LEPIDOPTERA NEWS

September 2000 **No. 3**

MONARCH WATCH 2000

Monarch Experts Call Monarch Situation in Mexico Critical

by Kurt Johnson

Fig. 1. Dr. Lincoln P. Brower, featured speaker, and one of the discoverers of the monarch's Mexican overwintering grounds and co-author of the new study showing habitat degradation in the Mexican monarch reserves, speaking at the Monarch Watch 2000 event in New York City.

In a double barreled admonition concerning threatened overwintering grounds of the Monarch Butterfly in Mexico, the *New York Times* published urgent new warnings by Dr. Lincoln Brower and other conservationists (September 12, Science Times section, p. 1) and, ten days later, New York City Parks officials hosted Monarch experts and conservationists from around the world echoing this announcement and recommending an effective response. The event on September 23, 2000, was called "Monarch Watch 2000 in Central Park" (URL's for the event and supportive organizations are posted below; see p. 10).

Speeches and written statements by Drs. Lincoln Brower, Orley Taylor, Paul Opler, and Robert Michael Pyle, along with officials of the Mexican government and conservationists from the World Wildlife Fund, declared Monarch conservation in Mexico in a "now or never" crisis. Supporting this message of urgency were representatives of other conservation groups, including the Michoácan Reforestation Fund and Monarch Butterfly Sanctuary Foundation (both working on-site in Mexico), and the Audubon Society, Sierra Club, Linnaean Society, the Metropolitan Biodiversity Center of the American Museum of Natural History, American Ethical Union, and the New York Butterfly Club.

News and film coverage, sparked by Mastervision (an educational video company which also provided funding support for the event), attracted reporters and camera teams from the television networks ABC and CBS, the *New York Times* and *Newsday* newspapers, as well as media representing Mexico. Parks Commissioner Henry Stem presented the event to the audience and media, while Alexander Brash, head of New York Urban Park Rangers, introduced Dr. Brower, noting he had first been inspired by him years ago while still a young student.

Before the speeches, lively cultural entertainment was supplied by the Consulate of Mexico, while Dr. Taylor's Monarch Watch program and New York Urban Park Rangers helped New Yorkers tag and release monarchs for their fall flight south. However, the colorful festivities were soon overshadowed by the extent of crisis emphasized by the speakers.

MONARCH CRISIS

Speeches by Drs. Brower and Taylor, Monica Missrie of the World Wildlife Fund in Mexico, and Mr. Jorge Pinto, Mexico's Consul General in New York, emphasized that monarch overwintering grounds are in a crisis situation. Reviewed were results of the first scientific study tracing the deterioration of the overwintering grounds since its establishment as a reserve in 1986. Portrayed clearly by maps, statistics, and biological information was a near 45% decline in the fir forests within the reserve region in east central Mexico (Fig. 2), in the state of Michoácan. Brower and the others noted that, given this startling decline, without an urgent and immediate conservation agenda, the Mexican monarch population may go into a sudden irreversible decline leading to their extinction, perhaps within a decade and certainly within our lifetimes.

The experts said that, although the current rate of deterioration indicated current roosting areas would, by demographic standards, be critically degraded by the year 2050, a more frightening possibility was that continued tree thinning, combined with the complex niche requirements of the overwintering monarchs themselves, might make successful mass roosting by the species in Mexico impossible much sooner, perhaps within a decade. "From what I've seen there year after year, I predicted it would be bad and getting worse," said Dr. [cont. on p. 7]

LEPIDOPTERA NEWS

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NEW MEMBERS: the ATL journals are $65 the first year for new members, the same as ATL members who pay before Dec. 31 each year. New members may join ATL anytime but membership begins in January (either the year of joining or for the next year).

TO OUR READERS

This issue has both a warning of conservation needs for the most famous butterfly in the world, the monarch, and possible solutions, as outlined in the Monarch 2000 event noted herein.

We also have several letters, but most have been sent in by myself; hopefully, more members will have comments to send in for future issues.

With 2001 coming up, we expect to issue our journals this winter so the 2000 issues get published, and be back on schedule later in the year. There are a number of articles awaiting publication in the journals, plus a supplement on some North American Gelechiidae and on butterflies from the Solomon Islands, among others.

Keep sending in your news and notices for future issues of the *News*, as well as more technical articles that can be published herein without page charges.

J. B. HEPPNER
Executive Director

NOTES

1. **2001 Annual Meeting**: April 20-22 in Gainesville.
2. **2001 Annual Photo Contest**: deadline is March 15, 2001. Note that the prize awards include a Grand Prize winner (award may be cash or a book).
3. **Cover Photos**: members can note that color photos for journal covers are always sought. ATL does not pay photo fees, but you do have the gratification of having your photo selected for one of the front or back covers. Photos should be exceptionally sharp and in our page proportion.
4. **ATL Debentures**: a number of ATL members have already taken advantage of our interest rates and invested in ATL debentures. Please let us know what you can do to help! Returns of principal (at end of period) and interest (paid annually) are guaranteed.
5. **ATL Home Page**: see it at http://www.troplep.org. Coming soon (hopefully): color photo files of worldwide butterflies and moths!
6. **2000 Journals**: the 2000 issues are in preparation and probably will be issued together as a group, or close together.
7. **ATL Photo Archives**: Do not forget to consider ATL as the ultimate depository for your valued color slides of moths and butterflies and larvae. Do not let your investment of time and effort go to relatives who may not appreciate photographs of Lepidoptera; donate them to the ATL Photo Archives. You are also welcome to send listings of your holdings to add to the ATL Photofile database: let others know what species you have recorded on film. You may have unique life history photos never seen before.
8. **Life memberships**: the Directors voted to increase life member dues, so since June 1, 2000, the ATL life membership will cost $2,000 (or $400 per year for 5 years).
9. **Membership List**: the new membership list is being compiled and should be out this year as an isue of the *News* (if it takes too long to complete, then in early 2001).

PUBLICATION DATES: 1999 ATL Publications

LEPIDOPTERA NEWS

Mar.	1999	No. 1	11 Mar 99
June	1999	No. 2	19 Aug 99
Sept.	1999	No. 3	13 Dec 99
Dec.	1999	No. 4	7 Feb 00

HOLARCTIC LEPIDOPTERA

Mar.	1999	Vol. 6, No. 1	3 Dec 99
Sept.	1999	Vol. 6, No. 2	29 Sep 00

TROPICAL LEPIDOPTERA

Suppl. 1		Vol. 10, S-1	2 Dec 99
June	1999	Vol. 10, No. 1	30 Dec 99
Nov.	1999	Vol. 10, No. 2	22 Nov 00

LETTERS

A WORLD *FOR* BUTTERFLIES

While I do appreciate the book review for my book that appeared in *Tropical Lepidoptera* (2000. 10(2):84), by Dr. Thomas C. Emmel, I would like to point out that the title of the book is "*A World for Butterflies*," not "A World of Butterflies." As Dr. Emmel says in the review, "the heart of the author's theme" is the ultimate chapter, "A World for Butterflies?," and that is why it was used as the title of the book (and not the third chapter title!).

I admit that the intentional play on the words "world" and "butterfly" for the chapter titles might confuse the issue for anyone that is not paying attention — after all, my publisher confused the issue at least once (on pp. 13, they referred to the website as

"www.aworldOFbutterflies" instead of the real one,

"www.aworldFORbutterflies") — but still, the title was as plain as it could possibly be.

PHIL SCHAPPERT
University of Texas, Austin, Texas

NOMINA NUDA IN 2000

Another case has arisen this year, as has often occurred in past decades, of usage of unpublished names by authors other than the proposer of the new names. In the current case, involving some new names of Dr. Mikhail Kozlov (Univ. of Turku, Turku, Finland) that are as yet unpublished, the authors involved have gone through a museum collection photographing species, found the new names and added them to their faunal book, along with photographs and short descriptions, thinking that the names would shortly be published (the authors noted "Kozlov, in press" after using each name). The book using these unpublished names in this case is a more popular format and not a technical book, but nonetheless the case is the same in terms of nomenclature.

As a result, the authors of the book involved were almost stealing intellectual property (hopefully unintentional). Although they formally acknowledge Dr. Kozlov as the proposer of the new names, the old Zoological Code would have assured the validity of these "descriptions" and would have made the book authors as the authors of the new names, and not Dr. Kozlov: this is what has always happened in past years in such cases. Fortunately, this is one situation corrected by the new 1999 Zoological Code, whereby the publication in question does not constitute a valid description inasmuch as types are not designated (Art. 16), among other criteria. Article 16 of the new Zoological Code states that a new name after 1999 must, 1) be explicitly indicated as a new taxon, 2) the original description must have an explicit holotype fixation, and 3) there must be a clear statement of intent of holotype deposition in a specified scientific collection. According to the new Code, the "new" names noted above are *nomina nuda*, or invalid names lacking a valid description. However, the new Code cannot serve as an excuse for these authors. Furthermore, the use of these unpublished names can create additional problems due to the possible use of these invalid names by other researchers.

Preparation of a comprehensive taxonomic revision may last for years, if not decades. During this time, the type specimens of new taxa, labelled as such but not yet formally described, may sit in museums for years, all the time very sensitive to any kind of intervention by others. In the case noted above, the specimens were labelled back in 1995, yet only now are in line to be validly published in 2001. The intellectual property aspect of the original researcher at this stage is protected only by the code of professional ethics. In decades past, it sometimes was the case that rival taxonomists were even "stealing" new species if someone hinted at what new species they were working on, so problems of protecting types of new species certainly has validity. There is no way to avoid labelling newly discovered specimens as new species in preparation for their publication, or to easily provide separate safe depository for species "in statu nascendi" in a major insect collection: the only alternative is for the researcher to retain possession of such specimens until the names have been published, but this is not always feasible over many years. Visitors coming to use collections in most museums will usually have access also to these undescribed species, or new "types," and thus, they clearly have a responsibility to verify the status of names on specimens. Photography and publication of such specimens is clearly beyond permissable scientific ethics, and should always be done only with the knowledge and consent of the describer of these new species.

As it turns out, one of the authors who published the book noted above not only has taken some new species names and published photographs and brief descriptions (no matter how innocently), as already noted, but in other books has also "published" other manuscript names (again, unknowingly) that were found in the drawers of the Natural History Museum (BMNH), in London: these latter names involve species identified and labelled with new names by George F. Hampson and other researchers from nearly 80 years ago, but never published prior to the deaths of these researchers, yet which still remain in the drawers in the collections much as other specimens. Evidently, the author involved was not aware that these were manuscript names. Visitors who are not knowledgeable in such matters, or who are unaware that large museums may have specimens labelled with manuscript names, should in no way assume that all specimens are properly labelled, or properly named, or that such names are valid or even published: they should check with the collection manager (in the case of the BMNH, the curators are well aware of these manuscript names, if they are only asked about it).

Keeping in mind that visitors to most museums must read some instructions, and certify acceptance of these rules, prior to being allowed full use of the collections, I suggest that a statement on the use of so-called manuscript names be included in the formal "rules" museums give to visiting researchers. For example: information on specimens bearing manuscript names (labeled "in litt." or "in press," or in some similar way) should not be published, or made use of, without written consent of the describer, who after all has discovered the species and has done all the research to name and describe it for publication. If the describer is deceased prior to finishing the publication of a new name, then the collection manager should be consulted. Equally, the major museums should adopt new policies to somehow segregate newly identified species so visitors cannot have immediate access to these specimens unless first consulting with the collection manager. Some museums still even keep holotypes in their main collections, rather than in special type cabinets that can be locked.

This matter, and notes about the use of his new names, was first brought to my attention by Dr. Kozlov. Herein other notes are added that I was aware of, in this way emphasizing these matters to our readers. Perhaps in this way others will better understand the many problems involved in the unauthorized use of manuscript names.

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NEARCTIC LEPIDOPTERA CATALOG

The *Atlas of North American Lepidoptera* series has been in preparation for a number of years now. Although an illustrated part on the swallowtails is planned, a new catalog has also been in progess for a few years and will be the first part issued to subscribers. Previous North American catalogs have been completed several times since 1860, most recently in 1938-39 and in 1983. Much has been added since 1983 and there also is considerable alteration of the classification of the families that also needs to be taken into account.

The new North American catalog will be complete in terms of synonyms and dates of description for all names, as well as the state or country of origin, this being in the same format as adopted for other ATL faunal projects. Inasmuch as the fauna is so large (ca. 12,000 species described thus far), and also for ease of use, the new catalog will be published as a 3-volume work, with the first part to be completed being on the butterflies. The butterfly section does not involve many

species but due to excessive synonymy and subspecies names, it involves a great number of names to catalog. There will also be a part on the micro-moths (plus Geometridae) and a part on the macro-moths. Each volume will have a separate index and a bibliography to the main literature. A hostplant index is planned for the future, as well as the illustrated species pages for each species. As with the Neotropical catalog, there remain so many species yet undescribed in North America (perhaps another 3,000 species, mostly among the micro-moths), that periodic updates will be necessary once the catalog is completed.

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NEOTROPICAL BUTTERFLY CATALOG

The *Atlas of Neotropical Lepidoptera* series has three catalogs already completed, covering all the Microlepidoptera (published in 1984), pyraloids to tortricoids (published in 1993), and part of the macro-moths (published in 1996). The next part expected in 2001 will be the catalog for butterflies and skippers. Although now a cooperative project among several researchers, the main intiator and organizer for this part has been Dr. Gerardo Lamas, of the Museo Nacional de Historia Natural, in Lima, Peru.

The butterfly fauna of the Neotropics, from northern Mexico and the West Indies to southern South America (including Chile), includes the largest butterfly biodiversity on earth, with an estimated 8,000 species. Dr. Lamas has been working on this catalog now for over 15 years, more recently adding the help of colleagues for skippers and hairstreaks, both the most difficult groups to be dealt with. Series subscribers will note that Dr. Lamas is the main author of the bibliography to literature on Neotropical butterflies, already published in 1995 as Part 124 of the *Atlas* series. Part 125 will be the Neotropical moth bibliography. Other future parts will conclude the catalog for Neotropical Lepidoptera and progress on species pages to illustrate and describe all the species of the region.

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LEPIDOPTERA OF CHILE

The Lepidoptera fauna of Chile is remarkably isolated from the remainder of South America, other than some overlap in western Argentina. The huge tropical fauna of the Amazon does not reach into Chile, being completely cut off by the high Andes mountains and plateaus of Peru and Bolivia, and extending all the way to Tierra del Fuego. Due to the isolation of Chilean fauna and the mostly temperate climate of Chile, the country has a much smaller fauna than in most other areas of South America.

Several families of moths have already been cataloged for Chile, primarily Cossidae, Geometridae, Lasiocampidae, and Noctuidae, among others. Work is now in progress to complete the Chilean Lepidoptera catalog by adding the other macro-moth families, plus the few butterflies (ca. 169 spp.) and the Microlepidoptera. While the Chilean butterflies are no problem to catalog, due to the few species involved, on-going studies by such researchers as Dubi Benjamini on the blues, will help elucidate some of the species complexes yet to be clarified in Chile.

Chilean Lepidoptera are of special interest not only due to their isolation from the rest of the more tropical Neotropics (e.g., there is only a single swallowtail known from Chile), but also due to the many affinities to South Pacific fauna, part of the ancient Gondwanaland distribution. The same is found among the many strange plants found in Chile, south of the northern desert regions.

It is anticipated that the Chile catalog will be in publication within a few years, and thereafter that species pages will be added to the on-going *Atlas of Neotropical Lepidoptera* series.

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REVIEW OF A REVIEW

In a recent review of my *Classification of Lepidoptera, Part 1* (Heppner. 1998. In *Holarctic Lepid.*, 5 (Suppl. 1): 1-148), John W. Brown presents such an inaccurate critique that I am obliged to respond to his review.

Brown's review (2000. *Proc. Ent. Soc. Wash.*, 102:1075-1076) begins with the remark that the schematic family trees of family phylogenies presented in my work are "based on intuition:" actually, a careful reading would show that they are based on the extensively researched Table of Family Characters in the book. Any subjectivity that Brown alludes to is not any different than what a more cladistic analysis (showing calculated percentages of degree of difference) would present in the choice of where to call a group a family, or a superfamily, and so forth; and, the presentation of the lineages also comes from the data in either case. Also, the classification is not based exclusively on wing venation (even though there are many illustrated), but on 24 major character sets of adult, larval and pupal morphology for each family (where known): the many wing venation figures are merely illustrated as a handy reference for the reader for what characters the wing venations do show.

The next thing Brown criticizes is the species totals for Tortricidae in the faunal totals for the world Lepidoptera fauna. Although all the faunal regions are undoubtedly undercounted, since many species remain to be named, he notes having 8,000 species names in his own card file for Tortricidae of the world, versus the 6,683 species which I mention in the faunal table (based on my 1991 summary): my total represents the *valid* names of described species of tortricids (up to 1990), not all the published species names available, which also would include all the synonyms he evidently is counting in his card file total. The true tortricid world fauna will probably top 12,000 species in any case, once all have been discovered and named.

He then finds two names (out of 100s noted) in figure captions of wing venations among tortricids, where older generic names were inadvertantly used, immediately concluding and extrapolating thereby that much of the book has questionable data. This kind of free extrapolation, by taking a few older names as evidence the entire work can then somehow be called into question, is inappropriate and only refers to nomenclature in any case: this is like finding a few words misspelled in Darwin's *Origin of Species* and thereby claiming that Darwin's theory is questionable.

Brown also questions the classification used in the book, mainly because of the arrangement for families of Zygaenoidea and Cossoidea, which does not agree with what some specialists have proposed in recent years. Actually, the so-called "global consensus" that has evolved for some Zygaenoidea classifications (among others) in recent works is erroneous in continuing to place all slug caterpillar families together merely due to their similar larvae (notwithstanding some other characters that appear to show close relationships, which is what other specialists have chosen to key in on): the larval similarities are a case of evolutionary convergence on a common larval adaptation, and do not involve evolutionary lineages from a common ancestor, as demonstrated when adult morphology is studied (among other characters), thus putting some families in Cossoidea and some in Zygaenoidea. In the same logic, agaristine Noctuidae, some zygaenids, uranioids, castniids, and butterflies, all have clubbed antennae: that does not prove that they are from the same evolutionary lineage, since other morphology demonstrates that they are not even closely related.

Undoubtedly, there will likely be more to discuss among specialists once the second part of my work on Lepidoptera classification is published in 2001, but hopefully one hopes for more useful dialog.

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TAIWAN LEPIDOPTERA SURVEY: 20 Years

The Taiwan Lepidoptera Survey, begun in 1980 at the request of the government of Taiwan as a collaborative national survey of Taiwan Lepidoptera, originally between the Smithsonian Institution and the Taiwan National Museum (later including the Florida State Collection of Arthropods), has resulted in the collection of Lepidoptera in almost every corner of Taiwan, one of the most extensive national surveys for one group of insects made in the last century for one area. This has already been well-publicized in the 1992 Taiwan Lepidoptera catalog (Heppner and Inoue (eds.). 1992. *Lepidoptera of Taiwan. Vol. 1. Part 2: Checklist.* Assoc. Trop. Lepid.). The result is a large accumulation of Taiwan Lepidoptera, currently under study at the Florida State Collection of Arthropods (FSCA), Gainesville, Florida, and in part at the Smithsonian Institution (USNM), Washington, DC.

The Taiwan Lepidoptera Survey, ongoing now for 20 years of nearly yearly field surveys, has been a cooperative effort by the Florida State Collection of Arthropods (Gainesville, FL), the Smithsonian Institution (Washington, DC), and in Taipei, the Taiwan Forestry Research Institute and the Taiwan Museum (now called the Taiwan National Museum). The Taiwan Museum has been the main Taiwan-based cooperating institution and the FSCA has been the main American cooperating partner in this international project. Partial funding has come from the National Science Foundation, through its International Programs division, as well as some funding from Taiwan's National Science Council and the Pacific Cultural Foundation. The immediate result of this funding was the 1992 publication of the Taiwan Lepidoptera catalog, edited by myself and Dr. H. Inoue. All other funding sources and other help is noted in the 1992 catalog.

The next part of the book series on Taiwan Lepidoptera, including a color synopsis of the Lepidoptera fauna, is nearly completed, and is now expected to be published in 2001. This next part of the series will include a gazateer to Taiwan place names, corrections and additions to the Taiwan catalog, introductory notes on the Taiwan Lepidoptera fauna, and notes. A third part to these introductory books will involve a hostplant index for Taiwan Lepidoptera. Future issues will illustrate and describe all the Taiwan Lepidoptera species in detail.

Of the few new species described so far from material collected in the Taiwan Lepidoptera Survey, the holotypes currently are stored at FSCA for the Taiwan Museum. The bulk of the Taiwan specimens are under study at FSCA, leading to an eventual sharing of specimens between FSCA and the Taiwan cooperating institutions. Other Taiwan collections are under study at the USNM.

While most persons working on Oriental fauna are aware of the Taiwan Lepidoptera Survey already for many years, this notice provides an update to a number of researchers who may not have knowledge of this large project. For example, over the last two years a group of Hungarian lepidopterists have made collections in Taiwan and immediately described new species. Additionally, the holotypes for their new species from Taiwan were deposited in collections in Hungary, even private collections. The Taiwan Lepidoptera Survey, contrarily, has agreements with the Taiwan Museum, whereby holotypes of new species described from project specimens remain the property of the Taiwan Museum and are only temporarily placed at FSCA while under further study.

The new species more recently described by others not associated with the Taiwan project are mostly based on itinerant collections made in Taiwan, without resort to all available museum material. Although this has been the custom in most cases with new species descriptions already for the past 200 years, mostly by amateurs — a kind of frenzy of new species descriptions based only on what the authors themselves have just collected — it is not what modern researchers should be doing. One can understand the lack of museum searches for additional specimens from all possible collections in some cases, but it is another thing to be seemingly ignorant of a nation-wide Lepidoptera survey already in place since 1980, with many 10s of 1000s of specimens in hand, and then ignore such specimens when describing new species: something almost unconscionable for a scientist.

In these instances in recent years, brief serendipitous collections made during a week or two in Taiwan resulted in some new species being discovered, and then various authors described these new species based on insufficient data. Because of inadequate field time, these new descriptions have been based on only a few specimens, or even unique specimens — even sometimes with the notation that the species apparently is "rare" — while at the FSCA or the USNM there might be 50 or 80 specimens of the same new species, and also with both sexes available for description, all in a collection base formed by thorough biodiversity surveys across Taiwan, in all seasons and over many years. If these authors had thoroughly checked other collections, or at least what is available with the Taiwan Lepidoptera Survey, their descriptions would not have been short of specimens, and their conclusions less erroneous. One can understand the impracticality of checking every major museum for specimens, but it is another matter indeed to fail to study specimens available from an on-going, well-known and intensive survey already in progress for 20 years. It is equivalent to collecting in Costa Rica and not knowing of the existence of the large collections already organized by INBio.

It can again be noted that recent new holotypes have been put in the Hungarian Natural History Museum, Budapest, and even private collections, even though Taiwan actually requires types of Taiwanese species to be deposited in a national collection in Taiwan (as do many countries today). In the past, most holotypes of new species from Taiwan have been deposited in foreign museums, predominately in Japan, England, and Germany. Yet, all holotypes from the Taiwan Lepidoptera Survey are destined for the main insect collection in Taiwan, at the Taiwan National Museum (formerly the Taiwan Provincial Museum), Taipei, as also duplicate specimens from the survey.

The historical trend for hasty new species descriptions, especially by amateurs, has been steadfast, and continues to be based mostly on itinerant collections, with deposit of holotypes in private collections, rarely in museums. The new Zoological Code (1999. ICZN) at least has taken one step to deal with this by requiring that each holotype have a designated depository, preferably a public museum. Unfortunately, the Code does not require thorough study of available specimens before a new species is described — this still remains the responsibility of the researcher — but the unwritten assumption is that each researcher will diligently check all available specimens before embarking on the description of a new species, if for no other reason than to better advance our science with accurate information.

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BUTTERFLY FIELD GUIDE CORRECTION

The overall excellent new field guide by Opler and Malikul, *A Field Guide to Eastern Butterflies*, part of the revised Peterson Field Guide series which replaced the 1951 version by Alexander B. Klots, was first published in 1992. I had not seen the revised edition of 1998 until recently, which prompts this note on a singular and unfortunate error in regard to our Association for Tropical Lepidoptera.

It is understandable that the 1992 edition made no mention of ATL, since we began in 1990 and the book was already in production. However, in its revised 1998 edition our society is mentioned in the section on North American societies for Lepidoptera, yet we are called the "Holarctic Lepidoptera Society." It is quite amazing to find our name mistakenly entered in this way. To mention only the *Holarctic Lepidoptera* journal (not *Lepidoptera News* or *Tropical Lepidoptera*) and then change our name to something never before heard of by anyone, all in such a commonly used and widespread book, is confusing to users. Hopefully, the publisher can correct this error in the next printing.

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TECHNIQUES: Double Mounts with Plastozote

Anyone working with Microlepidoptera or other small insects needs to use Minutien pins in double mounts (Fig. 1). The methodology involves a tiny Minutien pin (usually 0.15 or 0.2 mm thick, and about 10 mm long) that is used to pin through the thorax of a specimen and then pushed into a small block of material, which itself is then pushed through with a normal insect pin.

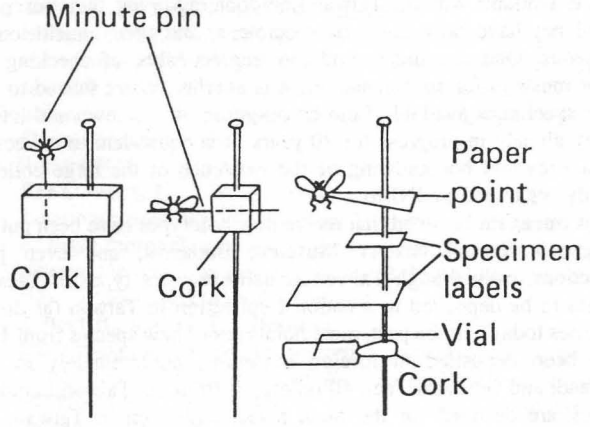

Fig. 1. Typical double mounts used for small insects; the larger block is the usual design used for Microlepidoptera (after Arnett, 1985). Note that moths should never be glued onto paper points, as in the example of a fly at right.

Until recent years, one mostly used polyporus, a white bracken fungus that when cut into thin strips yielded a dense, stable and appealing double mounting material. I have not been able to determine the reasons for the lack of further supply of polyporus these last 10 years or so, but presume it may have something to do with new environmental laws in Europe that may have prevented continued collections of the large bracken fungi from woodlands in England and other areas that seem to have supplied all the polyporus used by entomologists.

Besides polyporus, other materials that have been used over the years include cork and balsa wood. Both these alternates have their problems: cork does hold a pin well, but deteriorates with age more than polyporus and is more brittle with age; balsa wood is not flexible, harder than one wants and does not hold a pin well. And, both are not a pleasing white color, like polyporus. Even paper and cardboard have been used by some but both are too stiff to make useful double mounts.

The lack of a supply of polyporus for double mounts has resulted in the use of the just mentioned alternates, as well as newer synthetics, either plastic foam or a rubbery material. The rubber compounds are obtained in strips, like polyporus used to be sold for double mounts, or as a liquid that is poured into molds which provide rubbery strips upon hardening. The rubbery synthetic, however, is too flexible, is resistant to pins due to its dense texture and one wonders about its longevity in a museum environment. It does have the advantage of also being white in color, however. Plastic foam is usable, also is white, and adheres to pins fairly well, but is usually not dense enough to adhere tightly enough.

Plastozote, being a very dense form of plastic foam, is the welcome solution for double mounts. In fact, it is superior in all aspects to the natural polyporus. It is very white and unblemished, which some polyporus occasionally was, or became so with age. It has some flexibility but not too much. It is dense yet allows easy entrance of pins and adheres to the pins very tightly. As far as is known, it also does not age and should offer a very permanent material for double mounts of specimens that may be wanted for 100s of years in a museum. I have checked the plastozote with different chemicals (acetone, alcohol, ethyl acetate, and KAAD larval solution) and found no discernable change in the plastozote blocks after several days of soaking, indicating a very stable material. Plastozote was also recommended in an article on Microlepidoptera preparation by J.-F. Landry and B. Landry (1994. *J. Lepid. Soc.*, 48:205-227).

About the only difficulty with plastozote is in its preparation for double mounts. One can obtain plastozote sheets about 10 mm in thickness. One must then cut thin (ca. 3 mm) strips using a razor mat cutter, and then cut the small blocks from the strips (also ca. 3 mm wide), thus providing the desired double mount block of about 3 x 3 x 10 mm in size. Smaller blocks, often used in mounting flies and other such small insects, can of course also be cut (usually only 3 x 3 x 3 mm in size).

Advantages of plastozote double mounts:

1) Permanence: the material is impervious to moisture (thus not rusting the pins) and apparently has long-term permanence. Thus, the blocks can even be emersed in water and still used as before, something very advantageous under field conditions in tropical regions when insects are mounted directly in the field (polyporus, and most other double mount subsitutes, would swell in water and become unusable with too much moisture). Plastozote also is not eaten by museum pests like dermestids; polyporus attracts museum pests and would be eaten in time if pests were active.

2) Adherence: plastozote is dense enough to adhere tightly to pins, yet is cushiony and remains flexible; thus, no rotation of mounts or the specimen pins (subsitutes like cork and balsa wood invariably dry out more and let pins rotate over time).

3) Appearence: plastozote is snow white and unblemished (it seems impervious to common entomological chemicals like alcohol, ethyl acetate, and acetone).

4) Cost: plastozote is relatively inexpensive, so cost per block is very small (polyporus, even before the last years of supply, was becoming rather expensive, and cork and balsa wood also are more costly).

5) Preparation: plastozote is rather easily handled to make double mounts.

When using plastozote to make double mounts there are only two annoyances:

1) Static: plastozote generates considerable static electricity when handled as one cuts the sheets into blocks, so blocks "jump" around a lot until one gets them into a paper box of some kind to reduce static. This static, however, dissipates once a pin is used to finish a mount and does not harm any minute insect due to static charges when the Minutien pin and specimen are added.

2) Density: plastozote is dense enough to cause some problems in cutting the sheets into strips and then into blocks, since even sharp razors are quickly dulled by the material. Using single-edged razors, I have had to change them about every 30 minutes of very active cutting, and even after 10 minutes one already notices that the cutting is not as easy as with a new razor.

All in all, plastozote is highly recommended as the modern substitute for polyporus in the making of double mounts for insects. The most dense plastozote material I am aware of is manufactured in Taiwan.

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ARGYROTAENIA CITRANA NOT IN FLORIDA

A recent catalog of the Nearctic Tortricinae (Razowski, 2000. *SHILAP Revta. Lepid.*, 28:5-62), repeats the erroneous distribution of the tortricid, *Argyrotaenia citrana* (Fernald, 1889), as including the state of Florida. This error in distribution originates from misidentifications from decades ago, repeated in several publications over the last 50 years. It is the kind of data that seemingly cannot be purged from the literature.

Inasmuch as *A. citrana* is of economic importance as a citrus pest in California and adjacent Arizona, it is of great importance to Florida citrus to verify that this species does not occur in Florida. No specimen of this species has ever been found in Florida, and those thought to be *A. citrana* all have been checked and identified as other species, mostly *Argyrotaenia ivana* (Fernald, 1901). It is unfortunate that this new catalog would again repeat this old error in distribution.

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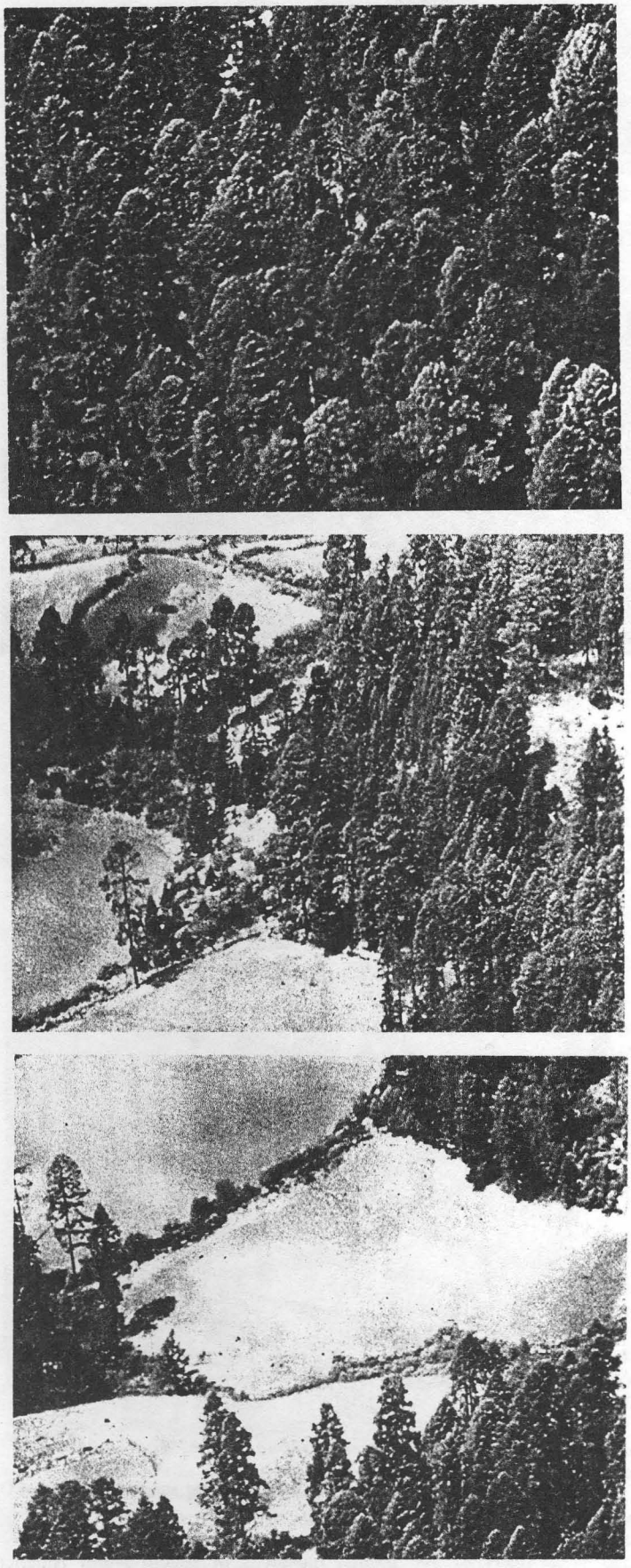

Fig. 2. Aerial photographs showing forest degradation at the monarch overwintering grounds in the Monarch Preserve, Michoácan, Mexico: a) original forest; b) partially cleared forest within the Preserve; c) nearly complete deforestation within the Preserve.

MONARCH WATCH [cont. from p. 1]

Lincoln P. Brower, a monarch biologist at Sweet Briar College, Sweet Briar, Virginia (formerly with the University of Florida, Gainesville), who was an author of the new study with colleagues at the Universidad Nacional Autonoma de México, Mexico City, and the World Wildlife Fund. "But I didn't predict it would be this bad. The maps just floored me." Dr. Karen Oberhauser, a monarch ecologist at the University of Minnesota interviewed by the *New York Times* noted, "It's the first study and a really important study. We didn't expect the change to be this great."

In the article by Carol Yoon, in the *New York Times* (Sep 12, 2000) it is noted that

> "researchers found . . . not only that forest was disappearing both inside and outside the preserves, but it was being removed in such a way that what forest remained was highly fragmented. Much of the forest has been significantly thinned, a process leading not to regeneration but instead to further degradation. Over the 28-year period of the study, the average size of the conserved patches of forest decreased nearly 90%, from 5,000 acres to 500."
>
> "As a result, even in remaining forest stands, trees are more exposed to wind, drying, greater temperature extremes and are more at risk of fire, all of which make the forests less suitable as resting grounds for the butterflies."

And further,

> "Dr. Brower said that in one region where there has always been a large monarch colony, development has encroached to the point that the once remote roosts of monarchs are now dangling in trees right next to farm fields. This winter, the butterfies startled biologists by abandoning the site, moving over the mountains to a more intact forest area — an increasingly rare commodity — that they had never used before."

Fig. 3. Mr. Jorge Pinto, Consul General of Mexico in New York, speaking on the teamwork of American and Mexican conservationists working on-site to save the monarch's Mexican overwintering grounds.

Fig. 4. Dr. Orley ("Chip") Taylor, of the Monarch Watch (University of Kansas) tagging program, speaking at the New York event.

EXPANDED CONSERVATION STRATEGY

Responding to the current crisis, monarch specialists and the Mexican representatives outlined an aggressive new strategy involving expansion of the preserve to more than three times it original size and new programs to address the needs of local residents who live within the reserves. Ms. Missrie noted that the new response was critical because not only had nearly 45% of the forests in the reserve region been destroyed since the Mexican government created the current reserve in 1986, the major weakness of the previous conservation strategy was resistance by the local populace. To address this need, Dr. Brower and Ms. Missrie said that not only would enhancement of the preservation and reforestation efforts currently being conducted in Mexico by the Michoacan Reforestation Fund and Monarch Butterfly Sanctuary Foundation be required, but establishment of an entirely new fund directed at the needs of local residents. The new entity, the Monarch Butterfly Conservation Fund, is being established at the moment and will be administered by the World Wildlife Fund and the Mexican Fund for the Conservation of Nature. Designed to streamline aid directly to local needs with little hierarchical interference, the fund will provide financial incentives for local residents to support the overall monarch conservation strategy. The MBCF has been seeded with $5 million of initial funding but, Brower and Missrie stated, it will require $30 million to meet its ultimate goal.

Mexico's Ministry of the Environment, Natural Resources and Fisheries has praised the aggressive new strategy, noting that it more comprehensively addresses the biological needs of the Monarch as well as the social and political realities surrounding the reserve. The expanded reserve acreage of 140,000 acres (versus the previous 40,000 acre reserve), they said, not only more adequately cover known overwintering sites, it also addresses needs of the larger watersheds of which the roosting forests are an integral part.

Drs. Taylor and Opler emphasized the international context of the crisis and proposed solutions. Dr. Taylor said,

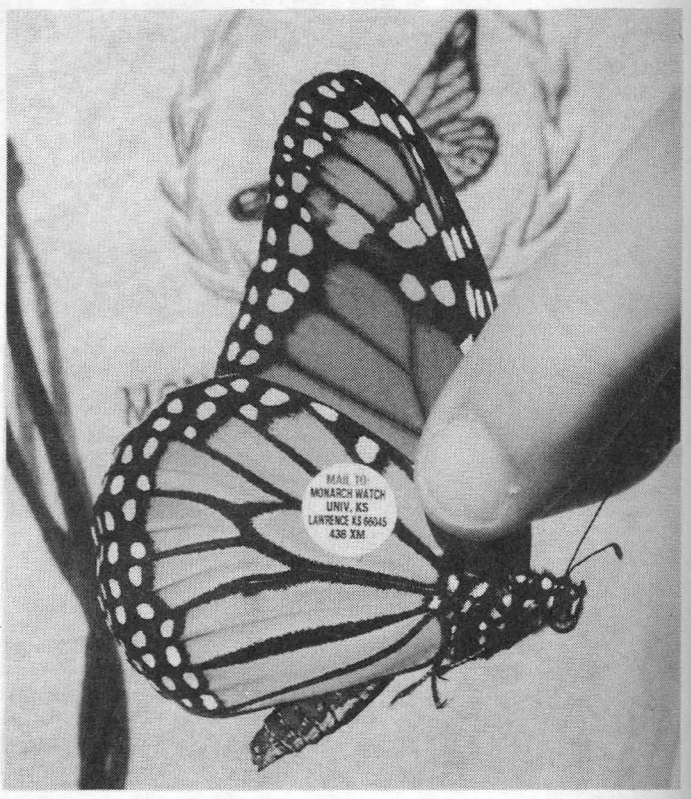

Fig. 5. A tagged monarch, with the Monarch Watch tag attached (courtesy of O. Taylor, Univ. of Kansas).

> "as many as 500 million monarchs in eastern North America migrate to Mexico . . . truly one of the world's wonders. Yet, the continuation of this phenomenon is threatened by deforestation in Mexico . . . . Conservation of this monarch migration is a significant concern."

Dr. Opler stated,

> "Monarch conservation is a two-way street . . . . It behooves us to give as much assistance to efforts in Mexico as we can from the United States."

Dr. Oberhauser, in subsequent comments, noted this as well, saying,

> "Monarchs also require habitat conservation in the United States and Canada; every monarch that overwinters in Mexico was a larva on milkweed plants up to 2000 miles north of the overwintering sites. We cannot simply look at the Mexican problem in isolation, but need to conserve breeding and migratory habitat as well."

LEPIDOPTERISTS' RESPONSE

In follow-up discussions, many lepidopterists emphasized that if the current urgent situation is to be successfully addressed, butterfly lovers (certainly the monarch's closest ally) must each make a personal effort to disseminate information about the crisis through their own personal "networks," especially through the e-mail and internet, which are inexpensive and fast. Urgency, versus complacency, came to the fore in comments I heard as I attended and returned from the Central Park event. As I heading out to attend, a colleague said "Kurt, come on, what difference would it really make if this butterfly went extinct?" When I began communicating with other lepidopterists after the program, more than one professional on my contact list reminded me "it's inevitable the Mexican overwintering grounds will eventually tank." Is this what we really want or expect? Dr. Brower was asked this same question by the CBS reporter attending the event. He gave the answer he is now famous for — that world citizenry protects wonders like the Mona Lisa and the Crown Jewels. At bottom, their value might seem as ethereal as a butterfly's. Yet, people have been taught that these art treasures have inherent value. "Shouldn't natural wonders be accorded the same inherent value?" Dr. Brower asked, to applause.

The *New York Times* article also stated:

> "Part of the problem . . . is that in 1986, when the Mexican government set aside the first sanctuaries, land was appropriated without compensation for the residents, who owned the land communally. As a result, . . . many residents are angry and have shown a blatant disregard for the prohibition of logging inside the sanctuaries."
>
> "In the hopes of curbing illegal logging in the new sanctuary, Mario Huacuja, Director of Communications for the [Mexican] Ministry [of Environment, Natural Resources and Fisheries], said . . . that in collaboration with private foundations, the Ministry was negotiating a novel system to pay local people for their lost logging rights in the preserve. In addition, there will be payments to people who help protect or restore the forest."
>
> "Despite the monetary incentives, there is already opposition to an expanded preserve. Some have argued, for example, that the monry being offered for logging rights, about $16 per cubic meter of wood, is below the market value and that residents will lose money."
>
> "Others note that whatever the monetary incentives, it will always be difficult to prevent illegal cutting in an area as desperately impoverished as that around the [monarch] wintering grounds."
>
> "Dr. Dennis Frey, behavioral ecologist studying monarchs at California Polytechnic University, said that on a recent visit to a monarch sancturary with a group of scientists, the sound of their approach silenced the work of a nearby, but hidden, woodsman, . . . 'but as soon we got back into our vehicles to go, the chop, chop, chop started up again immediately.'"

To help lepidopterists communicate the monarch's urgent situation, websites are posting succinct information on the current crisis that can be copied into e-mails and easily disseminated (see the URL lists below). Information flow is essential to protecting the monarch. As part of these efforts, Richard Stadin, President of Mastervision (producers of, among other documentaries, the Audubon Society's *Butterflies for Beginners*, Audubon Society's *Butterfly Gardening* and Audubon Society's *Video Guide to Birds of North America*), has initiated *Monarch Watch 2000*, which will offer a variety of technological support to the effort to inform the public about the Monarch crisis.

New funds will also be needed, and even professional fundraisers know how difficult it is to raise money. Even for favored causes, fundraisers estimate only 1 in 10 interested persons actually makes the move to contribute money. Usually the reason is they simply don't get around to putting the donation in the mail. Yet, fundraisers note, the same people will easily spend as much or more than a small donation on a quick lunch or drink with friends and family, even several days a week. Given this reality, one must reinforce the notion that it is lepidopterists who must now "get on the horn" and make monarch conservation their urgent priority. Try it. Go to that e-mail and send information out to everyone you know, urging them to provide support. It may work.

Dr. Taylor emphasized that although preserving the overwintering sites in Mexico is a bottom line in monarch conservation, our complexifying world also requires that monarchs everywhere become more well understood. "Our goals at Monarch Watch" he said at Central Park,

> "are not only to draw attention to these threats to the migration but also to evaluate the impact of overall human activities on monarch populations. If we are going to protect the monarch migration, we need to develop a baseline for the population, that is, to know the size of the population and to identify those factors that cause monarch numbers to decline or increase. The tagging program is helping us get these answers. Each year, Monarch Watch issues 250,000 tags to schools and volunteers. These assistants, including tens of thousands of children, tag approximately 70,000 monarchs each season. The data from recoveries of tagged monarchs in the United States and in Mexico enable us to: 1) determine the origins of the monarchs that reach Mexico; 2) calculate the mortality of monarchs during migration; and 3) estimate the overall size of the migratory population. In the future, data on population size and dynamics will be extremely important in determining whether the monarch populations are declining or increasing as a result of human activities."

As part of the Monarch Watch program, Dr. Taylor organized a demonstration monarch tagging so children could get an idea of how this was done. Monarchs from Long Island were collected for the event for the children present at the event to tag and release. Dr. Taylor noted that, "he was cultivating the fascination that many people have for these insects. . . ." (*New York Times*). But, as noted by the *Times*:

> "Using monarchs for such an agenda is not universally popular in the butterfly world. The president of the North American Butterfly Association [NABA], Jeffrey Glassberg, denounced yesterday's event, calling it a 'circus sideshow.' Mr. Glassberg, a molecular biologist by training, said that truly respecting monarchs meant treating them like wild creatures and observing them in their natural environment, not trucking them in for a demonstration. 'Butterflies are wild animals,' he said. 'To treat them as little toys that you take around and say, 'Isn't that cute?' sends completely the wrong message to people.'"

Dr. Robert Pyle, in his written statement for the event, however, noted other issues regarding the monarch that are in play today as well:

> "the regrettable trend of scattering monarchs hither and yon at weddings and other events has only muddied our ability to study their true movements," he said, but "this enlightened event can only help — help our understanding, help our community devotion to saving this great and endangered phenomenon, help the monarchs themselves."

The final statement in Dr. Pyle's message also aptly summarized the feelings that lepidopterists share for the monarch butterfly and also

Fig. 6. Dr. Lincoln P. Brower (center right), with Alexander Brash (center left), Director of New York Urban Park Rangers, with Urban Parks Ranger Director, Sara Hobel (right), and Central Park Plant Enhancement Director, Vicki Hornbostel (left), at the Monarch Watch 2000 event.

suggest the common ground that can galvanize lepidopterists in aggressively supporting their conservation: in "1976, shortly after the Mexican sites came to light," he said,

> "the North American migratory monarchs were declared the top priority in world butterfly conservation. That judgment has not changed, and has become much more urgent with recent disclosures of forest loss and chemical and genetic threats. This animal is truly the 'Monarch of the Americas,' with an enormous potential to link Canadian, American, and Mexican conservation action."

Dr. Pyle closed with an admonition we can all share: "Long may the monarchs reign over the skies and milkweed meadows of North America!"

Information Resources and Conservation Organizations Needing Financial Support

Support and financial contributions to any of the organizations under A (On-site Conservation) and B (Monarch Education and Research) will directly aid monarchs at their Mexican overwintering grounds:

A. On-Site Conservation in Mexico

1. World Wildlife Fund: watch for particulars of a new WWF administered foundation organized with the Mexican government specifically for this purpose: "Monarch Butterfly Conservation Fund" at, www.worldwildlife.org.
2. On-site Support for Community Infrasture: Monarch Butterfly Sanctuary Foundation at, www.mbsf.org.
3. Reforestation: Michoácan Reforestation Fund at, www.michoacanmonarchs.com.

B. Monarch Education and Research

1. Monarch Research, Education and Migration Tagging: Monarch Watch at, www.MonarchWatch.org.
2. Research on Overwintering Ground Deterioration: contact Monarch Butterfly Fund, Sweetbriar College, through e-mail at, brower@sbc.edu.
3. Monarch Education: Monarchs in the Classroom at, www.nmarchlab.umn.edu

C. Information Dissemination

1. Monarch Crisis Information: Mastervision at, www.mastervision.com/mw2000.
2. Monarch Crisis and Other Endangered Species: Endangered Butterflies Website (American Ethical Union) at, www.edutrek.net/endangeredbutterflies.html.
3. Monarch Crisis and Other Endangered Species: the Children's Butterfly Site at the following website (and all included links): www.mesc.usgs.gov/butterfly/butterfly.html.

KURT JOHNSON
Environmental Affairs, The Ethical Culture Society
Brooklyn, New York

Editor's Note

As for the Glassberg comments, in a letter-to-the-editor of the *New York Times*, not printed but posted on the Mastervision media site, the lepidopterist speakers at the event (Drs. Brower, Johnson, Opler, Pyle, and Taylor) stated, in response to the Glassberg quote,

> "Jeff Glassberg belittles the release of tagged monarch butterflies as a 'circus sideshow' in which butterflies are treated as 'toys.' To the contrary, tagging monarchs sheds light on how these remarkable insects find their way to mexico. Tagging also provides information on the size of their populations, data that are needed to establish the impact of deforestation . . . on monarchs in Mexico. . . . We live in a complex world in which education, persuasion, discussion, accomodation, compromise and mitigation are the realities of conservation. Mr. Glassberg's message may appeal to some, but it does not help in the task to save monarchs in Mexico."

NOTE: An abbreviated version of this article already was printed in 2000, in the *News of the Lepidopterists' Society* (Vol. 42, No. 3).

THE PIONEER CENTURY OF AMERICAN ENTOMOLOGY

by H. B. Weiss

Continued from Chapter X (see *Lepidoptera News*, June 2000)
J. B. Heppner, Editor

CHAPTER XI

SOME NOTES ON CANADA

When Champlain sailed up the St. Lawrence River during the summer of 1603 and again when he explored the shores of Nova Scotia in 1604 and again when he returned to Canada in 1608 and again in 1613, 1615, 1617, and in 1620 when he took his family to Quebec; during all these trips and during his residence in Canada, regardless of his abilities as an explorer and as a colonist, he was not a naturalist and even less of an entomologist, for his writings only mention mosquitoes and the presence of fleas in Indian huts and in the field.

Other travel accounts relating to the early settlement of Canada frequently contain references to the annoyance caused by insects, usually briefly and incidentally. However, Edward Allen Talbot, in his *Five Years' Residence in the Canadas* (London, 1824, 2 vols.), devoted a chapter to insects, in which he mentioned the "exquisitely beautiful" Canadian butterflies, the ravages of locusts and grasshoppers, mosquitoes, the horse-fly, etc. The horse-fly he spoke of as "the most formidable and relentless foe to which cruel inflictions the poor quadrupeds of Canada are doomed to submit."

In 1825, the expedition under the command of Sir John Franklin explored Canada from Fort William on Lake Superior to the Mackenzie River in latitude 65°, and the results were published by Sir John Richardson, a member of the party, in London in 1829 and at Norwich in 1837. The work was entitled *Richardson's Fauna Boreali-Americana.* Three volumes were published in London, and the fourth, which was occupied exclusively with the insects collected by the expedition and prepared by the Rev. Wm. Kirby, F.R.S., came out at Norwich. Four hundred and forty-seven species are described in this volume and a number are illustrated by colored plates.

PHILIP HENRY GOSSE (1810-1888)

Early in the nineteenth century, the natural history of Canada was studied by Philip Henry Gosse, and his entomological observations deserve extended mention here. He was born at Worcester, April 6, 1810, being the second of a family of four children. He grew up in the maritime section of Poole in Dorsetshire, and there became interested in sea anemones and insects, in which he was encouraged by his aunt, Mrs. Bell. He attended grammar schools at Poole and Blandford until 1825, when he entered a counting house at Poole, where he remained until 1827, when he went to Carbonear, Newfoundland, to work for a shipping firm. He was with this firm for eight years. His office work was not heavy and he had time to develop his taste for natural history. A purchase of Adam's *Essays on the Microscope* in 1832 crystallized his devotion to natural science.

Leaving Newfoundland in 1835, he bought a farm at Compton, Canada, where he taught school in the winter, and in 1836 he wrote his first book, *Entomologia Terrae Novae*, which has never been published. For many years it was lost and only recently has it been found and part of its contents made available. F. A. Bruton, of Somerset, England, published in *Entomological News*, February 1930 (pp. 34-38), a paper entitled "Philip Henry Gosse's Entomology of Newfoundland," in which he states that the book is small, having between sixty and seventy pages and including nearly 250 beautiful hand-painted figures of insects, larvae and pupae, with the pages "headed more or less according to the list of orders and genera given in the twelfth edition of Linnaeus' Systema Naturae." The book is devoid of descriptions of insects, but at the beginning are long lists of insects. Mr. Bruton took the book to the British Museum and the members of the entomological staff identified and classified the insects figured in it. These are set forth in detail in Mr. Bruton's paper. Lepidoptera, Coleoptera and Hymenoptera predominate.

Gosse was not a financial success as a Canadian farmer and he sold his farm in 1838 and went to Philadelphia, Pa., staying only long enough to visit the Academy of Natural Sciences and to become acquainted with some of the naturalists of that city. Alabama, specifically the township of Dallas, was his next stopping place, and here he taught village school for nine months. His *Letters from Alabama*, published in 1859 in London, has already been noted in Chapter ??. Early in 1839 he returned to England, and on the voyage from Mobile to Liverpool he wrote his *Canadian Naturalist.* The Rev. Thomas W. Pyles visited Compton in 1864, after reading Gosse's book, and published an interesting account of his pilgrimage (*23rd Ann. Rept. Ent. Soc. Ont. 1892*, pp. 22-29). At Compton, the inhabitants used to refer to Gosse as "that crazy Englishman who goes about picking up bugs." Pyles visited the haunts written about by Gosse and had a delightful time collecting quaint criticisms of Gosse. According to Pyles, Gosse was familiar with 26 Canadian butterflies, 43 Canadian moths, in addition to a variety of beetles, true bugs, flies, etc. He presents a list of Gosse's Lepidoptera with their present names. Pyles believed that the entomogical pages of the *Canadian Naturalist* were the weakest part of the book and that if Gosse had taken more pains with his identifications and had had a little more knowledge, his book would have taken its place along with such classics as the *Natural History of Selborne*, and Kirby and Spence's *Entomology*.

Back in London, Gosse opened a small school in the suburbs and lived precariously until 1843, when he wrote and sold his *Introduction to Zoology*. At the age then of thirty-three, he began to attract attention in the scientific world. The British Museum employed him to collect new birds and insects in the tropics, and in October 1844, he sailed for Jamaica. Arriving there, he lived at Bluefields for eighteen months, collecting and sending home during that time zoological animals of all descriptions. He returned to England in 1846, where he remained for the balance of his life. Early in 1847, his *Birds of Jamaica* was published, and in 1849 a folio of splendid plates appeared. He married in 1848 Miss Emily Bowes, and in 1849 his only child, Edmund, was born. The best written of his books appeared in 1851, *A Naturalists' Sojourn in Jamaica.* In this he was helped by Richard Hill, of Spanish Town. His later activities included the writing of books on the *Antiquities of Assyria*, *A Naturalist's Rambles on the Devonshire Coast*, and various ones on marine life.

Illness and the death of his wife in 1857 made parts of his life difficult. In his two volumes, *Life* and *Omphalos*, published in 1857, at a time when evolution was being publicly discussed, Gosse attempted to meet the difficulties of animal development in a conciliatory manner, and his books were not well received. This depressed him and he left London to live in St. Marychurch. From speculation, he turned to independent observation, and the result was

his important contribution to knowledge, *Actinologia Brittanica*, an elaborate and profusely illustrated work on sea-anemones. His *Romance of Natural History* was frequently reprinted. In 1860 he was married again, to Miss Eliza Brightwen, of Saffron Walden, and the remainder of his life was devoted to various works on natural history, religion, etc. He died August 23, 1888, in his seventy-ninth year, at his home in St. Marychurch.

MONTREAL NATURAL HISTORY SOCIETY

The Montreal Natural History Society was organized in 1827 by a number of English and French citizens, among the latter of which was the Honorable Toussaint Pothier, a fur-trader and proprietor of many seignories. These citizens were interested in science and in acquiring scientific knowledge and to achieve these ends they decided to organize and to form a museum and a library. In 1832, the Society was incorporated. The rooms first occupied by the Society were small, and within a few years it was able to obtain a large building on Little St. James Street, which was fitted up to contain a lecture room, museum and library. Eventually this building became too small and a new building of white bricks was erected in 1858 at University and Cathcart streets. The museum contained birds, reptiles, quadrupeds, mineralogical and geological specimens, fishes, corals, etc., and the walls were hung with paintings, Indian and other dresses, paper money, coins, medals, Egyptian and other antiquities. If it did not include insects in the early years, this omission was corrected later.

J. WILLIAM DAWSON (1820-1900)

In 1849, J. W. Dawson communicated to the Academy of Natural Sciences of Philadelphia a notice relative to the wheat midge in Nova Scotia. This was printed in their *Proceedings* (Vol. 4, pp. 210-211), and stated that the wheat midge had, within the last four or five years, extended its ravages to Nova Scotia. In addition, Dawson said that the females agreed, in their characters, with the figures and description of the European *Cecidomyia tritici* (Curtis, *Jour. Agric. Soc. England*), and gave his own observations on the habits of the species, its injury, and the dates when noticed.

Many years later, 1864, J. W. D. had a note in the *Canadian Naturalist and Geologist* (Vol. 1, No. 1, Feb. 1864, p. 64), relating to the maple-leaf cutter, an insect whose larva borrowed in maple leaves cutting out circular pieces to protect itself while eating the parenchyma of the leaf. The species was identified as *Ornix acerifoliella* Fitch, well known in New York, where it was ordinarily not destructive, and was reported by the Rev. Mr. Constabell of Clarenceville. Sir J. William Dawson was born at Pictou, Nova Scotia, October 13, 1820. While at school in Pictou he developed a liking for natural science and made a large collection of fossil plants from Nova Scotia coal measures. Later he studied at the University of Edinburgh. Two years after his return to Nova Scotia in 1847, he gave a course of lectures in Halifax on natural history subjects, in connection with Dalhousie Colleges, and he also organized classes for practical work in mineralogy and paleontology. In 1850, when only thirty years of age, he was appointed Superintendent of Education for Nova Scotia. In 1855, he was made principal of McGill College and assigned to the chair of natural history. In 1856, he received the degree M.A., and in 1844, LL.D., both from the University of Edinburgh. At one time he was one of a committee that conducted the *Canadian Naturalist and Geologist*. He died at Montreal, November 19, in his eightieth year.

JOURNALS

"The Naturalists' Calendar" series of papers started by Mr. William Couper in the *Canadian Journal of Industry, Science and Art*, in 1853 (Vol. 2, No. 1, April) mentioned the dates of the appearance in the spring and early summer, in Toronto, of various moths, butterflies, etc. In the April 1854 issue of the same journal, Dr. Thomas Cottle of Woodstock, under the title "On some of the Canadian Saturnidae [sic], and suggestions on the possibility of using their silk for textile purposes," described four large emperor moths found in Canada and proposed that experimental work should be done to determine the possibility of obtaining commercial silk from their cocoons.

In the *Canadian Journal* for April, 1855, (Vol. 3), Mr. Couper began to describe Canadian Coleoptera, and subsequently his descriptions totaled 142 species. At the same time, Professor H. Croft and Mr. F. H. Ibbotson, assistant Commissary General of Montreal, gave a list of their captures.

The Hessian fly reached Lower Canada in 1816 and the wheat midge in 1828. Both continued to increase and spread with resulting damage to the wheat fields. In August 1856, official notice was taken of them. At that time the Bureau of Agriculture for Upper and Lower Canada offered prizes of £40, £25, and £15 "for the best essays, respectively, on the origin, nature and habits, — and the history of the progress from time to time, — and the cause of the progress, — of the weevil, Hessian-fly, midge, and such other insects as have made ravages on the wheat crops in Canada; and on such diseases as the wheat crops have been subjected to, and on the best means of evading or guarding against them."

In the following April, twenty-two essays were submitted, and Professor H. Y. Hind, of Trinity College, Toronto, was awarded the first prize. The second prize went to the Rev. George Hill, rector of Markham. The Department printed Professor Hind's essay and gave it wide distribution.

The *Canadian Naturalist and Geologist* began in 1856 and according to page two of the cover of Volume 2, No. 1, March, 1857, it was managed by a committee of six appointed by the Natural History Society of Montreal. The members of this committee were J. W. Dawson, A.M., F.G.S., Principal of McGill College; T. Sterry Hunt, A.M., Chemist to the Geological Survey of Canada; E. Billings, Palaeontologist to the Geological Survey of Canada; David Allan Poe; W. H. Hingston, M.D., and James Barnston. The first cover page of four numbers of Volume 2 carried an illustration of an insect, the mourning cloak butterfly, a *Calosoma* beetle, and a *Pieris*. Sometimes the proceedings of the Natural History Society of Montreal appeared in its pages, and quite frequently, entomological articles.

In Volume 1, September 1856, (pp. 307-312). there were articles on the Hessian fly, wheat midge and joint worm, from Harris's *Treatise*, and from the *Report of the U. S. Commissioner of Patents for 1854*. On account of the recent appearance of the "fly" in Upper Canada, it was thought that the accounts would be timely. The same volume (pp. 260-75) carried a paper entitled "On the Metamorphosis of Insects" from Kirby and Spence's *Introduction to Entomology*. In Volume 1, January 1857 (pp. 450-457), there was reprinted from the *Journal of the Royal Agricultural Society of England*, a paper on "The Enemies of the Wheat Fly" by John Curtis. And in the same year, 1857, as previously noted, Professor Hind's prize-winning "Essay on the insects and diseases injurious to wheat crops" was published in Toronto. In addition, the early numbers carried some references to the published findings of English and American entomologists.

WILLIAM COUPER (? -1890)

One of the pioneer entomologists of Canada was William Couper. In 1857, he wrote for the *Canadian Naturalist and Geologist* (Vol. 2, No. 1, pp. 40-47) "Notes on the Distribution of Insects, &c.," in which he mentioned the geographical distribution of many species, especially Coleoptera, and in which he dealt with various means of dispersal. Wollaston, Doctor LeConte of Philadelphia, and Haldeman were cited. Another article of his in No. 2 (pp. 101-106) of the same journal was entitled "Instructions for Collecting and Preserving Insects." At this period the killing bottle was made

effective by spirits of wine or by good alcohol being poured in a bottle half full of sawdust. At this time Couper wrote that with one or two exceptions, the collections of Canadian Coleoptera were either local or composed of captures within certain limits and that a thoroughly Canadian collection could not be established until the collectors came to some agreement for the exchange of duplicates. The same was true with respect to Lepidoptera, this order being more neglected than the Coleoptera. Couper said that he did not know of one good collection in the Province. As for the Hymenoptera and Diptera, these too were neglected. General directions were given for finding specimens of Coleoptera and Lepidoptera.

In No. 6, December 1857, page 3 of the cover of the *Canadian Naturalist and Geologist*, there is an advertisement to the effect that William Couper is the successor to the late George Hadgraft, Naturalist, and that he is prepared to execute orders for preserving and stuffing specimens of natural history to imitate life. He offers to supply museums with the skins of American birds and with the eggs and skins of Canadian birds. A later advertisement gives his address as 9 Carleton Street, Toronto, 1859, and a still later one (December, 1859) as 75 St. Paul Street, Quebec, L.C.

In the *Canadian Naturalist and Geologist* for February 1858 (Vol. 3, pp. 24-25), Couper started a series of articles under "Entomology, No. 1." In his first paper he devoted two pages to the idea that the knowledge of entomologists is useless unless it is made available to others. In his second paper, which apparently ended the series (Vol. 3, June 1858, pp. 177-182), he wrote a paper for collectors dealing with various specimens which he had captured. In 1862, in the same journal, he wrote "On the destruction of apple trees by *Saperda candida* in districts surrounding Quebec," in which he mentioned the habits of the beetle, its ravages, and means of control, all accompanied by illustrations showing the adult, larvae, and infested branches.

In 1863, the Entomological Society of Philadelphia published in its *Proceedings* (Vol. 1, pp. 370-72), Couper's paper on the "Importance of Insect Architecture to Entomologists." This is a general paper, covering galls, tubes of caddis-fly larvae, wasp nests, cocoons, etc., of which he had a collection of 6,000 specimens. His remarks on tent-building ants occupy the next two pages of the *Proceedings* (Vol. 1, pp. 373-374).

Couper's entomological interests were not restricted, and he did not confine himself to one group to the exclusion of everything else. He wrote in 1864 "On the Larva of *Attacus polyphemus*" (*Canad. Nat. & Geol.*, n.s., Vol. 1, No. 5, Oct., pp. 376-377), describing his capture of two caterpillars, their feeding, spinning, etc., and his surprise upon finding them feeding on sweet briar. In No. 6 of the same publication (Dec. 1864, pp. 444-446), he published "On a gall-producing Hymenoptera reared from *Triticum repens* Linn.," which he identified as *Eurytoma fulvipes* Fitch, although Baron Osten-Sacken would not venture more than the generic name. A few life history notes are given and further study is urged. In 1865, he wrote a description of the male of "*Alypia langtonii*" (*Canad. Nat. & Geol.*, n.s., Vol. 2, No. 6, Dec. 1865, pp. 460-461); "Canadian Insect Architecture," (*Canad. Nat. & Geol.*, n.s., Vol. 3, No. 6, pp 461-465), a general account of the nest of Eumenidae, the work of mason bees, wasp cells, and eggs of a geometrid moth, with several illustrations by Geo. Jno. Bowles; "Descriptions of New Species of Canadian Coleoptera" (*Canad. Nat. & Geol.*, n.s., Vol. 3, No. 1, Feb. 1865, pp. 60-63), in which eleven species are described; "Description of a New Species of *Alypia*," this being the female.

Couper's earliest published entomological writings were probably those that appeared in *The Canadian Journal, a Repertory of Industry, Science and Art*, previously mentioned, which made its initial appearance in Toronto with the issue of August 1852. To Volume 3, 1855, (pp. 324-325), Couper contributed "Coleoptera Collected in Canada," a list of 12 species with short descriptions; "Canadian Coleoptera in the Collection of Fred. H. Ibbetson, Assistant Commissary General, Montreal" (Vol. 3, 1855, pp. 325-327), a list of 125 species and varieties arranged according to Melsheimer's *Catalogue*; "Vermes in Grasshoppers" (Vol. 3, 1855, pp. 355-377), a short paper telling of the occurrence of what he believed to be a species of *Echinorhynchus*; and "Coleoptera Collected in Canada" (Vol. 3, Nov. 1855, p. 376), in which 12 species appear together with brief descriptions.

In the interesting and detailed account of William Couper by James L. Baillie, Jr. (*Canad. Field Nat.*, Nov. 1929, pp. 169-176), it is stated that he came to Canada in 1842 from England and settled in Toronto, where he worked as a journeyman printer in the *Globe* office. Couper collected in all orders and was particularly interested in the distribution of Coleoptera during the early period of his entomological activities. At this time, books were scarce and systematists few. In the autumn of 1852, Couper prepared a collection of insects and insect architecture which was exhibited at the Provincial Fair, held at Toronto. In 1863, he published three naturalists' calendars for the Toronto area, recording the first appearances of various butterflies, moths, birds, dates on the ripening of wild fruits, notes on mammals, reptiles, etc. In 1855, he was elected to membership in the Canadian Institute (established in 1849) and by 1859 he had given up his trade and appeared as a naturalist, entomologist, and dealer in artificial eyes. In 1857, the museum of McGill College acquired Couper's collection of Toronto insects, which included 2,400 specimens in which there were 700 species of beetles. As early as 1855, he was a corresponding member of the Natural History Society of Montreal and in 1856 of the Literary and Historical Society of Quebec. In 1859, the latter part of the year, he was living in Quebec, and during his residence there he continued his collecting activities and published the results of his studies, as already noted. In 1862, he was a corresponding member of the Entomological Society of Philadelphia. In 1864, he was a member of the commiittee on insect architecture and in 1865 of the committee on Coleoptera and Diptera of the Entomological Society of Canada. In this latter year, he was made curator of the Quebec branch of the Society. In 1868, Couper was living in Ottawa, in 1871 in Montreal, in 1884 in New York state, at 114 Fourth Street, Troy, at his son's house where he is supposed to have died about 1890.

In 1864-65, he published his "List of Coleoptera taken at Quebec and other parts of Lower Canada" in the *Transactions of the Literary and Historical Society*, in which he described 13 species new to science. His later activities involved the collection of birds eggs along the north shore of the Gulf of St. Lawrence, the publication of his results the contribution of articles to the *Canadian Entomologist*, during the first and later years of its existence, an interest in spiders, more collecting trips to the north shore of the Gulf of St. Lawrence, correspondence with various entomologists and naturalists, articles on the fishes, mammals and birds of Canada, the organization of the Montreal branch of the Entomological Society of Ontario, the exhibition of specimens, the collection and sale of specimens, the editing of the *Transactions of the Ottawa Field-Naturalists Club*, etc., etc. He was an all-around and fully informed naturalist, and as one of the earliest observers and writers on insects in Canada, he added much to the store of knowledge of that country.

MORE JOURNALS

Mr. E. W. Billings in 1857 supplied an article entitled "Notes on the Natural History of the Mountain of Montreal" to the *Canadian Naturalist and Geologist* (Vol. 2, pp. 92-101), in which he referred to a few species of birds, Lepidoptera and shells. He mentioned *Vanessa antiopa* and *Arctia isabella* and included some records of collectors of *V. antiopa* in England.

In 1862, William Hincks thought that by publishing fragmentary portions of a provisional Fauna Canadensis, the cultivation of the zoological sciences in Canada would be stimulated, and that the accumulation of such material would be helpful to future workers.

Accordingly, he published in the *Canadian Journal* for that year (n.s., Vol. 7, pp. 446-461; pp. 484-502) a paper entitled "Materials for a Fauna Canadensis," and started with the Neuroptera to illustrate his proposal, giving a synopsis of the Canadian Neuroptera, a key to the families, an analysis of one family into subfamilies, another into genera, keys to several genera, and descriptions of several species found in Canada and in parts of the United States. The whole paper was an introduction to the classification of the Neuroptera. It appeared in two parts, the first devoted to dragon flies and the second to caddis flies. Hincks was undoubtedly influenced by Hagen's work on the Neuroptera.

In 1863, William Saunders, in pursuance of the suggestion made by Professor Hincks, published in the *Canadian Journal* (Vol. 8, pp. 349-377) a "Synopsis of Canadian Arctiadae [sic], including some Additional Species likely to Occur in Canada." This was accompanied in the same year by a paper by Charles J. S. Bethune (Vol. 8, pp. 1-16) on "Descriptions of some Species of Nocturnal Lepidoptera found in Canada" and in 1865 (Vol. 10, pp. 247-260) by another paper called "Nocturnal Lepidoptera Found in Canada" by the same author.

At this time books on natural history, especially for the use of beginners, were scarce and many amateur entomologists and collectors had no access whatever to published writings that would help them.

William Stewart M. d'Urban sub-curator of the Montreal Natural History Society, contributed in 1857 a lengthy paper to the *Canadian Naturalist and Geologist* (Vol. 2, July 1857, No. 3, pp, 161-170) called "Notes on Insects now injuring Crops in the vicinity of Montreal." He dealt mainly with cutworms and wireworms, mostly the former, although *Calosoma calidum* and the turnip beetle (*Haltica* sp.) are noted. For control, he recommended the digging of holes so that the cutworms would fall into them at night, the construction of a deep trench around a field, and the digging and destruction of them by hand. In the same issue (Vol. 2, July 1857, p, 227), d'Urban had a note on *Calosoma calidum* illustrated by a figure so that "non-entomologists" could recognize this useful species. *The Canadian Naturalist and Geologist* in 1857 and 1858 carried a series of papers under the general title, "On the order Lepidoptera, with the description of two species of Canadian Butterflies (Vol. 2, pp. 215-226; pp. 310-318; pp. 346-355; vol. 3, pp. 346-351; pp. 410-419). The first is an elementary systematic paper mostly on the family Papilionidae and genus *Papilio*. The second is a continuation of the subject, entitled "Descriptions of four species of Canadian Butterflies." The third part describes four species of Canadian butterflies, and the fourth, two species. The fifth is called "Description of a Canadian Butterfly and some remarks on the Genus *Papilio*." This last paper is signed William Stewart M. d'Urban, and apparently, he was the author of the series. The descriptions are not those of new species. Black and white illustrations accompany three of the papers.

In the December 1858, issue of the *Canadian Naturalist and Geologist* (p. 417), d'Urban criticized the work of E. Emmons, "Insects of the State of New York" (Vol. 5, of *Agric. of N. Y.*, Albany, 1854, $7.50), saying that it was inaccurate and that the figures were so badly done as to make it of little value to entomologists. However, he thought that as it contained figures and descriptions of some Canadian butterflies, it might be of some value to a beginner in helping him to name his specimens.

Three more papers by d'Urban were published in the *Canadian Naturalist and Geologist* previous to 1865. One was his "A Systematic List of Coleoptera found in the Vicinity of Montreal" (Vol. 4, 1859, pp. 307-320; and continued on pages 494-496). This was the result of two season's collecting, and Dr. J. L. LeConte named a large number for him. Dates, habitats and other notes are given. Another was his "A Systematic List of Lepidoptera collected in the vicinity of Montreal" (Vol. 5, pp. 241-266, 1860). This paper was dated January 4, 1860, Exeter, Devonshire. Upon his arrival in England in the autumn of 1859, d'Urban placed his Canadian Lepidoptera before Mr. Francis Walker, who named them and described the new species. This material d'Urban published in his "List." The third paper was entitled "Catalogue of Coleoptera Collected by George Barnston, Esq., of the Hon. Hudson's Bay Company, in the Hudson's Bay Territory" (Vol. 5, pp. 227-229, 1860). In the opening note, d'Urban, from Montreal, June 2, 1859, wrote that as Doctor LeConte had expressed a wish to examine any Coleoptera from the Hudson's Bay Territories, Mr. Barnston placed his collection in his (d'Urban's) hands for transmission to Philadelphia. Doctor LeConte furnished d'Urban with the list as presented.

George Gibb, M.D., M.A., F.G.S., member of the Canadian Institute, presented to the Natural History Society of Montreal, a paper "On the Generation of Sounds by Canadian Insects" that was published in 1859 in the *Canadian Naturalist and Geologist* (Vol. 4, No. 2, pp. 121-130). It was a general article covering cicadas, crickets, locusts, the "death-watch," Lepidoptera, etc., and of a type that one would expect a teacher to present to a class.

Entomological publications by Canadian authors were scarce at this time. In William Sharswood's, *Bibliographica liborum Entomologicorum*, published in *Linnaea Entomologica*, Leipzig, Germany, in 1860, papers by only four Canadian authors are listed — E. Billings William Couper, W. S. d'Urban and George Gibb. Apparently there were no others.

In 1861, D. W. Beadle, of St. Catherine's, C. W., published in the *Canadian Naturalist and Geologist* (Vol. 6, pp. 383-387) his paper, "List of Coleopterous Insects Collected in the County of Lincoln, C. W.," the specimens having been named by Dr. John LeConte. On the second cover page of the April 19, 1862 issue of the *Canadian Naturalist and Geologist*, there is a notice signed C. J. S. B., saying that he is preparing with the help of William Saunders of London, C. W., a list of all persons who study entomology in Canada, or who collect Canadian insects. The list was to be published in the *Canadian Naturalist* and both C. J. S. B. and Mr. Saunders wanted the names of the groups in which each person was interested. C. J. S. B. was, of course, the well-known Rev. Charles J. S. Bethune of Cobourg, C. W.

In the next number of the *Canadian Naturalist*, for June 1862, there was a "List of Entomologists in Canada" by C. J. S. Bethune, who stated that it was larger than anticipated and who suggested a club with meetings once or twice a year, at some central place. A list of thirty-six names and addresses followed, and all orders of insects were represented.

On the evening of Friday, September 26, 1862, nine or ten entomologists met at the home of Prof. H. Croft, of Toronto, but it was decided that owing to the small number present, a definite organization should not yet be formed, and that another meeting should be held during the coming spring. However, it was agreed that the objects of the society should be a complete collection of Canadian insects, to be kept in some central place for reference and study, and a depository of duplicate specimens for exchange and distribution among the members, and furthermore, regular meetings for mutual information and the advancement of science.,

Professor Croft's collection was then examined. He collected in all orders, especially Hymenoptera and Coleontera, and his beetle collection was the finest in the province. Professor Morris exhibited a number of rare specimens of Lepidoptera at this meeting. Professor Beverley R. Morris, M.D., who collected in all orders, especially Coleoptera and Lepidoptera, was connected with the Institution for Deaf and Dumb and the Blind, 490 Queen St., Toronto. Mr. Saunders and Mr. Bethune were present, and Mr. Saunders, whose insect collection had taken the first prize at a recent Provincial Exhibition, exhibited rare specimens of Lepidoptera. Other members exhibited specimens also, mainly Coleoptera and Lepidoptera.

On Thursday, April 16, 1863, a meeting was held in the library of the Canadian Institute for the purpose of forming a society. Nine

were present. Professor Hincks, who taught botany and zoology at the University of Toronto was elected temporary chairman, and Bethune, secretary protem. Letters were read from a number who could not attend, but who promised their support. Resolutions were then adopted agreeing that the Entomological Society of Canada should be formed, that the officers were to consist of a president, a secretary-treasurer, and a curator, each to be elected annually, that dues would be two dollars in advance, that application be made to the Canadian Institute for a meeting room, that two separate collections be formed, a general one to be the property of the Canadian Institute and a duplicate one, to be the property of the society and to consist of surplus specimens, for exchange purposes, under the supervision of the curator, that meetings be held at 3.00 p.m., on the first Tuesday of each month.

Professor Croft was elected president, Mr. William Saunders, secretary-treasurer, and Mr. J. Hubbert, curator. Mr. Bethune then read a paper on "Insect Life in Canada, March and April," and Mr. Saunders read "It Synopsis of Canadian Arctiidae." Following this, various specimens were exhibited. Those present were the Rev. Prof. W. Hincks, F.L.S., Prof. H. Croft, D.C.L., who taught chemistry at the University of Toronto, Beverley R. Morris, M.D., J. H. Sangster, A.M., principal of the Normal School, Toronto. J. Hubbert, of Knox's College, Toronto, who was especially interested in the Diptera and Neuroptera, Thomas Cowdry, M.D., and his son, H. Cowdry, both of York Mills, County of York, C. W., the Rev. C. J. S. Bethune, M. A. Cobourg, and W. Saunders, of London. Dr. Beverly R. Morris later returned to England where he edited a popular magazine of natural history.

At the December 8, 1863, meeting, various donations were received and a letter from Mr. Saunders was read relative to the practicability of publishing a catalogue of all known Canadian insects. After some discussion, it was decided that the society take immediate steps to prepare and publish catalogues of the Coleoptera and Lepidoptera, these to be followed by catalogues of other orders as soon as possible. Committees were named for this work.

The specimens of Orthoptera collected by Samuel H. Scudder during a canoe trip in the summer of 1860 from the Red River settlements to The Pas on the Saskatchewan River and during a few days' stay at Fort Garry were set forth under the title "List of Orthoptera collected on a trip from Assimoboia to Cumberland" by Samuel Scudder and published in the *Canadian Naturalist and Geologist* in 1862 (Vol. 7, pp. 283-288). The trip extended over the exact route taken by Sir John Richardson when he made the collections forming the basis of Kirby's work on the "Insects of Boreal America." Scudder collected the few species described by Kirby, and thus brought Kirby's species out of obscurity.

Under the title "An Entomological Grave Digger," Vincent Clementi B. A. Cantab, in a letter in 1862 to the editor of the *Canadian Naturalist* (Vol. 7, pp. 317-319), described the work and activities of one of the fossorial wasps, or sand wasps. He did not send specimens, so that its identity could not be specifically determined. The Rev. Vincent Clementi's name occurs in Bethune's list of Canadian entomologists, from Peterboro, C. W. and he was interested in Coleoptera and Lepidoptera.

On November 24, 1862, E. Billings. F.G.S., read before the Natural History Society of Montreal a paper on "Notes on some of the habits of the pine-boring beetles of the genus *Monohammus*." This was printed in 1862 in the *Canadian Naturalist and Geologist* (Vol. 7, pp. 430-438). Billings spoke of the value of Canadian forests and of the necessity for the study of insects. The paper is an economic one and only four species were known in that genus from Canada. Billings noted the habits, damage, etc., and said that although it seemed almost impossible to protect forests against insects, no one knew. What might be achieved by close study.

In 1863, Robert Paterson, M.D., published an article "On Ailanthine. The silk yielded by the *Saturnia* or *Bombyx cynthia*, with Remarks on the *Ailanthus glandulosa* or False Varnish Tree of China" (*Canad. Nat. and Geol.*, Vol. 8, pp. 260-268), which he had read before the Botanical Society of Canada January 26 of that year. At a meeting of the Quebec Branch of the Entomological Society of Canada held July 7, 1864, Mr. G. J. Bowles read a paper "On the Occurrence of *Pieris rapae* in Canada" (*Canad. Nat. and Geol.* n.s., Vol. 1, pp. 258-262). He had captured specimens in the summer of 1863 in the vicinity of Quebec, and Mr. Saunders had identified them. Mr. Bowles speculated as to how it had reached Canada, described the adult male and the larvae and referred to its parasites. Mr. Bowles was secretary of the Quebec Branch. The first annual meeting of this branch was held January 5, 1865, in the evening, in the rooms of the Literary and Horticultural Society. Mr. F. J. S. Dore presided. After donations were announced, various specimens were exhibited. The founders of this society were in favor of uniting with the Entomological Society of Canada at Toronto rather than having a distinct organization, and the proposals they made to Toronto were accepted. At the time of this meeting, the Quebec Branch had ten members. The president was F. J. S. Dore; vice president, Abbe Brunet, professor of botany at Laval University; secretary-treasurer, G. J. Bowles; curator, W. Couper; members of the council, R. H. Browne, A. L. Russell and G. C. Gibsone.

The last paper to be mentioned in this account is "Descriptions of three new species of Canadian nocturnal Lepidoptera," by C. J. S. Bethune. This was published in 1865 in the *Proceedings of the Entomological Society of Philadelphia.*

WILLIAM SAUNDERS (1836-1914)

W. Saunders in 1862 (*Canadian Nat. and Geol.*, Vol. 7, pp. 130-132) published a "List of the Diurnal Lepidoptera collected (unless otherwise noted) in the immediate vicinity of London, C. W.," and appended notes as to their abundance. During the same year the author sent a new paper "On some hitherto undescribed Lepidopterous larvae" to the *Proceedings of the Entomological Society of Philadelphia* (Vol. 2, pp. 28-30). In this he described the larvae of *Arctia americana*, *Catocola*, *Plusia*, etc., and mentioned their food plants. In 1863, Saunders described two new species of Arctiidae (*Proc. Ent. Soc. Phila.* vol. 2, pp. 59-60). He had just started his entomological career at this time and after 1865, many papers on the Lepidoptera came from his pen.

William Saunders accomplished much in spite of the few opportunities he had for a liberal education. He was born in Crediton, Devonshire, England, June 16, 1836, and came to Canada with his parents when he was twelve years old. He was able to obtain a technical training in chemistry, and in view of this he started in business in London, Ontario, as a retail druggist. His liking for nature led to the collection of plants and insects, and eventually he became an enthusiastic student of botany and entomology. His activity and care in preparing fluid extracts from medicinal plants, readily obtainable, led finally to the establishment of a paying wholesale and retail business. When he became Director of the Experimental Farms of the Dominion, as he did years later, his business was transferred to his sons. He was also interested in fruit growing and had a farm of his own near the city. For many years he was a director of the Ontario Fruit Growers' Association, and from 1882 to 1885, its president. On August 1, 1857, he married Sarah Agnes of London, Ontario. His death took place September 13, 1914, after an illness of two years. Doctor Saunders belonged to many scientific societies in the United States and Canada, and during his later years he received many distinctions and honors. His notable book *Insects Injurious to Fruits* was published in Philadelphia, Pa., 1883. In 1868, Doctor Saunders and C. J. S. Bethune began the publication of the *Canadian Entomologist.* He led a busy, useful and active life.

GEORGE JOHN BOWLES (1837-1888)

George John Bowles whose name has been mentioned several times, was for many years an active and valued member of the Entomological Society of Ontario and an able contributor to the magazine and annual report. He was born in Quebec on June 14, 1837, being the oldest son of John Bowles, a tradesman. His family in 1844 moved to Three Rivers in the Province of Quebec and lived there seven years, returning to Quebec in 1851. Bowles' formal school education was finished by studies at the Three Rivers Academy. For nineteen years he was a bank clerk in Quebec, eventually becoming assistant cashier.

It was not until about 1863 that he became interested in entomology and in this he was helped by Professor Saunders and Mr. William Couper. Between 1863 and 1872 much of his spare time was devoted to collecting Lepidoptera in the vicinity of Quebec and in studying the injurious insects of the locality. His papers were published chiefly in the *Canadian Naturalist and Geologist*, the reports of the Montreal Horticultural Society, and in the *Canadian Entomologist.*

In 1872, he moved to Montreal to become secretary-treasurer of the British American Bank-Note Company, a position he held until his death. His cabinet of insects was transferred to the museum of McGill University.

CHAPTER XII

ENTOMOLOGY IN EUROPE DURING THE PIONEER CENTURY IN AMERICA

The development of entomology during the period covered by this book parallels somewhat the economic development of the country. The earliest settlers were conquering the country and living on the natural food resources of the Atlantic Coastal Plain as best they could. In the midst of game and wild products of the earth they were frequently close to starvation, as they were too civilized to live like the Indians. At such a time, insects interested them only when certain species became annoying or troublesome.

As the settlers became more numerous, as agriculture developed, as explorers increased, the entomological fauna slowly became known and economic insect pests forced their attentions upon the planters. Many Europeans were interested in American insects, and numerous were the specimens sent to Europe by settlers and by explorers who came here to collect specimens of natural history. In 1687, the population of the settlements was small. Boston, Philadelphia and New York were the centers of internal trade, and by 1700 Boston had approximately 7,000 inhabitants, Philadelphia, about 5,000, and New York, less than 4,500. By 1763, the colonists, hampered by almost constant warfare with the Indians, had succeeded in clearing and settling a strip of Coastal Plain, about one hundred miles wide. Following the Treaty of Paris in 1763, which removed the French and Indian menace, pioneers quickly moved outward into Maine, New Hampshire and Vermont, and after the Revolution immigration continued into northern New England until by 1812 nearly all the farming land had been taken up. Meanwhile, settlers from New England had been moving to western New York, and from the older settlements of Pennsylvania the stream moved over the Alleghenies and into the valleys of Ohio. During such times, entomology was relatively unimportant, except for a few troublesome species that were prevalent in the older farming communities. With the growth of agriculture, there was the birth of agricultural societies and eventually these societies were forced to consider insect pests as well as soil fertility, crop adaptation, and other agricultural matters. Through these societies, knowledge was received and spread, and in many cases new work was supported and encouraged. Their transactions and memoirs dealt with observations and experiments. Frequently premiums were offered for methods of destroying insect pests, new methods of soil improvement, etc. Encouraged by state funds, county societies were established for a short time and then declined under a period of state aid, and then, beginning about 1835 to 1840, state legislatures were appealed to on all sides for appropriations for county societies, for establishing state boards of agriculture, for agricultural schools, for crop bounties, for surveys, and for studying injurious insects. So along with other things, entomology slowly developed.

The type of entomology prevalent at different periods and its slow development along different avenues is brought out in the previous chapters and there is no need to summarize or to repeat what has been said. However, the Americanization of entomology began with the activities of Thomas Say and gradually developed with the advent of other American workers. While America was going through the labor of entomological development, the science was operating on a comparatively high level in Europe, and had it not been for men like Say and his followers, this country, so far as entomology is concerned, would have followed European standards of thought much longer than it did.

During the time that travelers in America were making incidental observations on insects, a revival of interest in science was taking place in Europe (1550-1650) and we have such men as Edward Wotton, Thomas Mouffet, Conrad Gesner, Ulysses Aldrovandi, and John Jonston repeating the statements of Aristotle, Pliny and others instead of studying nature itself. In a strict sense these men were not entomologists, but naturalists, because of their wider interests. Nevertheless, they wrote about insects. Although the erudition of the encyclopedists continued to be republished, the next century with its lenses and microscopes saw the beginning of descriptive morphology, of better classification and even of experimentation.

JOHN RAY PERIOD

The period of encyclopedic entomologists was followed by one (1650-1750) known as the Ray Period, which included such investigators as Malpighi, Redi, Swammerdam, and Ray. These men were original workers and did not follow the footsteps of the ancients. During this period the beliefs of the past relative to the origin of many of the smaller animals were exploded. To Swammerdam should go the credit for founding our knowledge of the general anatomy of insects. Malpighi was the author of the first published work on the internal anatomy of insects, and Redi was the father of experimental entomology. Although John Ray's influence was on zoology in general, he and Francis Willoughby wrote *Historia Insectorum*, published in 1700, in which their classification was based largely upon the work of Swammerdam. Ray was the first to define species and to bring the conception into natural history.

To the Ray Period belongs Johann Goedart, who wrote a three-volume work on the metamorphoses and natural history of insects, which, while fanciful in many places, contains good observations on the habits of the Lepidoptera. Of this period also are Antony van Leeuwenhoeck, and Robert Hooke, microscopists and improvers of the compound microscope; Martin Lister, who wrote entomological articles and translated or republished the works of Goedart, and Ray; Maria Sibylla Merian, whose finely engraved, colored plates and her enthusiasm in studying the insects of Dutch Guiana will always be remembered; Eleazer Albin, who engraved and colored his own plates for his *Natural History of English Insects* (1720); Antonio Vallisnieri, the physician and naturalist of Padua, who, among other things, proposed a classification of insects based upon habits; Johann Leonhard Frisch, of Berlin, who wrote a valuable work in thirteen parts (1720-38) containing matter relative to many common injurious insects; Mark Catesby, whose work has been mentioned in detail on previous pages; and lastly René Antoine Ferchault Reaumur, whose work on the habits and metamorphoses of insects stands today as a monument to the soundness of his views and as one of the most important contributions ever made to the science of entomology. Reaumur, with his embracing vision, his keenness of observation and his conception of the importance of the study of insects, was one of the great leaders of the past.

LINNAEAN PERIOD

Following the Ray period, we come to that of Linné and his contemporaries, which is characterized by the establishment of a binomial system of nomenclature instead of the old descriptive phrases, and by fixed definitions of genera and species by Linné, DeGeer, Schaeffer, Bonnet, Clerck and Scopoli. Linné was a born systematist and his isolation developed independence and originality. He devised new classifications and systematized the knowledge of his predecessors. His system, based on a few external characters, was recognized by him as artificial and provisional and was intended as a move toward something better. In a speech delivered in 1743, he

held that each species of animal originated from a single pair, and cited as incontrovertible proof the Mosaic account of creation. In comparison with present knowledge, his familiarity with the fauna of the world was, of course, limited. In the tenth edition of his *Systema Naturae* (1758), the binomial system was adopted. In this edition he divided insects into the seven orders: Coleoptera, Hemiptera, Lepidoptera, Neuroptera, Hymenoptera, Diptera, and Aptera. His Coleoptera included the modern orders, plus Forficulida and Orthoptera; his Hemiptera, the Thysanoptera; and his Neuroptera, all the modern orders of Ephemerida, Plecoptera, Isoptera, Corrodentia, Platyptera, Neuroptera, Mecoptera, Trichoptera, and Odonata. In the Aptera, he placed all insects without wings or elytra except the female Mutillidae and included also all the arthropods which today are classed as Arachnida and Myriapoda. In each order were a small number of genera not arranged into families.

Linné recorded about 2,400 species of insects, the largest part of which he described. Of the insects described by him, about 300 occur in the United States, most of them having been described from Europe and some from South America. From Ray and from the scholastic system, Linné inherited the dogma of the separate creation and objective reality of species, and this became strengthened as a result of his observations. The resemblances between individuals of a single species was thought to be due to descent from an original pair. In later editions of his *Systema*, he held that "all the species of one genus constituted at first (at the Creation) one species; they were subsequently multiplied by hybrid generation, that is, by intercrossing with other species."

Carl Alexander Clerck, who wrote several important papers on insects and an illustrated work on spiders, used the binomial system in 1757, one year earlier than Linné's 10th edition. Clerck was a Swedish painter and a pupil of Linné. Another contemporary of Linné was Benjamin Wilkes, whose works appeared from 1741 to 1773. He was the author of 120 copper plates, in color, of English Lepidoptera, depicting their food plants and various stages of development. Pierre Lyonet, an engraver and interpreting secretary to the United Provinces (Holland), and Christian Sepp, a copperplate engraver of Amsterdam, both wrote works on insects, the former in 1760, and the latter from 1762 on. In 1766 and 1778, Jacob Christian Schaeffer's principal works appeared, both with numerous copperplates, the former being *Elementia Entomologica* and the latter *Icones Insectorum circa Ratisbonam indigenorum.*

Baron Carl DeGeer, the celebrated naturalist and entomologist, was also a pupil of Linné. He was one of the first to study the life histories of insects and he devised a system of classification based on the wings and mouth parts of insects. About 20 species of American beetles were described by him, and his entomological works appeared under about twenty titles, the most important being his *Memoirs pour servir a l'histoire des Insectes*, which appeared in Stockholm from 1752 to 1778. He was born in Finspang, Sweden, February 10, 1720, and died in Stockholm, March 8, 1778.

Other noteworthy authors of entomological works during this period were Charles Bonnet. Jean Antoine Scopoli, and Etienne Louis Geoffroy, the last being the author of a system of classification in which, in the Coleoptera, the number of tarsal joints was first made use of as a means of separation. Bonnet should be remembered for having discovered the continuing fertility of plant lice in the absence of males. During the period under consideration, many of the publications were illustrated by excellent and beautifully engraved colored plates, which have never been surpassed.

1775 to 1825

Descriptive and systematic entomology flourished in Europe during the fifty years from 1775 to 1825. Material was plentiful and easy to collect, and systematic entomology was not intricate as it has now become. Entomological societies were formed and journals devoted to entomology appeared. The naming of insects went on apace. The pupils and followers of Linné were numerous and included Eugen Johann C. Esper, who worked on the butterflies of Europe and foreign countries; Johann Friedrich Wilhelm Herbst, military chaplain in Berlin, whose works were popular and technical; Carl Peter Thunberg, who succeeded Linné as professor of natural history at Uppsala, and whose work was chiefly descriptive; Franz von Paula Schrank, of Bavaria, whose work was general; Pieter Cramer, an Amsterdam merchant who published 400 colored plates of exotic butterflies; Francois Huber, well known for his work on bees; George Wolfgang Franz Panzer, a Nürnberg physician, who wrote *Deutschlands Insecten* (1793-1813) with colored illustrations of each species; Jacob Hübner, an artist of Augsburg, who worked on the Lepidoptera of Europe and foreign countries; Pierre André Latreille, in whose works published in Paris from 1802 to 1806, families were first used as subdivisions of orders, and to whom we are indebted for a system of classification based on a combination of characters — transformations, wings, mouth parts — formerly employed alone, and for excluding Myriapods, Arachnida, and Crustacea from the class Insecta; Lepelletier, who wrote generally and on the Hymenoptera; Bracy Clark, an English veterinary surgeon, who wrote on the Oestridae; Jacob Sturm, a Nürnberg physician who published hundreds of colored copperplate illustrations of German insects; Johann Carl Wilhelm Illiger, whose catalogues and entomological magazine are so well known; Johann C. T. Friedrich Klug, a Berlin physician who wrote chiefly on the Hymenoptera; Johann Ludwig Carl Gravenhorst of the University of Breslau, who was interested in the parasitic Hymenoptera; Marchese Maximiliano Spinola, of Genoa, who wrote descriptive papers in French and Italian; Leon Dufour, a French physician, whose work was anatomical and descriptive; Johann Wilhelm Zetterstedt, professor in Lund, interested in the Diptera; Ernst Freidrich Germar, founder of *Germar's Magazine*; and so on.

Various species of American Diptera were named by Carl Friedrich Fallen (1764-1830), the Swedish entomologist and by the German entomologists, Johann Wilhelm Meigen (1763-1845) and Christian Rudolph Wilhelm Wiedemann (1770-1840).

JOHANN CHRISTIAN FABRICIUS (1745-1808)

In addition to the above mentioned entomologists, there are others who deserve equal, if not more attention, on account of their identification with American entomology. Johann Christian Fabricius, for instance, next to Linné, described more of the common insects of Europe than anyone else. He also described a large number from North America and other parts of the world. He was born at Tondern, Schleswig [now Germany], Denmark, January 7, 1745, and died at Kiel [Germany], March 3, 1808. He was principally a systematist and he devised a system of classification in which the mouth parts were used to separate orders. Of his 13 orders, only one, the Odonata, is recognized today. According to Essig (1931), Fabricius named the first insect collected on the Pacific Coast, a beetle, *Carabus taedatus* Fabr., supposed to have been taken by a member of James Cook's third voyage at Unalaska.

GUILLAUME ANTOINE OLIVIER (1756-1814)

Guillaume Antoine Olivier, who was born in France in 1756 and died in 1814, was the author of a great work on Coleoptera, *Entomologie ou Histoire Naturelle des Insects*, which was published in parts in Paris from 1789 to 1808. Some 300 species from North America are cited in this work. Horn, in reviewing the American species in Olivier's work in 1886, said that the vast majority of American beetles had been previously described by Fabricius, Olivier himself coming next in order, while a few are cited from Linné, DeGeer, Drury, Swederus and Herbst.

WILLIAM KIRBY (1759-1850)

Mention should be made here of William Kirby, the father of