LEPIDOPTERA NEWS

MARCH / JUNE 2002
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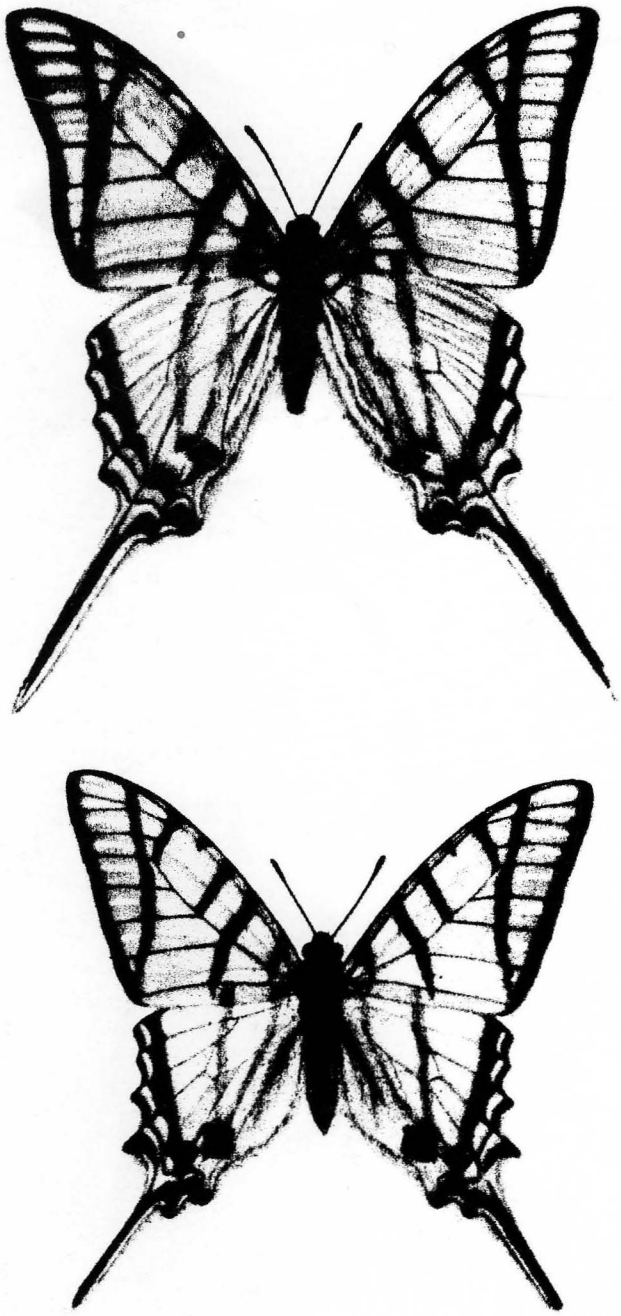

LEPIDOPTERA NEWS

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The Association for Tropical Lepidoptera, Inc., is a non-profit organization for the support of research on the biology, systematics, and conservation of tropical and subtropical Lepidoptera of the world. Funding for the Association helps to support research projects, field studies, and publications on tropical and subtropical Lepidoptera. The Association was organized in 1989 in Florida as a tax-exempt corporation under Section 501(c)3 of the IRS Code and is a publicly supported organization as defined in Sections 170(b)(1)(vi) and 509(a). Contributions are tax deductible in the United States.

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TO OUR READERS

This issue presents *Lepidoptera News* in a revised format and in line with our color journals. As noted to the membership in past issues, *Lepidoptera News* will now also have regular articles, in addition to member news, letters to the editor, book news, and other *News* features. Authors will now have a venue for publication without page charges. Only color will be at an extra charge. Color can be added on the inside covers, front and back, at modest cost (separate color inserts are also possible but the charges for these will be higher, due to added work for the printer).

Our *Lepidoptera News* cover and masthead page are changed with this issue to reflect the more extended role of *Lepidoptera News*. Line art or color photographs for covers are always welcome whenever you find or draw an appropriate image. Scientific articles will have the same peer review and referencing in *Zoological Record* as do articles in our color journals, *Holarctic Lepidoptera* and *Tropical Lepidoptera*; the only difference is the page charges needed for the full-color journals due to the excessive costs involved in having color dispersed throughout an issue. We have also transferred *Lepidoptera News* to a perfect bound binding process: this has been considered for some time inasmuch as 60-page issues nearly approach the limit of what one can bind with spine stapling. The printer uses a good binding, so the perfect binding should hold up well even with active use.

In this issue we have reprinted an interesting essay from Scudder's 1889 *Butterflies of New England*: any member who can decipher the identity of "C.H.B." is encouraged to send in a report. Nothing in Scudder's work could be found to identify this art historian. The images have been added to the current reprinting of the text (the Greek text sections are from the original, however).

This issue also starts a new series of faunal treatments of Lepidoptera. Most books that treat the fauna of a particular region generally have an introductory section on aspects of the region as they pertain to Lepidoptera, such as vegetation, climate, seasonality, habitats for different species of Lepidoptera, and so forth. Such introductions are exceedingly useful in planning trips to such regions, so we have contacted authors and/or publishers where possible to obtain permission to reprint such sections from various books. These faunal synopses and introductions should be useful to members and we hope to continue them as space permits, hopefully with a new region with every issue of *Lepidoptera News*. For March 2002, we have the introductory notes provided by the late Jan Kielland, from his book entitled *Butterflies of Tanzania*. Most of these notes that will be reprinted will involve books on butterflies, since few such works exist for moths, but clearly the introductory notes will serve enthusiasts of either group.

We have some scientific articles in this issue, plus another of Gerardo Lamas' updates on butterfly literature for the Neotropical region. The literature reviews are part of Dr. Lamas' earlier compendium on the Neotropical butterfly literature which ATL published a few years ago (in the *Atlas of Neotropical Lepidoptera* series), as well as part of his editing of the new butterfly catalog for the entire Neotropical region which we hope will be ready for printing later this year: this catalog is a collaborative effort of several specialists and will be the first modern, comprehensive, and detailed nomenclatural catalog for the Neotropical butterflies, for the area from the U.S.-Mexican border south to Cape Horn, including the West Indies.

J. B. HEPPNER
Executive Director

NOTES FOR MEMBERS

1. **2003 Annual Meeting**: September 25-28 in Gainesville, Florida. The 2003 meeting will be a Lepidoptera symposium to coincide with the opening of the new McGuire Center for Lepidoptera Research. The meeting and festivities are planned as a 2-year sequence, with the first phase (2003) for the building opening and the second phase (the 2004 meeting) for collection opening after an 18 month long curation effort to organize the initial collections that will be housed in the McGuire Center.

2004 – ATL Annual Meeting and Lepidoptera Symposium, Gainesville, Florida (date to be announced)

2006 – Lepidoptera symposium and joint meeting of ATL and the Lepidopterists' Society, Gainesville, Florida, June 30-July 3.

2. **Annual Photo Contest**: deadline is March 15 each year, but for the second year there were insufficient entries to be able to hold any contest. Once the membership wants another photo contest, then we can renew this effort, perhaps every 5 years. The submitted photographs for 2001 and 2002 will be selected for possible journal covers.
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: more color photo files of worldwide butterflies and moths!
6. **ATL Photo Archives**: 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 welcome to send listings of your holdings to add to the ATL Photofile database: let others know what species you have recorded on film.
7. **Life memberships**: ATL life membership is a single payment of $2,000 (or $400 per year for 5 years).

ELECTIONS

Results of the 2001 vote make Dr. Thomas C. Emmel President for 2002: Dr. Thomas C. Emmel, USA 145 votes

For Vice-President, Dr. Philip DeVries was elected.

Candidates for other offices were re-elected for another year of service.

LETTERS

Miami Blue: Further Comments

In regard to the Miami blue, *Cyclargus thomasi bethunebakeri* (sometimes classified in the genus *Hemiargus*) we all agree that this subspecies is rare. However, the two known Florida populations were discovered only recently and we simply do not know enough about the overall status of this butterfly to truly justify listing. In the very least, survey work is required to identify other potential habitats where the species may still survive. An understanding of known population sites is paramount before any suitable level of regulation, management, and/or recovery efforts are possible.

On the surface, the immediate listing of the Miami blue may seem like the proper thing to do, but may be seriously premature. The listings of the Karner blue (*Lycaeides melissa samuelis*) and the Mitchell's satyr (*Neonympha mitchellii mitchellii*) in 1992, and *N. m. francisci* in 1994, were supported by detailed data on their limited distributions and absence from many potential habitats. Organized surveys (even using aircraft) were conducted. In these cases, documented evidence of rarity and serious threats to their endangered habitats warranted listing. Conversely, no such studies have been undertaken for the Miami blue, which does not require endangered habitats in which to thrive. Immediate listing also ignores the potential for successful recovery without regulation.

This situation recalls the rediscovery of the Florida Attala butterfly (*Eumaeus atala*) in South Florida during the early 1980s. In fact, the scenarios are virtually identical. This butterfly, also a lycaenid, had not been seen for a number of years and was suddenly rediscovered by a relative of a amateur lepidopterist who photographed some "pretty butterflies" during a peaceful walk down the beach of a park in Miami-Dade County (Crandon Park). These photos were forwarded to other interested parties, including Dave Baggett and Roger Hammer, who confirmed the identification and visited the site. After this momentous discovery, one of the available options was to petition for federal listing. Nonetheless, listing was not pursued because it could have complicated studies necessary to further understand the ecology of the only remaining population of the species in Florida. They developed recovery plans and it was their combined reintroduction efforts that ultimately allowed the species to reach the level of abundance enjoyed today. The rest is history. Butterfly gardeners began planting cycads to get the Atala into their gardens. It has become a symbol of species resurrection by everyday nature lovers who believe they are contributing to the survival of a formerly rare species. It is very likely that this recovery initiative would not have been as rapid (or as successful) if the Atala butterfly had immediately been listed. Although it is often referred to as a "threatened" species, it has never been regulated by federal or state authorities. It remains unlisted (to the delight of those spraying cycads for troublesome larvae), continues to thrive, and is expanding with the help of hostplant cultivation.

If recovery efforts are required for the Miami blue, several lepidopterists here in Florida (myself included) have experience with the butterfly and could prove instrumental. Tom Emmel and Ron Boender could be approached for logistical support for any captive breeding/reintroduction efforts. If funding is an issue, donations could help maintain the initial stages of this venture. This type of funding may also be more accessible, especially in light of a tight USFWS budget for South Florida projects.

If this butterfly is conducive to recovery efforts, folks may be capable of encouraging (or even introducing) this beautiful, endemic little butterfly into gardens planted with balloon-vine and acacias. On the other hand, if the subspecies is successfully listed, private participation will be limited. Any direct handling of the species, even by well-intentioned gardeners, will be prohibited. We should not overlook this great source of knowledge and enthusiasm as a valuable means to assist this butterfly.

JOHN CALHOUN
Palm Harbor, Florida

Lepidoptera Mortality Documented on Roads

The recent paper by McKenna *et al.* (2002. Mortality of Lepidoptera along roadways in central Illinois. *J. Lepid. Soc.*, 55:63-68) has provided the first documented study of the massive numbers involved in road kill of butterflies from passing road traffic in such heavily congested areas as much of the eastern United States. The study site was in central Illinois, and based on the resultant estimates from the study, the weekly toll of killed butterflies along Illinois roads comes to about 20,000,000 butterflies, not to mention millions more of other insects. Presumably, similar figures should be valid for other heavily populated regions like parts of western Europe, Japan, and other countries with considerable motorized road traffic.

This new study presents us with the most clear example of why individual collectors of butterflies cannot possibly do any damage to butterflies to any significant extent, with the possible exception of cases of extremely localized and rare species that may warrant listing as officially protected species (yet see the notes about the Ehrlich study below). One can imagine how many Karner blues get killed by road traffic every year, which probably is more than collectors could capture if allowed to do so. Clearly, readers who have an anti-collector mentality can verify for themselves that this new study on butterfly road kill demonstrates beyond any doubt that even 1000s of butterfly collectors could not possibly collect millions of butterflies in a single week, as are exterminated simply by passing cars in just one state of the United States, and yet the butterfly species in central Illinois are still present year after year. Multiply the Illinois figures by 48 states in the main area of the United States, and even reduce the numbers to only a quarter of the Illinois estimates, and one gets about 240,000,000 butterflies killed by road traffic in a single week on American roads, or about 6.2 billion butterflies during the warmer 6 months of the year (April to September)!

The Illinois estimates also concluded that about 500,000 monarch butterflies could be involved at certain times of the year in weekly road kills: multiply this figure by about 10 weeks during migrations and other flight activity, and add in similar estimates for only about 20 other states (let alone where all the monarchs are distributed), and one comes to a figure of 100,000,000 monarchs killed by road traffic in a single year during migrations and local flights. This is nearly as much as were evidently killed in the 2002 winter freeze episode in the Mexican retreat for over-wintering monarchs. One can see that these and other butterflies have remarkable biological capabilities of reproduction to maintain their numbers against all these and other hazards.

One thing this new study clarifies beyond a reasonable doubt to a logical conclusion — and does so much better than past studies where hilltopping butterflies were collected in numbers to determine possible collector impact on localized populations and resultant conservation aspects for butterflies (Ehrlich study; see Pyle, Bentzien and Opler, 1981. Insect Conservation, *Ann. Rev. Ent.*, 26:233-258) — is that there are many more butterflies around than one thinks, and that they survive road dangers, parasites, bad weather, spiders, etc., and many other dangers on the way to adulthood and as adults, in addition to just crossing the road. Thus, other than for a few rare species, most butterflies cannot possibly be impacted by the few butterfly collectors who do some recreational collecting; even commercial collectors could not collect so many specimens as the road kill study indicates. Even in Taiwan, where the commercial collection of butterflies has been ongoing for decades, amounting to millions of specimens per year, not so many butterflies are taken out by colelctors there as are removed in a single week of road kill in just one state in the United States.

The experiment alluded to above, to collect all available butterflies from a study area to see if the species from a local population could recover, was conducted by Paul Ehrlich as part of his 20 year study of checkerspot butterflies in California and other western states: this was done both with intense collecting at one time and by studying a natural

decline due to a severe drought during some years. Ehrlich found that some of the *Euphydryas* (Nymphalidae) butterflies involved in the studies are well adapted to severe reductions in numbers in local populations, and could recover very well (see the summary in Ehrlich. 1983. Chapter 9. Genetics and the extinction of butterfly populations. In *Genetics and Conservation: a Reference for Managing Wild Animal and Plant Populations*, 152-163.). Ehrlich noted that "for insect populations similar in their dynamics to *Euphydryas*, conservation biologists need not concern themselves with the genetic effects of temporarily small population size." Not all butterflies, of course, have genetics and behavior traits for survival like these checkerspots of western North America, but small population size for many butterflies is not always something to be overly concerned about in terms of conservation and any resultant anti-collecting laws, particularly when so many other factors also impact butterflies, like road kills, for example. One can consider the numbers of road kills of the Schaus swallowtail on Key Largo in the Florida Keys: if collecting were such a serious threat to the species, then road kills would seem to be equally so, and thus by the same logic, Florida should close the North Key Largo road that passes through the land preserves under protection for this species and other Keys wildlife. However, as the McKenna *et al.* study shows, reductions such as road kills, will not impact most species enough to endanger most butterfly species, even with the large numbers of road kills involved; and one can add that collecting by recreational butterfly collectors will likewise have no significant effect.

My past notes in *Lepidoptera News* on the lack of credibility in the hysteria against collectors that abounds around the world (viz. the anti-collector laws in Germany and other countries) is only further supported by this road kill study from Illinois. However, should we stop our conservation efforts? Not at all, but we need to focus on habitat preservation and not let collectors be the scapegoat to be used by the anti-hunting/anti-collecting groups as a ficticious explanation for the supposed demise of butterfly abundance or reductions in any particular species. The anti-collector laws are just cosmetic, since reductions in habitats is what really drives butterflies and other wildlife to extinction. This brings to mind the recent flurry of activity regarding the Miami blue, which is probably only low in numbers because of natural fluctuations and the impact of reduced habitat, not because of collectors. No hostplants, no butterflies.

J. B. HEPPNER
Gainesville, Florida

FSCA Specimens Distributed by Kimball

One of the features of what now is a by-gone era was the latitude given researchers at some museums. Before 1900, many museums did not verify very well what specimens were given out as loans, or even freely gave away specimens to various researchers. Some 45 years ago, when Charles Kimball started working on the Florida Lepidoptera, the Florida State Collection of Arthropods (FSCA), in Gainesville, Florida, was his home base and the institute which ultimately published his well-known catalog of the Florida fauna (Kimball, 1965; also see Heppner, in press). During his years of study to identify all the Florida species of Lepidoptera, which continued until the time he died in 1982, Kimball sent specimens from his personal collection, as well as from the FSCA, to any specialist willing to examine them to try to get them identified. Many of the specimens from the FSCA were over time apparently just merged into other museum collections after Kimball died.

The procedure Kimball used was all done with the approval of the FSCA at the time and no formal loan documents were ever written up for these transactions: this is not any criticism of Kimball — he continued hard at work trying to get these specimens identified until the year he died — but is just a result of FSCA procedures at the time and the lax attitude of recipient museums not to return this material. As a result, FSCA specimens are distributed among most of the well-known specialists and museums in the United States, particularly for micro-moths. Kimball divided his private collection and gave about half of it to the FSCA over the years, while the remainder was kept at his home in Cape Cod, Massachusetts, and was ultimately willed to Harvard University and now resides at the Museum of Comparative Zoology (MCZ), Cambridge, MA. No doubt some of the specimens Kimball had borrowed from the FSCA and not yet returned before he died, are also now mistakenly at the MCZ. Likewise, a number of Microlepidoptera that Kimball had from the FSCA are mistakenly still at the National Museum of Natural History (USNM), Smithsonian Institution, Washington, DC, as well as other museums.

Over the years since 1983, I have been trying to have FSCA specimens returned from various museums and specialists in the United States, particularly when research papers have come out with specimen records that clearly pertain to FSCA specimens, but are marked in the publication as belonging to whatever museum collection the specimens currently are housed at. Some of this may be from some misunderstanding on the part of curators and what Kimball may have told them, but in any case almost none of these specimens have been returned. Some FSCA specimens have even become holotypes of new species and deposited at other museums (at least a few such cases may involve specimens now at the USNM).

The FSCA now has a modern and documented loan policy in place, just as at other major museums, but the material Kimball studied is largely still extant. Museums that received FSCA specimens from Kimball should be aware of this matter and return such specimens. On the other hand, any specimens collected by Kimball himself, or by some of the collectors he regularly obtained specimens from, obviously need to be considered Kimball material that can now remain wherever it is left: this would include specimens collected in Florida by Paula Dillman (Oneco), Shirley Hills (Pensacola), J. F. May (Weekiwachee Springs), and Mrs. Spencer Kemp (Key Largo), plus some of those from the late Harry O. Hilton (Shalimar and Ocean City, FL). In some cases the FSCA supplied light traps and other supplies to these persons and Kimball processed the material collected, organized it and identified what he could, or sent specimens to various cooperating specialists to help identify them. However, much of the material from these collectors, was also deposited in the FSCA, besides what Kimball distributed to other museums or kept himself.

Specimens clearly belonging to FSCA come from a number of collectors in Florida, mainly those employed by the Florida Dept. of Agriculture or by the University of Florida. As far as I am aware, virtually all specimens can be identified as FSCA property by being collected by these individuals over the years; Kimball only borrowed the unidentified material to have the specimens properly identified. The following collectors are involved with FSCA specimens up to 1982 (with notation as to the probable main locality for specimen data from Florida or the person's home base in Florida):

Adkins, T. R. (Ocala)
Ayers, C. I. (Gainesville)
Baker, G. H. (Vero Beach)
Baranowski, R. M. (Homestead)
Betts, H. M. (Macclenny)
Brown, A. C. (Gainesville)
Dekle, G. W. (Gainesville)
Denmark, H. A. (Gainesville)
Dickinson, C. L. (DeFuniak Springs)
Dowling, Jr., C. F. (Miami)
Foster, R. E. (Gainesville)
Frierson, P. E. (Gainesville)
Genung, W. G. (Belle Glade)
Habeck, D. H. (Gainesville)
Henderson, W. P. (Groveland)
Hetrick, L. A. (Gainesville)
Hill, L. B. (Largo)
Kelsheimer, E. G. (Bradenton)
King, J. R. (Ft. Pierce)

Knight, R. A. (Gainesville)
Kuitert, L. C. (Gainesville)
Link, O. D. (Gainesville)
Lloyd, J. E. (Gainesville)
Mead, F. W. (Gainesville)
Merkel, E. P. (Olustee)
Miller, R. H. (Monticello)
Perry, J. W. (Gainesville)
Phillips, A. M. (Monticello)
Poe, S. L. (Bradenton) (later moved to Virginia)
Poucher, C. (Winter Haven)
Snell, R. R. (Homestead)
Stegmaier, Jr., C. E. (Hialeah)
Tappan, W. B. (Quincy)
Tissot, A. N. (Gainesville)
Wade, Sr., G. F. (Bushnell)
Wagner, W. E. (Vero Beach)
Watson, J. R. (Gainesville)
Weems, Jr., H. V. (Gainesville)
Whitton, G. (Clearwater)
Wilson, J. W. (Sanford)
Wolfenbarger, D. O. (Homestead)
Woodruff, R. E. (Gainesville)

Specimens collected by the former staff members of the FSCA — Dekle, Denmark, Mead, Weems, and Woodruff — also belong to the FSCA, including what most of them also collected in many areas outside of Florida (e.g., Weems' specimens from any number of states such as North Carolina, West Virginia, Georgia, Ohio, and even Arizona, plus exotic areas like Mexico). Likewise, any older Florida specimens labelled "State Plant Board" belong to the FSCA.

The following persons, among others, donated Lepidoptera to the FSCA before 1982 and some of these may have been sent by Kimball to various specialists as well:

Baggett, H. D. (Jacksonville, FL): most of his collection came to the FSCA, from 1980-92, but some groups were dispersed (e.g., Baggett sent some of the Tortricidae to the Mississippi Entomological Museum, Mississippi State University, MS).

Brou, Jr., V. A. (Abita Springs, LA): donated large numbers of moths from Louisiana since 1972; FSCA also acquired his 45,000 specimen world-wide Sphingidae collection, with the help of Howard Weems.

Davidson, W. M. (Orlando, FL): some specimens came to the FSCA from 1968-84.

Dykstra, A. M. (Canton, MO): some specimens came to the FSCA from 1978-82.

Fairchild, G. B., (Gainesville, FL): mostly specimens from Nova Scotia and Florida, from 1968-93.

Fernald, H. T. (Orlando, FL): most of the Fernald collection is at the USNM, but specimens Fernald collected in his retirement in Orange County, Florida, were donated to the FSCA in 1952.

Frost, S. W. (College Park, PA): some specimens from Archbold Biological Station, Lake Placid, FL, were deposited by Frost with the FSCA in 1968.

Fuller, S. V. (Cassadaga, FL): collection donated to the FSCA from 1960-68.

Grimshawe, F. M. (Florida City): her remainder material came to FSCA from 1962-70.

Heitzman, J. R. (Independence, MO): has donated to the FSCA large numbers of Lepidoptera since 1968, mainly from Missouri and Arkansas.

Heitzman, Roger L. (College Park, MO): donated his collection to the FSCA from 1974-97.

Hilton, H. O. (Ocean City, FL): his private collection was donated to the FSCA from 1964-89.

King, H. L. (Sarasota, FL): collection donated to the FSCA from 1968-84.

Plomley, J. M. (Hollywood, FL): his collection was donated to the FSCA in 1994 but Kimball saw specimens before 1982.

Reinthal, W. J. (Knoxville, TN): collection donated to the FSCA from 1970-82.

Strickland, G. T. (Baton Rouge, LA): microlepidoptera donated to the FSCA from 1972-76.

Woodcock, H. E. (Chicago, IL): most of his collection went to the Canadian National Collection, but many Microlepidoptera were donated to the FSCA in 1960.

Zeiger, C. F. (Jacksonville, FL): collection donated to the FSCA from 1962-87.

Most museum staff do not have time to search their collection for specimens belonging to other museums that may have been inadvertantly mixed in with their collection if no loan papers are involved, but persons writing research papers based on specimen data should be aware of the origin of specimens, including FSCA specimens labelled with collector names known to involve only FSCA material. Over the years, I have noted a number of papers where collection data is listed for Florida species and where collector names indicate that these specimens undoubtedly belong to the FSCA, yet are listed as belonging to the USNM or some other museum.

The above listings clarify the identifying labelling of FSCA specimens by the name of the collector, and whenever such specimens are located they should be returned to the FSCA. Clearly, if holotypes are selected from specimens that are among certain FSCA material, the author is obligated to verify the correct status of such specimens and not immediately assume they belong to the current host museum collection. Some museum staff may just ignore such matters and keep all material sent around by Kimball, particularly since he has died and the FSCA has no official paper trail to know what Kimball borrowed, but the first list of collector names above, with clear attachment to the FSCA, indicates to all that these actually are FSCA specimens.

There is always some sharing among museums, particularly when a specialist gives identification services and retains a small sample of the specimens sent for identification, and the FSCA does likewise, but most of what Kimball sent for identification the last few years before 1982 and then left at various museums, has since not been returned to the FSCA, even after 20 years or more. Any holotypes from such specimens should clearly be returned to the FSCA. It is hoped this notice will alert taxonomists working on specimens with the above listed collector names (of the first list) affiliated only with the FSCA, that these specimens belong to the FSCA and not the current host museum, and should be returned to their rightful owner when their studies are completed.

J. B. HEPPNER
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Gainesville, Florida

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(in press). *Lepidoptera of Florida. Part 1. Introduction and Catalog.* In *Arthropods of Florida and Neighboring Land Areas*. Vol. 17. Gainesville: Fla. Dept. Agr. Consumer Serv., Div. Plant Indus. 656pp (55 pl.).

Kimball, C. P.
1965. *The Lepidoptera of Florida: an Annotated Checklist.* In *Arthropods of Florida and Neighboring Land Areas*. Vol. 1. Gainesville: Fla. Dept. Agr. Consumer Serv., Div. Plant Indus. 363pp, 36 pl.

Further Postscript to Mail Irradiation

In confirmation of what was noted last issue about future results to the U.S. mail system once irradiation of the mail becomes routine, the following note was received in January from Dr. Scott E. Miller, Chairman of the Entomology Dept., National Museum of Natural History, Smithsonian Institution, Washington, D.C. (all Smithsonian mail, as other government mail in Washington, already is being irradiated):

"*Lepidoptera News* 2001 #2 and 3 just arrived, fried by the irradiation process now used to protect government mail from anthrax. If possible I'd appreciate replacement copies."

Dr. Miller noted that his paper copies were in such bad condition (brittle, discolored and prematurely aged), that he asked for replacement copies. He also noted that the Smithsonian has a special mail box open now for incoming mail so it will not be irradiated:

P. O. Box 37012, National Museum of Natural History, Washington, DC 20013-7012.

Correspondents should use this new address, plus adding the room number or mail routing number for the person within the museum as before. Mail that goes to the old address is routed to Ohio for special irradiation and then returned to Washington, a process that takes about 2 months. In December, researchers at the Smithsonian were just getting their mail that was held in the system since September and October, 2001.

Re: Your Letter in the September 2001 Issue Entitled "NABA Calls Collectors Immoral"

I am an avid collector and a charter member of NABA, and while I agree with much of what you wrote, particularly about the positive role that collecting can play in the education of the young, and, of course, that habitat destruction and degradation — not collecting — is the cause of butterfly declines, I felt that some of what you wrote is unfair to NABA members.

First, although Dr. Glassberg is the founder and President of NABA, he is not NABA. NABA is neither pro-collecting nor anti-collecting, Many NABA members, and many lepidopterists who support NABA by writing articles for *American Butterflies* or by providing photographs for it, collect specimens. Off the top of my head, I can think of Dr. Emmel, Dr. Covell, Dr. Burns, Dr. Robbins, Dr. Gall, Dr. Sperling, Dr. Wright, Jeff Ingraham, and, I am sure, many others. [Also], Dr. Glassberg did not call all collectors immoral, only those who would collect from a population that is known to be on the verge of extirpation. Whether such a practice is immoral or not is certainly a matter of opinion, but saying that that type of conduct is immoral is a very different thing than saying that all collecting is immoral.

Second, I do not think it is constructive to liken Dr. Glassberg's opinions on collecting, whatever they are or are not, to the "Big Lie" of the Nazi's. The lies of the Nazi's led to the deaths of millions of human beings. The worst that could happen, assuming, for the sake of argument, that Dr. Glassberg or NABA advocated a complete ban on collecting, is that a law banning collecting would be passed. I hope never to see such a law in this country, and, if one is ever proposed, I will oppose it. But even if it was passed, such a law would hardly be the equivalent of living (or being murdered) under Nazi rule. As you point out, such bans are already in place in most European countries, and, of course, NABA had nothing to do with them.

I agree with you, that in order to avoid unnecessary and unwarranted collecting restrictions, collectors should work with government agencies to help educate them about the positive role collectors play in discovering, documenting and, yes, preserving biodiversity. Recreational hunters and, to a lesser extent, people who fish for sport, have opponents, but these sportspeople have been very successful in convincing state and federal wildlife agencies that their activities do not harm the environment. Collectors need to educate these same agencies that their recreational activities are not harming the environment and result in the accumulation of data that we can share with agencies and the scientific community, all to the ultimate benefit of the public at large.

Finally, you bring up a subject that is quite important *vis a vis* NABA's attempt to have the *Speyeria idalia* population on a military base in Pennsylvania recognized as a distinct subspecies. This effort is necessitated by the provisions of the ESA that allow a geographically isolated vertebrate population to be protected but not an invertebrate population, unless it is described as a subspecies. I have recently co-authored an article on this very subject.

HARRY ZIRLIN
New York, New York

[Editor's Note: In my previous letter about NABA, I certainly did not mean that any so-called "big lie" in regard to NABA and collecting being bad (or collectors immoral) made NABA equivalent to the Nazi use of this propaganda technique and its relation to deaths in WW2. It was not about the Nazi's and the war, but about the perfection of their propaganda techniques. My point was merely that the same technique is being used in terms of information broadcasting by NABA to some extent; not very overtly, but nonetheless in most NABA editorials one always can read the nuances or outright statements that collecting activity is not good or should not be done, and that only butterfly watching is the thing to do. The manipulation I wrote about pertains to not also educating NABA members on how much more collecting is still needed if we are to know the biologies of all butterflies, let alone the moths, and that recreational collectors do not inflict any significant harm on butterfly populations. One does not have to promote collecting and still educate the readership that collecting is needed and not a significant factor regarding the conservation of butterflies. As for some of the European countries, they are just using collectors as a scapegoat on which to blame butterfly decline, something which I do not want to see happening in this country.

As to hunters and sportfishers, and their lobbying efforts with local and national governmental agencies, clearly their several million members have greater impact and financial resources than do the barely 2000 or so U.S. butterfly collectors. Also, the dearth of any evidence of impacts on butterfly populations by collectors is overwhelming and also involves the vast differences in biology and reproductive capacity of butterflies versus such familiar animals as birds, but that is what NABA ignores in its literature for members, thereby not refuting the idea that butterfly collecting should not be done.

The matter of the regal fritillary (*Speyeria idalia*) still is pseudo-science in trying to fabricate a subspecies where there is no biological evidence to substantiate this: the fact that the Endangered Species Act (ESA) requires a named subspecies to have an invertebrate listed as endangered does not mean that one goes around naming subspecies just to get them listed. If this is done time after time (as has possibly already been done in the case of some named subspecies of California butterflies), then there is a danger that in the long run, authorities in the United States will eventually tire of this game and reject future claims to list butterflies unless entire species are endangered (and the latter is true for only a single butterfly species so far in the United States, the other 11 listed taxa all being localized subspecies of otherwise thriving species). The regal fritillary populations east of the Great Plains are now isolated due to habitat destruction, as far as is known, yet they are still not isolated long enough to be considered subspecies. I think the best impact for the future is to make sure all varieties of habitats are preserved somewhere, since even small areas can be enough for butterflies to thrive in many cases, as long as the hostplants are there and the habitat allows enough adult interaction for normal mating behaviors. **J.B.H.**]

Loss of Biodiversity and Immoral Collectors

Two of the editorials in recent issues of the *Lepidoptera News* deserve comments. What follows are my opinions, such as they are. I have unpopular beliefs regarding conservation and collecting.

As Paul R. Ehrlich indicated in his Presidential Address (*Lepid. News*, June 2001), most of Earth's biodiversity will go extinct before it can be described. We should just accept this and do our best to study all the remaining species we are able to before they are gone, including biological and ecological studies, nomenclature, and simple field collecting. This loss of life will increase as the human population increases. It makes no difference that there are now more conservation organizations doing more work than ever before. In the past 50 years, during which time conservation organizations have enjoyed the greatest membership and largest financial support, we have lost more habitat and species than in any other time in human history. Makes one wonder what, if any, real accomplishments these organizations have made that will actually endure for the next century. True, many wilderness areas, national parks, regional parks, and sanctuaries have been established directly due to the efforts of these organizations and conservationists. But in the future, these protected areas will be under increased pressure from the legions of additional humans that will populate the world. Regardless of how secure we feel our wildlife sanctuaries are now, any government in the world can declare wildlife preserves eminent domain and take them for resources in what is perceived to be the emergency of the time. Does anyone really think that a government of, for

example, a large tropical country in the Amazon basin is going to tell its starving, shelterless hordes of people, "Sorry, you can all starve to death, but this government is saving this forest for the eco-tourists and conservationists!" Any such government would be overthrown immediately. If not, it would be voted out quickly for neglecting its people. After all, what appears more important to the vast majority of people, a poor starving child in the arms of its starving mother, or saving the last square mile of forest for "future generations"?

What I find most remarkable is the inability of most so-called environmentalists to equate increased childbirth with loss of habitat. Even our most outspoken environmentalists are hypocrites. On a planet with over 6 billion people, no one who considers himself or herself to be an environmentalist, or claims to even care about the environment, adds to the greatest environmental problem of all, overpopulation, by making more babies. It is as simple as that. If 6 billion people are too many, then your 6-billion-and-first will also be too many. Yet not only are our lepidopterist organizations filled with people making more babies, even Sierra Club and Nature Conservancy members are busy popping out more babies as if there were an unlimited amount of space and resources available for their offspring. Former Vice President Al Gore, author of *Earth in the Balance*, has four children; the late Carl Sagan had five. The only lepidopterist and environmentalist couple I know who actually follows their belief is Julian and Kathy Donahue, who have no children (bless them!). Surely there must be more. And before you ask, no, I have no children, and never will, by choice. Yeah, yeah, if my parents had thought the same way as I do, I wouldn't be here. But when I, an only child, was born, the world still had 75% of its forests. It certainly didn't have six billion people.

It is time for everyone to make a decision. You are either part of the solution or part of the problem. There is no other choice. You make a baby, you destroy enough habitat to provide it with 4905 lbs. of beef, 5777 cubic feet of timber, 290 tons of coal, 80,598 gallons of petroleum, 13,653 lbs. of vegetables, 18,046 eggs, and kill 1123 lbs. of fish, just to name a few necessary resources. Your baby does not replace you since you do not disappear when it is born. Thus, baby makes three (or four or five, etc.). Some argue that Americans consume too much compared to people in other parts of the world, that our consumerism is responsible for the accelerated destruction of habitats: 24 acres per American vs. 5.2 acres for most of the rest of the world's population (Edward O. Wilson, How To Save Biodiversity, in *Nature Conservancy*, Spring 2002). But 280 million Americans destroying 24 acres apiece will cause only 4.67% of the destruction that 5.72 billion people destroying 5.2 acres apiece in the rest of the world will. Many Americans do consume too much, but if there were half as many people here, there would not be twice the amount of resources left (only 2.3% more). Besides, Americans contribute more financially towards conservation than most other people in the world do, and our birthrate is not nearly as high as it is elsewhere.

Look no further than your own offspring for the number one reason for habitat destruction. All of this does not mean I dislike or begrudge my friends and colleagues because they have families: I do not. They are good people, all of them. We simply all make decisions that affect our future and the future of our world. Do not expect someone else to make the sacrifices for you. No public figure or world leaders will advocate negative population growth because to do so is so very religiously, socially, economically, and politically "incorrect". Religiously incorrect, because after all (if you believe this stuff) God said to go forth and multiply (but multiply geometrically and destroy all of His other living creations in the process?); socially incorrect, because the family is sacred and people are taught from birth to keep the family tree going and pass on a living legacy because they are not "complete" unless they have reproduced; economically incorrect, because without population growth, there can be no economic growth; and politically incorrect, because any politician who advocates negative population growth commits political suicide for all of the preceding reasons.

So there really is no hope for saving much of the remaining natural world. Each new generation is born into an increasingly depauperate biota, and they naturally assume that this is the norm since they have nothing with which to compare it. The less diversity they see, the less motivated they are to save what is left. Go out and enjoy what's left while you can. Two hundred years from now the only remaining natural areas may have less diversity than a vacant city lot.

On to the editorial by J. B. Heppner, "NABA Calls Collectors Immoral" (*Lepid. News* No. 3, Sep 2001). There is no need to reiterate what Dr. Heppner has more than adequately criticized about the hypocrites in NABA. Why do I call them hypocrites? Each and every one of them who drives a car to a observation field trip location is responsible for the deaths of thousands of innocent, beneficial butterflies, moths, flies, wasps, bees, etc. Mr. Jeffrey Glassberg, take a look at the front of your radiator and windshield, and look at all of the insects you killed for the most trivial of all reasons: *they were simply in your way!* How immoral is that? These insects will never be used to further science or biology, and they certainly are not usable as specimens for collections. Automobiles indiscriminately "murder" billions of insects every year, and the autos NABA members drive kill their fair share. Read the staggering statistics yourself in the recent article by Mckenna, Mckenna, Malcom, and Berenbaum (2001. *J. Lepid. Soc.* 55(2):63-68, Mortality of Lepidoptera Along Roadways in Central Illinois): an estimated 20 million butterflies killed by autos in one seven-day period in Illinois! Are there even 20 million butterfly specimens in all of the collections in the world? At least the few specimens biologists collect will provide some use to science and biology. Those splattered on your NABA cars will just be washed down the gutter. And be careful where you step on those field trips. There are a lot of tiny arthropods leading important lives in their own little biosystems underfoot. NABA members should continue to make field observations, as these may be important to future diversity studies, but do not dare criticize the biologists among you who may be seeking and contributing significant knowledge other than sight observations.

THOMAS E. DIMOCK
Ventura, California

LEPIDOPTERA NEWS, 2002 (1-2): 6-9

THE BUTTERFLY IN ANCIENT LITERATURE AND ART

by C.H.B.
in Scudder (1889), *Butterflies of New England*

The earliest known mention of the butterfly is in a Chinese story beIonging to the 6th century before Christ. In it is related how Tschwangsang dreamed that he was a butterfly, and was told by his teacher, Lao-tze, in explanation, that at the time of chaos he had been a white butterfly whose soul, after its body had been swallowed by the Phoenix, lived on and appeared anew on earth in the form of Tschwang-sang (Stephani).

In Greek literature, the butterfly first appears in the writings of Aristotle, who says that butterflies are born from caterpillars, caterpillars from cabbage leaves; he describes the chrysalis, noting the fact that it moves when touched and also speaks of the egg, not however as an egg, but as a hard substance, liquid within, which is produced by butterflies; he also mentions the antennae. Aristotle speaks of transformations in other insects, but Theophrastus in one place says such changes are seen in butterflies only. Plutarch speaks briefly of this three-fold form of life in cater illar, chrysalis and butterfly. In Nicander, the φάλαινα is mentioned which "flutters round the lamp" and the scholiasts annotate "the φάλαινα is called ψυχή with us; φάλαινα is a Rhodian name." Hesychius cautiously defines a chrysalis as sprung "some say" from a caterpillar. The words ψυχή and papilio like the German Schmetterling, mean moth as well as butterfly, and Ovid's "papilione" in the following lines (Ov.M., 15, 376) is a moth:

> Quaeque solent canis frondes intexere filis
> Agrestes tineae, res observata colonis,
> Ferali mutant cum papilione figuram.

Böttiger translates "ferali papilione" as "selbst sich sengendem Schmetterling," suicidal butterfly one might say. Similar lines attributed to Lactantius describe cocoons seen among rocks (*De Phoenice*, 107):

> Ac velut agrestes, cum filo ad saxa tenentur,
> Mutari tineae papilione solent.

Pliny mentions the "papilio" seven times in his *Natural History*, meaning by the word in four of these places, moth. He gives an interesting description of the silk-worm and the formation of its cocoon, of the bee-hive moth and the means of destroying it, a subject which was treated by Aristotle and Columella before him. A curious passage is that where he says, "the moth (papilio) that is seen fluttering about the flame of a lamp is generally reckoned in the number of noxious medicaments; its bad effects are neutralized by the agency of goat's liver." In two of the remaining passages he bor-rows freely from Aristotle, but he carries the origin of the butterfly back to "the dew, which settles upon the cabbage leaf in spring, and is thickened by the action of the sun." After romance, a bit of fact from the same author is welcome:

> "There are some who look upon the appearance of the butterfly as the surest sign of spring, because of the extreme delicacy of that insect. In this present year, however, in which I am penning these lines, it has been remarked that the flights of butterflies have been killed three several times by as many returns of the cold." (Bohn's translation)

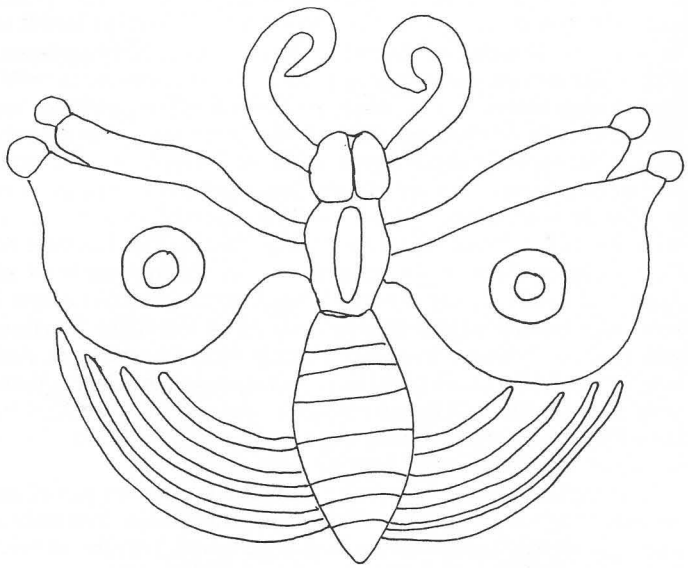

Fig. 1. Lepidopteran motif on a gem (late Minoan, ca. 1550 B.C., Knossos, Crete (Ashmolean Museum, Oxford).

Tertullian in speaking of different animals as opposed in their nature to different elements says, "In like manner, those creatures are opposite to water, which are in their nature dry and sapless; indeed locusts, butterflies and chameleons rejoice in droughts" (P. Holmes's translation).

Fig. 2. Lepidopteran motif carved in a Cretan axe (?1600 B.C.). The sphinx moth, *Smerinthus ocellatus* (Linnaeus), may be the model for the motif.

We have seen that the word ψυχή, meaning butterfly, first occurs three hundred and fifty years BC, but ψυχή, the soul, is imagined with wings in the time of the Homeric poems; since in Il. xxii:362, Od., xi: 222, the ψυχή is spoken of as flying away. Finally in an epigram by Meleager (Anth. Pal., xii:132) there is a play upon the double meaning of the word:

Οὔ σοι ταῦτ' ἐβόων, ψυχή, ναὶ Κύπριν, ἀλώσει,
ὦ δύσερως, ἰξῷ πυκνὰ προσιπταμένη;
οὐκ ἐβόων; εἶλέν σε πάγη. τί μάτην ἐνὶ δεσμοῖς
σπαίρεις; αὐτὸς Ἔρως τὰ πτερά σου δέδεκεν,
καί σ' ἐπὶ πῦρ ἔστησε, μύροις δ' ἔρρανε λιπόπνουν,
δῶκε δὲ διψώσῃ δάκρυα θερμὰ πιεῖν.
ἆ ψυχὴ βαρύμοχθε, σὺ δ' ἄρτι μὲν ἐκ πυρὸς αἴθῃ,
ἄρτι δ' ἀναψύχεις, πνεῦμ' ἀναλεξαμένη.
τί κλαίεις; τὸν ἄτεγκτον ὅτ' ἐν κόλποισιν Ἔρωτα
ἔτρεφες, οὐκ ᾔδεις, ὡς ἐπὶ σοὶ τρέφετο;
οὐκ ᾔδεις; νῦν γνῶθι καλῶν ἄλλαγμα τροφείων,
πῦρ ἅμα καὶ ψυχρὰν δεξαμένη χιόνα.
αὐτὴ ταῦθ' εἵλου· φέρε τὸν πόνον. ἄξια πάσχεις
ὧν ἔδρας, ὀπτῷ καιομένη μέλιτι.

Here ψυχή, or the human soul, is personified and is suffering for her love to Eros who torments her, but her outward form is that of a butterfly caught fast in birdlime.

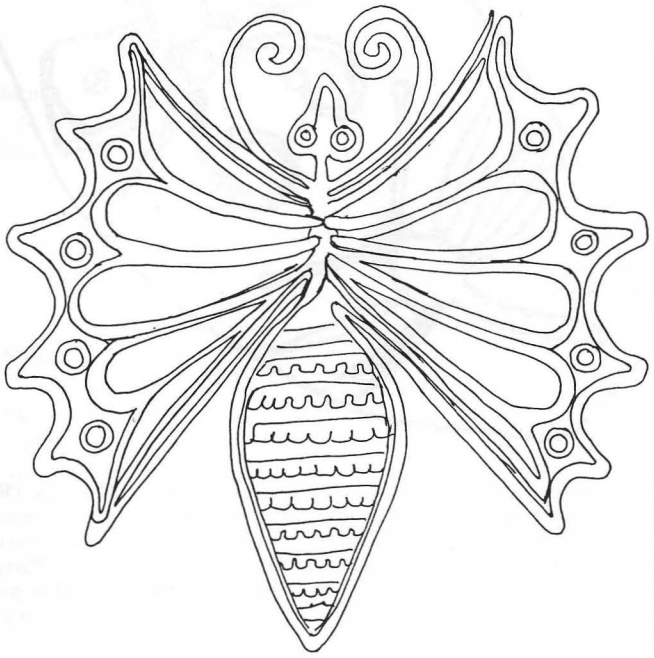

Fig. 3. Mycenean gold medal (National Archaeological Museum, Athens, Greece) with lepidopteran motif (ca. 1550-1500 B.C.). The female of the European butterfly, *Zerynthia polyxena*, may be a possible model?

The infrequent mention of butterflies by ancient authors contrasts strikingly with the frequency of their appearance in ancient art. "The myth of Psyche," says Collignon, "was consecrated by art nearly four centuries before Apuleius gave it a literary form." Stephani, who thinks that the Psyche myth originated nearly three centuries later, gives the same date, 250 B.C., as that of the first representation of the butterfly in art. "It is seen in a sardonyx-cameo set in a massive gold ring which was found in a grave on the peninsula of Taman in 1877. It represents Eros stretching out his hand to catch a butterfly which flutters before him at a slight distance from the ground." Stephani describes the butterfly in art as: the child of nature; the representative of vital energy common to all objects and having almost always a prophylactic object; a type of the human soul; and, in connection with Eros, Aphrodite and other divinities, a type of the loving human soul. He cites many examples of the first class, the oldest being found in two Series of Roman copper coins. In one series the butterfly is seen alone; in the other a bunch of grapes is added to it; they belong to the time of the second Punic War, 218 B.C. A few of the silver coins of Rhodos, on which the butterfly is seen, may be almost as old; but the greater part of them must be assigned to the first or second centuries B.C. Roman gold and silver coins on which butterflies occur belong to the last century B.C.: on a gold denarius issued 19 B.C. a crab is seen which is trying to catch a butterfly with its pincers; on a silver denarius a butterfly is seen sitting on a lituus; there are also other silver denarii on which a butterfly alone is seen.

Engraved stones of the time of the Roman emperors show a butterfly hovering over a rose, several butterflies poised on an ear of wheat. In a fresco a butterfly is seen fluttering near some strawberries and figs, while from either side a bird approaches. A butterfly on a grape vine, seen on a marble pillar, which must be considered as a funeral monument, belongs to the same class, and so do butterflies that a bird is about to attack; several funeral urns in Montfaucon's *Antiquité Expliquée* show examples of this sort. In a sepulchral cippus of the Villa Borghese a youth is seen surrounded by a monkey, a dog, a bird and a butterfly; the butterfly sits on his right hand, while a second butterfly close by is being devoured by a bird, and a third seems to flutter among the leaves of a shrub. This stone shows us that the butterfly was cherished and tended by boys and girls as a pet.

Examples of the second class, where the butterfly represents vital energy, are seen in precious stones that were worn as amulets. On an amethyst a butterfly is seen sitting on a great human eye; on a carnelian an actor with a mask is seen; on one side of him is a horn of plenty, on the other a butterfly. On seven engraved stones the butterfly is seen in connection with the peacock, whose tail was considered as an emblem of blossoming meadows. In five of these stones, the peacock drives the butterfly, which is attached by a double thread, and in one place two ears of corn are sprouting out of the ground before the bird; in a sixth stone the butterfly carries the great bird on its back. In a Herculaneum fresco a griffin, whose

use on amulets is well known, is seen driven by a butterfly. In a tomb lately discovered at Mycenae, little gold disks with butterflies engraved on them were found. The specimens of pottery in this grave were so rude, that it was at first thought to belong to a time 1200 years B.C., but an examination of all its contents makes it seem probable that it is a tomb of Goths who were for a time at Mycenae, who adopted the Greek custom of burying various objects with the dead, and added to their own pottery articles belonging to the spoils they had accumulated. These disks were doubtless attached to garments and served not only the purpose of ornamentation, but had the same prophylactic object that amulets have. A sard on which a butterfly is added to a horn of plenty, a dolphin, a rudder and a globe is doubtless a sailor's amulet.

Among the representations of the butterfly as the type of the human soul, the Capitoline sarcophagus takes the first place. In it Minerva places a clearly defined butterfly on the head of the newly created being. A bronze medallion coined in the time of Antoninus Pius shows the same scene, though the butterfly cannot be clearly distinguished. On funeral monuments a butterfly fluttering over a corpse, a skeleton or a skull is also a type of the soul. An interesting monumental relief which is now in the Palazzo Ricardi in Florence shows a funeral pyre, several persons standing around it, and a butterfly rising above the flames. A terra-cotta slab, now lost, showed a sepulchral altar on which a fire appeared to burn; over the altar fluttered a butterfly, and before it stood a woman pouring a libation. In connection with this a monument found in Spain has great interest; it bears an inscription beginning,

"Haeredibus mando etiam cinere[m] ut . . . volitet meus ebrius papilio."

and doubtless means that his heirs were to make a libation at his grave, so that "my butterfly may fly away satiated."

Roman engravers loved to depict philosophers in their meditations on death and the life beyond by representing them with a skull or skeleton before them and a butterfly hovering over it. In a scene on an engraved stone, where, beneath a pig, two Erotes are quarreling over a butterfly, Collignon sees "a very realistic symbol of the spiritual and material life."

The butterfly as a type of the loving human soul pictures oftener the sufferings than the pleasures of love. Bottinger thinks that the Greeks may have fancied the many moths that gathered around the torches of Eros, in festivities celebrated at night, to be souls of maidens in love, burning themselves at the torch of the god of love. In the Villa Maffei two Erotes are seen burning a butterfly over their crossed torches, while their heads are turned away as in grief; this may represent the purification of the soul, through suffering, in love. On a carnelian stone Eros is seen with a hammer and a large nail crucifying a butterfly. In St. Petersburg, "on a sardonyx vase, which is engraved in relief, a bride is seen, while three butterfly scenes show the kingdom of love; in one, Eros pursues a butterfly with his torch, in a second he is driving in a mussel shell drawn by two butterflies, in the third he is shooting with his bow at a butterfly that hovers above" (Böttiger). The pleasures of love are sometimes depicted, as when Eros kisses a butterfly. Occasionally Eros is seen, with hands bound behind, suffering in his turn, and the butterfly is sometimes present, endeavoring, Stephani thinks, to loosen the bands that confine her master. The word ψυχή, like the Latin anima, was used as a term of endearment by lovers. Gems and rings given as love tokens often bore the inscription:

ψυχή, καλή, ψυχή, ψυχή (τού δείνα).
Soul, beautiful soul, soul (of so and so).

There are other stones corresponding to these, on which only a butterfly and a person's name are engraved.

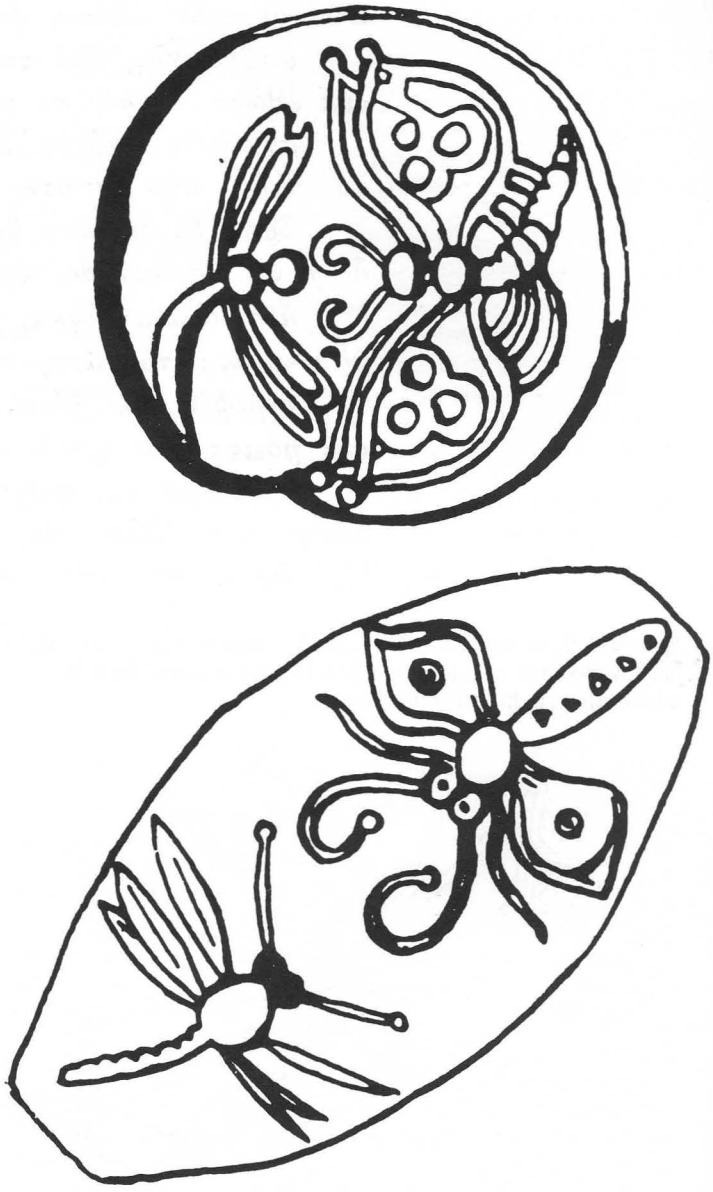

Fig. 4. Butterfly and dragonfly (?) on Aegean seals, Knossus, Crete (ca. 1500 B.C.). In each case, the "dragonfly" (left) may actually be some other prominent insect on Crete, since the antennae are knobbed: possibly an owlfly (family Ascalaphidae, Neuroptera), or one of the large antlions of southern Europe (family Myrmeleontidae, Neuroptera). The "butterfly" (right) may be a European lepidopteran with large eyespots, like the saturniid moth *Saturnia pyri* (Denis & Schiffermüller).

The pleasures and sufferings of love are often portrayed by Psyche in maiden form, sometimes with and sometimes without butterfly wings. Collignon says that Psyche is only the last of a series of forms attributed to the soul by Greek artists. In painted vases the different emotions of the soul are expressed by little winged genii, flying by the side of the person whose emotions their attitudes express. A terra-cotta bas-relief found at Milo shows the soul of the gorgon taking the form of an εϊδωλον as it leaves the body; it is still half caught in the bust whence it emerges. On painted vases the following types are found: 1. The soul has the form of a little hoplite fluttering near the dead warrior, showing on a small scale the man as he looked when living. 2. It is seen as a bird with a human head, or simply as a bird. An epigram of the

anthology shows Plato as an eagle on a tomb looking at the sky. 3. The εϊδωλον has only a distant resemblance to a human body; a little winged, slight figure without consistency, it flutters near the stela of the dead man in many Athenian lekythoi. Byzantine art has continued the tradition of Paganism; in the Death of the Virgin, seen in all Byzantine churches, Christ holds in his arms the soul of the Virgin, a little white-clad figure, in which a Christian translation of the εϊδωλον is easily recognized.

The myth of Psyche is depicted in a long series of statues, engraved stones, funeral bas-reliefs and Christian monuments. Psyche is tortured by Bros, who burns her with his torch; she stands with her hands bound behind her; she falls at his feet in a supplicating attitude; and she is held closely in his embrace. In some funeral bas-reliefs Psyche is associated in the Prometheus-myth with the allegory of birth and death. In the sarcophagus of the Bourbon Museum, she is led up to the newly finished being whom she is to animate, and turns her eyes away from the body extended before her with a gesture of repulsion. On the Capitoline sarcophagus the subjects are arranged with perfect symmetry: in the middle, Prometheus models the figure of a man, whom Athene animates by placing, a butterfly upon his head; further on, the man has just died; from his extended body the butterfly flies away; a funeral genius and a veiled woman are present; in the background are the three fates. On each side of this central part the subject continues symmetrically: on the right, Hermes, conductor of souls, leads Psyche away; on the left she is reunited to Eros, whom she embraces. A mural fresco in Pompeii, described by Collignon, depicts Psyche with her hands bound behind her back, held by an Eros, another Eros, wearing butterfly wings, burns her with two torches, a third, flying above Psyche, pours upon her the contents of a vase; both on the left and on the right of the group stands a figure whose face is hidden. Otto Jahn points out the striking analogy between this fresco and the epigram by Meleager, cited above.

Collignon thinks that Psyche represents the immortality of the soul, as a dogma, on Christian monuments, and as a poetic fancy, on some Pagan bas-reliefs. Stephani thinks that the subject was a favorite one on early Christian monuments, because Psyche and Eros are often represented as idealized children, and Christians were to become like children. He also says "no one will doubt that the custom of using the group (that of Eros and Psyche embracing each other) on funeral monuments has been caused by the belief that a corresponding enjoyment in the life beyond would be insured, through pictures of this sort, to the persons resting in these graves."

We see that the butterfly first appears in classic literature in the fourth century B.C., with no symbolic meaning, but simply as an insect. A hundred years later it is found on coins, alone and in connection with natural objects, still evidently without symbolic meaning. Two hundred years, later, about 60 B.C.,* we see in an epigram of Meleager that the butterfly has now become a type of the soul, and "the first works of art in which this idea is clearly to be seen all date from times succeeding the beginning of the Christian era" (Stephani). Stephani calls attention to the fact that the three-fold existence of the butterfly is emphasized by ancient authors, and says that it received the name ψυχή, life, because "the ancients believed that vital energy, which they called ψυχή, reveals itself in the butterfly, through the three very different forms which it suecessively takes, much more strikingly than in all other organisms." We notice in many interesting works of art, the prophylactic power ascribed to the butterfly; we see its use as a pet name; and we follow it, now symbolizing the soul, through the drama of creation, trial and death; while in, some representations of Psyche, the butterfly-winged maiden, we are carried with the released soul to a world where it is reunited to the divine love.

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* Stephani emphasizes this date, in opposing the statement that the butterfly was called ψυχή because in it was seen a type of the human soul.

EDITORIAL NOTES

The figures are added herein to the original unillustrated article in Scudder's (1889) book. Fig. 1 is redrawn from a photograph in Davies and Kathirithamby (1986); Fig. 2-3 are redrawn from figures in Manos-Jones (2000). Fig. 4 is from an illustration first reprinted in Davies and Kathirithamby (1986).

The identity of "C.H.B." is uncertain. Scudder (1889) added the article by C.H.B. on butterfly motifs in ancient art in his own classic three-volume monograph on the butterflies of the eastern United States.

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LEPIDOPTERA NEWS, 2002 (1-2): 10-11

NOTE

ARCTONOTUS LUCIDUS IN SAN DIEGO COUNTY, CALIFORNIA (LEPIDOPTERA: SPHINGIDAE)

J. B. HEPPNER [1]

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The recent papers on the elusive winter hawkmoth, *Arctonotus lucidus* Boisduval, by Osborne (2000) and Rubinoff (2002), brought back recollections of specimens which I collected near San Diego, California. This unusual small species only occurs along the Pacific Coast of North America, from southernmost California, and probably also from northern Baja California (Brown and Donahue, 1989), north to coastal southern British Columbia, and also into the interior in the north at least as far as western Idaho (Hodges, 1971). Papers by Comstock and Henne (1942), Osborne (2000) and Rubinoff (2002), provide the only original biological information published for the species thus far.

The new paper by Rubinoff (2002) interested me in that it stated that there was no evidence that the species had any diurnal activity, thus contradicting what Hodges (1971) noted for the species, namely that it could sometimes be found on flowers and in the daytime. Comstock and Henne (1942) first reared the species but did not mention any adult behavior in their paper; likewise, the paper by Osborne (2000) also does not offer details of adult behavior.

My knowledge of the species in Santee, a town about 15 miles inland from San Diego, involves crepuscular activity of the adults. The species is relatively rare, possibly more so due to its winter flight activity (which, however, corresponds to the real southern California "spring" when much of the region along the coast is green with fresh grasses, plus the first blossoming shrubs and wild flowers); also, most collectors are not active at this time of year. Holland (1903) illustrated and noted the rarity of this distinctive sphingid, with its olive-green forewings and purple-brown edged hindwings, so the identity was immediately clear. Thus, the specimens of *A. lucidus* that I collected in Santee, first in 1963 and then in early 1965, sparked my interest at the time inasmuch as the species was considered a rare catch.

In 1965, the species was taken at dusk flying over a lawn and near adjacent flowers (cultivated roses in this case): the activity time period involved was when there was still enough light to see brighter colors after the sun had already set (the exact time is not recalled but for late Jan to Feb it must have been about 1830-1900h). Once the first specimen was taken in this way in Jan 1965, daily searches were continued at dusk and more adults were found until 26 Feb, although never more than one adult on any given day. I recall the adults would fly low over the lawn at dusk and sometimes even alight on the grass.

The actual site in Santee was my former residence at the time, in a rather small residential area (about 90 houses) adjacent to and surrounded on three sides by a still undisturbed natural hillside shrub community typical for the region, so the nearest possible native hosts for the species probably were no closer than about 100m.

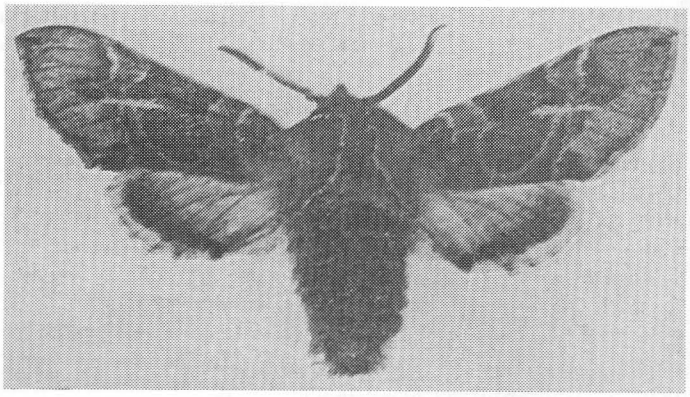

Fig. 1. *Arctonotus lucidus*, male (from Holland, 1903) (note that the illustrated specimen is somewhat worn, since the light horizontal line seen on the mid-wing vein of the forewing is an area where scales are missing; fresh specimens do not have such marks). (wingspread ca. 45mm).

The Santee (San Diego Co.) records are as follows (all collected by J. B. Heppner; now in the FSCA):

June [Jan] 1963, male [this specimen presumably was collected in Jan 1963 and incorrectly labelled, since no known flight activity has been recorded in June for the species, particularly in the southern end of its range. It is possible this single specimen from 1963 was taken at lights.]
21 Jan 1965, male
23 Jan 1965, male
18 Feb 1965, female
26 Feb 1965, male

Rubinoff (2002) stated that *A. lucidus* adults do not feed and are found only at lights. Inasmuch as the adults have an atrophied haustellum, it is possible the moths I encountered were only seeking humidity from newly watered grass and flowers, but they certainly were active at dusk. An anonymous reviewer noted that these moths may also have been following pheromone plumes, which is also plausible. Frank Hovore (pers. comm.) also has notes on the species flying at dusk east of Bakersfield, at Glennville (Kern Co.) and also nearby at Posey (Tulare Co.). He notes (Hovore, pers. comm.) that *A. lucidus* has been observed at these sites to fly at very low temperatures for a moth, at about 30-40°F (-1°C to 6°C) and even as low as 25°F (-4°C) at dusk and at lights: clearly a species well adapted to winter activity during the mild winters of central and southern California.

Ron Leuschner (pers. comm.) noted to me that his specimens of *A. lucidus* were all collected in California at lights during Jan-Feb (records in his collection date from 1955 to the present): from Middletown, Lake Co.; Rancho California and Anza, Riverside Co.; and Newhall, Los Angeles Co.

1. Contribution No. 932, Entomology Section, Bur. Ent. Nema. Plant Path., Div. Plant Industry, Florida Dept. Agric. & Consumer Serv., Gainesville, Florida.

The estimated range of *A. lucidus* is shown in Fig. 2: the map dots represent known collection localities for the species as documented by Smith (1993), while the estimated range of the species is demarcated by the solid black line. It is likely that the species occurs in southern British Columbia, as well as in northern Baja California adjacent to San Diego County, California. No specimens of *A. lucidus* have been recorded for any lowland Great Basin locality (the borderline exception is a record from Ada Co., Idaho, where the city of Boise is located), nor likewise from the deserts of southern California. More searching is necessary in remote regions and at the right season, but it appears *A. lucidus* only occurs in the Pacific Coast Ranges and Sierra Nevada foothills and then northwards to the Canadian border region. San Diego County is fairly well collected, as are other parts of southern California, and no specimens have been collected in desert areas even adjacent to the chaparral hill sites just west of these desert areas. The plant associations of San Diego County continue on into northern Baja California relatively unchanged, at least as far south as the Sierra San Pedro Martir, so *A. lucidus* is to be expected to also occur in this region as well: the lack of Baja California records no doubt is due to the lack of collecting in this region during the winter months when *A. lucidus* is on the wing.

There has been one other species placed in the genus *Arctonotus*, this being a resident of the Sinaloan region of Mexico, but this species (*P. terlooii* H. Edwards) is now considered in the genus *Proserpinus* according to the latest Neotropical catalog (Carcasson and Heppner, 1996). D'Abrera (1986) still has it in *Arctonotus* and even states it may occur in Arizona (this is presumed erroneous, as there are no available specimens from Arizona), but Kitching and Cadiou (2000) also have the species in *Proserpinus* in their recent catalog.

ACKNOWLEDGMENTS

My thanks to Thomas C. Emmel (McGuire Center for Lepidoptera Research, University of Florida, Gainesville, Florida) for help in obtaining a copy of the Comstock and Henne (1942) paper. Ron Leuschner (Manhattan Beach, CA) and Julian Donahue (Los Angeles, CA) kindly reviewed the paper, as did one anonymous reviewer, and all made useful comments and additions. Frank Hovore (Santa Clarita, CA) also had some comments that have been added to the text.

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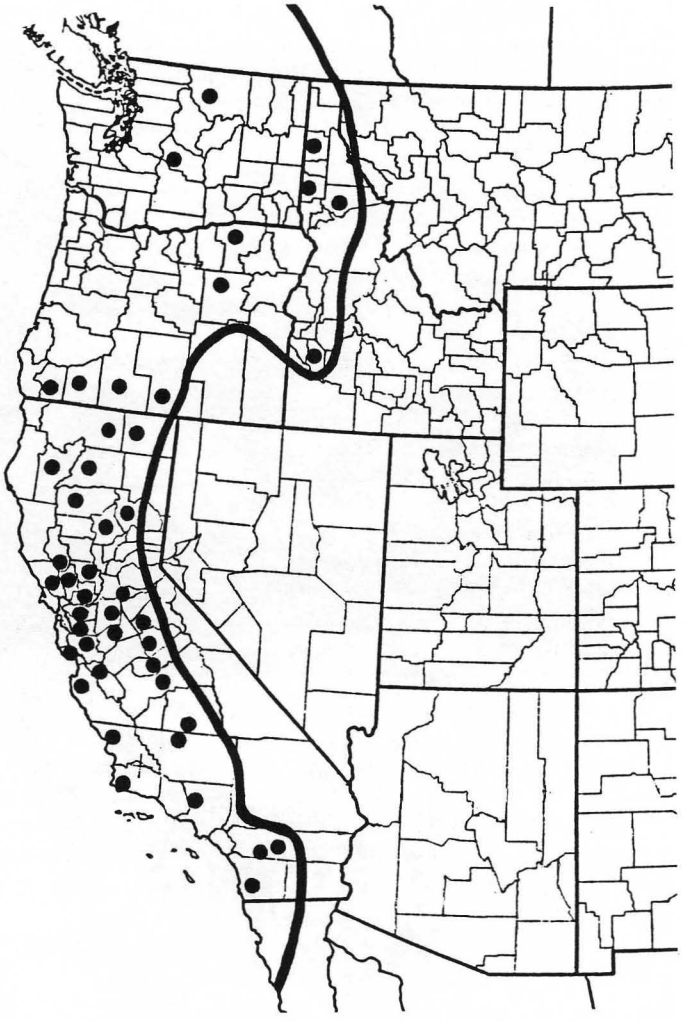
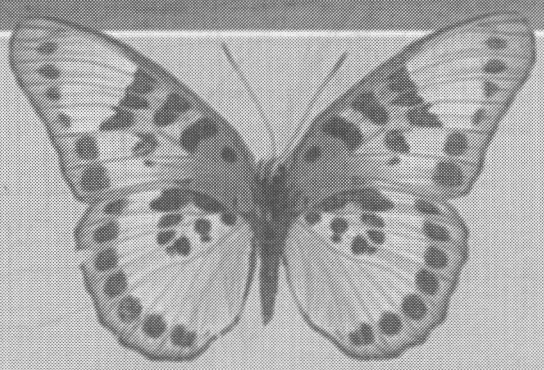
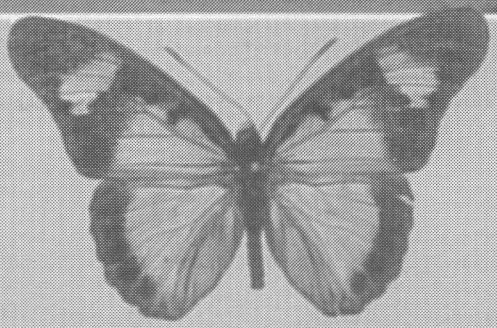


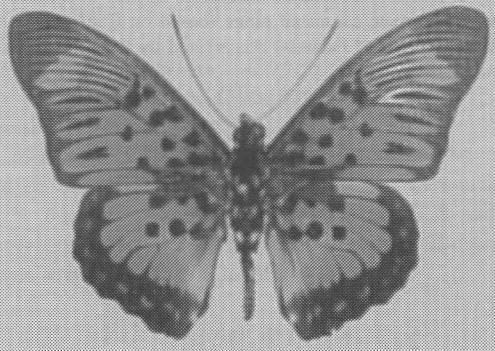
Fig. 2. Distribution map of *Arctonotus lucidus* in western North America, with the approximate estimated range (based on Californian and Pacific Northwest physiography and habitats) demarcated by the solid black line (modified from Smith, 1993).

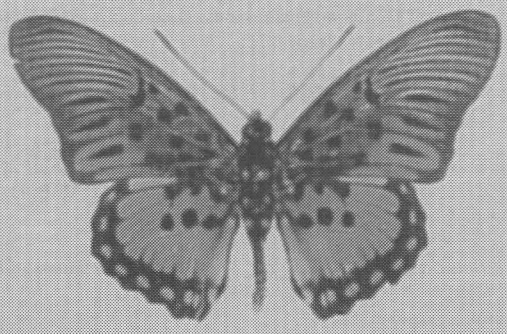
Butterflies of Tanzania

Jan Kielland









LEPIDOPTERA NEWS, 2002 (1-2): 12-36

LEPIDOPTERA FAUNAL REPORT: TANZANIA

by JAN KIELLAND

EDITORIAL NOTE: This first reprint of a faunal summary from a published book presents the habitats of the butterfly fauna of Tanzania. The faunal summaries usually presented in guidebooks for regions or countries are of use for future visits of enthusiasts and nature watchers, by providing information on the region, its climate, vegetation, and habitats. This series in *Lepidoptera News* will periodically present reprints from various guidebooks, so lepidopterists and others can benefit from the regional data.

Kielland's book, *Butterflies of Tanzania* (see dust jacket image in the frontispiece, p. 12), was published in 1990. The section reprinted herein covers pages 11-34 in his book. My thanks to Antiquariat Goecke & Bauer, who have rights to the book from the late Mr. Kielland, for permission to reprint this section (pp. 22-23 from the book are excluded since they deal with conservation issues for Tanzania that now seem too out of date to warrant reprinting here).

Climate and Topography

Tanzania is situated between 1°S and 11.75°S and 29.7°E and 40.4°E. The country enjoys a comparatively stable climate, apparently more stable than Kenya, at least the northern parts of Kenya, which are situated closer to the dry Sahel Belt.

The climate of western Tanzania, a belt from Tukuyu near Malawi to the Ugandan border, is more stable than in most other areas in that country. To a great extent this is due to the 600 kilometre long Lake Tanganyika, flanked on both sides by mountains and hills. The climate in the southern part is influenced by Lake Malawi and the high mountains in the region, and the northern part by Lake Victoria. The whole of this region enjoys a comparatively high rainfall, the highest occurring in the mountains of Tukuyu with rain practically the whole year, enabling people to grow tea there. From Mbeya, north to near L. Victoria, however, there are distinct dry and wet seasons. The wet season commences around the middle to the end of October, which is the beginning of the so-called short rainy season in some other parts of the country (e.g. the Northern Highlands). There is no distinct short rainy season in the west, but November to the end of December is a period of heavy showers followed by sunny periods during part of the day. This is followed by periods of 2–3 weeks in January with little or no rain; this pattern may continue into February with little rainfall, although there is almost always enough for the farmers. This is the period of the year which can be hazardous in other parts of the country with the risk of no rainfall, and when even the short rains fail.

In March the rainfall increases in intensity, and this marks the beginning of the main rainy season in other parts of the country. In the west the heavy rains usually stop towards the end of April, and in May only one or two showers may occur. From May, until mid October, there is no rain whatsoever, except in the Tukuyu area and Bukoba Region which are areas of high rainfall. The Mahale Mt. in Kigoma District may experience an occasional shower in August.

The huge drier central plateau of Tanzania (zone 2) separates the moister western and eastern parts of the country. In eastern Tanzania the highest rainfall is enjoyed by the Usambaras, the higher parts of the Uluguru Mts. and the south-eastern edge of the Uzungwa Range of mountains. The further west one goes, from the Uzungwa escarpment edge, the drier the climate becomes.

South of the Uzungwa Range are the Njombe Highlands which continue as far as the Kipengere Range, Mt. Rungwe and Tukuyu, and the Livingstone Mts., bordering L. Malawi. A lower continuation of these mountains stretches south bordering L. Malawi. When my friend T.C.E. Congdon and I visited Mbinga District and Kitesa Forest, west of Songea, it was noticeable how the climate and vegetation changed the closer we got to L. Malawi, from *Brachystegia*-covered hills to hills with evergreen forest on top. It was obvious that the climate close to the lake was considerably moister than at Songea.

Zone 6 on map 1, containing the Northern Highlands, is comparatively arid, except for the high mountains (e.g. Mt. Kilimanjaro, Mt. Meru, Oldeani-Ngorongoro) where the precipitation in the higher altitudes is quite heavy, but restricted to the rainy season only. Several salt lakes exist in this area, containing water for part of the year only (e.g. L. Eyasi, L. Manyara, L. Natron).

Faunistic zones in Tanzania

As every student of tropical butterflies will know, in countries with predominantly deciduous woodlands and evergreen forests confined to isolated, high mountains and scattered lowland patches, woodland species generally are widely distributed. On the other hand, a great number of true forest species are localized, or poorly distributed, due to the isolation of their habitats.

The enormous, comparatively dry, middle part of Tanzania faunistically divides the moister eastern and western parts of the country from each other. The fauna of western Tanzania is influenced from the north-west, south and south-west, and differs considerably from that of the east, being isolated from it by the wide stretch of drier and almost entirely deciduous habitats, extending from near L. Victoria, south into Zambia. This central plateau effectively acts as an ecological barrier, separating forest species in the west from those in the east. There might be other reasons as well, but this dry central plateau is certainly the main reason why the forest fauna of eastern and western Tanzania are so different (see map 1).

Tanzania may be divided into the following zones, corresponding mainly with the zoogeographic distribution of the butterflies, but which, to a certain degree, will also apply to other fauna and, to some extent, the flora as well (see map 1).

Zone 1.
This is the western zone with comparatively high rainfall and lush vegetation, divided into three subzones.

Subzone 1a.
This part is related to the Uganda-Zaire elements, particularly in the northern part of it. The Bukoba Region, with high rainfall, has strong resemblance to the Ugandan flora and fauna.

This north-western part of the country has not been well collected, and some recent superficial collecting near the Ugandan border turned up a number of species and races new to Tanzania, but all known from Uganda. Thorough collecting would certainly reveal a lot more. The northern part of this subzone is characterized by swamp-forests and forests flooded during part of the year. As one goes south this kind of habitat gradually peters out into ordinary riverine vegetation and deciduous woodland, similar to that of the following subzones.

Subzone 1b.
A large area comprising forest remains, riverine forests, many mountains and hills, intermingled with flat savanna country and *Brachystegia*-clad hills, commences at the southern end of Burundi and reaches the plains just south of L. Katawi approximately at the point where one starts to climb up to the Ufipa Plateau. It contains a large number of species (well over 700) with many forest elements from the north (Uganda and Zaire)* and woodland species, originating from the Zambia-Angolan woodland complex. It also contains a considerable number of species and subspecies endemic to this area. This section is comparatively well collected.

Subzone 1c.
This subzone is separated from 1b by the low, dry Katawi plain, and the montane fauna on the Ufipa Plateau is therefore quite isolated from montane areas of 1b, and this isolation is evident in the composition of the fauna. It is possible that this area fits closer to subzone 3a than to 1b, but some montane elements (e.g. *Papilio jacksoni kungwe*, *Colotis elgonensis nobilis*, *Aphnaeus eriksoni kiellandi*) are endemic to both 1b and 1c.

This area has been moderately collected, but mainly in the forests of Chala, Mbuzi Mt. and Bisi Mt., and not at all closer to the lake.

Zone 2.
This is the enormous central plateau of Tanzania, extending from L. Victoria in the north to the Zambian border in the south, bordering on Zone 1 in the west and reaching the western slopes of the high mountains in the east, and includes Dodoma town and its surroundings. The elevation is generally between 1100 and 1300 m.; a few highland plateaus reaches 1700 m. Most of it is covered with *Brachystegia*-like woodland, but areas in the north are alternately woodland and thornbush and thorn-*Acacia*. Between Dodoma and Tabora there are large tracts of very thick, deciduous bushland. Considerable areas around Dodoma consist mainly of thorny vegetation.

* Surprisingly, it seems to be more closely related to eastern Zaire than to Uganda and subzone 1a.

Explanation to map I
Areas enclosed with solid lines indicate highlands
— · — · — zonal boundary
..... subzonal boundary
– + – + – railway line

This zone is the driest part of Tanzania and contains practically no evergreen vegetation*. The southern and central parts of it have in fact been too little explored, due both to the difficulty of access to them and to their less-interesting fauna. (In dry woodland it is not easy to discover anything new, in contrast to more moist montane areas subject to endemism.) As far as I know, the higher plateaus of the area have not been explored with regard to insects.

Zone 3.
I have divided this zone into three sections, including the Southern Highlands and the Uzungwa Range. It generally consists of high, to very high, country.

Subzone 3a.
This area is separated from 1c by a comparatively narrow gap of the dry and fairly low country of zone 2. It includes mountains around Mbeya town, and extends south to Tukuyu and the Malawian and Zambian border, and east to a slightly drier and somewhat lower country between Makombako and Mufindi. The bulk of it is very high country from around 2000 m. to the summit of Mt. Rungwe (2960 m.). North of Mbeya it borders upon much lower and drier country containing woodland and thornbush. To the south it borders upon Zambia, Malawi and L. Malawi, and zone 5 (south of the high country around Njombe). Its fauna is influenced by elements from northern Malawi and the Uzungwa Range (section 3b). Endemism is not marked, but it contains a few localized species and races.

Subzone 3b.
This is a continuation of the Southern Highlands in subzone 3a, but with a slight depression where they meet (about 1600 m.) which cannot be much of a barrier. It includes the Uzungwa Range with the Iringa Plateau and Image Mt., and borders the Ruaha River in the north-east. This river runs through a deep valley (500–600 m.) covered in thornbush and thorn-*Acacia*, forming an ecological and topographical barrier between 3b and the mountains further north and north-east. The western part of 3b borders the dry Ruaha plains, commencing zone 2. This western part of 3b (Uzungwa Highlands and Iringa Plateau) is a lot drier than the mountains bordering the eastern part of it, with the Uzungwa escarpment. This scarp drops down to the Kilombero Valley which makes the south-eastern boundary, bordering 3c with the Mahenge Highlands on the other side. Mr. T.C.E. Congdon (personal communication) informs me that the mean rainfall of the south-eastern part of Mufindi approaches 2000 mm. close to the eastern escarpment. The Uzungwa Range contains a fair amount of endemism, and due to the altitude range and varied climate (moist and dry areas) and also due to large tracts of montane and lowland forests, the species density is high for a section of eastern Tanzania (close to 500 known species).

Subzone 3c.
Situated to the east of 3a and 3b, this area consists of large tracts of swamps and savanna country (the Kilombero Valley, excluding Magombera Forest and parts of the Selous Game Reserve). The south-eastern section of it (Ulanga District) is hilly, and apart from woodlands and some open grassland, it also contains a number of lowland and submontane forests, notably Muhulu Forest, close to Sali Mission. This forest is situated on a ridge (1600 m.) and overlooks the uninhabited Mbaraka Mts. to the south where several patches of forest can be seen on hilltops. Masagati Forest is a lowland forest (350–500 m.), situated at the western corner of 3c, containing hills and marshy valleys with a surprising number of butterfly species (on a single collecting trip, lasting 21 days, 205 species were recorded). A lowland forest species (i.e. *Euphaedra neophron*) is here represented by a distinct race, differing from populations found below the Uzungwa rift and further east. This indicates that Masagati Forest must have been isolated for a considerable time; but generally, the fauna of 3c corresponds with 3a and 3b.

Zone 4.
This is also divided into three subzones. Its mountains are much more discontinuous than in zone 3, and consequently, endemism is much more developed. Almost every sizable mountain in this area has its endemic species and subspecies, even mountains close to each other.

Subzone 4a.
This is a small area, mostly comprising a cluster of isolated mountains called the Rubeho Mts. These mountains

* A few isolated patches of zone 6 and subzone 4c are even drier.

are situated between the Ruaha River (which forms the boundary between 3b and 4a) and the Central Railway Line to the north. The western part of the Rubehos is drier than the eastern and adjoins zone 2. The main mountains are Mangalisa Mt., with the Mangalisa Forest Reserve (1900–2300 m.) covering the upper ridges and hills of the mountain; Wotta Forest Reserve, a small forest (1900–2100 m.) situated at Kibakwe Mission; Chugu Mt. with Mafwemiro Forest (1700–2100 m.), and Ukwiwa Forest Reserve (1600–2000 m.). A saddle of 1700 m. elevation connects Mafwemiro Forest with Ukwiwa Forest, but at this point (Mbuga Mission) cultivated land is disrupting the two forests which undoubtedly must have been connected not very long ago, as scattered evergreen vegetation and patches of forest occur everywhere. Several species and subspecies are endemic to these mountains.

Subzone 4b.

This is a comparatively large area, comprising four main mountain areas (Uluguru Mts., Nguru Mts., Nguu Mts. and Ukaguru with Kiboriani Mts.). The Kiboriani stand a bit apart from the Ukagurus. Scattered in the plains north of the Ukagurus are several small mountains or hills with evergreen forest near the summit (e.g. Njoge Mt.) and surrounded by rather dry thornbush, *Acacia* and other kinds of woodland. The fauna on the Ukagurus and Kiboriani is somewhat related to that of the Rubehos, but it also has affinities with mountains in section 4b.

Nguru Mts., Kanga Mt. and Nguu Mts. are all closely related faunistically and share some endemic taxa. The Nguu Mts., however, are much lower than the others (maximum 1600 m.) and therefore lack several of the more montane species. Kanga Mt. is very steep and reaches just over 2000 m. above sea-level, with forest covering most of it above 1000 m., and also down to 450 m. in places. Nguru Mts. are the highest, next to the Ulugurus, with peaks reaching up to 2400 m. This mountain range is very rich in endemism and was originally covered in forest down to the plains at 400 m., as at Turiani, but only small patches are left at 600 m. up to 900 m., and much of the forest up to 2000 m. has also been cut down.

About 70 kilometres south of the Ngurus is another isolated, larger mountain range, the Ulugurus, with two main parts (South Uluguru and North Uluguru), but connected by a saddle approximately 1700 m. at its lowest. One might therefore assume that this saddle could not act as a physical barrier, but apparently it does – at least to two related species of *Uranothauma* (Lycaenidae), one on each part of the mountain range, namely *U. uganda* endemic to North Uluguru and *U. lukwangule* endemic to South Uluguru (the Lukwangule Plateau). *U. lukwangule* occurs between 2400 and 2600 m., while the other flies lower down, between 1900 and 2140 m., which is the summit of Bondwa Mt.

The Ulugurus are very rich in species (over 430) and endemism abounds. A few Southern Highlands-Nyassa elements have penetrated to the Nguru and Kanga Mts. along the chain of mountains from Iringa over Image-Rubeho-Ukaguru, but the deep cleft of the Great Ruaha River has prevented movement of many high altitude species.

There is some affinity between the fauna of the Nguru Mts. with that of the Ulugurus, but in many aspects the Ulugurus stand by themselves.

Subzone 4c.

The most important parts of 4c are the East and West Usambara Mts. and the South Pare Mts.; these mountains are surrounded by low, savanna country, but between East Usambara and the coast much of the country was originally forested, but now hardly any of this is left. W. Usambara reaches 2200 m., while E. Usambara is not much more than 1000 m.

During my investigation of the Pare Mts. with regard to the butterfly fauna, I found that the part of it called 'South Pare' is decidedly more closely related to the West Usambaras than to North Pare, and that North Pare is closer to Mt. Kilimanjaro, and to the Lossogonoi Plateau, which includes Mt. Lossoganeu.

Both Usambara and South Pare have separate endemic taxa, but several are shared between them. They also have some relationship with the Teita Hills in the south-eastern part of Kenya. Although the Usambara and Uluguru mountains are among the best-collected areas in Tanzania, this does not mean that there is nothing new to science still to be found there; on the contrary, new taxa are continually being discovered.

Zone 5.

The western part of southern Tanzania has mountains reaching 1900 m., the highest ones situated close to L. Malawi. The part of it which is close to the lake receives much more rain than further east, and consequently most of the forests are found there, but much has been cut down and only patches are left (e.g. Kitesa Forest Reserve). The fauna of these mountains comprise species related to both Malawian and Southern Highland elements. A few subspecies and forms, typical of Malawi occur here.

Zone 6.
A large zone, divided into three, with section 6a being much larger than the other two. This is the zone I shall refer to as the 'Northern Highlands'.

Subzone 6a.
This section includes most of the montane areas in the Northern Highlands. The Oldeani-Ngorongoro Range includes volcanoes such as Loolmalasin, Lemagrut, Oldeani, Nainokanoka, Embulbul and Ngorongoro Crater. On the plains to the north-east the volcanoes, Gelai and Kitumbeine, are forested to a certain extent, but much of the forest on Kitumbeine has now been cut down. South of Serengeti, in the Mbulu Mts., there are still two large forests, the Nou and Marang, and a smaller one, the Hasama. Nou Forest extends up to 2400 m. and the others from 1700 to 2100 m.

The Mbulu Mts. are crystalline formations, not volcanic ones. The species density in the recent volcanic formations is lower than in the crystalline formations like Mbulu.

The western and southern parts of 6a are bounded by the drier and lower zone 2, south of Kondoa and Singida. Mt. Hanang (3418 m.) and Kwaraha Mt. (2415 m.) are in these two parts.

The northernmost part of 6a is not sufficiently collected to enable me to judge where to put its boundary correctly, so the one I have put in map 1 is merely the result of guess-work. I have not collected on Gelai and Kitumbeine, but as they are volcanoes I have to assume that their faunas will be related to those of other neighbouring volcanoes. I have not collected around Loliondo, close to the Kenyan border, and I know of no records from there.* The mountains there are a continuation of a mountain range crossing the border with Kenya, where the montane fauna is not quite the same as in 6a, but nevertheless some Kenyan elements must have spread into the mountains of 6a through Loliondo and Serengeti, such as *Papilio chrapkowskii* (in the Oldeani-Ngorongoro, Mt. Kwaraha and Mbulu forests), and *Charaxes druceanus septentrionalis* (Mbulu forests).

The highest mountain in 6a is the 4566 m. high volcano, Mt. Meru (the type-locality of *Papilio sjöstedti*). Between Mt. Meru and the Oldeani-Ngorongoro Range are the two *old* volcanoes, Monduli and Losimingor, both of which I have not collected on, but their fauna is undoubtedly similar to that of Mt. Meru, the butterfly species of which are closely related to those of Oldeani and Ngorongoro. Just to the south of these mountains, in the northern part of the Masai Plains, is a solitary mountain with forest on top, called Lolkisale (2132 m.). My visit to this forest proved that its fauna was very closely related to that of the forests of Oldeani and Ngorongoro.

Subzone 6b.
This small area contains Mt. Kilimanjaro, North Pare Mts. and the mountains of Lossogonoi Plateau. All these mountains are well separated by arid plains with grass and thornbush vegetation. North Pare and the mountains at Lossogonoi, as well as part of West Kilimanjaro, are crystalline formations, while East Kilimanjaro is volcanic. They have an affinity with 6a inasmuch as they (at least Kilimanjaro and North Pare) have some endemism in common in connection with Mt. Meru. North Pare has also been influenced by some Kenyan elements.

Subzone 6c.
Of this I know very little, if anything. It consists of hilly country, connecting this subzone with the Kenya highlands, and should produce a number of species and subspecies typical of the neighbouring part of Kenya.

Zone 7.
Likewise this is an area I have never collected in. It is hilly, but with a lower elevation than 6c. Its fauna has an affinity with that of Kenya, and some races of butterflies have not been recorded from elsewhere in Tanzania (e.g. *Charaxes smaragdalis homonymus*). This zone has been little looked into with regard to butterflies.

Zone 8.
Consisting of plains and rolling country with *Brachystegia* and other kinds of woodland, part of it includes most of the Selous Game Reserve and the Rufiji River basin. All of it is comparatively low-lying country; the southern part of it, however, is hilly. Few records are known from this area.

* Recently Mr. J.P. Lequeux's African collector obtained *Charaxes ansorgei loita* in Loliondo, previously only known from the Loita Hills in Kenya.

Zone 9.
This is the coastal zone, commencing at the border with Mozambique and terminating on the Kenyan border. I have divided it into two subzones.

Subzone 9a.
This is the northern part which differs to a certain extent from the southern section. The boundary line between 9a and 9b is vaguely determined, as most of this vast area of southern and central Zone 9 has very difficult access, with roads almost nonexistent. Consequently, very little collecting has been carried out, but at least, the southern part of it, the Rondo Plateau, close to Lindi, contains elements not encountered in 9a and vice versa. Within 9a several interesting lowland forest patches lie like the Pugu Hills near Dar es Salaam, Kiono Forest just west of Sadani, and others between Sadani and Tanga. The main vegetation type in 9a is moist deciduous woodland, often very dense and intermixed with lianas. Other forest patches are situated further inland, east of Handeni. 9a is the area which contains most of the tiny *Baliochila* species (Lycaenidae). Some species have been found only in this section and in corresponding habitats of south-eastern Kenya (e.g. *Neptis rogersi*, Nymphalidae).

Subzone 9b.
The western part of 9b is clad in woodland; the section of it closer to the coast is wetter and there is a succession of sandstone plateaus stretching northwards and reaching up to 900 m and often clad in evergreen forest. Some of the forest patches are larger and commence close to the Mozambiquan border at the Konde Plateau, and continue north to Kilwa, or close to the boundary of 9a. These forests are not generally known, and no collecting has been done there, except lately in the Forest Reserve on the Rondo Plateau which I have visited twice, the last time with Mr T.C.E. Congdon of Mufindi. We made some interesting finds; two entirely new subspecies (i.e. *Charaxes acuminatus rondonis* and *Pseudathyma lucretioides rondo*) and the new species *Pentila rondo*, described later, and *Euthecta cooksoni*, known only from Mozambique.

Zone 10.
This is Pemba Island, just off the coast from Tanga. It is a very interesting island and contains a number of endemic taxa, in contrast to Zanzibar. This is because Pemba has been isolated from the East African mainland for a long period, while Zanzibar's isolation is more recent. The northern part of it contains a large forest reserve, (i.e. the Ngezi Forest), and a few small forests at Ras Kiuyu, north-east of Wete. Several endemic taxa have so far been described from Pemba Island, and more are almost certain to follow, as collecting there has not been done very systematically. (It is not easy to collect on Pemba these days, as special permission must be obtained first, from the authorities on the island itself.)

Zone 11.
Most of this faunistic zone is Kenyan, of which only a small part extends into Tanzania at Mt. Longido (2630 m.) and the Meto Hills (2200 m.), both crystalline formations. The butterfly fauna of both these mountains turned out to be very closely related to the fauna of Kenya, and a number of races and species also occurring in Kenya were obtained.

Taxa occurring in Kenya also, but not elsewhere in Tanzania, are as follows:
Charaxes xiphares walewandae (described from Mt. Oldoinyo Orok, in southern Kenya, by Mr S.C. Collins), *Mylothris jacksoni* which was obtained on both mountains, and *Papilio mackinnoni reductofascia* (to be described later in this work) also occurs just inside Kenya on Oldoinyo Orok, and *Ypthima simplicia* has been found on the Meto Hills. If one includes in Zone 11 what occurs in neighbouring Kenya, several taxa will also be found to be endemic to that zone.

Zonal and subzonal endemism

Below is an account of the number of known endemic species and sub-species for the various zones. The habitats they occupy is also indicated, whether highland or lowland forest, woodlands or montane grassland. A species or subspecies is endemic to a certain mountain or a certain area if it is not known to occur elsewhere. One may also say that a certain species is endemic to Tanzania if it does not occur in any other country. In some cases, however, a species that one originally regarded as being endemic to one mountain may have been overlooked elsewhere and later turns up somewhere else, but the species I have listed below are, at least for the time being, termed 'endemic'.

Species	Habitat	1b	1c	2	3a	3b	3c	4a	4b	4c	5	6a	6b	6c	7	9a	9b	10	11
Papilio hornimani mbulu K	Hf											●							
Papilio hornimani mwanihanae K	F, Hf					●													
Papilio desmondi magdae Giff.	Hf											●	●						
Papilio mackinnoni reductofascia K	Hf																		●
Papilio mackinnoni mpwapwana K	Hf							●											
Papilio nobilis mpanda K	F, Hf	●																	
Papilio fülleborni rydoni K	Hf								●	●									
Papilio jacksoni kungwe Cott	Hf	●	●																
Papilio sjöstedti sjöstedti Aur	Hf											●							
Papilio sjöstedti atavus Le Cerf	Hf												●						
Graphium angolanus ssp. n	W																	●	
Graphium leonidas pelopidas Ob	W																	●	
Graphium poggianus wranghami K	F	●																	
Graphium poggianus kigoma B	F	●																	
Graphium porthaon tanganyikae K	F, Hw	●																	
Pieris brassicoides meridionalis J&T	Hoh											●							
Colotis elgonensis nobilis	C Hf	●	●																
Belen. raffrayi similis K	Hf, Hoh	●																	
Mylothris pluviata Ta	Hf								●										
Mylothris crawshayi leonora Kruger	Hf								●										
Mylothris kiellandi B	Hf									●									
Mylothris sagala mahale K	Hf	●																	
Mylothris sagala oldeanensis K	Hf											●							
Mylothris sagala seminigra T	Hf								●										
Mylothris rubricosta ssp. n	Hs					●													
Mylothris superbus K	Hf								●										
Amauris echeria meruensis Ta	Hf											●							
Amauris hyalites makuyuensis C	F	●																	
Amauris tartarea tukuyuensis K	F, Hw				●														
Aphys. pigmentaria kanga K	Hf								●										
Aphys. pigmentaria songeana K	Hf										●								
Aphys. pigmentaria uzungwae K	Hf				●	●													
Aphys. pigmentaria mbulu K	Hf											●							
Aphys. pigmentaria seminigra K	Hf								●										
Bicyclus pareensis K	Hf									●									
Bicyclus similis Cond	Hf	●																	
Bicyclus tanzanicus Cond	Hf	●																	
Bicyclus uzungwensis K	Hf					●													
Bicyclus uzungwensis granti K	Hf							●											
Henotesia elisi uluguru K	Hf								●										
Henotesia ubenica mahale K	Hf	●																	
Henotesia ubenica uzungwa K	Hf					●													
Physcaeneura robertsi K	W			●															
Neita orbipalus K	W											●							
Neita orbipalus congdoni K	W					●													
Neocoenyra fülleborni Thur	Hoh				●	●													
Neocoenyra fuligo K	Hoh							●											
Neocoenyra heckmanni heckmanni Thur	Hoh, Hf				●														
Neocoenyra heckmanni uzungwae K	Hoh, Hf					●													
Neocoenyra heckmanni mangalisa K	Hoh, Hf							●											
Neocoenyra heckmanni kennethi K	Hf								●										
Neocoenyra heckmanni songeana K	Hoh, Hf										●								
Neocoenyra jordani jordani Rebel	Hf								●										
Neocoenyra jordani septentrionalis K	Hf								●										
Neocoenyra mittoni Pinhey	Hoh				●														
Neocoenyra parallelopupillata Karsch	Hf									●									
Neocoenyra petersi K	H				●														
Cymothoe amaniensis Rydon	F									●									
Cymothoe aurivillii aurivillii S	Hf								●										
Cymothoe aurivillii tenuifasciae Rydon	Hf							●											
Cymothoe aurivillii latifasciata Rydon	Hf				●	●	●												
Cymothoe aurivillii nguru Rydon	Hf								●										
Cymothoe collinsi Rydon	Hf												●						
Cymothoe coranus kiellandi Bearain	F	●																	
Cymothoe lurida azumai C	F	●																	
Cymothoe magambae Rydon	Hf									●									
Pseudathyma uluguru K	Hf								●										
Pseudathyma lucretioides rondo K	F																●		
Pseudathyma plutonica expansa K	F, Hf	●																	
Euriphene safirina itanii C	F	●																	
Bebaeria orientis insularis K	G, F																	●	
Bebaeria sophus ochreata C	F	●																	
Euphaedra neophron rydoni How	F																	●	

Species	Habitat	1b	1c	2	3a	3b	3c	4a	4b	4c	5	6a	6b	6c	7	9a	9b	10	11
Euphaedra neophron kiellandi Hecq	F						●												
Euphaedra neophron violacea B	F											●	●						
Euphaedra sarcoptera nipponicorum C	F	●																	
Pseud. boisduvali pemba K	F																	●	
Pseud. deludens reducta K	Hf									●									
Pseud. deludens tanganyikae K	Hf	●																	
Neptis incongrua izidoro K	Hf								●										
Neptis incongrua nguru K	Hf								●										
Neptis aurivillii ufipa K	Hf		●																
Neptis ochracea reducta K	Hf	●																	
Hypolimnas antevorta Dist	F									●									
Junonia westermanni splendens Sch	F															●			
Issoria baumanni orintalis K	Hoh, F					●													
Charaxes acuminatus rondonis K	F																●		
Charaxes acuminatus usambarensis v.Som	F, Hf								●	●									
Charaxes maccleeryi v.Som	F, Hf								●										
Charaxes cynthia mukuyu v.Som	F	●																	
Charaxes brutus roberti Tur	F																	●	
Charaxes druceanus praestans Tur	F, Hf									●									
Charaxes lucyae lucyae v.Som	Hf									●									
Charaxes lucyae mwanihanae K	Hf					●													
Charaxes lucyae gabriellae Tur	Hf								●										
Charaxes lasti magombera K	F					●													
Charaxes lasti kimbozae K	F								●										
Charaxes smaragdalis kigoma v.Som	F	●																	
Charaxes mixtus tanzanicus K	F	●																	
Charaxes xiphares kilimensis v.Som	Hf												●						
Charaxes xiphares kiellandi Pl	Hf											●							
Charaxes xiphares sitebi Pl	Hf	●																	
Charaxes xiphares nguru Collins	Hf								●										
Charaxes xiphares walwandae Collins	Hf																		●
Charaxes pythodorus pallida v.Som	W, Sh			●															
Charaxes jahlusa kigomaensis v.Som	F, Fm	●																	
Charaxes etesipe pemba v.Som	F																	●	
Charaxes sp. n.	F	●																	
Charaxes blanda blanda Roth	W?																●		
Charaxes pembanus Jord	Fm																	●	
Charaxes usambarae v.Som & Jack	F, Hf									●									
Charaxes usambarae maridadi Collins	F, Hf								●										
Charaxes chunguensis White & Grant	Hf							●											
Charaxes gerdae Rydon	F, W	●																	
Charaxes grahamei v.Som	F	●																	
Charaxes zelica toyoshimai C	F	●																	
Charaxes ansorgei ufipa K	Hf		●																
Charaxes ansorgei kilimanjarica v.Som	Hf												●						
Charaxes ansorgei rydoni v.Som	Hf									●									
Charaxes ansorgei simonsi Tur	Hf								●										
Charaxes castor arthuri v.Som	F																	●	
Charaxes tavetensis pemba v.Som	F																	●	
Charaxes pollux maua v.Som	Hf											●	●						
Palla publius kigoma C	F	●																	
Ariadne enotrea archeri C	F, Fm	●																	
Salamis cacta amaniensis Vos	F								●	●									
Bem. quadricolor uluguru K	Hf								●										
Bem. quadricolor mahale K	Hf	●																	
Bem. quadricolor morogoro Sh	Hf								●										
Acraea baxteri oldeani K	Hf											●							
Acraea acuta rubrobasalis H	Hf									●									
Acraea acuta nigromaculata K	Hf								●										
Acraea acuta ngorongoro K	Hf											●							
Acraea alicia mbulu K	Hfm											●							
Acraea alicia uzungwae K	Hfm					●													
Acraea boopis ama Pierre	F															●			
Acraea cerasa kiellandi C	F	●																	
Acraea egina pembanus K	Fm, F																	●	
Acraea kappa Pierre	F	●																	
Acraea lycoa fallax Rog.	Hf											●	●						
Acraea ntebiae kigoma K	F	●																	
Acraea punctimarginea Pinhey	F							●	●										
Acraea rahira mufindi K	S					●													
Acraea rohlfsi Suff	F									●									
Acraea orestia sambar Stoneham	F									●									
Abisara neavei mahale K	F	●																	

Species	Habitat	1b	1c	2	3a	3b	3c	4a	4b	4c	5	6a	6b	6c	7	9a	9b	10	11
Abisara neavei congdoni K	F				●														
Alaena ferrulineata H-S	W											●							
Alaena kiellandi C	W	●	●																
Alaena madibirensis Wich	W					●													
Pentilla rondo K	F																●		
Telipna sanguinea kigoma K	F	●																	
Ornipholidotos nguru K	Hf								●										
Ornipholidotos kigoma K	F	●																	
Mimacraea gelinia gelinia Ob	Hf									●									
Mimacraea gelinia nguru K	Hf								●										
Baliochila pseudofragilis K	Fm, W											●	●						
Baliochila nguru K	Hf								●										
Baliochila pringlei St	Hf									●									
Baliochila congdoni K	F								●										
Aphnaeus eriksoni kiellandi St	W	●	●																
Spindasis tanganyikae K	Hoh, W	●																	
Spindasis collinsi K	Hf									●									
Aloeides molomo kiellandi C	Hoh	●																	
Aloeides conradsi conradsi	W, Oh			●															
Epamera congdoni K	Hf, Hfm					●													
Epamera congdoni uluguru K	Hf								●										
Epamera silanus alticola St	Hf								●	●									
Epamera nolaensis amanica St	Hf								●	●									
Etesiolaus pinheyi K	F								●	●									
Iolaphilus montana K	Hf	●																	
Virachola montana K	Hf					●													
Virachola ufipa K	Hoh		●																
Virachola mpanda K	Hfm	●																	
Pilodeudorix rodgersi K	Hf								●	●									
Anthene madibirensis Wich	W					●													
Anthene montana K	Hf								●										
Anthene hobleyi ufipa K	Hf		●																
Anthene sp.	Hf									●									
Anthene uzungwae K	Hf					●													
Anthene mpanda K	W	●																	
Triclema kimboza K	F								●										
Uranothauma uganda K	Hf								●										
Uranothauma usambarae K	Hf									●									
Uranothauma lukwangule K	Hf								●										
Uranothauma nguru K	Hf								●										
Uranothauma kilimensis K	Hoh												●						
Uranothauma heritsia chibonotanus Aur	Hf											●							
Harpendyreus marungensis mangalisa K	Hrs							●											
Harpendyreus bergeri St	Hrs								●										
Harpendyreus boma B.B	Hrs				●														
Harpendyreus aequatorialis vulcanica J&T	Hf											●	●						
Lepidochrysops chala K	Hoh		●																
Lepidochrysops anerius kiellandi St	W	●																	
Lepidochrysops carsoni B	W					●	●												
Lepidochrysops mpanda Tite	Hoh	●																	
Lepidochrysops kilimanjarensis Str	Hoh												●						
Lepidochrysops kennethi K	W					●													
Lepidochrysops dollmanni B.B	W	●																	
Celaenorrhinus kimboza Ev	Fl								●										
Celaenorrhinus	F					●													
Celaenorrhinus	Hf								●										
Celaenorrhinus	Hf							●											
Metisella congdoni de J&K	Hf, Rs				●	●													
Metisella perexcellens mpanda K	Hoh	●																	
Metisella carsoni B	Hoh	●	●																
Metisella	How							●											
Sarangesa tricerata compacta Ev	W																●		
Astictopterus bruno Ev	Hoh?				●														
Astictopterus tura Ev	Fm							●	●										
Ceratrichia bonga Ev	F								●	●									
Chondrolepis similis de J	Hf				●	●													
Chondrolepis obscurior de J	Hf					●													
Parnara guttana Ev	F									●									
Total		50	10	3	11	25	3	10	48	26	2	19	11	–	–	2	5	11	2
Subzonal endemism		45	5	3	7	19	1	8	36	18	2	13	6	–	–	2	5	11	2
Zonal endemism		55		3		33			74		2		25		–		7	11	2

Discussion

All the taxa endemic to the whole zone are included in zonal endemism. Species occurring in more than one subzone are not included under the column of subzonal endemism.

Below are numbers of endemic species and subspecies in each subzone:

Subzone	Species	Subspecies	Subzone	Species	Subspecies
1a	–	–	6a	2	11
1b	13	32	6b	3	3
1c	2	3	6c	–	–
2	1	2	7	–	–
3a	4	3	8	–	–
3b	7	12	9a	–	2
3c	–	1	9b	1	4
4a	4	5	10	1	10
4b	15	22	11	–	2
4c	11	7	Z	–	1
5	–	2			

Both taxa in no. 11 occur just over the border in Kenya as well. Z means Zanzibar which is close to subzone 9a, and perhaps should belong to it, but as it is an island I have made it separate.

In subzone 1a, 6c and zones 7 and 8 no endemic taxa are known, but collecting has been very superficial in these areas. However, one would expect that 1a and 6c as well as 7 would be poor in endemism as they are bordering on Uganda and Kenya with similar habitats. On the other hand, they contain a considerable number of Ugandan and Kenyan elements which are not found elsewhere in Tanzania. Zone 2, although a huge area, cannot develop many endemic taxa as there are few high mountains and practically no forest. Subzone 4b consists of several isolated mountains (inselbergs), each of them with endemic taxa. It is therefore of interest to specify the endemism of each separate mountain.

Uluguru Mts.	19	eight species and eleven subspecies
Kanga Mt.	2	one species and one subspecies
Nguru Mts.	10	four species and six subspecies
North Nguu Mts.	1	subspecies
Ukaguru Mts.	1	subspecies

Amongst endemic taxa in 3b eight are confined to the south-western part (Mufindi) and five to the north-eastern (Mwanihana Forest). The rest occur in both areas.

Trapping Charaxes and other butterflies

In earlier days the females of *Charaxes* were little known. They are not attracted to wet ground and animal droppings as the males are. Later, people started to use traps with bait of fermented fruit, which is attractive to both sexes. There are various ways of constructing these traps, some more convenient and efficient than others.

To start with I used traps with plywood floors attached to the bottom of the cloth cylinder, with a gap between the cloth and the floor for the butterflies to enter. This is the kind most people are still using, and which is described in papers and books. This type of trap is heavy because of the wood and the heavier wire which is often used; in addition it is less easy to get the specimens out of a fixed trap, and awkward to put the bait in. The whole procedure takes more time. Below I will describe a method which I have been using for a long time and I will also mention another which is being used by a friend of mine, Colin Congdon. I think a combination of the two would be the ideal thing, at least when you do not have to walk too far.

My trap consists of three light wire rings, pieces of good string, a piece of white cloth or canvas for the floor and cloth mosquito netting for the sides and top, as illustrated.

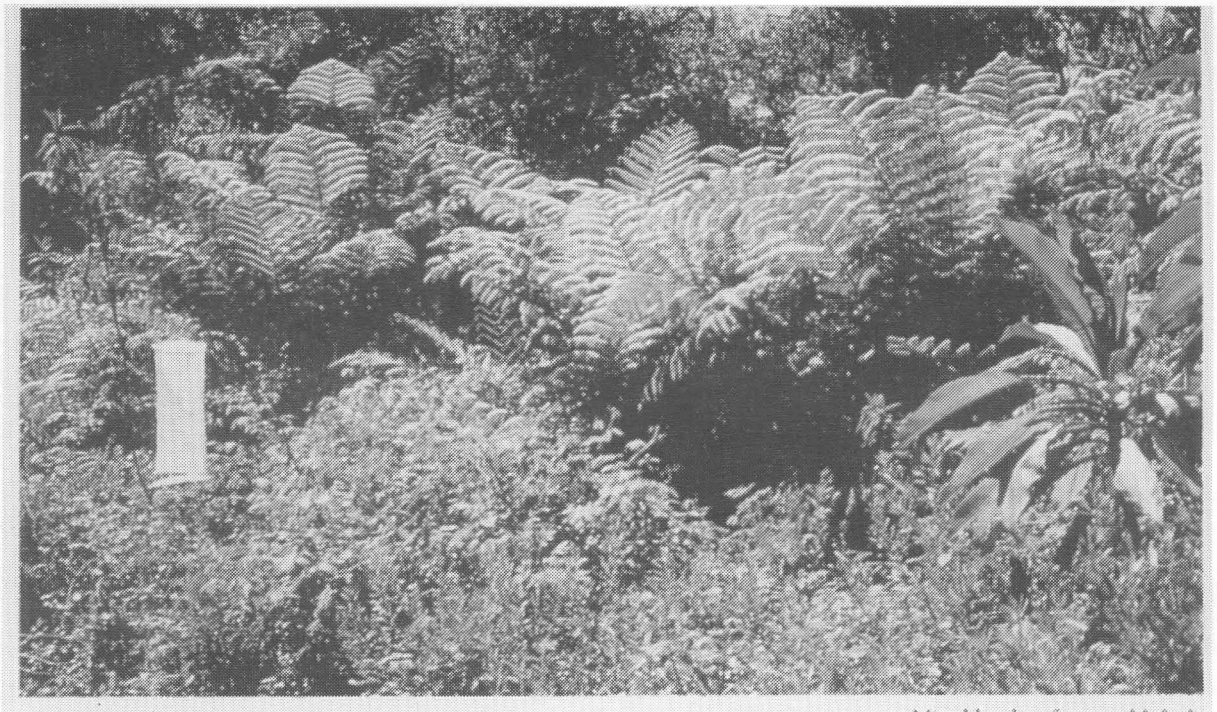
Canvas can be used for the floor, or simple white cloth which should be painted on both sides to make it waterproof. The cloth is bent over the circular lower wire frame and stapled on to it. Two lengths of string are fixed crosswise to the top frame, as shown, and left running down to the floor plate and through it for about 15 cm. and knotted below the plate at the appropriate length. It is important to leave about 15 cm. extra, below the floor, as it sometimes needs adjustment to get the right gap (4–5 cm.) between the floor plate and the mosquito netting, which lengthens somewhat when it becomes wet. Also the string tends to shrink if not of a good quality. A piece of oil cloth or other stiff material should be glued where the four holes in the floor plate are made, to reinforce the cloth or canvas, otherwise the knots on the underside will work through after a while. The wire ring above the floor plate is fixed only to the mosquito netting and not to the strings. In this way it can be slid up and down when you wish to replenish the bait, which is put on the floor tray, and when you take butterflies out of the trap. The usual method of fixing the mosquito cloth direct to the floor tray, with a fixed 4–5 cm. gap, makes these operations more awkward, and is also more time-consuming. It is a good idea to make the floor tray a little wider than the ring above it, making it easier for the butterfly to enter. This is practised by Congdon. His traps are wider and deeper than mine, which may make them more effective, but he uses the 'fixed' method which I now find awkward in comparison to the 'sliding' method, but he does not use a ring at the bottom of the netting cylinder which other people do. This means that he can push up the material more easily to get his hand in. Due to their size his traps take more space than mine, and are heavier when wet. Congdon saves weight by having only two rings, and by using aluminium wire, otherwise his traps would be considerably heavier than mine. This does not matter, really, when operating in places accessible by car. In remote areas, on the other hand, you may have to walk for days, even weeks, and then a light pack is a blessing. I have had to do this in most places I have collected in Tanzania, and therefore developed this lightweight trap.

A trap of 25–30 cm. × 60 cm., with painted cloth floor and thin wire rings weighs 150 gm (1.5 kg for 10 traps). Larger and heavier traps may weigh two or three times as much. People usually use too thick a wire. This is not necessary, as if it bends it can easily be straightened. Nor is it necessary to weld the rings as some people do. I bend the ends and pinch them together with pliers after hooking them onto each other.

Traps are particularly useful for trapping the fast flying *Charaxes*, which are otherwise difficult to catch, and most of all for the females which do not come down to suck on wet ground. But many other kinds of butterflies and wasps and beetles, not to mention flies, are caught. (I have often thought how ideal such traps would be for dipterists!)

The success of trapping depends a lot on what kind of bait you are using. Leopard or dog droppings are excellent for many kinds of butterflies, but you would be lucky to trap a female. Mashed, fermented fruits are the most-used bait. Bananas in particular, as they are nearly always available, and are really good for bait, but the bananas should be of the soft kind, and well ripened. Sugar bananas (the short, thick variety) are not suitable: they go vinegary, and the result looks lumpy and hard, and the smell is unattractive. After being mashed the bait should be left in a glass or plastic container for 6 to 8 days. (It is not necessary to add sugar or alcohol.) There is some effect even after a couple of days, but the older the bait is the better. I have used bait over six months old with excellent results. Some people, though, use the skins of the bananas as well (dump it all together in a container). I never use this method, except for a few experiments, because the skin spoils the effect after a few days. The mess just rots and becomes watery, and is then no good. However it can be a good idea to make a small portion with peel and all which can be used for the first few days, until your proper bait 'ripens'.

Apart from *Charaxes*, banana bait will attract many other Nymphalids, such as *Cymothoe* and *Euphaedra*. To get good results with *Euphaedra* you need to place the trap in half shade and as close to the ground as possible, as these butterflies go about their business in rather thick forest, and travel close to the ground in search of fallen fruit. You can probably get better results if you take up a position, waiting to pounce on them under a tree with lots of fallen fruit, where they often gather in numbers. Satyrids are greatly attracted to banana bait and can enter your traps by the hundred, making a nuisance of themselves! Hesperiids rarely enter, but a few species do (e.g. *Coeliades forestan*, *C. hanno*). Do not expect to get Papillo and Lyceanids on banana bait. Once or twice I have got *Aphnaeus orcas* on banana bait, and in Norway a number of hairstreaks, but those are the exceptions.



Trap at Mazumbai.

Mixed bamboo forest at Mufindi.

Mist forest on Nyumbenitu Mountain.

Montane forest on Image Mt., Iringa. The plastic 'tent' is in the foreground.

Ukaguru Mountains, taken from Mandege Forest Station.

Ridge on Mt. Kwaraha, at Babati. Newly-discovered habitat of *Papilio sjöstedti*.

Camp site at 1000 m., east side of Mwanihana forest, above Sanje.

Riverine Forest near Sitebi Mountain. Habitat of *Ch. xiphares sitebi.*

Butterfly collecting in Tanzania

GENERAL

To make a superficial collection of Tanzanian butterflies is no more difficult than in any other country; you can just stop somewhere on the roadside if you have your own car, if you live in a village you can collect in the vicinity of it, or if you are on holiday and are staying with friends you may collect in their garden. In this way you can obtain a nice little collection, but you would be very lucky to get anything new (or otherwise) of scientific value. For that, you need to know where to go, which is to the remotest and least-collected parts of the country. The most likely places to find interesting species are on mountains, in particular solitary mountains with montane forest, surrounded by low-lying, dry habitats. Most of such mountains contain endemic species or subspecies, due to their long isolation from similar habitats. Occasionally, though, I have been disappointed while visiting promising mountains. One example is Mt. Lossoganeu (written 'Lossogonoi' on some maps), standing alone on the dry Masai Plains south of Arusha. I was pretty certain that I should get something new there, but failed. It does not mean, however, that there is nothing new there; I could have arrived at the wrong time of the year, or just been out of luck. My stay was only a few days, which is not enough for a thorough search.

Another thing is worth mentioning if you wish to undertake serious collecting in Tanzania; you will need a permit from the Game Department to collect butterflies, otherwise you may find yourself in trouble. If you intend to explore a mountain for a few days, you will usually have to camp out close to where you intend to put up your butterfly traps and do your netting. To avoid trouble you should first call on the District Office and the local Office for Natural Resources in the area where you are collecting and show them your collecting permit. Normally they will give you a letter in Kiswaheli which you can show to the local village office before you camp up on the mountain, because these days people are very suspicious, no matter whether you are African, European or of any other nationality. Collectors of natural history specimens are always subject to suspicion, as people in general think that you are either out of your mind, or else are involved in something illegal or even worse. In many areas (the worst of these being Ufipa and South Pare Mts.) people believe that strangers go around cutting people's throats ('mchindaji' = cut-throat) in order to gather blood for sale to the hospitals! How this belief has come about is hard to understand, but people living in remote areas have vivid imaginations, and if they hear about somebody giving blood to hospitals (which of course is quite usual, and was particularly so during the war), imagination can create wonders! A scientific team from the Malaria Institute at Amani, in the Eastern Usambaras, had quite a rough time in South Pare when they wanted to take blood tests for malaria! It even went so far that they had to fortify themselves inside the local police station, and the police had to fire shots in the air and call for reinforcements from the district town, Same!

My sister and I once had a bad experience in Ufipa while camping by the roadside. That was before I knew about this dangerous belief. I had heard talk about it from the Africans, but merely thought it was a joke. Apparently, a woman had disappeared a few days before we arrived and we were blamed for it! In the bushland, not far from Dodoma, prospectors were killed due to the same belief. As far as I know, in Kenya they have no such belief, at least not one as serious, but there are many forested areas there where you should not go collecting or picnicking, because there are many robbers about. We have very little of this trouble in the outlying places of Tanzania; there you only get robbed in the towns! When you have been to a place once or twice and people know you, it is always much easier the next time.

Even though the formalities that I have mentioned above are a nuisance and a waste of time (many people are frustrated by the loss of time), I must say, as long as your credentials are in order, the officials in Tanzania usually are very friendly and helpful.

A SAFARI TO ONE OF THE REMOTEST PARTS OF TANZANIA.

It would be impossible here to write an account of *all* my collecting expeditions in Tanzania. I will, therefore, choose a single one which was quite rough, but nevertheless very interesting.

In December 1986 I planned to walk most of the way from Mpanda to Kigoma (see map 3) through some uninhabited mountains with many interesting forests and mountain grasslands. As it would be mainly walking, I left the car in Dar es Salaam (a Land-Rover I had borrowed from a friend of mine) and proceeded by train to Mpanda in company with my friend's African collector, Jason. It was several years since I had gone by train to Mpanda, and if I had known the condition of the train beforehand, I would certainly have taken the car after all.

I travelled by so-called first class in a sleeping compartment for two. Even so, there were five of us in it.

Luckily, I had the upper berth to myself, but the lower one contained three people and the fifth person sat on the waterless wash-stand all night. I knew that pick-pockets and robbers had a particularly good time on the trains, so when we found the door had a broken lock I put one of my aluminium net-handles crosswise between the lower berth and the door. This was quite effective, and one would have had to push very hard to bend it. The window had been smashed so we put the ladder across it, and I slept with a 'panga' (machete) on the upper berth. Once during the night I thought it best to visit the toilet and found the corridor packed with people. After spending half an hour climbing over sleeping bodies, trying not to trample on too many hands and legs, I eventually arrived at the appropriate door. However, on opening it, I found the room used as a sleeping quarter by half a dozen people, so there and then I gave up and started negotiating the way back to my compartment!

Anyway, we arrived safely to Mpanda, but as we were about ten hours late the train arrived close to eleven at night. I had to look up my half-Arab friend, Salum Said, or 'Salumu Tumbu' (Salumu and Belly) as he was called by everybody. He weighs 146 kg and only comes up to my shoulder. I have known him for more than thirty years, and each time I am in Mpanda I have to stay with him. To book in at a hotel would be a grave insult. Whether I turn up unexpectedly in the daytime or in the middle of the night makes no difference to his hearty welcome. To my many protests, he orders his wife and children to dish up some food in the middle of the night and the inevitable sweet tea with ginger which I have become very fond of.

Next morning Salumu took me out to Sibwesa in his Land Rover. For many years I did mica mining around Sibwesa, and plenty of people who had worked for me still lived around there. I got hold of Elias Jenga, who had been with me on collecting safaris the year before, and two other men of the Mbende hunting tribe, to help carry food. Salumu took all of us back to Mpanda, and two days later he drove us a few kilometres past Katuma Village from where we would have to continue on foot. My intention was to spend at least three weeks exploring several forests on the Sandstone Ridge, situated between Katuma Village and L. Tanganyika, but the two extra men I had with me to help to carry the food had an extraordinarily hearty appetite, so the time we could spend in uninhabited areas was sadly shortened. On trips like this I always live very primitively, otherwise the trips could not be realized; so all I carry with me for food is rice, beans, sugar, salt and some tea, and when tea and sugar are finished I just carry on with water – as simple as that.

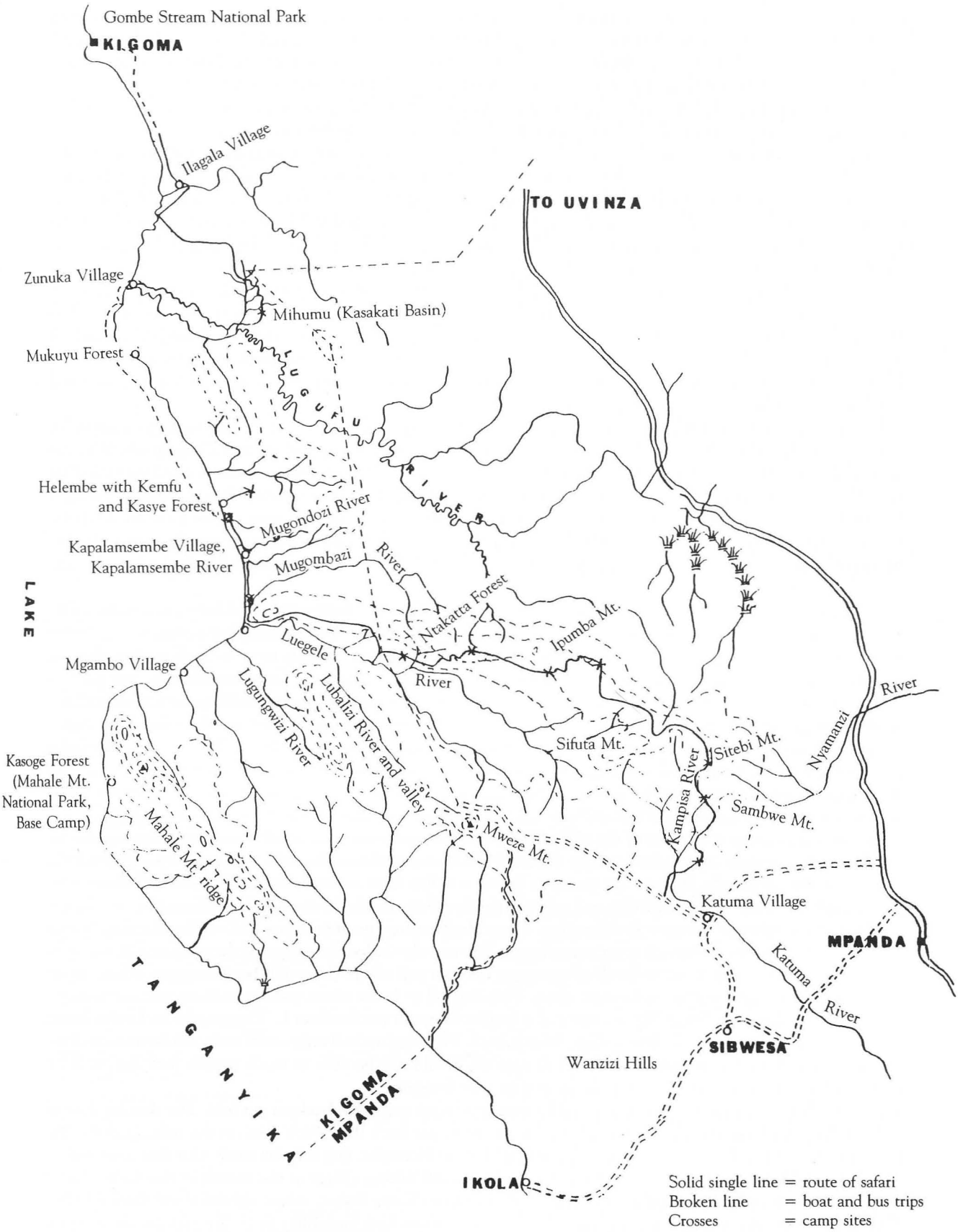
Owing to some very heavy rain during a whole day and night, we did not start off from Mpanda until it was late, so the first day we walked only for three hours until it started to get dark. By then we had reached a village, the last people we should encounter for more than two weeks. From here on there used to be an elephant trail, but as elephants and most other animals have been killed off in this area, their paths are now overgrown. Anyway, as it was early in the rainy season and the grass still short it was fairly easy going up a gently sloping ridge, leading up to a beautiful valley in which flows the Kampisa River (a small river flanked by quite extensive riverine forest) which joins the Katuma River further downstream. I had camped here many times in the past and we pitched camp at one of the places I had used before, just across the crystal-clear river. The place where we camped is situated at 1500 m. above sea-level, and further on, opposite to where we had come down, the valley is bounded by a 1900–2000 m. high ridge. Most of it is open grassland with small rivulets, flanked by forest, running down the mountain-side to join the Kampisa.

To my surprise, elephants had been here some time back, eating the fruits of the *uapaca* tree, of which they are very fond. We stayed in this peaceful valley, and collected, amongst others, *Charaxes imperialis ugandica*, *Ch. eudoxus mechowi* and *Ch. nichetes pantherina*.

On the fifth day of our safari from Mpanda we climbed the high ridge with open grassland and scattered, stunted trees and patches of forest, leftovers from a time when the whole mountain range must have been covered with forest. I found the old elephant path, leading down to the upper reaches of the Katuma River. It was badly overgrown, and in some places we had to deviate from it where it was overgrown with thickets. We skirted the mountain-side until we reached the far ridge which we followed down to my old camping site at Katuma River. This is the place where I once caught a female *Spindasis cynica*, a Lyceanid otherwise apparently only known from the holotype female from Solwezi in northern Zambia. I have repeatedly returned here to try and get its unknown male, but in vain, and this time was no exception. Another rare thing which is very difficult to obtain is *Charaxes xiphares sitebi* a few of which I have taken here and further up the river, at its origin on Sitebi Mt., but there was no sign of it this time.

I camped there for five days and by then I had started to get sore feet due to the daily rain showers and the continually wet grass, apart from all the rivers one had to wade through. These are sandstone formations, and consequently loose sand is everywhere, and it gets into your shoes and rubs the soaked skin like sandpaper.

The next day was Christmas Day which we spent near the summit of Sitebi Mt. at 2000 m. It took us three hours to get there from our camp at Katuma (1600 m.) and we spent the rest of the day collecting, but with poor results due to too much rain. I now found that the maize flour for my men had dwindled drastically from over 30 kg to less than 10 kg, and I had intended to collect in several more places before we reached L. Tanganyika and


Gombe Stream National Park
KIGOMA
Ilagala Village
TO UVINZA
Zunuka Village
Mihumu (Kasakati Basin)
Mukuyu Forest
LUGUFU RIVER
Helembe with Kemfu and Kasye Forest
Mugondozi River
Kapalamsembe Village, Kapalamsembe River
Mugombazi River
LAKE
Ntakatta Forest
Ipumba Mt.
Luegele River
Mgambo Village
Lugungwizi River
Lubalizi River and valley
Sifuta Mt.
Sitebi Mt.
Nyamanzi River
Kampisa River
Sambwe Mt.
Kasoge Forest (Mahale Mt. National Park, Base Camp)
Mahale Mt. ridge
Mweze Mt.
Katuma Village
MPANDA
Katuma River
SIBWESA
Wanzizi Hills
TANGANYIKA
KIGOMA
MPANDA
IKOLA
Solid single line = route of safari
Broken line = boat and bus trips
Crosses = camp sites

people! We still had a long way to go before we reached the latter, and there was no telling what sort of terrain lay in front of us, nor if we would meet with people before reaching the lake. I had been through that country twice before, but the last time was fifteen years ago, when there were many more elephants to make paths. Now most of the game tracks had disappeared and the vegetation itself had changed in that time. Consequently, it would have been virtually impossible to follow the same paths that I had done before, and as I could not know how many days we would need for the journey, I decided to move early the next morning.

I hoped we would be able to cross Luegele River in order to get to a village at Lubalizi for more food. We followed the high ridge to a place where we had to turn right. All the way it is beautiful country with open, grassy ridges and valleys with riverine forests. We saw a few buffalo, a herd of eland and, in several places, the shy mountain reedbuck. That day we walked for eleven hours and camped in Miombo woodland beside a water seepage. Before we had found a place to camp it started to rain buckets which drenched us and the campsite in seconds. But we got a fire going, always a blessing in such weather.

There were plenty of mushrooms which we picked whenever we had an opportunity in order to increase our rations. Sore feet were now also bothering two of the Africans, Elias and Jason, who were wearing shoes. The two others, who wore open sandals, had no trouble at all. I had with me three bandages, using one on each of my feet and one for Elias, together with ointment and cotton to keep the bandages from sticking to the sores. To start in the mornings one had to walk slowly, but after about half an hour one got more or less used to it and could speed up a bit.

The second day we also managed to walk quite a distance, due to the easy terrain, and again we camped in pouring rain. The third day from Sitebi got us into difficult terrain with steep clefts and a large forest blocking our way. I was quite excited to find this forest as it was one I had never seen before, and it looked very good for butterflies, but we could not stop to collect in it as we were getting short of food, even though I was rationing it by now; but I will certainly have that forest in mind for a future safari. I knew we were not far from the Ntakatta Forest, a large forest which I have visited many times, but at that time there were people living nearby. Apparently, now there were none as the paths had disappeared. Eventually we managed to find a way through the thick forest.

Down in the valley we had to cross a river several times. Due to the rough terrain and high grass in the valley we did not proceed very far that day before we had to camp. We passed several small forests which might have been interesting, but we could not stop. Another thing was our feet, which were in such a state that we probably would not have been able to do much collecting without resting for at least two days first, and for that we had no food to spare. In that condition your feet hurt like fire as soon as you stop walking, so you either have to sit down or carry on walking. By now there was hardly any skin left on my feet, on the soles or on top.

The next day I was certain that my old friends at Luntampa (near Ntakatta) had moved; there were no regular paths, only some footprints and marks in the trees made by a few hunters and honey gatherers. I then made for the Luegele River, hoping to cross it so that we could replenish our food at a village about three hours' walk beyond the river. At least I knew this still existed, as I was there the year before, but the river was in flood, so I could not risk crossing it as three of the chaps I had with me could not swim at all! There was nothing else we could do but to retrace our tracks for some distance and then cut across the wide valley until we reached the hillside on the other side. It is no use trying to follow a valley floor covered with tall grass when there is no proper path; the grass on the hillsides and ridges is nearly always much shorter and less affected by the thorny climbers which infiltrate the grass in this valley. These climbers are a great nuisance and will cut the skin of your legs to shreds if you walk through it for many hours. You can also judge the nature of the grass at a distance by the trees and vegetation. Certain kinds of tree grow on poor soil where there will be short grass, while others only grow where there is high and coarse grass. This is good to know when you are walking without a path.

On the fifth day from Sitebi Mt. we reached a regular footpath not far from L. Tanganyika and a few hours later, at dusk, we arrived at the first village, Mugombazi. That day we had only eaten some mushrooms, but we still had some food left, which I had saved in case we should not be able to reach people that day, and we wouldn't have done so if we had not hit upon that nice footpath.

In this village we got some food and rested for two days to get some skin back on our feet. The skin on the top and on the sides heals quickly, but it takes a long time to get back that thick skin on the sole. Luckily, the Africans did not get that trouble. Then we continued on to Helembe, not very far away. Our feet were still in bad shape so I hired a canoe at Helembe to take us to a small fishing village at the mouth of the Kasye River. From here it was only a one and a half hour's walk inland to Kasye Forest, where several rivers form a basin. This forest is one of my favourites, with a large number of interesting butterflies in it. We had another rest for our feet here in the village and next morning we arrived at my old camping site in the forest.

My main purpose here was to get more specimens of *Charaxes mixtus* which I had discovered the year before. Only a few males were taken then and I needed more, as well as its female, to be able to describe this new race

1 Mt. Kilimanjaro
2 Mt. Meru
3 Mt. Longido
4 Meto Hills
5 Ngorongoro-Oldeani Range and L. Eyasi
6 Mbulu Forests (Nou, Marang, Hasama) and L. Manyara
7 Mt. Hanang
8 Kwaraha Mt. at Babati
9 North Pare Mts.
10 South Pare Mts.
11 Usambaras
12 Mt. Lossoganeu
13 Mt. Lolkisale
14 Kiono Forest Reserve and Sadani
15 North Nguu Mts.
16 Nguru Mts.
17 Uluguru Mts.
18 Ukaguru & Kiboriani Mts.
19 Njoge Mt.
20 Rubeho Mts.
21 Mwanihana National Park
22 Mufindi
21–22 Uzungwa Range
23 Ulanga District with Muhulu Forest Reserve
24 Masagati Forest Reserve
25 Kitesa Forest Reserve
26 Rondo Plateau with Rondo Forest Reserve
27 Tukuyu with Mt. Rungwe and Musekera Tea Estate
28 Ufipa Plateau with Sumbawanga town, Bisi Mt., Chala Mt., Mbuzi Mt. and Lake Rukwa
29 Ngara District
30 Sandstone Ridge
31 Itumba District with Itumba Plateau
32 Minziru Forest
33 Loliondo District
34 Kitonga & Ruaha Gorges
35 Madibira Hills
36 Chimala & Ndumbi
37 Matamba & Kitulo Plateau
38 Livingstone Mts.
39 Madaba
40 Geita

------ Tanzania railways
Between 4 and 33 Lake Natron

(which has since been named *Charaxes mixtus tanzanicus*). We were lucky to get enough specimens of both sexes, both here and in a forest further on, Mihumu Forest. We spent two weeks at Kasye, after having sent home the two porters who were no longer needed.

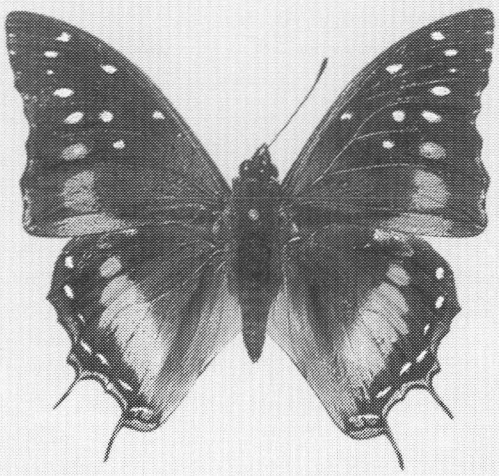
To my delight, chimpanzees were still present in Kasye Forest and a leopard as well as a lion were frequently heard at night. One day I sent Elias down to get more food and bananas for baiting the butterfly traps. He did not come back the first day, which meant that he would have had to go far to obtain what we wanted. In particular, ripe bananas were difficult to get nearby. Two hours after dark on the second day he arrived back to the accompaniment of a lion's roaring. He did not seem to be in the least perturbed by the lion, while Jason, on the other hand, was in quite a state. He was also frightened when the leopard coughed nearby; he was used to the presence of cattle only! It turned out that Elias had had to go to Lukoma, near Mgambo, to get ripe bananas, ten hour's walk each way, so no wonder it took him two days, and he had quite a load to carry as well.

From Kasye we went back to Helembe, and early next morning we caught the 'Mwangozo', a steamer which took us to a place called Kansanga (not the Kansanga down the lake to Zambia). Jason who had had enough of lions and skinned feet continued to Kigoma to take the train back to Dar es Salaam. It took quite a time for him to get there as the railway line had been disrupted by flood water near Dodoma. Elias and I took a canoe to Zunuka Village, opposite Lugufu River, and after I had seen the chairman of the village (who remembered me from an earlier safari years back), and bought some cassava flour from him, we set off, with two extra men to help carry our loads. We needed only one actually, but one man did not dare to go back through the bush alone, which meant we had to take two. So, for a rare change, I did not have to carry my own load.

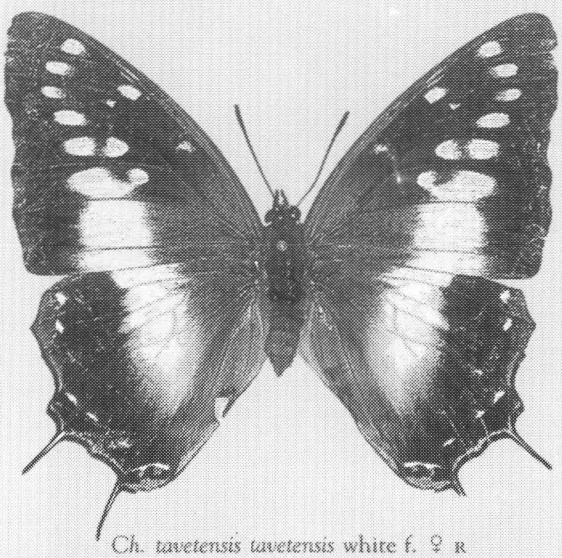
We walked until dark and camped near water. One of the porters was supposed to know the way, but next morning we soon got lost. I knew the direction though, so we only had to do some cross-country walking and soon hit a track, but further on the trail went in the wrong direction, so again we had to cut across country. I had been to Mihumu several times before, the last time in 1979, and have approached it from several directions, but now all the old elephant paths were gone; they were only visible now and again. Elias and I stayed a week at Mihumu, which is situated in a flat valley (the Kasikati basin) crossed by numerous small rivers lined by quite extensive forest. The basin itself, around 900 m. above sea level, is encircled by hills up to 1300 m. in height. Beside Ntakatta and Kasye Forests, Mihumu is amongst the best places I know of for butterflies. Every time I go there something new for Tanzania turns up, and this safari was no exception. We got the Liptenine *Citrinophila erastus pallida* there (a Lyceanid mimicking a Pierid), and I observed *Papilio lormieri* flying, both being new records for Tanzania. I also saw a Lyceanid which I could not identify; there were several specimens of it, but all the time they were too high up in the trees to reach, even with my extension-handled net. We trapped several specimens of *Charaxes mixtus tanzanicus* with banana bait. It is extraordinary that I have not seen it before, except perhaps once in Kasye Forest, although I have collected at Kasye more than a dozen times, and at Mihumu four times.

We arrived at Kigoma one and a half months after leaving Dar es Salaam, and, with my recent train experience in mind, I took the plane back to Dar!

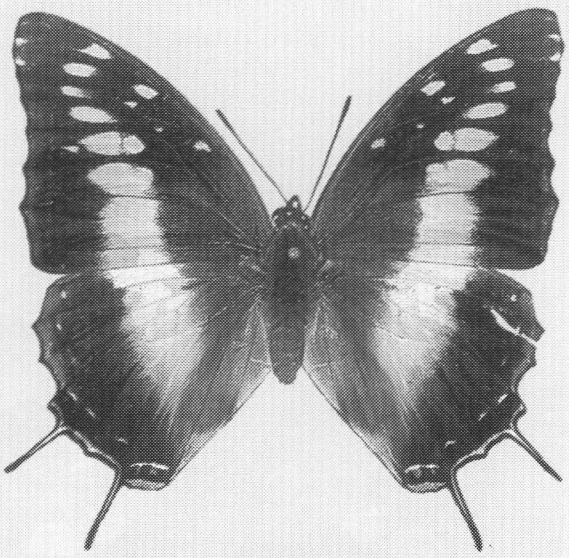
PLATE 31



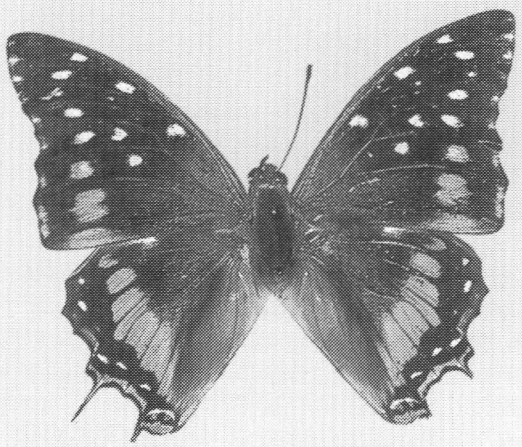
Ch. tavetensis tavetensis ♂ R



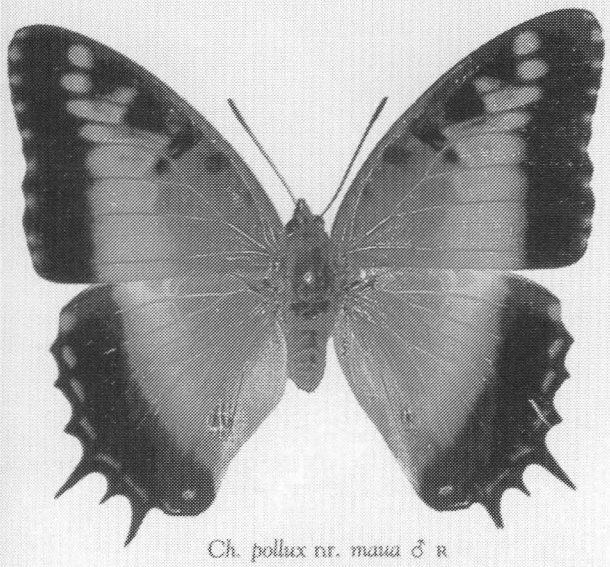
Ch. tavetensis tavetensis white f. ♀ R



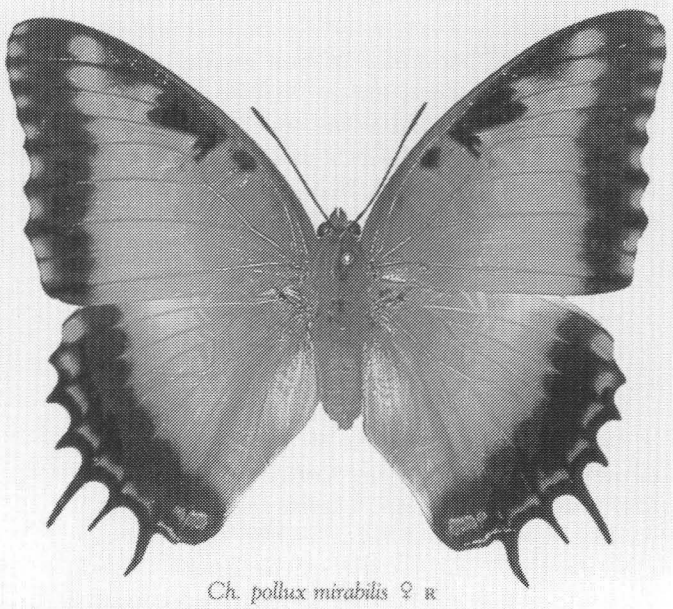
Ch. tavetensis tavetensis yellow f. ♀ R



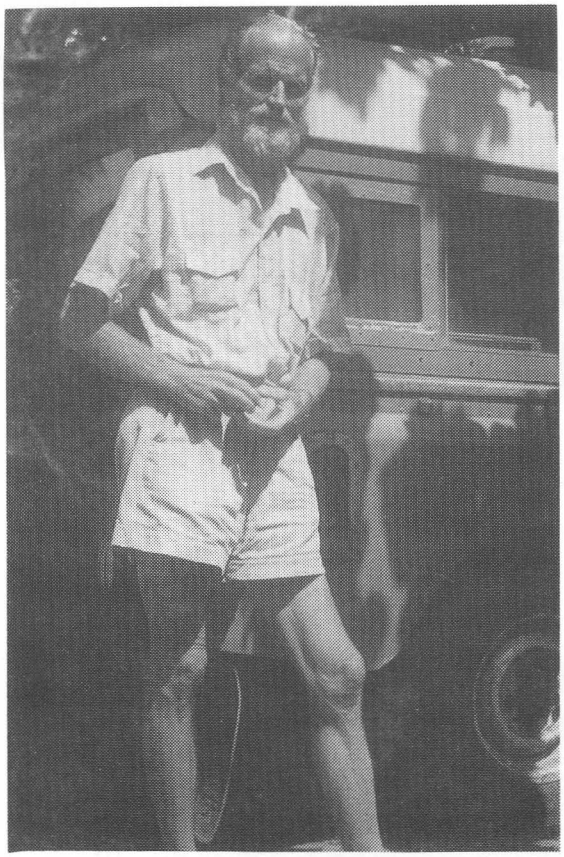
Ch. tavetensis shaba ♂ R



Ch. pollux nr. *mawa* ♂ R



Ch. pollux mirabilis ♀ R



Jan Kielland was born in Oslo, Norway in 1923.

Many of his ancestors were sailors or explorers or both. His father rode across the Argentine Pampas in 1909. Before then, two of his father's brothers had been in and died in Africa (one in Congo (Zaire) and the other in South Africa). The author's maternal grandfather, C.A. Larsen, did a lot of exploring in the Antarctic seas, and was one of the pioneers of the whaling trade in that area. The author's mother, who celebrated her centenary in 1989, tells him that he first started 'chasing butterflies' in their garden in Oslo at the age of two, and he says that he clearly remembers that he had a tiny collection of lepidoptera and other insects in a wooden box when he was 6 years old. Soon after (perhaps at eight) he collected his first *Parnassius apollo*. He thinks the specimen, a large female, still exists in the Museum collection in Oslo (at least, it was deposited there, together with his other Norwegian insects, when he left for Tanzania on 15 December 1945).

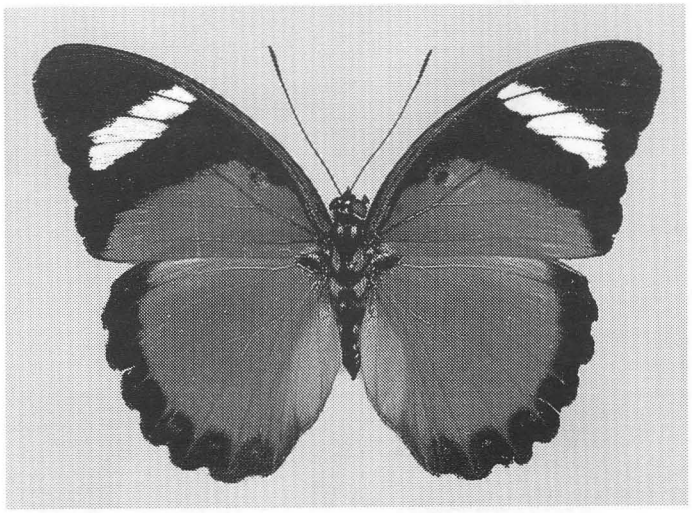
Jan Kielland finished college in Oslo at the age of 19, and as the world was at war he worked on farms as an agricultural apprentice for two years until the end of the war. During the last year of the war he also served in MILLORG (a resistance movement). Soon after the war he left for Tanzania to help his brother on his mixed farm in Oldeani, near Ngorongoro Crater.

In 1951 he started prospecting for mica and gold and mined mica in Kigoma and later Mpanda Districts. He seriously began collecting and studying Tanzanian butterflies after 1969, (the year in which he re-visited Norway for the first time after settling in Tanzania). At that time he had little else to do as mica prices were low and he was gradually winding down his business. Nevertheless he had a grand time collecting in, and exploring the remotest parts of Tanzania, areas where few foreigners had visited before.

In November 1974, he left Tanzania to try and resettle in Norway, but he found life there to be very dull. Since then he has very often visited Tanzania, staying from 3 to 12 months at a time, conducting research on butterflies. In this capacity he has collected in most parts of Tanzania.

The author has also been on a short collecting visit to Venezuela in South America, and to Thailand.

Jan Kielland is the author of many scientific papers and has described many new species and races of Tanzanian butterflies, some of which are published for the first time in this work.



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SYNOPSIS OF THE GENERA OF THE TRIBE GNORIMOSCHEMINI (LEPIDOPTERA: GELECHIIDAE)

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ABSTRACT.– The genera currently recognized in the tribe Gnorimoschemini are listed, together with a summary of their current species composition.

KEYWORDS: Afrotropical, Australian, biology, catalog, distribution, Ethiopian, fauna, hostplants, Nearctic, Neotropical, New World, Oceania, Old World, Oriental, Palearctic, phylogeny, taxonomy, USA.

Gnorimoschemine moths have been recognized as a group of similar species for some years, and finally segregated as a tribe of Gelechiidae nearly 40 years ago (Povolný, 1964b). Since then, more and more genera have been added to what is mainly a Holarctic group. Some of these subsequent additions resulted in their transfer, once identified as gnorimoschemine, from where they had been placed, scattered among the different gelechiid generic groups and even among other families like Lecithoceridae. Gnorimoschemine genera were provisionally arranged phylogenetically by Povolný and Šustek (1988), but are today further rearranged following numerous faunal additions. The studies by Povolný (1985a, 1991) offer the most comprehensive reviews of the tribe to date, and some of the introductory notes are reviewed below.

It should be noted that regardless of the extensive work already done on this group of moths, some of whose species are economically important, there nonetheless still remain a number of taxonomic and life history problems to elucidate, particularly among the tropical species. Nearly nothing is known of the actual genetics of the group, and few larvae have been described. We have some idea of the size of the tribe even though new species are still being described in large numbers (see Powell and Povolný, 2001), but biological studies are still greatly needed for most of the species.

The tribe Gnorimoschemini is now recognized to be one of the few discrete monophyletic entities of the Gelechiidae. The purely habitus definition of its taxa on external appearance of the moths is, however, rather difficult because of their overall similarity. Nevertheless, as shown by Povolný (1967b), there exist certain common trends in the forewing pattern characteristic of more or less extensive groups of species and genera (e.g., certain related species groups within the genera *Scrobipalpa*, *Euscrobipalpa*, *Gnorimoschema*, or the genera *Caryocolum* and *Microcraspedus*). These features include the presence of a triad of (dark) stigmata in the center of the forewing, a row of submarginal spots and a paler transverse subapical band (many species of *Euscrobipalpa*), or a dark forewing with more or less prominent white bands and or spotting (generally in *Caryocolum*). From such or similar groups of medial stigmata there often has developed a radiate pattern of uniformly longitudinal veins with or without a trace of spots (in several Nearctic and Neotropical species of the genus *Scrobipalpopsis* or in specialized Palearctic species of *Microcraspedus*), plus other probable derived forms of forewing pattern. On the other hand, a black forewing with white spotting characteristic of *Caryocolum* may occasionally and surprisingly occur also in other gnorimoschemine genera (*Euscrobipalpa*, *Scrobitasta*, *Eurysacca*). The triad of (dark) stigmata mentioned above is, however, present also in several other gelechiine genera, and it seems that convergent forms of the forewing pattern (possibly also archetypic) may occur in various genera of this tribe which are not necessarily close relatives. Consequently, irrespective of the above trends, no tangible characters are categorically indicative of the forewing pattern in tribe Gnorimoschemini.

The labial palpus is usually moderately long with some erect or roughened scales on the second segment, the third segment being a little, or visibly shorter, covered by appressed scales, moderately curved and usually not very acutely pointed. But there exist species having strikingly erect or roughened scales on the second segment (e.g., in the genus *Tila* and *Pogochaetia*, or in *Scrobitasta varians* Povolný), or the whole palpus is considered elongate with an extremely long, straight second segment (in *Tecia venosa* (Butler) from Colombia), reminiscent of numerous genera in Dichomeridinae. But numerous other "exceptions" could be given, and these make it difficult to apply this character generally.

Wing venation is an adaptive character and unfortunately is liable to be inconstant. Consequently, it is of little value in separating many genera of Gelechiinae (Sattler, 1973). Irrespective of these facts, experience has shown that with practice based on a synthesis of identification characters it is possible to recognize the members of this tribe from even among little known or unknown taxa of Gelechiinae. Such experience is, of course, difficult to transmit to other persons and, moreover, individual species still reveal new surprises. Thus, the only really indisputable characters by which the gnorimoschemine taxa can be unambiguously identified are to be found in the genitalic structures of both sexes. In general, gnorimoschemine moths can be characterized as follows:

Forewing mostly without groups of (slightly) roughened scales. 3rd segment of labial palpus usually slender, moderately pointed. Male genitalia with uncus prominent, hood-shaped, not differentiated from tegumen, its upper margin smooth with only poor pubescence. Gnathos a deeply hanging hooklet (obviously secondarily reduced in *Caryocolum*, *Lutilabria*, and related genera). Aedeagus usually straight, rather heavy and simple with basal inflation, short or long, occasionally with secondary spines or spiny fields on its wall. Valva simple and slender, clavate, often dilated terminally, slightly pubescent apically or with a row of bristles and having a distinct parabasal process. Sacculus fold distinct, with a medial excision and with a paired process. Female genitalia with subgenital plate usually simple, with moderately long anterior apophyses, periostially often with foam-like sculpture. Ostium bursae supported usually by a sclerotized narrow ringlet, ductus bursae sometimes (proximally) sclerotized. Signum of corpus bursae usually a little plate provided with a distinct to prominent thorn-formed hooklet or with a spine which is sometimes reduced (especially in several New World groups). Asymmetry of both male and female genitalia is rare and found in obviously specialized, mainly Neotropical taxa.

Adults have forewing lengths generally from 3.5-4mm in small species, as in the genera *Euscrobipalpa* and *Schmidtnielsenia*, and to 13-14mm in larger species like *Gnorimoschema gallaesolidaginis*, but the typical forewing length for species in the tribe is 6.5-7mm.

The distribution of the tribe is worldwide (Povolný, 1967b), and nearly 900 species have been described. About 550 species are restricted to the Palearctic region. This reflects more the intensity of

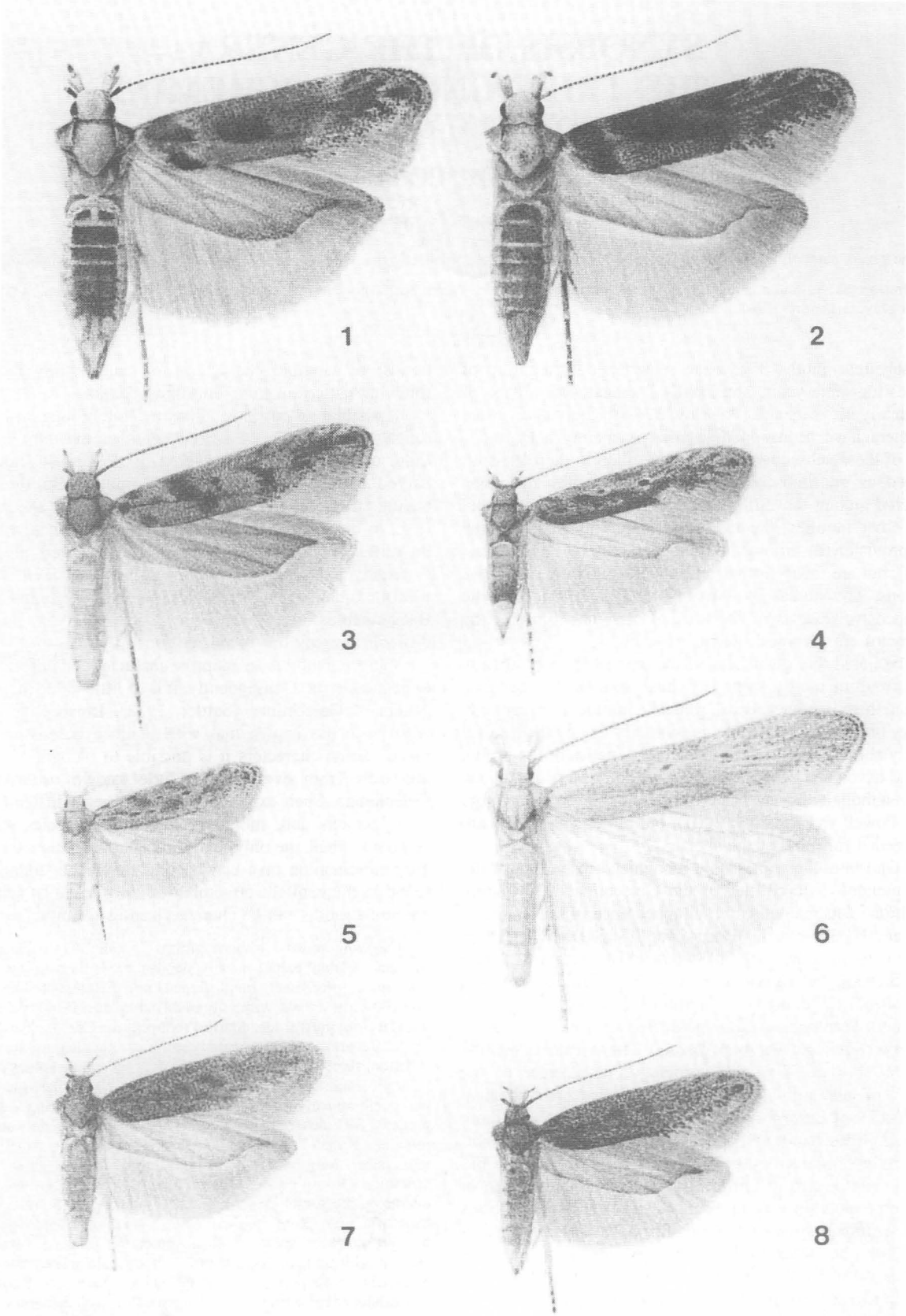

Plate 1. Typical Nearctic gnorimoschemine moths (from Powell and Povolný, 2001), all Californian: **1-2**) *Gnorimoschema grindeliae* Povolný & Powell, females; **3**) *G. debenedictisi* Povolný & Powell, male; **4**) *Scrobipalpula gutierreziae* Povolný & Powell, female; **5**) *Tuta chiquitella* (Busck), male; **6**) *Exceptia sisterina* Povolný & Powell, male; **7-8**) *Euscrobipalpa arenaceariella* Povolný & Powell, male, female dark form (Dr. F. Gregor, painter; all greatly enlarged).

research than the real situation, since discoveries of new species may be expected from the other regions. A revision of Afrotropical taxa remains an important task, and many undescribed species can be expected to exist, especially in the eremic steppes and semideserts of Africa. The present knowledge seems to indicate comparatively close relationship of the Afrotropical Gnorimoschemini with the taxa of the eremic habitats of the Palearctic Mediterranean (Povolný, 1981b), including the semideserts of the Near and Middle East. The Notogean (Oceania to Australia) Gnorimoschemini are generally poor in taxa and only a very limited number of endemic genera and species occurs in Australia and New Zealand. The Notogean members of some genera (*Kiwaia*, *Microcraspedus*, *Scrobipalpa*) show clear relationship to the Gnorimoschemini of adjacent semidesert habitats of Asia or are of pan-paleotropical distribution.

New World Gnorimoschemini comprise nearly 300 species, belonging obviously to deeply isolated genera outnumbering those of the Old World. The present picture of the Nearctic Gnorimoschemini remains very incomplete, as evidenced for example, by the fact that about 10 new species have recently been discovered just amongst material from the territorially limited sand dunes of California (see Powell and Povolný, 2001). Overall, Gnorimoschemini have been studied by relatively few authors and our present knowledge is rather scattered and nebulous. The present author has endeavoured for years to improve this situation (see Povolný, 1964-2001), but any estimate of the number of existing taxa is premature. The only way towards progress there seems to be with systematic regional research and the study of extensive series necessary for profound understanding of the species diversity and of the generic differentiation of the Neotropical Gnorimoschemini. We only may state that numerous relationships at the generic level exist in the Nearctic Gnorimoschemini (due to the obvious radiation of such genera as *Symmetrischema* and *Keiferia*, from South to North America) and that a high degree of Neotropical endemism exists, reflected by deeply isolated genera comprising often numerous species, of which many are still to be described.

Gnorimoschemini are essentially concealed feeders (Povolný, 1980b), living in shoots, buds, flowers, fruits and roots of their hostplants. Especially amongst the American (Nearctic) species, there is a strong trend towards development of galls (e.g., *Gnorimoschema*, s. str.), an apparent specialized feeding habit. Gall makers are less common or exceptional in other regions, but include *Scrobipalpa gallincolella* (Mann, 1872) in the Mediterranean and species of the genus *Vladimirea* on certain Zygophyllaceae in eremic habitats of the Palearctic region. A number of gnorimoschemine species have become pests of crops, and South America in particular has produced species of economic importance, mainly of cultivated Solanaceae which have been introduced to the Old World (e.g., *Phthorimaea operculella* (Zeller, 1873) and *Symmetrischema tangolias* (Gyen, 1913)). Some of them were described only comparatively recently, as for example *Eurysacca quinoae* Povolný, 1997, *Scrobipalpopsis solanivora* Povolný, 1973, *Symmetrischema capsicum* (Bradley & Povolný, 1965) (see also Povolný, 1979; Rasmussen *et al.*, 2001). Among the approximately 600 species of the tribe, the food plants of about 150 are known (Povolný, 1980a, 1981b). Asteraceae are frequent hosts of many Holarctic species. Another important family of food plants is the Solanaceae, preferred mainly by New World (both Nearctic and Neotropical) species, irrespective of the still limited knowledge of these relationships. Halophilous Chenopodiaceae are known to be characteristic food plants of a considerable number of semidesert species of Palearctic *Scrobipalpa (Euscrobipalpa)*, and this same plant family probably hosts gnorimoschemines in other regions, including South America. The related Caryophyllaceae seem to be nearly exclusive hostplants of the essentially Palearctic genus *Caryocolum*, which represents the best known group of Gnorimoschemini in this respect. Finally, Zygophyllaceae and Poaceae are known to be the hosts of the essentially Palearctic or Old World genera *Vladimirea* and *Microcraspedus*, respectively. There exists, however, obvious oligophagy of several species of Gnorimoschemini on such families as Rhamnaceae, Zosteraceae, Plumbaginaceae, Ericaceae, Labiatae, Rosaceae, Cruciferae, Polygonaceae, and Salicaceae. It remains unclear whether this is just a part of certain survival strategies (e.g., in saline or in other similar habitats offering limited choice of food plants), or whether mutualistic relationship (parallel speciation) is a more general trend in the relationship between Gnorimoschemini and their hostplants.

The following synopsis provides a current listing of the genera of the tribe as far as is known to date, with a total of 878 species worldwide. Based on the numbers of new species that continue to be found, the eventual worldwide fauna of Gnorimoschemini will probably exceed 1000 species. The most up-to-date classification based on the presumed phylogeny gives the following listing of the genera, their current species totals and their general distribution (more details for each genus follows in the alphabetical listing):

GNORIMOSCHEMINI

Symmetrischema	55	New World
Paraschema	1	South America
Scrobipalpoides	1	South America
Eurysacca	24	South America
Eurysaccoides	2	USA (California)
Scrobipalpula	49	New World
Keiferia	24	New World
Magnifacia	5	South America
Tuta	20	New World
Scrobipalpulopsis	15	New World
Phthorimaea	4	Neotropical (1 cosmopolitan)
Schmidtnielsenia	1	South America
Scrobipalpomima	18	South America
Scrobitasta	1	Neotropical
Tecia	5	Argentina
Scrobipalpopsis	8	Nearctic/Neotropical (1 Holarctic)
Scrobipalpa	3	Australia
Euscrobipalpa	297	Palearctic, also to Australia; USA
Ilseopsis	1	Palearctic
Turcopalpa	2	Palearctic
Gobipalpa	1	Palearctic
Ergasiola	1	Mediterranean to Japan, Africa
Australiopalpa	3	Australia
Exceptia	2	USA (California)
Microcraspedus	63	Palearctic to Australia; USA
Ephysteris	1	Palearctic; Africa
Ochrodia	1	Palearctic, also to Australia
Vladimirea	13	Palearctic
Phloeocecis	1	Oriental
Hedma	6	Palearctic, Africa, Oriental
Kiwaia	20	New Zealand; Palearctic
Gnorimoschema	83	Holarctic
Neoschema	2	USA (California/Nevada)
Neopalpa	1	USA (California); Mexico
Cosmardia	1	Palearctic
Tila	2	Palearctic
Nevadopalpa	6	USA (California)
Sattleria	1	Palearctic
Caryocolum	120	Palearctic (2 Holarctic)
Klimeschiopsis	3	Palearctic (1 Holarctic)
Lutilabria	2	Palearctic
Pogochaetia	1	Palearctic
Agonochaetia	6	Palearctic; 1 Nearctic
Frumenta	2	Nearctic
TOTAL	878	(plus ca. 175 undescribed)

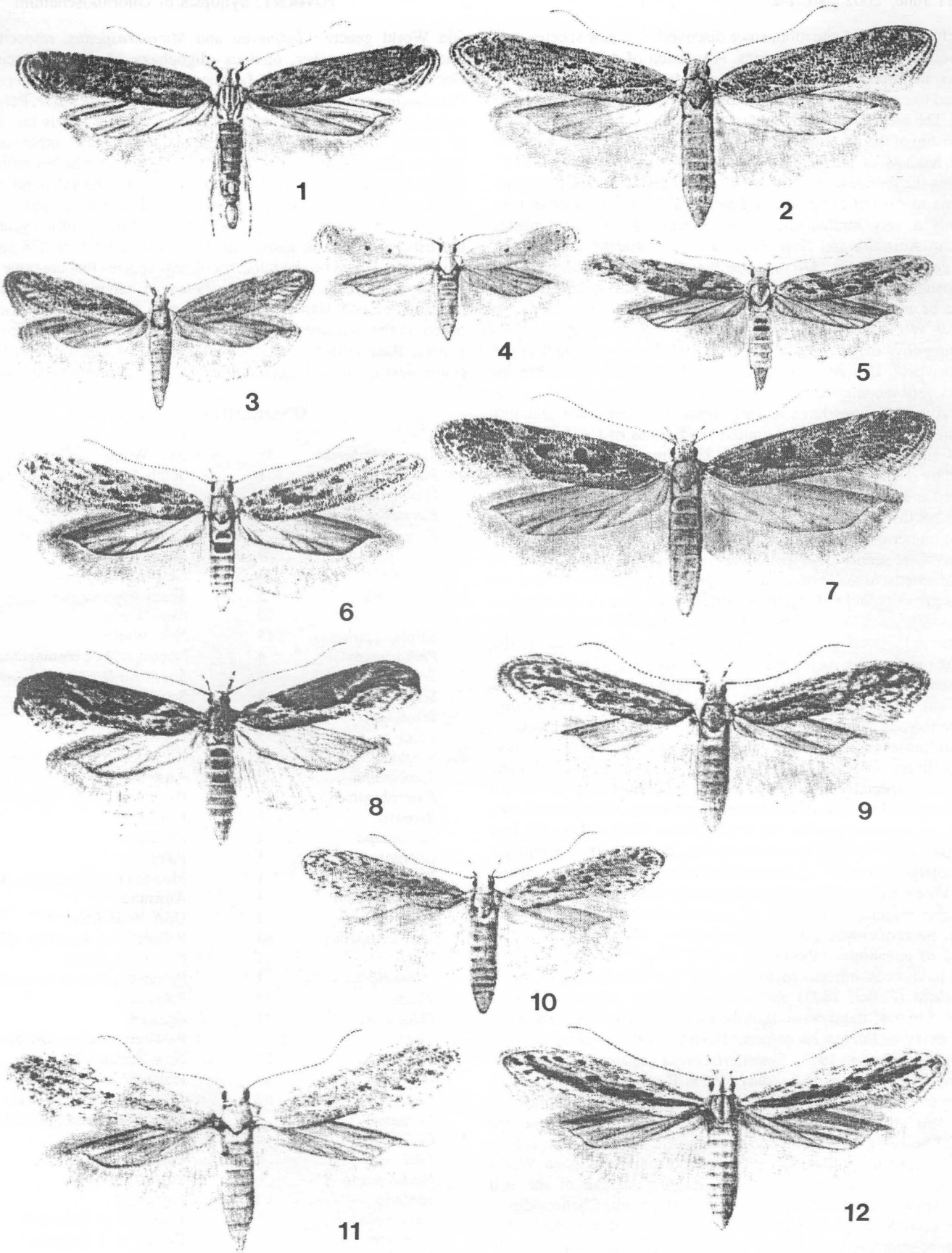

Plate 2. Typical Palearctic gnorimoschemine moths (No. 8 is Nearctic) (from Povolný, 1964b): **1**) *Phthorimaea operculella* (Zeller), Morocco; **2**) *Euscrobipalpa salinella* (Zeller), Corsica; **3**) *Ergasiola ergasima* (Meyrick), Spain; **4**) *Euscrobipalpa soffneri* Povolný, Bulgaria; **5**) *Gnorimoschema herbichi* (Nowicki), Slovakia; **6**) same, Macedonia; **7**) *Euscrobipalpa instabilella* (Douglas), Germany; **8**) *Gnorimoschema gallaesolidaginis* (Riley), USA (Connecticut); **9**) *Scrobipalpula psilella psilella* (Herrich-Schäffer), Austria; **10**) *Microcraspedus treskensis* (Povolný), Macedonia; **11**) *Microcraspedus insulellus* (Heinemann), Bulgaria; **12**) *Scrobipalpula psilella seniorum* (Povolný), Macedonia. (Dr. F. Gregor, painter; all greatly enlarged).

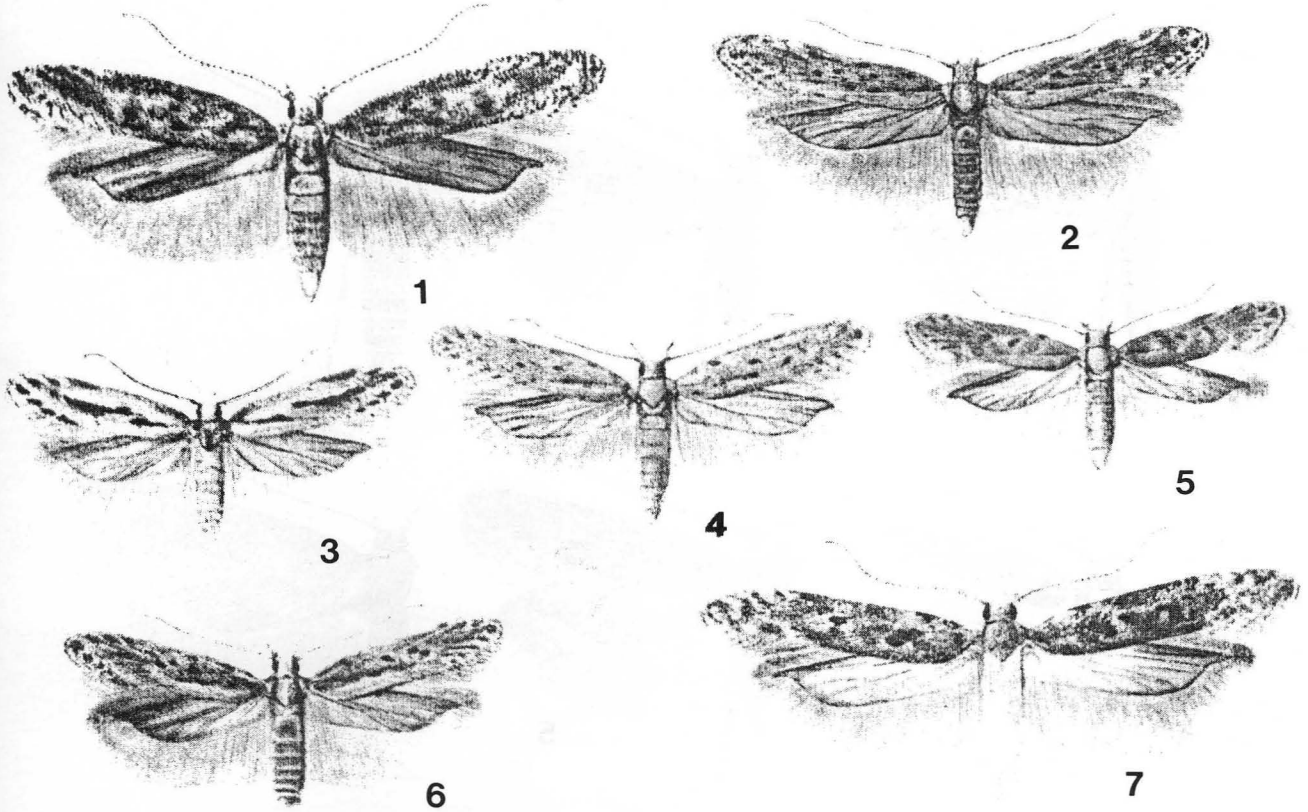

Plate 3. Typical Palearctic gnorimoschemine moths (from Povolný, 1964b): **1)** *Microcraspedus inustellus* (Zeller), Slovakia; **2)** *Euscrobipalpa samadensis* (Pfaffenzeller), Switzerland; **3)** [*Mirificarma burdonella* (Rebel), Corsica (since the publication of this plate the species has been excluded from Gnorimoschemini)]; **4)** *Euscrobipalpa obsoletella* (Fischer von Röslerstamm, Europe (introduced to South Africa); **5)** *Euscrobipalpa gallincolella* (Mann), Spain; **6)** *Euscrobipalpa suaedella* (Richardson), England; **7)** *Euscrobipalpa erichi* Povolný, Hungary. (Dr. F. Gregor, painter; all greatly enlarged).

GENERIC NOTES

AGONOCHAETIA Povolný, 1965
6 sp. in total: 5 sp. are Palearctic and 1 sp. is Nearctic.

AUSTRALIOPALPA Povolný, 1974
3 sp. from Australia, with 2 sp. being in the subgenus *Australiopalpula* Povolný, 1974.

BRACHYPSALTIS Meyrick, 1931
See *Tecia* Strand, 1910.

CARYOCOLUM Gregor & Povolný, 1954
120 sp. are Palearctic, 2 of which are Holarctic (possibly 2-3 sp. remain undescribed in the Nearctic) (see Huemer, 1988).

COSMARDIA Povolný, 1965
1 sp. in the Palearctic.

DISTINXIA Povolný, 1967
See *Vladimirea* Povolný, 1967; a subgenus of *Vladimirea*.

ECHINOGLOSSA Clarke, 1965
See *Microcraspedus* Janse, 1958.

EMPISTA Povolný, 1968
See *Kiwaia* Philpott, 1930; a subgenus of *Kiwaia*.

EPHYSTERIS Meyrick, 1908
1 sp. from Europe to central and southern Asia, plus Africa.

ERGASIOLA Povolný, 1967
1 sp. in India, now also distributed in Africa, the Mediterranean area (including Canary Is.) and Arabia to Japan, and in the Oriental Region: the species is a pest of eggplant.

EURYSACCA Povolný, 1967
24 sp. from South America (additional species remain to be described); 2 sp. are economic on potatoes (see Povolný, 1997).

EURYSACCOIDES Povolný, 1998
2 sp. in California.

EUSCROBIPALPA Povolný, 1967
297 sp. described (possibly with as many as 400 sp.): 292 sp. are Palearctic, plus 1 sp. from Australia, 1-2 sp. are Afrotropical, 1 sp. is Oriental, and 1 sp. is in California (USA) (possibly 2-3 other species remain undescribed in the Nearctic).

EXCEPTIA Povolný, 1967
2 sp. in California.

FAPUA Strand, 1910 (in Kieffer & Jörgensen)
See *Tecia* Strand, 1910.

FAPUA Strand, 1911, redesc.
See *Tecia* Strand, 1910.

FRUMENTA Busck, 1939
2 sp. in the Nearctic.

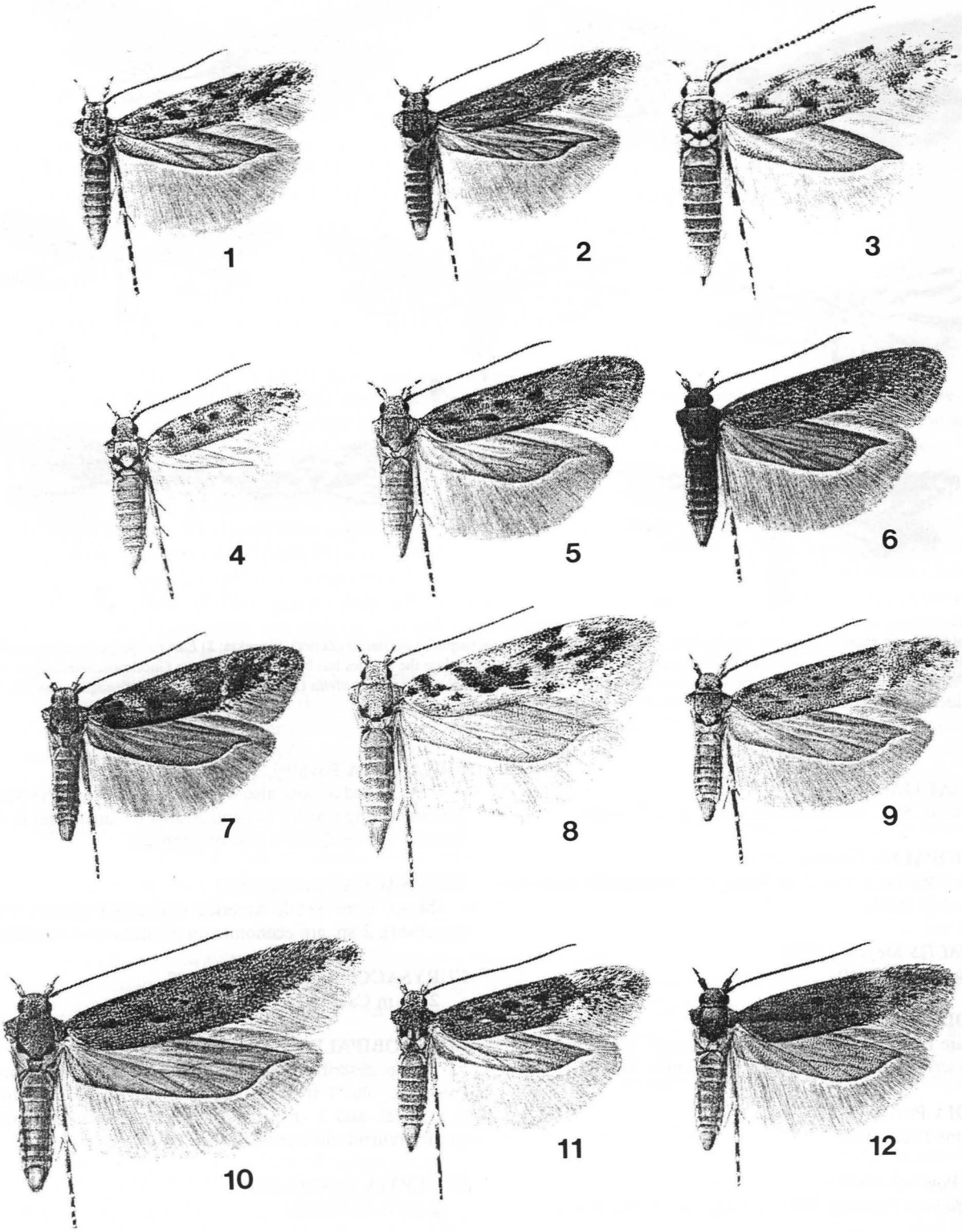

Plate 4. Typical Palearctic *Gnorimoschema* moths (from Povolný, 1992): **1**) *G. antiquum antiquum* Povolný, Turkey; **2**) *G. antiquum montanum* Povolný, Iran; **3**) *G. bodillum* Karsholt & Nielsen, Denmark; **4**) *G. elbursicum* Povolný, Iran; **5**) *G. epithymellum epithymellum* (Staudinger), Spain; **6**) *G. epithymellum brunneomaculellum* Hackman, Finland; **7**) *G. streliciellum streliciellum* (Herrich-Schäffer), Czech Rep.; **8**) *G. streliciellum hoefneri* (Rebel), Austria; **9**) *G. mongolorum* Povolný, Mongolia; **10**) *G. cinctipunctellum* (Erschoff), Russia (Amur); **11**) *G. valesiellum* (Staudinger), Switzerland); **12**) *G. vibei* (Wolff), Greenland. (Dr. F. Gregor, painter; all greatly enlarged).

GNORIMOSCHEMA Busck, 1900
Lerupsia Riedl, 1965
83 sp. described so far, with 65 sp. in the Nearctic and 15 sp. in the Palearctic region, while 3 sp. are Holarctic. The total number of species may exceed 80 sp. in the Nearctic.

GOBIPALPA Povolný, 1973
1 sp. in the Palearctic.

HEDMA Dumont, 1932
6 sp. described: 4 sp. are Palearctic, of which 1 sp. is also distributed in the Afrotropical region; 1 sp. is Oriental; and 1 sp. is from South Africa.

ILSEOPSIS Povolný, 1965
1 sp. in the Palearctic.

KEIFERIA Busck, 1939
Tildenia Povolný, 1967
24 sp. in the New World, with 20 sp. being Neotropical, 3 sp. Nearctic, and 1 sp. widespread in both regions.

KIWAIA Philpott, 1930
Zeempista Povolný, 1974
20 sp. dscribed: 15 sp. in New Zealand, plus 5 sp. in the Palearctic in the subgenus *Empista* Povolný, 1968.

KLIMESCHIOPSIS Povolný, 1967
3 sp. are Palearctic, 1 of which is Holarctic.

LATA Strand, 1910 (in Kieffer & Jörgensen)
See *Tecia* Strand, 1910.

LATA Strand, 1911, redesc.
See *Tecia* Strand, 1910.

LERUPSIA Riedl, 1965
See *Gnorimoschema* Busck, 1900.

LUTILABRIA Povolný, 1965
2 sp. in the Palearctic.

MAGNIFACIA Povolný, 1967
5 sp. in South America.

MICROCRASPEDUS Janse, 1958
Opacopsis Povolný, 1964
Echinoglossa Clarke, 1965
63 sp. described: 60 sp. are Palearctic and in the eastern Oriental; 1 sp. is Australian; 2 sp. are from California.

NEOPALPA Povolný, 1998
1 sp. in California and Baja California.

NEOSCHEMA Povolný, 1967
2 sp. from California and Nevada.

NEVADOPALPA Povolný, 1998
6 sp. in California.

OCHRODIA Povolný, 1966
1 sp. in the Palearctic, ranging to Africa and Australia.

OPACOPSIS Povolný, 1964
See *Microcraspedus* Janse, 1958.

PARASCHEMA Povolný, 1990
1 sp. from South America.

PHLOEOCECIS Chrétien, 1908
1 sp. in the Oriental Region, including Pakistan.

PHTHORIMAEA Meyrick, 1902
4 sp. in the Neotropical region (only 2 sp. may be valid). *Phthorimaea operculella* (Zeller) is now cosmopolitan as an introduced pest of potatoes.

POGOCHAETIA Staudinger, 1879
1 sp. in the Palearctic.

PRIMISCHEMA Povolný, 1989
See *Symmetrischema* Povolný, 1967; subgenus of *Symmetrischema.*

[PTYCERATA Ely, 1910]
This genus is not gnorimoschemine, but related to *Monochroa* and *Isophrictis* (Powell and Povolný, 2001). Hodges, in the 1983 North American Lepidoptera catalog erroneously listed *Ptycerata* as a senior name for *Scrobipalpopsis.*

SATTLERIA Povolný, 1965
1 sp. in the Palearctic (with 3-4 sibling species).

SCHMIDTNIELSENIA Povolný, 1987
1 sp. from South America.

SCROBIPALPA Janse, 1951
3 sp. from Australia.

SCROBIPALPOIDES Povolný, 1985
1 sp. from South America (Argentina).

SCROBIPALPOMIMA Povolný, 1985
18 sp. in the Neotropical region (possibly a number more remain undescribed).

SCROBIPALPOPSIS Povolný, 1967
8 sp., of which 6 sp. are Nearctic. 1 sp. is from the northern Neotropics, and 1 sp. is Holarctic.

SCROBIPALPULA Povolný, 1964
49 sp. known, with 30 sp. described being Neotropical and 11 sp. Nearctic, plus 1 sp. widespread in the New World and reaching the Palearctic (additional Neotropical species are expected).

SCROBIPALPULOIDES Povolný, 1987
See *Tuta* Strand, 1910.

SCROBIPALPULOPSIS Povolný, 1987
15 sp. known, with 8 sp. being described thus far for the Neotropical Region and 2 sp. in the Nearctic (mainly California and Nevada).

SCROBISCHEMA Povolný, 1980
See *Tecia* Strand, 1910.

SCROBITASTA Povolný, 1985
1 sp. in the Neotropical region.

SYMMETRISCHEMA Povolný, 1967
55 sp. from the New World (possibly many more to be de-

scribed). Three subgenera are involved in this Neotropical group: *Symmetrischemulum* Povolný, 1989, with 7 sp.; *Primischema* Povolný, 1989, with 7 sp.; and the nominate *Symmetrischema*, with 33 sp. in the Neotropical region, 3 also to the Nearctic (with 1 sp. introduced now to Australia), 5 only in the Nearctic.

SYMMETRISCHEMULUM Povolný, 1989
See *Symmetrischema* Povolný, 1967; subgenus of *Symmetrischema*.

[*SYNTHESIOPALPA* Povolný, 1966]
See *Trychnopalpa* Janse, 1958.

TECIA Strand, 1910 (in Kieffer & Jörgensen)
Fapua Strand, 1910 (in Kieffer & Jörgensen)
Lata Strand, 1910 (in Kieffer & Jörgensen)
Tecia Strand, 1911, redesc.
Fapua Strand, 1911, redesc.
Lata Strand, 1911, redesc.
Brachypsaltis Meyrick, 1931
Scrobischema Povolný, 1980
5 sp. in Argentina.

This genus and its synonyms have confused authorship due to the antecedent publication of the names by the botanists Kieffer and Jörgensen in 1910, with the Strand paper not published until 1911. Kieffer and Jörgensen reared the moths from galls in Argentina, which they sent to Strand for identification. Strand replied that the species were undescribed and even considered them in 3 genera: these new names he sent to Kieffer and Jörgensen who then published the new names with Strand as author in their paper of 1910. The formal publication by Strand did not occur until 1911. Later study of the types has revealed that all the species are congeneric, thus they all belong in the first genus named, *Tecia* (see Povolný, 1993a). Sattler (1973) and Hodges and Becker (1990) attributed the names to Kieffer and Jörgensen, but these botanists knew nothing of moth taxonomy and only used the names Strand had given them ahead of his publication. My conclusion is that Strand should be attributed as author of these names, as Strand *in* Kieffer & Jörgensen, 1910; the Strand, 1911 names would be redescriptions. *Tecia* was erroneously placed in Lecithoceridae on the basis of their unusual labial palpi. In the world catalog of Lepidoptera genera part on generic names of Microlepidoptera (Nye and Fletcher, 1991), *Tecia* was placed in Gelechiidae and Strand, 1911 was given authorship; Nye and Fletcher state that the 1910 publication of the names by Kieffer and Jörgensen was inadvertant use of manuscript names; since the names were published, this cannot be stated in this way, and thus listing Strand, 1910 *in* Kieffer & Jörgensen is the proper solution in this case.

TECIA Strand, 1911, redesc.
See *Tecia* Strand, 1910.

TILA Povolný, 1965
2 sp. in the Palearctic.

TILDENIA Povolný, 1967
See *Keiferia* Busck, 1939.

[TRYCHNOPALPA Janse, 1958]
Synthesiopalpa Povolný, 1966
This African genus is now excluded from Gnorimoschemini.

TURCOPALPA Povolný, 1973
2 sp. in the Palearctic.

TUTA Strand, 1910
Scrobipalpuloides Povolný, 1968
20 sp. from the New World (mostly in saline and maritime habitats).

VLADIMIREA Povolný, 1967
13 sp. in the Palearctic (subgenus *Distinxia* Povolný, 1967, with 1 sp., the remainder in the nominotypic subgenus).

ZEEMPISTA Povolný, 1974
See *Kiwaia* Philpott, 1930.

APPENDIX

The other tribes of the subfamily Gelechiinae include Gelechiini, Apatetrini, Anomologini, Metzneriini (or Isophrictini), Teleiodini, Anacampsini, and Chelariini.

Gelechiini

This tribe appears to still be heterogeneous and polyphyletic. The genus *Gelechia* s. str. has no gnathos, which is substituted by two ligulate ledges. *Chionodes* has the valva so reduced that it is like a filament. *Filatima* and *Neofriseria* have extremely short ungulate saccus, slender valva, extremely strong hook-shaped gnathos, uncus with spines, and a very short aedeagus.

Apatetrini

This tribe seems to be a well defined group. They show very subtle genitalia with the unculo-tegumen bilobate and membranous, valva short and armored with groups of minor but striking spines; aedeagus is minute.

Anomologini

A monophyletic tribe when certain genera are included, such as *Megacraspedus, Aristotelia*, and *Bryotropha*, with uncus distinct, gnathos spined and extremely robust, saccus well developed, and aedeagus strong.

Metzneriini

This is one of the best defined tribes (also called Isophrictini), other than Gnorimoschemini. The genera *Chrysoesthia*, *Xystophora*, *Isophrictis*, *Metzneria* (the largest genus in the tribe), *Ptocheusa*, *Monochroa* (another large genus), and *Eulamprotes* form a well defined monophyletic group, all showing completely reduced elements of the uncus, with tegumen reduced to only its base and membranous, valva short and crescent-like, with dense hair-like setae, aedeagus extremely robust with strong subovate caecum aedeagi and short corpus aedeagi (often with striking cornuti), sacculus part of valva foliate or lobate; and female genitalia with entire perigenital sclerites membranous, signa either absent (membranous) or present as small plates with a minor spine, with distal part of ductus bursae sometimes with sclerotized walls.

Teleiodini

Also a well defined tribe, with rather complex male genitalia, with saccus either membranous or completely absent, valva completely altered as filiform and long spine-like branches, with sacculus elongate lobate or sceondarily changed and sometimes forming a complex structure together with the valva; gnathos membranous or absent, aedeagus mostly membranous, tubulose; uncus often with a double tuft of stiff setae; female genitalia with subgenital plate (8th sternite) mostly membranous but periostium well visible due to sclerotization; ductus bursae thin and extremely long, and bursa short and globate; signum a sclerotized subtrapezoidal plate with lateral indentation. Genera included are *Teleiodes*, *Coleotechnites*, *Exoteleia*, *Carpatolechia*, *Pseudotelphusa*, *Teleiopsis*, *Xenolechia*, and *Altenia*.

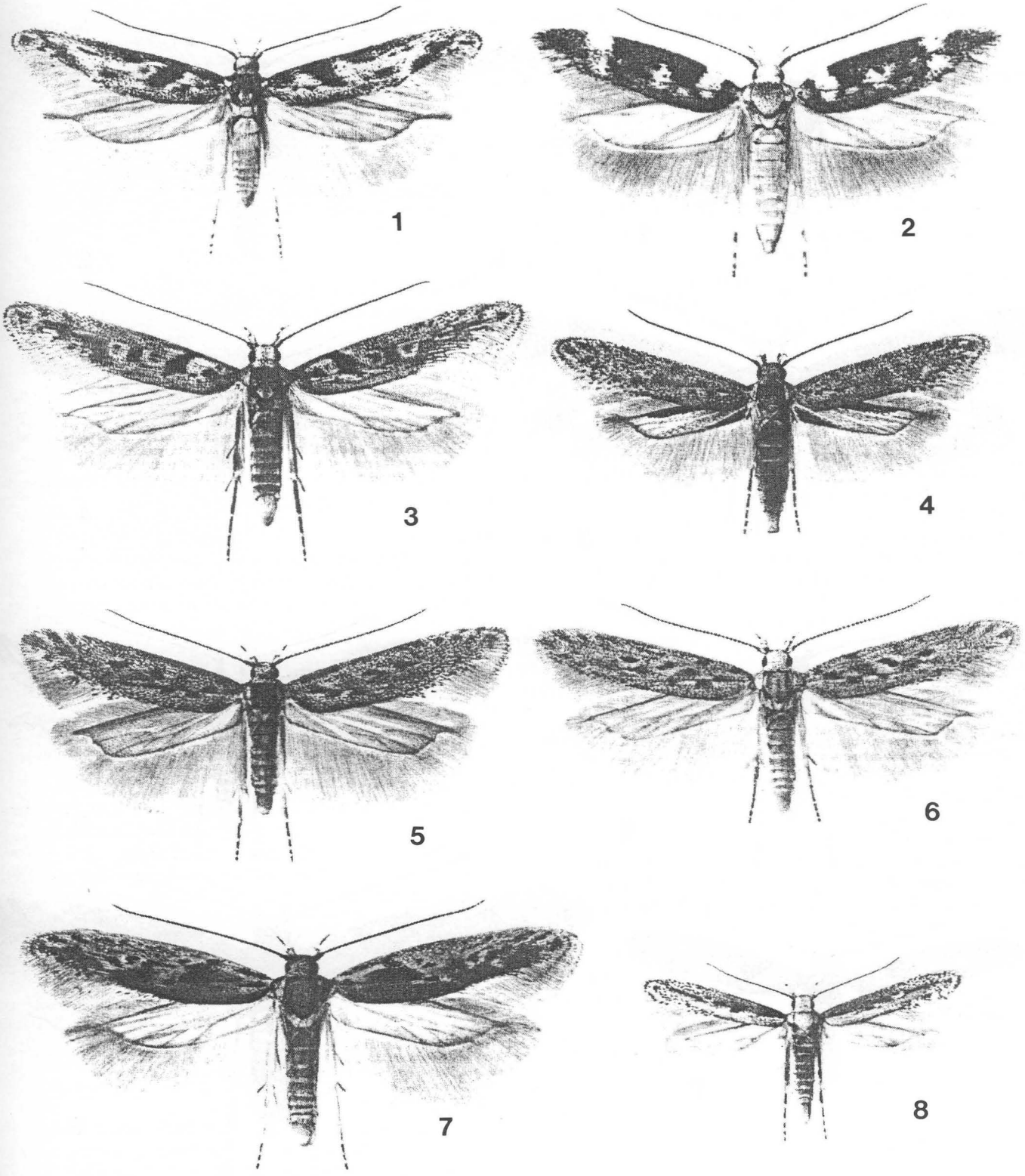

Plate 5. Typical Neotropical gnorimoschemine moths (from Povolný, 1994a): **1)** *Scrobipalpomima excellens* Povolný, Argentina (Chubut); **2)** *Scrobitasta varians* Povolný, Argentina (Neuquen); **3)** *Scrobipalpula falcata* Povolný, Argentina (Neuquen); **4)** *Scrobipalpula patagonica* Povolný, Argentina (Neuquen); **5)** *Tuta inapparens* Povolný, Argentina (Neuquen); **6)** *Magnifacia uncispina* Povolný, Argentina (Salta); **7)** *Phthorimaea robusta* Povolný, Argentina (Santa Cruz); **8)** *Schmidtnielsenia nielseni* Povolný, Argentina (Neuquen). (Dr. F. Gregor, painter; all greatly enlarged).

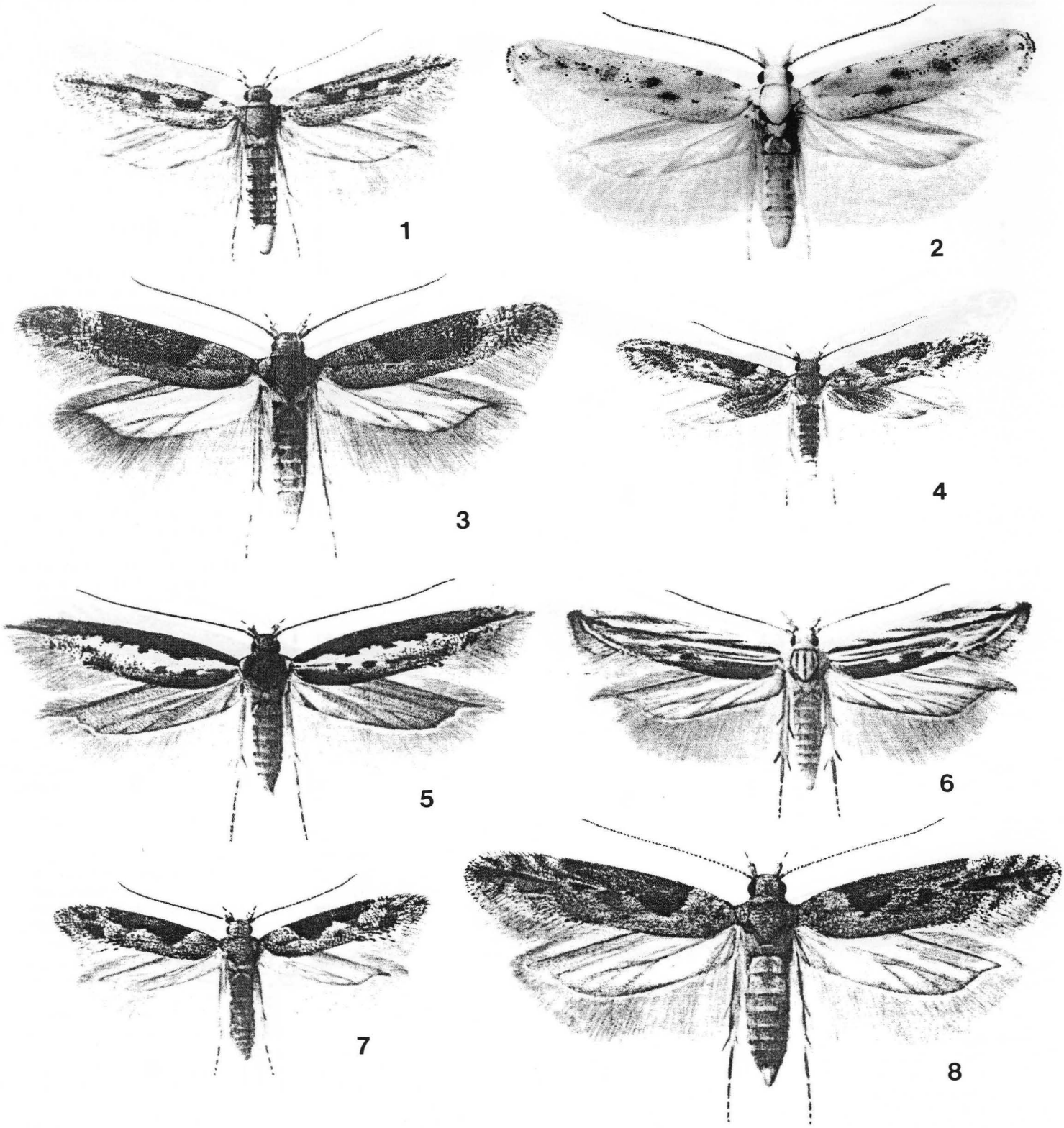

Plate 6. Typical Neotropical gnorimoschemine moths (from Povolný, 1994a): **1**) *Eurysacca annulata* Povolný, Argentina (Neuquen); **2**) *Eurysacca splendida* Povolný, Argentina (Neuquen); **3**) *Eurysacca tenebrosa* Povolný, Argentina (Santa Cruz); **4**) *Symmetrischema disciferum* Povolný, Argentina (Neuquen); **5**) *Symmetrischema symmetricum* Povolný, Peru (Lima); **6**) *Symmetrischema striatellum* (Murtfeldt), Chile; **7**) *Symmetrischema nummulatum* Povolný, Argentina (Rio Negro); **8**) *Symmetrischema tangolias* (Gyen), Peru (Uyurpampa). (Dr. F. Gregor, painter; all greatly enlarged).

Anacampsini

The tribe is possibly monophyletic but morphologically with very heterogeneous genital characters. Genera included are *Sophronia*, *Stomopteryx*, *Iwaruna*, *Anacampsis*, *Mesophleps*, and *Syncopacma*. All the main parts of the male genitalia (uncus, tegumen, valva, saccus, sacculus, aedeagus) well developed and often extremely "exaggerated": the aedeagus in *Syncopacma* is gigantic, bipartite with a filiform bifurcation, etc. The female perigenital sclerites, ductus bursae and bursa are mostly membranous; signum bursae either absent or more or less small and reduced.

Chelariini

The main genus is *Anarsia*, and together with *Hypatima* and *Nothris* show partly strongly asymmetrical male genitalia (*Anarsia* with valva asymmetrical), with long filiform process on a stronger valva, and valva with fields of striking osmeteric scales which are also sometimes present on the sacculus of *Hypatima* and *Nothris* when symmetrical; aedeagus well developed, terminally provided with a filiform ending; 8th sternite of female genitalia short and broad, poorly sclerotized; ductus and bursa complex membranous, and in *Nothris* a surprisingly long, spiral ductus bursae; signum a small subovate plate with serrate margin.

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ADDITIONS AND CORRECTIONS TO THE *BIBLIOGRAPHY OF BUTTERFLIES*, IN THE *ATLAS OF NEOTROPICAL LEPIDOPTERA*

No. V. COMPRISING MOSTLY WORKS PUBLISHED IN 2000

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The fourth set of *Additions and Corrections* to the annotated *Bibliography of Butterflies* (Lamas, Robbins, and Field, 1995) in the series *Atlas of Neotropical Lepidoptera, Vol. 124*, was published a year ago (Lamas, 2001, *Lepidoptera News* 2000(3): 21-35. The 289 additional references included herein comprise mostly works published in 2000, such as were recorded until August 31, 2001.

In the *Corrections* section, rather than repeating whole bibliographic entries, I have used **bold** typeface to indicate corrections made, which I hope will be self explanatory.

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CORRECTIONS

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Fasc. 124A. Noctuidae: Introduction (Heppner). ca. 260 pp. (8½ x 11 in). ISBN: 0-945417-99-3 in prep.

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BOOK NEWS

BUTTERFLIES OF THE WORLD
12. Papilionidae VI. Ornithoptera
by Oliver Schäffler

2001. Goecke & Evers, Keltern, Germany. 2 pts. (19pp, 52 pl.) (24 x 34cm), (ca. $37) paper. ISBN 0-931374-83-1 (also in German edition).
Also available from Flora & Fauna Books, P. O. Box 15718, Gainesville, FL.
Continuing the series *Butterflies of the World*, this 12th part covers birdwing butterflies not treated in or updated from Bela von Knötgen's 1997 book, entitled *Ornithoptera*. Part 12 is published in 2 sections, one for the text and one for the 52 color plates. The text section also has a color plate on the back cover, being a copy of a Rippon plate from 1892. The text section also has some black and white plates of some species. Various forms are noted, some of which are invalid according to the Zoological Code. The series is also available with German text.

Supplement 4. Catalogue of the Genera of Oeneis and Davidiana
by V. Lukhtanov and U. Eitschberger

2001. Goecke & Evers, Keltern, Germany. 37pp (24 x 34cm), $25 paper. ISBN: 3-931374-52-1.
This issue in the *Butterflies of the World* series presents a catalog for color part No. 11. The issue is titled as a supplement, even though the previous suplements were only French language editions of texts published in English and German. The main text and color plates for this supplement were published in 2000 by the same authors, so the catalog summarizes the taxonomy involved. There are distribution maps added, plus some genitalia figures. There also is the description of one additional new subspecies for an *Oeneis* from Russia (Siberia).

MACROMOTHS OF NORTHWEST FORESTS AND WOODLANDS
by Jeffrey C. Miller and Paul C. Hammond

2000. USDA Forest Service, Morgantown, WV (U. S. Geological Survey, Corvallis, OR). 133pp (21 x 28cm), paper (FHTET-98-18).
This large-format booklet illustrates, in color, 251 of the larger moths to be found in the northwestern United States, plus diagnostic notes on another 300 species, thus covering about a third of the macro-moth fauna of the region. Families treated include Arctiidae, Dioptidae, Drepanidae, Geometridae, Lasiocampidae, Lymantriidae, Noctuidae, Notodontidae, Saturniidae, Sphingidae, and Thyatiridae. Also noted briefly in the preliminary text is the family Epiplemidae, but no species are illustrated. A brief introduction covers Lepidoptera biology and techniques of moth collecting and rearing. Species texts are brief, with notes on identification markings, habitat, flight period, and known hostplants. This is the first book to illustrate western North America moths in color since Holland included a few western species in his *Moth Book* of 1898.

NOCTUID MOTHS OF TAIWAN
by H.-Y. Wang

2001. Ilan County Museum, Ilan, Taiwan. 295pp (15 x 21cm), paper.
This new book presents an overview of Taiwan Noctuidae, but mainly concentrates on the deltoid and catocaline species, with a scattering of other species added in at the end. The book treats 245 of the more than 950 noctuid species known for Taiwan. Text is entirely in Chinese except for the translated title and some English notes about the author in the cover flaps. Species have Latin names. There is no index, so one must peruse the contents pages to find a species. The excellent color photographs are all from museum specimens except for a few photos taken from nature, like on the cover, that are scattered throughout the book. The book will help enthusiasts identify some of the noctuids in Taiwan by comparison with the figures.

A WORLD REVISION OF THE GENUS Spodoptera GUENÉE (Lepidoptera: Noctuidae)
by M. G. Pogue

2002. American Entomological Society, Philadelphia, PA (*Memoir* 43). 202pp (19 x 27cm), $30.00 paper.
This revision treats an important economic genus of moths, commonly called armyworms for their often devastating caterpillar ravages, and provides the first modern and comprehensive worldwide revision of the genus. The world fauna encompasses 30 species and about half of these are often serious pests. In North America there are 9 species. The revision includes detailed descriptions of all species, and both for adults and larvae, amply illustrated (no color), plus range maps. There is a checklist, cladistic analysis, keys to adults and larvae, bibliography and index. The checklist is alphabetical and does not indicate localities, so one must dig through the main text to follow the phylogenetic relationships of the species and the distributions. Some new synonymies are recorded, mainly for the more obscure species.

A REVIEW OF THE AFROTROPICAL SPECIES OF THE GENUS Graphium (Lepidoptera: Rhopalocera: Papilionidae)
by Campbell R. Smith and R. L. Vane-Wright

2001. *Bull. Nat. Hist. Mus. (Ent.)* (London), 70:503-719, (17 x 25cm), £45 paper. (from Intercept, Hampshire, England. e-mail: intercept@andover.co.uk).
The authors have produced a major revision of the *Graphium* swallowtails of tropical Africa, recognizing 37 species, including one new species described from the Central African Republic. The revision includes a modern cladistic analysis of all taxa. There also is a clarification of the correct tribal name to be applied to what has been usually called "Graphini" in recent years and, thus, Leptocircini is the correct name to apply to this group of swallowtails. The prices for parts of the Natural History Museum journal is exceedingly high due to the Museum letting a commercial dealer handle production and sales; previously, the prices for each part were about 30% of what they now cost. The current revision includes 12 pages of color figures of adults and larvae; there also are some color distribution maps. The revision is based only on European collections plus two in Africa, with the only exception being study of material at the Carnegie Museum, in Pennsylvania (no other American collections were studied for added specimen data).

BUTTERFLIES OF EUROPE
by T. Tolman (illustrations by R. Lewington)

2002. Princeton Univ. Press, Princeton, NJ. 320pp, 106 color pl. (13 x 19cm), $26.95 paper.
This is a new edition of the 1997 Tolman book in the Collins Field Guides series, *Butterflies of Britain & Europe*, and now produced as a Princeton Field Guide. The text and plates are identical with the 1997 printing, thus this really is only a reprint edition in paperback. The color plates (104 numbered, plus two added plates as A and B) appear to be as excellent as the 1997 version, possibly reproduced even slightly better (the color printing was done in Hong Kong, while the 1997 version was printed in Singapore). Richard Lewington is the artist for the color plates. The price is about the same as the original cloth edition; it is uncertain if there previously was a paper edition.

MEETINGS

2002	Apr 5-7	**Association for Tropical Lepidoptera**, Gainesville, Florida, USA
	Jun 1-6	**Societas Europaea Lepidopterologica**, Korsør, Denmark
	Jun 13-16	**Lepidopterists' Society**, Charleston, South Carolina, USA
2003	Sep 25-28	**Association for Tropical Lepidoptera**, Gainesville, Florida, USA
2004	Sep	**Association for Tropical Lepidoptera**, Gainesville, Florida, USA (dates to be announced)
2006	Jun 30-Jul 3	joint meeting of ATL and the Lepidopterists' Society, Gainesville, Florida, USA (dates tentative)

LEPIDOPTERA NEWS

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