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PRESIDENTIAL ADDRESS—1973 THE NATIONAL COLLECTION OF LEPIDOPTERA

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James Smithson, an Englishman of noble birth, the natural offspring of the Duke of Northumberland and Elizabeth Keate Macie, a lineal descendant of Henry VII, bequeathed his estate to the United States Government "to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." Receipt of the bequest in 1838 precipitated a lengthy debate in Congress on whether the Government should, or indeed, could legally accept the funds and accompanying trust. In the Act of 1846, establishing the Smithsonian Institution, provision for a museum was made, and the name "United States National Museum" came into use in the year 1859. In 1884 appropriations to the Smithsonian for the U.S. National Museum were authorized and an annual report to the Congress by its Director was required. Today, the Museum's component parts are the National Museum of Natural History and the National Museum of History and Technology. It is the former in which we are interested here.

This brings us to the National Entomological Collections. The collections of all groups of insects consist of over 22,000,000 specimens. Of these approximately 3,500,000 are Lepidoptera.

The National Collection of Insects is now over 93 years old having been started in 1881 with the transfer of 50,000 specimens to the U.S. National Museum from the U.S. Department of Agriculture. In 1886, C. V. Riley (1843-1895), then Chief Entomologist with the U.S. Department

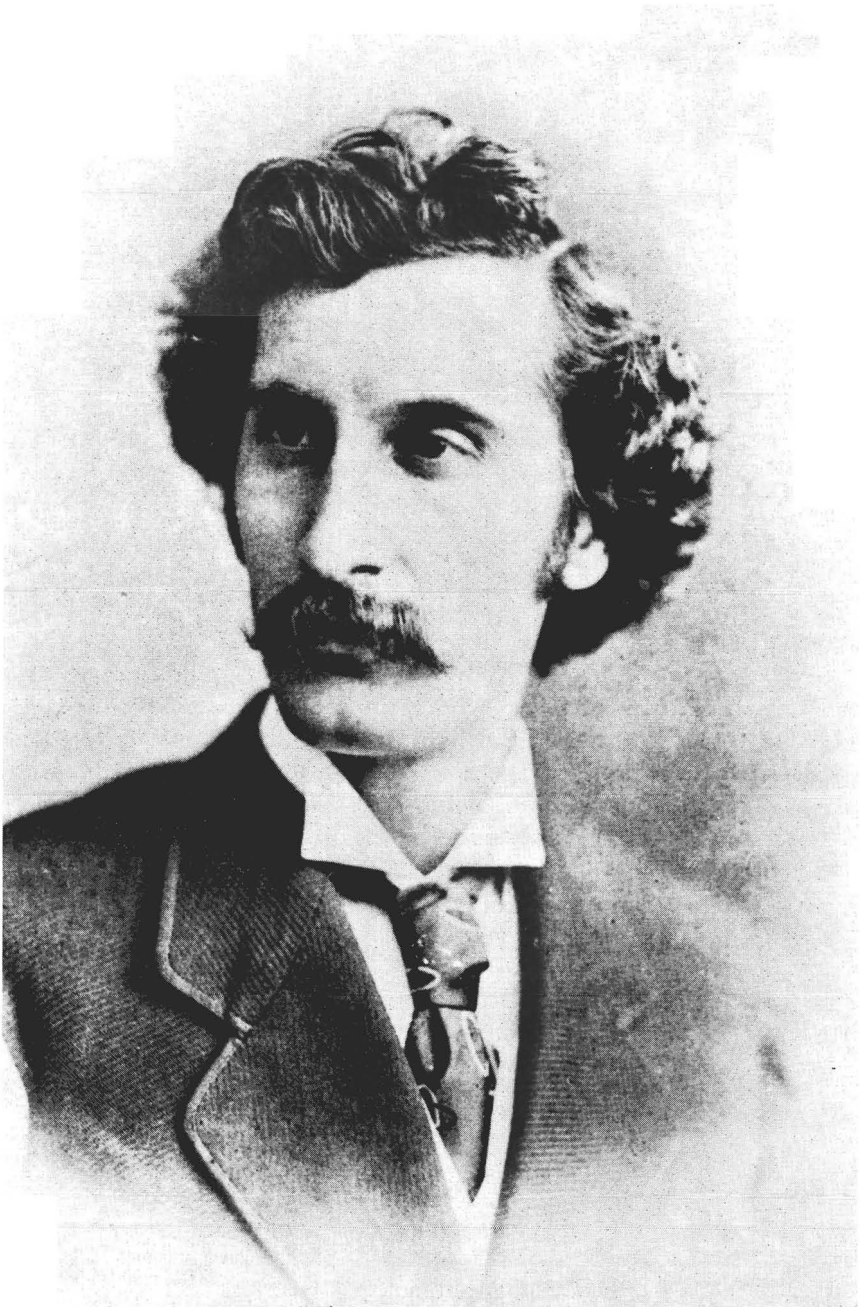


Fig. 1. C. V. Riley, 1843-1895

of Agriculture and honorary curator of entomology at the United States National Museum (appointed in 1882), donated 150,000 specimens of insects to the museum. In neither of the above cases was the number of Lepidoptera noted, indeed, it was not even certain that there were any Lepidoptera in these collections, but "C. V. Riley collection" labels are now occasionally found on specimens of Lepidoptera. Shortly before this time it is said that Townend Glover (1812–1883) also made a contribution to the National Museum, but there are no records in the Smithsonian to prove this claim. Since the earliest times the U.S. Department of Agriculture's entomological organizations and its entomologists have been closely linked with the National Museum and, indeed, the Department of Agriculture's contributions to the National Collection have been great and many.

There was no paid entomologist on the Smithsonian's staff until 1885 when John B. Smith, a lepidopterist, was appointed curator. From 1900 to 1940 the Smithsonian had one staff entomologist. This has now increased to 12, four of whom are lepidopterists. The U.S. Department of Agriculture had 16 specialists in 1930 and 29 in 1974. Of these, four are lepidopterists.

Five men, William Schaus, August Busck, Carl Heinrich, H. G. Dyar and William Barnes (the latter not a member of the museum staff) were primarily responsible for the early development of the National Collection of Lepidoptera.

August Busck (1870–1944)

August Busck was born in Randers, Denmark, 18 February 1870 and in 1893 he came to the Columbian Exposition in Chicago. In March 1896 he was appointed assistant in the Division of Entomology, U.S.D.A., becoming shortly thereafter a specialist in Microlepidoptera. He investigated the mosquito and Lepidoptera faunas of the West Indies in 1905 under the auspices of the Carnegie Institution and made a similar investigation of the mosquito and Lepidoptera faunas of the Canal Zone for the Panama Canal Commission in 1907. Parts of the results of these two expeditions were reported in the Howard, Dyar, Knab monograph of *The Mosquitoes of North and Central America and the West Indies*. Most of the Lepidoptera collected by Busck were reported by Dyar and himself, but some of Busck's material is still being used by today's workers.

Busck was one of the first to use consistently genitalic characters, the most important structures ever to be used in the classification of the various categories of Microlepidoptera.

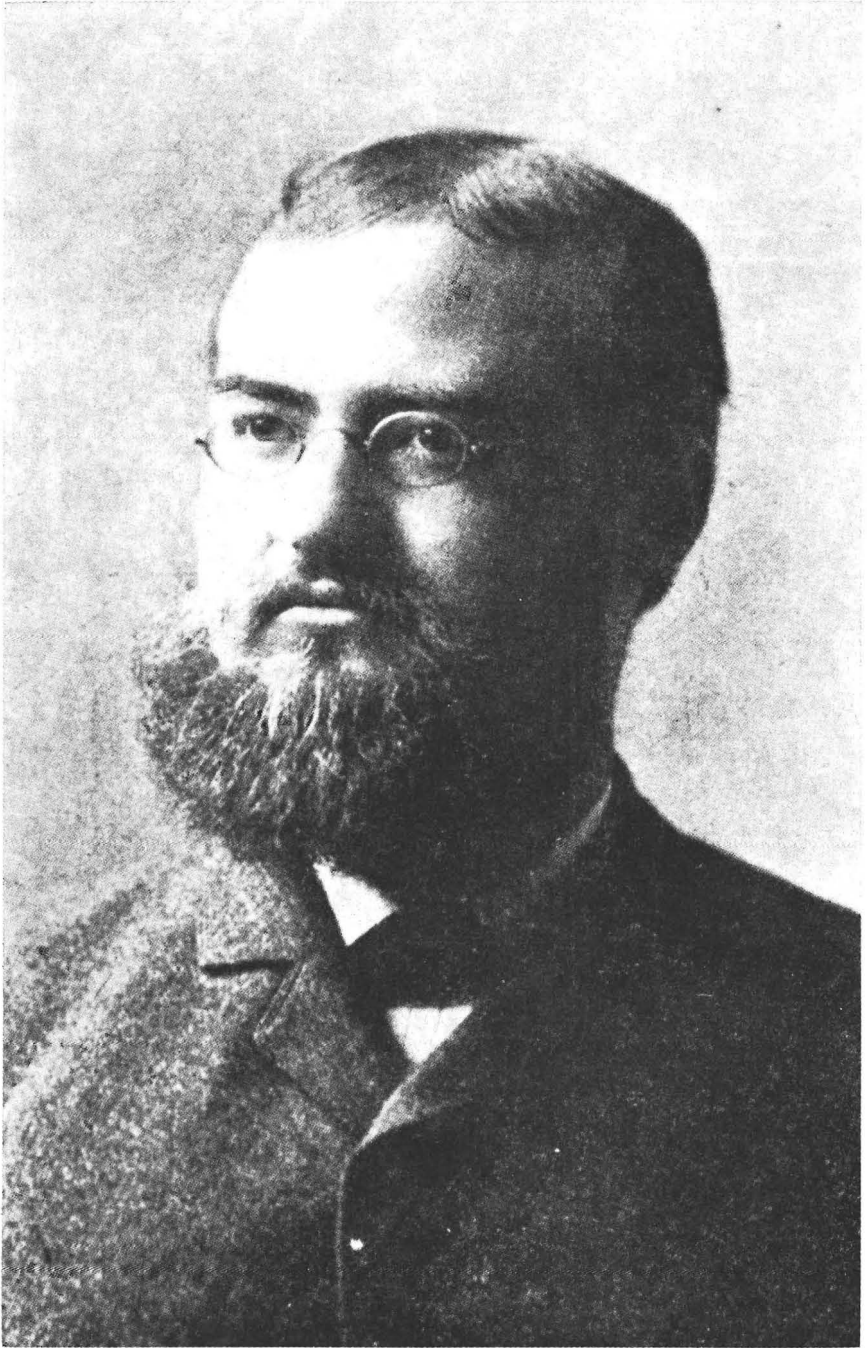


Fig. 2. John B. Smith, 1858-1912



Fig. 3. August Busck, 1870-1944

Throughout his career Busck was intimately associated with the USNM and its collection of Microlepidoptera is the second most extensive and important in the world, and for this eminence Busck must be given chief credit.

Harrison Gray Dyar (1866–1929)

Harrison Dyar was born in New York City and was educated at the Massachusetts Institute of Technology, Columbia University and in the field. He came to the U.S. National Museum in 1897 but was on the payroll of the U.S.D.A.

He was an extremely versatile man. He had a good eye for species, could comprehend major groups of insects and had the ability to study intensively the biology and early stages of one or another group. He excelled in all these fields and was able to make a synthesis of them. His publications include a larger number of full and accurate larval descriptions than the work of any other American entomologist. On the basis of his knowledge of adults, larvae and eggs his work may perhaps be considered the basis of our modern classification of moths.

His greatest work, however, in which he did the taxonomy, was the monumental work *The Mosquitoes of North and Central America and the West Indies* published in four volumes (1912–1917) by the Carnegie Institution. He is also the discoverer and promulgator of what has become known as “Dyar’s Law”—that the widths of the head of a larva in its successive stages follow a regular geometrical progression.

There was another entomological law that emanated from the National Museum known as “Schwarz’s law.” This refers to the accidental occurrence of an insect on a plant and thus the misinterpretation of its host and reminds us that “a bug must have some place to sit.”

Wilhelm Carl Paul Gottlieb Heinrich (1880–1955)

Carl Heinrich was born in Newark, New York, 7 April 1880 and has been described as a poet, writer, student of music, history literature and philosophy. He intended to study music under Edward McDowell but before the opportunity came McDowell died. He came to Washington in 1902 but did not begin working with the U.S. Department of Agriculture until 1913 and retired his services in 1949.

He published 87 papers and books, many of them editorial in nature. His two largest works were the *Revision of the family Olethreutidae* in two parts (1923–1926) and *American moths of the subfamily Phycitinae* (1956). His publications were not confined to entomological subjects.

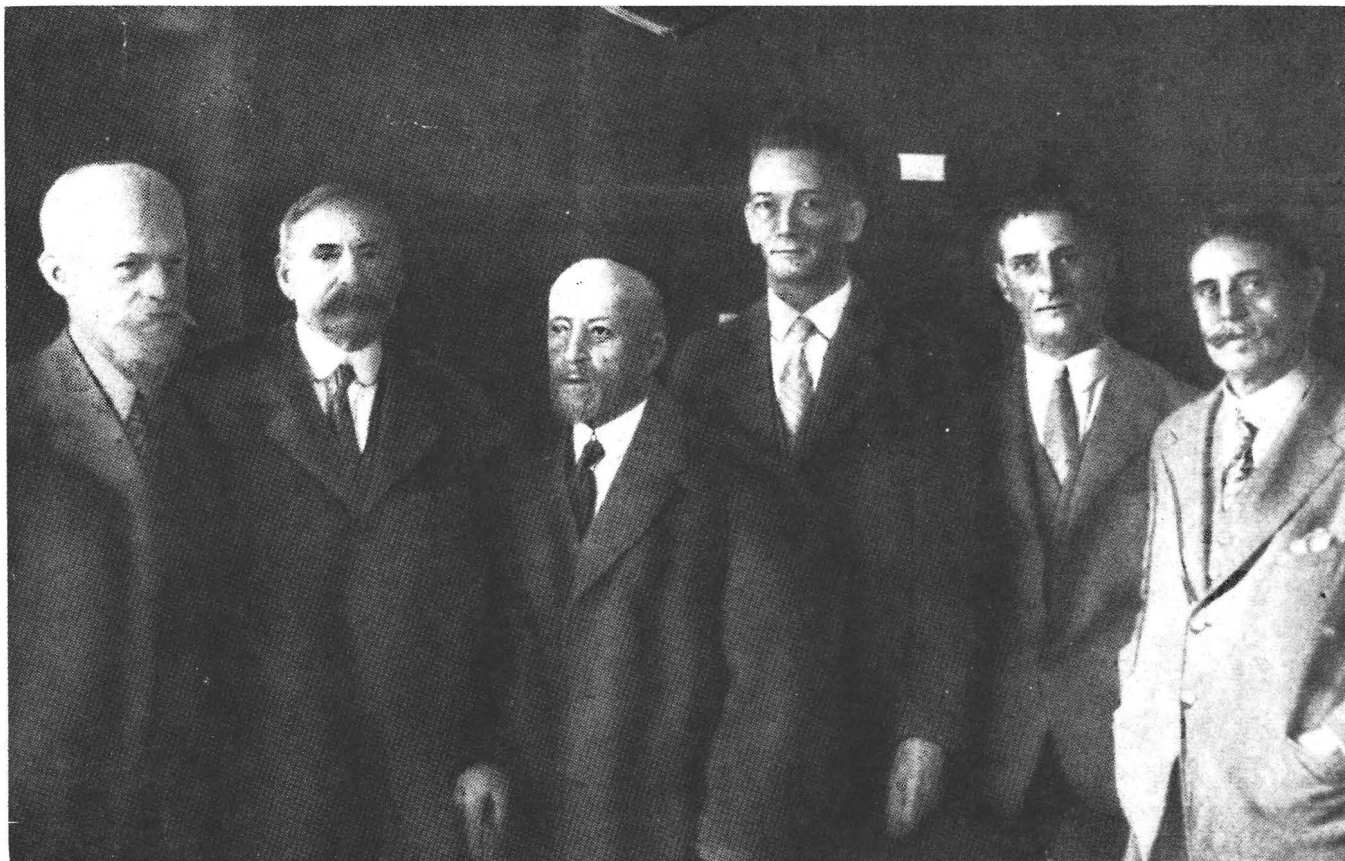


Fig. 4. Left to right: Harrison G. Dyar, William Schaus, L. O. Howard, Carl Heinrich, August Busck, Francis Noyes



Fig. 5. Carl Heinrich, 1880-1955

In 1901 he published a book of poems *Moods and Moments* and in 1929 his controversial, satirical *The Orphan of Eternity or the Katabasis of Lord Lucifer Satan*. In retirement he wrote 105 articles on subjects of public interest published in the News and Courier of Charleston, South Carolina.

William Schaus (1858–1942)

William Schaus was born in New York City 11 January 1858, the son of a well known art collector and dealer. He was schooled largely in Europe and his principal training was in music, art and languages; but as a young man he came under the influence of Henry Edwards and found his real vocation, in spite of paternal opposition.

Schaus made his first important collecting trip to Mexico in 1883 and subsequently made frequent and extended trips, with his companion Jack Barnes, to Mexico, Costa Rica, Guatemala, Panama, Cuba, Jamaica, Dominica, St. Kitts, the Guianas, Colombia and Brazil and collected over 200,000 Lepidoptera. He was one of the great contributors to, and dedicated workers in, the Lepidoptera collection. Schaus sums up his attitude to the National Collection in a letter from Costa Rica dated 15 March 1909, to Richard Rathbun, then Assistant Secretary of the Smithsonian, in charge of the National Museum, "I . . . announce to you the gift of my butterflies and Sphingidae to the Museum, as they were not included in the large collection of moths I gave the Museum three years ago—I am glad to be able to do so—I am still hard at work and securing many new and rare species, so there is no danger of the Smithsonian losing its foremost place as possessor of the finest collection of Tropical American Lepidoptera."

Schaus came to the National Museum in 1895. By 1906 he was back in Mexico. An accession of 7 June 1906 records "Large collection of Lepidoptera." Schaus' letter accompanying the gift states "The box contained . . . 22 parcels of Lepidoptera." Other accessions merely list "1 box Lepidoptera in papers (1907) Costa Rica, or "29½-cartons of unmounted insects, Costa Rica." Other accessions record material from Argentina, Guatemala, Bolivia, Ceylon, New Guinea, Ecuador and Brazil.

From 1919 until his retirement in 1938, Schaus was on the staff of the U.S. Department of Agriculture and in 1921 was made honorary assistant curator of insects of the U.S. National Museum. During his lifetime he published 122 papers in which he described more than 5,000 species.



Fig. 6. William Schaus, 1858-1942

William Barnes (1860–1930)

William Barnes was born in Decatur, Illinois, and except for his medical training at Harvard, post graduate medical study in Germany and some travelling, spent all his life there. He brought together the greatest, finest and most complete and most accurately determined collection of North American Lepidoptera in the world. If Dr. Barnes had done nothing but assemble this collection he would have done a great work, but he did much more. His copiously illustrated *Contributions to the natural history of the North American Lepidoptera*, which occurs in 5 volumes, embodies the researches of himself and his collaborators, and consists of extensive descriptive and revisionary papers.

Some details about the Barnes collection follow:

As early as 1921 a move was afoot to obtain for the National Museum the William Barnes collection. J. M. Aldrich, Associate Curator of insects, stated in a letter of 31 October 1921 to Dr. Stejneger, Head Curator of Zoology: "The value of the collection is so great that we can make no offer from the current revenues of the National Museum or the Smithsonian, that would not be absurd and pitiful. The case will require special action by Congress, I should think." Dr. Barnes was seeking \$200,000. What he had actually proposed doing was to give the collection to the Decatur and Macon County Hospital to be sold by them for added revenue. In 1922, Representative Moore of Illinois presented a bill (H.R. 10597) asking for enactment of authorization for the Secretary of the Smithsonian to purchase the Barnes collection for \$310,000 (including shipping). Negotiations continued until Dr. Barnes' death in 1930. The late Secretary Abbott, of the Smithsonian, on June 13, 1930 sent a memo to Dr. Wetmore, then Director, U.S. National Museum, stating "The executors desired to give the National Museum first opportunity to obtain the collection for \$50,000. (Barnes is reputed to have spent \$400,000 on the collection.) The collection was finally purchased through a congressional appropriation with a rider on an agriculture deficiency bill. Carl Heinrich and August Busck prepared the collection for shipment and the collection was accessioned February 16, 1931.

By the time I arrived at the National Museum both Barnes (who was not on the staff) and Dyar were dead, but Busck, Heinrich and Schaus were still active.

For many years Busck and Heinrich performed like twins. They dressed alike, both used a cane, and about the only way they could

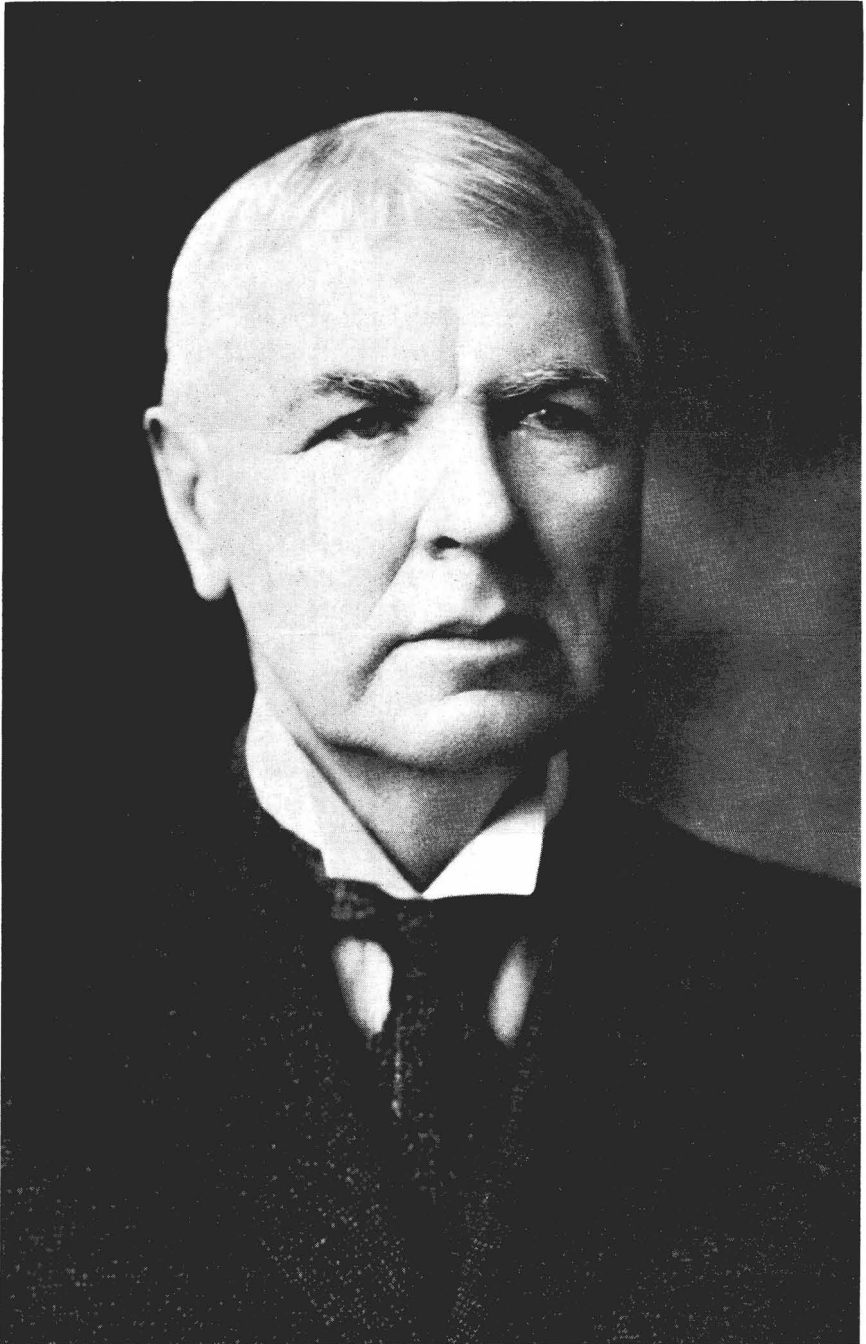


Fig. 7. William Barnes, 1860-1930

be distinguished at a glance was by the fact that Heinrich wore a monocle. This close relationship went on for years but finally something happened, to which I was not privy, and the friendship ended. After that, even up to the time of Busck's retirement in 1940 this feud lasted. They were civil enough to each other at the office, but after official hours there was no communication between them at all. When Busck's end was near, early in 1944, Heinrich relented and decided to go and visit, for the last time, this old friend. Busck was on his death bed, but said to Heinrich, "Vell, Carl, let's go downstairs and have a drink, I don't vant to die sober!" Busck died shortly thereafter.

For many years it was customary to accumulate reprints in the Division of Mammals, where we were allowed to examine and select what we wanted for our files. The practice was to indicate a bid, usually 5¢, and initial the amount offered. If someone wanted the reprint more than the first bidder he increased the offer to 10¢, and so on until bidding was closed. During one of these "auctions" a copy of Busck's *A Revision of the American Moths of the Family Gelechiidae . . .* 1903, appeared. I did not have this paper so I offered the usual 5¢. Busck's pride was hurt; he was angry. He burst into my office and roared, "I have just seen your bid on my gelechiid paper. I have bid 25¢ and if you vant the paper you will have to pay 30¢!". I did.

Heinrich is reputed to have started each day with a martini! He smoked cigars and cigarettes incessantly and used snuff. The smokers in the museum were provided with spittoons for their cigar and cigarette ashes and butts up until the 1950's. The spittoons were also used to throw waste from dissections. One day, inadvertently, when Heinrich threw away some waste from a dissection an aedeagus from a type went with it. Obviously, that was a loss that could not be accepted so Heinrich, with an aide, spent the day going through cigar butts, cigarette tobacco and waste, spoonful by spoonful, looking for the aedeagus. They found it!

Schaus was a bachelor. On one of his visits to England he employed a valet, Jack Barnes, who became his lifelong companion. Early in their association Schaus, in admiration for his friend, bought him a quantity of stocks. In the crash of 1929 Schaus lost much but after the crash Barnes' stocks appreciated and the valet became wealthier than the master. When Schaus died he left Barnes a considerable amount of money, plus a valuable stamp collection so Barnes was fixed for life.

Schaus enjoyed a wide correspondence throughout much of the world and wrote his correspondents in English, German, French and Spanish, as appropriate.

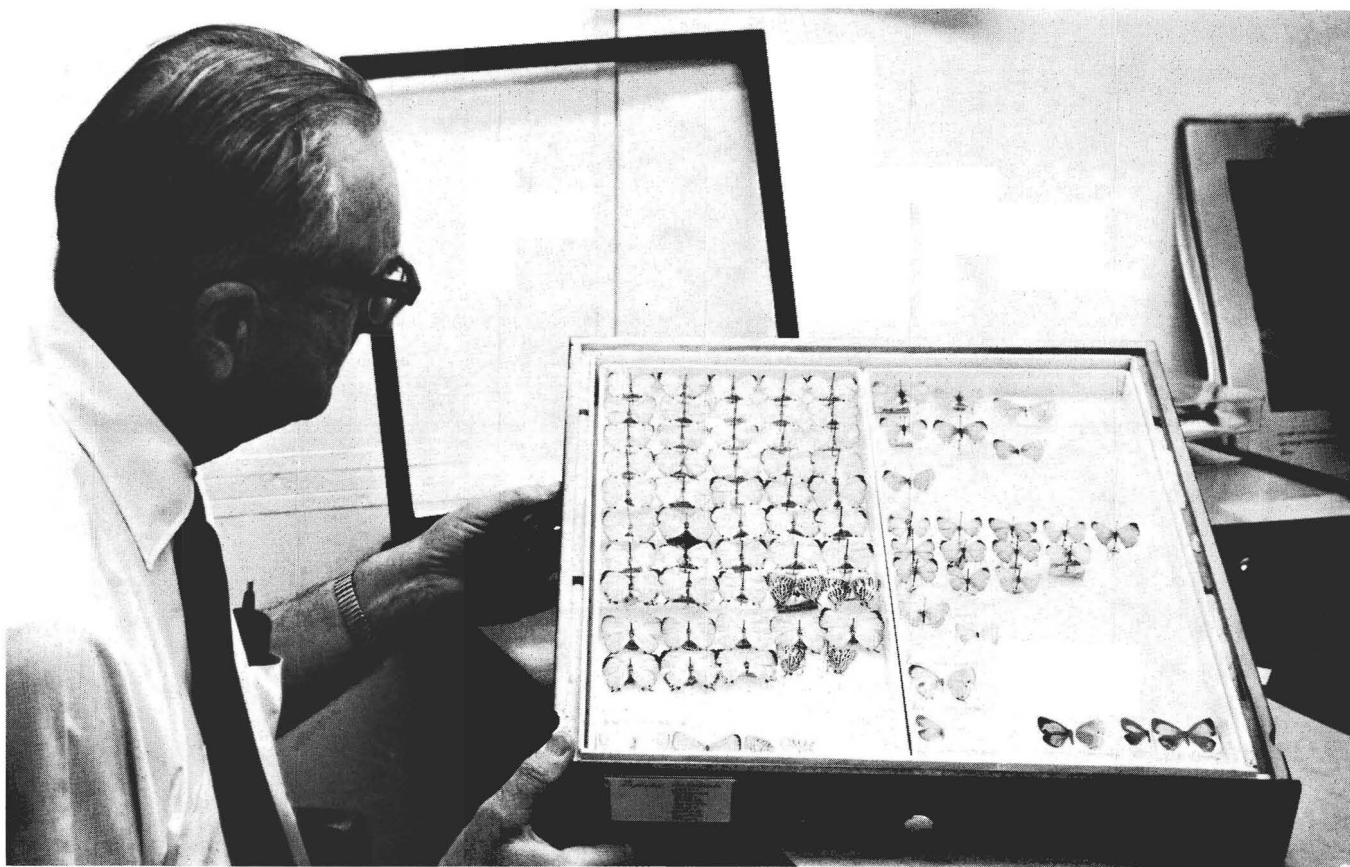


Fig. 8. A drawer containing *Zephyrus* species.

It is no wonder that Schaus described 5000 species. He took his work home with him! Nearly every night he would take home with him a small box containing half-a-dozen specimens, each representing a different species. In the morning he would return with each species described and each specimen labeled "type." Over the years there were some slight deviations from this practice but one can generally depend on the specimens labeled "type" as the ones he carried home.

Schaus had many friends among the wealthy and it was through them that he, singlehandedly, raised the money for the purchase of the Dognin collection. Schaus told me that the purchase price was over-subscribed and that he had had to return checks of \$5,000 and \$10,000.

In preparation for his retirement Schaus was cleaning out all personal belongings, among them many reprints of his papers. I discovered that he was discarding them and decided to retrieve them for future distribution. Schaus discovered this. One morning, not even stopping to remove his coat and hat, he stormed into my office and accused me of saving the reprints for later sale. From then on he tore each reprint in two before throwing it into the wastebasket!

The museum collection of Lepidoptera is housed in approximately 30,000 drawers, nearly 3,000 of which are devoted to Microlepidoptera. In recent years the unit tray system has been employed although the whole collection has not yet been converted to that type of housing. For large species, most Sphingidae, Saturniidae, Papilionidae, etc., whole drawers are still used, with no division being made in the drawers by trays.

Some of the more important accessions that are included in the national collection are as follows:

Alfieri, Anastase. 1966. (purchase). This material consists of Egyptian Heterocera, including many types.

Baker, Charles Fuller. 1928 (gift). No breakdown of the more than 300,000 specimens in this collection is given but it contains perhaps the largest number of Philippine Lepidoptera yet assembled by one person plus bountiful material from Malaya.

Barnes, William. 1931 (purchase). The accession shows a record of 473,500 but the actual count was 473,293 specimens including 1950 holotypes. This collection consists mainly of North American material. In the Barnes collection is incorporated material from the Oberthür, Taylor, Kearfott, Polling, Lacy, Field, Hill, Longley, Spalding and Merrick collections.

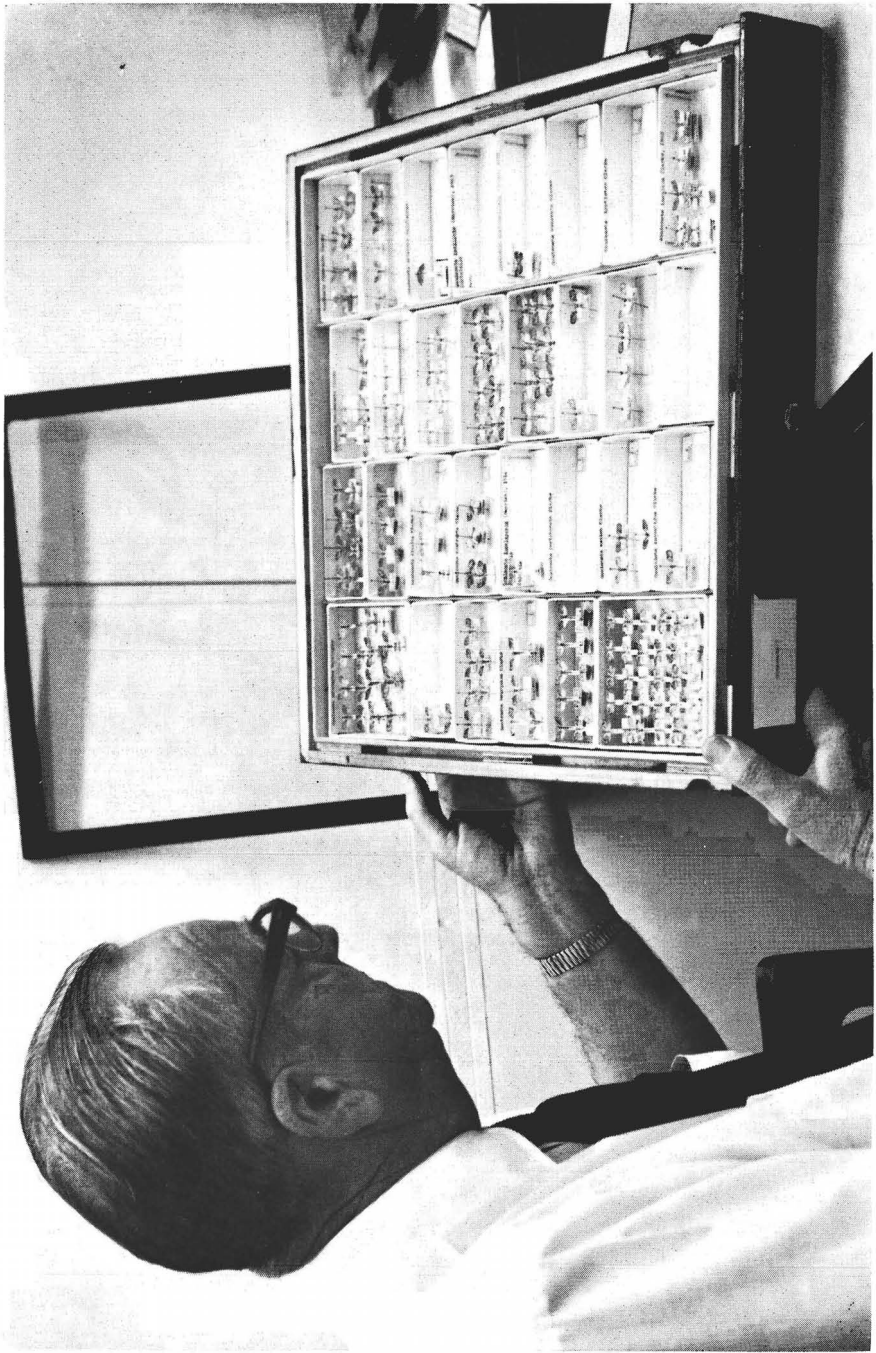


Fig. 9. A drawer of Microlepidoptera showing tray system.



Fig. 10. Douglas Ferguson (USDA) examining specimens in one of the lanes of the range.

- Blackmore, E. H. 1937-39 (gift). Though small, this collection is all from British Columbia and consists of 6950 specimens.
- Box, Harold. 1963 (gift). This collection consists of 5000 specimens, entirely of the important sugar cane feeding genus *Diatraea*.
- The Brighton Museum, Brighton, England. 1949 (gift). There are 15,000 Microlepidoptera in this material. Nearly all species from England are represented.
- The Brooklyn Museum. 1929 (gift). This material consists of 37,000 miscellaneous insects, and although the collection is comprised largely of Lepidoptera, the exact number of specimens of this order was never recorded. Contains types of Neumogen, Hulst and others.
- Clarke, J. F. Gates. 1937 (gift). From the Pacific Northwest. The original gift consisted of over 10,000 specimens. All Clarke types (over 300), except one, are in the national collection.
- Dognin, Paul. 1925 (purchase). This collection consists of 82,000 specimens among which are 3,000 Dognin types and over 300 Thierry-Mieg types. The collection was purchased through public subscription and was then presented to the museum.
- Dyar, H. G. 1903 et seq. (gift). The first contribution recorded from Dyar consisted of 20,320 specimens from British Columbia. In 1917 he added another 17,000 North American specimens and subsequently numerous smaller gifts.
- Engelhardt, George P., 1941-1943 (gift). Contains over 9,000 Aegeriidae. Its great value lies in the fact that nearly all specimens are reared and that larvae are associated with the adults.
- Ferguson, Douglas. 1970 et seq. (gift). There are 48,000 specimens from the Northeastern United States and eastern Canada, predominantly from Nova Scotia; also from Newfoundland.
- Fernald, C. H. 1924-25 (purchase). This is a type collection of Microlepidoptera containing not only Fernald's tortricid types, but types of Fitch's Pterophoridae and types from Fish. The collection also contains cotypes of Walsingham, Hulst, Packard and Grote.
- Field, W. D. 1947 (gift). This gift of 5,000 specimens is composed of Japanese and European Rhopalocera. Field contributed numerous other smaller gifts of North American Lepidoptera.
- Graham, David C. 1918-1948 (gift). Over the many years indicated, the Rev. David C. Graham sent thousands of Chinese Lepidoptera to the National Museum. These were never counted, but were recorded as so many packages.

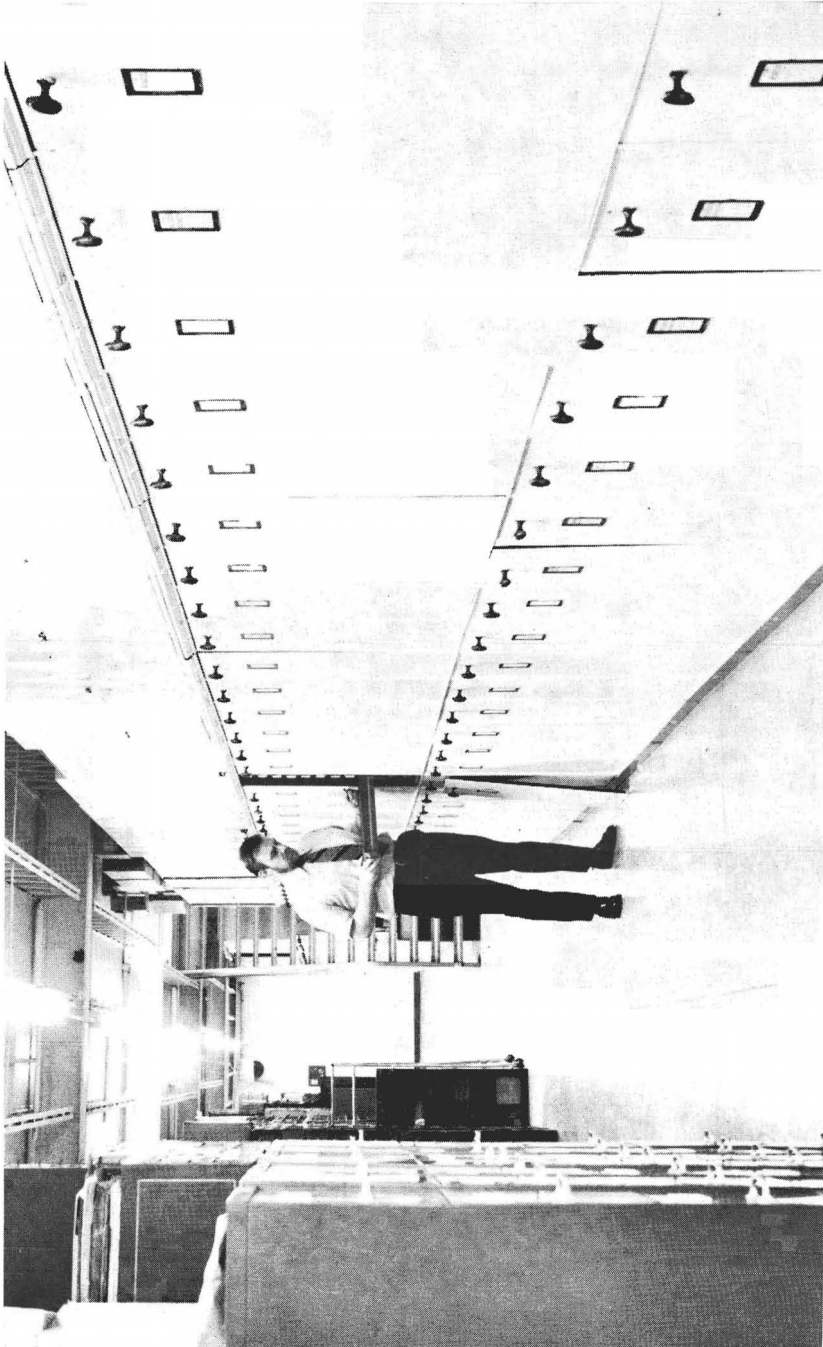


Fig. 11. Donald Davis on Microlepidoptera range.



Fig. 12. Mrs. Sally Adams (USDA), technician, making dissections.

- Hayward, H. C. 1949 (gift). The Hayward collection of English Tortricidae was obtained by the British Museum (Natural History) and presented to the USNM.
- Hodges, Ronald W. 1962 (gift). Consists of 25,000 specimens primarily of North American Microlepidoptera largely from Arizona, New York and Florida.
- Hopfinger, J. C. 1962 (purchase). This collection is worldwide in scope but the preponderance is from Washington State.
- Jones, Frank Morton. 1950-56 (gift). Of the 8,460 insects given to the National Collection the most important segment consisted of 4,400 specimens of Psychidae (bag worms). Most of the species included are from the Americas.
- Issiki, Syûti. 1972 (purchase). The Issiki collection constitutes the most complete assemblage of Japanese and Formosan Microlepidoptera ever brought together and contains about 95 per cent of the known Japanese species. There are 78 holotypes and more than 200 secondary types in this material.
- Meadows, Don. 1950 (purchase). There are nearly 9,000 specimens primarily from the Channel Islands, off the coast of California, in this accession.
- McAlpine, W. S. 1972 (gift). This collection consists of more than 12,000 specimens, predominantly of the butterfly genus *Calephelis*, but also it is strong in miscellaneous Michigan Lepidoptera. Most of McAlpine's types are included.
- McElvare, Rowland R. 1967 (gift). In this accession there are over 4,200 specimens of the sub-family *Heliothinae* (Noctuidae) from North America. Types of McElvare's species are in the National Collection.
- Nawa, U. 1903 (gift). Japanese Lepidoptera exhibited at the St. Louis World Fair constitute this gift.
- Philpott, A. 1928 (gift). Donated in this gift is a nearly complete collection of New Zealand Microlepidoptera.
- Rawson, George W. 1962-1972 (gift). The more than 9,000 specimens are mostly North American, predominantly from Michigan and Florida.
- Schaus, Wm. 1901 et seq. (gift). Altogether, as correctly as the records can be interpreted, Schaus donated most of approximately 200,000 specimens he collected from the Neotropical Region. But many of his contributions were merely recorded as "3 crates" or "2 crates," and the numerous specimens were never counted. About 5,000 of his types are included.



Fig. 13. Technicians Gary Hevel and William Rowe, Collections Management Services Unit.

Schönborn, Wm. E. and Theresa F. 1925 (gift). This collection consists of material from the eastern United States and Europe.

Shoemaker, Ernest. 1957 (gift). This accession records 60,338 specimens of insects but is not broken down by order. The collection contains mostly Neotropical and Nearctic species and is rich in the genus *Morpho*.

Smyth, J. Adger. 1947 (gift). Mr. J. Adger Smyth's father, Dr. Ellison A. Smyth, made this collection of more than 16,000 Lepidoptera, including two types. It is worldwide in coverage. Subsequently (1970) J. Adger Smyth donated an additional 1,174 specimens from the Americas and Africa.

Vallins, F. T. 1971 (purchase). This entire collection of 22,000 specimens of Lycaenidae is of Palaearctic origin. The collector endeavored to assemble series of species from throughout their ranges, thus showing all variations known.

In addition to the collections obtained from gifts, purchases, and transfers from other governmental agencies, much accrues to the national collection through field work by a very active staff. In recent years there have been many expeditions to many parts of the world which have produced Lepidoptera. Extensive field work has been conducted in many parts of North America, nearly every country in Central and South America, and the West Indies, Australia, Africa and Borneo. On the island of Dominica (BWI) alone a survey of the terrestrial arthropods continued over a period of three years, with a change of team and emphasis every three months. A continuing program, now in its fifth year, is being conducted in Sri Lanka (formerly Ceylon). Much material has been acquired from the islands of the Western and South Pacific, including Micronesia, Society Islands, Tubuäis, Marquesas and the Philippines.

Copies and original photographs for this article have been made by Mr. Victor Krantz, staff photographer, Smithsonian Institution.

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TECHNIQUE FOR SPECIFIC DETERMINATIONS OF DEAD PUPAE OF *EUPITHECIA* (GEOMETRIDAE)

Pupae of *Eupithecia* die even when reared under what seem to be optimal conditions. In many cases considerable time is spent on descriptions of larvae with the expectation of rearing adults to enable one to determine the species. When the specimen dies in the pupal stage this time may be lost unless one can determine the species from the pupa. Sometimes pupal development is such that adult features can be seen within the pupal case.

Method. To determine if the genitalia have developed sufficiently, sever the pupa between the fourth and fifth abdominal segments. If the internal organs have not developed sufficiently the abdomen will appear empty and it is of little use to proceed further. If such is the case, place the two halves of the pupal case in a gelatin capsule of suitable size and replace in the collection for future study. A shrivelled abdomen may, however, still be satisfactory for further work. About three-quarters of the specimens examined have had the genitalia developed sufficiently for one to make specific determinations. If the specimen seems developed enough, the entire severed abdomen is immersed in a 10 percent solution of potassium hydroxide for approximately 16-20 hrs. Do not attempt to forcibly remove the abdomen from the pupal case before immersion in KOH solution, unless it is already loose, otherwise both may be damaged. After removal from the caustic, place in a solution of 30 percent alcohol and the abdomen will separate very easily from the pupal case without damage. The empty portion of the pupal case should be placed out to dry and later put in a gelatin capsule along with the remainder of the pupal case. The cremaster and other important diagnostic characters can still be used for study. Process the abdomen as suggested by Hardwick (1950, Can. Entomol. 83: 231-235). Extreme care should be taken, however, during the dissection as the material is usually much more fragile than in a fully mature adult. One should also keep in mind that the pupal case may contain a parasite which has died before emerging. These are often quite large and can be mistaken for a moth before dissection.

This technique has proved useful for the determination of species in several other genera of Geometridae besides *Eupithecia*. Among these are the genera *Deilinia* Hbn., *Rheumaptera* Hbn., *Hydriomena* Hbn., *Drepanulatrix* Gump., *Semiolitha* Hbn., and *Itame* Hbn. This technique could very well prove useful in other families of Lepidoptera as well.

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