belgium |
| 4th | 1898 | Cambridge, England |
| 5th | 1901 | Berlin, Germany |
| 6th | 1904 | Berne, Switzerland |
| 7th | 1907 | Boston, U.S.A. |
| 8th | 1910 | Gratz, Austria |
| 9th | 1913 | Monaco, Monaco |
| 10th | 1927 | Budapest, Hungary |
| 11th | 1930 | Padua, Italy |
| 12th | 1935 | Lisbon, Portugal |
| 13th | 1948 | Paris, France |

International Congress on Entomology

| | | |
|-----|------|---------------------|
| 1st | 1910 | Brussels, Belgium |
| 2nd | 1912 | Oxford, England |
| 3rd | 1925 | Zurich, Switzerland |
| 4th | 1928 | Ithaca, U.S.A. |
| 5th | 1932 | Paris, France |
| 6th | 1935 | Madrid, Spain |
| 7th | 1938 | Berlin, Germany |
| 8th | 1948 | Stockholm, Sweden |

¹³1905, Stiles, C. W., "The International Code of Nomenclature as Applied to Medicine," U. S. Treasury Department, Hygienic Lab., Bul. No. 24.

¹⁴Proposed - 1842-43 by a Committee of the British Association for the Advancement of Science - Adopted by the American Society of Geologists and Naturalists - 1845 and by the B. A. A. S. in 1846.

¹⁵Dall proposed this code at the request of the American Association for the Advancement of Science.

¹⁶This code was proposed by Dauville to govern the naming of Fossils.

¹⁷This code was adopted by the German Zoological Society in 1894.

ENTOMOLOGICAL NOMENCLATURE AND LITERATURE
INTERNATIONAL RULES OF ZOOLOGICAL NOMENCLATURE

General Considerations

Article 1. Zoological nomenclature is independent of botanical nomenclature in the sense that the name of an animal is not to be rejected simply because it is identical with the name of a plant. If, however, an organism is transferred from the vegetable to the animal kingdom, its botanical names are to be accepted in zoological nomenclature with their original botanical status; and, if an organism is transferred from the animal to the vegetable kingdom, its names retain their zoological status.

Recommendation--It is well to avoid introducing into zoology generic names such as are used in botany.

Note: The aim is to never repeat a generic name in nomenclature. If a name were repeated, it would undoubtedly lead to confusion. When one sees the name Pyrus it means pear, so, if the same name were applied to a genus of beetles, one seeing the term Pyrus might or might not recognize whether the author had in mind the fruit or the beetle

If an organism is changed from one family to another, one class to another or from one kingdom to another, it retains its name.

Article 2. The scientific designation of animals is uninominal for sub-genera and all higher groups, binominal for species and trinominal for sub-species.

See opinions Nos. 19, 20, 24, 35, 43, 46, 50, 54.

Note: This article is not followed, as a rule, in the case of insects which are of less than specific standing. In catalogues, ordinarily sub-species and varieties are designated binominal and their status as a variety or sub-species is indicated by a letter following the number.

Example: (See Leng's Catalogue of North American Coleoptera, p. 114.)

In the family Staphylinidae:

4908 Thinusa fletcheri Casey.
a Thinusa robustula Casey.

Under the above rule, the name should be written:

Thinusa fletcheri robustula Casey.

However, the procedure of designating specimens of less than specific standing by the use of the letter simplifies matters once it is understood. It should be understood that the use of a trinominal is perfectly legitimate.

Article 3. The scientific names of animals must be words which are either Latin or Latinized, or considered and treated as such in case they are not of classic origin.

Family and Sub-Family Names

Article 4. The name of a family is formed by adding the ending idae; the name of a sub-family by adding inae to the stem of the name of its type genus.

Example: Genus Buprestis - Family Buprestidae.
Genus Micracis - Sub-Family Micracinae.

Article 5. The name of a family or sub-family is to be changed when the name of its type genus is changed.

Example: When the genotype of the old family Cecidomyidae was changed from Cecidomyia to Itonia, it was necessary because of Article 5 to change the family name to Itoniidae.

Generic and Sub-Generic Names

Article 6. Generic and sub-generic names are subject to the same rules and recommendations, and from a nomenclatural standpoint they are coordinate; that is, they are of the same value.

See opinion No. 72.

Article 7. A generic name becomes a sub-generic name when the genus so named becomes a sub-genus, and vice versa.

Article 8. A generic name must consist of a single word, simple or compound, written with a capital initial letter, and employed as a substantive in the nominative singular.

Recommendation--Certain biological groups which have been proposed distinctly as collective groups, not as systematic units, may be treated for convenience as if they were genera, but they require no type species.

Examples: Pentamera, Lamellicornia, Phyllophaga, etc.

Recommendations--The following words may be taken as generic names:

(a) Greek substantives, for which the rules of Latin transcription (transliteration (See Appendix F)) should be followed. Examples: Ancylus, Amphibola, Aplysia, Pompholyx, Physa, Cylichna.

(b) Compound Greek words, in which the attributive should precede the principle word. Examples: Stenogyra, Tylodina, Cyclostomum, Pelodytes, Hydrophilus, Rhizobius.

This does not, however, exclude words formed on the model of Hippopotamus, namely, words in which the attributive follows the principal word. Examples: Philydrus, Biorhiza.

(c) Latin substantives. Examples: Anchilla, Auricula, Delium, Harpa, Oliva. Adjectives (Prasina) and past participles (Productus) are not recommended.

(d) Compound Latin words. Examples: Nigrocornis, Striapunctata, Quinque, Vittata, Trivittata.

(e) Greek or Latin derivatives expressing diminution, comparison, resemblance, or possession. Examples: Dolium, Doliolum; Strongylus, Limax, Limacella; Limacia, Limacina, Limacites, Limacula; Lingula, Lingulella, Lingulepis, Lingulina, Lingulops, Lingulopsis, Neomenia, Proneomenia, Buteo, Archibuteo.

(f) Mythological or heroic names. Examples: Osiris, Venus, Crimora. If not Latin, these should be given a Latin termination. (Aegirus, Gondulia.)

(g) Proper names used by the ancients. Examples: Cleopatra, Belisarius, Melania.

(h) Modern patronymics, to which is added an ending to denote dedication.

Names terminating with a consonant take the ending ius, ia, or ium. Examples: Selysius, Lamarckia, Köllikeria, Mülleria, Stälia, Kroyeria, Ibanezia.

Names terminating with the vowels e, i, o, u, or y take the ending us, a, or um. Examples: Blainvillea, Wyvillea, Cavolinia, Fatioa, Bernaya, Quoya, Schulzea.

Names terminating with a take the ending ia. Example: Danaia.

In generic names formed from patronymics, the particles are omitted if not coalesced with the name, but the articles are retained. Examples: Blainvillae, Benedenia, Chiajea, Lacepedea, Dumerilia.

With patronymics consisting of two words, only one of these is used in the formation of the generic name. Examples: Selysius, Targionia, Edwardsia, Buthiersia.

The use of proper names in the formation of compound generic names is objectionable. Examples: Eugrimmia, Buchiceras.

(i) Names of ships should be treated the same as mythological names (Vega) or as modern patronymics. Examples: Blakea, Challengeria.

(j) Barbarous names; that is, words of non-classic origin. Examples: Vanikoro, Chilosa. Such words may receive a Latin termination. Examples: Yetus, Fossarus.

(k) Words formed by an arbitrary combination of letters. Examples: Neda, Clanculus, Salifa, Torix.

(l) Names formed by anagram.¹⁸ Examples: Dacelo, Verlusia, Linospa.

Article 9. If a genus is divided into sub-genera, the name of the typical sub-genus must be the same as the name of the genus. (See Art. 25)

Article 10. When it is desired to cite the name of a sub-genus, this name is to be placed in parentheses between the generic and the specific names. Examples: Vanessa (Pyrameis) cardui.

Note: In entomological literature, citations as indicated in Article 10 are very often erroneously used to refer to synonyms rather than to a sub-genus. Example: A scolytid was described by Mannerheim as Hylastes pumilus. Later this species was made the type of a new genus Dolurgus by Eichhoff. This name has been written Dolurgus (Hylastes) pumilus (Mann.) with the intent of showing that, in the case of pumilus, it was described by Mannerheim in the genus Hylastes but is now in the genus Dolurgus. This is contrary to the provisions of Article 10. Article 23 provides for such a transfer but does not provide for giving the name of the genus from which the transfer was made, in this case Hylastes.

RULES AND SUGGESTIONS ON GENERIC NAMES

Rule 1. No description of a new genus or sub-genus will be published unless there is cited as the genotype a species which is established in accordance with current practice of zoological nomenclature.

Rule 2. In all cases, a new genus or sub-genus must be characterized, and, if it is based on an undescribed species, the two must be characterized separately.

Rule 3. No description of a species, sub-species, variety or form will be published unless it is accompanied by a statement which includes the following information, when known: (1) type of locality; (2) of what the type material consists, with statement of sex, full data on localities, dates, collectors, etc., and (3) present location of type material.

Rule 4. No unsigned articles or articles signed by pseudonyms or initials will be published.

Rule 5. The ordinal position of the group treated in any paper must be clearly given in the title or in parentheses following the title.

Suggestion 1. All illustrations accompanying articles should be mentioned in the text and, preferable, in places where the object figure is discussed.

Suggestion 2. It is desirable in describing new genera and species that their taxonomic relationship be discussed and that distinguishing characters be pointed out.

Specific and Sub-Specific Names

Article 11. Specific and sub-specific names are subject to the same rules and recommendations, and, from a nomenclatural standpoint, they are coordinate, that is, they are of the same or equal value.

Article 12. A specific name becomes a sub-specific name when the species so named becomes a sub-species, and vice versa.

¹⁸Transposition of letters. A word read backwards.

Article 13. While specific substantive names derived from names of persons may be written with a capital initial letter, all other specific names are to be written with a small initial letter. Examples: Rhizostoma Cuvieri or Rh. cuvieri, Francolinus Lucani or F. lucani, Hypoderma Diana or H. diana, Laophonte Mohammed or L. mohammed,

Note: In American usage capitals are always omitted, even though the name came from a proper name. Example: Buprestis gibbsi, Platypus wilsoni.

Article 14. Specific names are:

(a) Adjectives, which must agree grammatically with the generic name. Example: Felis marmorata.

(b) Substantives in the nominative in apposition with the generic name. Example: Felis leo.

(c) Substantives in the Genitive. Examples: rosae, galliae, sancti-pauli, sanctae-helenae.

If the name is given as a dedication to one or several persons, the genitive is formed in accordance with the rules of Latin declination, in case the name was employed and declined in Latin. Examples: plinii, aristotelis, victoris, antonii, elisabethae, petri (given name).

If the name is a modern patronymic, the genitive is always formed by adding, to the exact and complete name, an *i* if the person is a man, or an *ae* if the person is a woman, even if the name has a Latin form. It is placed in the plural if the dedication involves several persons of the same name. Examples: cuvieri, mobiuseri, nunezi, merianae, sarasinorum, bovis (not bovis), salmoni (not salmonis).

Recommendation--The best specific name is a short, euphonic Latin adjective of easy pronunciation. Latinized Greek words or barbarous words may, however, be used. Examples: gymnocephalus, echinococcus, ziczac, aguti, hoactli, urubitinga.

It is well to avoid the introduction of the names typicus and typus as new names for species or sub-species, since these names are always liable to result in later confusion.

See Opinions Nos. 8, 50, 64.

Note: The reason for avoiding the names typicus and typus is evident when one realizes that future events may bring a number of species into the genus, and it may well turn out that the particular species may not be typical of the entire group.

Article 15. The use of compound proper names indicating dedication or of compound words indicating a comparison with a simple object does not form an exception to Art. 2. In these cases, the two words composing the specific name are written as one word, with or without the hyphen. Examples: nigro-italica or nigroitalica; quadrivittata or quadrivittata.

Expressions like rudis planusque are not admissible as specific names.

See Opinion No. 50.

Note: rudis planusque forms a trinomial and therefore violates the binomial rule.

Article 16. Geographic names are to be given as substantives in the genitive, or are to be placed in an adjectival form. Examples: californicus, montanus.

Recommendation--Geographic names used by the Romans or by Latin writers of the Middle Ages are to be adopted in preference to more recent forms. Words like bordeausiacus and viennensis are poor, but are not to be rejected on this account.

Article 17. If it is desired to cite the sub-specific name, such name is written immediately following the specific name, without the interposition of any mark of punctuation. Example: Agrilus arcuatus corlyi Horn.

Note: American Entomologists have by usage departed somewhat from the rules as laid down in Article 17. See Note under Article 2.

Article 18. The notation of hybrids may be given in several ways; in all cases the name of the male parent precedes that of the female parent, with or without the sexual signs:

(a) The names of the two parents are united by the sign of multiplication (x). Example: Capra hircus ♂ x Ovis aries ♀ and Capra hircus x Ovis aries are equally good formulae.

(b) Hybrids may also be cited in form of a fraction. The male parent forming the numerator and the female parent the denominator. Example: $\frac{\text{Capra hircus}}{\text{Ovis aries}}$. This second method

is preferable in that it permits the citation of the person who first published the hybrid form as such.

Example: $\frac{\text{Bernicla canadensis}}{\text{Anser cygnoides}}$ Rabe'.

(c) The fractional form is also preferable in case one of the parents is itself a hybrid.

Example: $\frac{\text{Tetrao tetric x Tetrao urogallus}}{\text{Gallus Gallus}}$

In the latter case, however, the parentheses may be used. Example: (Tetrao Tetric x Tetrao urogallus) x Gallus gallus.

(d) When the parents of a hybrid are not known as such (parents), the hybrid takes provisionally a specific name, the same as if it were a true species; namely, as if it were not a hybrid. The generic name is preceded by the sign of multiplication. Example: x Coregonus dolosus Fatio.

Formation, Derivation, and Orthography of Zoological Names

Article 19. The original orthography of a name is to be preserved unless an error of transcription, a lapsus calami, or a typographical error is evident.

See Opinions Nos. 8, 26, 27, 29, 34, 41, 60, 61, 63, 70.

Recommendation--For scientific names it is advisable to use some other type than that used for the text. Italics are usually employed. Example: "Rana esculenta Linne, 1758 lives in Europe."

Article 20. In forming names derived from languages in which the Latin alphabet is used, the exact original spelling, including diacritic marks, is to be retained. Examples: Seleysius, Lamarckia, Köllikeria, Mülleria, Stålia, Krøyeria, Ibañezia, möbiusi, mediçi, spitzbergensis, islandicus, patagonicus, färöensis.

Recommendations--The prefixes sub and pseudo should be used only with adjectives and substantives, sub with Latin words, pseudo with Greek words. They should not be used in combination with proper names. Examples: subviridis, subchelatus, Pseudacanthus, Pseudophis, Pseudomys. Words like sub-wilsoni and pseudo-grateloupana are not recommended.

The terminations oides and ides should be used in combination only with Greek or Latin substantives; they should not be used in combination with proper names.

Geographic and patronymic names from countries which have no recognized orthography or which do not use the Latin alphabet should be transcribed into Latin according to the rules adopted by the Geographic Society of Paris.

In proposing new names based upon personal names, sometimes written with ä, ö or ü, at other times with ae, oe, and ue, it is recommended that authors adopt ae, oe, and ue. Example: muelleri, in preference to mülleri.

Author's Name

Article 21. The author of a scientific name is that person who first publishes the name in connection with an indication, a definition or a description, unless it is clear from the contents of the publication that some other person is responsible for said name and its indication, definition or description.

Article 22. If it is desired to cite the author's name, this should follow the scientific name without interposition of any mark of punctuation; if other citations are desirable (date, sp. n., emend., sensu stricto, etc.) these follow the author's name, but are separated from it by a comma or by parentheses. Examples: Primates Linné, 1758, or Primates Linné (1758)

Recommendation--When the name of the author of a scientific name is abbreviated, the writer will do well to conform to the list of abbreviations published by the Zoological Museum of Berlin.¹⁹

Article 23. When a species is transferred to another than the original genus, or the specific name is combined with any other generic name than that with which it was originally published, the name of the author of the specific name is retained in the notation but placed in parentheses. Examples: Trypodendron retusum (Leconte); Phloeosinus dentatus (Say).

If it is desired to cite the author of the new combination, his name follows the parentheses. Example: Limnatis nilotica (Savigny, 1820) Moquin-Tandon, 1826.

Article 24. When a species is divided, the restricted species to which the original specific name of the primitive species is attributed may receive a notation indicating both the name of original author and the name of the reviser. Example: Taenia solium Linne, partim, Goeze.

The Law of Priority

Article 25. The valid name of a genus or species can be only that name under which it was first designated on the condition:

- (a) That (prior to January 1, 1931) this name was published and accompanied by an indication, or a definition or a description; and
- (b) That the author has applied the principles of binary nomenclature.
- (c) But no generic name or specific name, published after Dec. 31, 1930, shall have any status of availability (hence also of validity) under the Rules, unless and until it is published either:
 - (1) with a summary of characters (seu diagnosis; seu definition; seu condensed description) which differentiate or distinguish the genus or the species from other genera or species;
 - (2) or with a definite bibliographic reference to such summary of characters (seu diagnosis; seu definition; seu condensed description); and further,
 - (3) in the case of a generic name, with the definite unambiguous designation of the type species (seu genotype; seu autogenotype; seu orthotype).

Note: In designating a new generic name the Genotype must be indicated.

Recommendations--(a) It is requested that an author who publishes a name as new shall definitely state that it is new. This should be stated in only one (i.e., in the first) publication, and the date of said publication should not be added to the name in its first publication.

(b) It is requested that an author who quotes a generic name, a specific name or a sub-specific name shall add at least once the author and year of publication of the quoted name, or a full bibliographic reference.

¹⁹ Liste der Autoren zoologischer Art- und Gattungsnamen zusammengestellt von den Zoologen des Museum für Naturkunde in Berlin, Berlin, 2. vermehrte Auflage, 8°, 1896.

Note: It is unfortunate that authors do not follow this recommendation consistently.

See Opinions Nos. 1, 2, 4, 5, 9, 10, 12, 13, 15-17, 19-21, 24, 28, 37-40, 46, 49-54, 56-59, 65-67, 73, 78, 84, 87, 88, 90.

Application of the Law of Priority

Article 26. The tenth edition of Linne's *Systema Naturae*, 1758, is the work which inaugurated the consistent general application of the binary nomenclature in zoology. The date 1758, therefore, is accepted as the starting point of zoological nomenclature and of the Law of Priority.

See Opinions Nos. 3, 12, 13, 15, 16, 51, 52.

Article 27. The Law of Priority stands, and, consequently, the oldest available name is retained:

- (a) when any part of the animal is named before the animal itself;
- (b) when any stage in the life history is named before the animal itself;
- (c) when the sexes of an animal have been considered as distinct species or even as belonging to distinct genera;
- (d) when an animal represents a regular succession of dissimilar generations which have been considered as belonging to different species or even to different genera.

See Opinions Nos. 44, 88.

Examples:

- (a) Many fossil species are named from fragments.
- (b) A larva may be described and named prior to the finding of the adult. Such a name is valid for the species.
- (c) In many cases, sexual dimorphism is so pronounced as to lead to two different names being applied. Only the first is valid.
- (d) Species with alternation of generations and alternate host plants, such as are often found in such groups as *Cynips*, frequently lead to much synonymy.

Article 28. A genus formed by the union of two or more genera or sub-genera takes the oldest valid generic or sub-generic name of its components.

If the names are of the same date, that selected by the first reviser shall stand.

The same rule applies when two or more species or sub-species are united to form a single species or sub-species.

Recommendation--In the absence of any previous revision, the establishment of precedence by the following method is recommended:

- (a) A generic name accompanied by specification of a type has precedence over a name without such specification. If all or none of the genera have types specified, the generic name the diagnosis of which is most pertinent takes precedence.
- (b) A specific name accompanied by both description and figure stands in preference to one accompanied only by a diagnosis or only by a figure.
- (c) Other things being equal, that name is to be preferred which stands first in the publication (page precedence).

See Opinion No. 40.

Article 29. If a genus is divided into two or more restricted genera, its valid name must be retained for one of the restricted genera. If a type was originally established for said genus, the generic name is retained for the restricted genus containing said type.

Recommendation--To facilitate reference, it is recommended that when an older species is taken as type of a new genus, its name should be actually combined with the new generic name, in addition to citing it with the old generic name. Example: Gilbertella Eigenmann, 1903, Smithsonian Misc. Coll., v. 45, p. 147, type Gilbertella alata (Steindachner) = Anacyrtus alatus Steindachner.

See Opinion No. 10.

The Designation of the Genotype

Article 30. The designation of type species of genera shall be governed by the following rules (a - g), applied in the following order of precedence:

See Opinions Nos. 11, 14, 18, 23, 31-33, 42, 43, 45, 62, 68, 69, 71, 79, 81, 86.

I. Cases in which the generic type is accepted solely on the basis of the original publication are:

(a) When, in the original publication of a genus, one of the species is definitely designated as type, this species shall be accepted as type, regardless of any other considerations. (Type by original designation.) (See Opinion No. 7.)

(b) If, in the original publication of a genus, typicus or typus is used as a new specific name for one of the species, such use shall be construed as "type by original designation."

(c) A genus proposed with a single original species takes that species as its type. (Monotypical genera.) (See Opinions Nos. 6, 9, 22, 30, 42, 47.)

(d) If a genus, without originally designated (see a) or indicated (see b) type, contains among its original species one possessing the generic name as its specific or sub-specific name, either as valid name or synonym, that species or sub-species becomes ipso facto type of the genus. (Type by absolute tautonymy.) (See Opinions Nos. 16, 33, 35.)

Example: Gryllotalpa gryllotalpa.

II. Cases in which the generic type is not accepted solely on the basis of the original publication are:

(e) The following species are excluded from consideration in determining the types of genera. (See Opinions Nos. 14, 32, 35, 56.)

Species which were not included under the generic name at the time of its original publication.

Species which were species inquirendae from the standpoint of the author of the generic name at the time of its publication.

Note: That is, species which were only provisionally placed in the genus at the time it was erected.

Species which the author of the genus doubtfully referred to it.

(f) In case a generic name without originally-designated type is proposed as a substitute for another generic name, with or without type, the type of either, when established, becomes ipso facto type of the other. (See Opinions Nos. 9, 46.)

(g) If an author, in publishing a genus with more than one valid species, fails to designate (see a) or to indicate (see b, d) its type, any subsequent author may select the type, and such designation is not subject to change. (Type by subsequent designation.) (See Opinions Nos. 6, 9, 10, 43, 56.)

The meaning of the expression "select the type" is to be rigidly followed. Mention of a species as an illustration or example of a genus does not constitute a selection of a type.

III. Recommendations--In selecting types by subsequent designation authors will do well to govern themselves by the following recommendations:

(h) In case of Linnean genera, select as type the most common or the medicinal species. (Linnean rule, 1751.)

(i) If a genus, without designated type, contains among its original species one possessing as a specific or sub-specific name, either as valid name or synonym, a name which is virtually the same as the generic name, or of the same origin or same meaning, preference should be shown to that species in designating the type, unless such preference is strongly contraindicated by other factors. (Type by virtual tautonymy.) Examples: Bos taurus, Equus caballus, Ovis aries, Sphaerostoma globiporum; contraindicated in Dipetalonema (compare species Filaria depetala, of which only one sex was described, based upon one specimen and not studied in detail).

(j) If the genus contains both exotic and nonexotic species from the standpoint of the original author, the type should be selected from the nonexotic species.

(k) If some of the original species have later been classified in other genera, preference should be shown to the species still remaining in the original genus. (Type by elimination.)

(l) Species based upon sexually mature specimens should take precedence over species based upon larval or immature forms.

(m) Show preference to species bearing the name communis, vulgaris, medicinalis, or officinalis.

(n) Show preference to the best-described, best-figured, best-known, or most easily obtainable species, or to one of which a type specimen can be obtained.

(o) Show preference to a species which belongs to a group containing as large a number of specimens as possible (De Candolle's Rule).

(p) In parasitic genera, select, if possible, a species which occurs in man or some food animal, or in some very common and widespread host species.

(q) All other things being equal, show preference to a species which the author of the genus actually studied at or before the time he proposed the genus.

(r) In the case of writers who habitually placed a certain leading or typical species first as "chef de file," the others being described by comparative reference to this, this fact should be considered in the choice of the type species.

(s) In the case of those authors who have adopted the "first species rule" in fixing generic types, the first species named by them should be taken as the types of their genera.

(t) All other things being equal, page precedence should apply in selecting a type.

Article 31. The division of species into two or more restricted species is subject to the same rules as the division of a genus. But a specific name which undoubtedly rests upon an error of identification cannot be retained for the misdetermined species, even if the species in question are afterwards placed in different genera. Example: Taenia pectinata Goeze, 1782 = Cittotaenia pectinata (Goeze), erroneously determined by Zeder, 1800, as "Taenia pectinata Goeze" = Andrya rhopalocephata (Riehm); the latter species does not take the name Andrya pectinata (Zeder). (See Opinion No. 13.)

Rejection of Names

Article 32. A generic or a specific name, once published, cannot be rejected, even by its author, because of inappropriateness. Examples: Names like Polyedon, Apus, albus, etc., once published, cannot be rejected because of a claim that they indicate characters contradictory to those possessed by the animals in question.

Article 33. A name is not to be rejected because of tautonymy, that is, because the specific or the specific and sub-specific names are identical with the generic name. Examples: Trutta trutta, Apus apus apus.

Article 34. A generic name is to be rejected as a homonym²⁰ when it has previously been used for some other genus of animals. Example: Trichina Owen, 1835, nematode, is rejected as homonym of Trichina Meigen, 1830, insect.

²⁰A homonym is one and the same name for two or more different things. Synonyms are different names for one and the same things.

See Opinions Nos. 12, 29, 83.

Code of Ethics

Without presuming to be the arbiter of points of general ethics, the Commission feels that there is one phase of this subject upon which it is competent to speak, and in reference to this point, suggests to the Congress the adoption of the following resolution:

Whereas--experience has shown that authors, not infrequently, inadvertently publish as new designation of genera or species, names that are preoccupied, and

Whereas--experience has also shown that some other authors, discovering the homonymy, have published new names for the later homonyms in question, be it therefore

RESOLVED--That when it is noticed by any zoologist that the generic or specific name published by any living author as new is in reality a homonym, and therefore unavailable under Articles 34 and 36 of the Rules on Nomenclature, the proper action, from a standpoint of professional etiquette, is for said person to notify said author of the facts of the case, and to give said author ample opportunity to propose a substitute name.

Article 35. A specific name is to be rejected as a homonym when it has previously been used for some other species or sub-species of the same genus. Example: Taenio ovilla Rivolta, 1878, (n. sp.), is rejected as a homonym of T. ovilla Gmelin, 1790.

When, in consequence of the union of two genera, two different animals having the same specific or sub-specific name are brought into one genus, the more recent specific or sub-specific name is to be rejected as a homonym.

Specific names of the same origin and meaning shall be considered homonyms if they are distinguished from each other only by the following differences:

- (a) The use of ae, oe and e, as caeruleus, coeruleus, cereuleus; ei, i and y, as chiropus, chiropus; c and k, as microdon, mikrodon.
- (b) The aspiration or non-aspiration of a consonant, as oxyryncus, oxyrhynchus.
- (c) The presence or absence of a c before t, as autumnalis, auctumnalis.
- (d) By a single or double consonant; litoralis, littoralis.
- (e) By the endings ensis and iensis to a geographical name, as timorensis, timoriensis.

Article 36. Rejected homonyms can never be used again. Rejected synonyms can be used again in case of the restoration of erroneously suppressed groups. Example: Taenia giardi Moniez, 1879, was suppressed as a synonym of Taenia ovilla Rivolta, 1878; later it was discovered that Taenia ovilla was preoccupied (Taenia ovilla Gmelin, 1790). Taenia ovilla, 1878, was suppressed as a homonym and can never be used again; it was stillborn and cannot be brought to life, even when the species is placed in another genus (Thysanosoma). Taenia giardi, 1879, which was suppressed as a synonym, becomes valid upon the suppression of the homonym Taenia ovilla Rivolta.

Recommendations--To avoid confusion, it is well to avoid the introduction of new generic names which differ from generic names already in use only in termination or in a slight variation in spelling. But, once introduced, such names are not to be rejected on this account. Examples: Picus, Pica; Polyodus, Polydon, Polyodonta, Polyodontas, Polyodontus; Macrondon, Microndon.

The same recommendation applies to new specific names in any given genus. Examples: necator, necatrix; furcigera, furcifera; rhopalocephala, rhopalicocephala.

If, from the radical of a geographic name two or more adjectives are derived, it is not advisable to use more than one of them as specific name in the same genus, but, once introduced, they are not to be rejected on this account. Examples: Hispanus, hispanicus; moluccensis, moluccanus; sinensis, sinicus, chinensis; ceylonicus, zeylanicus.

The same recommendation applies also to other words derived from the same radical and differing from each other only in termination or by simple change in spelling.

Suspension of Rules in Certain Cases

RESOLVED--That plenary power is herewith conferred upon the International Commission on Zoological Nomenclature, acting for this Congress, to suspend the Rules as applied to any given case, where in its judgment the strict application of the Rules will clearly result in greater confusion than uniformity, provided, however, that not less than one year's notice shall be given in any two or more of the following publications; namely; Bulletin de la Societe zoologique de France, Monitore Zoologico, Nature, Science (N.Y.), and Zoologischer Anzeiger, that the question of a possible suspension of the Rules as applied to such a case is under consideration, thereby making it possible for zoologists, particularly specialists in the group in question, to present arguments for or against the suspension under consideration; and provided also that the vote in Commission is unanimously in favor of suspension; and provided further that if the vote in Commission is a two-thirds majority of the full Commission, but not a unanimous vote in favor of suspension, the Commission is hereby instructed to report the facts to the next succeeding International Congress; and

Note: This power is constantly being invoked by the commission.

RESOLVED--That in the event a case reaches the Congress, as described above, with a two-thirds majority of the Commission in favor of suspension, but without unanimous report, it shall be the duty of the President of the Section on Nomenclature to select a special board of three members, consisting of one member of the Commission who voted on each side of the question and one ex-member of the Commission who has not expressed any public opinion on the case, to review the evidence presented to it. Its report, either majority or unanimous, shall be final and without appeal, so far as the Congress is concerned; and

RESOLVED--That the foregoing authority refers especially to cases of the names of larval stages and the transference of names from one genus or species to another; and

RESOLVED--That the Congress fully approves the plan that has been inaugurated by the Commission of conferring with special committees from the special group involved in any given case, and that it authorizes and instructs the Commission to continue and extend this policy.

See Opinions Nos. 76, 80, 82, 89, 90.

SOME EXAMPLES OF OPINIONS²¹ RENDERED BY THE INTERNATIONAL
COMMISSION ON ZOOLOGICAL NOMENCLATURE

Opinion 1

The word "indication" in Art 25A is to be construed as follows:

(a) With regard to specific names, an "Indication" is (1) a bibliographical reference, or (2) a published figure (illustration) or (3) a definite citation of an earlier name for which a new name is proposed.

²¹Complete text of opinions rendered up to number 156 are to be found in: Opinions Rendered by the International Commission on Zoological Nomenclature, Smithsonian Miscellaneous Collections, Vol. 73, Nos. 1-8, Opinions 1 - 67 in part I
Opinions 68 - 130 in part II
Opinions 134 - 155 Published in 1944
Opinions and declarations rendered by the Commission are being published in three volumes concurrently as follows:
VOLUME 1, containing nine declarations never previously published and a reissue of Opinions 1-133, the original issue of which is not exhausted; VOLUME 2, containing Declarations 10-12 and Opinions 134-181, all of which were adopted by the International Commission at their meeting held at Lisbon in 1935; VOLUME 3, containing Opinions adopted by the Commission since their Lisbon meeting.

(b) With regard to generic names, (1) a bibliographical reference or (2) a definite citation of an earlier name for which a new name is proposed or the citation or designation of a type species. In no case is the word "indication" to be construed as including museum labels, museum specimens or vernacular names.

This opinion was given in response to certain questions especially in reference to the Law of Priority (Art. 25) and its application (Art. 26).

Opinion 9

The use of the name of a composite genus for a component part requiring a name.

Summary. The decision as to whether the name of a composite genus, when made up wholly of older genera, is tenable for a component part requiring a name, depends upon a variety of circumstances. There are circumstances under which such a name may be used, others under which it may not be used (Art. 30).

Statement of Case. The following case has been submitted for opinion:

Is the name of a composite genus, when made up wholly of older genera, tenable for a component part requiring a name? Example:

Phalangipus Latreille, 1825, is equivalent to Libinia Leach, 1815, and Doclea Leach, 1815, and Egeria Leach, 1815.

Libinia and Doclea are valid names, but Egeria is preoccupied. May Phalangipus be used in its place?

Discussion:

(Art. 30f.) With the original name and the proposed substitute, the type of either becomes automatically the type of the other.

(Art. 30.) If the new generic substitute is merely mentioned in connection with the species, it becomes necessary to inquire into the type species.

(Art 30g.) If the type of either or of both has not been designated, any author has a right to make such designation.

(Art. 25.) Both names may be valid for the respective genera, in case they are available. Opinion concurred in by 13 commissioners, 2 not voting.

Opinion 14

The type species of Etheostoma rafinesque, 1819.

Summary. The designation of E. blennioides Rafinesque, 1819, as type of Etheostoma rafinesque, 1819, by Agassiz, 1854, is not invalidated by the fact that Agassiz used as basis for his generic diagnosis, characters taken from an erroneous specific determination of 1839. Not only does Agassiz distinctly state that "Eth. blennioides Raf." is type of "Etheostoma Raf.," but even if the question of erroneous identification of E. blennioides by Kirtland be taken into consideration the conclusion must be drawn that this erroneous identification did not exclude the original specimens of E. blennioides from being covered by this specific name; on the contrary, the name as used by Kirtland, 1839, still involved the type specimens; removing now the erroneously determined specimens of 1839, which by Article 30e (a) are excluded from consideration in designating the genotype, the original type specimens of 1819 remain and, upon the premises submitted, represent the type of the genus.

Opinion concurred in by 9 commissioners

Opinion dissented from by 4 commissioners

Not voting-----2 commissioners

Opinion 40Salmo eriox vs Salmo trutta and Salmo fario; Heniochus acuminatus vs Heniochus macrolepidotus.

Summary: On the basis of the premises submitted, it is not necessary to substitute eriox in place of fario or trutta; Cuvier's (1817) selection of macrolepidotus has precedence over the selection of acuminatus by Jordan and Seale, 1908.

Statement of Case. Salmo eriox vs Salmo trutta and Salmo fario.

In naming the European trout, Linnaeus, *Systema Natura*, Ed. 10. 1758 tom. 1. pp. 308, names Salmo eriox (No. 2), Salmo trutta (No. 3), and Salmo fario (No. 4) page 309. These three names belong to one species. The two names, Salmo fario (based on brook trout) and Salmo trutta (based on sea run specimens) have both been in common use, the name Salmo fario most generally. Salmo eriox based on the gray trout of Sweden has line priority over both, and page priority over the name most commonly used, Salmo fario. Which name should be used? The issue lies between convenience and common usage on the one hand and page priority on the other.

Statement of Case. Heniochus acuminatus vs. Heniochus macrolepidotus.

The same principle applies in the case of Heniochus acuminatus, the name having page priority versus Heniochus macrolepidotus, the name in common use. Linnaeus, *Systema Natura*, Ed. 10, 1758, tom. 1., p. 273, describes Chaetodon acuminatus, and on page 274 he describes the same fish as Chaetodon macrolepidotus. This species has been known for a long time as Heniochus macrolepidotus, it being the type genus Heniochus. Lately, 1908, in the "Fishes of Samoa," Jordan and Seale call attention to the identity of acuminatus instead of macrolepidotus. Is this justifiable?

Discussion:

According to Article 28, if two or more competitive names are of the same date, that selected by the first reviser shall stand. A recommendation under 28 provides that in absence of any previous revision, the establishment of precedence by various methods is recommended; among these methods the following is mentioned: "Other things being equal, that name is to be preferred which stands first in the publication (page precedence)."

According to the premises submitted, the issue lies between convenience and common usage on the one hand and page priority on the other. Accordingly, all other things are not equal in this case, and it is best to select the most commonly used name, which under the circumstances is Salmo fario.

The same general principles apply to acuminatus versus macrolepidotus, and the name selected by the first reviser who recognized and published the correct synonym should stand. According to the premises submitted, it would appear that Jordan and Seale, 1908, were the first to do this; they selected acuminatus in preference to macrolepidotus. Cuvier, 1817 (*Régne animal*. v. 2, p. 335), however, stated that acuminatus is the female and later (1829:191) that it is only an individual variety of macrolepidotus, and he gave preference on both dates to the latter name. If it can be shown that some earlier writer recognized the synonymy and selected acuminatus, such selection would, according to the Code, take precedence over the selection macrolepidotus by Cuvier (1817). Unless such earlier selection can be shown, Cuvier's (1817) selection of macrolepidotus stands.

Dissenting Opinions:

Hartert: Page precedence should be prior, and Cuvier was not a first reviser. He did not revise nor monograph the South Sea Fishes but only mentioned some in his *Régne animal*.

Jelink: Salmo eriox was the first published name like Chaetodon acuminatus, and they should have priority.

Stejneger: According to premises submitted, the issue between convenience and common usage on the one hand, and page priority on the other, but as a matter of fact, the issue lies in the question as to who first united the three Linnean specific names and which did he select for the united species. Professor Robert Collet did it in 1875 and selected eriox which must stand.

Opinion 44

Leptocephalus vs Conger

Summary: Leptocephalus Gronovius, 1763, Gmelin, 1789, type morrissii, takes precedence over any later generic name for which the adult stage of this animal has been designated as type.

Statement of Case. President David Starr Jordan has submitted the following case for opinion.

The genus Leptocephalus originates with Gronovius, Zoophylaceum, p. 409, 1763. It is quoted by Scopoli, 1777, and again by Gmelin, Syst. Nat. Ed. XIII, 1789, who names the species Leptocephalus morrissii. It is a larval conger.

Later many species have been made known, and several genera, forming a so-called family, Leptocephalidae. Still later, it was shown that all so-called Leptocephalids are larval forms, and that Leptocephalus morrissii was the young of the fish then known as Muraena conger L., the tupe of the genus Conger Cuvier 1817.

Must Leptocephalus supercede Conger as a generic name, or may it be retained in its long usage of a designation for the band-shaped larva of eels generally?

Discussion:

Leptocephalus Gronovius, 1763, p. 409; Scopoli, 1777; Gmelin, 1789a, p. 1150, was published as a monotypic genus, type morrissii, and not as an artificial collective group.

Opinion 50

Aphis aquilegiae flava vs. Aphis trirhoda

Summary: Since the name Aphis aquilegiae flava Kittel, 1827, is polynominal and not available under the code, Aphis trirhoda, 1849, it is the correct name for the species.

Statement of Case. Doctor John J. Davis has submitted the following case for opinion:

Aphis aquilegiae flava, n. sp. Kittel, Mem. Soc. Linn., Paris, v. 5, p. 148, 1827. Aphis trirhoda, n. sp. Walker, Ann. Mag. Nat. Hist., Lond., v. 4, 2s., pp. 45-46, 1849. Hyalopterus aquilegiae, n. sp. Koch, Pflanzenaue, pp. 19-20, 1857. Hyalopterus flavus Kittel, Schouteden, Mem. Soc. Entom. de Belg. v. 12, p. 230, 1906. In this publication Schouteden drops the first name proposed by Kittel on grounds of inconvenience. Hyalopterus aquilegiae-glavus (Kittel) Hayhurst, Journal N.Y. Ent. Soc., v. 17, p. 107, 1909. He used the full name proposed by Kittel in 1826, making it binominal in effect by use of a hyphen.

I should like to know which is correct, Schouteden or Hayhurst?

Discussion:

A reference to Kittel, 1827, p. 148, shows that he described 13 new species of Aphis, naming them after the hosts.

Species number 5, 6, 7, 8, 9, 10, 11 and 12 are named binominally, while species number 1, 2, 3, 4 and 13 have trinominal specific names, the specific name not being the specific binominal of the hosts. One of these names, Aphis aquilegiae flava, is mentioned by Dr. Davis.

Article 15 of the Code authorizes the use of the compound proper names indicating a comparison with a single object.

Kittel's second species is "A. aquilegiae flava." The host is Aquilegia vulgaris.

From the foregoing it seems evident that Kittel has adopted for these two species a polynominal nomenclature; hence, the specific names in question are not available under Article 2, 14, 15 and 25 of the Code.

According to the premises submitted, Aphis trirhoda Walker, 1849, is the next name proposed for this species. Walker gives no synonyms, but the name was properly published, and, on the basis of the premises submitted, is the correct name for the species.

Opinion written by Stiles.

Opinion concurred in by 11 Commissioners.

Opinion dissented from by one Commissioner.

Opinion 92

Summary: Designations of animals, according to the system proposed by Herrera in the case submitted for opinion, are formulae, not names. Accordingly, they have no status in nomenclature, and, therefore are not subject to consideration under the Law of Priority. No author is under obligation to cite these designations in any case of synonymy, index, or other list of names.

Statement of Case. W. Dwight Pierce submits the following case for opinion:

Herrera, 1900, proposed to prefix all zoological generic names with a syllable to indicate class, and to terminate them with "us" or "s", and to place behind them certain initials further to assist in locating the genus: Insapis mellifica (I, HY, A).

Discussion:

The foregoing case was submitted, for consideration and report, to the International Commission on Entomological Nomenclature, from the Secretary (Karl Jordan) of which the following report has been received: The case though based on insects, is of general nature, and therefore one for the Commission to deal with. It has been submitted to European Entomological Committees only. Ten members have given their opinion. All agree as follows: According to Herrera's one showing, the names of the genera are Apis, Musca, Otus, etc. If any of these names should be preoccupied, the formulae Insmusca, Insbombyxus, etc., cannot be considered as replacing preoccupied names. If Herrera has published such a formula as a title for a new genus (Insexus), Exus should be regarded as the name of the new genus. In quoting literally from the work of Herrera, the formulae "Insbombyxus" should be placed between inverted commas, "....." "Insmusca domestica," without the initials following in Herrera's formula. If the quotation is not literal, Musca, Bombyx, etc., should be used.

The Secretary to the International Commission on Zoological Nomenclature concurs in general with the foregoing report, but invites attention to certain features of the case submitted.

In principle, according to the premises submitted, the designations by Herrera are of essentially the same kind as the designations by Rhymbler, 1910, Zoologischer Anzeiger, pp. 453 to 471, and Verhandlungen des VII, Internationalen Zoologen-Kongresses, zu Graz, 1910 (published 1912), pp. 859-874.

The following case is an example which illustrates Rhumbler's system: Pachynodon reverendus Am. egh, Eupachnodontos ereverendos A. m. fossiller Ungulate aus dem ostlichen Sudamerika.--E=Saugetier; u=Ungula.

It has long been a principle in zoological nomenclature that a name is only a name.

Article 32 of the International Code reads: A generic or a specific name, once published, cannot be rejected, even by its author, because of inappropriateness. It is obvious that the formulae in question suggested by Rhumbler and by Herrera would not be clear to readers unless they had constantly at hand the keys to these formulae. Accordingly, in general usage it would be impossible for the average reader clearly to recognize which portions of the formulae represented generic names and which portions designated classification, or whether a formula or a name were present (c.f. *Eustrongylus*) and this confusion would be increased by changes in the classification. The result would be a chaotic condition, in Nomenclature, in which it would be impossible for the average reader to orientate himself.

If on the other hand, the entire combination of letters of punctuation marks adopted were accepted as the technical name, the combinations resulting from change of names depending upon change of knowledge in respect to classification and distribution would be such as to outweigh any possible advantage that could be gained by recognizing the combinations as names, since as names they would not be in this case subject to emendation.

Finally, the propositions made by Rhumbler and Herrera have never been adopted in the International Code, and the only paragraph in the Code which, in the most liberal interpretation, could be cited in favor of these designations is Article 8, Recommendation k, which provides that one may take as generic names, words formed by an arbitrary combination of letters. Examples: *Neda*, *Clamculus*, *Torix*, *Salifa*.

In view of the foregoing premises the Secretary recommends that the Commission adopt as its Opinion the following:

Designations of animals, according to the system proposed by Herrera in the case submitted for opinion, are formulae, not names. Accordingly, they have no status in Nomenclature, and are, therefore, not subject to consideration under the Law of Priority. No author is under obligation to cite these designations in any table of synonymy, index or other list of names.

Opinion written by Stiles.

Opinion concurred in by 14 Commissioners.

Opinion dissented from by no Commissioners.

Not voting, four Commissioners.

Bather: The whole matter seems to be still simpler than this elaborate Opinion (with which I entirely agree), viz., Herrera and Rhumbler were merely making proposals of a general nature; they were in fact proposing a new scheme of nomenclature. Their proposals were not accepted and we have nothing to do with their suggested examples.

Jordan, (D.S.): By all means discourage this sort of thing.

Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature. From *Bul. of Zool. Nomen.* Vol. 1., part 3, pp. 1-86.

- Declaration
- 1 - The code of ethics to be observed in the renaming of homonyms.
 - 2 - Avoid issuing author's reprints or separates in advance of the number of the Journal which contains the article.
 - 3 - The importance of giving a clear indication of the date of issue of every publication is stressed.
 - 4 - On the power of the International Commission to suspend the rules in certain cases.

- Opinion 145 - On the status of names first published in works rejected for nomenclatorial purposes and subsequently published in other works.
 146 - Suspension of rules for Colias Fab.
 147 - Interpretation of Article 34 in relation to the rejection of certain names.
 148 - Interpretation of Article 25 and 34 of the code in relation to the availability of generic names.
- Declaration 6 - On the need of quoting bibliographical or other references for all names cited in Zoological works.
 7 - Similar to No. 3

REMARKS ON FAMILY NAMES

Melander²² points out that the rules do not stipulate the manner in which the type genus of a family is to be selected.

- (a) Some prefer to conserve the names in accepted usage, accepting as type genera long-recognized, usually dominant forms.
 (b) Some accept the earliest described genus, renaming families after the oldest genus where necessary.
 (c) Others extend to the family name the law of priority, the same as applied to genera.
 (d) A few would erect family names in the same fashion as orders, disregarding the code and type genera.

(In this case it would be possible to have family names without corresponding generic names.)

In 1912 at the 8th International Zoology Congress at Gratz, it was proposed that the law of priority apply to names of family and above, just as it applies to genera and below.

Oberholser (Science V. 52, pp. 142-147, 1920) presented four reasons why it might be objectionable to select automatically the oldest generic name as the family type.

- (a) The family would be changed when any genus with an older name was added to the group.
 (b) The transfer of an older genus to another family would cause confusion by the corresponding transfer of the family name.
 (c) Its universal application would produce wholesale changes in nomenclature.
 (d) There would be no permanent concept of a family type.

Oberholser's rules, except the 13th, which follow, have been approved by a number of competent entomologists.

1. The name of a family is to be formed by adding the ending idae to the stem of the tenable name of its type genus.
2. The name of a sub-family is to be formed by adding inae to the stem of the tenable name of its type genus.
3. Sub-family names shall, for purposes of nomenclature, be accorded the same treatment as family names.
4. The type genus of a family or sub-family must be one of its included genera.
5. The type genus of a family or sub-family is the included generic group from the name of which the family or sub-family name was originally formed, and is to remain the type genus irrespective of changes in its name.
6. A family or sub-family name formed from the name of an included genus is valid, whether or not originally accompanied by a diagnosis or by specific mention of the type genus.
7. The law of priority, subject to that of generic names, shall be fully operative in relation to family and sub-family names.

²²1930 Melander. Selection of Family names. Trans. of IV. Int. Congress of Ent., pp. 657-664.

8. In the application of the law of priority, consideration is to be given to all names employed, respectively, in a family or sub-family sense; and to all supergeneric group names not higher than the grade of family, if based on an included genus. Any such names when brought into use must have their endings changed to idae or inae if they were originally proposed with other terminations.

9. When a family or sub-family is divided, its name is to be retained in both family and sub-family sense in that part containing the type genus of the original group. The remaining portion should take as its family or sub-family designation the earliest name based on any of its included genera. If there is no such name, the family or sub-family may take for its type genus any included genus, preferably the most characteristic or best known.

10. When a sub-family is raised to family rank, its type genus is to be retained as the type genus of such family group.

11. The family or sub-family formed by the combination of two or more families or sub-families takes for its type genus the generic group in any of its components that was first made the basis of a family or sub-family name.

12. When, for any reason, the name of the type genus of a family must be changed, the dependent family name must be changed to correspond to the new designation of the type genus.

13. Of two family or sub-family names in zoology having exactly the same spelling, the latter is to be distinguished from the earlier by the prefix "Pro". Hypothetical example: Propicidae.

It is evident that the law of priority, which aims at stability, would, if extended to sub and family names, lead to confusion. The growing tendency is to restrict the scope of a family by confining it to fewer genera. As an example, some Linnaean genera became sub-families then families, and many today are considered superfamilies. Musca became Muscidae, and now there are a number of dipterous families in that group. The tendency is especially evident in the hymenopterous parasites.

In the Stricklandian Code of 1842, it was recommended that the earliest described genus be taken as the type of the family. The application of the law of priority to family names would not stabilize them, nor would the fixation of type genera stabilize them as long as the provision of the International Code states that the family name must be changed whenever the type genus is superceded. (Sunk in synonymy.)

The discovery of Meigen's paper of 1800 changed Cecidomyidae to Itonididae and made numerous other confusing changes.

Nomina Conservanda. At the second Ent. Congress at Oxford in 1913, it was proposed that when a name had been accepted and unchallenged for 25 years it then be irreplaceable. Others have advocated that names in general use for 30 or 50 years not be changed for nomenclatorial reasons. The Commission has not yet accepted these suggestions.

Regarding the formation of lists of nomina conservanda, a committee of entomologists at Cornell University--Bradley, Comstock, Needham, Reed, Riley, Anna Morgan, Herrick, Crosby, Wright, Matheson, and Embury--in 1912 sent the following request to the Commission on Nomenclature: "To avoid disadvantageous changes in the nomenclature of genera by the strict application of the rules of nomenclature and especially of the principle of priority, the International Commission on Zoological Nomenclature is empowered to prepare such a list of names to be retained. These names are to be by preference those which have come into general use in the fifty years following their publication, especially those generic names upon which long used family names are based and those which have been used in monographs and important works up to the year 1890. With each generic name thus conserved is to be cited a type species to be chosen with a view to retaining the name in its most widely known sense, even if thereby an exception must be made to the other provisions of this code."

In order to fix the names of disputed genera in common use and especially those serving as the basis for family names, Apstein (1915), with the assistance of many specialists, published a list of animals, including over a thousand genera of insects, with fixation of date and type species. This list was submitted for ratification to the Commission on Nomenclature, which rendered the opinion that the list was too lengthy for it to act upon in toto. This praiseworthy undertaking had in mind the removal from further molestation of such commonly-used names as: Cimex, Capsus, Gerris, Hydrometra, Phymata, Berytus,

Thyreocoris, (Hemiptera); Helodes, Trogosita, Malachius, Lampyrus, Trichopteryx, Cantharis, Scolytus (Coleoptera); Acrocera, Borborus, Cecidomyia, Leptis, Mycetophila, Rhyphus, Scatophaga, Scenopinus, Xylophagus (Diptera); Proctotrupes, Pomilus, Sirex, etc., etc.,

Handlirsch, in Schroeder's Handbuch, gives a code of nomenclature, rule VIII of which states: "For every group of animals, science recognizes only one valid name, which is regularly the oldest. Only such names may be removed from the action of the law of priority as are universally known and used in many textbooks, or have medicinal, technical or economic use, as well as those on which higher groups are based." In accordance with his view, Handlirsch (pp. 91-97) then gives a list of about 800 names of families and genera as nomina conservanda to be removed from further dispute.

McAtee (1926) has voiced his main objections to the adoption of nomina conservanda, as follows: "such names will block the development of taxonomy; they will not succeed in preserving definite concepts, they are unfair to early workers, and they will be ignored by taxonomists." In answer, the dictionary may be cited as serving a purpose similar to the proposed list. The dictionary has not blocked the progress of language, though it may be unfair to early workers; it does help to preserve definite concepts, and it is constantly being used.

The family term for a group was first used by De Jussieu in 1789. Sub-family and tribal names are of more recent conception, as are sub-species trinomials.

The theory of binomial nomenclature acts on certain assumptions:

1. That all species are distinct; that there are no intergrades.
2. That every author of a species is familiar with all previous work in this group.
3. That any person able to publish scientifically is competent to write adequate descriptions.

To overcome the first defect, trinomials, varieties, sub-species quadrinomials and even quinquenomials are used as are formulae for hybrids, etc. The designation of physiological species is still a troublesome question.

The second assumption is, in this present day, preposterous. With authors in every country writing in every language and publishing in all manners, it is quite impossible for anyone to be familiar with all the work in a group of any magnitude. Synonyms are inevitable. Nomenclator Zoologicus is a great aid in cutting down synonyms, but the impossibility of keeping this up to date modifies its usefulness. Kennedy has suggested that all new names be registered in a central bureau to be checked. This most excellent idea will probably never be carried out, due to the lack of funds.

The error of the third assumption is obvious when one observes the very incomplete and inadequate descriptions, the personal interpretations of terms and the absence or poor quality of illustrations.

It appears that "synonyms, like the poor, we shall always have with us."

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- Frison, T. H., The Significance of Economic Entomology in the Field of Insect Taxonomy, pp. 749-752.
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- Lindley, E. G., The Present Status of Entomological Nomenclature, pp. 758-761.

THE TYPE

According to Walther Horn (1929), there are 119 words compounded with the word type. D. L. Frizzell (1933), in his Terminology of Types, lists 233 type terms. The early writers did not designate types, and, according to Holland (1929), Boisduval was one of the first to label the specimens from which the description was drawn as type. The early practice was to label all specimens in the series "type." Later, one specimen was selected and the balance were labeled cotype. Lord Walsingham took exception to this word, which he declared was a mongrel formed from combining the Latin preposition "con" with the Greek noun "Typor". He proposed "paratype" instead, and invented a number of other compound words which have come into general acceptance, such as "homotype" (Homoeotype). There is considerable divergence of opinion as to the exact definitions of some of the terms (such as holotype) which follow. Many workers are of the opinion that the great majority of these terms is superfluous. Waterston (1929) believes we should use only one term, i.e., type. Horn (1929) recommends that only three or four terms are necessary.

Fernald (1939), treating of types other than genotypes, lists three categories:

1. Primary types or Proterotypes, including Allotype, Chiotype, Holotype, Lecotype, Paratype, etc.
2. Supplementary types, defined as "the described or figured specimens used by any authors to supplement or correct knowledge of a previously-defined species." These include Neotype, Heautotype, Plesiotype, etc.
3. Typical Specimens (Icotypes): "specimens that have not been used in published descriptions or figures but consists of material which authors have worked on or such as have been collected at the original locality," such as Homoetype, Idiotype, Metatype and Topotype.

Fernald lists 108 terms used in type designation. Many are synonyms and seldom used. He points out that there are no rules for nomenclatorial terms, although some workers feel that the law of priority might well apply here in order to prevent duplication of terms.

Most terms now used apply to adults; there is no law to prevent a worker from employing a new set of terms applying to eggs, larvae, pupae or even to the various instars of the larvae. One might go even further and erect type terms for the forms of webs of caterpillars, the mines of wood borers or leaf miners, for the homes (galls) of Cynipidae.

Williams (1940), in discussing Fernald's paper, states that designating a particular specimen as "type" is a purely "mechanical device" and adds nothing to our knowledge, but goes on to say that its value lies in supplementing insufficient knowledge and preventing doubt or mistakes in identification. He further states that the "type" is a dodge to determine to which species the original name shall apply where there has been two or more species confused. He goes on to add that in his opinion there is no excuse for terms other than type. He is also of the opinion that terms to designate "type" specimens of the opposite sex or immature stage are most dangerous; that such terms serve neither scientific nor nomenclatorial purpose.

Williams apparently ignores many possibilities, such as designating (by type nomenclature) specimens of the opposite sex in dimorphic species; specimens to replace lost types; the fact that homoeotypes, cotypes, etc., may be made available to numerous workers who, because of geographical location, might never have the opportunity of examining the type. Such specimens, we believe, serve to make identification more certain and, thereby, prevent or at least reduce synonymy.

While it is true that many of the type terms now used could be eliminated without serious loss to entomological workers, many other terms carry distinct advantages and will surely survive.

Most of the terms listed below will be found, from time to time, in literature. The list is not complete.

1. Allotype: A specimen of the opposite sex to the type. It can be designated by a subsequent author.
2. Apotype: A specimen (not the type) used for further description or for a figure, by a person other than the original author, thereby differing from autotype. A hypotype or pleisotype.
3. Autotype: Any specimen an author uses as illustration of his species and which has been compared with the type or cotype. A heautotype.
4. Chiotype: The specimen upon which a manuscript name is based. If and when the description is published, the name becomes a type.
5. Cotype: All of the series present before the describer at the time the description is drawn (not including type and allotype). The term means with (the) type, but some maintain the term applies to all of the series and only when no type specimen has been designated.
6. Genoholotype: The species on which a genus is based, whether unique or one of a series. It must be specifically indicated as the generic type by the author. Essentially the same as genotype.
7. Genoelectotype: The one species of a series designated as the type of a genus by the describer subsequent to the description.
8. Genotype: The type species of the genus and so designated.
9. Geotype: A specimen from the type locality.
10. Haplotype: A generic type by a single reference (only species).
11. Heautotype: See autotype.
12. Holotype: A type when unique. A specimen selected²³ by the author and designated by him as the type becomes the holotype when the description is published. No subsequent author can select a holotype. The term is correctly used only when a species is described from a unique specimen.
13. Homoeotype: (Sometimes erroneously referred to as homotype) A specimen named by a person, other than the author, after comparison with the type. If the comparison is made by a specialist in the group, the specimen becomes a very valuable acquisition to any collection. This would be especially true if the type was to become damaged or lost.
14. Hypotype: See apotype.
15. Icotype: A typical specimen used for the purposes of identification, but which has not been used in literature.
16. Ideotype: A specimen named by the author after comparison with the type, but not from the type locality.

²³- 1897 Schuchert. *Science* (n. s.) Vol. V., p. 637.

17. Lectotype: A cotype chosen by one, other than the author, to replace the type subsequent to the original description. To be valid, it must be published.²⁴
18. Logotype: A genotype by subsequent designation.
19. Metatype: A specimen compared with the type by the author and found to be conspecific with it. It should be from the same locality as the type.
20. Monotype: Usually defined as a holotype based on a single specimen. When holotype is correctly used, monotype is synonymous.
21. Morphotype: A selected specimen of the second or later form of a dimorphic or polymorphic species.
22. Neallotype: An allotype described after publication of the original description. Such a specimen would be of the opposite sex of the type.
23. Neotype: A plesiotype selected to represent the holotype when the latter has been destroyed or lost.
24. Ornatype: See topotype.
25. Orthotype: A genotype by original designation.
26. Paratype: This term was invented by Lord Walsingham to replace the term cotype. Every specimen in the series before the author at the time the original description was drawn, other than the type and allotype. These may be designated at the time of the original description or later.
27. Plastotype: Cast of a type.
28. Plesiotype: See apotype.
29. Pseudotype: A genotype by erroneous designation.
30. Topotype: A specimen of the species collected at the exact locality from which the original type came. It is very valuable if it is a homotype and the original type has been lost.
31. Type: The specimen chosen by the author to represent the species and used by him in describing the species. It must be labeled and published.

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Part II

ENTOMOLOGICAL LITERATURE

A BRIEF DISCUSSION OF SYSTEMS OF LITERATURE CLASSIFICATION

Libraries in the United States employ two major systems of classifying or cataloging information: the Dewey Decimal system and the Library of Congress system. Other systems are used to a lesser degree; for example, the Expansive or Cutter system. Foreign countries employ still other systems, although some use the Dewey system and a few, the Library of Congress system.

The Cutter system, originated by Charles A. Cutter, uses the 26 letters of the alphabet as a basis, making many divisions possible. For example, zoology is listed under the letter "O"; vertebrates, under the letter "P"

The Dewey Decimal system, favored by many, is the most frequently used system in American public and college libraries. Since Melvil Dewey developed it in 1873, several revisions have been published; the first in 1876, the 14th in 1942.

For biology the Dewey system is weak because 1) the zoological divisions are far behind modern taxonomy, and 2) the same number of categories are available for small groups as for large ones. To illustrate: reptiles, with 4000 species, and insects, with nearly a million species, are given the same amount of space. From an entomological standpoint the system is out-of-date. For example, it classifies the order Plecoptera under Neuroptera and does not provide for many of the more recently by named orders.

The Dewey system has ten main classes from 000 to 900. Each class has nine groups from 10 to 90. Class 000 contains encyclopedias, periodicals and similar publications. Class 500 is for natural sciences, and the following outline shows the position of insects in this classification, with the order Coleoptera reproduced word for word as it is given in Dewey's "Decimal Classification and Relative Index" (1932).

500 Natural Sciences

- 592 Invertebrates
- 593 Protozoa - Radiates
- 594 Mollusks
- 595 Articulates - including insects
 - .1 Worms, Vermes
 - .2 Arthropoda
 - .3 Crustacea
 - .4 Arachnida
 - .5 Onychophora
 - .6 Myriapoda
 - .7 Insecta
 - .71 Thysanura
 - .76 Coleoptera Beetles
 - .761 Pentamera
 - .762 Adephaga: Whirligig, tiger beetle, water beetle
 - .763 Clavicornia: Burying beetle, larder beetle
 - .764 Lamellicornia: Dung Beetle, June beetle, rose chafer
 - .765 Sternoxia: Click beetle, wire worm
 - .766 Malacodermata: Ship-timber beetle, powder-post beetle
 - .767 Heteromera: Blister beetle

ENTOMOLOGICAL NOMENCLATURE AND LITERATURE

- .768 Tetramera: Weevil, leaf beetle
- .769 Trimeria: Lady-bird beetle

596 Vertebrates

The economic aspect of insects is included under agriculture, classification 630, which is listed here to show the position of insects.

630 Agriculture

632 Hindrances Protection

- .1 Elemental destruction
- .2 Galls (Cecidiology)
- .3 Bacteria
- .4 Fungi
- .5 Parasitic and injurious plants
- .58 Weeds
- .6 Injurious animals
- .7 Injurious insects
- .71 Thysanura
- .72 Orthoptera
- .75 Rhynchota, Hemiptera
- .76 Coleoptera
- .8 Diseases and injuries other than those covered by 632.2-632.7
- .9 Means of protection (screens, scarecrows, etc.)
- .93 Plant quarantine
- .94 Methods of apparatus (spraying, dusting, fumigating)
- .95 Preparations and materials
- .951 Insecticides (also 632.7)
- .952 Fungicides (also 632.4)
- .953 Antiseptics
- .96 Natural enemies of pests

638 Useful invertebrates raised or exploited

Beekeeping, as listed under the Dewey Decimal system, illustrates the minuteness of the indexing. (Note the long number combinations)

- 638.1 Beekeeping
 - .16 Honey and other hive products
 - .165 Varieties of honey
 - .1652 Marketing forms
 - .16528 By color
 - .165282 Light
 - .165283 Amber
 - 638.165284 Dark

Under the Dewey Decimal system, the following is a typical listing:

Essig, E.O. A History of Entomology
595.7
E78h

The classification number 595.7 is the Dewey Decimal system number under Natural Science referring to Insecta. "E" refers to the author Essig; "78" is the author number assigned by the Cutter-Sanborn tables;²⁵ "h" refers to the title, "A History...."

²⁵Book numbers were originated by Schwartz in 1871 to translate author names into figures; Cutter added decimal figures and Edmonds, the initial author letter. Cutter worked out tables for this translation. His two-figure alphabet was lengthened by Kate Sanborn to a three-figure table, now known as the Cutter-Sanborn table.

Other symbols are also used to refer to the number of copies; to the volume number; to a translation into English; to the size (q for quarto, approximately 11 inches high), to insure that the book will be filed in a space tall enough to accommodate it; etc.

The Library of Congress system uses a combination of letters, plus numbers and decimals. It is preferred by larger libraries because it permits fine divisions.

An act of Congress in 1800 established the Library of Congress with an appropriation of \$5000 for the purchase of books. The first catalogue published in 1802 lists 964 volumes; by 1812 the number had increased to 3067, all of which were classified according to size.

The library was largely destroyed by the British when they captured Washington in 1814. The following year Congress authorized the purchase of President Jefferson's library of 7000 titles. The library gradually expanded; by 1901 it contained 100,000 volumes which were moved to a new permanent building. At the present time the Congressional Library contains in excess of eight million books and pamphlets.

About 1900 the number of volumes was so great that classification of material presented a serious problem. Since neither the Cutter system nor the Dewey system was adequate for a Congressional library, a new method of classification, the Library of Congress system, was developed.

The system has many shortcomings, but it must be borne in mind that it was devised for the Library of Congress and was not expected to be adopted by other libraries. Some of the problems encountered in developing the system included classifying books written in over 100 different languages; cataloging material from societies, colleges, etc., as well as from authors; and handling general publications, which often contained material in totally unrelated fields. Experts could not be provided in every field, thus inconsistencies were bound to arise.

By using letters preceding numbers, the Library of Congress system is able to attain great detail without lengthy call numbers. In addition, the system is expandable, according to the amount of space needed. Following is its classification of insects:

Q Science

QL Zoology

- QL460 Insects
 - 461 Periodicals, Societies, etc.
 - 462 Collected works - non-serial
 - 463 General works
 - 464 Field and laboratory manuals
 - 465 Collecting and preservation
 - 466 Pictorial works (Icones)
 - 467 Popular and juvenile
 - 468 Classification, check-lists, catalogs, collections
 - 469 Geographic distribution (divided by country only as specified)
 - 473 North America
 - 474 United States
 - 475 By States A-W
 - 476 Canada
 - 477 Mexico
 - 478 Central America
 - 479 West Indies*
 - 481 South America*
 - 482 Europe*
 - 483 Asia*
 - 485 Africa
 - 487 Australia and New Zealand
 - 489 Pacific Islands*
 - 491 Arctic and Antarctic
 - 494 Anatomy, Morphology

- 495 Physiology
- 496 Biology, Metamorphosis, Social life, Instinct
- 497 Miscellaneous
- 501-4 Aptera
- 506-9 Orthoptera
- 511-14 Neuroptera
- 516-19 Trichoptera, Phryganeidae
- 521-24 Hemiptera
- 531-38 Diptera
- 541-62 Lepidoptera
- 563-69 Hymenoptera (see also SF 521-33, Bee Culture)
- 571-97 Coleoptera
- 571 Periodicals, Societies, Etc.
- 572 Collected works - non-serial
- 573 Comprehensive works
- 574 Compendis
- 575 Pictorial works (Icones)
- 576 Popular and juvenile
- 577 Classification, check lists, catalogs, collections
- 578 Geographic distribution (divided by countries only as specified)
- 581 North America
- 583 United States
- 584 By States, A-W
- 585 Canada
- 586 Mexico
- 587 Central America
- 588 West Indies
- 589 South America*
- 591 Europe*
- 592 Asia
- 593 Africa
- 594 Australia and New Zealand
- 595 Pacific Islands*
- 596 Systematic list (sub-divisions, alphabetically)
 - .C15 Cantharidae
 - .C2 Carabidae
 - .P5 Phytophaga
 - .S75 Staphylinidae
- 597 Anatomy, Morphology, Physiology, Biology
- 599 Strepsiptera

* .A1, General: .A3 - Z, Special Countries, Islands, or Regions.

The Library of Congress system offers two main advantages: 1) libraries may subscribe to Library of Congress cards, thus solving the problem of classification, at least in part, and 2) it is a system elastic enough to permit adequate handling of such categories as taxonomy and related fields.

Larger categories or classes are designated by capitol letters and among the 26 letters used in classification, Q (Science) will contain the major portion of titles relating to entomology. However, the following will also contain many important works relating to special fields of entomology: R (Medicine); S (Agriculture); SB (Field Crops, horticulture, plant pests and plant diseases); SF (Animal culture, silkworms and beekeeping); T (Technology, general); and Z (Bibliographies and indexes).

In spite of the guide to classification available in most libraries, the same title may appear under a different designation in different libraries. This is the result of the fact that classifiers do not always see "eye to eye". For example:

"The House Fly as a Danger to Health" by Austen is listed as Qh 1/B75, under Natural History and forms part of a series; "Flies in Relation to Disease" by Graham-Smith is RC 117.F6, under Medicine.

From an entomological point of view it would be logical for these books to be classified under medical entomology (QL) or under insects and diseases. However, a librarian's viewpoint differs from that of a specialist with regard to classification. The result: a given title may be found under (QL) (Entomology) in one library; under (RC) (Medicine) in another; and under (S) (Agriculture) in still another.

Call numbers consist of a class mark indicating the group in which a book belongs and a book number signifying its place in a particular group. Call numbers were devised in order that books could be quickly, accurately and easily filed, issued, located and returned to the files. The classification number, regardless of the system used, indicated the subject matter of the book. The book number is a symbol or combination of symbols in the form of numbers and letters used to separate one book from others on the same subject. The first letter of the book number is the initial letter of the author's surname. Following this is the author number, which under the Library of Congress system is arrived at by using a rather complicated system. The final symbol is the work mark which indicates the title or edition of the book. However there are numerous exceptions to the above rule.

A book must have a permanent station in its class, termed a book number. For example: Author B's first book is classified QH 201/B72 (B72 is the author number); his second book in the same category is classified QH201/B72h (the "h" in this instance, refers to the initial letter of the first word of the title--not an article--"A History of"). Each book number is verified and a main entry card prepared giving the title, author (plus his or her birth and death dates), contents, publication place, publisher, size, date of printing, pagination, number of volumes, plates, illustrations, maps, etc. Cross index cards are used to list a co-author, inverted titles, subjects covered by the book, society sponsorship, etc.

Following book numbers, such helpful symbols as volume (V), number (No.), edition (Ed.), etc., are listed. Books translated into English are indicated by a large letter "E". In cases where books are brought out by societies, the society is considered the author.

The foregoing system is arbitrary but convenient. To quote the librarian who was largely responsible for it, "The system has not sought to follow strictly the scientific order of subjects. It has instead sought a rather convenient scheme of various groups, considering them as groups of books, not as groups of mere subjects. It has also sought to avoid technical, foreign or unusual terms in the designation of these groups."

From a survey of many libraries, it is apparent that, with regard to books on entomology, libraries have adopted a system of filing volumes as books; not according to their content. Closely-related subject material is often filed in widely different categories because it is more convenient to the library. Mistakes in classification, of course, can happen in any system. To help improve the system of classification, Dr. Evans of the Library of Congress is making every attempt to use only personnel trained in the field of classification. In addition, he is sending untrained members of his staff to schools where such training is available.

The following are given as examples of how books on entomology may be filed:

Of two books on medical entomology, one, Matheson, R., "Medical Entomology", is classified RC115 (under Medicine), while another, Riley, W. A., "Medical Entomology", is number QL99 (under Medical Zoology). Riley's book was probably placed in said category because it is further titled, "A Survey of Insects Affecting Health".

Thompson's book on biological control of insects is listed under HD9011, while Sweetman's "Biological Control of Insects" is classified SB931 (under Horticulture). It is possible that the latter is so listed because it contains a chapter on weed control.

In historical entomology, the following classifications were noted: "The Historical Development of Insect Classification" by Wilson, QL468 (under Classification and Nomenclature); Osborn's "Fragments of Entomological History", Q121 (under History by Country); L. O. Howard's "Fifty Year Sketch of Medical Entomology", QL1 (published in Smithsonian reports under U. S., General); Essig's "History of Entomology", QL462 (under Collected Works); Essig's "Sketch History of Entomology", QL, General. Howard's book and Essig's

"Sketch" are so classified because they were published in periodicals. (The latter are filed separately as groups, regardless of their content.)

The works of an author such as E. O. Essig are practically all on entomology, yet are classified QL462/E7 (History of Entomology), QL463/E7 (College Entomology), and Q1473/E8 (Insects of Western North America).

Even the literature on a single order of insects is not listed in any one group. "Beetles Damaging Seasoned Timber" by Altson is found under TA422 (under Forestry) because it is a reprint from a timber trade journal. "The Succession of Insects" by Blackman is filed under SD143, since it was published in the New York Technical Publication on Forestry. "Furniture Beetles, Prevention of Damage, etc." by Graham, published in the British Museum Economic series, is filed under TX325.

References on Book Classification and Use of the Library

- 1932 Dewey, Melvil
Decimal Classification and Relative Index. 13th edition. Forest Press, N. Y. 1647 pages.
- 1936 Hutchins, Margaret
Guide to the Use of Libraries: A Manual for College and University Students. 5th Edition, revised. H. W. Wilson Co., N. Y. 252 pages.
- 1937 Barden, Bertha
Book Numbers. American Library Association, Chicago, Ill.
- 1938 Soule, Byron Avery
Library Guide for the Chemist. McGraw-Hill Book Co., N. Y. (pgs. 1 - 11 arrangement of a library; pgs. 12 - 23, the card catalog.)
- 1940 Grout, Catherine
Library of Congress Classification. Columbia University Press, N. Y.
- 1945 Smith Roger Cletus
Guide to the Literature of the Zoological Sciences. 1945 revised edition. Burgess Publishing Co., Minneapolis, Minn. 114 pages.
- 1946 Aldrich, Ella Virginia
Using Books and Libraries. Revised edition. Prentice-Hall, Inc., N. Y. 86 pages.
- 1948 Library of Congress Classification
Class "Q" Science. 4th edition. U. S. Government Printing Office, Washington, D. C. 213 pages.
- 1949 Brown, Zaidee Mabel
The Library Key: An Aid in Using Books and Libraries. 7th edition, revised 1948. H. W. Wilson Co., N. Y. 150 pages.
- 1949 Minnesota University Division of Library Instruction
Use of Books and Libraries. University of Minnesota Library, Minneapolis, Minn. 99 pages.

GENERAL REMARKS

The term "bibliography" properly refers to an exhaustive compilation of the literature pertaining to one particular subject or phase of a subject.

To be able to know where to find information is as much a part of education as to acquire it.

The annual contribution to scientific literature is so vast that it is beyond the hope of any one individual to become acquainted with all of it.

Literally thousands of new species of insects are described each year; thousands of papers in various languages cover the different phases of Entomology. These papers are by no means of equal value and few people have access to more than a very small percentage of them.

The worker must learn to use the various indexes, to consult works which carry reviews of current literature in the field in which he is interested, and, if one is particularly interested in a particular phase, it may be well to maintain a private card index on that subject.

HOW TO REVIEW LITERATURE AND ASSEMBLE A BIBLIOGRAPHY

It is no easy task to assemble a complete or nearly-complete bibliography on a given subject. Entomology is no exception. When one begins the study of any problem, a very comprehensive bibliography on that subject is absolutely indispensable for a number of reasons:

1. It will give the worker many hints upon the various angles of approach.
2. It acquaints one with what has been done on the problem by other workers.
3. It prevents useless duplication of work.
4. It enables the worker to present a historical sketch of his subject, which is considered an essential part of any extensive paper.
5. It enables one to add a useful bibliography to his paper.
6. It often enables one to check results.

In a subject such as entomology there are innumerable books, bulletins, circulars, reports, journals, pamphlets, synopses, monographs, treatises and papers which may be a source of information. It would be an endless task to start looking blindly through these (if they were available), attempting to compile a bibliography.

There are, however, certain sources likely to yield much more information than others for the time expended.

First, bibliographical works. Collections by authors who have, by long, hard work, gathered together titles from which one may select those of interest in his particular case. For example: *Index Litteraturae Entomologicae* by Walther Horn and Sigm. Schenkling, published in Berlin in 1929, is a volume of 1426 pages, wherein more than 25,000 titles are cited. It is a bibliography of practically all articles on entomology up to and including the year 1863.

Second, Catalogues. For instance, the Catalogue of the Library of Congress; Catalogue of the works on entomology in the Library of the Department of Agriculture; or catalogue of the manuscripts, papers, synopsis, etc., on insects to be found in the British Museum.

Third, Indexes. Example: the several volumes of "Index to American Economic Entomology," Banks and Colcord.

Fourth, Catalogues of Groups. Example: the Bibliographical Catalogue of North American Diptera by Aldrich; Lepidoptera by Dyar; Hemiptera by Van Duzee; Coleoptera by Leng, or Buprestidae of North America, Chamberlin, with 900 titles.

Fifth, Monographs or extensive papers. (Good when the subject deals with a species, genus, family or order.) Example, the "Mosquitoes of the Americas" by Dyar; "Nearctic Termites" by Banks and Snyder; "Blattidae of North America" by Hebard, etc. Most such works contain quite extensive bibliographies.

HOW TO PRESENT A BIBLIOGRAPHY

It is very desirable that a uniform method of citation be adopted in presenting references. At the present time and more especially in the recent past, references have been presented in any manner that the writer saw fit, and, in many cases, they were not

consistent throughout even one paper. For instance, they might start with the title of the article in one, or the journal in another, while a third citation might begin with the year of the author. Example:

- (1) Aldrich, 1905 - A Catalogue of North American Diptera, Smithsonian Miscellaneous Collections. Volume 46.
- (2) 1905, Aldrich - A Catalogue of North American Diptera, Smithsonian Miscellaneous Collections. 46.
- (3) Smithsonian Miscellaneous Collections. 46 - A Catalogue of North American Diptera, Aldrich, 1905.
- (4) Catalogue of North American Diptera, Smithsonian Miscellaneous Collections 46, 1905 - Aldrich.

The following two forms have been recommended by the Government Printing Office:

- (1) Chronologically with regular sequence.
Year, author's surname, initials, title of the paper verbatim (capitalized as is demanded by the language used); title of publication in full or, in better-known works abbreviated;²⁶ the volume in Arabic numerals underscored (bold face), colon, followed by page numbers.

Example:

1905 Aldrich, J. M. Catalogue of North American Diptera. Smithsonian Miscellaneous Collections 46:1-680.

- (2) Alphabetically. The form followed in U.S.D.A. publications is to list the references alphabetically by authors using the following form:

Craighead, F. C.

1927. The Turpentine Borer on the Florida National Forest. Forest Worker 3 (4):11-12

1928. Some Effect of Fire and Insect Attack on Short-leaf Pine. Forest Worker 4 (2):11-12

Always present the title in full at least once. If cited repeatedly, it may be abbreviated: For example, the above, if repeated, can be set down thus:

Craighead, 1928, ibid. 4 (2): 11-12.

It is permissible to abbreviate the title of a journal if it is well known. For example: Journ. Econ. Ent. 4:211.

On the other hand, little-known publications should not be abbreviated unless they have previously been given in full.

Example:

Bull. R. Acad. Med (Bulletin of Royal Academy of Medicine.)
C. R. Acad. Sci. (Canadian Royal Academy of Science.)

Foreign titles are often difficult to decipher when abbreviated. For example:

Vesh. D. Zool. Gesell.

Do not abbreviate titles of books.

In the case of joint authorship, each author's name should be presented in the same manner. Example:

Brown, J. G. and White, R. F., not Brown, J. G. and R.F.White.

²⁶Authorities for abbreviations. 1939 Carolyn Whetlock. Abbreviations used in the USDA for titles of publications; USDA Misc. Pub. 337, 278 p.

Listing references chronologically has the very distinct advantage of enabling the reader to more easily ascertain what has been more recently published on the subject. In many cases recent papers give a resume of previous articles on the same subject, thus making it unnecessary for the reader to look up the older articles.

On the other hand, listing alphabetically has the advantage of bringing all the works of one author together.

There are other common usages in citing literature in a bibliography, for example:

Biological Abstracts and the Review of Applied Entomology use the following form:
Author, title, periodical, volume, page and date.

This method has the advantage (or disadvantage) of bringing all numbers into close association and if the publication is one which does not number its volumes, it serves to fix the date at an appropriate point.

The Experiment Station Record cites the title first, followed by author, periodical, volume, date and pages.

There are still other forms and an author is free to adopt any form which he feels is best suited for his particular purpose. However, when a form is adopted, it should be strictly maintained throughout that particular paper. Editors of some Journals require that the author of any article to be published in their periodical must conform to their style. It is therefore wise to look over numerous articles and study the style of the publication in which one expects the article to appear.

Points to watch in citing references:

- (a) When an author uses two family names connected by a hyphen, the name is cited as though it were one word.

Example: F. H. Gordon-Adams would be cited:

Gordon-Adams, F. H.

On the other hand, if the author used F. H. Gordon Adams, it would be cited:

Adams, F. H. Gordon. or Adams, F. H. G.

- (b) When several articles have been published by one author in the same year, they should be arranged by dates of publication, and, if they have been cited in the body of the article, each should be distinguished by a suffix.

Example: 1918, 1918a, 1918b, etc.

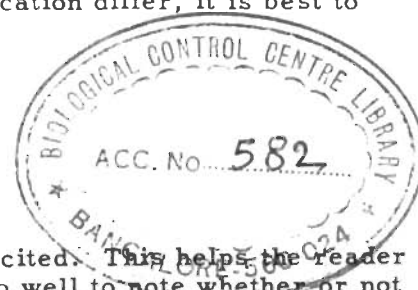
- (c) Give the full title of books, name of publisher and place of publication, as well as the other data required.

- (d) Where the date of the article and the date of actual publication differ, it is best to cite both.

Example: Boyden, B. L.

1936 Parlarotia Date Scale Nears Ex-
termination in cooperative Cam-
paign. U.S.D.A. Year Book for
1935, pp. 269-270.

- (e) Give the number of the first and last page of the article cited. This helps the reader judge how important the article is likely to be. It is also well to note whether or not the article is illustrated. If illustrations contain both figures and plates, such information should be given.



- (f) So-called bibliographies without titles are almost as useless as "insects without labels".
- (g) In citing foreign references, it is well to give a translation of the title. (See Review of Applied Entomology.)
- (h) If publications have issued two or more series, it is well to give the series number in parentheses before the volume number, or the letters n.s. denoting new series. The date of the publication will often indicate this to the experienced worker, but may be confusing to the uninitiated.
- (i) In the event a bulletin has been issued in numerous parts, that fact should be noted.

Example: Rohwer, S. A.

1911 Studies in the Sawfly Genus *Hoplocampa*.
U.S.D.A. Bur. Ent. Tech. Ser. Bul. 20, Part
IV, pp. 139-163.

In the following pages an attempt will be made to point out the various sources, so that one seeking information about any given phase of entomology--be it a particular species, genus or order, or insecticides, biological control or quarantine--will have at least an idea of how to find such information.

BIBLIOGRAPHICAL WORKS

Although not primarily entomological, the following are important source references and worthy of consideration:

Bibliographical Works Relating to Zoology and Natural History

- 1835 "Archiv für Naturgeschichte".
to One volume published each year, giving the titles of publications relating to natural
Date sciences that have appeared the preceding year.
- 1846 Engelmann, W. and Carus, J. V.
to Bibliotheca Historica Naturalis. (Published in Leipzig, Germany.)
1860 Vol. I covers the period 1700 to 1846. In 1861 a supplement was published in two
volumes, edited by J. V. Carus and W. Engelmann. These two volumes cover the
years 1846 to 1860
- 1864 Zoological Record
to (Published by the Zool. Society of London.)
Date One volume published each year, divided as to subject, contains a digest of arti-
cles and a record of the zoological literature of the world, including names of
new genera and new species. The portion on entomology may be obtained sepa-
rately from the Imperial Institute of Entomology, 41 Queens Gate, London S.W.7.
- 1867 "Catalogue of Scientific Papers"
to (Published by the Royal Society of London.)
Date One of the better bibliographical reference works, more than 20 volumes have
been published.
- 1878 Zoologischer Anzeiger,
Lists current zoological literature. Beginning in 1896, published as an annual vol-
ume.
- 1879 Scudder, Samuel
Catalogue of Scientific Serials. (Published by Harvard University as Special Bul-
letin No. 1.)
Covers the years 1633 to 1876.

- 1886 Taschenberg, O.
to Zoological bibliographies issued in signatures supplementing the work of Engel-
1923 mann and Carus (see above). Covers the period from 1800 to 1923. In eight vol-
umes containing 6,620 pages, it is considered one of the best zoological bibli-
ographies.
- 1896 Concilium Bibliographicum
to (Published by the International Congress of Zoology.)
1940 Issued as a card index and in book form, consisting of 42 volumes entitled Bibli-
ographia Zoologica. Ceased publication in 1940.
- 1896 Document Catalogue
to Catalogue of the public documents of Congress and of all departments of the U.S.
Date government. "A comprehensive index" provided for by an Act of Congress, ap-
proved January 12, 1895. (Printed by the Gov't Printing Office and available from
the Supt. of Documents, Washington, D.C.)
- 1897 Bolton, H. C.
Catalogue of Scientific and Technical Periodicals. (Published by Smithsonian Insti-
tution.)
Covers the years 1665 to 1895.
- 1900 United States Catalogue, The
to Published monthly with an annual culmulative index. It is a world list of books in
Date English language, arranged by author, subject and title, edited by Mary Burnham
and Carl Hurd and published by The H. W. Wilson, Co., New York.
- 1903 Woodward, B. D., Editor
to "Catalogue of Books, Manuscripts, Maps and Drawings in the British Museum of
1922 Natural History."
This is more than a mere catalogue. It contains a wealth of information in six
volumes. It is one of the works most frequently cited and is probably the out-
standing bibliography on natural history.
- "Index Catalogue of the Surgeon General's Library."
Contains a great many references of interest to the entomologist. More than 40
volumes indexed by both subject and author, covering more than 1500 serial pub-
lications, 300,000 bound volumes and a half million pamphlets.
- 1910 U. S. Library of Congress - Division of Documents
to A monthly check list of state publications, the series started with Volume I pub-
Date lished in January, 1910. Publications are listed alphabetically by states and by
departments under each state. Each volume contains an index.
- 1916 The Agricultural Index
to A subject index to a selected list of agricultural periodicals, books (included
Date since 1921) and bulletines, it contains a list of experiment station literature, Ag-
ricultural Department literature and a check-list of occasional publications.
(Published by the H. W. Wilson Co., New York)
- 1925 Monthly Catalogue
to (Published by Superintendent of Documents, Washington, D.C.)
Date A monthly catalogue of U.S. public documents, issued since July 1925. (Published
due to the length of time that elapses between the appearance of the volumes of
the Document Catalogue.)
- Weekly list
A weekly list of selected titles of U.S. Government publications issued by the
Supt. of Documents as a supplement to the Monthly Catalogue.

- 1927 Union List of Serials in Libraries of the United States and Canada
to 1,588 pages (1927).
Date A list of periodicals exclusive of government publications. Supplements are issued from time to time. H. W. Wilson Co., N.Y.
- 1939 Schmeckebier, L. F.
Government Publications and Their Use. (Z1223-Z.7, S3.)
Published by Brookings Institution.
- 1939 Besterman, Theo.,
A Bibliography of Bibliographies.
Vol. I, A to L, 587 pp., Vol. II, M to Z, 641 pp. Indexed. University Press, London.
- 1939 Weston, S. M.
Publications of the Govt. of British Columbia, 1871-1937.

Bibliographical Works Relating to Entomology

Note: For a bibliography of early bibliographies, see Horn and Schenkling, 1929, pp. XVII-XXI below.

- 1837 Percheron, A.
Bibliographie Entomologique.
2 vols. Contains many interesting features, including a chronological table of titles on various subjects.
- 1862 Hagen, H. A.
Bibliotheca Entomologica.
Issued in 2 volumes, 1861-1862; 1,079 pages. A fundamental book listing, by authors, nearly all works down to 1862.
- 1871 Societe Entomologique de Belgique. Brussels.
to Catalogue de la bibliotheque.
1881
- 1900 Banks, Nathan
A List of Works on North American Entomology, U.S.D.A. Div. Ent. Bul. No. 24
n.s. 95 pages. Washington, D.C.
- 1901 Bethune, C.J. S.
to Bibliography of Canadian Entomology for the Years 1900-1903 Published by the
1904 Royal Society of Canada in their Transactions.
(2nd Ser.) Vols. VII, VIII, IX and X.
- 1911 Banks, Nathan
A List of Works on North American Entomology, U.S.D.A. Div. Ent. Bul. No. 81
n.s. 118 pages.
A revision of Bulletin 24, with the addition of titles published between 1900 and 1910. (See this work for a list of catalogues, works on classification, monographs, etc., of orders and families issued prior to 1910.)
- 1889 Henshaw, Samuel., and Banks, Nathan - Colcord, Felt, Hawes and others.
to Bibliography of American Economic Entomology.
1949 Complete sets, Parts I-VIII, 1889-1905
And--the continuation:
Index to literature of American Economic Entomology,
Published by the Amer. Assoc. Economic Entomologists
I, 1905-14. By Nathan Banks, 330 pp.
II, 1915-19. By Mabel Colcord, 390 pp.
III, 1920-24. By Mabel Colcord, 441 pp.
IV, 1925-29. By Mabel Colcord, 518 pp.

- V, 1930-34. By Colcord and Felt, E. P. 639 pp.
 VI, 1935-39. Compiled by Mabel Colcord and edited
 by E. P. Felt and S. W. Bromley, 815 pp.
 VII, 1940-44. Bromley, S. W. and Hawes, I. L. 1063 pp.
 (Published in 1949)

Probably the most valuable work on American economic entomology. So arranged that one may readily obtain references on any given subject (such as lead arsenate, bark beetles, airplane dusting, etc.) for the period covered by the particular volume.

- 1888 Schwarz, E. A.
 "The Published Synopsis, Catalogues and Lists of North American Insects; Together with Other Information Intended to Assist the Student of American Entomology."
 Bull. #19 (Old Series) of U.S.D.A., Div of Entomology.
- 1896 U. S. Superintendent of Documents
 to Catalogue of the Public Documents of Congress and of all Departments of the Gov-
 Date ernment of the U.S.
 Known to most librarians by the binder's title Document Catalogue, the contents are arranged alphabetically by subject.
- 1906 Clark, Josephine A.
 "Catalogue of Publications Relating to Entomology Contained in the Library of the Department of Agriculture."
 U.S.D.A. Library Bulletin No. 55. 562 pages. Includes an index to authors and insect families. The works are listed under general headings, such as galls, forest insects, sericulture, etc. More than 100 serial publications are listed.
- 1911 Bulletin of Entomological Research
 to See page 90.
 Date
- 1925 Sherman, John D.
 Some Entomological and Other Bibliographies. Journ. New York Ent. Soc. 32:206-215.
 An interesting article on bibliographies.
- 1926 Biological Abstracts.
 to Published by the University of Pennsylvania.
 Date Covers all field of biology
- 1928 Wade, J. S.
 A Bibliography of Biographies of Entomologists, with special reference to North American Workers. Ann. Ent. Soc. Amer. 21:489-520.
- 1929 Hagen, H. A., Horn, W., and Schenkling, S.
 Index Literaturae Entomologicae.
 Includes works published during 1863, bringing the bibliography down to 1864 where the Zoological Record begins. This revised edition contains some 8,000 titles not given by Hagen. The new edition consists of 4 parts, of which the third was issued in 1928, the fourth in 1929.
- 1930 Colcord, Mabel, et al.
 Check list of Publications on Entomology through 1927. Bibliographical Contribution No. 20.
 Mimeographed. 261 pages.
 In addition to the publications of the Bureau of Entomology, those emanating from other Bureaus which deal with entomological subjects are also listed; a subject index is included.

- 1934 Vappula, N. A.
to Finnish Entomological Literature.
Date (See under Finland, p. 91)
- 1935 Hunt, Mable G.
Index to Publications of the U.S.D.A. for 1926-1930.
Publications listed under subjects, such as sprays, insecticides, insects, etc.
U.S.D.A. Misc. Pub. No. 153.
- 1936 Journal of the Society for the Bibliography of Natural History, London.
Vol. 1-1936 Issued by the Commonwealth Institute of Entomology.
- 1938 Patch, C. E.
Index to entomological publications of the Department of Agriculture for 1884-1936, I-III. (Ottawa: Canada Dept. Agr., Ent. Branch, 1938, pt. 1, pp. 1-140; 2, pp. 144-280; 3, pp. 281-410.)
Contains approximately 4,800 names and 15,000 references, the insects are listed by their scientific names and the synonyms are cross-indexed. The information prefixed to the index includes (1) a list of publications consulted, (2) abbreviations used for the publications reviewed, (3) a bibliography of authors, and (4) a list of authorities with abbreviations.
- 1938 Hayes, W. P.
Bibliography of Keys for the Identification of Immature Insects. Ent. News 49:247-251.

INDEXES AND GUIDES TO POPULAR SCIENTIFIC LITERATURE

- 1891 Poole's Index to Periodical Literature. (A subject index)
to First appeared in 1891; covered the literature from 1802-1881. Supplements were
1906 issued as follows:
First supplement covered the period 1882-1886
Second supplement covered the period 1887-1891
Third supplement covered the period 1892-1896
Fourth supplement covered the period 1897-1901
Fifth supplement covered the period 1902-1906

Published by Houghton Mifflin Co., New York; publications ceased in 1906.
- 1900 Reader's Guide.
to Started in 1900, it appears monthly. There is also an annual volume. Covers popular
Date lar publications. (American material only) Indexed by authors and subjects, with
some titles.
Published by H. W. Wilson, Co., New York.
- 1907 International Index to Periodical Literature.
to Began in 1907, it is quite similar to the Reader's Guide but covers more foreign
Date and semi-scientific periodicals. (American and foreign material) Published by H.
W. Wilson Co., New York.
- 1940 Altsheler, Brent (Compiler) Natural History Index - Guide
An index to 3,365 books and periodicals. 2nd revised and enlarged edition.
Published by H. W. Wilson Co., New York.
- 1945 Carpenter, M. M.
Bibliography of Biographies of Entomologists. Amer. Mid. Naturalist 33:116

Where to Find Information Relative to What Has Been Published
by the United States Department of Agriculture

The various bureaus and divisions of the United States Department of Agriculture, as well as the Department itself, have published a tremendous number of reports, pamphlets,

yearbooks, circulars, bulletins and miscellaneous papers, so that it is quite difficult to find all material that has appeared on any particular subject.

The fact that from time to time the system of numbering has been changed and a new series started leads to confusion.²⁷ There is, as far as we are aware, no single reference which gives a complete list of publications; however, by consulting the following, practically any desired information may be found.

- 1902 Handy, R. B. and Carson, Murna A.
List of titles of publications of the United States Department of Agriculture from 1840 to June 1901 inclusive.
Bulletin No. 6, Division of Publications.²⁸
- 1927 Hunt, Mabel G.
List of publications of the United States Department of Agriculture from January 1901 to December 1925 inclusive
Miscellaneous Publications No. 9.
- 1932 Hunt, Mabel G.
List of publications of the United States Department of Agriculture from January 1926 to December 1930 inclusive.
Miscellaneous Publications No. 153.
- 1936 Hunt, Mabel G.
List of publications of the United States Department of Agriculture from January 1931 to December 1935 inclusive.
(Supplementary to Miscellaneous Publications 9 and 153)
Miscellaneous Publications No. 252.
- 1932 Bradley, Mary A. and Hunt, Mabel G.
Index to Publications of the United States Department of Agriculture 1901-1905.
Unnumbered Miscellaneous Publications.
- 1935 Bradley, Mary A.
Index to Publications of the United States Department of Agriculture 1926-1930. Unnumbered Miscellaneous Publications, 694 pages.
- 1941 Doyle, Mabel Hunt
List of Publications of the United States Department of Agriculture January 1936 to December 1940 inclusive.
(Supplementary to Miscellaneous Publications No. 252)
Miscellaneous Publications No. 443.
- 1941 Zimmerman, F. L. and Read, P. R.
Numerical List of Current Publications of the U.S. Dept. Agric.
Miscellaneous Publications No. 450, 929 pages.

Yearbooks of the Department of Agriculture

- 1902 Greathouse, Charles H.
Index to yearbooks of the United States Department of Agriculture for the years 1894 to 1900. Division of Publications Bulletin No. 7.
- 1907 Greathouse, Charles H.
Index to yearbooks of the United States Department of Agriculture for the years 1901 to 1905. Division of Publications Bulletin No. 9.
- 1913 Greathouse, Charles H.
Index to the yearbooks of the United States Department of Agriculture for the years 1906 to 1910. Division of Publications Bulletin No. 10.

²⁷Some confusion may be cleared by consulting Zimmerman and Reed, 1941.

²⁸Name changed July 1, 1923 to Office of Editorial and Distribution Work.

ENTOMOLOGICAL NOMENCLATURE AND LITERATURE

Creathouse, Charles H.

Index to the yearbooks of the Department of Agriculture for the years 1911-1915. Division of Publications, unnumbered Bulletin.

Special attention is called to the 1952 year book which is entitled "Insects." 780 pages and 72 colored plates.

Farmer's Bulletins

Creathouse, C. H.

Index to Farmer's Bulletins Nos. 1 to 250. Division of Publications Bulletin No. 8.
Index to Farmer's Bulletins Nos. 273 to 382. Division of Publications Circular No. 4.
Index to Farmer's Bulletins Nos. 1406 (1926) to 1650 (1930). (36 on Entomology) will be found in Miscellaneous Publications No. 153.
Index to Farmer's Bulletins Nos. 1642 (1931) to 1755 (1935). (16 on Entomology) will be found in Miscellaneous Publications No. 252.

Entomology

Catalogue of the Publications on Entomology contained in the Department Library (Department of Agriculture, Bureau of Entomology, Library).

Library Bulletin No. 55 of the Department of Agriculture.

McClord, Mabel., et al.

A check list of publications on entomology issued by the U.S. Department of Agriculture through 1927 with subject index.

Bibliographical Contributors No. 20 (mimeographed).

Massall, Albert and Potter, Magie.

Index - Catalogue of Medical and Veterinary Zoology Part I. Authors AA to AZ. 142 pages.

Un-numbered Publications of the Bureau of Animal Industry.

Three additional parts had been published to 1940. These cover authors alphabetically as far as the letter E.

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS RELATING TO ENTOMOLOGY

The greatest source of material on American Entomology is to be found in the publications of the U.S. Department of Agriculture. Such materials may be listed under three

Department Series - U.S.D.A.

- | | |
|----------------------------|-----------------------------|
| (a) Annual Reports | (h) Monthly Reports |
| (b) Bulletins | (i) Office of the Secretary |
| (c) Circulars | (j) Special Reports |
| (d) Farmer's Bulletins | (k) Technical Bulletins |
| (e) Journ. Agric. Research | (l) Weekly News Letters |
| (f) Leaflets | (m) Yearbooks |
| (g) Miscellaneous | (n) Posters |
| Circulars | |
| Publications | |
| Special Reports | |

Bureau of Entomology

- | | |
|--------------------|------------------------|
| (a) Annual Reports | (c) Circulars |
| (b) Bulletins | Old Series |
| Old Series | New Series |
| New Series | (d) Insect Pest Survey |

- | | |
|-----------------------------|-------------------------------------|
| (e) Unnumbered Publications | (j) Entomology (Current Literature) |
| (f) Insect Life | (k) News Letters |
| (g) Publications "E" Series | (l) Extension Entomologist |
| (h) Technical Series | (m) Review of Patents |
| (i) U.S. Ent. Commission | (n) E T Series |

3. Publications of Other Bureaus or Divisions -

- (a) Bureau of Agricultural Economics
- (b) Bureau of Animal Industry
- (c) Bureau of Biological Survey
- (d) Division of Botany
- (e) Bureau of Chemistry
- (f) Office of the Experiment Stations
- (g) Federal Horticultural Board
- (h) Food, Drug and Insecticide Division
- (i) Forest Service
- (j) Office of Information
- (k) Insecticide and Fungicide Board
- (l) Library
- (m) Bureau of Markets
- (n) Bureau of Plant Industry
- (o) Division of Pomology
- (p) Division of Publications
- (q) Office of the Solicitor
- (r) States Relations Service
- (s) Division of Statistics
- (t) Weather Bureau

(1a) Department of Agriculture - Annual Reports 1839-1927

1837 First report 1837 - two page pamphlet issued by Commissioner of Patents. From
- 1837 to 1861 the report on Agriculture formed a part of the report of the Patent Office
1861 In 1849, the report was incorporated in a separate volume.

1862 In 1862, the Department of Agriculture was established and issued annual reports up
to 1893. Beginning with the report for 1894, this was prepared in two volumes, one the
Date Secretary's report contains purely executive material from the Chiefs of Bureaus.
The other known as the yearbook, contained articles on agricultural science, includ-
ing entomology. In 1889, the head of the Department of Agriculture was given the title
of Secretary of Agriculture and became a member of the Cabinet.

The first article on entomology appeared in 1847. pp. 175-179 - Silk (Muscardine
disease produced Botrytis bassiana).

Up to 1928, 139 articles of more or less interest to entomologists appeared in the re-
ports and yearbooks. The more important articles also appeared as reprints.

The following will assist in determining the contents of the various yearbooks.

Division of Publications Bulletin No. 7 - An index to the yearbooks of 1894 (the first
yearbook published) to 1900, inclusive. Published in 1902.

Division of Publications Bulletin No. 9 - Index to the yearbooks 1901 to 1905. Pub-
lished in 1907.

Division of Publications Bulletin No. 10 - Index to the yearbooks 1906 to 1910.
Published in 1913.

The titles of those yearbook separates will be found in Miscellaneous Publications 6, 9,
153, and 252.

The number of entomological papers varies, for example:

ENTOMOLOGICAL NOMENCLATURE AND LITERATURE

| <u>Yearbook</u> | <u>Number of articles on Entomology</u> |
|-----------------|---|
| 1931 | 11 |
| 1932 | 3 |
| 1933 | 5 |
| 1934 | 10 |
| 1935 | 10 |

(lb) U.S. Department of Agriculture Bulletins

1913 In July 1913, the Bureau of Entomology discontinued its series of bulletins, circulars,
to etc., and a new series of department bulletins was established. Contributions from
1927 various bureaus are in the series, thus only a part of the numbered bulletins pertain
to entomology.

From 1913 to 1929, 1500 bulletins were issued. Of these, 286 are listed as containing entomological material. Most of these are labeled as "Contributions from the Bureau of Entomology," and some bear an additional marking (Professional Paper).

The first bulletin relating to entomology is No. 5, 1913, Webster, F. M. The Southern Corn Root Worm or Bud-Worm (Diabrotica duodecimpunctata Oliv.) 11 p. Illustrated.

The last one in 1927 on entomology was Bulletin No. 1490, 1927, Snyder, T. E. Defects in Timber caused by Insects. 46 pages.

The titles of all departmental bulletins up to 1929 will be found in Bibliographical Contributions No. 20. (see page 58)

Nos. 1 (1913) to 1363 (January 1, 1926) titles are listed in Miscellaneous Publications No. 9. Of the 1363²⁹ bulletins, 485 refer to insects, insecticides, control measures, beekeeping or other entomological material. This does not include those bulletins on the food of birds, etc., which may contain insect material.

Nos. 1357 (1926) to 1500 (1929) titles will be found in Miscellaneous Publications No. 153. Of the 143 bulletins appearing between 1926 to 1929, 20 are on entomology.

This series has been succeeded by Technical Bulletins.

(lc) Department Circulars

1919 During the period 1919-1927, a series of Departmental Circulars numbered from 1 to
to 425 were issued. Like the bulletins, these emanated from the various divisions,
1927 chiefs, etc., so only a portion pertain to entomology. Of the 425 circulars issued, 55
are entirely or partially devoted to entomological material.

Titles of those 55 will be found in pp. 23-26 of the U.S.D.A. Library Bibliographical contributions No. 20. Titles of all those issued between 1919 and 1925 will be found in Miscellaneous Publications No. 9. Titles of those issued in 1926-1927 (284-425) appear in Miscellaneous Publications No. 153.

Circulars

1927 The above-mentioned series was succeeded by a series of circulars of which 568 have
been issued to June 1940. Some 75 are devoted in whole or part to entomology. The
first is No. 7, issued November 1, 1927--An Apparatus for the Rapid Vaporization of
Carbon Disulphide; No. 568, issued June 1940--Factors Influencing the Use of Some
Common Insecticide-Dispensing Agents. Titles will be found in Misc. Pub. Nos. 153,
252, etc.

²⁹A few numbers were not issued and a few numbers were issued later; hence, the discrepancy in the numbers 1363 (1925) and 1357 (1926).

Department Reports (1 to 117)

1862 These reports ran from 1862 to 1915. The first fifty-eight (1862 to 1898), were issued to without numbers, but in report No. 59, a list of titles and assigned numbers are given.
 1915 Some 25 contain articles on entomological subjects.

(1d) Farmer's Bulletins

1891 A series of publications contributed from the various bureaus and known as Farmer's to Bulletins began in 1891. More than 2000 bulletins have been issued to June 1949. Of
 1939 these, more than 550 pertain to entomological subjects. Among those dealing in whole or in part with entomological subjects may be noted contributions from:

Division of Gardens and Grounds
 Office of the Experiment Station
 Div. of Vegetable Physiology and Pathology
 Bureau of Biological Survey
 Division of Soils
 Division of Pomology
 Bureau of Plant Industry
 Bureau of Animal Industry
 Bureau of Chemistry and others

A list of titles of those relating to entomology published between 1891 and 1927 will be found in Bibliographical Contributions No. 20, pp. 29-53. (i.e., 1 to 1548)
 Indexes to Farmer's Bulletins have been published from time to time. See under Farmer's Bulletins, page 57.

(1e) The Journal of Agricultural Research

Established in 1913, this semi-monthly publication carried articles on technical agricultural research problems by workers in the U.S.D.A. or experiment stations. The articles also appear as separates, and all separates from the Bureau of Entomology belong to the "K" Series. Some articles not of the "K" Series may contain information of interest to entomologists, such as those from the Bureau of Biological Survey, Chemistry or Plant Industry. Articles emanating from the state experiment stations are not marked "K" Series but bear the state abbreviation and a number. Ex: (Ore.-1.), (Ala.-7), (Minn.-16).

From 1913 to Vol. 78 (June 1949), there have been published about 350 "K" Series papers. An index to the "K" Series up to 1930 will be found in Library Bibliographical Contributions No. 20, pp. 53-75. This Journal ceased publication with Vol. 78, No. 12, June 1949.

Papers from other series of Entomological interest:

Bureau of Plant Industry "G" Series.
 Insects as vectors of virus disease, etc.

Bureau of Chemistry "E" Series.
 Chemistry of insecticides, etc.

Bureau of Animal Industry "A" Series.
 Animal parasites, etc.

Station Articles on Entomology:

Practically every state experiment station has contributed to this series, for example:

| | | | | |
|-------|------------------|---------------|----|--------|
| Minn. | 103 (up to 1938) | N.Y. (Geneva) | 14 | (1939) |
| Me. | 26 (1940) | Va. | 14 | (1939) |

| | | | | | |
|-------|----|--------|------|----|--------|
| Wisc. | 98 | (1938) | Utah | 30 | (1933) |
| Kans. | 63 | (1931) | Iowa | 30 | (1939) |
| Mont. | 24 | (1936) | Fla. | 21 | (1938) |
| N.J. | 33 | (1940) | | | |

Station articles on entomology to 1930 are also indexed in Library Bibliographical Contributions No. 20. Further information relative to station articles will be found under Station Publications, pages 75-76.

(1f) U.S.D.A. Leaflets

Only a very few leaflets --all of an elementary nature-- have been published.

Two pertain to entomology: No. 2 Cutworms in the Garden 1927 (2pp.) and No. 12 The Striped Blister Beetles on Soybeans 1927 (5 pp.)

(1g) Miscellaneous Circulars

1897 This series was started in 1896, but only two circulars were printed, then the series was discontinued. In 1923, it was revived with No. 3. Some 110 circulars were printed, 1923 ten of which relate to entomology. All are largely either very elementary or of such a nature as to be of interest only at the time of publication.

1927 No. 46 (1925) A Bibliography of the European Cornborer (Pyrausta nubilalis) by Wade is of interest.

Miscellaneous Publications

1927 Late in 1927, the above series was succeeded by Miscellaneous Publications. 362 Miscellaneous Publications had appeared up to January 1940, but few dealt with entomology.

Nos. 98 to 235 were issued during 1931-1935. Titles are to be found in Miscellaneous Publication No. 252 (1936). Only six are on Entomology.

No. 120 - A Digest of the Literature on Derris used as an Insecticide.

No. 198 - An Annotated Bibliography of the Hessian Fly.

Nos. 9, 153 and 252 - U.S.D.A. Publications which have already been referred to. See page 56 and 75.

Miscellaneous Special Reports.

1883 Ten reports under this head were issued between 1883 and 1886. Nos. 2, 8, and 9 contain articles on silk or cotton. Reports discontinued.

(1h) Monthly Reports U.S.D.A.

Issued from May 1863 to December 1876, then discontinued. Contain reports on crops and special subjects of interest to farmers. See Special Reports below.

Entomological articles are scattered through the various reports issued between 1865 and 1876 on such subjects as the silk worm, potato beetle, cotton insects, locusts, bees, etc.

U.S.D.A. Posters

Posters of the Bureau of Entomology have been designated "E" Series. See (2g) page 65.

Some 50 posters of this series have been issued on such subjects as Boll weevil, Cattle ticks, Chinch bug, European corn borer, Japanese beetle, Gipsy moth, Hessian fly, etc.

(li) Office of the Secretary

Circulars No. 1 to 161 inc. and No. 183 (162-182 never published).

Series started in 1896 and discontinued after 1921. There are 19 circulars which pertain to entomology, mainly on regulatory, quarantine or elementary control subjects.

Titles will be found in Miscellaneous Publication No. 9.

Extension Service

A series of mimeographed material numbered 1 (March 31, 1927) to 24 (December 31, 1927) on the Corn Borer.

Un-numbered Publications
1875-1924

A series of 14 un-numbered publications, largely reports of Bureau Chiefs, Commissioners, etc., most of the material appeared elsewhere. Those issued between 1902 and 1924 contain nothing on entomology.

U.S.D.A. Special Reports

These were numbered 1 to 117 - 1877 to 1917 and largely were reports on crop conditions and statistics previously contained in the Monthly Report of the Department of Agriculture. A few such as Banks' "Acarina of North America", are important. Seven of these - Nos. 7, 8, 11, 22, 35, 36, 50 - and some of the later numbers contain some entomological material on cotton insects, silk culture, horse flies, ticks, etc.

(lk) U.S.D.A. Technical Bulletins

1927 This series began in 1927 and succeeds the Department Bulletins. No. 1 was issued in 1927 and No. 229 in 1930. Of these 229, 48 pertain to entomology, and the titles appear in Miscellaneous Publication No. 9. No. 210 was issued in 1931 and No. 502 in 1935. Of these 46 are on entomology, and titles appear in Miscellaneous Publication No. 252. Forty-six of these deal with parasites. No. 879 appeared in October, 1944.

(l-l) U.S.D.A. Weekly News Letter

1913 Volume 1 appeared in 1913 and Volume 9 in 1921. Discontinued, then replaced by the
- "Official Record," it contains popular notes on insects of economic importance. In al-
1921 most every case, the information has appeared elsewhere in detail.

Official Record

1922 Began with Vol. 1 in January 1922--Vol. XI, 1932. Similar to the Weekly News letter,
to they appear each week.
Date

(lm) U.S.D.A. Yearbook

First appeared in 1894, succeeding a part of the Annual Report. Contains articles and statistical matters emanating from the various bureaus, divisions and offices of the Department of Agriculture. Most of the articles, reprinted as separates, are so marked.

From 1894 to 1910, most articles on entomology were written by L. O. Howard, C. L. Marlatt, F. H. Chittenden, A. D. Hopkins and A. L. Quaintance. Up to 1927, only 100 entomological articles have appeared in the 33 Yearbooks.

All articles in the Yearbooks have been indexed. See page 57

(1n) Posters

Large colored posters depicting the life history or destructive nature of some species of insect have been issued at intervals for a number of years.

"The Cotton Boll Weevil," "Corn Ear Worm," "Cabbage Worm," "Gipsy Moth," "European Corn Borer," "Hessian Fly," "Japanese Beetle," etc., have been subjects of one or more posters.

The titles of some 50 are listed in Library Bibliographical Contributions No. 20, on pp. 79-81.

(2) U.S.D.A. Bureau of Entomology

The Division of Entomology was established in 1863 when Townend Glover was appointed entomologist. Prior to this date, articles pertaining to entomology appeared in the agricultural report of the Patent Office.

(2a) Annual Report

Since 1863 there has appeared the Annual Report of the Entomologist which is bound with the report of the Secretary of Agriculture. It is also issued under separate cover as the Author's Edition. These reports were rendered by the following:

| | |
|-----------------|-----------|
| Glover, T. | 1863-1877 |
| Riley, C. V. | 1877-1878 |
| Comstock, J. H. | 1879-1881 |
| Riley, C. V. | 1882-1893 |
| Howard, L. O. | 1894-1928 |
| Marlatt, C. L. | 1929-1933 |
| Strong, L. A. | 1934-1941 |
| Annand, P. N. | 1941-1950 |
| Hoyt, A. S. | 1950- |

(2b) Bureau of Entomology Bulletins (Old Series)

Nos. 1 to 33 1883 to 1895

These 33 bulletins contain the results of the early work in the Bureau pertaining to experiments, observations on the life histories and habits of the more common insects, early work with insecticides and some taxonomic studies.

Bureau of Entomology Bulletins (New Series)

Nos. 1 to 127 1896 to 1914

A continuation of the Old Series. These bulletins form the foundation of American Entomological Literature.

A complete list of titles appears on pp. 101-113 of the check list of Publications on Entomology, Library Bibliographical Contributions No. 20, 1930.

(2c) Bureau of Entomology Circulars (First Series)

Some 40 of these Circular Letters were published between 1884 and 1890, but only about 25 are known to be in existence.

Bureau of Entomology Circulars (Second Series)

Nos. 1 to 173

1891 to 1913

All entomological subjects, written largely by Howard, Marlatt, Hopkins, Chittenden and Webster.

No. 1 issued in 1891 is entitled "Condensed Information Concerning the more Important Insecticides" --7 pages. Author not given.

No. 173, 1913--by Morgan and Parman, "Arsenate of Lead as an Insecticide against the Tobacco Horn Worm," 10 pp., 1913.

(2d) Insect Pest Survey

A monthly review of entomological conditions throughout the United States (mimeographed).

Vol. 1 issued in (May-Nov.) 1921 has 7 numbers, 285 pp.

Vol. 2 (1922) to Vol. 5 inc. (1925) each contain 8 numbers.

Vol. 6 (1926) to Vol. 21 (1942) each contain 10 numbers.

Supplements were issued to many of the later numbers.

Each volume has an index; ceased publication at the end of 1942 owing to a shortage of paper.

Beginning November 1942, an insect pest survey supplement has been issued irregularly and unnumbered news letters titled Insect Pest Survey, More Important Insect Records, has been issued monthly.

(2e) Bureau of Entomology Un-numbered Publications.

As far back as 1878, un-numbered publications appeared. Comstock's "Report upon the Cotton Insects" was published that year.

A list of titles will be found in Library Bibliographical Contributions No. 20, page 137 and in Miscellaneous publication Bulletin No. 9, page 103, covering those issued up to 1925.

(2f) Insect Life - See Serial Publications.(2g) Publications "E" Series.

Mostly mimeographed and in the form of news letters. No. 1 appeared February 2, 1915--2 pages devoted to spraying citrus trees in Florida. No. 273, issued in 1927, "Method of preparing Extract of Pyrethrum Flowers." Up to the present time, more than 630 have been mimeographed. E. 632 appeared in February, 1945. Note titles of some of these under Insecticides page 118.

(2h) Bureau of Entomology Technical Series.

Nos. 1 to 27

1895 to 1915

Series discontinued in 1915.

Of a technical nature and often consisting of several parts, many were in the nature of monographs, such as Hopkins' Genus Dendroctonus. Others were taxonomic studies of a group of catalogues.

(2j) United States Entomological Commission Bulletins.³⁰

Riley, Packard and Thomas formed the personnel of the first Commission and operated under the Department of the Interior, were attached to the Geological and Geographical Survey until 1881 when the Commission was transferred to the newly-formed Department of Agriculture.

Bulletins 1 and 2 appeared under the direction of the U.S.G. and G. Survey of the Territories. (The Hayden Survey.) Nos. 3 to 7 were issued under the direction of the Department of Interior. None was issued under the Department of Agriculture.

| | |
|--|------|
| 1. Destruction of Locusts. | 1877 |
| 2. Natural History of the Rocky Mountain Locust. | 1877 |
| 3. The Cotton Worm. | 1880 |
| 4. The Hessian Fly. | 1880 |
| 5. The Chinch Bug. | 1877 |
| 6. General Index. | |
| 7. Insects Injurious to Forest and Shade Trees. | 1881 |

Five annual reports were also issued.

1. 1887 mainly on the Rocky Mountain Locust.
2. For the year 1878-79, mainly on the Locust.
3. 1883 - On a number of common pests, i. e., Locusts, Western Cricket, Army Worm, Hessian Fly, etc.
4. 1883 - A revised edition of Bulletin No. 3 on the Cotton Worm and other Cotton Insects.
5. 1890 - A revised and enlarged edition of Packard's Bulletin No. 7 on Forest and Shade Tree Insects.

Circulars

The Department of Interior also issued 12 circulars based mainly on material in the above mentioned bulletins and reports.

(2k) Entomology Current Literature.

A mimeographed series containing selected references of new books and articles which had been included, to a limited extent, in the monthly news letter.

Publications of the U.S.D.A. and the various state agricultural experiment stations are omitted, since they are listed weekly in the Official Record of the Department.

Vol. 1, No. 1 bears the date January-February 1932, and a number appeared every other month, six numbers to a volume, one volume per year.

(2-1) U.S.D.A. Bureau of Entomology and Plant Quarantine News Letter.

(Superceded the monthly news letter of the Bureau of Entomology when this was combined with the Bureau of Plant Quarantine.)

Started as a mimeographed publication.

Vol. I, No. 1 is dated August 1, 1934, on the printed cover but bears the date June 1934 on the first page.

³⁰These early reports, etc., were not issued under the jurisdiction of the Department of Agriculture, but under the Department of the Interior.

Each number consists of about 25 pages of timely information for bureau workers, usually outlining what other bureau workers are doing. The contents are "Not for Publication."

Vol. I - 5 numbers 1934

One volume of 12 numbers appears each year, 1935 to date

(2m) U.S.D.A. Bureau of Entomology and Plant Quarantine.

The Extension Entomologist (Mimeographed).

This publication is for the purpose of passing information on to field workers from the Washington office.

Vol. 1 consists of three numbers. 1 (July), 2 (Sept.) and 3 (Dec.), 1937.

Vol. 2: No. 1 (March), 2 (May), 3 (July), 4 (Sept.), 5 (Dec.), 1938.

Vol. 3: No. 1 (March), 2 (June), 3 (Sept.), 4 (Dec.), 1939.

Vol. 4: No. 1 (Jan.), 2 (May), 3 (July), 1940

Ceased publication with Vol. 6, 1942.

(2n) A Review of U.S. Patents Relating to Pest Control.

Published under the auspices of the Bureau of Entomology and Plant Quarantine.

A mimeographed series begun in 1928.

Vol. 1, No. 1 was published in January 1928.

Vol. 23 published in 1950.

(2o) U.S.D.A. Bureau of Entomology and Plant Quarantine.

"ET" SERIES. Entomological Technique.

A series of mimeographed circulars beginning with ET 1, February 1934.

Nos. 1- 35 were issued in 1934.

" 36- 69 " " " 1935.

" 70- 93 " " " 1936.

" 94- 117 " " " 1937.

" 118- 136 " " " 1938.

" 137- 152 " " " 1939.

" 153- 165 " " " 1940.

No. 220 appeared in November 1944.

An index to Circulars Nos. 1-50 was issued in October 1935; Index to 51-100 issued in 1937; Index to 101-150 in September 1939.

(3) Publications of Other Bureaus and Divisions.

(3a) Bureau of Agricultural Economics.

Reports on the honey market, etc. (Mimeographed).

(3b) Bureau of Animal Industry (Organized 1884).

Titles of all publications of this bureau relating to Entomology will be found in Library Bibliographical Contributions No. 20.

Annual Reports

Beginning in 1884, this Bureau published a report each year; discontinued same after the 28th in 1911, following which date the Chief of the Bureau gave his report in the Annual Report of the Department of Agriculture.

In many of these reports, beginning with the 4th in 1887, will be found articles relating to animal pests, such as buffalo gnats, fever ticks, sheep scab, chicken ticks, tsetse fly, etc.

Bureau of Animal Industry Bulletins.

Division of Publications Circular No. 15, Index to the Publications of the Bureau of Animal Industry Jan. 1911 to July 1913.

1 to 167 1893 to 1914

This series of 167 bulletins contains 16 which relate to entomological subjects. Nos. 1, 3, 21, 39, 40, 42, 69, 78, 97, 107, 112, 144, 152, 163 and 167. The series was discontinued after Bulletin 167 was issued in 1914.

Such subjects as Texas fever in cattle, anthrax, nematode parasites, biology of the fever tick, etc., are found in this series.

Bureau of Animal Industry Circulars.

1 to 218 1893 to 1913

Like the Bulletins, a few of the circulars relate to insect pests of animals. Some 24 have an entomological aspect, dealing largely with cattle ticks and other animal parasites.

A few of the orders, rules and regulatory announcements have a bearing on legislative entomology, as they pertain to dipping of stock, movements of infested animals, fly traps at slaughter houses and prevention of spread of animal diseases.

This Bureau also issued many un-numbered publications relating to animal parasites and diseases. These are listed on page 148 - 151 of U.S.D.A. Library Bul. No. 20.

(3c) U.S.D.A. Bureau of Biological Survey Bulletins.

(Series discontinued in 1913).

Division of Publications Circular No. 8--Index to the Publications of the Biological Survey Jan. 1911 to July 1913.

1 to 94 1889 to 1913

Bulletins on Ornithology and Mammalogy, are, in many cases, devoted largely to the food habits and contain much information on the insect food of birds and mammals.

21 of the bulletins of this series are important in this field, including

- Bul. 4 - Insect food of the crow.
- 7 - Preliminary report of the food of woodpeckers.
- 12 - Insectivorous song birds.
- 22 - Birds known to eat the boll weevil.
- 32 - Food habits of the grosbeaks.
- 37 - Food of the woodpeckers of the United States.
- 56 - The value of swallows as insect destroyers.

Circulars

Eight of the circulars of this Bureau also contain similar information. No. 1 issued in 1889--No. 82 issued in 1911.

Bureau of Biological Survey, North American Fauna.

These are seldom noted by entomologists.

No. 7 - The Death Valley Expedition--1893, pp. 233-268. Deals with a small collection of insects made in Death Valley by Riley.

No. 46 - A Biological Survey of the Pribilof Islands 1923. Part II - Insects, Arachnids and Chilopods--pp. 129-244. The various orders have been worked up by specialists.

(3d) U.S. Department of Agriculture, Division of Botany.

Organized in 1876 and merged with Bureau of Plant Industry in 1901.

Bulletins
(Series now discontinued)

A few of the 29 Bulletins (Nos. 9, 11, 20 and 25) contain a little information on insects associated with plant diseases.

(3e) Bureau of Chemistry.

Created in 1862 as the Division of Chemistry; changed to the Bureau of Chemistry in 1901 and united with the Bureau of Soils to form the Bureau of Chemistry and Soils in 1927. Also handles the work of the Insecticide and Fungicide Board under the Food, Drug and Insecticide Administration.

The Annual Reports were printed in the reports of the Department of Agriculture from 1893 to 1923. They were also issued separately. Practically every one of these reports devotes a few pages to insecticides and fungicides.

Bureau of Chemistry Bulletins.

Division of Publications Circular No. 7, Index to Publications of the Bureau of Chemistry, Jan. 1911 to July 1913.

1 to 166 (Series Discontinued) 1883 to 1913

Adulterants in honey, beeswax; chemicals in dried fruits; compositions of insecticides and similar subjects are dealt with in some of these bulletins.

Some 24 are listed as containing material of entomological interest. Two of the circulars, No. 10 and 86, contain similar material. There were 115 circulars published. The series was discontinued in 1913.

(3f) United States Department of Agriculture
Office of the Experiment Station

Organized in 1888 - Abolished July 1, 1915
Reorganized July 1, 1923

Annual Reports

From 1903 to 1911 - Reports of investigational work in Puerto Rico, Hawaii and Guam are given briefly.

- - - - -

From 1916 to date, Allen, E. W., Flint, E. R., and Schulte, J. I. report on Entomological Investigation.

Office of the Experiment Stations Bulletins

(Discontinued in 1913)

1 to 256

1889 to 1913

Entomology is discussed briefly in the Proceedings of the Annual Conventions of the Association of American Agricultural Colleges and in the digests of various publications. The 21st convention was reported in Bul. 196 in 1907.

The Experiment Station Record - 1889 to 1946

Appears twice a month; two vols. per year and abstracts articles on entomology and other sciences. Publication discontinued with the index number to Vol. 95, 1946.

- (3g) Federal Horticultural Board created in 1912; charged with the enforcement of plant and insect quarantine and with issuing the notices of quarantine.

Service and Regulatory Announcements of the Federal Horticultural Board.

Issued quarterly, beginning in 1914. About 100 have been issued; all relate to quarantine and insecticide.

(3h) Food, Drug and Insecticide Administration

Created in 1927--carries on the regulatory work previously performed by the Bureau of Chemistry, and is now combined with the Insecticide and Fungicide Board under the above title.

The Food, Drug and Insecticide Review

Contains mainly legal matters, such as decisions, notices of judgments and regulatory announcements.

(3i) U.S.D.A. Forest Service

The Division of Forestry was established in 1881; became the Bureau of Forestry in 1901; changed to the Forest Service in 1905.

Bulletins

1 to 127

(Series discontinued in 1913)

1887 to 1913

Of the 127 bulletins, only 10 contain information of an entomological nature. Nos. 13, 19, 22, 26, 31, 33, 38, 46, 59, 66 and 85.

Circulars

1 to 216

1886 to 1913

Eight of the 216 circulars refer to insects; namely numbers 41, 64, 70, 135, 163, 187, 192 and 215.

Other Publications of the Forest Service

Reports on Forestry: The reports of 1876, 1880, 1882 and 1884 contain some references to insects.

Use Book and National Forest Manual. Issues from 1906 to 1911 contain a few pages on disposal of Insect Infested Timber.

The Forest Worker: A mimeographed bi-monthly paper first issued in 1924; starting with Vol. 3, it was printed. Contains frequent contributions from the Forest Insect Division of the Bureau of Entomology.

- (3j) Office of Information - Radio and press service for popular appeal.
- (3k) Insecticide and Fungicide Board. Regulatory announcements and insecticide decisions.

(3l) Library

Library Bul. 55 - Catalogue of Publications Relating to Entomology in the U.S.D.A. 1906.

Arranged under subjects and orders, a most useful publication.

Library Bibliographical Contributions No. 20 - Check list of publications on Entomology. issued by the U.S.D.A., 1930.

- (3m) Bureau of Markets - Crop estimates and seed reports.

(3n) Bureau of Plant Industry:

Organized in 1901 by consolidating the divisions of Agrostology, Botany, Seed and Plant Introductions, Seed Division, Vegetable Physiology and Pathology Divisions.

Bulletins 1 to 285 (Discontinued in 1913) 1901 to 1913

Some bulletins pertaining to a certain plant may have a few pages devoted to the enemies of that particular plant. In many cases, the inter-relationship of insects and plant diseases are discussed. Of the 285 bulletins published, 26 are listed as containing entomological material.

Circulars 1 to 132 1908 to 1913

Fifteen circulars refer to insects in whole or part.

(3o) U.S.D.A. Division of Pomology.

Organized in 1886; merged with Plant Pathology in 1901. Bul. 5 (1897), and Bul. 9 (1901) refer to fig insects.

(3p) U.S.D.A. Division of Publications.

Between 1893 and 1913 ten bulletins and several circulars were published, mainly indexes.

The information contained is more readily accessible in other publications, Circular 16 (1911) lists publications of the Bureau of Entomology.

(3q) U.S.D.A. Office of the Solicitor.

Circulars

Circular No. 1 (1906) - No. 91 (1918)

Plant Quarantine Laws, etc., are set forth in a series of un-numbered circulars.

(3r) State Relations Service. Popular documents.

Covers Boys' and Girls' Clubs, how teachers may use Farmer's Bulletins, etc. 5 References to entomology.

(3s) U.S.D.A. Division of Statistics.

Contains monthly crop reports on bees, honey, etc., and percentage of damage to given crops, such as rice, cotton, etc., which may affect production and price.

(3t) Weather Bureau.

Originally a part of the War Department, was transferred to the Department of Agriculture in 1890.

Bulletins

No. 33 on weather folk lore mentions insects, p. 24.

Monthly Weather Review

Occasionally contains articles such as Influence of the Wind on the Movement of Insects (Feb. 1920) or The Effect of a Florida Freeze on Insects.

Insular Stations

Under the direction of, or work in cooperation with the U.S. Department of Agriculture.

Alaska. Annual Reports of the Experiment Station for 1915, 1919 and 1920 include short articles on root maggots.

Guam. Two Bulletins, one Circular and Annual Reports issued from 1911 -

Hawaii. Annual Reports³¹ appeared in publications of the Office of Experiment Station. From 1906 to date they have appeared separately.

1902-1903 J. G. Smith, Entomologist
 1904-1908 D. L. Van Dine, Entomologist
 1909-1915 D. T. Fulloway, Entomologist
 1917-1920 J. M. Westgate
 1921-1923 W. T. Pope
 1924-1930 J. M. Westgate

Hawaii Bulletins

From 1902 to 1926, 25 regular bulletins pertained to entomology; 13 Press Bulletins and 3 Extension Bulletins were issued.

Puerto Rico

Annual Reports issued by the Experiment Station since 1903. Of those published, seven bulletins and seven circulars deal either wholly or in part with entomology.

Bulletin No. 1 was published in 1901 and No. 15 in 1912. Five relate to entomology: Some are printed in two editions, one English the other Spanish.

³¹Reports (of the Entomologist)

1896-97 Biennial; 1898 annual. Reports of Minister of Interior from 1905 included in Report of Bd. of Agric. and Forestry. 1905-1908 annual; 1910 biennial.

Virgin Islands

Since 1920 the Experiment Station has issued an Annual Report of the Entomologist, and five bulletins containing some entomological material have appeared. They are of local interest only.

U.S. DEPARTMENTS OTHER THAN THE DEPARTMENT OF AGRICULTURE

U.S. Treasury DepartmentUnited States Public Health Service.

"The Public Health Reports" first published in 1878. Appearing weekly, they are now (1950) in their 65th volume.

Contain (1) current information regarding communicable diseases in the U.S. and, to some extent, diseases in other parts of the world; (2) articles relating to the cause, prevention and control of disease and (3) special articles relating to public health. Under the latter heading will be found many articles relating to insects and other arthropods which transmit disease.

For example, the following titles are taken from six reports chosen at random from volume 55 (1940):

Protective Vaccine Against Epidemic and Endemic Typhus Fever.
Anopheles walkeri a Vector of Malaria in Nature.
 The Burrowing Owl as Host to the Tick Ornithodoros parkeri.
 Tularaemia Infection (Bacterium tularense) Found in Streams.
 Note on Two California Species of Siphonaptera.
 Relapsing Fever Spirochetes in Ornithodoros hermsi.
O. hermsi as a Vector of Relapsing Fever in Idaho.
 Sources, Symptoms and Prevention of Tularaemia.
 Persistence of Bact. tularense in Tissue of Ticks.
 Ticks (Ornithodoros) Found in Arizona Bat Caves.
 Report of Anopheles darlingi in Central America.
 Description of Two New Species of Ticks from Western States.

The National Institute of Health, under the Public Health Service of the Treasury Department,³² has issued a series of Bulletins, some of which bear the sub-title Hygienic Laboratory Bul. Series. U.S. Hygienic Laboratory Series Bulletins 1-172 (1900-1940).

A number are important from an entomological point of view, especially in the medical field.

One of the more recent publications in this series -- Bulletin No. 171, "The Genera Dermacentor and Otocentor (Ixodidae) in the United States with Studies in Variation" -- is a contribution from the Rocky Mountain Tick Laboratory at Hamilton, Mont., by R. A. Cooley. Containing 89 pages, it is superbly illustrated with 30 plates, several of which are colored.

United States Department of the Interior

The only publications emanating from the Department of the Interior which relate to entomology are:

The Reports of the U.S. Entomological Commission previously enumerated, (see page 65) and the ³³ U.S. Geological Survey.

³²The Public Health Service is now under the Federal Security Agency. See also Malarial Control in War Areas P. 84.

³³Title varies: Geological and Geodetic Survey, Geographical Survey, Geological and Geographical Survey of the Territories, etc.

Of the several series of publications emanating from the Geological Survey, such as Annual Reports, Monographs, Bulletins, Special Publications, etc., very few pertain to entomology.

Annual Reports were issued first in 1880; insects occasionally mentioned.

Monographs have been issued from time to time, are numbered 21 to 40. Two, by S. H. Scudder, relate to fossil insects.

Bulletins have been issued since 1883; more than 900 have appeared (up to 1939). A few deal with fossil insects.

Reports cover such activities as the Hayden and Powell Surveys; in most cases, contain a report on zoology, including entomology. Some important papers by such authorities as Le Conte may be found.

Titles and indexes may be found in the following:

"Catalogue and Index of the Publications of the Hayden, King, Powell and Wheeler Surveys", compiled by L. F. Schmickebier and published as Geological Survey Bulletin No. 222 in 1904 (208 pp.).

A complete list of "The Publications of the U.S. Geological Survey", published by the Government Printing Office, Washington.

Catalogue and Index of Publications of the U.S. Geological Survey 1880-1901 by P. C. Warman published as Geological Survey Bulletin No. 177 in 1901 (858 pp.).

A continuation of the above, covering 1901-1903, published as Geological Survey Bulletin No. 215 in 1903.

Publications of the Smithsonian Institution
(The National Museum)

Bulletins:

First issued in 1875, they are composed of lengthy papers on various subjects, monographs, systematic treatment of a group, catalogues, reports of expeditions, etc. Of some 170 bulletins published in this series, many are very valuable works on entomology.

Proceedings.

Began in 1878, they are primarily a means of publication for original papers on material in the National Museum, and are published as separates for distribution as soon after publication as possible. Later, when the whole volume appears the date of distribution for each separate is recorded in the table of contents.

There is one volume per year.

Miscellaneous Publications.

Issued in parts similar to the proceedings. For example, "Catalogue of Lepidoptera of North America" by J. G. Morris issued in May 1860 forms a part of Vol. 3. Volume 103 published in 1944.

Titles of these publications may be obtained from the following sources:

- 1902 Geare, Randolph, I.
List of Publications of the U.S. National Museum 1875-1900.
National Museum Bulletin No. 51, 168 pp.

1906 --

A continuation of the above covering the years 1901-1906.
National Museum Bulletin No. 51 supplement No. 1.

1914 --

A continuation, "Publications issued by the U.S. National Museum
1906-1912," published by the National Museum, not numbered.

II. STATE PUBLICATIONS

Every state in the Union has a State Experiment Station and six states (Washington, Missouri, Virginia, New York, and Connecticut) have two stations. The majority of entomological literature for each state emanates from these stations, most of which are operated in connection with State Colleges. (Each has one to several sub-stations.) Many states have a Department of Agriculture with a Division of Entomology and a State Entomologist. In some cases, the State Forester has an entomologist on his staff. Other states have a Division or Bureau of Natural Resources. Pennsylvania has a Department of Forests and Waters with a Research Division in which an entomologist is employed. Illinois has a State Natural History Survey under the Department of Regulation and Education.

All such departments, boards, commissions, etc., publish circulars, bulletins or reports from time to time, and very often these are of great value to the entomologist.

As an example, the reports of the state entomologists of New York contain a wealth of information and should be found in every entomological library. The early reports are especially valuable and although they are quite old, they are constantly referred to by present day workers.

1854-70 1st to 14th by Asa Fitch, first state entomologist
1882-97 1st to 13th by J. A. Lintner, successor to Fitch
1898-1917 14th to 33rd by E. P. Felt

Many other states have published reports of great value, including Missouri, Illinois and Minnesota, which were among the pioneer states in this work.

Missouri: Reports of the State Entomologist. 1869-77
1st to 9th by C. V. Riley.

Minnesota: Reports of the State Entomologist. 1895-1900
1st to 6th by Otto Luggler 1,489 pp., all published

Illinois: Reports of the State Entomologist
1867 - 1st by B. D. Walsh
1871-74 - 2nd-5th by Wm. Le Baron
1876-80 - 6th to 11th C. T. Thomas
1882-1916 - 12th to 29th S. A. Forbes

Early reports contributed by nearly every state are extremely valuable. A few states issue a regular monthly publication, such as the California State Commission of Horticulture Monthly Bulletin and the Quarterly Bulletin of the Florida State Plant Board, Vol. I of which appeared in 1916. (See serial publications)

A complete list of the Bulletins of Agricultural Experiment Stations in the United States can be found in the following publications:

List of those published from the time of establishment to the end of 1920, in U.S.D.A. Department Bulletin No. 1199 issued in 1924.
Those for the calendar years 1921-1922, in U.S.D.A. Department Bulletin No. 1199, supplement No. 1, issued in 1924.
Those for the calendar years 1923-1924, in supplement No. 2 of Department Bulletin No. 1199, issued in 1926.

Those for 1925-1926, in supplement No. 3 of Bulletin No. 1199, issued in December 1927.

Those for the years 1927 and 1928, "List of Bulletins of the Agricultural Experiment Stations for the Calendar Years 1927 and 1928" in U.S.D.A. Miscellaneous Publications No. 65, issued in January 1930.

Those for 1929-1930 (title as above except for years), in U.S.D.A. Miscellaneous Publications No. 128, January 1932.

Those for 1931-1932 (same title), in U.S.D.A. Miscellaneous Publications No. 181, issued March 1934.

List for 1933-34 in Miscellaneous Publications No. 232, issued February 1936.

List for 1935-1936 in Miscellaneous Publications No. 294 issued March 1938.

List for 1937-1938 in Miscellaneous Publications No. 362 Issued January 1940.

All of the above, except the first, were compiled by Catherine E. Pennington, Library Assistant, Office of the Experiment Station.

All are indexed as to authors and subjects.

Circulars and other publications of the stations are not included.

Many articles are contributed by State Experiment Station workers to the Journal of Agricultural research. See page 60.

The U.S. Library of Congress, Division of Documents.

Monthly check list of state publications, Vol. I, 1910, published in 1912 and continued to date. (Compiled by various authors), will enable those interested to keep up to date.

III. SERIAL PUBLICATIONS³⁴

UNITED STATES

American Entomological Society. Philadelphia. (See also Entomological Society of Philadelphia)

Transactions of - Vol. 1, 1867 - to date.

Memoirs Nos. 1-9, 1916-1937.

Proceedings Vol. 1-6, 1862-1867.

American Entomologist, The. Washington, D. C.

Vol. 1-2, Sept., 1868 - Dec. 1870; Vol. 3 (2nd Ser. V. 1), Jan. - Dec. 1880.

Title Varies. The American Entomologist, 1870; The American Entomologist and Botanist, 1880; The American Entomologist edited by Walsh and Riley. Not published between 1871-1879. Semi-popular illustrated monthly magazine on entomology.

Association of Economic Entomologist, The. Menasha, Wis.

Proceedings of the 1st to the 6th meetings, 1889-1904 appeared in Insect Life:

1. Insect Life Vol. 2, pp. 177-184.

2. Insect Life Vol. 3, pp. 180-250.

3. Insect Life Vol. 4, pp. 4-73.

4. Insect Life Vol. 5, pp. 67-130.

5. Insect Life Vol. 6, pp. 61-201.

6. Insect Life Vol. 7, pp. 55-215.

Proceedings of the 7th to the 19th meetings published in the U.S.D.A. Div. Ent. Bulletins (n. ser.): 2, 6, 9, 17, 31, 37, 40, 46, 52, 60 and 67. Since 1908, they have appeared in the Journal of Economic Entomology.

³⁴A very useful article which should be consulted is "An Annotated Check List of the More Important Entomological Periodicals" by Evelyn S. Claassen in the Ann. Amer. Ent. Soc. 38: 403-411, 1945. Both American and foreign publications are listed.

Proceedings of the 20th meeting are in Vol. I, No. 1, Journal of Economic Entomology. Subsequent meetings detailed in the Journal.

- *American Midland Naturalist,³⁵ South Bend, Ind.
Vol. I, 1929-to date. Published bimonthly at Notre Dame Univ.
- *American Museum Novitates. New York.
1921 to date. Devoted to zoology. Pub. by Amer. Mus. Nat. Hist.
- *Bartlett Tree Research Laboratory, Sanford, Conn.
Bulletins published irregularly; entomological articles by E. P. Felt and others.
- *Bernice P. Bishop Museum, Honolulu, T. H.
Bulletins, 1-172 (No. 172 issued 1942). Numerous papers on polynesian insects.
- *Biological Abstracts, Philadelphia, Pa.
Vol. I, 1916, to date.
Published by the Union of Biological Societies, University of Pennsylvania.
Abstracts all biological articles.
- *Biological Society of Washington, Washington D. C.
Proceedings, Vol. I, 1887 - to date.
- *Boston Society of Natural History Journal, Boston, Mass.
Vol. I (1834), Vol. VIII (1863). All published.
- Boyce Thompson Institute, Menasha, Wis.
Contributions, Irregular; No. 11 appeared in 1939.
- Brooklyn Entomological Society, Brooklyn, N. Y.
Bulletin, First Series Vols, 1-7, 1878-85. Second Series
Vols, 8-45, 1912-50.
- *Buffalo Society of Natural History, Buffalo, N. Y.
Bulletin, Vols, 1-10, 1874-1912.
Vols, 1-5 contain much on Entomology.
- Butterfly Farmer, The. Truckee, Cal.
Vol. I, 1913-1914. All published.
- *California Acoademy of Science Proceedings, San Francisco, Calif.
1st Ser. Vol. I, 1854-57; Vol. II, 1858-62; Vol. III, 1863-1868; Vol. IV, 1869-1873; Vol. V,
1873-1874; Vol. VI, 1875; Vol. VII, 1877.
2nd ser. Vol. 1-6, 1888-1896.
3rd ser. Vol. 1-3, 1897-1904, and Vol. IV, 1-5, 1905-1906.
4th ser. Vol. 1-15, 1907-1926 - to date.
- *California Department of Agriculture, Sacramento, Calif.
Monthly Bulletins, Vol. I, 1911 to date. Contains considerable economic entomology.
- Cheyenne Mountain Museum, Colorado Springs, Colo.
Bulletin, Vol. I, parts 1 & 2 all published.
Part I Hesperioidea. Pt. II Styridae.
- Chicago Entomological Society, Chicago, Ill.
Occasional Momoirs. Vol. I. 1900. All published.

³⁵Works marked with an asterisk (*) are not primarily entomological but often contain papers of interest to the Entomologist.

Coleopterists' Bulletin, Washington D.C.

Vol. I, 1947 - to date. A bi-monthly magazine devoted to Coleoptera.

Contributions to Natural History of the Lepidoptera of North Amer.

Decatur, Ill. Vol. I, 1911 to Vol. V, 1924. Ceased publication in 1924. (Vol. V contains only three numbers.)

*Elisha Mitchell Scientific Society, Chapel Hill, N.C.

Vol. I, 1883. Journal published semi-annually. Sponsored by the North Carolina Academy of Science.

Entomologica Americana, Brooklyn, N. Y.

Vol. I, 1885; Vol. VI, 1890. Ceased publication in 1890. Resumed publication 1926, New series Vol. VII, 1926 - to date. Quarterly, each issue usually a monograph. Published by the Brooklyn Entomological Society.

Entomological News, Philadelphia, Pa.

Vol. I, Jan. 1890 - to date.

Each issue contains bibliographical references to current entomological literature. Ten numbers per volume.

Entomological Society of America, Philadelphia, Pa.

Annals, Vol. I, 1908, to date. Published quarterly.

Thomas Say Foundation publication Vol. I (1916) - Vol. III (1931).

Entomological Society of Philadelphia, Academy of Science, Philadelphia, Pa.

Proceedings, Vol. 1-6, 1861-1867. No more published. Superseded by Transactions of American Entomological Society.

Entomological Society of Washington, National Museum, Washington, D. C.

Proceedings, Vol. I, Feb. 1884, to June 1885. Beginning with Vol. 51 (1949). Issued bi-monthly.

Entomological Student, Philadelphia, Pa.

Vols. I - II, 1900-01 all published. Edited by J. C. Bradley.

Entoma, New Brunswick, N. J.

A directory of insect pest control, listing insecticide manufacturers, insecticides, chemicals, etc. A trade journal, published by the Eastern Branch of the Assoc. of Econ. Entomologists. First published in 1935, bi-annual since 5th edition, 1943. 6th ed. 1945, 10th ed. 1950.

Exterminators Log, Kansas City, Mo.

1933 - date. A trade paper for the pest control industry.

*Experiment Station Record, Washington D. C.

Vol. I, 1889 - discontinued with Vol. 95 & index published in 1946. Two volumes per year with an index to each volume. (See page 69).

*Florida Academy of Science.

Proceedings, Vol. I, 1935 - date.

Florida Entomologist, Gainesville, Fla.

First three Vols. (1917-1919) were entitled the Florida Buggist. 4th entitled Florida Entomologist. 1917 - date.

*Florida, University of, Orlando, Florida.

Publications in biological science - Vol. I, 1925 - to date.

*Great Basin Naturalist, Provo, Utah.

Vol. I, No. 1, July 1939. Nos. 3 and 4 issued as one number in 1940. Vol. II, No. 1, 1941. A quarterly publication issued by Brigham Young University. It is not devoted entirely to entomology but nearly so.

Hawaiian Entomological Society, Honolulu, T. H.

Proceedings, Vol. I, 1905-7; Vol. II 1908-12; Vol. III 1913-17; Vol. IV, 1918-20; Each succeeding Vol. covers a period of three years. The first three volumes consist of 5 numbers. Each volume after 1917, contains 3 numbers.

Hawaiian Sugar Planters Association, Honolulu, T. H.

Bulletin of the Experiment Station, Entomological Series 1 to 20, 1906 to 1928 (No more published).

*Hilgardia, University of California Press, Berkeley, Calif.

Vol. I, 1925 - to date. A Journal of Agricultural Science, published by the California Agricultural Experiment Station. Numerous articles on entomology.

Invertebrata Pacifica, Claremont, Calif.

One Vol. of 12 numbers 1903 to 1907. No more published. (See footnote No. 9, p. 543, in "A History of Entomology" by O. E. Essig.)

Insecutor Inscitiae Menstruus, Washington, D. C.

Vol. I (1913) to 14 (1926) all published. Devoted chiefly to Diptera (especially mosquitoes) and Lepidoptera.

Insect Life, Washington, D. C.

Vol. 1-7, July, 1888 - July, 1895; and General Index, 1897.

- Vol. 1. Nos. 1-12, July, 1888-June, 1889; 388 p.
2. Nos. 1-12, July, 1889-June 1890; 418 p.
3. Nos. 1-12, August, 1890-August, 1891; 519 p.
4. Nos. 1-12, October, 1891-August, 1892; 441 p.
5. Nos. 1-5, September 1892-July, 1893; 402 p.
6. Nos. 1-5, November, 1893-August, 1894; 405 p.
7. Nos. 1-5, September, 1894-July, 1895; 448 p.

General Index to the seven volumes of Insect Life, (1888-1895) 1897. 145 pages. Devoted to the economy and life habits of insects, especially as they relate to agriculture. Edited by C. V. Riley and L. O. Howard.

Insect Pest Survey Bulletin (See page 64)

*Illinois State Laboratory of Natural History, Urbana, Ill.

Bulletin, Vols. 1-16, 1876-1926, published at irregular intervals.

*Journal of Agricultural Research, Washington, D. C.

K series 1913 to 1949

Reprints Nos. 1 (1913) to 233 (1932).

About 90 other entomological papers have appeared; see page 60.

Journal of Economic Entomology. Menasha, Wis.

Vol. I, 1908-to date.

The leading Journal on economic entomology published bi-monthly by the Amer. Assoc. of Econ. Entomologists.

*Journal of Parasitology, Lancaster, Pa.

Vol. I, 1908, to date. Published bi-monthly by the American Soc. of Parasitologists.

Twenty five year index published in 1940. Contains much information on parasitic insects.

Kansas Entomological Society, Manhattan, Kan.

Journal, Vol. I, 1927, to date.

Lepidoptera, Forest Hills and Salem, Mass.

Vol. I, 1916-17, Forest Hills.

Vol. II-V, 1918-1931, published by S. E. Cassino Co.

*Lloydia, Cincinnati, Ohio.

Vol. I, 1938, to date.

A quarterly journal of biological science published by Lloyd Library of Natural History.

Lorquinia, Los Angeles, Calif.

Vol. I, 1916-17.

*Michigan Agr. Exp. Sta., East Lansing, Mich.

Quarterly Bulletin, Vol. I, 1918, to date.

Microentomology, Stanford University Press, Stanford, Calif.

Vol. I, 1938, to date.

North American Entomologist, Buffalo, N. Y.

Vol. I, July 1879 - June 1880. No more published.

Ed. by A. R. Grote.

New Jersey Mosquito Extermination Association, New Brunswick, N. J.

Proceedings, Vol. I, 1913, to date.

New York Entomological Society, New York, N. Y.

Journal, Vol. I, March 1893, to date.

Published quarterly by the Society.

*Ohio Biological Survey, Ohio State University, Columbus, Ohio.

Bulletins, Vol. I, 1913. Suspended 1922-25, 1928, 1931.

No. 38 was issued in 1941. None since.

*Ohio Naturalist, Columbus, Ohio.

Vol. 1-15. (1900-1915) changed to Ohio Journal of Science.

*Ohio Journal of Science, Columbus, Ohio.

Vol. 16, 1916, to date. (Vols. 1-15 were called Ohio Naturalist. See above.)

*Oklahoma Acad. Science Proceedings, Norman, Okla.

Vol. I, 1910-1920, Vol. II, 1921; one volume per year. Very little on entomology after Vol. II. (University of Okla. in co-operation with the Okla. Acad. of Science).

Pacific Coast Entomological Society, San Francisco, Calif.

Proceedings, Vol. I, 1901-1921. Fifteen parts (all published).

Replaced by Pan-Pacific Entomologist.

*Pan-American Sanitary Bureau, Washington, D. C.

Bulletin Vol. I, 1921, to date. Published monthly by the Bureau. Articles in Spanish, English, Portuguese and French. Largely devoted to the field of medical entomology.

Pan-Pacific Entomologist. San Francisco, Calif.

Vol. I, 1924, to date. Published by the Pac. Coast Ent. Soc.

Papilio, New York and Philadelphia, Pa.

Vol. I, 1881 Vol. IV, 1884. No more published. Edited by Hy Edwards and E. M. Aaron. Devoted exclusively to Lepidoptera.

- *Peninsula Horticultural Society, Dover, Del.
Proceedings (Annual).
Contains numerous articles on entomology.

- Pest Control and Sanitation, Hollywood, Calif.
Vol. I, 1932, to date. Monthly organ of the pest control industry.

- *Philadelphia Academy of Science, Philadelphia, Pa.
Proceedings, Vol. I, 1841, to date.

- *Philippine Journal of Science, Manila, P. I.
Vol. I, 1906 - Vol. 76, 1941. Preceded by a series of 36 bulletins from government laboratories.
Three volumes per year to 1941.

- *Philippine Journal of Agriculture, Los Banos, P. I.
Vol. I, 1911 - Vol. 29, 1938.

- *Pomona Journal of Entomology and Zoology, Pomona, Calif.
Vol. 1, 1909, to Vol. 42, 1951. Ceased publication in Aug., 1951.

- Practical Entomologist, The, Philadelphia, Pa.
Vol. I, Oct. 1865 - Sept. 1866.
Vol. II, Oct. 1866 - Sept. 1867. No more published.
Published by Ent. Soc. of Philadelphia (Amer. Ent. Soc.) monthly. Cresson, Grote, McAllester and Walsh, editors.

- Psyche, Cambridge, Mass.
Vol. I, May 1874 to Apr. 1875; Vol. 57, 1950.
A monthly journal of entomology published by the Cambridge Entomological Club.

- *Science, Washington, D. C.
Vol. 1-23 First Series 1883-1894.
Vol. I, 1895, New Series to Vol. 93, 1945, to date (Published weekly).

- *Southern California Academy of Science, Los Angeles, Calif.
Proceedings Nos. 1-6 - 1896-1899.
Bulletin, Vol. I, 1902, to date. One volume each year.
Contains many articles on entomology.

- *Tennessee Acad. Science, Nashville, Tenn.
Journal, Vol. I, 1925, to date (Some entomology).

- *Texas Academy of Sciences, Austin, Texas.
Transactions, Vol. I, 1917, to date.

- *United States National Museum, Washington, D. C.
Proceedings, Vol. I. 1878-to date.
Devoted very largely to zoology, with much of interest to entomologists.

- University of California, Berkeley, Calif.
Publications in Entomology, Vol. I, 1906 - Vol. VII, 1934.

- University of Washington, Seattle, Wash.
Publications in Biology, Vol. I, 1934-to date. Largely entomology.

*Utah Academy of Science, Arts and Letters, Salt Lake, Utah.
Proceedings, Vol. I, 1927-to date.

Ward's Entomological Bulletin, Rochester, N. Y.
A trade journal with many interesting notes. Ward's
Natural Science Establishment.

*Washington Academy of Science, Washington, D. C.
Journal Vol. I, 1911-to date.

*Wasmann Collector, The, San Francisco, Calif.
Vol. I, 1940-to date.
Devoted to biology in general and published quarterly by the
Wasmann Biological Society of the University of San Francisco.

*Wisconsin Natural History Society, Milwaukee, Wis.
Bulletin 1-190. Published in cooperation with the Public
Museum of the City of Milwaukee. Contains some entomology.

International Congress on Entomology.
Transactions 1 to 8 (See below).

Since the transactions of this society belong to the entire scientific world, they cannot be listed under any one country.

There have been eight meetings and the transactions were printed in the country where the meetings were held. The papers are printed in the language of the author, i.e., in the language in which they were presented at the meetings. Many very important papers have appeared in these transactions.

The meetings have been held at irregular intervals as follows:

| | | |
|-----|------|---------------------|
| 1st | 1910 | Brussels, Belgium |
| 2nd | 1912 | Oxford, England |
| 3rd | 1925 | Zurich, Switzerland |
| 4th | 1928 | Ithaca, U. S. A. |
| 5th | 1932 | Paris, France |
| 6th | 1935 | Madrid, Spain |
| 7th | 1938 | Berlin, Germany |
| 8th | 1949 | Stockholm, Sweden |

BOTANICAL PUBLICATIONS OF INTEREST TO THE ENTOMOLOGIST

Many articles on the inter-relationship of insects and virus diseases, insects and fungi, and similar subjects will be found in botanical publications:

American Journal of Botany, Burlington, Vt.
Vol. I, 1913-to date.

Botanical Review, Lancaster, Pa.
Vol. I, 1934-to date.

Botanical Gazette, University of Chicago, Chicago, Ill. (Crawfordsville, Ind.)
Vol. I, 1875-to date. (Vol. I issued as Botanical Bulletin.)

British Mycological Society, London, England.
Bulletin 1916-to date.
Articles on entomogenous fungi and related subjects.

Phytopathology, Lancaster, Pa.
Vol. I, 1910-to date.
Published monthly by the American Phytopathological Society.

Review of Applied Mycology, Kew, England.
Vol. I, 1929-to date.

Mycologia, The New York Botanical Gardens, New York.
Vol. I, 1909-to date.

CHEMICAL PUBLICATIONS OF INTEREST TO ENTOMOLOGISTS

Many articles on insecticides will be found in these publications:

Industrial Engineering Chemistry, Chicago, Ill.
Published annually since 1928.

Journal Association of Agricultural Chemistry, Washington, D. C.
Vol. I, 1917-to date.

Journal of Organic Chemistry, Bethume, Md.
Vol. I, 1924-to date.

Soap, New York, N. Y.
Vol. I, 1935-to date.
A trade paper.

MEDICAL PUBLICATIONS OF INTEREST TO ENTOMOLOGISTS

Much information relative to insects and diseases appears in purely medical publications, some of which are listed below:

American Journal of Hygiene, Lancaster, Pa.
Vol. I, 1910-to date.

American Journal of Public Health and the Nation's Health, Boston, Mass.
American Pub. Health Assoc.
Vol. I, 1911-to date.

American Journal of Tropical Medicine, Baltimore, Md.
Vol. I, 1920-to date. Published bi-monthly.

American Medical Association, Chicago, Ill.
Journal, Vol. I, 1883-to date.

American Veterinary Medical Association, Chicago, Ill.
Journal Vol. I, 1877- (Vol. 99, 1941). Two volumes per year.

Ectoparasites, London, England.
Vol. I, 1915-to date.

Hygienic Laboratory Bulletins, Washington, D. C.
(See page 72).

Helminthological Abstracts, St. Albans, Eng.
Vol. I, 1923-to date. Contains abstracts of current articles with subject and author index in each issue. Published at irregular intervals, five or six numbers a year.

Helminthological Society of Washington, D. C.
Proceedings, Vol. I-1933-to date.

- Journal of Parasitology, Lancaster, Pa.
Vol. I, 1914-to date. Published bi-monthly by Amer. Soc. of parasitologists.
25-year index published in 1940.
- Journal of Hygiene, Cambridge, England.
Vol. I, 1900-to date.
- Medicina, Mexico City, D. F.
Vol. I, 1920-to date.
- Medical Journal of Australia, Sydney, Australia.
Vol. I, 1939-to date.
- Medical Parasitology, Moscow, Russia.
1931-1939. In Russian - Usually a summary in English, French or German.
- Memoirs Institute Oswald Cruz, Rio de Janeiro, Brazil.
1905-1940.
- National Institute of Health Bulletins, Washington, D. C.
Continuation of Hygenic Lab. Bulletins. (See page 72).
- Parasitology (English), Cambridge and London, England.
Vol. I, 1908-to date.
- Public Health Reports, Washington, D. C.
See page 72.
- Puerto Rico Journal of Public Health and Tropical Medicine.
(Printed in Menasha, Wisconsin).
Vol. I, 1924-to date. English and Spanish.
- Revista de la Facultad de Medicina, Bogota, Colombia.
Vol. I, 1933-to date. Contains articles on mosquito-born disease, etc.
- Revista del Institute de Salubridad y Enfermedades Tropicales. Mexico, D. F.
Vol. I, 1939-to date. Quarterly, contains papers relative to public health.
- Rivista Malarial, Rome, Italy.
1921-1939 (Perhaps longer).
- Tropical Disease Bulletin, London, England.
Vol. I, 1903-to date.
Published by the Bureau of Hygiene and Tropical Disease.
An important abstract journal containing much information relative to medical entomology and parasitology of the world.
- Because of the importance of malaria and other diseases in war time, a great many articles relative to this subject have appeared. Many of these were printed in publications unknown to, or seldom consulted by entomologists. Some of these are:
- American Journal of Pathology, Boston, Mass.
Vol. I, 1925 - Vol. 20, 1945-to date.
- American Journal of Tropical Medicine, Baltimore, Md.
Vol. I, 1920 - Vol. 25, 1945-to date.
- Archives of Internal Medicine, Amer. Medical Assoc., Chicago, Ill.
Vol. I, 1883 - Vol. 62, 1945-to date.
- Journal of Bacteriology. Society of Amer. Bacteriologists, Baltimore, Md.
Vol. 1, 1896 - Vol. 49, 1945-to date.

Journal of General Physiology. Boston and Baltimore.
Vol. I, 1917 - Vol. 28, 1945-to date.

Journal of Immunology, Baltimore, Md.,
Vol. I, 1895 - Vol. 50, 1945-to date.

Journal of Infectious Diseases, Menasha, Wis.
Vol. I, 1871 - Vol. 74, 1945-to date.

Journal of the National Malarial Society, Washington, D. C.
Vol. I, 1907 - Vol. 38, 1945-to date.

Malarial Control in War Areas, Atlanta, Ga.
Monthly Report of the Federal Security Agency - U. S. Public Health Service.
A mimeographed report issued from 1942-1945.
These are intended primarily for workers engaged in malarial control work
and many issues are restricted.

Mosquito News, New Brunswick, N. J.
Organ of the American Mosquito Control Association, Vol. I, 1941-to date.

Society for Experimental Biology and Medicine, New York, N. Y.
Proceedings, Vol. I, 1903-to date.

Southern Medical Journal, Birmingham, Ala.
Vol. I, 1907-to date.

Transactions of the Royal Society of Tropical Medicine and Hygiene, Manson
House, London, W. 1, England.
Vol. I, 1906-to date.

OTHER PUBLICATIONS (Not primarily entomological)
OF INTEREST TO ENTOMOLOGISTS
(Domestic and Foreign)

American Forest and Forest Life, Washington, D. C.
Published by the American Forestry Association.
Vol. I, 1894. Carries occasional articles of a semi-popular nature on forest insects.

American Lumberman, Chicago, Ill.
Vol. I, 1899-to date.
Articles on termites and wood borers.

American Wild Life Conference, Washington, D. C.
Transactions, Vol. I, 1936. Articles on animal parasites.

American Naturalist, Boston, Mass.
Vol. I, 1867-to date. Contains semi-popular entomological articles from time to time.

American Wood Preservers Association, Chicago, Ill.
Proceedings, 1905-to date. Carries many articles on termites and other wood-boring
insects and their control.

Annals of Applied Biology, London, England
Vol. I, 1913-to date.

Canadian Journal of Research, Ottawa, Ont.
Vol. I, 1924-to date. Published by National Research Council in four sections, section D
of which is devoted to zoological sciences. Monthly.

Canadian Sportsman and Naturalist, Montreal, Que.
Vols. 1-3, 1881-1883, consecutively numbered pages. Contains articles on entomology.

Caribbean Forests, Rio Piedros, P. R.

Vol. I, 1940-to date. Deals with forest insects of the Caribbean area.

Forest Worker, Washington, D. C.

Vol. I, 1924.

Published bi-monthly by the Forest Service, U.S.D.A.

Journal of American Forestry.

Vol. I, 1902-to date. Carries many articles concerning forest insects, especially the economic aspects of same.

Journal of Animal Ecology, London, England.

Vol. I, 1932-to date.

Journal of Experimental Biology, London, England.

Vol. I, 1923-to date.

Journal of Experimental Zoology, Philadelphia, Pa.

Vol. 91, 1942-to date.

Main Forest Service, Augusta, Maine.

Bulletin No. 1, 1923, No. 5, 1925. Issued irregularly.

Michigan Agricultural Experiment Station, East Lansing, Mich.

Quarterly Bulletin. Vol. I, 1918-to date.

Microscopical Society, London, England.

Quarterly Journal. Vol. I, 1876-to date.

National Shade Tree Conference. Ohio State Univ., Columbus, Ohio.

Proceedings; (annual) since 1924.

Nature, London, England

A very old and popular publication now (1950) in its 159th Volume.

Scientific Agriculture (Canadian), Ottawa, Que.

Vol. I, 1921-to date. A Canadian research journal similar to U. S. Journal of Agricultural Research.

The Timberman, Portland, Ore.

Vol. I, 1899-to date.

Tropical Agriculture, Trinidad, B. W. I.

Vol. I, 1933-to date.

FOREIGN SERIAL PUBLICATIONS

AUSTRIA

Konowia, Vienna.

Vol. I, 1922. Published up to 1938, possibly longer.

BELGIUM

Bulletin Agriculture Congo Belgique. Brussels.

1909-1929-? Published in French with an English summary of many articles.

Société Entomologique de Belgique. Brussels.

Bulletin et annals published at irregular intervals since 1857. Memoires published irregularly.

Catalogue de la bibliotheque, Brussels, 1871-1881.

BRAZIL

Biologico, San Paulo.
Vol. I, 1934-to date.

Revista de Entomologic. Rio de Janerio.
Vol. I, 1931-to date.
An illustrated quarterly review of Entomology. Articles are presented in French,
English, Portuguese, Spanish and German.

Papéis a vulsos do Departamento de Zoologia. Santa Paulo.
Vol. I, 1941-to date.

BRITISH COLONIES (Exclusive of Br. North America)

Agricultural Journal of Fiji, Suva, Fiji.
Vol. I, 1929 - Vol. 14, 1943.

Entomological Society of Southern Africa, Pretoria, S. A.
Journal. Vol. I, March 1932 - Vol. II, Oct. 1939.

Entomological Society of India, New Delhi, India.
Indian Journal of Entomology. Vol. I, 1933-to date.

Journal Department of Agriculture of So. Australia, Adalaid, Australia.
Vol. I, 1896? - Vol. 47, 1943.

Linnean Society of New South Wales, Sidney, Australia.
Proceedings, 2nd series began in 1886 with Vol. I.

Queensland Agricultural Journal, Brisbane, Australia.
Vol. I, 1886 - Vol. 57, 1943.

CANADA (Including Nova Scotia and New Brunswick)

Acadian Entomological Society.
See Ent. Soc. of Nova Scotia.

Acadian Naturalist, Fredricton, N. B.
Vol. I, 1943-to date.

Canadian Entomologist, Guelph, Ontario.
Vol. I, 1868-to date.
Published by the Ent. Soc. of Ontario (Toronto)

Canadian Journal of Research (See page 85.)

Entomological Society of British Columbia; Vernon and Victoria, B. C.
Proceedings. No. 1, 1911-to date. One number each year. Quarterly Bulletin Nos.
1-10 issued March, 1906, to June, 1910. No more issued.

Entomological Society of Nova Scotia and the Acadian Entomological Society, Truro, N. S.
Proceedings. (Vol. 7-10 Proc. Acadian Ent. Soc.) Nos. 1-10, 1915-1924. No more
published.

Entomological Society of Ontario, Toronto, Ont.
Annual Reports. 1870-to date.
One report each year.
Title of early reports: "Annual Report of the Noxious Insects of the Province of
Ontario."

Le Naturaliste Canadien.
Published in various places; see below.
Vols. 1-42, Dec., 1868, to June, 1926.

Vols. 1-20, published by L'Abbe Provancher, 1868-90. (1-8 at Quebec; 9-20 at Cap Rouge.)

Vols. 21-48, published by Canon Huard, 1894-1926. (21-28 at Chicoutomi; 29-52 at Quebec.) Each volume consists of 12 numbers, except Vol. 14 (three issues only: January, February, October, 1883.)

Vol. 12 (Nos. 133-144) extended over a period of two years 1880-81.

Vol. 15 began July, 1885, and Vol. 20, (Nos. 11 to 12; pages 201-253) with general index of contents of the Provancher series of 20 volumes, appeared July, 1891.

The Huard series began July, 1894.

The founder of this magazine, Provancher, was, during his lifetime, almost the only contributor to its pages. The Provancher volumes average about 400 pages each (Volume 14, 76 pages only); are largely devoted to entomology. There are but few plates, and plates 1 and 2, referred to in text of Volume 3, were probably never issued to subscribers.

Province de Québec Ministère des Terres et Forêts, de la chasse et de la Pêche
Service d'entomologie, Québec.

Contributions. Published irregularly, at least 20 having appeared to 1943.

Articles in English or French.

Quebec Society for the Protection of Plants from Insects and Fungus Diseases,
Québec.

Annual reports published by the Provincial Legislature as a supplement to the
Report of the Department of Agriculture. First Annual Report 1907-08, to date.

Reports of the Entomologist of Canada, Ottawa, Ont.

1st and 2nd, 1884-1885.

Succeeded by the Reports of the Entomologist and Botanist.

CHILE

Revista Chilena de Historia Natural, Santiago.

Vol. 1, 1896 - Vol. 49, 1945.

CHINA

Agricultural index to periodicals and bulletins in Chinese and in English.

Compiled by the Division of Agric. History, Dept. of Agric. Econ., Univ. of Nanking,
Nanking, China.

Covers the period 1858-1931, published in 1933 - 731 pp. Supplement covering
1932-1934, published in 1935 - 348 pp.

Entomology and Phytopathology, Hangchow.

1933 - ? Published by the Bureau of Entomology of China.

Chinese Journal of Zoology, Nanking.

Vol. I, 1935 to 1940, possibly longer.

Published by the Zoological Society of China.

Bureau of Entomology, Hangchow.

Technical Bulletin. No. 4, 1931.

Lingnan Agricultural Review, Canton.

Canton Christian College.

Quarterly founded in 1922. In 1927 changed to:

Lingnan Science Journal, Canton.

1927, to date ? Published in English and Chinese.

Musee Hunde, Shanghai.

Notes d'entomologie chinoise.

Published irregularly at Université l'Aurore.

Pekin Society of Natural History, Peking.
 Bulletins Vol. I, 1926, Vol. 4, 1930.
 Combined with the Bulletin of the Dept. of Biology, Yenching Univ. to form the
 Peking Natural History Bulletin.

Peking Natural History Bulletin, Peking.
 1930-?

CZECHOSLOVAKIA (CECHOSLOVAKENSIS)

Sborník Entomologického oddelení národního, Prague.
 Bulletin of the Entomological Section of the National Museum.

Acta Societatis entomologicae, Bohemiae.
 Vol. I, 1904 - 1939?

DENMARK

Entomologiske Meddelelser; udgivne af Entomologisk Forening, Copenhagen.
 Vol. 1-5, 1887-1896.
 Series 2, Vol. I, 1897-to date.
 Text in various languages.
 Videnskabelige Meddelelser Naturh fra Dansk Naturhistorisk Forening, Copenhagen.
 Vol. I, 1857 - Vol. 84, 1927.

ENGLAND

Annals of Applied Biology, London.
 Vol. I, 1913-to date.

Amateur Entomologist, London.
 Vol. I, 1935-to date.
 Journal of the Amateur Entomological Society.

British Entomological Society, Southampton.
 Journal Vol. I, 1933-to date.

Bulletin of Entomological Research, London.
 Vol. I, 1910-to date.
 Published quarterly by the Imperial Institute of Entomology. Name changed to
 Commonwealth Institute of Entomology.

City of London Entomological Natural History Society, London.
 Transactions: Vol. I, 1890 - Vol. 42, 1932.

Cistula Entomologica, London.
 Vol. 1, 1869-76. 578 pp. 10 pl.
 Vol. 2, 1877-82. 619 pp. 11 pl.
 Vol. 3, (Parts 26-29.) 1882-83. 152 pp. 5 pl.

Empire Marketing Board, London.
 Bulletins. Cover all phases of agriculture throughout the British Empire. The
 following have been issued on entomological subjects:
 No. 12, Report on Insect Infestations of Dried Fruit.
 No. 17, Schistosomiasis and Malaria in Relation to Irrigation.
 No. 24, Report on Insect Infestation of Stored Cacao.
 No. 29, The Biological Control of Insects and Plant Pests.
 No. 42, A Preliminary Report on an Investigation into the Biological Control of
 West Indian Insect Pests.

Entomologist's Record and Journal of Variation, London.
 Vol. I, 1890-to date.

- Entomological Current Literature, London.
Vol. I, 1932-to date.
- Entomologist's Annual, London.
Vol. I, 1855, to Vol. 20, 1874. Discontinued.
- Entomological Magazine, London.
Quarterly. Vol. I, 1832-1833 - Vol. V, 1837-38. Changed to "The Entomologist".
(See below)
- Entomologist's Monthly Magazine, London.
Vol. I, 1864-to date.
- Entomologist's Weekly Intelligencer, London.
Started April, 1856, Vol. I. Suspended with Sept., 1861, issue, Vol. X.
- Entomological Society of London.
See Royal Entomological Society of London.
- Entomological Society of London, London.
(The earlier Society of same name.)
Transactions: Vol. I, 1812. XII: 340 pp: 9 col. pl. No more issued.
- Journal of Entomology, Descriptive and Geographical, London.
Started April, 1860. Suspended June, 1866. Two volumes published.
- Novitates Zoologicae, Tring.
Vol. I, 1883 - ?
- Magazine of Natural History, London.
Vols. 1-9, edited by Loudon, 1826-36.
Vols. 1-4, edited by Loudon and Charlesworth, 1837-40.
Two of the forerunners of the Annals and Magazine of Natural History.
- Parasitology, Cambridge.
A supplement to the Journal of Hygiene. Vol. I, 1908-to date.
- Review of Applied Entomology, London.
A monthly descriptive record of important current entomological publications of agriculture and medical interest to the entire world. Issued to two Series, A--Agricultural; b--Medical and Veterinary. Vol. I, Published in 1913-to date.
- Royal Entomological Society of London, London.
Transactions. Vol. I, 1836?, to date.
Proceedings:
Series A: General Entomology, Vol. I, 1926-to date.
Series B: (Formerly STYLOPS), Vol. I, 1932-to date.
Devoted to systematic papers.
Series C: Vol. I, 1936-to date. Account of the meetings.
- The Society for British Entomology, London.
Transactions: Vol. I, 1934-to date.
Journal: Parts 1 and 2, 1934. Parts 3 and 4, 1935. Parts 5 and 6, 1936. Parts 7 and (?), 1937.
- The Entomologist, London.
Vol. I, 1840-42, Vol. II, 1864.
Suspended 1843-1863. Articles during this period printed in The Zoologist.
- Zoological Society of London, London.
Transactions: Vol. I, Part 1, 1833.

General Index of Vols. 1-10, 1881.
 Proceedings. 1864-1916, all with colored plates.

FINLAND

Annals Ent. Fennici, Helsinki.
 Vol. I, 1935 - Vol. 16, 1940 (continued)?

Finnish entomological literature published in 1934-1939 including economic entomology and control of insect pests.

By Niilo A Vappula, Helsinki.

| | | |
|------|------|-------------|
| 1934 | 17p. | 200 entries |
| 1935 | 22p. | 350 entries |
| 1936 | 24p. | 350 entries |
| 1937 | 24p. | 350 entries |
| 1938 | 22p. | 361 entries |
| 1939 | 16p. | 250 entries |

Notulae entomologicae, edidit Societas entomologica helsingforsiensis, Helsinki.
 Vol. I, 1921-to date. Four number a year, with text in German, English, Swedish.

FRANCE

Annales des Epiphytes, Paris.
 Semi-monthly (Six numbers to volume).
 Founded 1912. Vol. 18, 1932, one volume per year to 1939.

Bulletin de la Societe Entomologique de France, Paris.
 Semi-monthly founded in 1832; text in French. Was issued with the Annals through 1893; Appeared separately from 1894 to 1940. Suspended publication due to war conditions.

L'Abeille, Paris.
 Vol. I, 1864 - Vol. 49, 1940. Probably suspended. Devoted exclusively to Coleoptera.

Petites Nouvelles Entomologiques, Paris.
 Vol. I, Nos. 1-138, 1869-1875, 554 pages.
 Vol. II, Nos. 139-216, 1876-1879, 312 pages.
 (No more published).

Revue Francaise d'entomologie, Paris.
 Museum National D'histoire Naturelle.
 Labratoire d'entomologie.
 Bulletin. Vol. I, 1912. Annual. Some English.

Revue de pathologie vegtote et d'entomologie agricole, Paris.
 Vol. I, 1914-to date.

Societe Entomologique de France, Paris.
 Annals: One volume per year. Founded in 1832.
 Bulletin: Early volumes not numbered.
 Vol. 37, 1932-to date. French.

GERMANY

Bibliographica Zoologica, Berlin.
 Vol. I, 1896. Vol. 50, 1940. Literature listed in language in which it appeared.
 One volume per year.

Entomologische Litteraturblätter, Bernburg.
 Vol. I, 1901 discontinued with Vol. 14, 1915. Text in German.

Repertorium entomologicum. Herausgegeben von der Deutschen entomologischen Gesellschaft, Berlin.

Vol. I, 1924-?

Entomologische Blätter; Zeitschrift für Biologie und Systematik der Käfer.

Vol. I, 1905-to date ? Bi-monthly.

Entomologische Zeitung. Printed at various places, see below.

Stettiner. Founded in 1840. Vol. 101, 1940. German. Printed at Stettin, Leipzig, Altenburg and Weiman. Title varies.

Neue Beiträge zur Systematischen Insectenkunde, Berlin.

Irregularly published. Founded 1801.

Supplementa Entomologica. Published at various cities, see below.

Irregularly published since 1912 by German Entomological Museum. Printed at Potsdam (1-9) and at Lucka (10, to date). Vol. 17 appeared in 1929. Text in German.

Zeitschrift für wissenschaftliche Insektenbiologie, Berlin.

(Varying number in each volume year.)

Founded 1896 as: Allgemeine Zeitschrift für Entomologie. Name changed in 1905. Vol. I, 1905, to Vol. 27, 1937. Suspended publication.

Zoologischer Anzeiger, Leipzig.

Founded in 1878, Vol. 65, 1940. Semi-annual with text in German, French and English.

ITALY

Bollettino della Societa entomologica italiana, Genoa.

Vol. I, 1869 - Vol. 59, 1927. Possibly published up to 1939. Memorie Vol. I, 1922 - Vol. 12, 1932.

Bolettino di Entomologia agraria, Padua.

Annual 1894-1901.

Contribuzione Alle Consocenze dei, Portici.

Termitidi e Termitoflora del America Meridionale Portici. Vol. I, 1903 - Vol. 19, 1931. Italian.

Redia Giornale di entomologia, Florence.

Monthly. Founded in 1903. Italian. (Occasional articles in English or French.)

Rivista Biologiche Colon, Rome.

Vol. I, 1938-?

JAPAN

Botany and Zoology, Tokyo.

Vol. I, 1932 - Vol. 8, 1940.

Insecta Matsumurana, Imperial University, Sappora.

Vol. I, 1926, ceased publication in December 1942. Articles in Japanese, English, German and French.

Insect World, Gifu. (In Japanese)

Vol. I, 1895 - Vol. 44 appeared in 1940. Discontinued 1945.

Kansai Entomological Society, Kyoto.

Transactions Vol. I, 1930 - Vol. 9, 1939. Discontinued in February 1944.

Kontyu, Tokyo.

Vol. I, 1926 - Vol. 13 appeared in 1939. Discontinued in August 1944.

Natural History Society of Formosa, Taihoku, Formosa.
Transactions Vol. I, 1911 - Vol. 30, 1940. Ceased in December 1944.

Oyo-Kontyu. Published by Nippon Society of Applied Entomology, Imperial Agriculture Experiment Station, Nisigohara, Takinogowa, Tokyo.
Vol. I, 1938 - Vol. II, 1940. Discontinued October 1943.

So far as known to the author, the foregoing have not resumed publication at this time (1950) except *Insecta Matsumurana*. This publication or a new one under the same name appeared with Vol. I, 1948. (two numbers) Vol. II, 1949. Published Quarterly.

Nippon Lepidopterological Society, Kyoto.
Transactions, Vol. I, No. 1, December 1945, four parts to each volume, published at irregular intervals. Text in Japanese.

MEXICO

Ciencia, Mexico, D. F.
Vol. I, 1940. A quarterly review of Spanish American Science.

LaNaturaleza, Mexico, D. F. (Museo Nacional de Historia Natural; Sociedad Mexicana de Historia Natural).
Vol. 1-7, June 1, 1869-1886.
Series 2, Vol. 1-3, 1887-1903.
Series 3, Vol. I, Nos. 1-4; 1910-1912. Ceased publication.

POLAND

Roczn Ochr Rosl, Warsaw.
1933-1938.

Bulletin Entomologique de la Pologne, Warsaw.
Tom (Vol.) I, 1922- Tom IV, 1926.

RUSSIA

Societe Imperiale des Naturalistes, Moscow.
Bulletin. Vol. I, 1829, Vol 62, 1886. New Series. Vol. I, 1887, Vol. 30, 1916.
New Series. Section Biologique. Vol. 31, 1917. Vol. 37, 1928.

Early volumes contain original descriptions of many insects collected by Russian naturalists in Alaska, British Columbia and along the North Pacific Coast of the United States.

Revue Entomologicae U.R.S.S., Leningrad.
Vol. I, 1911. Vol. 27, 1938 ? Articles in Russian, usually with summary in English or German.

Revue Russe d'Entomologie, St. Petersburg.
Tom I, 1900 - Tom 20, 1926.

SPAIN

Eos. Revista Española de Entomología, Madrid.
Vols. 1-11 issued 1925-1935. Vol. 12, Nos. 1-4 (June 1937). Discontinued. Quarterly. Spanish. (Occasional articles in English, French or Italian.)

Bulletin de la Sociedad entomologica de España, Madrid.
Tom. I, 1918 - Tom X, 1927 - ?

SWEDEN

Entomologisk Tidskrift, Stockholm. (Formerly at Upsala.)
Founded in 1880, each volume a single number with text in Swedish. (Some papers in English or German.) Continuous 1880-1928, possibly longer.

Meddelanden Från Statens Skögsforsöksanstalt, Stockholm.
Haft (Vol.) I, 1904? - Published to 1930, possibly longer.

Opuscula Entomologica, Lund.

Published by Societas Entomologica Lundensis. Began publication in July 1936; probably suspended due to the war. Quarterly with text in Swedish, English or German.

Sartryck ur svenska skagsvärd sföreningens Tidskrift, Stockholm.
Häft, 1924? - 1934 - probably longer.

Except for fundamental works or those of especial value, older works have been omitted in the following, but may be found listed in U.S.D.A. Bulletin No. 81--"A List of Works on North American Entomology" by Nathan Banks, 1910.

IMPORTANT WORKS ON GENERAL ENTOMOLOGY

- 1734-42 Reamur, R.A.F. de.
Memoires pour servir a l'Histoire des Insectes. 6 vols., 267 plates. Paris.
- 1758 Linnaeus, C.
Systema Naturae. Tenth edition. Tomus I, Regne Animal. 823 pp. (Engelmann facsimile Edition, Lipsiae, 1894. An exact reproduction of the 1758 edition.)
This Tenth Edition of Linnaeus has been universally adopted as the cornerstone and beginning of all modern zoological science and classification.
Linnaeus arranges the
Mammalia (pp. 14 - 77) in 39 genera with 184 species.
Aves (pp. 78 - 193) in 63 genera with 554 species.
Amphibia (pp.194 - 238) in 16 genera with 217 species.
Pisces (pp.239 - 338) in 51 genera with 378 species.
Insecta (pp.339 - 640) in 75 genera with 2109 species.
Vermes (pp.641 - 823) in 69 genera with 936 species.
- 1775-1801 Fabricius, J. C.
1775 Systema Entomologiae (832 pp.).
1776 Genera Insectorum (310 pp.).
1778 Philosophia Entomologica (178 pp.).
1781 Species Insectorum. Two volumes (over 1000 pp.).
1787 Mantissa Insectorum. Two volumes (730 pp.).
- 1792-1798 Entomologia Systematica. emendata et aucta.
Volume 1, 1792 XX: 330:538 pp.
Volume 2, 1793 VIII: 519 pp.
Volume 3, 1793-4 IV: 487:349 pp.
Volume 4, 1794 VI: 472 pp.
and
Suppl. 1798. 2:572 pp.
- 1801-1807 Systema Eleutheratorum
Volume 1, 1801. XXIV:560 pp.
Volume 2, 1801. 687 pp.
Volume 3, 1803. Systema Rhyngotarum. 314 pp.
Volume 4, 1804. Systema Piezatorum. 439 pp.
Volume 5, 1806. Systema Antiliatorum. 372 pp.
Volume 6, 1807. Systema Glossatorum.
- 1813-1827 Gyllenhal, Leonhard
Insecta Suecica descripta - Four volumes.
- 1824 Say, Thomas
The scattered writing of Thomas Say on "American Entomology" were gathered together and published under the above title in three volumes at New York. These were edited by J. L. LeConte, and published in Philadelphia in 1859.

- 1834-1838 Lacordaire, Jeane T.
Introduction a l entomologie. Two volumes. A very important source work on classifications.
- 1837 Kirby, Wm.
Fauna Boreali Americana (Richardson). In four volumes, this work was published in Norwich, England. The original is very rare.
- Part IV on Insects was written by Wm. Kirby and contains the original descriptions of many North American forms. A reprint of the portion pertaining to "Insects of the Northern Parts of British America," in abridged form, was published by the Entomological Society of Ontario in the Canadian Entomologist, beginning in April, 1870, (Vol. II, No. 6), and completed in 1876 (Vol. VII). It was then issued (undated) as a separate work.
- This work is annotated, bringing the nomenclature up to date of publication. There is also an appendix, by Dr. George Horn, noting synonymy, etc.
- 1871 Schröder, Christoph Wilhelm Marcus
Handbuch der entomologie, bearb. von dr. C. Börner .. prof. dr. P. Deegener .. prof. dr. K. Eckstein .. (u.a.) hrsg. von prof. dr. Chr. Schröder ... Jena, G. Fischer, 1925-29
Three Vols. Reissued in 1925-29.
V. 1 "bringt die bearbeitung der Anatomie, Histologie und Morphologie der Larven und Imagines, der Oo - und Spermatogenese wie Embryogenie, die allgemeinen Morphologie der Erscheinungen der Parthenogenesis, Dimorphose, Metamorphose.." (Various authors)
V. 2 Bionomie, Blütenbiologie, Psychologie, Zoogeographie, Deszendenztheorie. (Various authors)
V. 3 Bearbeitung der Paläontologie and Phylogenie wie der systematischen Übersicht, von dr. A. Handlirsch.
- 1879-1915 Godman, F. D., Salvin, O., and others
Biologia Centrali-Americana
This monumental work, planned and executed by F. D. Godman and O. Salvin, entirely at their own expense, covers the Fauna, Flora and Archaeology of Mexico and Central America. The zoology portion was issued in 215 quarto parts, 1879-1915 with 886 colored and 275 plain plates as follows:
- Coleoptera, by J. S. Baly, H. W. Bates, W. F. H. Blandford, G. C. Champion, H. S. Gorman, G. H. Horn, M. Jacoby, K. Jordan, G. Lewis, A. Matthews, D. Sharp and C. O. Waterhouse. 18 volumes. 1880-1910 with 350 plates (297 colored) showing 8,596 species; 8,703 pages of text. (730 new genera and 11,675 new species are described.)
- Lepidoptera:
Rhopalocera, by F. D. Godman, assisted by G. C. Champion and O. Salvin. 3 volumes, 1879-1910, with 113 colored plates showing 1,206 species; 1,269 pages of text in which are described 119 new genera and 376 new species.
- Heterocera, by H. Druce and Lord Walsingham. 4 volumes, 1881-1915, with 111 colored plates showing 2,276 species; 1,594 pages of text in which are described 95 new genera and 1,898 new species.
- Hymenoptera, by P. Cameron and A. Forel. 3 volumes, 1883-1900, with 38 plates (34 colored) representing 920 species; 1,071 pages of text in which are described 1,053 new species.
- Diptera, by J. M. Aldrich, A. L. Melander, C. R. Osten Sacken, F. M. Van Der Wulp, W. M. Wheeler and S. W. Williston. 3 volumes, 1886-1903, with 21 colored plates exhibiting 436 species; 995 text pages, and 935 new species.

- Thynchota Heteroptera, by G. C. Champion and W. L. Distant. 2 volumes, 1886-1903, with 21 colored plates exhibiting 436 species; 995 text pages and descriptions of 935 new species.
- Rhynchota Heteroptera, by G. C. Champion and W. L. Distant. 2 volumes, 1880-1901, with 61 plates (45 colored) showing 1,416 species; 878 text pages, 135 new genera and 870 new species are described.
- Rhynchota Homoptera, by W. L. Distant, W. W. Fowler, and T. D. A. Cockerell. 2 volumes, 1881-1909, with 34 colored plates showing 761 species; 523 pages of text with descriptions of 69 new genera and 604 new species.
- Neuroptera (Odonata and Ephemeroidea), by P. P. Calvert and A. E. Eaton. One volume, 1892-1908, with map and 10 plates (2 colored) showing 178 species; 420 pages of text in which are described 85 new species.
- Orthoptera, by L. Bruner, A. De Bormans, A. P. Morse, A. Pictet, H. De Saussure, R. Shelford, and L. Zehnter. 2 volumes, 1893-98, with 30 plates (6 colored) showing 310 species; 870 pages of text and 362 new species.
- Arachnida:**
 Araneida and Opiliones, by O. P. Cambridge. 2 volumes, 1889-1905. 93 plates (63 colored); 927 pages of text in which 92 new genera and 839 new species are described. 981 species are figured.
- 1918 Comstock, J. H., and Needham, J. G.
 The Wings of Insects. 400 pages - 10 plates. Comstock Pub. Co., Ithaca, New York.
- 1923 Wheeler, W. M.
 Social Life Among the Insects. 375 pp. Extensive bibliography. Harcourt - Brace Co., N.Y.
- 1926 Essig, E. O.
 Insects of Western North America. 1035 pages, with 766 illustrations. This monumental work is not merely an economic work, but a general manual of Western North American Insects, including those of the entire Pacific Coast and of the entire western area bounded on the east by the Rocky Mountains. Macmillan Co., N. Y.
- 1926 Tillyard, R. J.
 The Insects of Australia and New Zealand. 560 pages. Illustrated. Chiefly devoted to morphology and classifications, etc. Angus and Robertson, Sydney, Australia.
- 1928 Ferris, G. F.
 Principles of Systematic Entomology. 169 pages. Stanford University Press, Stanford, California.
- 1928 Leonard, M. D. (editor) and others.
 List of insects, spiders, etc., of New York State. 1121 pages. Cornell University Agricultural Experiment Station Mem. 101. Very carefully prepared by specialists in the various orders and very useful in checking names, etc.
- 1928 Needham, J. G., Frost, S. W., Tothill, B. H.
 Leaf Mining Insects. 351 pp. Extensive bibliography pp. 324-340. The Williams and Wilkins Co., Baltimore, Md.
- 1928 Uvarov, B. P.
 Insect Nutrition and Metabolism. Trans. Ent. Soc. London, Vol. 76, part 2, pp. 255-343. Contains a very valuable summary of the literature on the subjects.

- 1929 Wardle, R. A.
The Problems of Applied Entomology. 587 pages. Host Resistance - Climatic Resistance - Tropic Behavior - Disease - Parasites and Predators - Theory of Insecticides - Stomach Poisons - Contact Insecticides - Fumigants - Cultural Influences. Area problems of the various continents such as Eastern Asia, Australia, etc., and some of the islands, such as Hawaii. Excellent bibliography. McGraw-Hill Co., N. Y.
- 1931 Imms, A. D.
Recent Advances in Entomology. 374 pages. Morphology - Metamorphosis - Paleontology - Behaviour - Coloration - Ecology and Its Practical Application - Parasitism - Biological Control. Blakiston Co., Philadelphia, Pa.
- 1931 Essig, E. O.
A History of Entomology. 1029 pages. Pre-historic Entomology - California Indians in Relation to Entomology - Historical Background - Principal Institutions in California Featuring Entomology - Some Historical Facts Concerning the More Important Mites and Insects of California - Biological Control of Pests - Insecticides - Entomological Legislation - Biography. Macmillan Co., N.Y.
- 1931 Uvarov, B. P.
Insects and Climate. 227 pages. Trans. Ent. Soc. of London, Vol. 79, Part I. Very extensive bibliography.
- 1931 Chapman, R. N.
Animal Ecology. 464 pages. With special reference to insects. Light - Temperature and Moisture as Ecological Factors - Physical Conditions of Environmental Media - Nutrition - Biotic Factors in Anecology - Synecology - Chronology - Aquatic Synecology - Aquatic Communities - Terrestrial Synecology - Communities of the Soil - Sand Dune Communities - Grass and Herb Stratum - Shrub and Tree Stratum. Extensive bibliography in connection with each chapter. McGraw-Hill Co., N. Y.
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Fundamentals of Insect Life. 581 pages. Treats insects from the biological point of view. Bibliography pp. 522-526. McGraw-Hill Co., N. Y.
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- 1934-1937 Peterson, Alvah
A Manual of Entomological Equipment - Part I, 1934 - Part II, 1937. Part one illustrates equipment and methods. Part two contains abstracts of articles on rearing methods. Lithoprinted - Edwards Bros., Ann Arbor, Mich.
- 1934 Imms, A. D.
General Textbook of Entomology, third edition. First published in 1925 with 698 pages and more than 600 figures. Second edited in 1929. One of the outstanding general entomological texts in the English language. E. P. Dutton Co., N. Y.
- 1934 Folsom, J. W. and Wardle, R. Q.
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- 1935 Balduf, W. V.
The Bionomics of Entomophagous Coleoptera. Part I, 220 pages. Bibliography arranged by families pp. 168-185 - Planographed. John S. Swift & Co., St. Louis, Mo.
- 1935 Snodgrass, R. E.
Principles of Insect Morphology. 667 pages. Illustrated. Extensive bibliography on pp. 625-646. McGraw-Hill Co., N. Y.

- 1936 Doane, R. W., Van Dyke, E. C., Chamberlin, W. J., and Burke, H. E.
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- 1937 Melander, A. L.
Source Book of Biological Terms. 157 pages. (Dept. of Biology. The College of the City of New York) The Comet Press, Brooklyn, N. Y.
- 1939 Balduf, W. V.
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- 1939 Felt, E. P.
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- 1939 Graham, S. A.
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- 1939 Peterson, Alvah
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The Principles of Insect Physiology. 434 pages. 316 illustrations. Extensive bibliography. E. P. Dalton and Co., N. Y.
- 1940 Leach, J. G.
Insect Transmission of Plant Diseases. 615 pages. Chapters: Introduction - The Interrelationships of Plants and Insects - Symbiosis Between Insects and Microorganisms - The Relation of Insects to the Spread and Development of Plant Diseases - Plant Diseases Caused by Toxicogenic Insects - Insects and Bacterial Diseases - Insects and Fungus Diseases - Insects and Virus Diseases, etc. Selected bibliography in connection with each chapter. McGraw-Hill Co., N. Y.
- 1940 Comstock, J. H.
Introduction to Entomology. Ninth revised edition. The outstanding American work on general entomology. More than 1000 pages and in excess of 1200 figures. Aside from the introductory matter, each order of insects and classes of near relatives are discussed in some detail. Numerous references and a bibliography of about 100 pages. Comstock Publishing Company, Ithaca, N. Y.
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- 1949 Chu, H. F.
How to Know Immature Insects. Wm. C. Brown Co., Dubuque, Iowa. 234 pages. 631 figures.
- 1949 Steinhaus, E. A.
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- 1950 Craighead, F. C.
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CATALOGUES, MONOGRAPHS, ETC., ON SINGLE ORDERS AND LESSER GROUPS

I. Order Protura

- 1940 Ewing, H. E.
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II. Order Thysanura

- 1891 MacGillivray, A. D.
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- 1903 Guthrie, J. E.
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- 1906 Jackson, C. F.
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- IV. Order Orthoptera
- 1896 Scudder, S. H.
Index to the Mantidae of N. A., *Can. Ent.* 28:207-210.
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- 1916 Hebard, M.
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- 1917 Hebard, M.
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- 1919 Rehn, J. A. G.
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(No. 2107) 86 pages.
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- 1948 Hall, D. G.
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- 1950 Bates, M.
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A Generic and subgeneric Synopsis of the U. S. Ants, based on Workers. Amer. Midland Naturalist 37:521-627.
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- 1915 Banks, N.
The Acarina or Mites. U.S.D.A. Office of the Sect. Report No. 108. 153 pages. Bibliography pages 143-146.
- 1925 Miller, A. E.
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1911 Argasidae. 104 pages. (1908). Part II, Ixodoidea. 120 pages. (1911).
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- 1944 Cooley, R. A. and Kohls, G. M.
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Spiders

- 1912 Comstock, J. H.
The Spider book. Doubleday, Page & Co., New York. In this work Comstock not only treats the true spiders but also the other Arachnida. Bibliography.
- 1928 Savory, Tho. H.
The Biology of Spiders. The Macmillan Co. 376 pages. Bibliography pages 349-369.
- 1939 Petrunkevitch, A.
Catalogue of American Spiders. Part I Trans. Conn. Acad. Arts and Sciences 33:133-338. This is more than a catalogue since it contains keys. Other parts are under preparation.
- 1940 Comstock, J. H. and Gertsch, W. J.
The Spider Book. Doubleday Doran & Co., Garden City, N. Y. 729 pages, 770 text figures. In this edition the nomenclature is brought up to date; otherwise there is little change. Revised by Gertsch.
- 1948 Kaston, B. J.
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USEFUL REFERENCES ON SPECIAL SUBJECTS

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Airplane and Insect Control

- 1934 McBath, W. E.
A Bibliography on the Use of Airplanes in Insect Control from 1922-1933. U.S. D.A. Bur. Ent. Mimeographed. 37 pages.
- 1947 Hawes, I. L. and Eisenberg, R.
Bibliography on Aviation and Economic Entomology. U.S.D.A. Bibliographical Bul. 8. 190 pages. Brief abstracts are given on 1084 papers published between 1919 and 1945.

Bee Culture

- 1930 Hitz, V. F. and Hawes, Irma.
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- I. Books
- II. Reprints and Separates
- III. U.S.D.A. Publications
- IV. Publications of States
- V. Laws
- VI. Periodicals arranged by titles
- VII. Periodicals arranged by countries
- VIII. Index

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Biological Control

- 1930 Thompson, W. R.
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- 1935 Balduf, W. V.
The Bionomics of Entomophagous Coleoptera. John Swift & Co., St. Louis, Mo. 220 pages. Extensive bibliography by families, pages 168-185. (Planograph)
- 1936 Sweetman, H. L.
The Biological Control of Insects. Comstock Publishing Co., Ithaca, N. Y. 461 pages. Bibliography pages 390-420.
- 1939 Balduf, W. V.
The Bionomics of Entomophagous Insects. John S. Swift Co. 384 pages. Extensive bibliography. (Planograph)

- 1940 Clausen, C. P.
Entomophagous Insects. McGraw-Hill Book Co., N. Y. 688 pages. Extensive bibliography pages 613-659.
- 1943 Thompson, W. R.
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1944 Catalogue.
- Part I Parasites of Archnida and Coleoptera. 151 pages. 1943.
Part II Parasites of Dermaptera and Diptera. 99 pages. 1943.
Part III Parasites of Hemiptera. 149 pages. 1944.
Part IV Parasites of Hymenoptera, Isopoda, and Diptera. 129 pages. 1944.
Part V Parasites of Lepidoptera. 130 pages. 1944.

Since each of the above basic works contains an extensive bibliography and since one or more is usually available to any worker, there is no point in enumerating other works on biological control in this volume.

Climate and Insects

- 1913 Sanderson, E. D. and Peairs, L. M.
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- 1931 Uvarov, B. P.
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- 1893 Viallanes, M. H.
Memoir on the Nervous Centres and Sense Organs of Articulated Animals. Ent. News. 4:200-202. Classification of Arthropods as based on the brain and nervous system.
- 1894 Banks, N.
On a Classification of Arthropods. Ent. News. 5:213-16. Contains a criticism of Kingsley's classification and discussion of the features which the author believes should be used in classifying Arthropods.
- 1897 Smith, J. B.
Classification of the Orders of Insects. Proc. Ent. Soc. Wash. 4:81. A complete revolutionary classification of the orders of Hexapoda.
- 1904 Smith, J. B.
Some Remarks on Classification. Ent. News. 15:179-86. A plea for common sense in the classifying and re-classifying of insects and the basing of classifications on ease of usability, rather than exact, technical perfection.
- 1907 Woodworth, C. W.
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Classification of Orders of Insects. Ent. News. 26:120-2. Synopsis of the ways different authors subdivide the class Hexapoda into orders.
- 1932 Brues, C. T. and Melander, A. L.
Classification of Insects. Bul. Muse. Compar. Zool. Vol. 73. Cambridge, Mass. 672 pages. Illustrated. In addition to keys to insects, Part II deals with other Terrestrial Arthropods. A glossary of special terms is given on pages 605-616.

- 1937 Wilson, H. F. and Doner, M. H.
The Historical Development of Insect Classification. John S. Swift & Co., St. Louis, Mo. 133 pages. Bibliography pages 124-126. (Planographed.)

Diet

- 1945 Brues, C. T.
Insect Dietary. Harvard Univ. Press. 466 pages. Illustrated.

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- 1890 Scudder, S. H.
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- 1893 Boyle, C. B.
A catalogue and bibliography of Fossil N. A. Mesozoic Invertebrata. U. S. Geological Survey Vol. 73.
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- 1930 Carpenter, F. M.
A Review of Our Present Knowledge of the Geological History of the Insects. Psyche 37:15-34.

Fossil Ants of North America. Bul. Mus. Comp. Zool. 70:1-66.
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Fossil Insects from Creed Formation, Colorado. Part I. Psyche 45:105-109.
- 1947 Carpenter, F. M.
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The Development of Russian Entomology. Journ. N. Y. Ent. Soc. 37:153-155.
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A History of Entomology. MacMillan Co., N. Y. VII to 1029 pages. Well illus-
trated. Biographical sketches of 117 entomologists. Chronological table of
events giving the dates of birth and death of many entomologists. Essentially a
history of Entomology in California.
- 1931 Weiss, H. and Ziegler, G. M.
Thomas Say. Chas. Thomas and Co. 260 pages.
- 1936 Weiss, Harry B.
The Pioneer Century of American Entomology. Published by the author. New
Brunswick, N. J. 320 pages. (Mimeographed.)
- 1937 Osborn, Herbert.
Fragments of Entomological History. Published by the author, Columbus, Ohio.
Part I. 394 pages. Ibid. 1946 Part II. 232 pages.
- 1939 Gibson, Arthur
The Canadian Entomological Service, Fifty Years of Retrospect. 1888-1937.
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- 1940 Fifty Years of Entomological Progress. Journ. Econ. Ent. Vol. 30.
Marlatt, C. L. Part I 1889-1899, pp. 8-15
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Metcalf, C. L. Part III 1909-1919, pp. 21-30
Essig, E. O. Part IV 1919-1929, pp. 30-58
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Insecticides

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Bibliography of Nicotine. Part I, Chemistry of Nicotine, 257 pages. U.S.D.A.
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1933; Second Edition 1936; Third Edition 1945. The pagination is continuous thru
the three editions to a total of 690 pages.
- 1945 Gough, H. C.
A Review of the Literature on Soil Insecticides. Imp. Ins. of Ent. London. 161
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- 1946 Leary, J. C. and Others.
DDT and the Insect Problem. McGraw-Hill Co. 164 pages.
- 1947 Detheir, V. G.
Chemical Insect Attractants and Repellents. Blakiston Co., Phila. 289 pages.
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Manual of Tropical Medicine, William Wood & Co., N. Y. 3rd Ed. 2436 pages.
- 1920 Brues, Chas. Thomas.
Insects and Human Welfare, Harvard University Press, Cambridge, Mass. 104
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Medical Parasitology. Columbia Univ. Press, N. Y. 286 pages. Very brief bibliography.
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Note: See Folsom & Wardle, 1934, pp. 549-561 for additional titles.

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Textbook of Embryology of Invertebrata. Macmillan Co., London, England. Vol. 1, Ed. by Walter Heaps.
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Principles of Insect Morphology. McGraw-Hill Co., N. Y. 667 pages, 319 figures. Bibliography.
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The Principles of Insect Physiology. Dutton & Co., N. Y. 434 pages, 315 figures. Bibliography.
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Principles of Insect Pathology. McGraw-Hill Co., N. Y. 757 pages.

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Zoological Names

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Vol. I. Covers the Species and Genera 1758-1800.
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- 1910 Waterhouse, C. C.
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- 1923 Schulze. Kireckenthel, and Heider.
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Vol. I 957 pp. Names A-C
Vol. II 1025 pp. Names D-L
Vol. III 1065 pp. Names M-P
Vol. IV 758 pp. Names Q-Z
Vol. V Covers the period 1936-1945.
Constitutes an attempt to give an complete a record as possible of the bibliographical origin of the name of every genus or subgenus in zoology published, in works not excluded by the International Commission on Zoological Nomenclature. See also Zoological Record under serial publications.

WORKS NOT EXCLUSIVELY ENTOMOLOGICAL BUT OF VALUE TO ENTOMOLOGISTS

- 1913 Shelford, V. E.
Animal Communities in Temperate America. The Univ. of Chicago Press, Chicago, Ill. The Geographic Society of Chicago. Bul. No. 5, 362 pages.
- 1931 Chapman, R. N.
Animal Ecology, with Special Reference to Insects. McGraw-Hill Book Co., N. Y. 464 pages. Bibliography with each chapter.
- 1937 Galtsoff, P. S., Lutz, F. E., Welch, P. S. and Needham, J. G.
Cultural Methods for Invertebrate Animals. Comstock Pub. Co., N. Y. 590 pages.

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ENTOMOLOGICAL NOMENCLATURE AND LITERATURE

1939

Pearse, A. S.

Animal Ecology. McGraw-Hill Book Co., N. Y. Second Ed. 642 pages. Extensive bibliography 569-633 pages. (Note: Owing to the fact that no titles are given in the bibliography, it is of limited value.)

SCIENTIFIC PUBLICATIONS

Every student of entomology desires to make known his discoveries and experiences. In order to do this, he must prepare articles for publication. These may embody the results of experiments on insecticides; development of new apparatus or techniques; the working out of the life history or habits of certain insects; or the descriptions of new genera, or new species. It may be desired to make known the results of a collecting trip into new or little-known territory, or the results obtained in extended library research.

There are many phases of entomology which offer a fertile field for the writer. Regardless of the particular line these writings follow, there are certain fundamentals which should be observed. Part III of the present work is an attempt to make the fundamentals of good writing available.

It is well for the student to understand something of the art of printing, therefore, a brief outline of the early history of typography is given. A glossary of some of the terms most commonly used in referring to manuscripts and to printing is also included.

These subjects all relate directly to a study of nomenclature and literature and are not readily accessible to the beginner. Hence, it is felt that they are not out of place in a work such as *Entomological Nomenclature and Literature*.

A BRIEF HISTORY OF EARLY TYPOGRAPHY (Printing)

Typography is the art of writing by the use of type.

The art of printing or impressing figures, words, lines, etc., on other objects (paper, vellum, etc.), as well as the art of engraving, which is intimately connected with printing, existed prior to the 15th century. Manuscripts of the 12th century show initials, which, from their uniformity, are believed to have been made by impressing stamps or dies, a form of printing. As early as 1436, binders produced letters on their covers by the use of blocks engraved with a single letter.

Block printing and printing with movable type seem to have been produced in China and Japan long before they were known in Europe. It is said that in the year 175 A.D. the text of certain Chinese classics was cut upon tablets from which impressions were

taken. Copies of these are reported to be still in existence.

In the 6th century, the founder of the Suy dynasty printed from wood blocks, and, by the 10th century, books from wood engravings are reported to have been common. Buddhist "printed books" are referred to as early as 987 A. D.

The Chinese are said to have used movable type made of clay in the 11th century, while the British Museum has a Korean book printed from movable type in 1337. The Koreans are credited with having invented copper type in the beginning of the 15th century.

Up to the middle of the 14th century, all books, pictures, and even playing cards, in Europe were products of pen and ink or of the brush. Illustrators, scribes and translators were professionals, although much of the copying of manuscripts was done in the monasteries.

It is said that the great libraries of Brussels, Bruges, Antwerp, Ghent, etc., contain, all told, over 3,000 beautifully illustrated, superbly hand-written books.

The art of printing from wooden blocks on silk, cloth, vellum, paper, etc., made its appearance in Europe in the 12th century. The discovery was, of course, a great improvement and time saver, since numerous impressions could be made once the blocks were engraved. The first impressions were on cloth and vellum, (paper seems to have come into use in the 14th century) and first appeared as single sheets. Later they were gathered in "quires" and formed what were known as blockbooks. The oldest dated print is in the Brussels Museum and has the date MCCCC-VIII (1418). Most other very early known examples are from Germany.

The taking of impressions from the blocks was a laborious process and materials could be printed on one side only.

In some cases, texts were hand-written and the illustrations were from wood cuts. Such works are known as xylochirographs (wood-handwritten books). Though very few of these exist with dates, there is one dated 1440 and another 1463.

Movable metal type: For more than 400 years a dispute has waged as to when, where and by whom the art of typography was

invented. Some contend that John Gutenberg, of Mainz, Germany, was responsible, but there is very strong evidence to show that Lourens Janszoon Coster of Haarlem, Holland, should have the credit. (See the Encyclopedia Britannica under "Typography.")

The earliest known printed paper from movable metal type appears to be a letter of Pope Nicholas V, dated October 22, 1454. The printer is not given. There are, however, undated examples of movable type printing thought to have been done as early as 1443-1444.

A tremendous amount of research has been carried on to determine whether Gutenberg or Coster should be credited with the invention; however, the question is still a de-

batable one. Suffice to say that the art was founded in Germany or Holland by one of these two men about 1440-1443 and that it was more or less perfected by 1454. By 1477, printing was practiced in most of the European countries: Netherlands, Germany, Italy, France, Spain, Switzerland and England. Printing was established in other countries as follows: Mexico, 1544; Peru, 1585; Manila, 1585; Cambridge, Massachusetts, 1638; and Halifax, Nova Scotia, 1766.

From the crude, slow hand methods of the 15th century, printing has gradually passed through a great many successive changes until today linotype machines can run the type for a great daily newspaper in a matter of a few hours.

BRIEF GLOSSARY OF TERMS USED IN REFERRING TO MANUSCRIPTS AND PRINTING

AGATE - A size of type. Called 5 1/2 point under the POINT SYSTEM.

AUTHOR'S ALTERATIONS - Work done by the compositor after proof has been rendered to the author and corrected by him.

AUTHOR'S PROOF - A proof sent to the author to be compared with the copy, then corrected if necessary.

BIBLIOGRAPHY - A list of books concerning a particular subject.

BOLD-FACE - A name given to type that is heavier than the text in which it is used. Side-headings are usually set in BOLD-FACE.

BOURGEOIS - A size of type. Called 9-point under the POINT SYSTEM.

BRISTOL-BOARD - A fine quality of cardboard used for drawing, printing, etc.

CAPS - Capital letters.

CAPTION - A heading, as of a chapter, table, etc.

CHALCOGRAPHY - Copper plate engraving; earliest known date, 1446.

COPY - All material furnished to the printer, to be used by him in the production of printed matter. It may consist of manuscript, reprint, illustrations, photographs for reproduction, etc.

CORRECTIONS - Any changes made in type after proofs have been taken.

CUT - A printed illustration; also refers to the plate or block from which an illustration is printed.

DELETE - To expunge; to remove.

ELECTROTYPE - A facsimile of set type, slugs or relief plates forming a printing surface in one piece. Books are usually printed from electrotype plates, not from typeforms.

ERRATA - The plural of erratum; an error. Specifically, errors discovered in a book after printing. A slip of paper or an extra page, calling attention to the errata and correcting same, is frequently inserted at the next printing.

FACE - That part of a type that is inked and which leaves the impression on a printed surface.

FIGURE - A small illustration or diagram printed in the text of a page.

FOLIO - (a) The name given to a sheet of paper 17 by 22 inches in size.
(b) A page number. Even numbers are placed on the left-hand page and odd numbers on the right-hand page.

FOLLOW COPY - An order indicating that the compositor is to set up matter exactly as it appears in copy, making no changes whatever in phraseology, punctuation, capitalization, etc.

FOOTNOTE - An explanatory note put at the foot of a page; usually referred to by some specific mark in the text.

FOUL PROOF - Proof upon which the author has marked the changes desired, as distinguished from the revised proof.

GALLEY PROOF - A pull of proof taken while the type is standing in the galley, a flat metal tray used to hold type.

HALF-TONE - A photographic process of making relief-plates on metal (copper, zinc, etc.) for illustration (the entire surface of the plate is broken up into regular series of small dots.) A **SILHOUETTE** or **OUTLINE HALF-TONE** is one in which the background has been cut away. A **VIGNETTE HALF-TONE** is one in which the outside edges are shaded and appear to fade away until they are lost on the white surface of the paper.

ITALIC - A sloping type face.

LAI D PAPER - Any paper which, when held to the light, shows close, parallel lines, some of which frequently run at right angles.

LINE DRAWING - A drawing in ink or crayon from which a **LINE ETCHING** is made.

LINE ETCHING - A **PHOTO-ENGRAVING** made from a pen-and-ink drawing without the use of a screen employed in making **HALF-TONES**. In a line etching, all lines are reproduced as they appear in the drawing.

LOWER CASE - The lower of a pair of type cases; the one in which small letters are kept: Also, one of the small letters. To designate a lower-case letter on a proof, the contraction "l.c." is written.

MARGIN - The amount of space around the printed matter on a page.

MS - A manuscript; plural, **MSS**.

PAGINATION - The numbering of pages in a book.

PHOTO-ENGRAVING - Any engraving process in which photography plays an important part and by which an illustration plate is reproduced directly from the copy, such as zinc etching, half-tone, etc.

PICA - The name of a type size. Under the **POINT SYSTEM**, pica became 12-point. It is the unit used in designating the size of a printed page. There are six picas to an inch. A type page 4 by 7 inches measures 24 by 42 picas. It is also the unit of length of leads, slugs, rules, furniture, etc.

PLATE - Any metal surface so prepared that after being inked it is capable of yielding impressions. Also a printed illustration occupying a full page or more.

POINT - The present standard of measurement for type, the unit being 1 point, or approximately 1/72 of an inch. Actually is 0.013837 inch.

POINT SYSTEM - A system of casting type bodies on a multiple of a unit called a point.

PRESS PROOF - A final impression taken on the press and on paper to be used for the finished work. Not often done due to the expense.

PROOF - Any printed impression of a job that has been made for the purpose of inspection and correction.

PROOFREADER - One whose duty it is to read proofs and mark the errors.

SCREEN - A term used in referring to the number of dots to the linear inch in a HALF-TONE plate or negative. The screen of a plate is determined by the quality of paper upon which it is to be printed.

SMALL CAPS - Capital letters, usually made for book fonts, of a smaller size than regular capitals.

TEXT - Straight matter that forms the body of a book.

TRACING CLOTH - Smooth, transparent linen cloth, sized on one side, on which tracings of drawings are made.

TYPOGRAPHY - The art of printing from type. More particularly, type-setting, or the proper assembling and grouping of type units in a piece of type composition.

VIGNETTE - A HALF-TONE plate, the edges of which gradually fade away until they become lost on the white surface of the paper.

WASH DRAWING - A painting used as a substitute for a photograph. Usually drawn with paints ranging through all the tones of gray, from pure white to black.

WOODCUT - A printing plate of wood on which an image has been left in relief by cutting away the background.

WOVE PAPER - Paper that is free from watermark lines which characterize a LAID PAPER.

ZINC-ENGRAVING - A printing-plate made of zinc, the background of which has been etched away, leaving the design in relief.

XYLOGRAPHY - Wood engraving; earliest known date, 1418.

PREPARATION OF ARTICLES FOR SCIENTIFIC PUBLICATIONS

There is no general set procedure, no formula and no absolute standard for guidance in preparation of articles for journals. Much depends on the subject, the prospective reader, the available space in the periodical and, above all, on the personal opinion of the author.

Who should criticize an article? All journals have an editor, and in many cases, an editorial or policy board, or committee whose function it is to criticize and pass impartially on manuscripts submitted for publication. These critics must consider available space, the desires of their subscribers and the general policy of the journal, as well as the contents of the manuscripts, in determining

whether or not the article is suitable for publication in their particular magazine.

The reader is likely to be the most severe critic, and the writer should always keep in mind the fact that every reader is a potential critic. A writer should, without question, go to great pains to eliminate errors; should avoid over and under statement, and should not resort to reporting wishful thinking as fact.

The most severe critic of all should be the writer himself. All authors should (though few do) subject their paper to the most severe criticism. A manuscript should be studied from the standpoint of the editor and the reader. An author should be certain that he has said exactly what he intended to say; that he is both willing and able to defend his statements.

Many journals publish notices, stating policies regarding the length of papers they are financially able to accept, size and type of cuts, separates and other points to be observed by the potential author. These should be strictly complied with if the writer plans to submit his manuscript to such journal for publication.

"The Journal of Agricultural Research" has published pamphlets to guide prospective authors. These are: "Preparation of Manuscripts for the Journal of Agricultural Research" and "Editorial Policy Regarding the Journal of Agricultural Research".

There are certain principles the writer of a scientific article must always keep in mind.

The article, once printed, is a lasting monument. If it is carefully prepared, thoroughly correct and represents the best findings on the subject, the author may long be proud of his work. On the other hand, haste, carelessness and dishonesty on the part of an author will result in a paper the author may wish to disown since the printed page is there for all to see, its elimination is impossible. It is, therefore, all-important to remember that the article forms a permanent record.

Dishonesty in scientific work is absolutely unforgivable.

A writer often experiences great difficulty in recognizing faults in his own paper, while a co-worker may at once see them clearly. Too many workers, when asked to read carefully and criticize a paper, read and return it without criticism, for fear of offending the writer. It is not necessary, or often to be expected, that all criticism or suggested changes, additions or alterations, will be followed. Yet criticism is likely to prove helpful in bringing to the attention of the author points that had not occurred to him, and improvements in the paper are almost sure to follow. The critic serves to bring to the attention of the author points likely to be observed by other readers. Criticisms serve to point out faults, and it is far better that a writer recognize and correct such faults before publication. After publication, the author can do nothing to right these errors.

From a study of a large number of articles in various entomological journals, it appears that many are written in order that the author may get his name into print. An article can be justified only if it contains new information, or information that is presented in a new light or is made more understandable in view of present-day methods. Compilations, although they contain absolutely nothing new, may be of great value, especial-

ly when the compiler has brought out material from little-known or rare works, thus making otherwise obscure information readily available to the average worker.

A good article should possess certain fundamentals; namely, it should have (1) purpose and (2) character, and the writer should have in mind (3) its scope and (4) a logical plan for arranging the contents.

1. Purpose

As previously pointed out, too often the purpose of an article seems to be simply a means for the writer to get his name in print, in order that he may establish a reputation as a writer of articles. The real purpose and only valid reason for publishing an article should be to make a contribution to scientific knowledge.

Every writer knows that the length of an article is no criteria of its value. The most valuable article in a volume may be only one or two pages in length. It is usually a rather simple matter to expand a subject into a very long paper. As a rule, such procedure only serves to bury the fundamentals in a mass of detail, which may be only remotely related to the main subject. When an author can reduce the space of an article by 25 or 50 percent and, at the same time, not sacrifice the real scientific value of that article, he is a good author.

Scientific honesty must be the guiding influence. Personal bias must not be allowed to enter. Preconceived ideas of what results one will obtain in experiments are dangerous and should be eliminated. Prejudices should play no part in setting down results. Facts should be presented as they actually occur and should stand on their own foundation. Careful, accurate work, painstakingly and honestly presented, will bring its own reward. Fame for the writer will take care of itself.

Frequently investigators labor long hours, with great enthusiasm, on research work that leads to some new truth and, when the problem is complete, they are satisfied, and do not take the time necessary to assemble, verify, check, compare and tabulate the results in order to interpretate their work for publication. Research answers its real purpose only when it is published, with suitable discussion, and its significant relationships are shown for the benefit of all workers in the same or related fields. Publication, therefore, should be the ultimate end.

2. Character

The character of an article for a scientific journal is, first, that it be based on absolute fact, and, second, that it be truthfully

presented in a scientific manner. It may present argumentative views, but if only clear-cut facts are presented, there is little call for lengthy contriversa. A vast difference exists between fact and theory; between knowledge and belief. The true scientific article is based on solid data, carefully checked experiments and deep study. Facts should be plainly stated, without reservations, evasiveness or attempts to deceive.

Scientific articles are, of necessity, technical, and are written for professionals in their particular fields. It is not necessary to waste space in an explanation of terms utilized. However, if an author invents new terms or uses old terms in any but their usually recognized sense, an explanation is due the reader.

Printing costs are high and few scientific publications are endowed. Yet, almost without exception, they receive more material than they can use. Therefore, the author should remember that no purpose is served by entering into discussions regarding elementary phases of the subject. Lengthy discussions of introductory material, known to any student of the subject or available in any elementary textbook, will usually result in the paper being returned, marked "not usable for publication."

3. Scope

The writer should remember that he is not writing a textbook, but an article for a journal. Careful consideration should be given to exactly what he desires to cover. All that has been previously or adequately covered should be eliminated. An explanation of matter with which readers are probably already familiar should not occupy valuable space. The subject should be covered in sufficient detail to allow workers to follow the ideas and evaluate the results. Extreme brevity should be avoided, as should unnecessary length. Brevity may leave the reader in doubt. A too-long article may not be read.

Frequently, so-called progress reports appearing in scientific journals are lengthy articles that lead one to the middle of the subject, then stop. Little, if anything, is gained by publishing such articles. As a rule, it is safer and more satisfactory to wait until completion of experiments before attempting to burst into print. Later work may prove that preliminary reports were erroneous and misleading. Too often progress reports, which lead one to believe that other papers are to follow, are the last to appear on the subject. It is seldom that partial reports are of such value or importance as to require their immediate publication, although there may be exceptions. In a pamphlet on

the preparation of articles for the Journal of Agricultural Research, the following appears regarding progress reports:

"Occasionally the progress of an extensive research is considerable and the data available are important, yet the entire problem has not been completed. Under these circumstances an article which is a preliminary report of very extensive research and which announces some of the more important new features of the work may be published in the JOURNAL and the completed work issued later."

4. Arrangement of Contents

The study of any article raises questions in the minds of readers. Hence, it is necessary that the contents be logically arranged and that questions likely to arise be fully answered. When the reader has finished an article no logical questions should remain unanswered in his mind. Questions that may occur to the reader are often so well known to the writer that he fails to answer them.

Questions arising most frequently will be answered if the author keeps in mind the following: when, where, why, how, what and by whom? When and where was the work done? Why was it undertaken? What were the purposes in view? How was the work accomplished? (Enough of the technique should be explained so that the reader can judge its value.) Was the apparatus used of a usual or unusual type? (If the latter, explain fully.) What were the results? What significant facts were discovered? What do they prove? What conclusions are justified by these results? Who was responsible for the work?

Although mentioned last, the "who" will be largely answered at the beginning of the article. Due recognition should always be given those who have rendered assistance. This may be done near the beginning or near the end of the paper.

Although all of the foregoing facts may not pertain to your special article, they, nevertheless, are factors essential to a good article. Perhaps other questions may arise. If so, they should be answered. For instance; an article containing only technical descriptions of a new genus or a few new species, or an article reporting the discoveries made in a scientific journey by a naturalist, may not necessarily involve all the afore mentioned.

The presentation of the subject may follow the outline indicated below:

1. Title of the article.
2. Name, title and location of the author.
3. Introduction
4. Historical facts
5. Methods and techniques used
6. Interpretation of data

7. Conclusions
8. Summary
9. Literature cited

Title

The title of an article should be brief, yet should convey at a glance something of the contents. Before selecting a title, one should study numerous titles in various journals. Some thought should be given to the selection of appropriate words. Brevity is desirable but an author should not be too brief. A title such as "An illustrated journal article presenting information on the Satin Moth as it has been found under Pacific Coast conditions, with special mention of the moth's parasitic enemies" is entirely too lengthy and might better read: "The Satin Moth and Its Parasites on the Pacific Coast." That the article is in a journal and is illustrated are self-evident; its content would be sufficiently indicated in a brief title.

Some authors contemplate a series of articles dealing with a particular group of insects. When the first article is completed and published, his title may read: "Contribution to our Knowledge of the _____ flies belonging to the Genus _____, No. I". Future papers on the same subject should logically be contributions No. II, No. III, etc. Frequently however, the intended subsequent articles never appear. The result is that other persons may spend many hours searching for subsequent articles, not knowing they were never published. It is better to give each article an appropriate title and present it on its own merits. If and when future articles on the same group appear, the author can cite the previous article or articles.

The Author

It is only fair that the reader be given more than merely the name of the author. A. A. Doe may be sufficient for those who know Mr. Doe personally, but the printed page is not read in only one locality, nor by only the present generation. It is a permanent record, and many years hence workers may want to know how much weight to give Mr. Doe's article. Then, too, workers may desire to communicate with Mr. Doe. It should not be considered advertising when an author indicates that he is an "M.D.", "Ph.D.", or "Sc.D.". Titles are evidence that the writer must have had considerable fundamental training to have acquired one or more degrees. An author's position and rank are of interest to the reader; further more, they give some idea of the correct evaluation that may be placed on the contents of the article. The author's affiliation may serve two purposes: (1) enabling the reader to contact

the author, and (2) indicating the probable geographical location of the experiments carried on.

Introduction

Everyone has doubtless seen articles in which the author plunges so abruptly into his subject as to leave the reader with a feeling of shock. It is always much more reassuring for a reader to enter the subject "through the front door" and pause a moment "in the reception room". Such details as the purpose of the work, when and where it was carried on, its relationships to any similar work previously done by the author or by other workers, if any such exist, should always be mentioned. It may be advisable to state whether similar work is under way or contemplated.

Historical Review of Literature

Before beginning any experiment, a careful review of all available literature is a prime requisite. Such a review is likely to bring out many very useful points:

- (a) It acquaints the worker with what has already been done.
- (b) It often presents various types of techniques and procedures and may describe apparatus that will prove useful in the contemplated work.
- (c) It often points out why other experiments have failed, thereby enabling the worker to avoid the costly mistakes of others.
- (d) It may present a means of comparing one's work with that of others.
- (e) It may present points that otherwise might have been overlooked.
- (f) It may enable the worker to accept certain findings as fact, without having to prove them, thus saving valuable time. (It should be borne in mind, however, that the other experiments were probably conducted under different conditions.)

Owing to the tremendous increase in the number of workers and the resultant accumulation of detail on various subjects, extreme care should be used in evaluating previous work and results. A writer should always separate fact from theory, proved results from questionable data. He should ascertain who the thorough and careful workers are, and, since it is often impossible to review all literature, he should learn to select the best and to conserve space in an article. Only material pertinent to a particular subject should be listed and as briefly as possible, consistent with the object in view.

The body of a paper answers the question "how". A full explanation of how the data were obtained, what methods were used and

the type of technique and apparatus should be explained. If necessary, local conditions should be explained. The method used in checking results should be stated fully. Although a writer may have become so accustomed to his technique and to the use of his apparatus that they appear very simple, the reader has not had this advantage. Description of apparatus may be desirable. A few well-executed sketches often serve to make plain points that would require pages of detailed explanation; in such cases, sketches save valuable space.

Many experiments lead to the accumulation of large amounts of data. One of the chief tasks of the worker is to sift these data. Much must be discarded, frequently an extremely difficult part of the work. The data are the result of long, hard, painstaking research and mean much to the worker. Yet, to give them in detail would result in lengthy, complicated tables, in which the important information may be lost in a mass of detail. The wheat should be separated from the chaff, and, where possible, presented in short, concise tables, or, if it lends itself to portrayal in graphic form, graphs may be used. In either case, a table or a graph is used to present a picture of the results in a manner so that the content may be readily grasped without too much reference to printed material.

To quote again from the article on advice to authors published by the Journal of Agricultural Research:

"It is seldom practical or desirable to include all the data obtained in an investigation. Many of the data pertaining to intermediate steps and individual records of negative results are unessential to the majority of readers and do not justify the expense of publication. The desire of writers to make published articles a complete record of their studies is often founded on the criticism of some readers who assume that, if everything is not given, something of importance may have been withheld or conclusions may have been incorrectly drawn. The contention that the reader should be able to check up completely the author's findings from the published account is generally not justified, though the extent to which it is desirable to report details of research is admittedly a difficult question, not to be determined by set rules. The reader has a right to essential scientific evidence, but evidently there must be a limit, dependent upon the suggestive value of the details and incidental matter. Critical judgment is essential regarding what is feasible, so far as the agencies for publication are con-

cerned, and what is desirable, so far as the reader and the permanent value of the research are concerned."

After all data and other material have been presented, the reader should not be left to flounder about looking for the meaning of all facts. It is not the reader's place to guess what it is all about.

Conclusion

In the conclusion the author should analyze and interpret the results impartially. Conclusions should be substantiated by data. Fact is fact, theory is theory and they must be so labeled. It is unnecessary and usually inadvisable to repeat much of the data in the conclusion. Always keep in mind the fact that printing is expensive and space must not be wasted. A summary of the important points brought out in the paper forms a valuable part of the contribution. In fact, many readers are likely to look to the summary before reading a long article. It should serve as an abstract. For the reader who is busy and interested only in a general way in the particular subject, the summary will often suffice. It should be so written that he will not be compelled to read the entire paper in order to obtain information of most value to him.

Bibliography-Literature cited

It is customary to give at least a short bibliography, containing references to the most useful books and/or articles dealing with the subject. For methods of presenting a bibliography, see page 49.

Under the heading "literature cited," a writer should list only references that have been actually referred to in the article. If not too numerous, literature cited may be listed as footnotes. If the list is lengthy, it is best to present it at the end of the article. Each citation may be numbered and the numbers may be used in the body of the article to refer to the appended list. Some authors prefer to refer to literature cited by giving the date and the author's name in parenthesis at the applicable point.

General Remarks

Few writers are capable of composing a really good article in the first draft. As a rule, it will be necessary to revise and rewrite an article a number of times before it is completely acceptable to that most severe critic, the writer.

Haste to see an article in print often results in the observation: "There are so many places in which the paper might have been improved." If a writer is not absolutely satisfied with his paper, criticism is certain

to follow. Insist on reading proof, and remember that major changes can be made in the proof only at considerable expense. Be considerate of the journal's budget.

Brevity has been mentioned a number of times, but it is important that a writer shall not carry it to the point where clearness is sacrificed. Brevity is a relative thing. A paper two pages in length may be entirely too long for the subject, while a paper of 50 pages may be entirely too short to cover another subject adequately. An author should use whatever space is necessary to present the subject clearly, without using vague or useless words and phrases. The intelligence of readers should be neither over nor underestimated. The greatest sin against brevity is repetition. Needless repetition will often lead to exasperation rather than emphasis.

Consistency

A point often overlooked in papers is uniformity or consistency. The metric system of measurement is usually employed in scientific articles (although there may be sufficient reason for using some other system). Sometimes an author will use the metric system in one paragraph and the English system of measurement in the next. Only one method should be used throughout a paper. This applies not only to use of systems of measurement but to the way in which footnotes are arranged and noted; to the arrangement of bibliographies and literature citations, and to the numbering of figures, tables, graphs, etc., as well as to spelling.

Some entomological writers are in the habit of using words in a wrong sense. For instance, many textbooks contain such statements as "the third joint of the tarsi is twice as long as one and two combined". Joint is an articulation; the writer is actually referring to the segment, or that portion which lies between two joints. Incorrect usage of words should be carefully avoided.

Preparation of Manuscripts

All manuscripts should be typed on one side of the paper only and should be double-spaced on letter-size paper (8 1/2" x 11"). All pages should be numbered consecutively and the total number of pages should be written at the top of the first page of the manuscript. If a subsequent page is added, it should be numbered the same as the preceding one, followed by a small letter; for example, 20a. Page 20 should carry a notation that an extra page has been added. If a page is withdrawn--for example, page 9 of a manuscript is removed--a notation should be made on page 8 showing there is no page 9.

Always allow ample margins, usually 1 1/2 inches at the top, bottom and left side of each page.

It is very important that a complete carbon copy of your manuscript be retained, since there is always the possibility of the original being lost in transit.

Extensive papers should contain a table of contents, and it is well to include a list of illustrations, if same are numerous. The latter is for the benefit of the editor and, as a rule, will not be published.

Illustrations

The fact an author has a number of fine photographs is not sufficient reason for including them in an article. Reproductions of illustrations, especially those other than line drawings, is expensive. The following points should be considered when use of illustrations is contemplated:

1. Is the illustration necessary? If the picture will serve to clarify a situation, this is sufficient reason for its incorporation. (Line drawings are always preferable to half-tones, if they serve the afore mentioned purpose.)

2. Do the illustrations apply directly to the material discussed? Merely because pictures are excellent examples of photographic art does not entitle them to a place in a scientific article.

3. Are they excellent pictures that will reproduce in a creditable manner? Poor illustrations cost just as much to reproduce as good ones. Poor pictures do not add to, but actually detract from, the value of an article.

4. Are the illustrations of the proper size? It is important to keep in mind the size of the page of the prospective publication medium. Seldom is it possible to reproduce figures larger than 4 1/2 x 6 inches and, in most cases, figures must be much smaller. This should be kept in mind when preparing the original. If an original drawing is, for example, 12x15 inches or larger and is to be reduced to 2 1/2 by 3 inches, it may lose some of its detail. Reductions result not only in the shortening of all lines but in a reduction in the width of those lines. Small cuts used as text figures often form a valuable addition to printed matter. In the case of line drawings, many of these may be incorporated in a single original sheet. After the cut is made, they are sawed apart and inserted in their proper position in the text. Such procedure will materially reduce the cost of cuts. When a number of figures intended for reduction are drawn on a single sheet, it is important that the same percent-

age of reduction shall apply to all, in order that the engraver may photograph and reproduce the entire sheet at the same time. It is not necessary, however, that the drawings be grouped in proper sequence, as the plate can easily be cut into separate figures.

Direct Photo-engraving

When an actual reproduction of the original drawing is desirable, a direct photo-engraving process is employed. Illustrations of biological subjects are usually reproduced by this process. Copy must be drawn in black India ink, on smooth, white bristol board or drawing paper or on tracing cloth.

To allow for reduction, such illustrations should be larger than the desired reproduction, but should not exceed five times its area. The author should bear in mind that the lettering as well as the drawing will be reduced, and should make the original lettering large enough to be legible after reduction. When the length of a line is reduced in the course of this process, a corresponding reduction in its weight, or breadth follows. Relative weights of lines and the arrangement of drawings are very important in securing attractiveness, interest and "life" in the reproduction.

Half-tones

When cuts are made from photographs the half-tone process is employed. Photographs for half-tone reproductions must be clear and sharp, and should be printed in black on white paper, preferably with a glossy finish. Half-tones can also be made from wash drawings.

Color-Plates

Because of the extra expense of engraving and printing, illustrations in color are seldom warranted. By the use of conventional signs and shadings, it is possible to convey information usually given by colors. When the three-color process is absolutely essential, the author must submit either (1) a finished drawing in the exact colors to be reproduced or (2) a Kodachrome transparency or a color print from the latter.

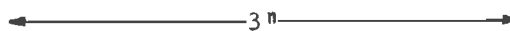
Drawings or illustrations should never be mounted or pasted directly on the manuscript, but prepared separately included with the manuscript.

Figures should be numbered in the order in which they are to appear. The usual method is small "fig. 1" or capital "Fig. 1", using arabic numerals. The point at which they are to be inserted in the manuscript is indicated in parenthesis at the proper place

by the designation of the figure: for example, (fig. 1). When one illustration contains a number of figures, these are designated by capital letters A, B, C, etc. In referring to a part of a figure, small letters a, b, c, etc., are employed.

Titles or legends for figures or plates are not included in the text. They may be written with ink on the back of the picture, and a typed list appended at the end of the manuscript. Do not write with pencil or use a typewriter to place titles on the back of pictures. The titles may be typed on separate paper and pasted on the back of the photograph.

The desired size of the finished text figure is indicated on the back or on the margin of the original being submitted. For example, a drawing 10 x 12 inches is to be reduced to 3 inches. The three-inch dimension will be indicated by lines and arrows, as shown below.



Photographs to be reproduced for plates or figures must be of a glossy finish and should not be mounted. They may be attached at the top to a letter-size sheet of paper. The plate number and legend should be placed on the paper, and, in order to avoid confusion or error in case the photograph and the paper become separated, it is well to place the same information in pencil on the back of the photograph. The title of the article should be written with ink on each plate and figure.

Abbreviations

Recognized abbreviations are acceptable, and, when the metric system measurements are employed, abbreviations are always used where there is a recognized form such as mm, cm, cc, etc. If the English system of weights and measures is employed, abbreviate same only when used in tables or charts.

Names

The first time common names of plants and animals appear, they should be followed by the scientific names, placed in parenthesis. When repeated, it is not necessary to repeat the scientific names. When employing common names of insects, use the list published by the Association of Economic Entomologists.

Proper Names

The author alone is responsible for the correct spelling of proper names used, and

³⁶A corrected proof sheet and revised proof of same page, reprinted by permission from "The Manuscript - A Guide for Its Preparation," published by John Wiley & Sons, Inc.

he should carefully verify the spelling, since no corrections are made by the editor.

Geographic Names

The United States Department of Agriculture recommends that the following authorities be consulted in order to insure uniform and correct spelling of geographic names:

1. Correct Orthography of Geographical names (decisions of the U. S. Geographical Board)
2. U. S. Postal Guide
3. Lippincott's Gazetteer of the World
4. International Postal Guide
5. Rand-McNally and Company's Atlas

Orthography

It is well to consult the following standard authorities with regard to spelling, use of capitals, hyphenated words, etc.

1. Webster's New International Dictionary
2. Style Manual of the Government Printing Office

(The latter can be obtained from the Superintendent of Documents, Washington, D. C.)

Quotations

As in the case of proper names, the author is responsible for all quotations and should

very carefully verify such material in order to insure its accuracy.

Correction of Proof

Changes in proof are costly, and unless an author is willing to assume a part of the cost, major changes in proof should be avoided. It is necessary, therefore, to take sufficient time to go over the manuscript thoroughly so that little editing and no major changes in the proof will be necessary.

Where corrections in the proof are necessary, the author should use recognized proofreader's symbols so that his changes will be clearly understood by the printer. On the following page are the recognized symbols, with their meanings.

In correcting proof, all corrections applying to the left half of the page are placed in the left margin and all corrections applying to the right half are placed in the right margin. Examples shown are taken from Wiley & Sons "The Manuscript", clearly indicate the correct use of proofreader's symbols:³⁶

PROOFREADER'S MARKS

| | |
|------|--|
| ^ | Insert the letter, word or punctuation mark indicated. |
| ⊙/ | Insert or substitute a period at the place indicated. |
| ✓ | Insert an apostrophe. |
| ↖ ↗ | Insert quotation marks. |
| =/ | Insert a hyphen. |
| # | Make a space at the point indicated. |
| ○ | Close up or join separated letters or words. |
| ∂ | Delete or take out. |
| lc | Change from capital to small letter. |
| cap | Change to capital letter. |
| s.c. | Change to small caps. |
| ital | Change to italics. |

| | |
|----------|---|
| rom | Change to roman type. |
| wf | Wrong font letter. |
| tr | Transpose. |
| ⌈ | Words or letters inclosed by line should change places. |
| ¶ | Paragraph here. |
| no ¶ | No paragraph here. |
| Stet, or | Restore word or sentence mistakenly marked out. |
| Qy. | Is this right? |
| x | Broken letter. |
| L | Move to left. |
| ┐ | Move to right. |
| ↓ | Push down space. |

There are times when an author may wish to indicate the style of type desired for headings, sub-headings, etc. By the following

system whereby the portion desired in a particular style of type is underlined the printer will be able to carry out the author's wishes.

A CORRECTED PROOF-SHEET.

caps THE PAN-AMERICAN SPIRIT *of*

tr To reach the goal toward which we are pressing
lc forward, the governing multitudes must first acquire
of knowledge that comes from universal education,
x wisdom that follows practical experience, personal
l independence and self-respect befitting men who
2 acknowledge no superior, self-control to replace that
external control which a democracy rejects, respect
for law, obedience to the lawful expressions of the
public will, consideration for the opinions and inter-
ests of others equally entitled to a vote in the State,
loyalty to that abstract conception—one's country—
as inspiring as that loyalty to personal sovereigns
L which has so illumined the pages of history, sub-
lc ordination of personal interests to the public good,
love of justice and mercy, of liberty and order, all
these we must seek with slow and patient effort; and
of of how many shortcomings in his own land and
of among his own people each one of us is conscious.
of Yet no student of our times can fail to see that
of not America alone, but the whole civilized world, is
of swinging away from its old governmental moorings
of and intrusting the fate of its civilization to the
of capacity of govern. By this pathway mankind is
of to travel, whithersoever it leads. Upon the success
of of this our undertaking the hope of humanity de-
of pends. Nor can we fail to see that the world makes
of substantial progress toward more perfect popular
of self-government.

of the popular mass

REVISED PROOF OF SAME PAGE

THE PAN-AMERICAN SPIRIT.

To reach the goal toward which we are pressing forward, the governing multitudes must first acquire knowledge that comes from universal education, wisdom that follows practical experience, personal independence and self-respect befitting men who acknowledge no superior, self-control to replace that external control which a democracy rejects, respect for law, obedience to the lawful expressions of the public will, consideration for the opinions and interests of others equally entitled to a voice in the State, loyalty to that abstract conception—one's country—as inspiring as that loyalty to personal sovereigns which has so illumined the pages of history, subordination of personal interests to the public good, love of justice and mercy, of liberty and order. All these we must seek with slow and patient effort; and of how many shortcomings in his own land and among his own people each one of us is conscious.

Yet no student of our times can fail to see that not America alone, but the whole civilized world, is swinging away from its old governmental moorings and intrusting the fate of its civilization to the capacity of the popular mass to govern. By this pathway mankind is to travel, whithersoever it leads. Upon the success of this our undertaking the hope of humanity depends.

Nor can we fail to see that the world makes substantial progress toward more perfect popular self-government.

One line indicates print in italics.

Two lines indicate small capital letters.

Three lines indicate print in regular capital letters.

A wavy line indicates print in bold-face type.

Two solid lines and one wavy line calls for small bold-face capital letters.

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Any manuscript is first-class matter and must be paid for at first-class postage rate. A manuscript when accompanied by proof, however, is fourth-class matter and the postage rate varies according to the zone if the weight exceeds eight ounces. When the weight is less than eight ounces, the postage rate on fourth-class matter is one cent for each two ounces to any point in the United States. Fourth class packages should not be sealed, and it is well to mark packages "Manuscript - First Class" or when containing printer's proof, mark them "Printer's proof - Fourth Class".

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