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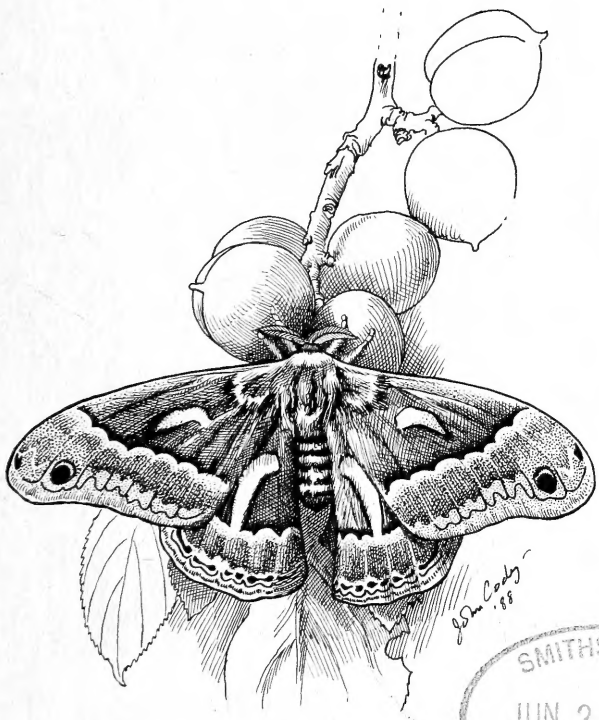

5 June 1990

The object of the Lepidopterists' Society, which was formed in May 1947 and formally constituted in December 1950, is "to promote the science of lepidopterology in all its branches, ... to issue a periodical and other publications on Lepidoptera, to facilitate the exchange of specimens and ideas by both the professional worker and the amateur in the field; to secure cooperation in all measures" directed towards these aims.

Membership in the Society is open to all persons interested in the study of Lepidoptera. All members receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer full dues for the current year, together with their full name, address, and special lepidopterological interests. In alternate years a list of members of the Society is issued, with addresses and special interests. There are four numbers in each volume of the *Journal*, scheduled for February, May, August and November, and six numbers of the *News* each year.

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Cover illustration: Female ceanothus moth, *Hyalophora euryalis* (Boisduval), resting on a branch of immature apricots shortly after emerging from her cocoon. Submitted by John Cody, 2704 Woodrow Court, Hays, Kansas 67601.

JOURNAL OF
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PRESIDENTIAL ADDRESS, 1989: WHY CAN'T LEPIDOPTERISTS BE MORE LIKE BOTANISTS?[1]

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Additional key words: identification manuals, faunal inventory, biodiversity, National Lepidoptera Agenda.

When members of The Lepidopterists' Society elected me to be their President in 1988 I was both honored and flattered. And *honor* is the appropriate term: the Society's Secretary, Treasurer, and Editors do most of the work and provide continuity to our ongoing operations, while the President has only three principal functions—all of which occur within a four-day period at the end of a year of doing not much of any significance. One function is to chair a meeting of the Executive Council. That's done. The second is to pass on the symbols of office to the next President. That's coming up. The third function is to present a Presidential Address. That's right now. And it's the toughest part of the job, because the subject of the address should be one of general interest to the members of the Society, rather than my research, curatorial, and public service activities in which I am intimately involved on a daily basis—and about any of which I could speak for hours with few or no notes. The task is made easier, however, by my being able to say what I think without having to prove it, and by not having to subject my thoughts to the peer-review filter.

The importance of habitat preservation, for the sake of our natural environment, and the importance of collecting *now*, for the sake of advancing our knowledge, are two subjects very important to me, but

[1] Based on a draft composed in the snug comfort of a van camped at 8400 feet in New Mexico's Sacramento Mountains two days prior to the Society's 40th Annual Meeting in Albuquerque, July 1989. A family emergency necessitated the author's premature departure from the meeting, and the address was never delivered. The author suggests that any errors in logic or lucidity be attributed to a temporarily oxygen-starved brain rather than to any permanent organic disorder.

I chose not to address them further since several of my presidential predecessors have already done so quite adequately.

I considered talking about the fact that human overpopulation is the compelling and ultimate environmental issue, from which virtually all others flow—but I realized that I would only be telling you something you already know, particularly since our eminent fellow lepidopterist, Paul Ehrlich, is one of the most outspoken and eloquent proponents of this view.

On my way to this meeting I spent several days exploring the cultural and natural riches of this magnificent state of New Mexico. Besides learning that Deming is the home of "clean water and fast ducks," in the course of some very fruitful botanizing I realized that the state flower, *Yucca elata*, is clearly one of the most spectactular and striking plants in the American Southwest.

Ever since my college days in Michigan I've been fascinated by plant identification, not only as a direct adjunct to the study of Lepidoptera and the food they eat, but also as a tool for understanding and describing habitat differences and, frankly, just for the fun of learning the name of another organism I've met in my travels. Now, no matter where I go, I am able to recognize a few old friends, while encountering a lot of new plants I've never seen before. I still remember my surprise when I discovered that my midwestern botanizing had left me totally unprepared for a *woody* composite, which I encountered in abundance soon after moving to the Southwest.

My old friends, *Gray's Manual of Botany* and the *Spring Flora of Wisconsin*, were useless in my new environment, as I found myself having to build an entirely new botanical reference library to help me cope with all the surprises that awaited me. And I was not disappointed—plant books by the score abounded: handbooks on trees and shrubs of southern California; trees, shrubs, and wildflowers of the Sierra Nevada; cacti of California; wildflowers of the California desert; keys to the flowers and shrubs of the desert; a manual of southern California plants; a manual of plants for the entire state of California—my shelves groaned, and sagged even further as my travels and botanical interests took me farther afield into adjacent states and Mexico.

But the point is that I have been able to find a book to identify virtually any plant nearly everywhere my travels have taken me—and yet I live in a state with at least 3000 species of moths and nary a list of what those species are, much less where and when they occur within the state and how to identify them.

Had I stumbled upon the Great American Anomaly? Or some Grievous Inequity? I finally had a subject worthy of Presidential exploration.

Was this abundance of plant manuals peculiar to California? A stroll

through the Museum's botany library quickly convinced me that this was indeed not the case. A sample of some North American titles I found: *A Flora of Tropical Florida* (Long & Lahela 1976); *Manual of the Plants of Colorado* (Harrington 1954); *Arizona Flora* (Kearney & Peebles 1951—treating 3370 species!); *Flora of Alaska* (Anderson 1959); *Wild Flowers of the United States* (Rickett, various dates; multi-volume regional work heavily illustrated with color photos); *Illustrated Flora of the Pacific States* (Abrams 1940–1960); *Trees, Shrubs, and Woody Vines of the Southwest* (Small 1972); *Gray's Manual of Botany* (Fernald 1950—treating 5523 species of the northeastern U.S.); *Manual of the Vascular Plants of Texas* (Correll & Johnston 1970—treating nearly 5000 species!); *A Utah Flora* (Welsh et al. 1987—treating 2572 species); *Intermountain Flora* (Cronquist et al., various dates); *Aquatic and Wetland Plants of Southwestern United States* (Correll & Correll 1975); and *Flora of Baja California* (Wiggins 1980—treating 2705 species).

Furthermore, I found numerous more specialized manuals and monographs, including *Moss Flora of North America* (Grout 1972); *Agaves of Continental North America* (Gentry 1982); *Atlas of North American Astragalus* (Barneby 1964), and *Manual of the Grasses of the United States* (Hitchcock 1951). Wow!

How does this abundance of botanical manuals compare with identification tools available for Lepidoptera? Although I shall be concentrating on comparisons within the North American flora and fauna, with which I am most familiar, similar comparisons most likely can be made everywhere else on earth with the possible exception of western Europe.

Butterfly people have it easy. Many state and regional manuals have been published, with many still in print (e.g., New York, Michigan, Missouri, Georgia, Oregon, Indiana, Rocky Mountains), not to mention several readily available continent-wide identification manuals by Scott, Howe, Ehrlich and Ehrlich and, for the skippers, by Evans, Freeman, and Lindsey, Bell, and Williams, *PLUS* a comprehensive bibliography of all state and regional butterfly lists *ever* published for North America (Field et al. 1974). Most regional manuals have been written as a labor of love by non-professionals (that is to say, by people who aren't paid to be lepidopterists).

Identifying a moth in North America is another story altogether, and I think that our scarcity of identification references is the *fundamental* reason we don't have more moth collectors. To test this view I examined the moth handbooks in my office and found deficiencies in virtually all of them. Here are some examples from the North American fauna for continent-wide works:

1. Noctuidae, one of the largest moth families, with at least one widely collected genus (*Catocala*):
   a. Hampson (1903–1913), *Catalogue of the Lepidoptera Phalaenae in the British Museum*, Vols. 4–13: treated all world species known at the time, including all North American species; now out of date, expensive, and not fully illustrated.
   b. Seitz (1923), *Macrolepidoptera of the World*, Vol. 7: never completed, expensive, out of date.
   c. Barnes & McDunnough (1918), *Illustrations of the North American species of the genus Catocala*: out of print, hard to find, expensive, out of date.
   d. Lafontaine (1987), *Euxoa, Moths of America North of Mexico*, Fascicle 27.2: treats only a single (but large) genus, expensive.
2. Phycitine Pyralidae: Heinrich (1956), *American Moths of the Subfamily Phycitinae:* excellent genitalic figures for virtually all species in the Western Hemisphere, but not a single photograph of an adult moth!
3. *Acrolophus:* monographed by Hasbrouck (1964), male genitalia well figured, but lacks figures of female genitalia and has no photos of adults.
4. Pterophoridae: monographed by Barnes & Lindsey (1921): surprisingly useful but now outdated and hard to find.
5. Olethreutine Tortricidae: monographed by Heinrich (1923, 1926): genitalia well illustrated but not a single figure of wing pattern, now hard to find and somewhat outdated.

Although *The Moths of America North of Mexico* series is slowly filling the void in identification manuals for the North American fauna, and doing it in a superb fashion, it is beset with at least three lingering problems: it *is* unquestionably slow (begun 18 years ago), it is expensive, and it tends to be biased toward eastern collections.

With very few exceptions, the regional identification manuals for North America are similarly limited:

1. Forbes (1954), *Lepidoptera of New York and Neighboring States*, Part III, is the only comprehensive state faunal identification manual that contains *keys*, but it suffers from a lack of photographs of adult moths.
2. Kimball (1965), *Lepidoptera of Florida*, is an illustrated and annotated checklist, not an identification manual.
3. Covell (1984), *Field Guide to the Moths of Eastern North America*, is the best regional moth manual we have, but it does not cover the entire fauna.

Every single one of the references cited above is diminished by one or more limitations of being out of date, out of print, incomplete, inadequately illustrated, or too expensive.

Before a comprehensive identification manual can be produced, you first need to have a list of species present in the area to be covered. Several such lists have been published, including:

1. Hodges (1983), *Check List of the Lepidoptera of America North of Mexico* [North American faunal list].
2. Moore (1955), *Annotated List of the Moths of Michigan* [excluded the "microlepidoptera"].
3. Kimball (1964), *Lepidoptera of Florida*.
4. Forbes (various years), *Lepidoptera of New York and Neighboring States:* a comprehensive work that embraced all species known to occur in the state, thus serving as a state list.

In addition, there are a number of lists that inventory, in varying detail, a portion of the moth fauna occurring in a given area, such as those by Tietz (1936, *The Noctuidae of Pennsylvania*); Selman and Barton (1971, *The Sphingidae of Northeast Arkansas*); Metzler (1980, *Saturniidae of Ohio*); and Godfrey, Cashatt, and Glenn's fascinating 1987 annotated checklist of the 30,000 "microlepidoptera" that Murray O. Glenn, a farmer, collected as a hobby in a small section of Illinois.

The search through my library did produce, however, a very few works that approach my concept of the ideal identification manual in that they are current, complete, contain keys and/or diagnoses, and are well illustrated. However, they all have one drawback: they are government or organizational publications unobtainable through normal bookselling channels—you have to scrounge the publisher's name and address, and enter into correspondence to ascertain availability and price. Three examples are McGuffin's series, *Guide to the Geometridae of Canada* (Entomological Society of Canada); Pogue and Lavigne's *The Tortricinae of Wyoming* (1981, University of Wyoming Agricultural Experiment Station); and the unquestioned cream of the crop, to the best of my knowledge the best regional moth identification guide *ever* published in North America, William E. Miller's *Guide to the Olethreutine Moths of Midland North America* (1987, U.S.D.A. Forest Service, Agric. Handbook 660). This last publication could easily serve as an idealized model for the scores of similar manuals we need—the use of color photos is the only improvement it could have used.

I am amazed, or perhaps stunned is a more appropriate word, that neither of the two states with biological or insect survey programs, each having published major works on their insect faunas (Illinois Biological Survey and California Insect Survey), has published a single work on its moth fauna, not even at the family level. Texas, with one of the richest Lepidoptera faunas in North America, has not even produced a guide to its butterflies, not to mention its moths!

This appalling disparity—the abundance of plant identification manuals and the paucity of moth identification manuals—led me to investigate the cause of this discrepancy, with the hope of finding some clue that we lepidopterists can use to our advantage.

At first, I thought that the botanists had it easier because they don't have to deal with the overwhelming numbers of species we moth people face. Wrong! Published estimates for the number of known, named species of Lepidoptera in the world range from 113,000 to 150,000 or more (with some estimates for the actual *total* world fauna, both named and unnamed, of ten times or more this number)—for the sake of this discussion I shall use an estimate of 140,000 known species of Lepidoptera in the world. By comparison, there are some 225,000 species

of flowering plants (dicots and monocots) in the world, or 61% more species of plants than there are of Lepidoptera. In North America north of Mexico, there are more than 11,000 named species of Lepidoptera, compared with *twice* that number of species of plants (22,200).

Considering the fact that most Lepidoptera feed, as larvae, on only one species of plant, or on a few closely related species of plant, and further taking into account that most plants probably serve as host to more than one species of lepidopteran, I think it is reasonable to expect that, on average, there is *at least* one species of lepidopteran for every species of flowering plant (disregarding, for the moment, the species whose larvae feed on lower plants, detritus, etc.). This translates to a *potential* North American Lepidoptera fauna of over 22,000, a reasonable figure when one considers the large numbers of new species being discovered in poorly studied families (e.g., Gelechiidae, Scythrididae). Using these same assumptions for the world Lepidoptera fauna, we can reasonably expect the *potential* world fauna to be about a quarter of a million species, or about twice the number of species we have succeeded in describing in the last 200 years!

No, the botanists have not been so successful because their job has been easier. The *real* reason that botanists know their business so well is because of their subject matter: plants are necessary for converting solar energy to a form that can be utilized by animals, and are thus fundamentally essential for human existence and survival. *Homo sapiens* has a vested and direct interest in plants, not just for food, but for fiber, shelter, medicine, ornamentation, etc. Human survival, population expansion, and colonization all depend on our having an intimate knowledge of botany.

So *of course* we're going to know far more about plants than about any other component of our natural environment, including a lot of apparently non-essential incidental botanical knowledge of no immediate practical advantage acquired during the course of applied research.

What, exactly, do I think is so special about botanists? The two qualities of botany and botanists that I admire most, and which I perceive to be deficient or lacking among lepidopterists, are (1) the availability of an identification manual for virtually any group of plants virtually anywhere on earth, and (2) the ability to agree on the importance of floristic studies, and then to cooperate in providing the funds and staff to accomplish the goals.

Why are botanists so much more successful in understanding their discipline than we lepidopterists? And here I am addressing not the practical, applied aspects of botany, but basic knowledge of natural history, taxonomy, and distribution.

First, there are simply more of them than us! The Lepidopterists' Society has just 1500 members in 50 nations, and is the only organization in North America devoted entirely to Lepidoptera. In contrast, just look at some of the botanical organizations in the United States: Botanical Society of America, American Society of Plant Taxonomists, American Fern Society [there are only 345 species of ferns in North America north of Mexico!], Phycological Society of America (algae), Mycological Society of America (fungi, 1600 members), North American Mycological Association, American Orchid Society, the Bromeliad Society, and doubtless others, not to mention native plant societies, garden clubs, and special interest groups devoted to limited subjects such as bonsai, roses, insectivorous plants, etc.

Secondly, they are publishing fools! Every one of the organizations I just listed has its own publication. Furthermore, numerous other publications emanate from free-standing institutions, such as the Missouri Botanical Garden (*Annals*), New York Botanical Garden (a slew of titles, including *Brittonia, Botanical Review, Economic Botany, Memoirs, Flora Neotropica*, etc.), Field Museum of Natural History (*Fieldiana*, with ongoing series on *Ferns & Fern Allies of Guatemala, Flora of Peru, Flora Costaricensis*, etc.), and Rancho Santa Ana Botanical Garden (*Aliso*), to mention just a few.

The study of plants has certain obvious advantages over the study of Lepidoptera, and I think this is another reason why botanists far outnumber us. Specifically, plants are a lot easier to study—although they are often seasonal (as are leps), they stand still for prolonged scrutiny and manipulation, and can be found in exactly the same spot the next day; they are (usually) diurnal, conspicuous, attractive and esthetically pleasing, and easily observable; many wild species can be adapted for domestic cultivation. Although butterflies (and some moths) share some of these characteristics, the fact that they don't allow a close approach and manipulative examination (without stalking and netting them) makes them unworthy of study by the casual naturalist. And moths—well, you can forget about the general public having an intellectual interest in any moth smaller than a bat, and usually not even then. (Interestingly, the sedentary nature of caterpillars, on the other hand, lends them to be observed in a more leisurely, plant-like, fashion.)

The availability of plant identification manuals seems to have a catalytic effect on a person's interest in botany—being able to readily learn the name of one plant leads to a desire to learn the names of additional plants. In fact, the late Harry Clench, co-founder of our Society, observed a similar positive reinforcement phenomenon when he attributed two spurts in the growth of our domestic membership to the "Klots factor" and the "Ehrlich factor," otherwise unexplained surges in mem-

bership a year after the publication of two popular butterfly field guides—collectors had found a way to identify their captures, at the same time discovering the existence of an organization of similarly inclined naturalists.

There thus seems to be a number of fundamental differences between the study of plants and the study of Lepidoptera, so that the two can not be compared fairly. However, I have left until last one final difference that I think we *can* do something about.

After discussing the matter with entomologists and botanists, I have concluded that entomologists in general, and lepidopterists in particular, tend to be aloof, egotistical, self-centered, selfish, secretive, individualistic, and unwilling or unable to agree on a cooperative national/international agenda. The entomological community appears to have a low general regard for faunistic studies and basic taxonomic research, so that grant proposals in these disciplines receive low marks when competing against sexier or more high-tech fields of entomological inquiry. In the United States I am aware of only one major grant-funded moth faunal survey (in Costa Rica, possibly funded because of the superior reputation of the investigator rather than the significance of the survey itself) and not a single similarly funded taxonomic study. (It is encouraging that there are more and more locally funded, locally focused studies, such as inventories of the butterfly fauna of natural areas, but I am concerned here with the negative national attitude toward such studies.)

Botanists, in contrast, seem to have no difficulty agreeing on the importance of floral surveys and taxonomic research both at home and abroad, and in providing the manpower and finances to accomplish the task. Because botanists agree on the necessity of this type of research, this view is reflected in positive anonymous peer reviews of grant proposals, which are then funded.

Botanists can justify their existence because they study this planet's energy source. We entomologists, and particularly lepidopterists, can justify our existence because we study the primary herbivores, those animals at the bottom of the food chain that benefit man and the ecosystem by providing food for birds, fish, herptiles, and even man, and by recycling nutrients and enriching the soil, by pollinating plants, and so forth, in addition to some of them just being lovely to look at; comparatively few species actually compete with man for food or fiber.

The naked truth of the matter is that we are still very ignorant about one of the best known groups of insects! Not only have we named only about half the species in existence, but we don't know what most of them eat, much less their role in the grand scheme of things. Even more frightening is the fact that they are surely becoming extinct as

rapidly as any other group of organisms as their habitats and hostplants are being destroyed.

It is sad and unfortunate that entomologists as a group are perceived by the general public as harmless at best, insane at worst; while butterfly collectors are frivolous airheads and moth collectors have most likely lost all touch with reality. Burdened as we are with these misperceptions of our worth, it is difficult for us or the object of our inquiry to be taken seriously. The fact that we like our work is complicated by the fact that the animals we study are actually beautiful; it is even more complicated if we work on *small* species, because the general public equates size with significance.

I have now completed my examination of "Why can't lepidopterists be more like botanists?" There may still be some hope for us! The *Moths of America North of Mexico* project and the *Atlas of Neotropical Lepidoptera* project are positive steps in the direction I feel we should be following, but both suffer from a shortage of funds and a severe lack of specialists to participate. (The shortage of taxonomists is a general one, not limited to lepidopterists; the ultimate reason is slashed funding for jobs in systematics as a result of a perceived relative lack of significance of this discipline.) Pending legislation for a national biological inventory would be a major step forward *if* it receives adequate funding.

The most important basis for our Society, and the one that makes us so special, is that we are organized to serve as the meeting ground for amateurs and professionals, for the mutual benefit of both and for the advancement of lepidopterological knowledge. The "professionals," unfortunately, are a vanishing race, torn between the conflicting goals of producing the taxonomic and faunistic monographs and manuals we need so badly on the one hand, and providing guidance and assistance to the amateur community on the other hand. We have seen examples of outstanding work by our amateur members, and I know that many more members are capable of similarly fine contributions if only they could receive a little encouragement and help. Without that help they are left to their own devices, leading to results that may be less than satisfactory.

Short of a miraculous but unlikely increase in funding for taxonomic research, if we are to make any significant progress in understanding the taxonomy and distribution of our Lepidoptera fauna it is absolutely essential that we adopt a plan, a National Lepidoptera Agenda, that will make the most efficient possible use of our biggest resource, our members. The formalization of this Agenda will require a lot of thought by all our members and particularly by the Executive Council, our elected representatives. Some suggestions to consider in the implementation of the Agenda include:

identification and techniques workshops at national meetings
traveling workshops and seminars to regional meetings
use of the Publication Fund to publish identification and techniques manuals
a techniques video (an advanced techniques video could be filmed in a lab or at one of the workshops)
a newsletter of Lepidoptera taxonomy, a periodical directory of who is working on what group, and who has material available for study
a directory of taxonomic "holes": a guide to taxa in need of specialists and/or more specimens
a similar directory of regional/habitat "holes": a guide to areas with poorly known faunas
participate in national discussions on biological surveys and standardization of databases; contract/cooperate with The Nature Conservancy's Natural Diversity Data Base program
disseminate information to members on curatorial standards and database management systems
publish bibliographies of taxonomic revisions (perhaps providing copies of original works on microfilm, computer disc, video disc, or xerographic copies)
establish a "specialist network" to make critical identifications for faunistic publications
compile a directory of "visiting specialists" willing to provide on-site taxonomic assistance to those paying expenses
publish a directory of research collections willing to accept and curate voucher specimens from faunal surveys
publish a leaflet on how to ship specimens safely
publish a handbook or video on rearing techniques
promote preservation of larvae and parasitoids by publishing a leaflet on proper techniques
reinstate/resurrect the larval voucher repository program
commission/solicit and publish a compendium of hostplant data for North American "microlepidoptera" (to complement data in Tietz); consider funding or seek grant for development of a database for this purpose
consider establishing a network of semi-autonomous regional branches or affiliates (including existing regional groups), to foster communication, standardization, and unification of purpose

Proposing suggestions is easy; implementing them is the tough part. Although the Society has an abundance of very talented and capable members, fewer than 10 of them—all volunteers—are responsible for our day-to-day operation. With a little leadership and guidance from the Executive Council, let us hope that more of our members will become personally involved in helping to make the National Lepidoptera Agenda become a reality. Perhaps lepidopterists *can* be more like botanists.

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AMBLYSCIRTES: PROBLEMS WITH SPECIES, SPECIES GROUPS, THE LIMITS OF THE GENUS, AND GENUS GROUPS BEYOND—A LOOK AT WHAT IS WRONG WITH THE SKIPPER CLASSIFICATION OF EVANS (HESPERIIDAE)

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ABSTRACT. In detecting and correcting errors at all these taxonomic levels, I lean heavily on genitalia. Two similar, closely related, ostensibly allopatric differentiates treated by some as species and by others as subspecies are indeed separate species that are barely sympatric: *Amblyscirtes celia* Skinner and *A. belli* Freeman. Most closely related to this pair is the mainly Mexican complex *A. tolteca* Scudder/*prenda* Evans, rather different in facies and currently misplaced in a different species group of *Amblyscirtes*. Another species that looks very like an *Amblyscirtes*—*simius* Edwards—assuredly is not! Although, like *simius*, *A. alternata* (Grote & Robinson) has a short, blunt antennal apiculus that is "wrong" for *Amblyscirtes*, *alternata* clearly belongs. Placed by Evans (1955) in his N or *Lerodea* group of American hesperiine genera and said to be allied to *Atrytonopsis*, *Lerodea*, and *Oligoria*, *Amblyscirtes* actually has close ties with various neotropical genera in Evans's J or *Apaustus* group: *Remella*, *Mnasicles*, and *Callimormus*! By extrapolation, much of Evans's taxonomic system just below the level of the subfamily may be invalid. Ironically, a Guatemalan skipper that Bell (1959) described in the J group genus *Moeris* (with which Evans erroneously synonymized *Remella*) is really an *Amblyscirtes*: *A. patriciae*, new combination. This species clusters with *A. folia* Godman, *A. immaculatus* Freeman, and *A. raphaeli* Freeman, which come from southern Mexico.

Additional key words: genitalia (male and female), *Callimormus*, *Mnasicles*, *Remella*, *Moeris*.

Arbitrary change in the rank of a species can sow confusion. Merely by listing *Wallengrenia egeremet* (Scudder) as a variety of *W. otho* (Smith), Edwards (1877) launched a systematic muddle lasting nearly a century and culminating in a published load of bioillogicalities (details in Burns 1985). Unless we ignore arbitrary action from the outset (and lepidopterists seldom do), it will sooner or later require critical response.

With just 7 specimens of *Amblyscirtes belli* Freeman from northern Texas and 11 of *A. celia* Skinner from southern Texas, Evans (1955) made them subspecies. Freeman (1941) had described *A. belli*, in terms of facies, from 109 specimens from Dallas County in northeastern Texas which he compared with 37 specimens of *A. celia*, the most similar species, noting four facies differences (not altogether valid). Skinner (1895) had described *A. celia*, also in terms of facies, from an unstated number of specimens from Blanco, Comal, and Nueces counties in southcentral Texas.

Close similarity plus apparent or actual allopatry do not, of themselves, warrant reduction to subspecific rank. Careful analysis of various

skippers has revealed monophyletic groups of closely related but largely or entirely allopatric species—see, for example, the superspecies in *Erynnis* and *Atrytonopsis* (Burns 1964, 1983).

Evans's (1955) action has been divisive: supported most notably by dos Passos (1964), Harris (1972), and Scott (1986), with echoes to the present (Watson & Hyatt 1988); and opposed by Freeman (1973), MacNeill (1975), and Miller and Brown (1981, 1983), as well as by others, with some waffling—Opler and Krizek (1984:259) treated *A. celia* and *A. belli* separately but allowed that "Celia's Roadside Skipper is sometimes considered to be the same species as Bell's Roadside Skipper."

Facies differences between *A. celia* and *A. belli* (unevenly dealt with in many of the works cited above) are subtle and variable but pervasive enough to suggest different species in the context of the genus *Amblyscirtes*. Still, rank is arguable. New information is needed.

Freeman (1973, and again in Irwin & Downey 1973), in defending the rank of species, cited an instance of sympatry between *A. celia* and *A. belli* near the type-locality of the latter in Dallas County, Texas. Because I found *celia* common 265 km to the southsouthwest at Austin, Travis County, Texas, in 1966 and 1967, contact seemed plausible. But because Freeman mistook a few of my 56 Austin specimens of *celia* for *belli* at that time, I was dubious—until 1989, when he graciously collected, mounted, and forwarded 8 ♂ 3 ♀ of *celia* and 6 ♂ 1 ♀ of *belli* that were flying together at Garland, Dallas County, Texas, during August and September, and when I discovered, among *Amblyscirtes* in the National Museum of Natural History (USNM), a misplaced worn female of *belli* taken at Austin in May 1980. Like many other pairs of differentiates, these two skippers overlap narrowly in eastcentral Texas.

Without giving specifics, Freeman (1973:54) added, "There are slight differences [between *celia* and *belli*] in the genitalia, however genitalic determinations in the genus *Amblyscirtes* are practically impossible with most species due to the fact that the basic pattern is very similar." The qualification is disturbing. Early in the same review of *Amblyscirtes*, Freeman (1973:41) put it this way: ". . . there is a remarkable similarity in the male genitalia of all of the species. Often worn specimens are very difficult to identify even after an examination of the genitalia due to this great consistency in basic form." Long before, having reprinted the Skinner and Williams (1923) figures of the male genitalia of *Amblyscirtes* from the United States and Canada, Lindsey et al. (1931:126) observed, "The genitalia of all of these species are remarkably uniform in structure." I am skeptical, then, when Freeman (1973:45, 48, 50, 51, 54) repeatedly asserts—for five pairs of species whose rank has been (or, in one case, may be) questioned—"there are

differences in the genitalia," especially since he never says what any of those differences are.

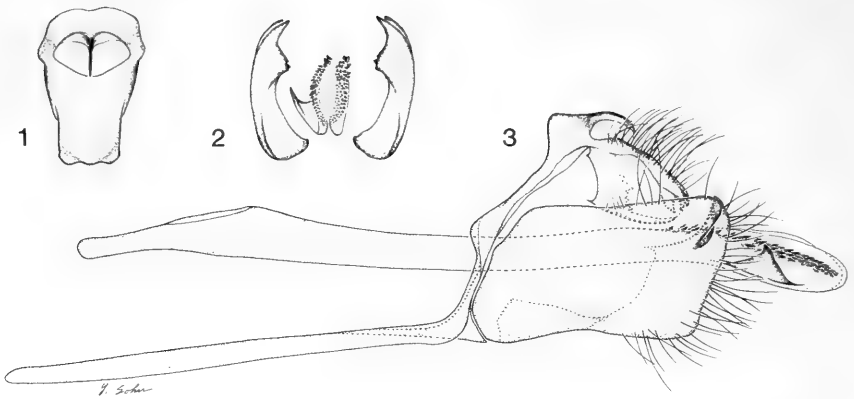
Considering the genitalic conservatism, intrageneric taxa showing distinct genitalic differences will almost certainly be species rather than subspecies. However, I must stress that in *Amblyscirtes,* as elsewhere, genitalia vary individually so that, even in a local population of a single species, no two tails are exactly alike; and the detection of "distinct genitalic differences" entails much dissection and comparison. In comparing genitalia of different species in this and similar taxonomic papers, the reader should keep in mind that many of the differences between figures are individual instead of interspecific and that the angle of illustration (and hence of observation) is crucial.

A Tail of Two Species

At certain angles, the male genitalia of the taxa in question clearly differ. From above, the middle of the distal end of the uncus looks convex in *A. celia* (Fig. 1) but concave in *A. belli* (Fig. 4). In all species of *Amblyscirtes* the simple, roughly rectangular valva ends in a prominent, pointed, dorsally directed terminal process that is slightly set off from the body of the valva and slightly medial to it (Figs. 3, 6, 13, 20, plus figures in many other sources, especially Godman & Salvin 1879-1901, Skinner & Williams 1923, Lindsey et al. 1931, and Evans 1955). A posterior look at the distal end of the valva shows—at the level of the base of the dorsally directed terminal process—a major, modestly dentate, medial expansion in *A. celia* (Fig. 2) which, by contrast, is relatively low and smooth in *A. belli* (Fig. 5).

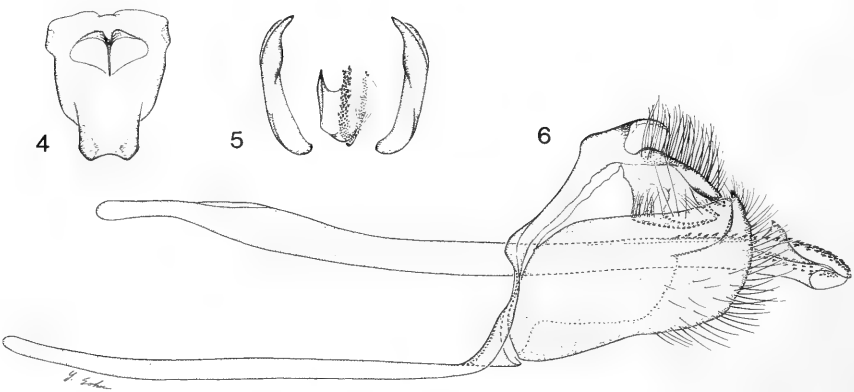
The distal location of these genitalic characters often makes them accessible in situ. Using both wet and dry dissection, I have examined them critically in 43 males of *A. celia* from Dallas, Travis, Bastrop, Comal, Bexar, Kendall, Kerr, Harris, Hidalgo, and Cameron counties, Texas, plus Ciudad Victoria and Ciudad Mante, Tamaulipas, Mexico; and in 40 males of *A. belli* from Dallas and Tarrant counties, Texas, Garfield County, Oklahoma, Carroll, Faulkner, and Pulaski counties, Arkansas, Labette County, Kansas, Barry and St. Clair counties, Missouri, Fulton and McCracken counties, Kentucky, Madison County, Tennessee, Fulton County, Georgia, and Pickens County, South Carolina. The genitalic differences hold over the range of each species, even where the two are sympatric or geographically close (nearly half the *celia* genitalia examined come from Austin, Texas, and nearly a fifth of the *celia,* and more than half the *belli,* from around Dallas, Texas).

Though highly variable, the female genitalia also differ in a distal



FIGS. 1–3. Male genitalia of *Amblyscirtes celia* from Austin, Travis Co., Texas, 15 May 1967, J. M. Burns (genitalic dissection no. X-2528) (USNM). 1, Tegumen, uncus, and gnathos in dorsal view; 2, Distal ends of valvae and aedeagus in posterior view; 3, Complete genitalia (minus juxta and right valva) in left lateral view.

character (mere removal of terminal ventral abdominal scales will reveal it). The sclerotized posterior margin of the lamella postvaginalis (just ventral to the ovipositor lobes) is, in *A. celia*, widely but decidedly V-shaped, with the point of the V anterior, midventral, and more or less rounded into a small midventral notch (Fig. 7). In *A. belli* this sclerotized posterior margin varies from shallowly U-shaped (Fig. 9) to shallowly W-shaped to virtually straight. I have compared this feature again and again in 33 females of *A. celia* from Dallas, Travis, Bexar, Harris, San Patricio, Hidalgo, and Cameron counties,Texas; and in 25



FIGS. 4–6. Male genitalia of *Amblyscirtes belli* from the vicinity of Irving, Dallas Co., Texas, 28 July 1984 (X-2529) (USNM). 4, Tegumen, uncus, and gnathos in dorsal view; 5, Distal ends of valvae and aedeagus in posterior view; 6, Complete genitalia (minus juxta and right valva) in left lateral view.

females of *A. belli* from Travis and Dallas counties, Texas, Pulaski County, Arkansas, Labette County, Kansas, St. Clair and Cape Girardeau counties, Missouri, Fulton County, Georgia, and Pickens County, South Carolina.

In both species the sclerotized ductus bursae—which angles to the left (Figs. 7, 9)—is not a plain tube: approximately the anterior third bears a wide, deep groove in the left side which, posteriorly, becomes shallow as it twists to the dorsal side and disappears (Figs. 7–10). Details of expression vary greatly. Because most of this variation is individual, no consistent interspecific differences emerge.

Disruption of Species Groups

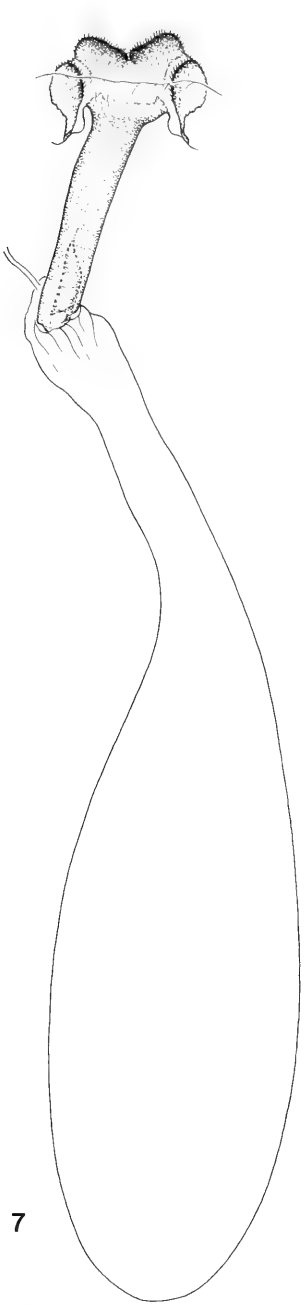
Both *A. celia* and *A. belli* display a striking asymmetry of the aedeagus. (This feature, too, is distal and thus visible without dissection whenever the superlengthy shaft projects from the end of the abdomen.) Along the left side of the aedeagus, just before its end, a large, thin, triangular plate with a long base curves outward and upward forming a conspicuous pointed titillator (Figs. 2, 3, 5, 6).

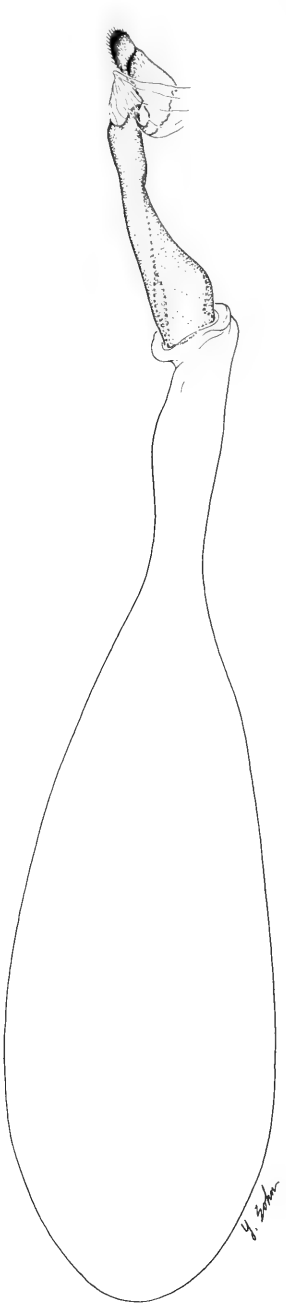
No one has ever mentioned it. Skinner and Williams (1923:144, fig. 24) and Lindsey et al. (1931:pl. 31, fig. 24), in illustrating the right valva and the distal end of the aedeagus of what they called *A. celia*, either got the wrong species or missed the titillator, which, given its size and the amount of detail in their figures, seems unlikely. On the other hand, Evans (1955:pl. 82, fig. N.2.18), without comment, caught the titillator in his caricature of distal portions of *A. celia* genitalia.

Nothing like it appears in any of his 22 other genitalic caricatures of *Amblyscirtes* species—not even the one for *A. tolteca* Scudder (Evans 1955:pl. 82, fig. N.2.11). Ranging through most of Mexico, *A. tolteca* apparently gives way in the west and northwest (especially in Sonora plus southern Arizona) to what Evans (1955) briefly described (in terms of size and facies) as subspecies *prenda*, which Freeman (1973) raised to the rank of species without adequate justification. Though lacking enough material to resolve the status of *tolteca* vis-à-vis *prenda*, I can definitely say that both have a titillator like that of *A. celia* and *A. belli* and, furthermore, that no other known species of *Amblyscirtes* does.

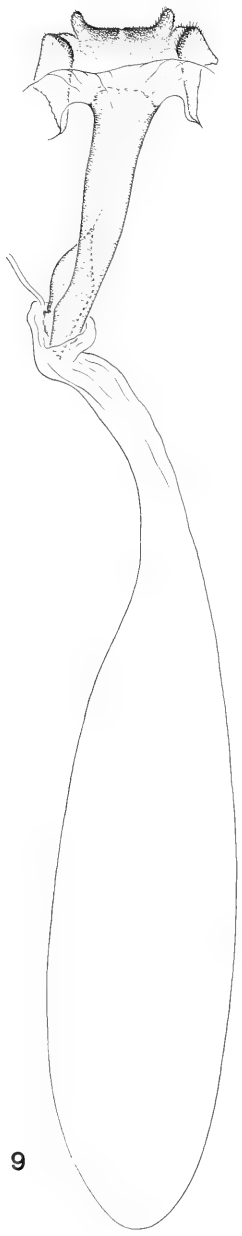
Using a few characters of facies, Evans (1955) divided the sizeable and superficially variable genus *Amblyscirtes* into four species groups which Freeman (1973), in his review of the genus, endorsed. Freeman also followed Evans's sequence of species—as have most workers, with little or no deviation, from dos Passos (1964) on. This arrangement puts *A. celia* plus *A. belli* far from *A. tolteca/prenda* in a different species group.

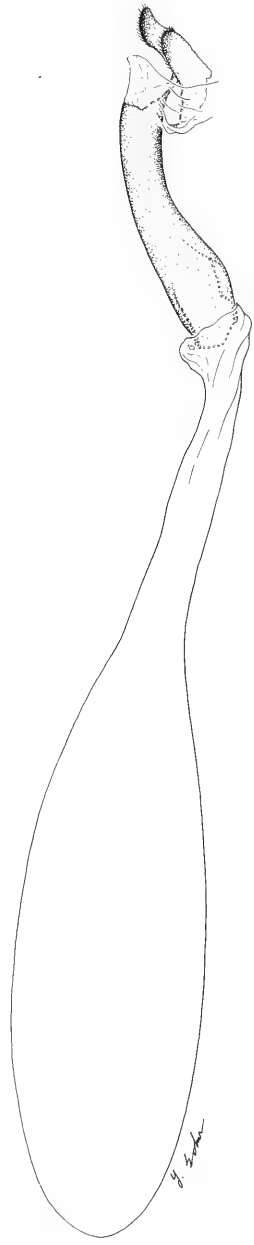
The distinctive titillator unites them in a close-knit assemblage (above





FIGS. 7, 8. Female genitalia of *Amblyscirtes celia* from Austin, Travis Co., Texas, 25 May 1967, J. M. Burns (X-2452) (USNM). 7, Sterigma, bursa copulatrix, and part of the ductus seminalis in ventral view; 8, Sterigma and bursa copulatrix in right lateral view.





FIGS. 9, 10. Female genitalia of *Amblyscirtes belli* from Vickery, Dallas Co., Texas, 30 August 1952, H. A. Freeman (X-2692) (USNM). 9, Sterigma, bursa copulatrix, and part of the ductus seminalis in ventral view; 10, Sterigma and bursa copulatrix in right lateral view.

a superspecies since *A. celia* and *A. tolteca* overlap broadly in Mexico). Though all have a fundamentally similar spot-pattern on the ventral secondary, the four taxa run a gamut in average spot expression from weak in *belli* and rather better in *celia* to strong in *tolteca* and very strong in *prenda*; and *tolteca/prenda* stand out especially on account of a bold double spot in the cell and a sharp spot in space $1b_1$, on both surfaces of the primary, plus several spots on the dorsal secondary—all of which *A. celia* and *A. belli* lack. (In these species of *Amblyscirtes*, males express spots better than females.) In addition, primaries are more pointed in *tolteca/prenda* than in *celia* and *belli*. (And primaries are more pointed in males than in females.)

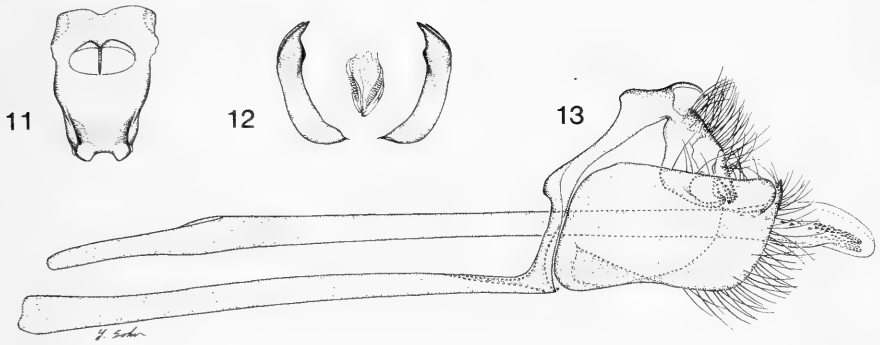
Banishing the Imposter

Originally described in *Amblyscirtes*, *simius* Edwards (1881) was moved by Barnes and McDunnough (1916) to *Chaerephon* Godman—which Hemming (1935) pegged as a junior homonym and renamed *Yvretta*—from which Freeman (1943) moved *simius* back to *Amblyscirtes*, where it remains (uncomfortably). (Draudt [1924] put it in *Stomyles*, which has long been considered a synonym of *Amblyscirtes*.)

Barnes and McDunnough justified removal by citing the third palpal joint and the antennal club. The third joint of the palpus is relatively short and directed forward to moderately upward in *simius* but long, slender, and about vertical in most species of *Amblyscirtes*; the antennal club looks nearly blunt with an exceedingly short and stubby apiculus in *simius* but conspicuously pointed with an abruptly constricted and attenuate apiculus in *Amblyscirtes*. Also mentioning the peculiar stigma, Barnes and McDunnough (1916:125) went so far as to say, "it may be necessary to erect a new genus for" *simius*; but conservatively, and tentatively, they placed it in *Chaerephon*—which is wrong (compare the figures of the male genitalia of *simius* with those of the other two species under *Chaerephon* in Skinner & Williams 1923, reprinted in Lindsey et al. 1931).

Proclaiming that "Edwards was correct when he described this species in the genus *Amblyscirtes*," Freeman (1943:75) argued his opposite case using the very same characters—third palpal joint and antennal club—which he misrepresented. Freeman (1943:76) admitted that "genitalically this species is not like other members of the genus *Amblyscirtes*."

Evans (1955), MacNeill (1975), Stanford (1981), and Scott (1986) reiterated that the genitalia of *simius* are aberrant for *Amblyscirtes*; and the three Americans added, on this and other (especially behavioral) grounds, that *simius* may belong in another genus. Having shown conclusively that "genitalic characters, generally so useful in differentiating



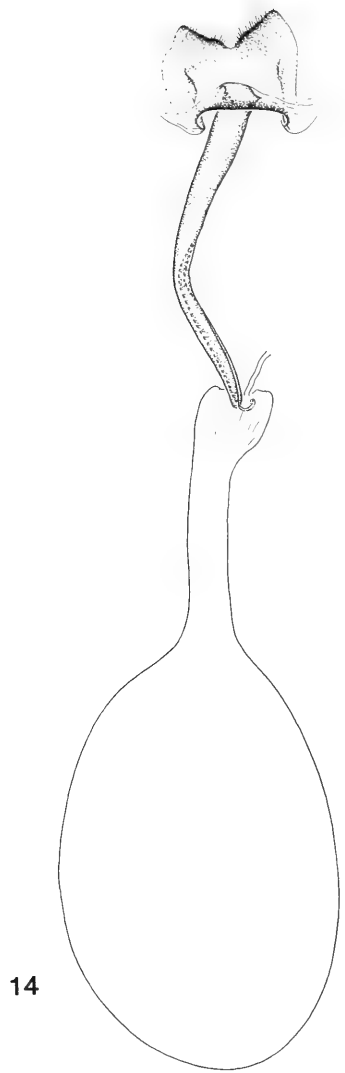
FIGS. 11–13. Male genitalia of *Amblyscirtes vialis* from Lexington, Middlesex Co., Massachusetts, 2 June 1975, J. M. Burns (X-2516) (USNM). 11, Tegumen, uncus, and gnathos in dorsal view; 12, Distal ends of valvae and aedeagus in posterior view; 13, Complete genitalia (minus juxta and right valva) in left lateral view.

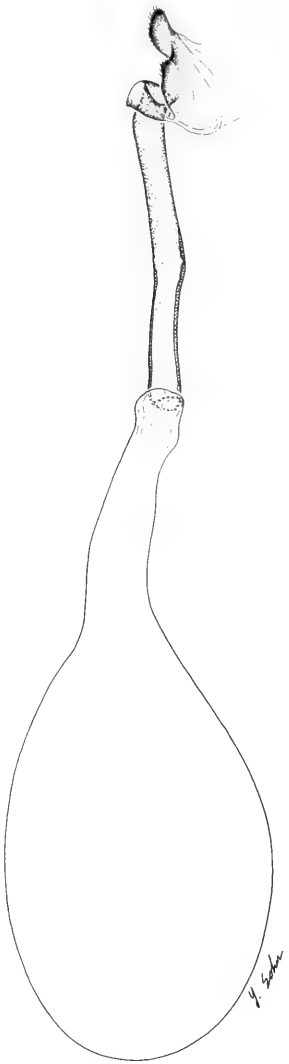
species, are also exceptionally valuable at the generic level in skippers" (Burns 1987:173), I wish, once and for all, to banish *simius* from *Amblyscirtes*.

In both sexes the genitalia of *A. celia* and *A. belli* (Figs. 1–10) are obvious variations on the theme of the type-species, *A. vialis* (Edwards) (Figs. 11–15). In males this singular theme boasts several salient elements: a wonderfully long, narrow aedeagus (Figs. 3, 6, 13) split distally into two, more or less parallel, linearly toothed ends (Figs. 2, 3, 5, 6, 12, 13); a correspondingly long, narrow saccus (Figs. 3, 6, 13); and a tegumen with a delicate, middorsal, caudally arching prong supporting membrane over a variously oval to cordate to triangular dorsal opening (Figs. 1, 3, 4, 6, 11, 13).

The male genitalia of *simius* (Figs. 16, 17) differ radically: the aedeagus is relatively short and stout, without distal modification, but with a pair of simple cornuti (lacking in *Amblyscirtes*); the saccus, though somewhat long, is not half what it is in *Amblyscirtes*; and the tegumen, uncus, and gnathos are all utterly distinct, both in form and in relative proportions, from their counterparts in *Amblyscirtes*. As in many other hesperiine skippers, the paired distal tips of the gnathos are completely free of the overlying uncus instead of being individually joined to its underside, as they are in *Amblyscirtes*. Any fancied resemblance between the valvae in lateral view is doubtless convergent.

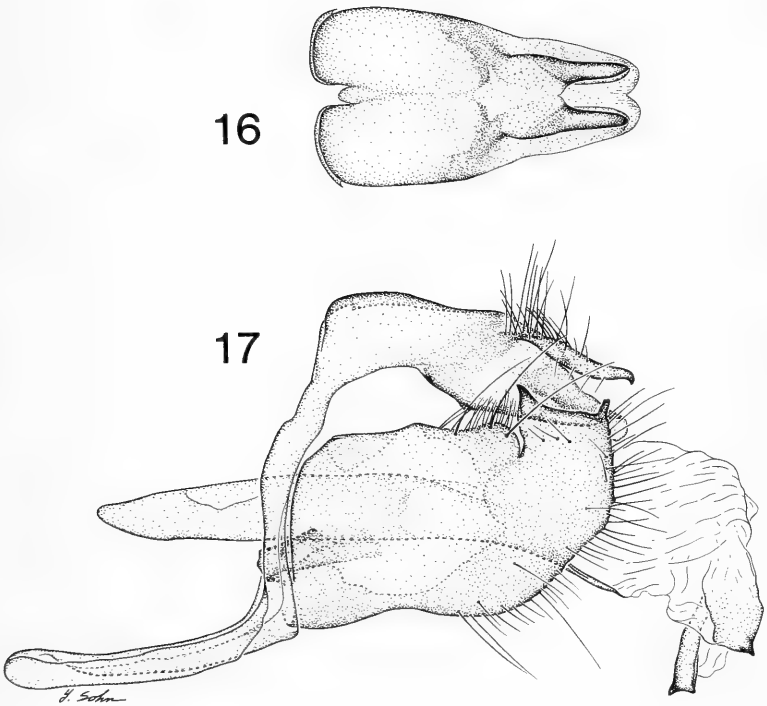
The female genitalia of *simius* stand apart at the grossest level: after 4 or 5 minutes of boiling in 10% KOH, they are virtually membranous throughout—even the lamella postvaginalis and the ductus bursae. These parts are always well sclerotized in *Amblyscirtes* (Figs. 7–10, 14, 15), even after 7 or more minutes of boiling.





FIGS. 14, 15. Female genitalia of *Amblyscirtes vialis* from Jacksonville, Windham Co., Vermont, 5 June 1963, J. M. Burns, E. D. Hanson, and D. W. Hottenstein (X-2519) (USNM). 14, Sterigma, bursa copulatrix, and part of the ductus seminalis in ventral view; 15, Sterigma and bursa copulatrix in right lateral view.

Where does *simius* go? Not in any named nearctic genus, but conceivably in a neotropical one. After all, a basically tropical skipper genus can produce a species that breaks the distributional mold by occurring primarily, and extensively, in North America north of Mex-



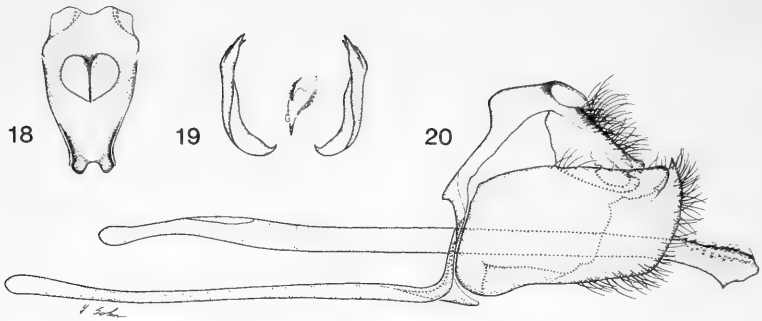
FIGS. 16, 17. Male genitalia of *? simius* from Horsetooth Mountain Park, 1800 m, Larimer Co., Colorado, 14 June 1987, P. A. Opler (X-2509) (USNM). 16, Tegumen, uncus, and gnathos in dorsal view; 17, Complete genitalia (minus right valva) in left lateral view, with vesica everted to show cornuti well.

ico—witness *Epargyreus clarus* (Cramer). To describe a new genus for *simius* still strikes me as premature (as it did Barnes & McDunnough in 1916). For the present I advertise its tail (Figs. 16, 17) so that others, too, may look for a possible match. Though I cannot fix its genus, better that *simius* float than clutter the wrong one.

Sometimes It's Okay To Be Different

The sole excuse for its erroneous placement is that *simius* looks like an *Amblyscirtes*—but we know that facies can converge and appearances, deceive. As discussed above, not only are the entire genitalia of *simius* wrong for *Amblyscirtes* but so are such prominent cephalic appendages as the palpus and, particularly, the antenna, whose apiculus is a blunt fraction of what it ought to be.

In this connection, it is instructive to point out for the first time that *A. alternata* (Grote & Robinson) has a similarly short, blunt apiculus!



FIGS. 18–20. Male genitalia of *Amblyscirtes alternata* from 5 km N Panacea, Wakulla Co., Florida, 5 April 1980, J. M. Burns (X-2457) (USNM). 18, Tegumen, uncus, and gnathos in dorsal view; 19, Distal ends of valvae and aedeagus in posterior view; 20, Complete genitalia (minus juxta and right valva) in left lateral view.

Nevertheless, *alternata* is a true *Amblyscirtes*: the third joint of its palpus is long, slender, and erect; and (what is really crucial) its genitalia (Figs. 18–20) are a manifest variation on the *Amblyscirtes* theme (compare Figs. 1–6, 11–13). Note that the aedeagus carries a subterminal titillator in the form of a modest midventral keel (Figs. 19, 20). Both this keel and the much reduced apiculus are unique in the genus *Amblyscirtes*.

Biologic variation may sharply change the singular genitalic theme itself. In three species, *A. nereus* (Edwards), *A. eos* (Edwards), and *A. nysa* Edwards, the delicate, middorsal tegumen prong—one of the "salient elements"—totally disappears. But the underlying dorsal opening persists, as do all other salient elements. Nature simply makes it harder to generalize.

Neotropical Ties and Disruption of Genus Groups

With *simius* out, the rest of the 30 species currently in *Amblyscirtes* (Freeman 1973) comprise a related lot sharing more or less similar genitalia. Still, the genus is mixed with respect to such features as facies, the length of the apiculus, the third joint of the palpus, and, most important, the stigma of the male. Not just the species groups of *Amblyscirtes* but the exact limits of the genus may need to be reworked.

But larger, more basic problems loom. When he arranged the genera of American hesperiines in 8 groups (lettered H to O), Evans (1955: 7–8, 383) put *Amblyscirtes* in the N or *Lerodea* group (the smallest), observing that, "The 4 genera placed in this group [*Atrytonopsis, Amblyscirtes, Lerodea*, and *Oligoria*] appear to be more or less allied and would be out of place in any other group." Actually, the nearest relatives of *Amblyscirtes* are far removed in Evans's J or *Apaustus* group!

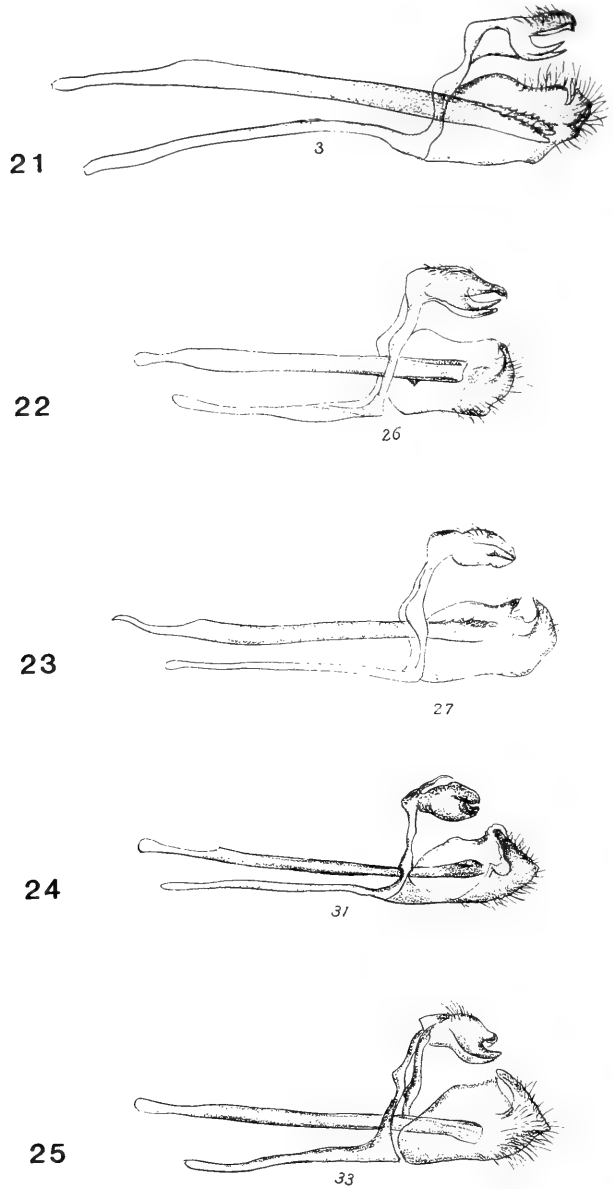
Support for this startling assertion comes from figures of male genitalia in two classic works treating skippers at opposite ends of the neotropics (Mexico and Central America; Argentina). The critical figures (Godman & Salvin 1879–1901:vol. 3, pl. 99, fig. 3, pl. 103, figs. 26, 27, 31, 33 [all reprinted in this paper as Figs. 21–25]; Hayward 1950: pl. 8, fig. 3, pl. 13, figs. 5, 11) show salient elements of the singular *Amblyscirtes* theme—especially those relating to the aedeagus and the saccus, but, in one case, even the delicate tegumen prong—coupled with valvae loosely reminiscent of *Amblyscirtes* valvae. According to Evans (1955), those figured genitalia belong to 5 species in 3 genera—*Moeris remus* (Fabricius), *Mnasicles geta* Godman, *M. hicetaon* Godman, *Callimormus juventus* Scudder, and *C. alsimo* (Möschler)—and those genera (all polytypic) constitute, respectively, numbers 33, 6, and 2 of his *Apaustus* group (which contains 53 genera in all).

At this point I must sunder the Evans combination *Moeris remus* and restore *remus* to its proper genus. Without any question, the figures of the male genitalia of the type-species of Godman's new genera *Perimeles* (Godman & Salvin 1879–1901:vol. 3, pl. 99, fig. 3 [Fig. 21 in this paper]) and *Moeris* (vol. 3, pl. 100, fig. 2 [Fig. 26 in this paper]) reflect very distinct genera, which Evans (1955:146) wrongly lumped. The genitalia of the type-species of *Perimeles—remus* Fabricius—suggest *Amblyscirtes*, while the genitalia representing *Moeris* do not. There has been a legitimate name change, though: *Perimeles remus* became *Remella remus* when Hemming (1939) saw that Godman's *Perimeles* is a junior homonym and replaced it with *Remella*.

Having examined a number of genitalic dissections of *Remella, Mnasicles*, and *Callimormus* for myself, I reiterate that those small neotropical skippers are phylogenetically close to *Amblyscirtes*. To see—almost at a glance—that the male tails of *Atrytonopsis, Oligoria*, and *Lerodea* depart much farther from those of *Amblyscirtes*, compare relevant figures in Godman and Salvin (1879–1901), Lindsey et al. (1931), Hayward (1950), and Burns (1982, 1983).

Blatant genitalic heterogeneity in both the J and the N groups of Evans probably exceeds what I have indicated. Worse yet, it may occur in other groups, invalidating much of Evans's taxonomic system just below the level of the subfamily.

I have a final irony in the fire. In the course of checking out possible neotropical relatives of *Amblyscirtes*, I studied the male holotype (the only known specimen) of what Bell (1959) designated *Moeris patriciae* (taken by Patricia Vaurie at Salamá, elevation 3000 ft [915 m], in the middle of Guatemala on 22 July 1947), including the slide Bell had made of its genitalia. From this—as well as from Bell's (1959:figs. 9, 15) illustrations of the whole animal and its genitalia—the skipper



FIGS. 21–25. Godman's figures of male genitalia of various neotropical relatives of *Amblyscirtes*; complete genitalia (minus juxta and left valva) in left lateral view. Note that, because Godman removed the left valva, his figures show the inner surface of the right valva, whereas mine of *Amblyscirtes* show the outer surface of the left valva. 21, *Remella remus*; 22, *Mnasicles geta*; 23, *Mnasicles hicetaon*; 24, *Callimormus juventus*; 25, *Callimormus alsimo*.

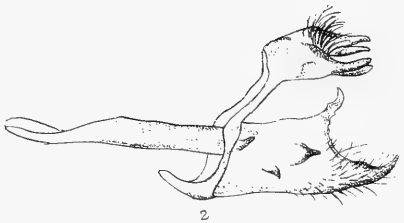


FIG. 26. Godman's figure of the male genitalia of *Moeris striga*; complete genitalia (minus juxta and left valva) in left lateral view. Even in a limited lateral comparison, this tail differs grossly from that of *Remella remus* (Fig. 21): the aedeagus is short and simple but equipped with cornuti, the saccus is very short, and the distal ends of the valva are much produced.

obviously belongs in *Amblyscirtes* as then and now conceived. *Amblyscirtes patriciae* (Bell), **new combination,** clusters with *A. folia* Godman, *A. immaculatus* Freeman, and *A. raphaeli* Freeman, which come from southern Mexico.

For *Amblyscirtes,* these species are large to extremely large in size (the length of the male primary ranges from about 15 to 20 mm). Males have a well-developed, conspicuous, linear stigma, in three sections, consisting mainly of fine, dense, short, brown, hairlike scales. The longest (and uppermost) section begins at the origin of veins 3 and 4, runs along the lower side of the cubitus, diverges from it well before the origin of vein 2, and extends down to that vein. The second and third sections pick up below vein 2 as a pair of dashes or dots, much more nearly vertical in orientation, that extend to, or toward, vein 1. Although tripartite, this stigma looks more or less continuous to the naked eye. The apiculus of the antenna (unfortunately missing from the specimen of *A. patriciae*) is perceptibly longer and more delicate than it is in other *Amblyscirtes.* The third segment of the palpus is relatively short, rather than long and slender. A pale area (cream or tan or yellowish) tends to develop on the ventral primary in the distal half of space 1b.

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A NEW SPECIES OF *PIRUNA* FROM MEXICO (HESPERIIDAE)

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ABSTRACT. *Piruna kemneri* is described from Oaxaca and Puebla, Mexico, the type series consisting of 18 males collected by John Kemner and one male collected by H. A. Freeman. The new species is differentiated from its most similar ally *P. haferniki* Freeman 1970 by morphological and genitalic characters. Holotype and genitalia of a paratype are illustrated.

Additional key words: *Piruna kemneri, P. haferniki, P. brunnea, P. pirus, P. cyclosticta.*

During the summers of 1987–88 John Kemner collected rather extensively over Mexico. Among the many interesting species of Hesperiidae that he collected in the state of Oaxaca was an undescribed species of *Piruna* Evans that is described here. According to Evans' (1955) arrangement this species belongs in Group H of the Hesperiinae.

Piruna kemneri Freeman, new species
(Figs. 1, 2, 3)

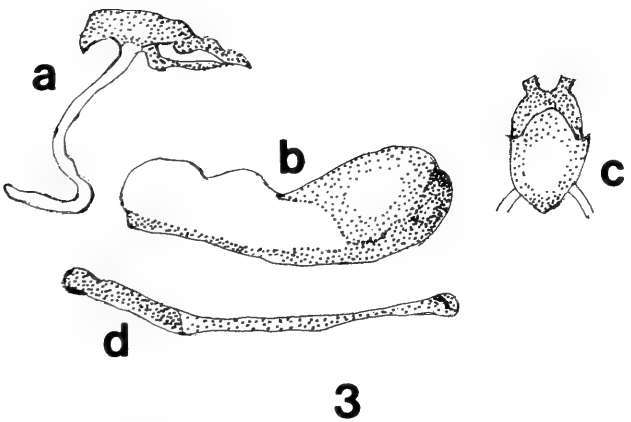
Male upper side (Fig. 1). Primaries black, with seven variable white, hyaline spots; a round or linear spot in space 2 and, midway between this spot and base of wing, another spot in same space, which may be absent in some specimens. In space 3, a small round or linear spot situated directly under apical spot in space 6. Three, small, apical spots, in line, with the one in space 7 being minute and sometimes absent. A small, round, upper cell spot. Fringe black becoming whitish at the tips. Costal margin slightly concave. Secondaries black, unmarked. Fringe black, becoming lighter at tips, uncheckered.

Male under side (Fig. 2). Primaries brown, lightly overscaled with golden scales, with space 1 being lighter in coloration than the rest of the wing. All spots are white, hyaline, and better defined than on upper side. Fringe dark, brownish black, slightly checkered. Secondaries brownish black, with a heavy overscaling of golden scales over the basal half of the wing and extending from anal fold to space 3. There is a heavy concentration of golden and white scales midway between the apex and base of the wing near the costa, forming an irregularly shaped blotch. The remainder of the wing brownish black. No hyaline spots present. Fringe dark brownish black, uncheckered.

Body. Thorax black, heavily overscaled with brown hairs above, lighter beneath due to brown and golden hairs present. Abdomen dark brownish-black above, lighter beneath. Head black, covered with brown hairs. Palpi black above, sordid white at base below, gray at termen, dark grayish on lateral sides. Legs brown. Antennae, both shaft and club, dark brownish black above, lighter beneath, club pale beneath, yellowish. Apiculus gold.

Wing measurements. Holotype. Primaries: base to apex, 10.5 mm; apex to outer angle, 7 mm; outer angle to base, 9 mm. Secondaries: base to end of vein 3, 8.5 mm; center of costa to anal angle, 7 mm. Total expanse: 22 mm. Average total expanse of paratypes: 22 mm (n = 17).

Types. Holotype, male, Mexico: Oaxaca: 5 miles north of Oaxaca, Hwy. 175, ca. 1800 m elev., 21 July 1987 (leg. John Kemner) in the American Museum of Natural History, New York. There are 17 male paratypes, 16 same location and collector as holotype, collected during July and August 1987–88, at present in my collection, and one male paratype from Mexico: Tehuacan, Puebla, 14 August 1964 (leg. H. A. Freeman) in the American Museum of Natural History.



FIGS. 1, 2. Upper side (Fig. 1) and under side (Fig. 2) of *Piruna kemneri* Freeman, holotype, male, Mexico: Oaxaca, 5 miles north of the city of Oaxaca, ca. 1800 m elev., 21 July 1987 (leg. John Kemner).

FIG. 3. *Piruna kemneri*, male genitalia of paratype (Genitalia Vial H-904), same location and collector as holotype, 11 July 1988. a) tegumen, uncus, gnathos, and associated structures in lateral view; b) right valva in lateral view of interior, upper part ampulla, lower part harpe; c) same as (a), in ventral view; d) aedeagus in lateral view.

Etymology. I take great pleasure in naming this new species for my good friend John Kemner who collected most of the type series.

This new species is a member of the *brunnea* complex (Freeman 1970) of *Piruna*, which contains *brunnea* (Scudder), *cyclosticta* (Dyar), *pirus* (Edwards), and *haferniki* Freeman, and is characterized by having no spots on either the upper or under side of the secondaries. All other *Piruna* have either spots or streaks on the upper or under side of the secondaries. The male genitalia of members of this complex have the terminal end of the harpe smooth with no indication of being serrate or having spines, which are present in most of the other species of *Piruna*. The members of this complex are briefly described as follows: ***brunnea*** (Scudder) 1872—Average expanse of primary 13 mm. Black. Two apical spots in spaces 6 and 8. Discal spots in spaces 2 and 3. Cell spot may or may not be present. No basal spot in space 2. Under side of secondaries chocolate brown. ***pirus*** (Edwards) 1878—Average expanse of primary 11 mm. Brownish-gray. Three apical spots. Discal spots in spaces 2 and 3 may or may not be present. Small cell spot usually present. No basal spot in space 2. Under side of secondaries ferruginous. **cyclosticta** (Dyar) 1902—Average expanse of primary 11 mm. Brownish-gray. Three apical spots. Discal spots in spaces 2 and 3 well defined. Cell spot always present. Basal spot in space 2 always present and well defined. Under side of secondaries dull brown. ***haferniki*** Freeman 1970—Average expanse of primary 11 mm. Blackish-brown. Three large apical spots, in line. Discal spots in spaces 2 and 3 well developed. Cell spot large. Basal spot in space 2 always present and well developed. Under side of secondaries overscaled over basal and submarginal areas purplish-gray leaving the center of the wing dark brown.

The most closely related species to *kemneri* is *haferniki*, from which it can be separated by the following features. In *haferniki* the apical, discal, and cell spots on the primaries are much better developed than in *kemneri*. Perhaps the easiest way to separate the two species is to compare the under side of the secondaries. *P. haferniki* has the unusual purplish-gray overscaling over the basal half of the wing and extending from the anal fold along the outer margin to space 5, leaving the discal area from space 1 to costa a broadly triangular area darker than the remainder of the wing, which lacks overscaling. *P. kemneri* has a heavy overscaling of golden scales over the basal half of wing and extending from space 1 and anal fold to space 3, leaving the remainder darker, except for the large irregularly shaped, lighter blotch midway between the apex and base on the costa, produced by a heavy concentration of golden and white overscaling. The costal margin of the primaries of *P. kemneri* is slightly concave, in contrast to all other species of *Piruna*.

The male genitalia of *kemneri* (Fig. 3) differ from *haferniki* in the following ways: the tegumen (lateral view) is broader; terminal end of divided uncus is straight and not curving laterally like *haferniki* (ventral view); ampulla is narrower at posterior end than in *haferniki* and the anterior end is broader and more upturned than in *haferniki* (lateral view); and the harpe is slightly narrower at the terminal end than in *haferniki* (lateral view). These genitalic differences are based on the examination of four *kemneri* paratypes.

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GENERAL NOTES

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PREDATION OF FIVE SPECIES OF NOCTUIDAE AT ULTRAVIOLET LIGHT BY THE WESTERN YELLOWJACKET (HYMENOPTERA: VESPIDAE)

Additional key words: *Nephelodes minians, Pseudaletia unipuncta, Heliothis zea, Trichoplusia ni, Catocala faustina.*

Between 23 September and 26 October 1989, I observed several western yellowjackets, *Vespula pensylvanica* (Saussure), preying on five species of Noctuidae at an ultraviolet light in central Colorado.

Vespula pensylvanica ranges from Hawaii, east across the Rockies onto the high plains of central Colorado (Akre, R. D., A. Greene, J. F. MacDonald, P. J. Landolt & H. G. Davis. 1980, Yellowjackets of America north of Mexico, U.S. Dept. Agric. Handbook No. 552, pp. 69–71). This predation was observed in Greenwood Village, a suburban area southeast of Denver, in Arapahoe County. Wasps began arriving at the ultraviolet light about 15 min before sunrise and returned continually until later afternoon, searching for moths. The wasps patrolled even on days when the ultraviolet light was not used the previous night. Although only one wasp was observed at a time, it is likely that more than one individual was involved in the attacks.

Moths attacked by *Vespula pensylvanica* were resting either on the white sheet behind the ultraviolet light, or on the house wall adjacent to the sheet. The wasp attacked by stinging a moth once in the abdomen. Some moths jumped and flew away, but others fell to the ground, flapping their wings. The wasp then followed the moth to the ground and stung it several more times. After the moth stopped moving, the wasp bit the moth's wings off at the base, and ate the body. Usually ($n = 5$), the abdomen and most of the thorax was eaten by the wasp, leaving only the tougher parts of the thorax and head. In one case, the wasp flew off with the prey.

The five species observed to be victimized by *V. pensylvanica* were: *Nephelodes minians* Guenee., *Pseudaletia unipuncta* (Haworth), *Heliothis zea* (Boddie), *Trichoplusia ni* (Hübner)(identified in Covell, C. V., 1984, A field guide to the moths of eastern North America, Houghton Mifflin, Boston, pls. 22, 29, 31), and *Catocala faustina* Strecker (identified in Holland, W. J., 1968, The moth book, Dover, Toronto, pl. 33). The successful attack on the *Catocala* species was surprising because *C. faustina* is much larger than the wasp. Other moths present but not attacked included several larger *Catocala* species and one unidentified, blackish Noctuidae.

Two other published observations of vespid wasps preying on adult Lepidoptera were recorded by S. H. Scudder (1889, The butterflies of the eastern United States and Canada, with special reference to New England, published by the author, Cambridge, MA), who observed a *Liminitis arthemis* (Drury) in the clutches of a large vespid wasp that had seized its prey as it sunned on a road (p. 1612). Scudder (p. 1217) also recounted an earlier observation made in England by G. Newport (1863, Trans. Entomol. Soc. Lond. 1:228–230), who reported a successful attack by *Vespa vulgaris* on *Pieris rapae*. Although this is not the first published observation of a vespid wasp preying on adult Lepidoptera, it is the first observation of a vespid preying on moths that have been attracted to UV lights (Frank, K. D., 1988, J. Lepid. Soc. 42:63–93). (For further observations of invertebrate predation of Lepidoptera, see Nielsen, M. C., 1977, The Great Lakes Entomol. 10:113–118.)

I thank Richard S. Peigler, Denver Museum of Natural History, for his invaluable help and advice in preparing this paper. Five voucher specimens of *V. pensylvanica* were deposited in the Denver Museum of Natural History.

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LYCAENA HYLLUS (CRAMER) (LYCAENIDAE): NEW HOST AND MATING BEHAVIOR IN A DROUGHT-INDUCED POPULATION EXPLOSION

Additional key words: dispersal, parasitism, *Aprostocetus*, Eulophidae, *Polygonum natans*.

On 24–26 August 1988, we observed a large population of the bronze copper, *Lycaena hyllus* (Cramer), in a wet meadow approximately 4–5 ha at the north end of Carnelian Lake, Stearns County, Minnesota. The lake has no natural outlet and fluctuations in the lake level are due to differences between precipitation and evaporation. The area was observed again in August 1989. Weather conditions during both years were warm and sunny with daytime high temperatures of 23–26° C.

In 1988 the wet meadow inhabited by *L. hyllus* consisted of a dense herbaceous community of *Polygonum coccineum* Muhl., *P. natans* Eat., *P. persicaria* L., *Rumex* spp., grasses, and sedges. *P. coccineum* grew in dense stands up to 1.5 m tall. The shorter *P. natans* covered areas as large as 9 × 15 m. First instar as well as older larvae and pupae of the bronze copper were found on *P. natans*. This is a new larval foodplant record for *L. hyllus*. Plants previously reported as larval hosts are *Rumex crispus* L., *R. obtusifolius* L., *R. longifolius*, *R. patientia* L., and *P. coccineum* (Scott, J. A., 1986, The butterflies of North America: A natural history and field guide, Stanford Univ. Press, Stanford, California, 583 pp.). Both *P. coccineum* and *P. natans* exhibited extensive feeding damage assumed to have been caused by larvae of the bronze copper. We did not observe females ovipositing on either plant but one was seen crawling about the base of *P. natans* plants. On 13 September 1988, 35 adult parasitoids of an undetermined species of *Aprostocetus* (Hymenoptera: Eulophidae) emerged from two pupae collected on *P. natans*. This is the first report of *L. hyllus* as a host of any species of *Aprostocetus* (M. E. Schauff, Systematic Entomology Laboratory, PSI, pers. comm.).

Males and females of the bronze copper nectared on the abundant flowers of *P. coccineum*. Both males and females rested and basked on *P. natans* with open wings; the males apparently engaged in perching behavior to await females. Perching behavior is typical of species in which the distribution of foodplants throughout the normal flight area is spotty (Scott, J. A., 1975, J. Res. Lepid. 14:1–40). Males in the vicinity of *P. natans* behaved markedly differently from those on the taller *P. coccineum*. Large numbers of males, estimated between 15–25/10 m^2, were observed patrolling 0.5–1.5 m above large patches of *P. natans*. Many fewer females were observed in these areas. Males, which did not interact outside of *P. natans* patches, sometimes chased each other in groups of 10 or more and often reached heights of 2–3 m. Males flew into and crawled beneath *P. natans* plants and several were observed to land on pupae attached to leaves, suggesting that females probably are mated soon after emergence.

Courtship behavior and mated pairs were observed from 0930–1200, but were more common from 1300–1500. Males sometimes chased females, but behavior that culminated in mating was not observed. Only 10 mated pairs were encountered in this gigantic population, suggesting intense competition among males for receptive females. Males that attempted to mate landed next to a resting female and both sexes began to flutter their wings rapidly. The male moved rapidly around the female and, when behind her, placed his head and antennae beneath her wings, i.e. male nudging (Scott, J. A., 1973, J. Res. Lepid. 11:99–127; Scott, J. A., 1974, Pan Pac. Entomol. 50:9–22). The female's abdomen remained horizontal to the leaf surface throughout the entire courtship. Attempts by the male to copulate by moving the abdomen laterally were apparently blocked by the open position and fluttering of the female's wings (Scott, J. A. & P. A. Opler, 1975, J. Lepid. Soc. 29:63–66). Female fluttering is a rejection dance in *Lycaena* (Scott, J. A., 1974, J. Lepid. Soc. 28:64–72), indicating either that females were not old enough to mate or that they had previously mated. Occasionally the male closely followed the female down into

the vegetation. After approximately 1 min of this rejection dance by the female, the male flew. Five males in succession were rejected by one female. Males that landed near a mated pair flew off after several seconds of wing fluttering by all three.

Estimates of the density of adult butterflies in the wet meadow in August 1988 ranged from 1 to 25/10 m^2 (1000 to 2500 adults/ha) in areas with large *P. natans* patches. The population explosion of *L. hyllus* may have resulted from the effects of the extreme drought conditions throughout central Minnesota during the spring and summer of 1988, which exposed shoreline that was colonized by *P. natans* and *P. coccineum*. These *Polygonum* have both terrestrial and aquatic forms (Gleason, H. A. & A. Cronquist, 1963, Manual of vascular plants of northeastern United States and adjacent Canada, D. Van Nostrand Co., Princeton, NJ, 810 pp.) enabling them to invade rapidly and dominate. We did not observe large numbers of bronze coppers in 23 previous years of normal and above normal precipitation. The presence of several female bronze coppers visiting flowers approximately 1 km from the meadow suggests that dispersal may be an important means by which this butterfly exploits temporary wetland habitats.

After twelve additional months of below average precipitation, the lake level had dropped several more feet by 20 August 1989, exposing additional shoreline. Areas that had been newly exposed in 1988 were extremely dry. Plant diversity had increased at the expense of the *Polygonum* species. The dense stands of *P. coccineum* observed in 1988 were greatly reduced except for newly exposed areas of the slough and shoreline. Searching the area on 20, 21, 22, and 26 August 1989 revealed only 10 adult male *L. hyllus*. Explanations of the population crash may include parasitism and a reduction of suitable larval foodplants.

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SEASONAL VARIATION OF OCCURRENCE OF DEFORMED COCOONS OF THE TASAR SILK MOTHS *ANTHERAEA MYLITTA* (DRURY) AND *ANTHERAEA PAPHIA* (L.) (SATURNIIDAE) IN INDIA

Additional key words: bipupate, bishellate, flimsy cocoons.

The tasar silk moth, *Antheraea mylitta* (Drury), is trivoltine in India and is reared in the Rainy season (July–August), Autumn (September–October), and Winter (November–December). By contrast, *Antheraea paphia* (L.) is reared only during the Autumn season; although it multiples in nature during the Rainy and Winter seasons, its economic performance at these times is poor. Tasar culture is an age-old practice in Orissa and good cocoons are more highly valued in tasar commerce than deformed cocoons because of the former's better reelability (ability to be spun onto a reel with a continuous filament for production of fine fabrics). Although the occurrence of deformed cocoons in the tasar crop is a common phenomenon, the seasonal variation of their occurrence has not been

TABLE 1. Seasonal variation in percentage occurrence of deformed cocoons of *A. mylitta*[1] and *A. paphia*.[1]

Season	Tasar species with commercial names of the seasonal crops	Deformed cocoons (%)			
		Bipupate	Bishellate	Flimsy	Total
Rainy	*A. mylitta* (Ampatia)	0.047	0.698	6.130	6.875
	A. paphia (Godamodal)	0.008	0.154	0.125	0.287
Autumn	*A. mylitta* (Daba)	0.060	1.073	25.912	27.045
	A. paphia (Bogei)	0.021	1.868	10.412	12.301
Winter	*A. mylitta* (Jadei)	0.131	1.479	47.559	49.169
	A. paphia (Patrajhada)	0.005	0.132	0.122	0.259

[1] N = 10,000

documented, which creates confusion in commercial sectors during grading and trading. This study documents the relative abundance of deformed cocoons produced in different rearing seasons of the year.

Because of the availability of both *A. mylitta* and *A. paphia*, the important tasar zones of Singda, Kendujuani,Thakurmunda, Sarat, and Kaptipada in the Mayurbhanj district of Orissa were chosen for this study. Ten thousand cocoons of both *A. mylitta* and *A. paphia* were collected at random in five equal groups from the above five localities during each of the three rearing seasons in 1987. The Rainy season and Winter cocoons of *A. paphia* were collected from natural populations in the forests of the study sites. All other samples were taken from commercial cultures. Deformed cocoons were sorted from good cocoons in each sample group.

Deformed cocoons were classified as either bipupate (a single cocoon having two pupae), bishellate (two cocoons joined by their shells, which interrupts the continuity of the silk filament), or flimsy (cocoons having thin and unsubstantial shells without strength or solidarity) (Nayak, B. K., M. L. Gupta, B. C. Guru & B. N. Satpathy, 1987, Towards classification of cocoons in tasar silk insect *Antheraea mylitta* Drury (Lepidoptera: Saturniidae), Sericologia 27:505–512). The mean percentages of each class of deformed cocoons during each season were calculated and the data were analyzed by season and by species (Table 1).

In *A. paphia*, the percentage of deformed cocoons was highest (12.30%) during the Autumn Season, followed by Rainy Season (0.29%) and Winter Season (0.26%) (Table 1). In *A. mylitta*, the highest percentage (49.17%) of deformed cocoons appeared during the Winter season, followed by Autumn season (27.05%) and Rainy season (6.88%). Trends in the occurrence of deformed cocoons of both *A. paphia* and *A. mylitta* were found to be similar with respect to each type of cocoon deformity.

The percentage of flimsy cocoons in *A. mylitta* increased dramatically from the Rainy season (6.13%) to Winter Season (47.60%), whereas the number of flimsy cocoons was negligible (0.12%) in natural populations of *A. paphia* during the Rainy and Winter seasons.The maximum number of deformed cocoons of *A. paphia* occurred during Autumn Season and was probably due to its rearing in semidomesticated conditions. Such rearing is against its natural tendency, as it usually grows only during the Rainy and Winter seasons. In the case of *A. mylitta*, the percentage of deformed cocoons was much greater and might result from the frequent handling of the silkworm during the semidomesticated rearing.

The higher frequency of deformed cocoons in the Winter Season might result from physioclimatic stress at the onset of Winter in the places of study. Nayak et al. (Nayak, B. K., A. K. Dash, P. K. Das, A. K. Sasmal & B. N. Satpathy, 1986, Sex association in doubled cocoons of tasar silk insect *Antheraea mylitta* Drury (Lepidoptera: Saturniidae), Sericologia 26:285–290) assumed that physiological, physical, or environmental stress causes formation of bipupate (double) cocoons. However, studies should be carried out

to determine the effects of varying climatic conditions and of handling of silkworms during rearing and spinning on the frequency of deformed cocoons.

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BOOK REVIEWS

Journal of the Lepidopterists' Society
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CIE GUIDES TO INSECTS OF IMPORTANCE TO MAN. 1. LEPIDOPTERA, by J. D. Holloway, J. D. Bradley, and D. J. Carter (C. R. Betts, ed.). 1987. CAB International Institute of Entomology, London. Distributed by CAB International, 56 Queen's Gate, London SW7 5JR, United Kingdom; and 845 North Park Avenue, Tucson, Arizona 85719, USA. 262 pp., many unnumbered illustrations, 19.3 × 26.7 cm. Hard cover, ISBN-0-85198-594-6, £25.00 ($52.25); spiral bound, ISBN-0-85198-594-7, £14.00 ($29.00).

Fortunately for lepidopterists, the first guide produced by the Commonwealth Institute of Entomology (CIE) treats the Lepidoptera. It is a good, generalized introduction to the order that addresses characterization and recognition for the world fauna of higher taxa down to the family level, and for several large families, to the subfamily level. In this effort the work is a boon to students and nearly unique for contemporary treatments. It was developed as a manual for students of the CIE training course for recognition and handling of Lepidoptera.

The introduction treats characterization of the order, discussion of injurious and beneficial species, problems associated with identification, collection and preparation of specimens, and a checklist of higher taxa. I found myself agreeing with the caveat concerning the need to exercise care to ensure that specimens are properly handled, mounted, and labeled so that as many characters as possible are retained. Directions for dissecting and mounting genitalia on slides are perhaps not quite adequate for the uninitiated who does not have access to a tutor, but they suffice. Euparol is indicated as the mounting medium of choice; Canada balsam should be recognized as another long-term mounting medium. A checklist of higher taxa presents useful information on numerical size of families, their geographic distribution, and their current placement within superfamilies, infraorders, and suborders.

Suborders, infraorders, and divisions are briefly characterized following N. P. Kristensen (1984, Steenstrupia 10:141–191). Note that 99% of the Lepidoptera are in the division Ditrysia of the infraorder Heteroneura and suborder Glossata. Categories to division are keyed in four couplets; several taxa are grouped in the same couplet. Adult ditrysian Lepidoptera are keyed to family using characters of the head, thorax, wings, and abdomen when possible. Occasionally, genital characters are used. All characters are illustrated throughout the key. Inevitably, some specimens will not pass through the key "correctly," and considerable practice with specimens and access to an array of identified specimens are useful adjuncts to the process. Identification of Lepidoptera is not easy—it requires considerable experience—but it is made easier by concentrating on a limited geographic area.

Most of the text is devoted to characterization of families and subfamilies; John Bradley is responsible for the "microlepidoptera" and Jeremy Holloway for the "macrolepidoptera." Each does a fine job of summarizing characters, capturing nuances of significant features that are useful but not invariably diagnostic, balancing various authors' views of classification, illustrating useful characters, citing pertinent literature [however, Derzhavets (1984) cited on page 147 was omitted from the references section], and noting representative species. Many will be surprised that nearly all examples are drawn from faunas other than the New World. David Carter developed the illustrated key to last instar larvae and the family characterizations based on this stage. The key is usable but could afford a few more illustrations of characters and character states. Because I identify 1500+ mostly non-North American microlepidopteran larvae each year, I have become addicted to the illustrated key by F. W. Stehr and P. J. Martinat (1987, pp. 306–340, *in* Stehr, F. W., ed., *Immature Insects*), which is particularly well illustrated, as a preliminary source for family level identification.

A short glossary is helpful. The 21-page list of references (nearly all post 1950) is very useful for anyone attempting to learn more about classification of the order.

I strongly recommend this book to those lepidopterists who want to stray beyond the butterflies and skippers for a general introduction to this extremely diverse group.

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Journal of the Lepidopterists' Society
44(1), 1990, 38

NORDEUROPAS PRYDVINGER (THE OECOPHORIDAE OF NORTHERN EUROPE), by Eivind Palm (in Danish with brief English summary for each species). [DANMARKS DYRELIV, vol. 4]. 1989. Fauna Boger, Copenhagen. Distributed by Apollo Books, Lundbyvej 36, DK-5700 Svendborg, Denmark. 247 pp., 214 text figs., 199 maps, 25 color plates. Hard cover, 17.5 × 25 cm, ISBN 87-87738-08-6, Danish kroner 420 (plus postage) (about $56.00).

This work is a manual of the Oecophoridae of Scandinavia, areas immediately adjacent to the Baltic Sea, and northern Netherlands with particular emphasis on Denmark. It has an introduction to the family, its zoogeography, morphological characters of adults, immatures, ecological habitats, phenology, and economic importance. It has a map of the region to show the counties/districts of the countries and one at a larger scale of Denmark. Subfamilies and genera have identification keys, but species do not. For genera the treatment consists of a brief summary of distribution, number of species, diagnosis, differentiation from closely allied taxa, discussion of immature stages and hosts; for species it consists of differentiating characters, extensive statement of distribution, and bionomics. Each species has a dot map to indicate verified distribution data by county/district for the entire region, and for 80 species there is an additional map showing more specific localities within Denmark. Illustrations generally are very good, particularly the eight color plates of adults. Each species has at least one specimen shown in color, sometimes more when the species is variable or when the sexes are dimorphic or dichromatic. Differences between closely similar species are illustrated by male and/or female genitalia, monochrome plates of wings with key characters indicated, or line drawings of specific structures. Occasional habitat photographs to indicate where a species has been found are interesting but not always top quality.

Scandinavia has an oecophorid fauna of 119 species as compared with approximately 226 in America north of Mexico. Within the family, representation by subfamily (number of North American taxa in parentheses) differs greatly between the two areas: Depressariinae 74 (108), Ethmiinae 6 (50), Peleopodinae 0 (2), Stenomatinae 0 (24), Oecophorinae 35 (41), Deuterogoniinae 1 (0), Chimabachinae 3 (1), reflecting both Scandinavia's northern location relative to the Palearctic Region and the development of Stenomatinae and Ethmiinae in the northern Neotropical and southern Nearctic Regions. The distribution maps show very clearly that most species occur within the southern ½–⅔ of the area; only *Agonopterix arctica* (Strand) occurs in the north and not in the south, and only a limited number of species occur throughout Scandinavia.

Perhaps because the volume is a manual, complete lists of synonyms and literature citations to them are missing. I was puzzled by the "Literature" section not being alphabetically arranged throughout. It appears as though items were found after the initial numbered list was developed and added at the end; thus, there are four alphabetically arranged lists within this section.

The English summary for each species treats distribution, frequency of occurrence, habitat(s), and when and where adults may be collected. Although the text is in Danish, reference to the illustrations, similarity of many words to English cognates, and equivalents in scientific terms, make the content generally available to an inquiring English reader.

I recommend this work to everyone interested in gelechioid moths in particular, and Lepidoptera in general. The author and editor are to be commended for this fine volume and for the execution of the series.

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SATURNIIDAE: ECOLOGICAL AND BEHAVIORAL OBSERVATIONS OF SELECT ATTACINI, by Robert D. Weast. 1989. Published privately by the author, whose address is: 5324 NW 78th Court, Johnston, Iowa 50131. 53 pp., 3 color plates, 1 text fig. Soft cover, 21.5 × 28 cm, no ISBN number, $16.90 (postpaid).

With the increasing availability of word processing programs and desk-top publishing on personal computers, it came as no surprise to see this vehicle used to publish an entomological work. Such methods need to be used cautiously to publish scientific work, and apparently the result does not constitute valid publication under the International Code of Zoological Nomenclature (1985, Articles 8 & 9). Since Weast did not propose any new names, the question of whether this book (some may prefer to call it a booklet) is a valid publication is not so critical. However, should this outlet become commonly utilized, the tempting and obvious opportunity to circumvent peer review and editorial input of the manuscript can lead to reduced quality of scientific literature. Even where manuscripts are refereed by other scientists, I would recommend that authors abstain from using desk-top publishing for work that is intended to have widespread and permanent application.

The vinyl cover, textured bond paper, and plastic spine are of good quality. The three color plates are glossy photographic prints measuring 18 × 25 cm and are attached loosely onto the pages with rubber cement. They should have been dry mounted. I will protect my copy by sheathing those three pages individually in clear plastic. The 13 photos in these three plates have great aesthetic and scientific value. The book will be fine for personal libraries, but less suitable for loaning out of public libraries.

The text provides discussions filled with details pertaining to field observations, rearing procedures, geographical localities, and ecological aspects. I learned a lot. I am sure that the great majority of statements in the text are accurate and factual. Weast generously gives credit throughout the text to all his correspondents for their ideas and discoveries; many authors are much less willing to credit others. Weast has made many trips to study Saturniinae, and in this book shares a lot of his personal observations made in southern Texas, Arizona, France, etc., effectively conveying his life-long enthusiasm for these big moths. He has carried out various experiments to introduce/colonize certain species (*Samia cynthia, Callosamia promethea, Automeris io*) into urban and rural locales, mostly in Iowa, where they did not occur formerly. Some data are qualitative, but he provides enough quantitative data in tabular form, combined with insightful discussion, that I believe this work will be useful to persons studying saturniid population ecology. Weast is to be commended for disproving the myth that everything is already known about the large, common saturniids.

The organization is weak in some ways. Many disjunct points are scattered throughout the text. Some paragraphs consist of a single sentence. Some are arranged under inappropriate subheadings. Certain examples detract from the scientific image of the work; these include referring to vertebrates as vertebrae (in a discussion on predation) and misusing the word speciation to convey a taxonomic rather than an evolutionary concept.

I was pleased to find satisfactory answers to several questions I have long puzzled over. These include: Why has *Samia cynthia* died out in certain cities and not others? Does *S. cynthia* really occur in Savannah, Georgia, and throughout most of Ohio and Indiana? Is the widely published report of an urban population of *C. promethea* specializing on lilac in Milwaukee, Wisconsin, really valid? What is the western range of *C. promethea* along the region between Minnesota and central Texas?

Most errors in the text are minor, but I feel the need to rectify a few. Weast consistently misspells Lemaire as LeMaire and Veracruz as Vera Cruz. The 1906 and 1907 citations in his bibliography were published by Caroline Soule, not Fred Tepper. Israel is incorrectly referred to as Palestine. Lastly, I suspect it unwise to publish the particulars when your friends repeatedly break federal law by collecting in national parks.

I consider the book to be overpriced, but the price is still generally affordable and substantially lower than the cost of most scientific books on the market. Despite the

shortcomings I have outlined above, it offers a lot of value and interest. I recommend it to the many lepidopterists who are enthusiastic in their rearing and field collecting of larger Saturniidae.

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Journal of the Lepidopterists' Society
44(1), 1990, 40

THE BUTTERFLIES OF MANITOBA, by Paul Klassen, A. Richard Westwood, William B. Preston, & W. Brian McKillop. 1989. Manitoba Museum of Man and Nature, Winnipeg, Manitoba, Canada. vi + 290 pp. with 27 color plates, distribution maps, and various text illustrations. Soft cover (plastic laminate), 20.5 × 25 cm, ISBN-0-920704-16-6; $18.66 (U.S.) + $1.70 shipping.

This book is a comprehensive treatment of the butterfly fauna of Manitoba. The introductory pages include such topics as butterflies in perspective, nomenclature, the differences between butterflies and moths, butterfly life histories, Manitoba as an environment for butterflies, Manitoba biomes, butterfly distribution, conservation, and study, with a brief historical perspective on early lepidopterists in Manitoba. The scientific treatment begins with the Hesperioidea and concludes with the Danaidae. Then follows a listing of potential and dubious species, a comprehensive list of references, and a glossary of terms. The six appendices include butterfly collecting methods, a list of larval and adult foodplants, a checklist of Manitoba butterflies, geographic locations (latitude and longitude) of collection sites with a map of major areas, summary of flight periods, and the Lepidopterists' Society's "Statement of the Committee on Collecting Policy." An index of species concludes the book.

Each species entry includes information and topics in the following order: common name, scientific name (author and date) with basic synonyms, plate and figure numbers, description, life cycle, habitat, range, Manitoba records, subspecies, general remarks. A dot distribution map accompanies each entry, with the dots color-coded for each family. The color plates are well done, and, for the most part, the specimen colors are natural (for museum specimens), while the plate backgrounds vary from white to antique-white. Specimens are shown life-size with three illustrations for each species: male dorsal, female dorsal, and ventral (male or female). Scientific nomenclature follows Klassen's 1984 Manitoba checklist published in J. Lepid. Soc. (38:32–39), and differs significantly in some groups from the 1981 Miller and Brown catalogue and other recent publications. The Miller and Brown names, however, are shown as synonyms. This is the only area in which I offer adverse criticism, as yet another set of scientific names is introduced, which only further muddles nomenclature.

Manitoba encompasses six vegetation zones ranging from tall grass prairie through boreal coniferous forest to arctic tundra. Consequently there is wide diversity among the 144 butterfly species recorded from this province. Although several subspecies have been described from Manitoba, there are no unique species. The dominant groups are Nymphalidae (40 species), Hesperioidea (33), Lycaenidae (27), and Satyridae (19).

The Butterflies of Manitoba, with an overall format of 8 × 10″, is nicely produced and has a pleasing aspect regarding the general layout. The text provides a wealth of information about Manitoba butterflies and is certainly "must" reading for any collector wishing to visit this Canadian province. This book is the most recent addition to the collection, from various publishers, of North American regional butterfly works that have appeared during the past several years. It will be a valuable addition to the bookshelf of any collector with an interest in the North American fauna.

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Journal of the Lepidopterists' Society
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MARIPOSAS DE VENEZUELA, by Theophile Raymond. 1982. Ediciones Corpoven, Caracas, Venezuela. 275 pp., 53 plates. Hard cover, 29.5 × 23.7 cm, approx. $30.00.

Theophile Raymond was a classic naturalist about whose life we know very little, except for his scientific accomplishments during the late 19th and early 20th centuries. His research in natural history was diverse and notable and his role in the early scientific development of Caracas is well recognized, but he is best known for his studies on butterflies.

Young Raymond arrived in Venezuela from Martinica, probably in the early 1890's, and it is presumed that he collected butterflies ever since. His premature death, in 1922, left fatherless perhaps one of the best and largest butterfly collections in Venezuela. Nothing is known about what happened to this collection, and the reason why it was not preserved by any of his notable scientist coworkers remains an enigma. Today there is no doubt that it was lost forever.

His manuscript *Fauna Entomológica Venezolana. Lepidópteros Rhopaloceros,* written in 1902, which remained undiscovered for many decades, now is available to lepidopterists in the present excellent facsimile edition entitled *Mariposas de Venezuela.* Included in this edition is an interesting biographical sketch of Raymond, written by the now deceased Dr. Francisco Fernández-Yépez, a pioneer Venezuelan lepidopterist. Fernández-Yépez also made modifications in the original text, added new identifications, and corrected errors. Fifty-three full-color original plates, drawn and painted by Raymond, are included. The first 47 plates represent the most common butterflies (and some Geometridae and Uraniidae) of Venezuela. The remaining six plates illustrate members of the family Sphingidae. Only the Hesperiidae and some members of the Lycaenidae and Satyridae are not classified, because Fernández-Yépez believed that more time and study were required to properly identify the specimens illustrated.

The original text of 1902 was hand written in beautiful classic script, providing a strong indication of the care and dedication he put into his scientific work. The calligraphy of the latter pages tends to be notoriously impaired, possibly due to his battle with tuberculosis and his interest in concluding the work rapidly. A sanitary seal printed in the original book is witness to his lost battle. Despite the fact that it represents an unfinished work and that it far from covers the entire butterfly fauna of Venezuela, it remains a valuable scientific and historic contribution to Venezuelan and neotropical entomology. It is a unique and rare documentation of the butterfly fauna of Caracas and neighboring areas of yesteryear, before strong demographic influences began to change the abundance and diversity of this group of colorful insects.

Mariposas de Venezuela, published in 1972 by Michael Schmidt, is primarily directed at amateur lepidopterists and provides but a poor description of the abundant and rich fauna of this country. Raymond's work is a much more professional representation, even though it was written much earlier. It covers both practical and theoretical lepidopterology, and contains an exceptional recount of the classic taxonomic methods of Linné, Dégeér, Scopoli, Fabricius, Latreille, Godart, and many other naturalists. Finally, Raymond describes the natural history of thirteen species of Papilionidae, demonstrating a good capacity for such detailed biological studies.

Undoubtedly, this book is a bibliographic curiosity, but it is also an important work that reflects both scientific and artistic facets of lepidopterology.

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Journal of the Lepidopterists' Society
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ATLAS OF THE JAPANESE BUTTERFLIES, edited by Toshio Inomata. Color photographs by Katsuji Iwao. 1986. Take Shobo Co. Ltd., 7-3, Iidabashi 2, Chiyoda, Tokyo, 102 Japan. 500 pp., numerous text figs., 86 color plates. Hard cover, 21.5 × 35 cm, no ISBN number, £440 (about $704.00).

This authoritative and beautiful work surely must be the ultimate regional butterfly book. The authors, editor, and publisher have combined the best features one could dream up, and even a few that you would likely never have envisioned yourself, in creating this masterpiece on the Japanese butterfly fauna. Under the editorship of Toshio Inomata, five authors have joined with Katsuji Iwao's photographic talents to produce this intellectual and visual feast.

The book opens with 86 outstanding color plates of greatly reduced adult figures illustrating all of the species, subspecies, and forms of the butterflies of Japan. What is extraordinarily innovative in this work is the lavish use of these color plates to illustrate the total known range of minute variations within each species. For example, variation in the first papilionid alone, *Leuhdorfia japonica*, is illustrated across three and a half plates, utilizing some 368 (!!) adult specimens of this single species. Male and female, dorsal and ventral surfaces, are illustrated for all species and subspecies. Lest one feel that these figures may be too small to depict all essential details, this reviewer may assure you that he has never seen finer studio photography and photographic reproduction of adult butterfly figures. All details can be seen accurately. Additionally, the publishers have reprinted each plate in a huge oversized poster print of approximately 51 × 71 cm, with the same immaculate care of reproduction shown in the original plates! These 86 poster-size plates come included with the case-bound volume of the book, and are placed in a special protective clothbound wooden case with its own lock and appropriate fasteners! To top all of this, an acrylic and aluminum frame is provided (stored inside this large plate case) to mount your "print of the month" on the wall of your office or living room to admire and enjoy! Perhaps the reader of this review is now beginning to realize why this book costs over $700 U.S.

The text of the *Atlas* is presented in four principal parts. Part I consists of a synonymic catalogue of the butterflies of Japan by Toshio Inomata and Yuji Itagaki. This excellent section of 72 pages is in English and includes all names that have been applied to genera, species, and subspecies. It also includes a line or two on the distribution of each species and subspecies throughout Japan and the rest of the world. From all indications, the coverage is complete and without any obvious errors.

Part II is a detailed discussion of the species of Japanese butterflies, authored by Toshio Inomata, Masumi Ikeda, Yasunori Kishida, and Yoshitaka Kanada. This section is almost entirely in Japanese; only the scientific names and authors' names and dates, along with plate and figure numbers, are given in English. The authors include synonyms and present a detailed discussion of distribution, including excellent distribution maps for all the islands of Japan.

Part III, by Toshio Inomata and Yuji Itagaki, consists of one of the most innovative features in any general work on butterflies: namely, a treatment of the type specimens of the Japanese butterflies and their institutional depositories, with monochromatic plates of the types and of aberrant forms. Besides illustrating both dorsal and ventral surfaces of 257 type specimens, with most specimens enlarged beyond life size, the authors provide an exhaustive table, mostly in English, listing the number of types, kind of types (holotype, syntype, lectotype, neotype), number of males and females, type locality, date of types, and location of types. This invaluable section will be of use to all museums and systematists working on Asian butterflies.

Part IV, entitled "Butterflies and International Code of Zoological Nomenclature," is in Japanese and is written by Toshio Inomata. It not only discusses the I.C.Z.N., but shows how our nomenclature has changed from the time of Linnaeus to today's detailed nomenclatural descriptions, construction of synonymies, and other useful tools of the modern systematist.

At the end of the book is a list of new names and other nomenclatural changes in the work. The new genus described here is *Sibatinozephyrus* Inomata, of which the type species is *Zephyrus fujisanus* Matsumura, 1910 (Lycaenidae: Theclinae). Its distribution is confined to Japan. Finally, an extensive section in Japanese presents locality data for the specimens in the 86 color plates. A complete index to Latin scientific names and to Japanese names is also included.

As treated in this book, the Japanese butterfly fauna includes 19 species of Papilionidae, 30 Pieridae, 77 Lycaenidae, 2 Libytheidae, 22 Danaidae, 63 Nymphalidae, 29 Satyridae, and 37 Hesperiidae. The rich Japanese fauna of 279 species of butterflies is therefore comparable to what occurs in large mountainous temperate-zone sections of western North America, such as the states of California or Colorado. The remarkable richness of the Lycaenidae and the Satyridae in Japan is especially notable. The *Atlas* authors and illustrators have made it possible for workers in the Palearctic and the Nearctic to learn much about their favorite groups by the study of this incredibly complete and magnificently wrought volume and its accompanying plates.

Even for the marvelous books on butterflies now being published around the world, this volume from Japan sets a new standard to which publishers may aspire. While the extremely high price puts the volume out of reach of most individual lepidopterists, the work definitely should be purchased by institutional libraries and museums around the world to make its uniquely complete coverage of the Japanese butterfly fauna generally available to researchers and students of Lepidoptera.

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Journal of the Lepidopterists' Society
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BUTTERFLIES OF LAOS, by Akira Motono and Noriko Negishi (supervised by Tadahiro Takakura). 1989. Kirihara Shoten, 2-44-5, Koenj-minami, Suginami-ku, Tokyo 166, Japan. 215 pp., numerous text figs., 6 color plates, 118 half-tone plates. Hard cover, in slip case, 20 × 27 cm. No ISBN number. $50.00 (seamail), $60.00 (airmail) from publisher.

In recent years, a number of books and other publications have appeared on the butterflies of various countries in Southeast Asia. Several good books are available on butterfly faunas of Taiwan, India, Malaysia, Thailand, and most recently Nepal. Additionally, Karal Spitzer and his colleagues in Czechoslovakia have been publishing notable papers on butterfly communities in southern Vietnam from 1983 to date. The accumulating data on faunistic composition and habitat preferences in the tropical habitats of these areas are providing important information on the evolution and ecology of tropical Lepidoptera, in particular pointing out the importance of contiguous undisturbed forest tracts for some species, and the role of fragments of forests (or natural clumps of trees and shrubs) as the main and constant sources of species diversity in some of the Southeast Asian biomes, including even open savanna (Spitzer, K., J. Leps & T. Soldan, 1987, Acta. Entomol. Bohemoskov. 84:200–207). Thus, besides providing richly illustrated catalogs of these highly diverse tropical butterfly faunas, these publications are beginning to play an important role in conservation biology.

Now Japanese lepidopterists once again have proven that their intensive field work throughout Southeast Asia in pursuit of Lepidoptera, combined with the outstanding quality of printing offered by a number of Japanese publishers, can produce superb references on Southeast Asian butterflies. This book by Motono and Negishi is the first significant work on Laotian butterflies, supplementing the substantial work already published on the butterfly faunas of adjacent Thailand and Vietnam. The *Butterflies of Laos* illustrates and describes very briefly 512 species, including color plates of some of the larger and more common butterflies of Laos. The text and monochrome plates include

44 species of Papilionidae, 39 Pieridae, 20 Danaidae, 123 Nymphalidae, 38 Satyridae, 9 Amathusiidae, 4 Libytheidae (this must be a record for the number of snout butterflies found in one fairly small geographic area!), 6 Riodinidae, 131 Lycaenidae, and 98 Hesperiidae. Of these, 62 are pictured in color (dorsal surfaces only), and all species are pictured in half-tone plates (usually the dorsal and ventral surface of the male of each species, or occasionally the female, but rarely both sexes). Each section of the text is printed in both English and Japanese.

The book begins with several pages of introduction to the history of collecting in Laos and discusses the geography, seasonality, and topography of that country. A complete list of the 512 species in the butterfly fauna covered in this book is then given, with an index to the illustrations. The species included are only those that are in the authors' collections and in those of their friends, so the list is admittedly incomplete. In the explanatory notes on each species that follow, the name, dates of capture, frequency of occurrence, and collection localities in Laos are given. Although extremely telegraphic in format, this procedure does allow a great deal of information to be conveyed in the space of relatively few pages. The half-tone illustrations are excellent and readily allow identification of virtually all the species of butterflies and many of the skippers figured. The color plates offer a selection of some of the more beautiful and unusual species found in the country. The book ends with an index to the genus, species, and subspecies names, a two-page list of references, and a brief biography of each of the two authors and the editorial supervisor of the project (all three are members of the Lepidopterological Society of Japan). The book is nicely produced with clear typography, 10 half-tone illustrations of various habitats in the country, and a map of Laos and adjoining areas.

The map shows that the Lao People's Democratic Republic occupies a key biogeographic position between Thailand and Cambodia (Kampuchea) on the south, Vietnam on the southeast and east, and China and Burma to the northeast and northwest, respectively. It is thus situated in the center of the Indo-Chinese Peninsula and extends over 1000 km between latitudes 14° and 22.5°N. The highest point in the country is 2800 m and these northern central highlands slope gently downward in central and southern Laos to the east and the west. The country has a marked alternation of wet and dry seasons, with the rainy season beginning in May and lasting until October. In March and April, before the start of the rainy season, the weather can be quite warm (22° to 39°C). In December, January, and February, the temperature drops to between 10° and 29° in southern Laos and far cooler in upper Laos. This book will help a visiting lepidopterist to plan the best time to visit the country for a maximum diversity of species, which seems to appear in March and April as the rains begin, although a great many species are also found from August through November.

In *Macrolepidoptera of the World* (1908–28), A. Seitz discussed only 30 species from Laos. Brief papers since that time, primarily by Japanese workers, have added some species to this list. This is the first comprehensive and systematic study of the butterfly fauna of Laos ever published, and, although Laos still remains relatively unexplored, is an important contribution to our understanding of the distribution and ecology of Southeast Asian butterflies. Obviously, many additional butterflies, probably including undescribed subspecies or even new species, await discovery in Laos as the country becomes more accessible to future research. This book will do much to stimulate further interest in the butterflies of the Indo-Chinese Peninsula and deserves a place in the library of every lepidopterist and institution interested in Old World tropical butterflies.

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OBITUARY

James Wilson Tilden (1904–1988)
A Remembrance

J. W. "Bill" Tilden passed away on 27 December 1988. He will be missed in many ways by all who knew him. Bill was a walking encyclopedia of entomological information. A simple question about insects from student or colleague would invariably bring an informed and detailed response replete with facts and figures. Arnold "Bud" Applegarth reported that his stock answer for students asking difficult questions was always, "Go down the hall and ask Dr. Tilden. He'll be able to tell you that." Bill's expertise was not confined to insects, however. He was also knowledgeable about other invertebrates, birds, plants, rocks and minerals, and vector control as well.

J. W. "Bill" Tilden, 1986 (photograph by Hazel Tilden).

Bill was possessed of an inquiring mind from an early age and his curiosity knew no bounds. His personal living "computer" was loaded with information on many subjects beyond biology. How broad the spectrum and how readily facts were recalled was impressed upon my wife Eileen and me during the final months of work on *A Field Guide to Western Butterflies*. During this period Bill drove down from San Jose to Watsonville almost every day and we put in long hours on the manuscript, legends, and plates. However, we did take time out to eat and butterflies were ignored for a time. Lunchtime conversation ranged far and wide. Among the favored topics were the big bands and their vocalists, early radio programs, classical music and opera, and movies of the 20's, 30's, and 40's. Early writers and their publications came in for discussion often. Because of the fruit we were eating for lunch, old, rare varieties of apples, pears, plums, and peaches were remembered. Bill had been a "fruit tramp" for several years starting

in the late 20's and I was now growing many of those old varieties remembered from childhood in Placer County.

Regardless of the subject that came up, Bill was able to reach back into the deep recesses of his memory and resurrect the basic facts about the specific subject under discussion. For a popular song of the 20's, 30's, or 40's he might recall such things as the band and vocalist responsible for its popularity, the year it was introduced or revived, the names of the members of the band and instrument each played, and in many cases the name of the hotel or nightclub where the group played regularly. Bill learned to play the slide trombone in the early 20's, joined the San Francisco Musician's Union in the late 20's, and during the 30's and 40's played professionally from time to time with jazz bands in the Monterey Bay area, the San Francisco Bay area, and at Lake Tahoe.

Rarely did a meal go by without Bill being reminded of a poem or a passage from a writer such as Burns, Kipling, Tennyson, Whittier, Shakespeare, or perhaps Robert W. Service. After a moment Bill would recite the passage word for word. As a result of this indulgence in nostalgia, Eileen and I began to keep what we called our "Ask Bill" list of questions on a pad near the phone. So we, along with his many friends, miss Bill in many ways.

Details concerning the Tilden family, Bill's early life, education, and professional career have appeared in the March/April 1989 issue of the *News of the Lepidopterists' Society* (Smith, A. C., 1989, No. 2, p. 38) and will not be repeated here.

Bill started collecting Lepidoptera seriously in Santa Cruz in 1927 through the influence of E. A. Dodge and J. P. Strohbeen. His first exchange of specimens took place with Hugh Gibbon of Miniota, Manitoba, Canada a few years later. When I started corresponding and exchanging with Bill in 1933 he sent me his "Exchange list of duplicates," which then consisted of 158 species of butterflies, 10 moths (saturniids and sphingids), many skippers, and many noctuids, geometrids and micros. At that time he was also corresponding and exchanging specimens with W. D. Field and V. F. Calkins in Kansas, A. E. Brower and L. P. Grey in Maine, O. E. Booth in Iowa, H. Glazbrook in Texas, and Lowell Hulbirt and Dale Bulgrin in California, among others. I first met Bill in the fall of 1933 when he was working in a cannery in San Leandro.

In 1933 Bill and his brother Tom went to work collecting insects of all orders in large numbers for L. M. McQuesten of the National Insect Company, Davis, California. Mr. McQuesten then made up a set of ten large Riker mounts to demonstrate the different orders of insects, which he sold to schools. Bill continued to supply insect specimens to McQuesten from time to time for several years.

Again in the summers of 1963 and 1964 Bill took on a professional collecting job for the newly established California State College (now University), Hayward. He signed a contract to provide a synoptic collection of mounted and identified San Francisco Bay Region insects, and large numbers of mounted and preserved (in alcohol) specimens in certain orders for classroom use, about 4000 specimens altogether. For the most part, though, Bill collected butterflies, moths, and beetles for his own research and enjoyment and to discover and publish new information about their distribution, life history, ecology, habits, and habitats.

Bill had planned to go to the University of California in Berkeley when he graduated from high school in 1922 but that did not work out. Nevertheless he continued to hope that it would be possible to continue his education. Over the years several older friends, including Charles Bowles, M. Soutar, and Dr. Holman suggested repeatedly that he should get a college education. In the spring of 1938 Bill stopped by our apartment in San Jose. During the visit he asked us what we (I am not using the editorial plural, but the twin "we," as all events prior to 1944 included my twin brother, Edgar A. Smith) thought of San Jose State and especially its entomology courses. Needless to say, we praised everything about it highly, especially the teacher, Dr. Carl D. Duncan. We went on to tell him that the Pacific Coast Entomological Society was having its annual field trip meeting at Alum Rock Park, hosted by San Jose State's Comstock Entomology Club on the following Saturday—9 April 1938. We invited him to come and meet Carl Duncan. Bill came, we introduced him, and he and "Dunc" spent a good part of the afternoon getting acquainted. They took to each other at once. Bill was favorably impressed and soon made his decision

Spring collecting trip to Patagonia Mountains, Arizona, 1939. From left to right: Ed Smith. J. W. "Bill" Tilden, Darrel Welch, and Art Smith, standing in front of the 1937 Chevrolet that was flooded while crossing the Sonoita River (photograph by Art and Ed Smith).

to attend San Jose State. We invited Bill to share our apartment and he moved in with us for his freshman year and our senior year.

In the late 20's, the 30's, and early 40's, Bill managed to collect throughout most parts of California. By the late 30's he was also collecting in the adjacent states. As a matter of fact, one collecting expedition to Arizona during spring vacation in 1939 came very close to ending the careers of Bill Tilden as well as Art and Ed Smith and Darrel Welch, a volunteer assistant. We had had excellent weather and very good collecting in Sabino Canyon, Madera Canyon, and in the Nogales area. We then headed up a dirt road from Sonoita that wound up into the Patagonia Mountains along the Sonoita River. It was warm and sunny when we started and the stream we crossed and recrossed was only a few inches deep. As we proceeded higher into the mountains the sun disappeared, we saw a huge black cloud ahead to the south, and the stream crossings seemed to be a few inches deeper. Thunder and lightning accompanied by light rain then began. We came to a very broad crossing, but were cautious enough to stop, wade out and check the water depth. It only seemed deep enough to reach the running board at that time so we proceeded slowly in low gear. About midstream we could see the water rising rapidly on all sides. Suddenly the engine drowned out and we sputtered to a halt. We quickly put Darrel (the lightest person) behind the wheel with instructions to keep it in low gear and keep pressing the starter (in those days you pressed it with your foot). The remaining three of us had jumped out and were frantically pushing as hard as we could. By then the water was above our knees and a few moments later a crest brought it above our hips. With the combination of pushing and aid from the starter we finally made it to the other side just before the highest crest of the flash flood arrived. A few minutes later and we certainly would have been swept away and washed down the canyon. An hour later the sun was out and drying our belongings, which were spread all over the landscape. A ring of mud on the inside of the car right up to the lower edge of the windows showed how deep the water had been and how fortunate we had been!

Bill soon began to collect throughout the country and, in fact, everywhere he traveled. After signing the contract for the Peterson field guide to western butterflies, Bill began a program of extensive trips to visit the areas covered by the book—from the middle of Kansas to Hawaii, and from the Mexican border to Alaska and western Canada. During the period from 1969 to 1986 Bill, alone or with Hazel and sometimes Bruce as well,

traveled more than 210,000 miles in their van on collecting and field survey expeditions. This included three trips to Alaska, and numerous trips to the states along the Mexican border, the northwest, the Rocky Mountains, and the prairie states. He visited every state and province in the area designated at least once and most of them many times.

During the 60's and 70's Bill collected many interesting butterflies in the Lower Rio Grande Valley of Texas. Among them were a number that represented new United States records for Mexican species. A representative collection of all those taken at the Santa Ana National Wildlife Refuge, Hildago County, Texas was deposited with the Refuge and has now been added to the National Museum of Natural History collection in Washington, D.C.

After Bill's heart surgery in 1971, I visited him at Stanford Hospital. He looked up at me from his hospital bed and said, "Well, Art, I guess I'll never collect another butterfly." And he didn't for some time. Then one day, parked by the roadside, Bill saw something "choice" (as he would say) fly across the road. He grabbed a net and said to Hazel, "If I can't go after that butterfly, life just isn't worth living." And off he went. He continued to collect until his legs failed to cooperate in 1986.

The J. W. Tilden Lepidoptera Collection was left to the California Academy of Sciences in San Francisco. Actually, Bill had been transferring portions of his collection to the Academy since 1946. The total number of Lepidoptera donated to the Academy to date is 43,547. The collection is very strong in North American butterflies, with Bill's favorite families, the Hesperiidae and the Lycaenidae, especially well represented. In the moths, the Saturniidae, Sphingidae, Arctiidae, and Noctuidae (especially the underwings) are most numerous. Many exotics from Southeast Asia, Europe, Japan, and Latin America are also included. Unmounted butterflies and moths in papers, numbering between five and six thousand specimens will also be turned over to the Academy. Insects of other orders and miscellaneous other terrestrial arthropods add another 1648 specimens to the collection.

The Tilden collection includes 95 paratypes in the families Papilionidae, Nymphalidae, Satyridae, Hesperiidae, Pieridae, and Lycaenidae. One is Mexican, five Canadian, and the remainder are from the United States.

The specimens (representing over 500 species) used to make the photographic illustrations for the plates in the Houghton Mifflin book, *A Field Guide to Western Butterflies* by J. W. Tilden and Arthur C. Smith, are being kept in a separate collection. Plate specimens from the Smith Collection, including the rare (only 10 others known) hybrid between the West Coast Lady and the Red Admiral, will go to the Academy at a later date.

The J. W. Tilden Coleoptera Collection of some 8000 specimens is now on permanent loan to the California Academy of Sciences and title will be transferred to the Academy at a future time. Approximately the same number of beetles had been presented by Bill to the Academy in earlier years, starting in 1946.

Bill was active in many organizations, environmental and historical, as well as biological in nature. In addition to The Lepidopterists' Society (Charter Member, 1947; President, 1978) he belonged to the Pacific Coast Entomological Society (Life Member, 1943; President, 1960), California Academy of Sciences (Elected Life Fellow, 1968), Entomological Society of America, Coleopterists' Society, Xerces Society, California Native Plant Society, Santa Cruz Bird Club (Honorary Member), Santa Clara Valley Audubon Society, Point Reyes Bird Observatory, Santa Cruz Museum Association, Sierra Club, Bohart Museum Association, Coyote Creek Riparian Station, San Jose Historical Museum Association, California Pioneers of Santa Clara County, Santa Cruz County Historical Trust, National Trust for Historical Preservation, Sigma Xi, and the Explorer's Club, as well as others.

NEW TAXA DESCRIBED BY JAMES WILSON TILDEN

Lepidoptera–Lycaenidae

1. Schellbach's Copper. *Tharsalea arota schellbachi* Tilden. 1955. TL: North Rim, Grand Canyon, Arizona.
2. Lembert's Hairstreak. *Callophrys lemberti* Tilden. 1963. TL: W. above Tioga Pass, Yosemite National Park, California.

3. Mansfield's Hairstreak. *Mitoura siva mansfieldi* Tilden. 1951. TL: Seven miles west of Simmler, San Luis Obispo Co., California.
4. Pallid Blue. *Euphilotes rita pallescens* (Tilden & Downey). 1955. TL: Little Granite Mtns., Dugway Proving Grounds, Tooele Co., Utah.
5. Boharts' Blue. *Philotiella speciosa bohartorum* (Tilden). 1968. TL: Briceberg, Mariposa Co., California.
6. Behr's Blue. *Glaucopsyche lygdamus incognita* Tilden. 1974. TL: Alum Rock Park, Santa Clara Co., California.

TAXA NAMED IN HONOR OF JAMES WILSON TILDEN

Lepidoptera–Nymphalidae

1. *Basilarchia tildeni* Field. 1934. TL: Vic. Lawrence, Kansas. [Now a synonym of *arthemis astyanax* (Fabricius)].

Lepidoptera–Hesperiidae

2. *Hesperia comma tildeni* Freeman. 1956. TL: Cherry Flat Reservoir, Santa Clara County, California.

Lepidoptera–Lycaenidae

3. *Euphilotes enoptes tildeni* (Langston). 1964. TL: Del Puerto Canyon, 22 mi. W. Patterson, Stanislaus County, California.

Coleoptera–Cerambycidae

4. *Tanyochraethes tildeni* Chemsak & Linsley. 1965. TL: Welder Wildlife Refuge, San Patricio County, Texas.

Lepidoptera–Gelechiidae

5. New Genus, *Tildenia* Povolny. 1967. Type Species—*Tildenia glochinella* (Zell. 1873).

Hymenoptera–Andrenidae

6. *Andrena tildeni* Ribble, 1974. TL: Soboda Hot Springs, Riverside County, California.

Lepidoptera–Gracillariidae

7. *Cameraria tildeni* Opler & Davis. 1981. TL: Kings Mountain, San Mateo County, California.

Additional new insect taxa associated with the name of J. W. Tilden will continue to appear in the literature for a time as work in progress is completed. These names will include patronyms and taxa carrying the name Tilden as co-author.

PRESENTATIONS BY J. W. TILDEN AT MEETINGS OF THE PACIFIC COAST ENTOMOLOGICAL SOCIETY: SUMMARIZED IN THE PROCEEDINGS, AND PUBLISHED IN THE PAN-PACIFIC ENTOMOLOGIST

1. 1942. Tilden, J. W. and E. G. Linsley. Range Extensions in *Pleocoma*. 18:39.
2. 1949. The Insect Fauna of *Baccharis pilularis*. 25:42. (Formal address.)
3. 1954. *Philotes rita* associated with *Eriogonum wrightii*. 30:84.
4. 1959. Alpine Butterfly Associations at Tioga Pass, Yosemite National Park. 35:56. (Formal address.)
5. 1964. Stylopized Wasp. 40:61.
6. 1967. Food Plant of *Vanessa tameamea*. 43:91 .
7. 1967. The Kauai Green Sphinx Moth, *Tinostoma smaragditis*. 43:91.

SCIENTIFIC PAPERS, NOTES, AND BOOKS BY JAMES WILSON TILDEN

1940

1. Preliminary List of the Butterflies and Skippers of Santa Clara and Santa Cruz Counties, California (mimeographed). Natural Science Department, San Jose State College, San Jose, California.

1941

2. Collectors' Calendar for Santa Clara and Santa Cruz Counties, California, and Preliminary List of the Butterflies and Skippers of Santa Clara and Santa Cruz Counties. Entomologists' Exchange News 6(4):1–6.
3. Tilden, J. W. and G. S. Mansfield. Some Observations and Captures of California Lepidoptera. Pan-Pacific Entomologist XVII (3):113–114.

1942

4. *Erynnis lacustra* (Wright) from Near The Type Locality (Lepidoptera, Hesperiidae). Pan-Pacific Entomologist XVIII(1):8.
5. Tilden, J. W. and G. S. Mansfield. A Capture of *Lerodea eufala* Edwards at Light (Lepidoptera, Hesperiidae). Pan-Pacific Entomologist XVIII (1):26.
5. An Unusual Record for *Ochlodes yuma* (Edwards) (Lepidoptera, Hesperiidae). Pan-Pacific Entomologist XVIII(1):29.

1944

6. Tilden, J. W. and G. S. Mansfield. Notes on Three Species of *Coenonycha* Horn (Coleoptera, Scarabaeidae). Pan-Pacific Entomologist XX(3):115–117.
7. Breeding of *Phoebis sennae marcellina* Cram. in San Jose, California (Lepidoptera, Pieridae). Pan-Pacific Entomologist XX(3):115-117.

1945

8. Notes on Redwood Cerambycidae (Coleoptera). Pan-Pacific Entomologist XXI(1): 30–31.
9. Notes on Some Moths of the Family Saturniidae (Lepidoptera). Pan-Pacific Entomologist XXI(1):32–33.

1946

10. An Occurrence of *Schizopus* in Monterey County, California (Coleoptera, Buprestidae). Pan-Pacific Entomologist XXII(2):60.

1947

11. Mansfield, G. S. and J. S. Tilden. An Additional Locality for *Aulicus terrestris* (Coleoptera, Cleridae). Pan-Pacific Entomologist XXIII(1):34
12. An Occurrence of the Pupa of *Glaucopsyche lygdamus behrii* (Edwards) in an Ant Nest (Lepidoptera, Lycaenidae). Pan-Pacific Entomologist XXIII(1):42–43.

1948

13. Aestivation in Larvae of *Arachnis picta picta* Packard (Lepidoptera, Arctiidae). Pan-Pacific Entomologist XXIV(1):31.
14. The Insect Community on *Baccharis pilularis* De Candolle. Doctoral Dissertation, Stanford University. 408 pages. Copies at Stanford University and in Tilden Library.

1949

15. Notes on Parasites of Certain Microlepidoptera (Gracilariidae). Pan-Pacific Entomologist XXV(1):27–28.

16. A Note on *Caicella mysie* (Dyar) (Lepidoptera, Hesperiidae) with a figure of the Male Genitalia. Bulletin of the Southern California Academy of Sciences XLV111 (1):4–6.
17. Note on *Tragidion armatum* (Lee) (Coleoptera, Cerambycidae). Pan-Pacific Entomologist XXV(1):37.
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19. Oviposition of *Cryptocephalus confluens* Say (Coleoptera, Chrysomelidae). Entomological News LX:151–154.
20. Oviposition and Hatching of *Pselliopus spinicollis* Champion (Hemiptera, Reduviidae). Pan-Pacific Entomologist XXV(4):190–192.

1950

21. Microlepidoptera Associated with *Baccharis pilularis*. 1. Pterophoridae. The Wasmann Journal of Biology 8(1):81–88.
22. Biological Notes on *Corythuca morilli* O. & D. (Hemiptera, Tingidae). Entomological News LXI:135–137.
23. Notes on *Oxygrillus ruginasus* (Lec.) (Coleoptera, Scarabaeidae) and *Xylotrechus undulatus* (Say) (Coleoptera, Cerambycidae). Pan-Pacific Entomologist XXVI:37, 46.
24. Oviposition and Behavior of *Liriomyza pusilla* (Meigen) (Diptera, Agromyzidae). Pan-Pacific Entomologist XXVI(3):119–121.
25. Notes on the Habits of *Phylobaenus scabra* (Le Conte) (Cleridae). The Coleopterists' Bulletin IV(2):17–19.
26. The Feeding of *Podabrus pruinosus* Le Conte (Cantharidae). The Coleopterists' Bulletin IV(6):92.

1951

27. Notes on *Chrysobothris bacchari* Van Dyke (Buprestidae). The Coleopterists' Bulletin V(1):1–3.
28. Observations on *Rhopalomyia californica* Felt (Diptera, Itonididae). Pan-Pacific Entomologist XXVII(1):20–22.
29. The Insect Associates of *Baccharis pilularis* De Candolle. Microentomology 16(1): 149–188.
30. Microlepidoptera Associated with *Baccharis pilularis*. II. Tortricidae, Phaloniidae, Gelechiidae. The Wasmann Journal of Biology 9(2):239–254.
31. Biological Notes on Two Species of Chrysopidae (Neuroptera). Entomological News LXII:224–226.
32. On the Distribution of *Heliopetes domicella* (Erichson) (Lepidoptera Hesperiidae). The Lepidopterists' News V(6–7):70.
33. A New Subspecies of *Mitoura siva* Edwards (Lepidoptera, Lycaenidae). Bulletin of the Southern California Academy of Sciences 50(2):96–98.
34. A Note on the Manner of Feeding of *Agulla adnixa* Hagen (Raphidiodea, Raphidiidae). Pan-Pacific Entomologist XXVII(4):192.
35. Concerning the Identity of *Mitoura nelsoni muiri* (Lepidoptera, Lycaenidae). The Lepidopterists' News 6(6–8):95–96.

1952

36. Range Extension of *Pholisora libya* Scudder (Lepidoptera, Hesperiidae). Pan-Pacific Entomologist XXVIII(2):92.
37. Observations on the Habits of Certain Syrphids (Diptera). Entomological News LXIII:39–43.

1953

38. Observations on the Biology of *Psoa maculata* Le Conte (Psoidae). The Coleopterists' Bulletin VII(2):9–12.

39. Biological Notes on *Trirhabda flavolimbata* (Chrysomelidae). The Coleopterists' Bulletin VII(3):20–23.

1954

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41. Microlepidoptera Associated with *Baccharis pilularis*. III. Aegeriidae, Coleophoridae. The Wasmann Journal of Biology 12(1):43–52.
42. New Santa Clara County Mosquito Records. California Vector Views 1(5):3.

1955

43. Interspecific Cannibalism in *Brennus* Mots. (Coleoptera, Carabidae). The Coleopterists' Bulletin IX(1):10.
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45. A Revision of *Tharsalea* (S.Str.), with Description of a new Subspecies (Lepidoptera, Lycaenidae). Bulletin of the Southern California Academy of Sciences 54(2):67–77.
46. Tilden, J. W. and J. St. Germaine. Flies of Public Health Interest in Santa Clara County. 1. Chicken Manure. California Vector Views 2(3):12.
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1956

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1957

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52. Taxonomic History and Distribution of *Ochlodes yuma* (Hesperiidae). The Lepidopterists' News 11(4–5):151–152.
53. *Carterocephalus palaemon* in California (Hesperiidae). The Lepidopterists' News 11(1–3):43.
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1958

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59. The Butterfly Associations of Tioga Pass. The Wasmann Journal of Biology 17(2): 249–271.
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1960

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1961

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1962

66. General Characteristics of the Movements of *Vanessa cardui* (L.) (Nymphalidae). Journal of Research on the Lepidoptera 1(1):43–49.
67. Additional Records of *Satyrium behrii* (Lycaenidae) from Oregon. Journal of the Lepidopterists' Society 16(3):199–200.

1963

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1965

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1967

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78. Obituary—Carl Dudley Duncan. Pan-Pacific Entomologist 43(2):97–99.

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FEATURE PHOTOGRAPHS

Journal of the Lepidopterists' Society
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BUTTERFLY PHOTOGRAPHY IN THE TROPICS

Butterfly photography in tropical habitats is usually a much greater challenge than photographing butterflies in temperate North America. Here, I briefly explain some of the techniques I have developed in the tropics, and recount some personal experiences that emphasize the points I wish to make.

Since 1973, when I first became interested in photographing butterflies, I have visited several tropical countries, including Malaysia, East Africa, Mexico, Costa Rica, Venezuela, and Brazil (twice). The examples in this article are from my most recent trip to Brazil, in November 1989, led by Thomas C. Emmel for Holbrook Travel of Gainesville, Florida.

Equipment and Techniques

In the tropics, I use the same basic equipment that I use to photograph butterflies in North America (Opler, P. A. & G. O. Krizek, 1984, Butterflies east of the Great Plains: An illustrated natural history, Johns Hopkins Univ. Press, 294 pp.): a 35 mm single lens reflex camera with a 200-mm macro lens and a flash unit mounted directly to the hot shoe connection on the camera body. I shoot Ektachrome film (Eastman Kodak Company, Rochester, NY 14650) for color transparencies (ASA 200) with the camera's shutter speed set at $\frac{1}{250}$th of a second and the lens set to a small aperture (=high f-stop). The combination of flash and small aperture produces well-lit close-up photographs with acceptable depth of field. Batteries in the flash unit should be changed about every third roll, and sweat should be wiped off camera equipment each evening to insure proper operation.

I recommend that the photographer work at a given tropical locality for a number of days in a row. In that way familiarity with the community of butterflies can be gained and the photographer can work on photographing particular species. On a two-week trip I can usually count on obtaining good to very good photographs of 50–70 butterfly species.

Ideally, I try to take many photographs of the same butterfly using several lens aperture settings. On my camera these are f32, f22, and f16. Such a range of exposures gives me the best chance of having at least one properly exposed and correctly focused photograph. I try to collect the subjects photographed so that I can identify them after my return home. Often, however, I am able to take only one exposure and am unable to capture the butterfly before it flies away. Even more discouraging is the fact that several times on each trip I see the photo of a lifetime take off into the forest before I am able to take a single exposure. On my last trip this happened when a freshly emerged *Pierella* (Satyrinae) with iridescent blue upper hindwings perched in front of me and then took off one second before I could press the shutter release.

Of course, sometimes my luck is good. Once, as I followed a patrolling *Haetera piera* (Satyrinae), it disappeared around a tree trunk, and when I came around the tree I discovered a mated pair, with male and female leaning in different directions (Fig. 1).

Butterfly Behavior

In many tropical habitats, butterfly behavior is sufficiently different to cause problems for the photographer. One of the standbys of the temperate zone photographer—butterflies visiting low flowers—is usually not available. Instead, tropical butterflies must be photographed while perching, while mating, or while feeding on rotting fruit, animal dung, or bird droppings. Many butterflies perch too high in trees to be photographed or perch on the underside of leaves. Furthermore, tropical forests are filled with would-be predaceous birds, large ants, anoles, and large insects. As a result, most tropical butterflies are very nervous and are apt to land only for a second or two.

Attractive nymphalids usually perch with their wings closed and open them only periodically, and then only for a brief moment. The photographer must be aware of this and must wait patiently with the camera in hand ready to take an exposure. In this way

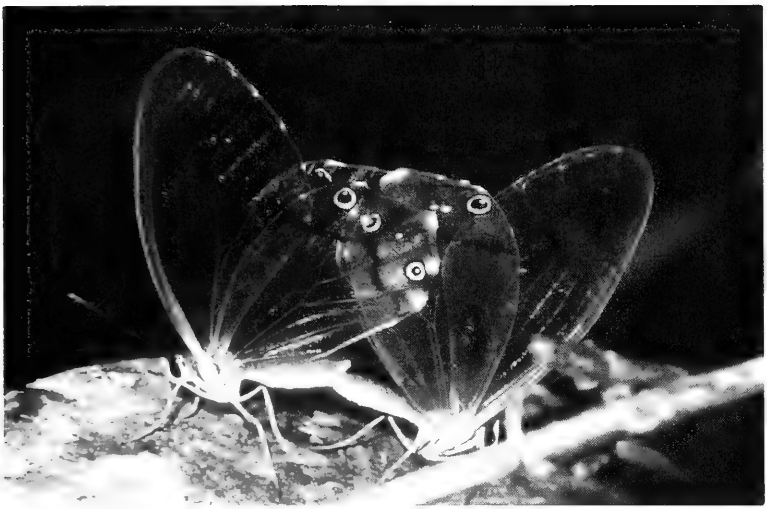

FIG. 1. *Haetera piera* L. (Satyrinae), pair *in copula*. Brazil: Rondonia, 60 km S of Ariquemes; 9 November 1989.

I have been able to photograph the iridescent blue upper wing surfaces of morphos (*Morpho helenor/achilles*) and preponas (*Prepona demophon*) (Nymphalidae) (Plate 1). The use of baits is a good way to attract these butterflies to a convenient area for photography. The best baits are feces, rotting meat, or rotting fruit. African collectors have told me that excrement from big cats such as leopards is the best bait for *Charaxes* spp. (Charaxinae). I often use human excrement or rotting fruits such as mangos or

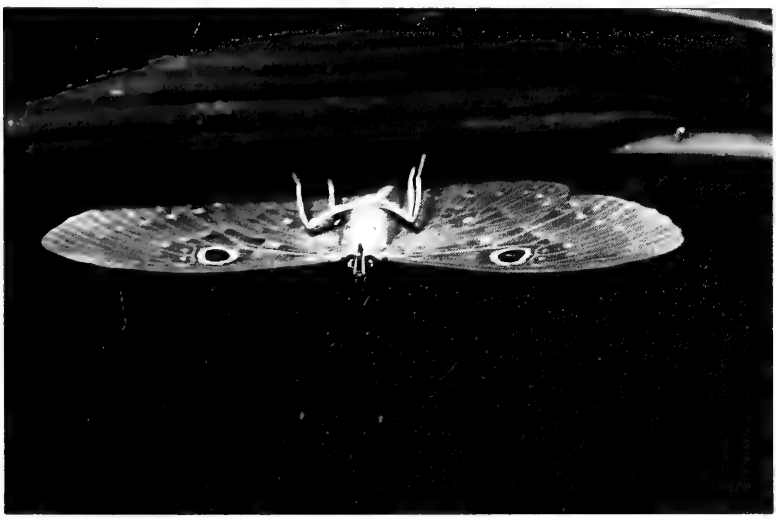

FIG. 2. *Eurybia lycisca* (Ww) (Riodinidae). Costa Rica: Cartago Province, Turrialba; 15 May 1985.

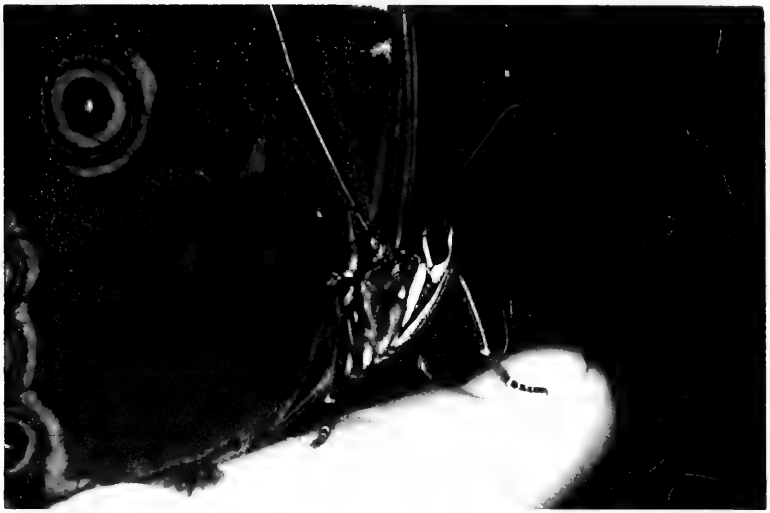

FIG. 3. *Morpho helenor/achilles* (Morphinae), rare behavior by an otherwise shy species, exploring the author's left index finger with its proboscis. Brazil: Rondonia, 60 km S of Ariquemes; 10 November 1989.

FIG. 4. *Batesia hypochlora* Felder (Nymphalinae), perching on the author's left calf. Brazil: Rondonia, 60 km S of Ariquemes; 11 November 1989.

→

PLATE 1. Above: *Prepona demophon* L. (Nymphalinae), feeding at rotting banana. Brazil: Rondonia, 60 km S of Ariquemes; 3 November 1989. Below: *Temenis pulchra* Hewitson (Nymphalinae), upperside of basking male. Brazil: Rondonia, 60 km S of Ariquemes; 11 November 1989.

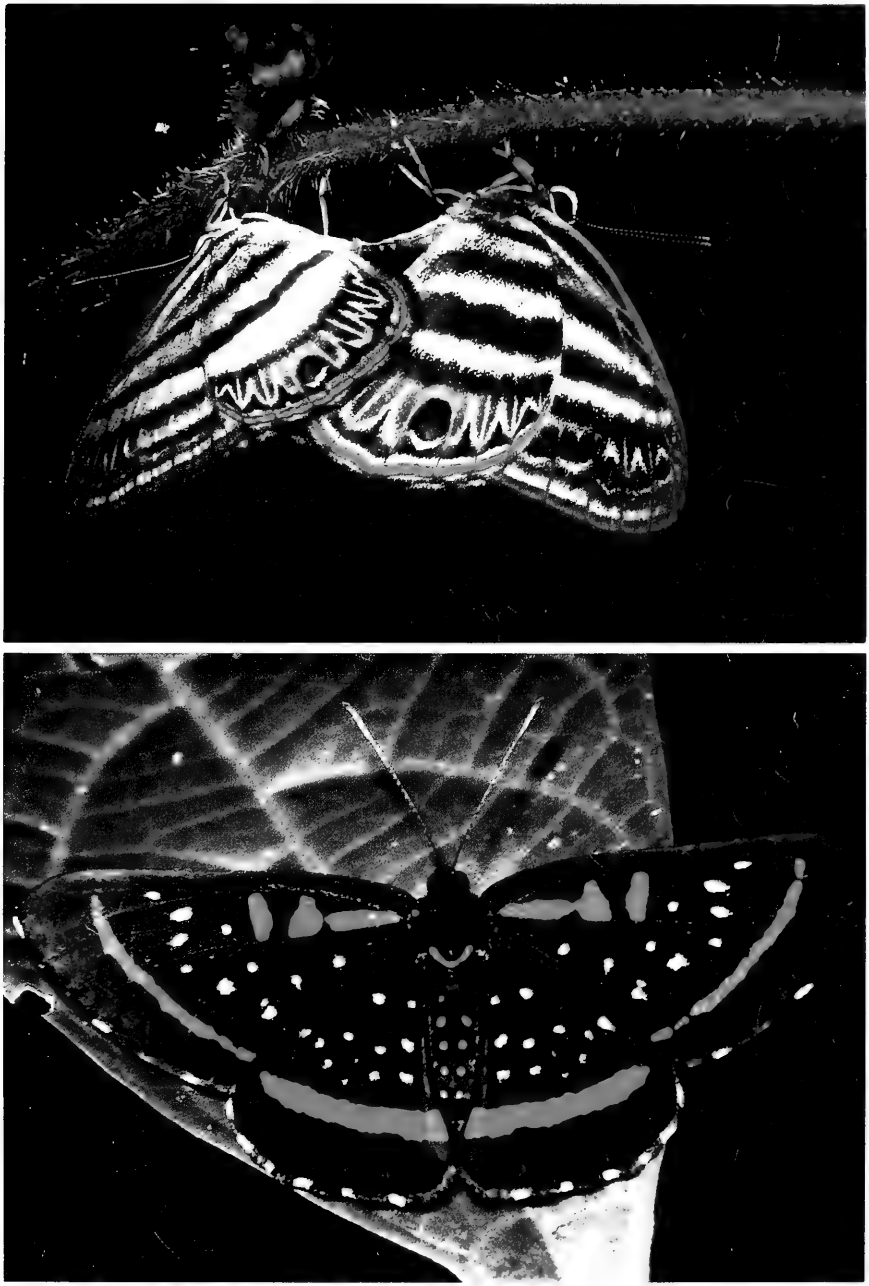

PLATE 2. Above: *Euselasia* (*eutychus* species group) (Riodinidae), pair *in copula*. Brazil: Rondonia, 60 km S of Ariquemes; 9 November 1989. Below: *Amarynthis meneria* Cramer (Riodinidae). Brazil: Rondonia, 60 km S of Ariquemes; 5 November 1989.

bananas to make several bait stations on the ground and periodically visit them in sequence to see what has arrived.

To photograph metalmarks or skippers perched beneath leaves, I must lie on my back and inch slowly under the plant. Of course, just as I am in the perfect position and ready to "capture" my quarry on film, it may flit off to another leaf. Once, in Costa Rica, I repeated my back inching approach to a perched *Eurybia lycisca* (Riodinidae) ten times before I was able to focus in and with trembling hands takes several photographs (Fig. 2).

Nymphalids may land on sweat-drenched clothing or arms instead of the intended bait, and, rather than just shoo them away, I try to photograph them. This can be especially difficult because they are so close that the minimum lens to subject distance is just barely possible, and because I have to hold the lens, camera, and flash in one hand while the butterfly perches on the other (Fig. 3). Sometimes a butterfly may perch on my pants in a position awkward for photography (Fig. 4). Despite occasional difficulties and discomfort resulting from biting insects, high heat and humidity, fogged lenses, and occasional dehydration, patience and persistence will be rewarded with crisp, close-up photographs of some remarkable butterflies (Plates 1 & 2).

In summary, photographing butterflies in the tropics can be more rewarding than just trying to capture and kill each butterfly as quickly as you discover it. In the course of my photography I have learned much about the behavior of tropical butterflies. It is a pleasure to share this knowledge through my photographs.

All photographs were taken with a Nikon FA camera, fitted with a Micro-NIKKOR 200mm 1:4 lens, and, when appropriate, Nikon extension rings PN-11 and PK-13. A Nikon SB-15 electronic flash, attached to the hot shoe on the camera, was used in conjunction with Ektachrome 200 slide film. The Nikon FA camera has a TTL (through the lens) metering system that automatically admits the necessary amount of light from the Nikon SB-15 flash in TTL mode. Exposures were taken at $\frac{1}{250}$ sec at apertures from f16–f32.

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MANUSCRIPT REVIEWERS, 1989

The merit of a scientific journal depends on the quality of its reviewers as well as of its authors, but the former are usually unknown to readers. The *Journal* relied on the expertise of 61 reviewers last year to provide 87 evaluations of manuscripts. It is with much gratitude that the *Journal* acknowledges the services of the people listed below from whom manuscript reviews were received in 1989.

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