

The Insects of Virginia: No. 1

PART I

Introduction to the Series of Bulletins
on the Insects of Virginia, with
a Literature Review

Michael Kosztarab
Professor of Entomology
Virginia Polytechnic Institute
Blacksburg, Va.

PART II

The Biotic Regions of Virginia

Richard L. Hoffman
Professor of Biology
Radford College, Radford, Va.

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I—Introduction to the Series of Bulletins on the Insects of Virginia, with a Literature Review

Michael Kosztarab

Objective

The insects of Virginia are poorly known, although the first North American insect (the tiger swallowtail butterfly) was described from "Virginia" (Forbes, 1928, as quoted from Moufet, 1634), and systematic collections of insects from the state started with the establishment of the Virginia Agricultural Experiment Station, as early as 1888 (Alwood, 1890). Smyth (1895, 1899) collected insects intensively and studied their biology for over 30 years, concentrating on Montgomery County Lepidoptera. After Dr. Smyth retired in 1925, very few of the new V.P.I. staff members or other workers did systematic and distributional studies on the Virginia insects. For example, the only published comprehensive systematic work on a group of insects in Virginia is the study by Clark and Clark (1951) on the butterflies of Virginia. There is a real gap in this type of study in Virginia, compared with the amount of work done in other states. To make up for this deficiency, the author intends with this paper to initiate a series of publications recording the insect fauna of Virginia: a systematic treatment which includes records on biology and ecology of the different Virginia insect groups. It is sincerely hoped that many professional and amateur insect enthusiasts will contribute to this series of papers. Nine scientists to date have offered to prepare 11 publications for this series.

Economic Importance

A series of publications dealing with the insects of Virginia and including general information of their distribution, life history, ecology, economic importance, and supplemented (where possible) by identification keys, should be valuable to many people whose work is directly or indirectly affected by insects. It is in the interest of farmers, orchard owners, nurserymen, gardeners, and the householders of the towns and spreading suburbs of Virginia to know the best method for controlling insect infestations and the best time for insecticide application. Other information, e.g. the host preference, overwintering sites, time of adult appearance and egg hatching, duration of the different life stages, parasites and predators of pest species, and number of yearly generations under the different climatic conditions in Virginia, should also be useful in timing the control measures.

The correct identification of the pest is the starting point of any control program. Therefore, besides the compilation of the insect faunistic data for Virginia, this work should be expanded in the future to include detailed taxonomic treatment for the insect orders and families. This will be achieved by preparing adequate descriptions and illustrations for each species, and by providing keys for their identification. Examples of insect damage from the state are being preserved at V.P.I. for aiding as reference materials in future identification work and descriptions (Kosztarab, 1966).

How Many Species In Virginia?

It was estimated by Borror and DeLong (1964) that there are 84,557 insect species known from North America north of Mexico. Brimley (1938, 1942) and Wray (1950) reported 11,094 different insect species from the bordering state of North Carolina, but Wray assumed that this number would be at least doubled if intensive collecting was done over the entire state. Leonard (1928) listed 15,450 species occurring in New York state. Because of the diversity of the life zones in Virginia (Hoffman, 1969), it is estimated that over 20,000 species of insects occur in this state. The economic insect survey file at V.P.I. includes more than 10,000 individual reports on over 1,500 insect pest species of agricultural and medical importance. Conservative estimates show that there are over 2,100 beneficial insect species in Virginia, belonging to 11 orders. These include the parasites and predators of pest insects and a large number of pollinating bee species.

Thousands of individual collections were made in Virginia since 1888, from which about 100,000 specimens are stored in the V.P.I. insect collection (Covell and Kosztarab, 1966). A large proportion of the Virginia insects collected before 1925 was donated by Professor E. A. Smyth, Jr., to the U. S. National Museum.

Who Can Contribute and How?

The authors of this series may be any of the following: members of the V.P.I. faculty, students or former students who want to publish research work completed at V.P.I., associated workers in co-authorship with V.P.I. faculty members, individuals willing to deposit significant Virginia insect material in the V.P.I. collection, persons identifying large sections of the V.P.I. insect collection, or workers contributing individually or through their institutions toward the cost of printing their publications.

It is planned to publish each contribution separately; however, for economic reasons, publications on related groups or subjects, totaling 16 or fewer printed pages, may be printed together in the same issue. All manuscripts for this series should be submitted to the Head of the Department of Entomology, V.P.I., who will arrange for review and editing of each manuscript for uniformity before submitting it to the Administration of the V.P.I. Research Division for approval. The Editor of the Research Division Bulletins will proceed with the final editing procedures of each manuscript before printing. Each issue will be published in a uniform style and size so that several may be bound together in book form. Contributors are urged to consult the Style Manual for Biological Journals (1964) before preparing manuscripts for publication for this series.

Since a large portion of the insects collected in Virginia is stored in the U.S. National Museum, it is expected that researchers working up records on any insect group will check the specimens from Virginia at the U.S.N.M. during the preparation of their articles. The Virginia Polytechnic Institute collections, library, insect survey files, and other facilities will be available for workers who want to contribute papers.

Projected Goals

It is hoped that this beginning on the Virginia insects will lay the foundation of an organized natural history survey, especially of a "Virginia State Natural History Survey" in the near future. It should lead to a better realization of the value of such work by our legislators, state officials, and others who may read the various bulletins.

The pollution of our rivers and of the air in the metropolitan areas is becoming an alarming problem. Information is still not available on how the pollution changes the structure of our present plant and animal communities in Virginia. This series and similar projects in other disciplines may one day make such information available. The Illinois State Natural History Survey has a staff of over 100 professional employees presently working on these types of problems (Mills, *et al.*, 1958). The "Virginia State Natural History Survey" could work in coordination with the yet-to-be established "Virginia Museum of Science and History" suggested by MacCord (1967).

Review of Selected Works

There were several persons who, as general collectors of insects in Virginia, contributed toward the knowledge of our state fauna, and whose names should not be left out of this review. Several of these scientists were, or are, employees of the U.S. National Museum or the U.S.

Department of Agriculture, who have lived or are still living in northern Virginia. Two of these workers were Harry A. Allard and his son Howard, who, while living in Arlington, took many collecting trips in Virginia. Among the 254 papers written by H. A. Allard (Gurney, 1964), there are several dealing with Virginia Orthoptera and cicadas although his major interest was in plant physiology. Nathan Banks lived in Fairfax County and collected a wide range of insects in the state between 1904 and 1912. Herbert S. Barber, as a U.S. National Museum specialist of Coleoptera, made extensive collections, especially of beetles (Chrysomelidae, Lampyridae) in Virginia during the 1930's and 1940's. J. C. Bridwell and Donald W. Clancy from the U.S.D.A., while stationed at Charlottesville, collected many insects, especially mealybugs, in that area. Bridwell's main interest was in weevils. Their material was incorporated in the U.S. National Museum Collection. Oliver S. Flint (1956-66) and Ashley B. Gurney (1963), workers at U.S.N.M., are among the most enthusiastic present-day general collectors in Virginia. Henry G. Hubbard and Eugene A. Schwarz specialized in Coleoptera of the state around the turn of the century. Henry Ulke, another coleopterist and noted Virginia collector, was interested in the smaller beetles, Pselaphidae, Scydmaenidae, and Silphidae. His collection was given to the Carnegie Museum. George B. Vogt, of the U.S.N.M., made collections of Buprestidae, Cerambycidae and Chrysomelidae in the state. Many insect specimens from forest and ornamental plants, especially from nurseries in Virginia, were collected by Messrs. F. R. Freund, W. H. Matheny, and C. R. Willey of the Virginia Department of Agriculture and Commerce, and by Mr. C. L. Morris of the Virginia Division of Forestry. From this material were built collections of insects for their respective offices, while many samples were sent to the U.S. National Museum for identification and verification.

Other general insect collectors associated with V.P.I., either in the past or at present, are: W. B. Alwood, J. M. Amos, J. L. Bishop, M. L. Bobb, L. R. Cagel, D. H. Cochran, C. V. Covell, Jr., C. B. Dominick, J. McD. Grayson, L. A. Hetrick, C. H. Hill, R. L. Hoffman (now at Radford College), W. S. Hough, O. W. Isakson (1967), M. Kosztarab, H. M. Kulman, D. E. Messersmith, R. R. Mills, A. P. Morris, S. E. Neff, R. L. Pienkowski, J. L. Phillips, E. M. Raffensperger, J. O. Rowell, W. J. Schoene, J. C. Smith, E. A. Smyth, W. A. Tarpley, E. C. Turner, Jr., G. W. Underhill, D. F. Vest, and A. M. Woodside.

Young (1945) prepared a list of the activities and publications of the Virginia Agricultural Experiment Station between 1889-1944. His list contains useful records for persons interested in the papers published and

work done by biologists and entomologists employed by the Experiment Station.

It is not the objective of this review to refer to all publications giving information on insects of Virginia. There are many records on Virginia insects in monographs covering some of the North American insect families and genera. Cited here are only those relatively few publications that are more or less specific studies on Virginia insects, and of taxonomic nature.

The compilers of this series would like to help future workers studying Virginia insects, and to give proper credit to authors, by providing a preliminary list of references for each insect order and family in the issues to follow. For this, authors who have included records on Virginia insects in their papers are asked to supply the compilers with reprints, and with information regarding the whereabouts of the Virginia specimens they have studied.

Work on Specific Groups

New species of PROTURA were described by Ewing (1921) from Virginia. DIPLURANS (Japygidae) were collected by Richard L. Hoffman and included in a study by Smith and Bolton (1964). Spring-tails as agricultural pests in the state were reported by Smith (1917). Maynard (1951), in his monograph on the COLLEMBOLA of New York State, included descriptions and distributional records on several species present in Virginia. MICROCORYPHIA collected by R. L. Hoffman were sent to Dr. P. Wygodzinsky of the American Museum of Natural History, who will publish on these later.

Banks (1904c) reported on 4 genera of EPHEMEROPTERA. About 6,600 specimens have been collected in central Virginia by Pugh (1956), who recognized 36 species. Reid R. Gerhardt, as a graduate student, enlarged the insect collection of Virginia Polytechnic Institute with many adults. Traver's (1932-1933) work on the mayflies of North Carolina should be a useful reference to any person studying Ephemeroptera in Virginia.

Among the early workers on Virginia ODONATA were Calvert (1890), Williamson (1903), and Banks (1908a). Each added new distributional records to the Virginia faunal list. Odonata of Virginia have been collected and studied more recently by R. L. Hoffman, D. Innes, D. E. Messersmith, J. K. Novack, M. D. Ries, and G. M. Simmons. Gloyd (1951) determined Odonata in the V.P.I. collection through 1948, and included several new species records for Virginia. Byers (1951) published some notes on the Odonata fauna of Mountain Lake,

while Donnelly (1961), presented many records from Northern Virginia. Ries and Cruden (1966) gave the known distribution of *Anax longipes* in the state. At present, Mrs. Donald T. Ries is preparing a manuscript on the Odonata of the York-James Peninsula. She informed this author about the availability of about 50 titles, as references to the Odonata fauna of Virginia. Odonata is one of the orders which probably will be worked up taxonomically for this series soon.

ORTHOPTERA have been more extensively collected in Virginia than any other group of insects. Most of the material and the organization of the V.P.I. insect collection is due to R. L. Hoffman, R. R. Mills and W. A. Tarpley. Other collectors and also publishers on Virginia Orthoptera were: H. A. Allard, A. N. Caudell, H. Fox, A. B. Gurney, M. Hebard, and J. A. G. Rehn. Allard (1914, 1916, 1930, 1939) added some new state records on crickets, and described in detail several of the sound-producing Orthoptera. Caudell (1928, 1929) recorded the Chinese mantid as far south as Virginia, and described a new variety of Tettigoniidae from Cape Henry. Caudell and Allard (1930's) prepared a monograph on the Orthoptera of the District of Columbia, Maryland, and Virginia. Unfortunately this manuscript was never completed and published, but it is available at the U.S. National Museum for persons interested in bringing it up to date for publication. Fox (1917, 1938) gave distributional and ecological notes on over 100 species and subspecies of Virginia Orthoptera. Gurney (1941) presented detailed taxonomic and bionomic notes, with distribution in Virginia and other states, on the grasshopper, *Melanoplus impudicus* Scudder. In a previous study Rehn and Hebard (1916) included 93 Orthoptera and one DERMAPTERA species from Virginia. Some Tettigoniidae were reported from Virginia by Hebard (1938, 1945). In 1945, Hebard listed 86 species from the Appalachian mountains in the vicinity of Hot Springs, Bath County, Virginia.

Two new species of termites, ISOPTERA, were described, one from Falls Church by Banks (1907a); the other from Cape Henry by Snyder (1924, 1925).

PLECOPTERA distributional records were given by Banks (1904c), and descriptions are available on two species of *Allocaënia* (Ross, 1964; Ross & Yamamoto, 1967).

Banks (1904c) reported several species of PSOCOPTERA from the state. Ewing (1930) gave distributional records, morphology and taxonomy of one MALLOPHAGA species in Virginia, while Emerson (1964a, 1964b) listed distributional records from many host animals present in the state.

The THYSANOPTERA fauna of Virginia is very poorly known. Three new species were described from material collected in the state by Crawford (1943), and Hood (1916, 1952).

HEMIPTERA lists and new state records were compiled by Banks (1907b, 1912), Girault (1915b), Rehn & Hebard (1916), Knight (1918), McAtee (1919b, 1923), and Hoffman (1953). New species were described: Reduviidae, by Banks (1910); Corixidae, by Abbott (1916); Miridae, by Knight (1926); and Nabidae, by Harris (1940). Bobb (1950) concentrated on the aquatic and semi-aquatic hemipterans while preparing a detailed Ph.D. study at the University of Virginia. In his dissertation 90 species were treated. His specimens are in the collections of the U.S. National Museum, University of Kansas, and at V.P.I. It is the author's sincere hope that this work will be brought up to date and published in the near future. Bobb's publications (1951a, 1951b, 1953) include life history studies and distributional records on three aquatic species. Nonaquatic Hemiptera have been worked up taxonomically by R. L. Hoffman, and his manuscript on this interesting and economically important group is currently under preparation.

HOMOPTERA groups, probably due to their economic importance in agriculture, have been studied intensively in Virginia. Cicadas of Virginia have been listed by Davis (1922), McAtee (1927) and Allard (1938). Davis (1922) also described a new species from the state. Stearns (1927) published a faunal list of the leafhoppers of Virginia, which was later supplemented by Wene and Dominick (1941). Wheeler (1942) collected 30 species of *Empoasca* in light traps. Ball (1928) reported on the spittlebug, *Aphrophora saratogensis*. McAtee (1919a) prepared a key to the *Eupteryx* species, including records on one species from Virginia. Baker (1916) gave biological data on the species of the genus *Eriosoma* found in Virginia. Smulyan (1920) investigated the morphology of some economically important species of aphids, and prepared descriptions and keys for three species of *Aphis*.

There are several publications dealing with the scale insect species of economic importance in Virginia, but among the early workers only Hough (1922, 1925) conducted morphological investigations to clarify species differences. Morrison (1939) described a new species of *Matsucoccus* from Virginia. Kosztarab has been studying the Virginia scale insect fauna since 1959. Results of this study will be published through this series in the near future. However, some records on Virginia armored scale insects were included in one of his publications (Kosztarab, 1964). Russell C. Brachman is investigating the mealybug fauna while Mike L. Williams the soft scales of the state at present.

NEUROPTERA seems to be one of the most neglected insect orders in Virginia. Banks collected and reported on a few species (1904c), and on a rare neuropteran, *Dilar americana*, near Falls Church (1907c). Flint (1964a, 1965b) gave distributional records and morphology for some *Sialis* and one *Neohermes* species. Three *Chrysopa* species present in Virginia were described with distributional records by Bram and Bickley (1963).

Early studies on Virginia COLEOPTERA were conducted by Horn (1868), Banks (1912), Girault (1904, 1913a, 1913b, 1915b), McAtee (1916), Snyder and Shannon (1919), and Knull (1920, 1927). Hoffman (1937) reported *Pseudolucanus placidus* from Virginia. Robinson (1941) partly based his new species description of *Trox tytus* on Virginia material. King (1942) described the taxonomic distinction between *Cyl-lene robiniae* and *C. caryae*. While working at V.P.I. for a Master of Science degree, King (1947) studied the species variation in the hind wings of *Silpha* and *Saperda*. Barr (1960, 1962, 1965) described new Carabidae species and one new genus from southwest Virginia material. Richard L. Hoffman collected many Coleoptera specimens, especially Cerambycidae and Scarabaeidae from Virginia, and is preparing a manuscript on the Cerambycidae of Virginia.

Pierce (1918) included in his comparative morphology work several host records on STREPSIPTERA present in Virginia.

Banks (1904c) reported on two genera of MECOPTERA. Specimens collected by R. L. Hoffman in Virginia were sent for study to Mecoptera specialist G. W. Byers. Parfin (1955) and Tombes (1956) gave information on the occurrence of two species in the state.

TRICHOPTERA larvae and adults more recently have been collected in southwest Virginia by Charles V. Covell, Jr., Richard L. Hoffman, Stuart E. Neff and Judy A. Wilburn. Most of their materials have been included in the V.P.I. collection. Almost all the adult specimens were identified or verified by O. S. Flint. Banks (1904a, 1904c) listed several species, including new ones, from the state. Betten (1934) included some Virginia records in his study on the caddisflies of New York State. Ross (1938, 1939, 1962) gave distribution for some and described two new species, while Flint (1958, 1965a), reported three new species from Virginia. Flint (1956, 1960, 1962, 1964b, 1966) presented distributional and biological data, also morphological descriptions for several species from Virginia. Flint and Wiggins (1961) reported three additional species from the state.

The LEPIDOPTERA fauna of Virginia was systematically studied by Ellison A. Smyth from 1891 to 1925. He was especially interested

in the Sphingidae, but added several new records to the Virginia fauna list on other groups of Lepidoptera. Smyth (1902a) reported that the V.P.I. Lepidoptera collection included about 3,300 species. The diverse interest and quality of his work proved him to be one of the outstanding biologists of his times. He prepared morphological descriptions of Lepidoptera larval stages (Smyth, 1900b, 1912), and conducted rearing experiments to clarify the species. He also described their seasonal forms (Smyth, 1902b, 1908), and studied their biology where this was possible (Smyth, 1900a). Other workers who studied Lepidoptera in Virginia were: Braun (1908, 1920); Dyar (1910); Girault (1908, 1913a, 1913b, 1913c, 1913d, 1915b); Wood (1916); Wood and Gottschalk (1942a, 1942b, 1942c); Skinner (1920); Jones (1926); Clark and Clark (1939, 1951). There were many other collectors of Lepidoptera who specialized in Virginia butterflies, but because they were listed in a detailed bibliography by Clark and Clark (1951), were not included in this review.

The only comprehensive study available at the present on a group of Virginia insects is "The Butterflies of Virginia", prepared by Austin H. Clark and Leila F. Clark (1951). Intensive collections of Virginia Lepidoptera were made by Charles V. Covell, Jr. in 76 counties, especially from 1960 to 1965, while studying at V.P.I. He also revised and enlarged the V.P.I. Lepidoptera collection, published on the occurrence of *Satyrium kingi* in Virginia (Covell, 1962), revised and brought up-to-date the faunal list of the Virginia butterflies and skippers (Covell, 1967). His Ph.D. dissertation (Covell, 1965) includes several records on the species of *Scopula* (Geometridae) in Virginia.

DIPTERA are among the orders studied more intensively in Virginia, especially those families of medical and veterinary importance.

The first faunal list of the mosquitoes (Culicidae) of Virginia was compiled by Dyar (1922). Mosquito surveys have been conducted in the Williamsburg area by Dorsey (1944). An annotated list of the mosquitoes of Virginia was published by Dorer, Bickley, and Nicholson (1944), with some further information on their distribution, added to this list by Bickley (1957) with two new species records for Virginia. Gladney worked on some phases of ecology of 23 species of mosquitoes in Southwest Virginia. Gladney and Turner (1969) completed a manuscript for publication in this series on the mosquitoes of Virginia, with new records for the state.

Investigations on the *Culicoides* (Ceratopogonidae) of Virginia (survey, bionomics, transmission of infectious synovitis) were the subject of two doctoral studies (Messersmith, 1961, 1964, 1965, 1966; and Hair, 1966) and a M.S. thesis (Wherheim, 1962) at Virginia Polytechnic In-

stitute. Wirth (1951) listed over 30 species from Virginia, of which 8 were new. The larval habitats of 21 *Culicoides* species were described by Hair, Turner, and Messersmith (1966).

Underhill (1940) reported the distribution of two simuliid species feeding on turkeys.

Other workers who contributed to the knowledge of the Diptera fauna of Virginia are listed in the following paragraph:

Johannssen (1929) described *Sciara lurayi* as a new species from the caverns of Luray, while Fisher (1943) listed species of Mycetophilidae from Virginia. A new species of Itonididae was described by Foote (1953) as a pest of holly in 3 eastern states, including Virginia. Banks (1904b) redescribed and gave the life history of the "yellow fly", a tabanid, from the Dismal Swamp. Thompson (1967) recorded some Tabanidae from the state in his recent work. Cresson (1920) studied Virginia specimens of *Pogosoma* (Asilidae). New species of Dolichopodidae were described from the state by Van Duzee (1914a, 1914b, 1915). A new *Phyllomyza* species (Milichiidae) was described by Steyskal (1942), while Cresson (1924) selected the type of *Rhysophora robusta* (Ephydriidae) from Virginia material. Levitan (1952) listed 28 species of Drosophilidae from southwest Virginia. A new species, *Fannia americana* (Anthomyiidae), was described from the state by Malloch (1927). Tachinid new species were described by Townsend (1916) and Reinhard (1958), while Rowe (1932) recorded *Polidea areos* from Virginia. Banks (1907d, 1912) captured 121 species of Diptera in the state.

Parasitic dipterans were investigated by Townsend (1916) and by Bobb (1942, 1963), while a case of human myiasis due to green bottle fly larvae was reported by Pratt (1956).

Fortunately, two of the present V.P.I. staff members (Stuart E. Neff and E. Craig Turner, Jr.) are interested in the Diptera of Virginia. The V.P.I. Diptera collection is under revisionary work and organization by G. Tanner. J. Bruce Wallace has completed a Ph.D. study on the ecology and description of immature stages of the genus *Cordilura* under the direction of Neff, who himself is working on the ecology and description of immature stages of Scatophagidae. Roth and Neff (1964) observed the larvae of five Diptera species in the profundal bottom fauna of Mountain Lake, while Neff and Berg (1966) reported six species of *Sepedon* (Sciomyzidae) from Virginia.

A quick check of the publication by Ewing and Fox (1943) on the fleas of North America shows how little is known on the SIPHONAPTERA fauna of Virginia. Jan G. Humphreys, a Ph.D. candidate in the Department of Entomology at V.P.I. is preparing a publication on

the Siphonaptera of Virginia, which may be printed in this series on the Insects of Virginia.

Distributional records on miscellaneous HYMENOPTERA from Virginia were given in a series of publications by Girault (1904, 1913a, 1913d, 1915a, 1915b, 1916). Two new species of sawflies of the genus *Neodiprion* were described by Ross (1955), while Morris, Schroeder and Bobb (1963) gave a detailed account on the biology of the pine sawfly. Woodwasp distributional records from the state were presented by Rohwer (1918). Morrison (1917) and Muesebeck (1936) described three new species of braconid wasps from Virginia. Trigonaliidae and Roproniidae wasps were reported by Banks (1908b). Fouts (1924) in his revision on the North American Platygasterinae included descriptions and distributional records on 11 species from Virginia, with 15 additional ones from the District of Columbia. He (Fouts, 1948) also reported 10 species, including two new ones, of *Trimorus* (Scelionidae) from the state. Krombein (1951, 1952, 1962) who is living in Arlington, Virginia, listed with biological notes several species of wasps (Dryinidae, Tiphidae, Mutillidae, Vespidae, Pompilidae and Sphecidae) from northern Virginia. Two Ampulicidae were recorded from the state by Bradley (1934).

The sphecid wasps have been among the more intensively studied Hymenoptera in the state. Plate (1934) reported on one species, while Will (1935) described the epidemics of the giant sand wasp (*Sphecius speciosus*) at Narrows, Virginia. Prey records, including distributional records, on several species in the state were given by Krombein in a series of articles (1948b, 1956, 1958a, 1963). Krombein (1958b, 1959, 1961) also studied the dispersal of introduced species of sphecid wasps in Virginia.

Bees were recorded in the state by Swenk (1907), Lovell (1909), Cockerell (1908, 1915), Ellis (1915), and Jackson (1920). The biology of miscellaneous beneficial parasitic wasps was studied and their distribution recorded by Gahan (1933), Krombein (1948a), and Bobb (1962, 1963, 1965).

LIST OF SELECTED LITERATURE
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- 1907b. Rare Hemiptera in Virginia. Ibid. 18(10): 425.
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The INSECTS of VIRGINIA: No. 1

Part II: The Biotic Regions of Virginia

*Richard L. Hoffman**

Introduction

From the standpoint of biogeography, the Commonwealth of Virginia enjoys an especially favorable position. In an east-west direction, the state embraces no less than five of the major physiographic provinces of eastern United States, with a resultant diversity of topography and habitat types. Through the combination of latitudinal location (36.30 to 39.30° N.) and a considerable range of vertical relief (sea level to 5,720 feet), a variety of biotic associations determined primarily by climatic factors is found within the political boundaries of Virginia. To a greater extent than in adjoining states, the surface drainage is shared among basically old and geographically important river systems. Yet, despite the long and venerable tradition of education and culture in Virginia, relatively little attention has been paid to the biota of the state — we still know only very imperfectly what kinds of plants and animals occur here, to say nothing of the patterns and dynamics of their distribution.

So far only a few groups of organisms have been surveyed as regards their occurrence in Virginia, namely the birds, mammals, and various small groups of vascular plants. For the state there exist a recent manual on the ferns and allied forms (Massey, 1944); a fairly detailed account of the butterflies (Clark and Clark, 1951); a checklist of the avifauna (Murray, 1952); and a popularized handbook of the mammals (Handley and Patton, 1947). Aside from these, one must turn to technical literature—monographs and other systematically oriented papers—for in-

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