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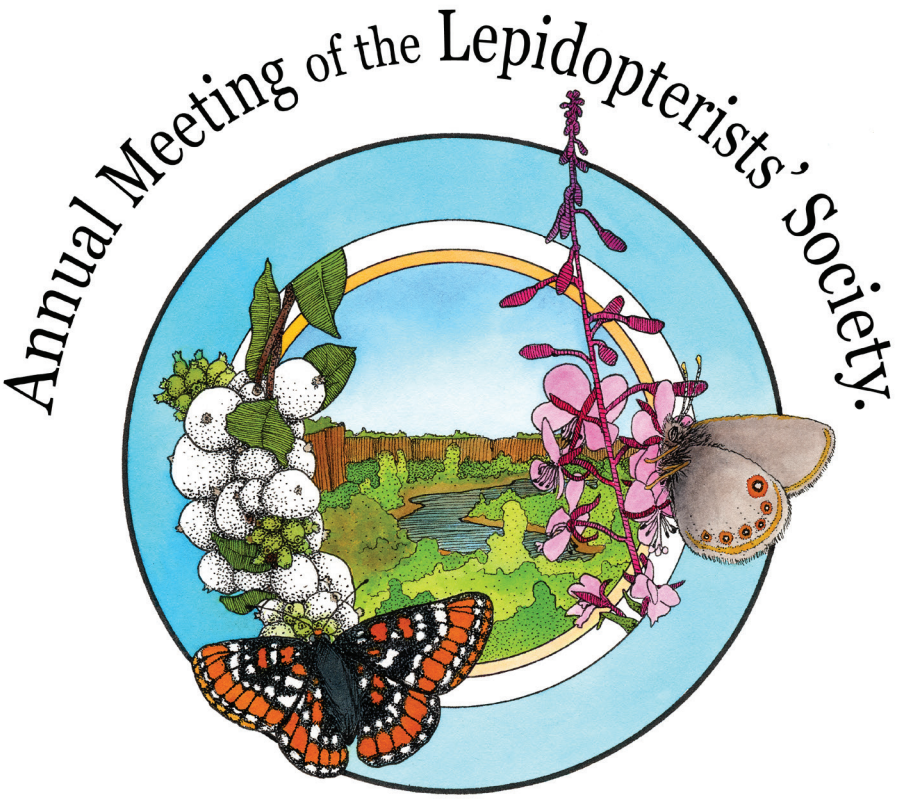

Program and Abstracts

71st Annual Meeting of the Lepidopterists' Society

July 19–23, 2023
Billings, Montana

Mat Seidensticker,
Todd Gilligan, and
Chuck Harp (Eds)

C. P. GILLETTE
Museum of Arthropod Diversity

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71st Annual Meeting of the Lepidopterists' Society

July 19–23, 2023, Billings, Montana

Edited by
Mat Seidensticker[1],
Todd Gilligan[2], and
Chuck Harp[3]

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PROGRAM

Wednesday, July 19

8:00am–3:00pm: **Butterfly Field Trip to Red Lodge area**
- Meet in Northern Hotel lobby at 8am
- Photographers (Nancy Ewer): Palisades Trail, Fox Rd
- Collectors: Willow Creek Trail or Red Lodge Ski Area

9:00am–3:00pm: **Executive Council Meeting** (Babcock Room, Northern Hotel)

4:00pm–6:00pm: **Reception** (North Ballroom, Northern Hotel)

8:00pm–12:00am: **Moth Photography Field Trip** (Bob Martin)
- Meet in Northern Hotel lobby after the reception
- Riverfront Park, Billings

Moth Collecting Field Trip (Chuck Harp & Mat Seidensticker)
- Meet in Northern Hotel lobby after the reception
- Cooney Reservoir, approximately 45 mins south of Billings
- Two separate light sheets

Thursday, July 20 – Hart Albin Conference Room, Northern Hotel

9:00am–9:05am: **Welcome** (Meeting Committee)

9:05am–9:25am: **Introduction and History Billings** (Kevin Kooistra, Museum Director, Western Heritage Center)

9:25am–9:45am: **The Natural Parks of Billings** (Mike Pigg, Director, Billings Parks & Recreation Dept.)

9:45am–3:00pm: **Contributed papers**

Special Session **Montana Moths**

9:45am–10:15am: **Mat Seidensticker**, Chuck Harp, Marian Kirst, Chris Grinter & Lorinda Bullington: The Montana Moth Project: Past, Present, and Future

10:15am–10:45am: **Chuck Harp:** C. P. Gillette's Museum's Partnership with a Montana Wildlife Group: A ttempting to Sample Moths Across the Treasure State, Update Through Year 3

10:45am–11:00am: **Break**

11:00am–11:30am: **Marian L. Kirst:** The Montana Moth Project: Illuminating the Diversity of South-Central Montana's Moth Fauna Through Citizen Science and Targeted Sampling

11:30am–11:50am: **Greg Pohl** & Steve Nanz: The Past, Present, and Future of Lepidopteran Checklists in North America

11:50am–1:30pm: **Lunch**

1:30pm–1:50pm: **Todd Gilligan** & Donald Wright: *Epiblema, Sonia, Suleima*, and *Notocelia* of the Contiguous United States and Canada

1:50pm–2:10pm: Oksana Vernygora, **Felix Sperling** & Julian Dupuis: Toward Transparent Taxonomy for *Speyeria* and *Argynnis*: Introducing a Web Tool for Evaluating Alternate Classifications

2:10pm–2:30pm:	**J**in Zhang, Qian Cong & **Nick Grishin**: Genomic Screening as a Tool for Species Discovery
2:30pm–2:50pm:	**Marissa Miller**, Clement Bataille, Tom Sherratt & Felipe Dargent-Bocanegra: Evaluating Isotopes as Tools to Determine Natal Origins of Spruce Budworm Moths
2:50pm–3:10pm:	**Alberto Zilli**, Jérôme Barbut, Leejiah J. Dorward & David C. Lees: Updates on the Bird Tear-Drinking Habits by Species of the Genus *Hemiceratoides* (Erebidae)
3:10pm–3:30pm:	**Alessandro Giusti:** The Lepidoptera Collections at the NHM and Some of the Collection-Based Projects
3:30pm–3:45pm:	**Break**
3:45pm–4:30pm:	**Pacific Slope Chapter Meeting**

Friday, July 21 – Hart Albin Conference Room, Northern Hotel

9:00am–3:00pm:	**Contributed Papers**
9:00am–9:20am:	**Andrew Dang** & Adriana Briscoe: Characterizing the Molecular Basis of Red-Green Color Vision in *Heliconius* Butterflies by Focusing on Photostable Red Filtering Pigments
9:20am–9:40am:	**Piotr Nowicki:** Challenges of Butterfly Conservation in Urban Landscape
9:40am–10:00am:	**Ernest H. Williams:** How Many Butterfly Species on an Isolated Maine Island?
10:00am–10:20am:	**Julian Dupuis:** Beguiled by Buck Moths: Combining Genomics and Chemical Ecology to Elucidate a Charismatic Species Group
10:20am–10:40am:	**Break**
10:40am–11:00am:	**Kelli J. McKeegan**, Matthew L. Forister, Mike B. Teglas & Angela M. Smilanich: Taking Natural Surveys to the Lab: Describing Infection Patterns of an Insect Densovirus in a Western North American Lycaenid
11:00am–11:20am:	**David Haviland:** Novel Approaches to Managing Lepidopteran Pests on Nut Crops in California
11:20am–11:50am:	**Chuck Harp & Todd Gilligan:** The Central Rockies Have Lost Three Prominent Lepidopterists in the Past Six Months
11:50am–1:30pm:	**Lunch**
1:30pm–1:50pm:	**James K. Adams:** Eleaner R. Adams, My Most Important Mentor in My Study of Lepidoptera
1:50pm–2:10pm:	**Jean-François Landry**, Bernard Landry & Paul Goldstein: Microlepidopterist Foray in Macromoth Systematics
2:10pm–2:30pm:	Jin Zhang, Qian Cong, Jinhui Shen, Leina Song & **Nick Grishin**: Insights from Large-Scale Butterfly Genomics
2:30pm–2:45pm:	Michael Nee, David Bettman & **Chris Grinter**: Recuration of the CAS Lepidoptera collection
2:45pm–3:00pm:	**Jason Dombroskie**: Ithaca is Leps: 150 years of the Cornell University Insect Collection
3:00pm–3:15pm:	**Break**
3:15pm–4:00pm:	**Business Meeting** • Summary of the EC meeting • Announcement of the 2024 meeting (Jason Dombroskie) • Other business

5:00pm–8:00pm: **BBQ at Montana Audubon Center**
- Catered by Famous Dave's
- Alcohol will be available

8:00pm–12:00am: **Moth Collecting** (Montana Audubon Center)
(Community collecting/photo opportunities will be setup)

Saturday, July 22

8:00am–2:00pm: Butterfly Field Trip in Billings Area
- Meet in Northern Hotel lobby at 8am
- Photography (Nancy Ewer): Dover Park, Billings
- Collecting: Phipps Park, Billings

6:00pm–9:00pm: **Banquet** (North Ballroom, Northern Hotel)
- Student Awards
- Presidential Address
- Karl Jordan Medal
- Door Prizes

Sunday, July 23

8:00am–all day: **Field Trip to Beartooth Plateau** (Marian Kirst, Chuck Harp & Todd Gilligan)
- Hellroaring Plateau and Quad Creek areas
- Meet in Northern Hotel lobby at 8am

ABSTRACTS, ORAL PRESENTATIONS

Eleaner R. Adams, My Most Important Mentor in My Study of Lepidoptera

James K. Adams
Department of Life Sciences, Dalton State College, Dalton, Georgia 30720
jadams@daltonstate.edu

Eleaner R. Adams was first and foremost my mom. However, when she noticed I had an interest in Lepidoptera as early as 1 ½ years of age, she decided to foster that interest and therefore became by first mentor. As my interest intensified, she continued to travel with me (including to many Lep Soc meetings) and participate in collecting and sorting specimens. She became quite an accomplished lepidopterist herself, although she wouldn't admit that. I hope you will enjoy this presentation celebrating the impact my mom had on my study of Lepidoptera!

Characterizing the Molecular Basis of Red-Green Color Vision in *Heliconius* Butterflies by Focusing on Photostable Red Filtering Pigments

Andrew Dang & Adriana Briscoe
University of California Irvine, Department of Ecology and Evolutionary Biology, 322 Steinhaus Hall, Irvine, California 92697
danga5@uci.edu

Red filtering pigments (RFPs) are responsible for red-green color vision in many nymphalid butterfly species including *Heliconius*. RFPs can extend archetypal insect trichromatic color vision by absorbing short wavelength light thereby redshifting some green-sensitive photoreceptors to red-sensitive ones. Despite the importance of RFPs to photoreceptor tuning, little is known about their evolution and molecular properties. Here we investigate RFPs using phylogenetic reconstruction, gene expression, immunohistochemistry, and confocal microscopy. We identified a candidate gene that is expressed in butterfly head tissue of *Heliconius* species known to have RFPs. We then linked its encoded protein's expression to where RFPs are expressed in *Heliconius melpomene* oommatidia. Further, characterization of the gene's mRNA expression in *H. melpomene* eyes will be done via in situ hybridization. These findings are an important step in characterizing red-green color vision evolution in butterflies.

Ithaca is Leps: 150 years of the Cornell University Insect Collection

Jason Dombroskie
Cornell University Insect Collection, Cornell University, Comstock Hall, Department of Entomology, Ithaca, New York 14853-2601
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The CUIC started in the 1870's as a modest collection of economically important insects of the Cayuga Lake area and through hundreds of expeditions, research projects, purchases, and exchanges has grown to 7 million specimens of 200,000 species from nearly every country. Roughly 18% or over 1.2 million specimens of the collection are Lepidoptera, including over 400 holotypes. In the previous decade an army of technicians and students have curated all of the Leps except for the Pyraloidea and some of the Papilionoidea. Much of this was accomplished through two NSF grants that allowed us to expand and curate the Macrolepidoptera, including imaging 8,000 Franclemont genitalia slides and associated specimens. Going forward, the CUIC continues to grow through researchers from many institutions and by acquiring collections, and we are opening our doors to amateur entomologists.

Beguiled by Buck Moths: Combining Genomics and Chemical Ecology to Elucidate a Charismatic Species Group

Julian Dupuis
Department of Entomology, University of Kentucky, S225 Ag Science Center North, 110 South Limestone, Lexington, Kentucky 40546
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The charismatic, day-flying buck moths of the *Hemileuca maia* species complex are among North America's most enigmatic groups of Lepidoptera regarding their evolutionary history, ecological specialization, and taxonomy. While the group is geographically widespread, populations are highly localized and stenotopic, exhibit considerable ecological and morphological variability, and display widely variable specificity to host, habitat, and sex pheromone attraction. As such, they are an ideal model for investigating patterns and constraints of local adaptation and the effects of ecological specialization on speciation. Here, I report on recent efforts to combine genomics and chemical ecology to understand the evolutionary history of this group. This genomic foundation provides a novel lens with which to assess host and habitat specificity, diversification of sex pheromone components, and taxonomy of the group, including several species of conservation concern.

Epiblema, Sonia, Suleima, and *Notocelia* of the Contiguous United States and Canada

Todd Gilligan & Donald Wright
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Following two previous volumes treating *Eucosma* (Wright & Gilligan 2015) and *Pelochrista* (Wright & Gilligan 2017), we continue our revision of the North American Eucosmini with a volume on four related genera. This highly diverse group contains many difficult species complexes that have resulted in taxonomic confusion for nearly the last 100 years. In total, we treat 51 species of *Epiblema*, 15 species of *Sonia*, 11 species of *Suleima*, and 6 species of *Notocelia* that occur in the contiguous United States and Canada. Included are descriptions of 20 new species, a new combination, discussions of several unresolved species complexes, and designations of 10 lectotypes. The 87 species accounts are accompanied by 540 adult images and 612 genitalia drawings. This fascicle will be published in the fall of 2023 by the Wedge Entomological Foundation as a part of the Moths of North American (MONA) series.

References

Wright, D.J. & Gilligan, T.M. 2015. Eucosma *Hübner of the Contiguous United States and Canada (Lepidoptera: Tortricidae: Eucosmini).* Alamogordo, NM: Wedge Entomological Research Foundation. 256 pp

Wright, D.J. & Gilligan, T.M. 2017. Pelochrista *Lederer of the Contiguous United States and Canada (Lepidoptera: Tortricidae: Eucosmini). The Moths of North America, Dascicle 9.5.* Almogordo, NM: Wedge Entomological Research Foundation. 376 pp.

The Lepidoptera Collections at the NHM and Some of the Collection-Based Projects

Alessandro Giusti
Natural History Museum, Insects Division, Cromwell Road, London SW7 5BD, United Kingdom
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Alessandro Giusti is a senior curator at the Natural History Museum (NHM) in London, UK, and he is responsible for the collections of the macro-moths in the superfamilies Bombycoidea, Lasiocampoidea, Mimallonoidea, and part of the Zygaenoidea. This is approximately 15% of the total Lepidoptera holdings of the NHM, which is ca. 13 million specimens. In this presentation Alessandro will give a short overview of the Lepidoptera collections at the NHM and some of his past and current main projects within this.

C. P. Gillette Museum's Partnership with a Montana Wildlife Group: Attempting to Sample Moths across the Treasure State, update through Year 3

Chuck Harp
C.P. Gillette Museum of Arthropod Diversity, Department of Agricultural Biology, Colorado State University, Fort Collins, Colorado 80523-1177
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The Northern Rockies Research and Educational Services (NRRES) has been doing wildlife studies for several years on the 15,000-acre MPG Ranch south of Missoula, Montana, deep in the Bitterroot Mountains of western Montana. It is with their help that we continue to add valuable material from a poorly known and under collected region of the country. The program has grown to a state-wide effort with additional help from Marian Kirst of Billings, Montana, and her posse of volunteers. Their combined efforts have produced scores of new state distribution records, hundreds of county records, and at least one U.S. record. This presentation will introduce us to the long-term project to document the moths of the Treasure State of Montana.

The Central Rockies Have Lost Three Prominent Lepidopterists in the Past Six Months

Chuck Harp & Todd Gilligan
C.P. Gillette Museum of Arthropod Diversity, Department of Agricultural Biology, Colorado State University, Fort Collins, Colorado 80523-1177
chuck.harp@colostate.edu

This talk is a tribute to three men that have devoted more than a combined 200 years to the study of butterflies and moths. Dr. John Nordin of Laramie, Wyoming died on January 25, 2023. Dr. Paul Opler of Loveland, Colorado passed away on February 6, 2023. James Scott of Lakewood, Colorado died unexpectedly on May 21, 2023. Each made monumental contributions to the field of Lepidopterology through their writings, their donated specimens, their mentorship, and their inspiration to other researchers, students, and friends. We will give a brief overview of some of their achievements and discuss how their work helped to further our knowledge of Lepidoptera for generations to come.

Novel Approaches to Managing Lepidopteran Pests on Nut Crops in California

David Haviland
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Nut crops in California serve as excellent host plants for Lepidopteran pests, such as navel orangeworm and codling moth. Historically, efforts to manage both pests relied heavily on broad spectrum pesticides that had negative side effects on natural enemies and the environment. Over the past two decades, technological advances have allowed for more innovative management strategies. Mating disruption, which is accomplished through the mass-release of synthetically produced pheromone, has shown to reduce damage by navel orangeworm by approximately 50%, and is now used on more than 400,000 acres. More recently, sterile insect technique, which involves the mass-release of irradiated (sterilized) moths to mate with wild moths has been under investigation. Both techniques serve as excellent examples of recent innovations within agricultural industries to manage agricultural pests in a way that is sustainable, with minimal impact to the environment, using methods that are safe to natural enemies and pollinators.

The Montana Moth Project: Illuminating the Diversity of South-Central Montana's Moth Fauna through Citizen Science and Targeted Sampling

Marian L. Kirst
Staff Entomologist & Program Developer, Northern Rockies Research and Educational Services, 2439 Rancho Rd., Billings, Montana 59102
marian@nrres.org

The Montana Moth Project (MMP) is a pioneering effort to comprehensively document and investigate the diversity, distribution, and phenology of Montana's moth fauna through a combination of temporally and geographically varied sampling; targeted coverage of unique habitats (such as the Pryor Mountains in south-central Montana); and the development of consistent and engaged volunteer "moth crews" in the state's urban center of Billings. Via these efforts, the MMP team has documented an impressive array of moth species across Montana's varied ecosystems, including a few entirely new species, a U.S. record, as well as filling in data gaps for numerous "expected" but previously un-documented moths. We have paid particular attention to South-Central Montana, which continues to produce some the project's most interesting records, thanks, in part, to the region's disparate topography and the presence of the Pryor Mountain range, and ecological "hot spot" that contains the state's only stretch of true red desert.

Microlepidopterist Foray in Macromoth Systematics

Jean-François Landry, Bernard Landry & Paul Goldstein
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The genus *Hypenopsis* Dyar, 1913 (type species: *Hypenodes macula* Druce, 1891) is removed from synonymy with *Schrankia* Hübner, 1825 (Lepidoptera, Erebidae, Hypenodinae) and reinstated as valid. *Hypenopsis* and its type species *H. macula* are both redescribed based on the first morphological study of the genitalia of its two syntypes, and a lectotype is designated. Three new species are described based on morphology and supported by COI sequence data: two North American species long misidentified as *'Schrankia' macula*, and one from the Galápagos Islands. Two other species from Panama described in *Hypenopsis* (*H. flualis* Schaus, 1916 and *H. musalis* Schaus, 1916), and later included in *Schrankia* are illustrated for the first time: the genitalia of their holotypes show that they do not share diagnostic characters of either *Schrankia* or *Hypenopsis*, and their COI barcode sequences are distinct from either genus as well as other Hypenodinae genera; they are here regarded as Hypenodinae incertae sedis.

Taking Natural Surveys to the Lab: Describing Infection Patterns of an Insect Densovirus in a Western North American Lycaenid

Kelli J. McKeegan, Matthew L. Forister, Mike B. Teglas & Angela M. Smilanich
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The Melissa blue butterfly *(Lycaeides melissa)* is a multivoltine Lycaenid widespread across western North America. It specializes on native legumes, but with recent incorporation of alfalfa as an exotic host. We previously discovered wild-caught Melissa blue adults with the *Junonia coenia* densovirus (JcDV), with variation of viral frequency and load across populations. In this study, we reared larvae from wild-caught *L. melissa* females on different host plants and infected them with JcDV at the third instar. Frass was also collected for a measure of virus eliminated into the environment, and a

subset of larvae were sacrificed at 2-day increments post-inoculation to be screened for viral load. JcDV-infected individuals developed faster and had lower final mass than controls (regardless of host plant). Larvae sacrificed four days after inoculation, and those reared on alfalfa, had the highest viral load compared to other individuals and the lowest survival to adulthood, respectively.

Evaluating Isotopes as Tools to Determine Natal Origins of Spruce Budworm Moths

Marrissa Miller, Clement Bataille, Tom Sherratt & Felipe Dargent-Bocanegra
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marrissamiller@hotmail.com

Eastern spruce budworm moths are an important pest species in North America. They have a multi-million-dollar impact on Eastern North America's forestry industry and influence ecosystem functioning (Elliot 1960). Their outbreaks are cyclical, but research on the patterns of these outbreaks has been limited, largely due to limitations of traditional tracking tools. For example, their populations have high gene flow, limiting the use of population genetics; individuals are too small for radiotelemetry devices; and haphazard dispersal patterns make mark-recapture approaches unfeasible. The use of stable isotopes as an alternative to traditional tracking tools is proving to be a promising avenue to track unusual animal dispersals. Regions have a unique isotopic signature that gets integrated into an animal's tissue as it consumes plant matter at its origin. Through my research I have explored the use of the isotopic tracks $\delta 2H$ and $\delta 34S$ to help determine the natal origins of spruce budworm moths.

Reference

Elliott, K.R. 1960. A history of recent infestations of the spruce budworm in North-Western Ontario, and an estimate of resultant timber losses. *Forestry Chronicle* 36: 61–82.

Recuration of the CAS Lepidoptera collection

Michael Nee, David Bettman & Chris Grinter
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cgrinter@calacademy.org

In 2017, the California Academy of Sciences Lepidoptera collection began an overhaul. Historic curation efforts left all families with a mixture of Hodges checklist arrangement and/or alphabetical curation of non-US taxa. To-date, all moth families have been fully recurated using a modern classification. Insights, discoveries, and lessons learned will be discussed.

Challenges of Butterfly Conservation in Urban Landscape

Piotr Nowicki
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With worldwide expansion of cities, many local hotspots of terrestrial biodiversity have become encompassed into urban landscape. Butterfly conservation in such areas brings novel challenges, but also some opportunities, which I discuss using the experiences from the Kraków metropolis in Poland. A huge rise in land prices has led to the abandonment of traditional management and vegetation overgrowth as well as growing investment pressure on the remnants of precious meadow habitats. The establishment of the protected Natura 2000 sites for the flagship Phengaris butterflies halted this pressure in some areas, but inevitably increased it elsewhere. Further eminent threats to butterfly species of conservation concern include ill-advised afforestation projects, spread of invasive plants, also from gardens, and climate change worsened by the city heat island effect. Nevertheless, the persistence of flagship butterflies in an urban setting also helps to raise public awareness and support for conservation actions.

The Past, Present, and Future of Lepidoptera checklists in North America

Greg Pohl & Steve Nanz
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We review the history of North American Lepidoptera checklists, comparing the species counts from 1891 to 2023. A new checklist has been prepared with the assistance of 28 co-authors. We summarize how the list was developed and the information it contains. It lists 13,080 valid species, 191 excluded species, thousands of subspecies and synonyms, and many new taxonomic acts. The manuscript is in the final stage of formatting and should be published by the Wedge Entomological Foundation before the end of 2023. Initially, the checklist will be available in printed form. After two years, our intent is to make an electronic version of the list freely available, and regularly updated online at the Moth Photographers Group website.

The Montana Moth Project: Past, Present and Future

Mat Seidensticker, Chuck Harp, Marian Kirst,
Chris Grinter & Lorinda Bullington
Northern Rockies Research & Educational Services, P.O. Box 1242, Lolo, Montana 59847
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Montana is a large and habitat-diverse state historically under-surveying for its moth fauna. We started the Montana Moth Project (MMP) in 2020 as a long-term effort to document the diversity and distribution of moths across all 56 Montana counties. Since its inception, the MMP has preserved nearly 29,000 macro moth specimens representing about 1,100 species at the C.P. Gillette Museum of Arthropod Diversity and hundreds of micro moth species (with many more awaiting identifications) at the California Academy of Sciences. The MMP also includes several subprojects tracking moth abundance and diversity related to climate and investigation of moth-plant interactions using DNA metabarcoding on MPG Ranch in west-central Montana. We will discuss how the project started, current progress, and the next steps while highlighting our MPG Ranch research.

Toward transparent taxonomy for *Speyeria* and *Argynnis*: introducing a web tool for evaluating alternate classifications

Oksana Vernygora, Felix Sperling, & Julian Dupius
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1. Informative and consistent taxonomy above the species level is essential to communication about evolution, biodiversity, and conservation, and yet, the practice of taxonomy is considered opaque and subjective by scientists and the public alike.
2. Here, we present TaxonomR, an interactive online decision-support tool to evaluate alternative taxonomic classifications. This tool implements an approach that quantifies the criteria commonly used in taxonomic treatments and allows the user to interactively manipulate weightings for different criteria to compare scores for taxonomic grouping under those weights.
3. We use the butterfly taxon *Argynnis* to demonstrate how different weightings applied to common taxonomic criteria result in fundamentally different genus-level classifications that are predominantly used in different continents and geographic regions.
4. TaxonomR is not a prescriptive application. Rather, it aims to be a tool that potentially supports global harmony in biodiversity assessments through evidence-based discussion and community-wide resolution of historically entrenched taxonomic tensions.

How Many Butterfly Species on an Isolated Maine Island?

Ernest H. Williams
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Repeated surveys have documented nearly 50 butterfly species on Monhegan Island, a small, isolated island off the coast of Maine. Given the size of the island, this total is a surprisingly high proportion of the 118 species reported for the entire state. Of the total recorded on the island, about 33 species may be seen every year, including small residents and large migratory species. Southern migrants appear occasionally. A new comparison of Monhegan to another Maine island indicates that several species that might be expected are missing because of limited habitat and foodplant. Ongoing changes to this butterfly fauna are taking place because of climate change and alterations in vegetation and land use.

Genomic Screening as a Tool for Species Discovery

Jing Zhang, Qian Cong & Nick Grishin
Howard Hughes Medical Institute and Department of Biophysics and Department of Biochemistry, University of Texas Southwestern Medical Center, 5323 Harry Hines Boulevard, Dallas, Texas 75229
grishin@chop.swmed.edu

Traditionally, visual screening of specimens for wing pattern differences and comparing genitalia dissected for many specimens have been used to spot and discover new species of Lepidoptera. When used with caution, COI barcoding can further indicate potential new species, including cryptic. Whole genomes represent their organisms and can be used to detect gene flow and gene exchange between populations and species, and therefore are particularly suitable to assess the reproductive barrier for specie delimitation. Coupled with the sequencing of primary type specimens to associate existing names with sequenced populations, we applied genomic analysis to search for new butterfly species, and the highlights of this study will be presented.

Insights from Large-Scale Butterfly Genomics

Jin Zhang, Qian Cong, Jinhui Shen, Leina Song & Nick Grishin
Howard Hughes Medical Institute and Department of Biophysics and Department of Biochemistry, University of Texas Southwestern Medical Center,, 5323 Harry Hines Boulevard, Dallas, Texas 75229
grishin@chop.swmed.edu

We capitalize on recent breakthroughs in sequencing methods to obtain whole genome datasets for many thousands of specimens, from recently collected to two centuries old. Using butterflies as model organisms, we address general problems in biology, from learning about genotypic determinants of phenotypic traits to revealing principles of evolution and the significance of gene exchange between different species through hybridization. We use genomics to solve long-standing problems in nomenclature, such as associating century-old and frequently damaged primary type specimens with present-day populations. Genomic datasets yield well-resolved phylogenies and improve taxonomic classification. Genome-scale trees reveal levels of diversification, i.e., periods of bursts followed by extinctions suggesting that a limited number of taxonomic ranks, such as tribes and genera, can be applied to these levels defined by longer tree branches. This apparent discreteness resulting from continuous processes is observed at all levels, including species, and genomics offers hints about species delimitation.

Updates on the Bird Tear-Drinking Habits by Species of the Genus *Hemiceratoides* (Erebidae)

Alberto Zilli, Jérôme Barbut, Leejiah J. Dorward & David C. Lees
Natural History Museum, Insects Division, Cromwell Road, London SW7 5WD, United Kingdom
a.zilli@nhm.ac.uk

Following initial records of *Hemiceratoides* (Saalmüller, 1891) in Madagascar, new observations carried out in Tanzania reveal that bird tear-drinking by moths of the genus *Hemiceratoides* Strand, 1911 is also taking place on the African mainland. This finding prompted us to undertake a review of the genus, to discover that all species share the same specialized structures on the proboscis, so that "ophthalmotropy" on birds is likely a common trait to all of them. Morphological studies on samples from whole Africa also led to the discovery of two undescribed species, one being actually that of the sightings in Tanzania, and that another species currently placed in the genus *Siccyna* Nye, 1975 is in fact one of *Hemiceratoides*. Some unusual morphological configurations found in the male and female genitalia and the peculiar configuration of the labial palps in male *H. sittaca* (Karsh, 1896) will also be discussed.

Paul Opler working in the Sierra Nevada, 2016. All Photos: Evi Buckner-Opler.

Obituary Paul Alexander Opler (1938–2023), with list of publications

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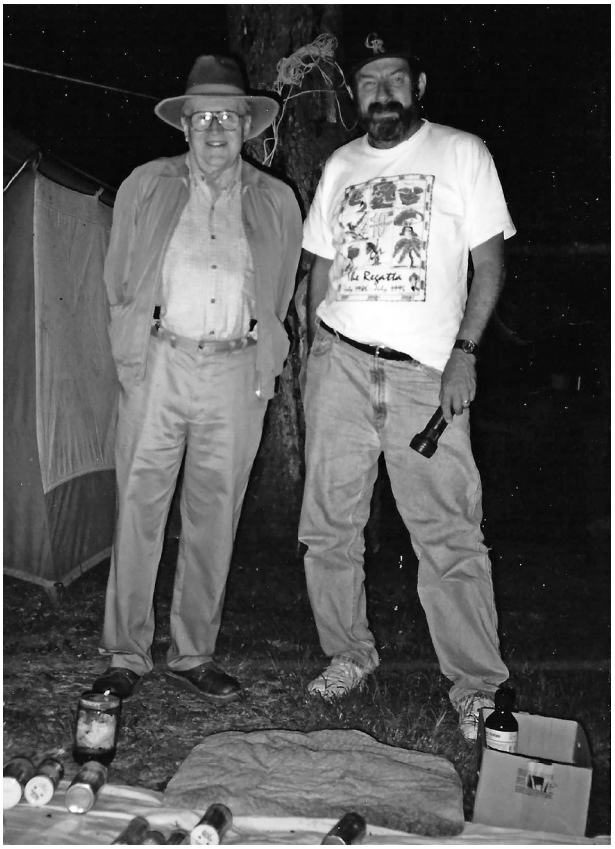
Paul Opler was an international authority on Lepidoptera who is best known to a broader audience for his books on butterflies and moths, including the *Peterson Field Guide to Eastern Butterflies*, the *Peterson Field Guide to Butterflies of Western North America*, *Butterflies East of the Great Plains: An Illustrated Natural History*, and *Moths of Western North America* (with Jerry Powell). On February 6, 2023, at the age of 84, he lost his battle with cancer.

Paul was born on August 3, 1938 in Ann Arbor, Michigan to Pauline Schneirla Opler and Ascher Opler. The family moved to California when he was six years old, and by the time Paul was nine he had developed a love for nature, especially butterflies and birds. In 1952, he joined the Lepidopterists' Society. Paul received his BS (Entomology) from UC Berkeley in 1960. In 1961, he was drafted into the U.S. Army and assigned to First U.S. Army Medical Laboratory in New York, studying mosquitoes from all New England army bases and missile sites. He earned his M.Sc. (Entomology) from San Jose State University in 1965, studying *Euchloe* butterflies, guided by J.W. Tilden, and his PhD in entomology from UC Berkeley in 1970 on the biosystematics of microlepidoptera associated with California Oaks, supervised by Jerry Powell. After receiving his doctorate Paul moved his family (his first wife Sandra, two young sons and an adopted infant daughter) to Costa Rica for 4 years where he studied Lepidoptera as part of his post-doctoral Fellowship with the Organization for Tropical Studies, as well as the local vegetation, bees, and bats. The results of this postdoc project were documented in an impressive 25 papers and book chapters.

He was then hired by the U.S. Fish and Wildlife Service as the first entomologist in the newly created Endangered Species Program in Washington D.C. before being transferred in 1983 to Fort Collins, Colorado, where he served as Chief-Editorial-Director at the USFWS Division of Research, and then to the Biological Resources Division of the U.S. Geological Survey. He also became the first editor of the Entomological Society of America's *American Entomologist*, which he helped to emerge from its rather simple predecessor, the *Bulletin of the ESA*. In 1989, he was elected President of the Lepidopterist's Society (see Anon.

1994) (and was elected Honorary Life Member in 2011). In 1992, he became Scientific Editor of the project *Status and Trends of Our Nation's Biological Resources* (see Mac et al. 1998 in his publication list). Despite his administrative duties and meeting-heavy professional life, he managed to publish prolifically throughout his career leading to the imposing list of publications compiled below.



Paul Opler (right) with Doug Ferguson (see Hodges 2003) at the Lepidopterists' Meeting in Sierra Vista in July 1999.

Since his retirement from the government in 1997 he worked as a Special Appointment Professor for Colorado State University in the Department of Agricultural Biology in the Gillette Museum of Arthropod Diversity and served as assistant director of this nearly five million specimens strong collection, adding a wealth of specimens himself from his research trips to Mexico, Costa Rica, and Europe, as well as the Western US. During his time the Lepidoptera holdings of the Gillette Museum have increased 20-fold, through donations and collecting. With the help of his wife Evi he taught classes on the

Paul Opler (left) with Bob Pyle in Modoc County, California, in July 2008.

natural history of butterflies in Rocky Mountain National Park, Colorado; the Teton Science School, Wyoming; and in the Sierra Nevada Field Campus, California, for San Francisco State University. In more recent years he was excited to be part of a DNA project with Nick Grishin in Texas, which has already resulted in several published papers. He also was a Research Associate at the Smithsonian Institution in DC, as well as at the Museum of Nature & Science in Denver, CO. He was elected Fellow of the Entomological Society of America in 2018 and of the Royal Entomological Society of London in 2019.

A wonderful interview with the 79-years old Paul from 2017 was published in *American Entomologist* (Rice 2018) and whoever wants to find out more about his time in the Endangered Species Program might have a look at the interview that Robert Pyle conducted with young Paul in 1975 (Pyle 1975). Most of his statements and thoughts are as relevant today as they were then.

In recent years Paul became interested in his family's genealogy and identified over 3000 family members, always excited to find and keep in touch with his new-found relatives. Paul was preceded in death by his parents, Ascher Opler and Pauline Schneirla Opler, and his first wife, Sandra Opler, the mother of his three children: Tim Opler in New York, David Christian Opler in France, and Laura Farris in North Carolina. Paul

Paul Opler (left) doing research at Bonner Peak Ranch, Colorado, with Scott Ellis and Lydia Thompson, June 2022.

will be dearly missed by his wife Evi Buckner-Opler and her family in Germany and Italy, his sister Nora Opler McCreary, California; his three grandsons in France; stepmother Tamar Opler-Heyman, New York; his former sister-in-law Kay Cotter, California; his nieces and nephews and their families; his cousin Judy Driscoll in North Carolina; and his stepson Hans-Eric Buckner and family in Montana.

Paul will live on in the memories he made with his family, many friends and colleagues, the many books and papers he wrote to advance the knowledge of Lepidoptera, and the many bird surveys and bird counts he participated in throughout his life.

List of Paul Opler's Publications

1961

Opler, P. & Powell, J.A. 1961. Taxonomic and distributional studies on the western components of the *Apodemia mormo* complex (Riodinidae). *Journal of the Lepidopterists' Society* 15 (3): 145–171.

1962

Opler, P.A. 1962. Some notes on *Callophrys (Mitoura) johnsoni* (Lycaenidae) in California. *Journal of the Lepidopterists' Society* 16 (3): 193–194.

1966

Opler, P.A. 1966. Studies on the Nearctic *Euchloe*. Part I. Introduction. Part 2. Chronological review of the literature and bibliography *Journal of Research on the Lepidoptera* 5 (1): 39–50.

Paul's last Christmas, with his wife Evi Buckner-Opler, taken at Rocky Mountain National Park, 2022.

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Opler, P.A. 1966. A possible record for the occurrence of *Callophrys (Xamia) xami* (Lycaenidae) in California. *Journal of the Lepidopterists' Society* 20 (4): 212.

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Brown, R.M. & Opler, P.A. 1967. Biological observations on *Callophrys viridis* (Lycaenidae). *Journal of the Lepidopterists' Society* 21 (2): 113–114.

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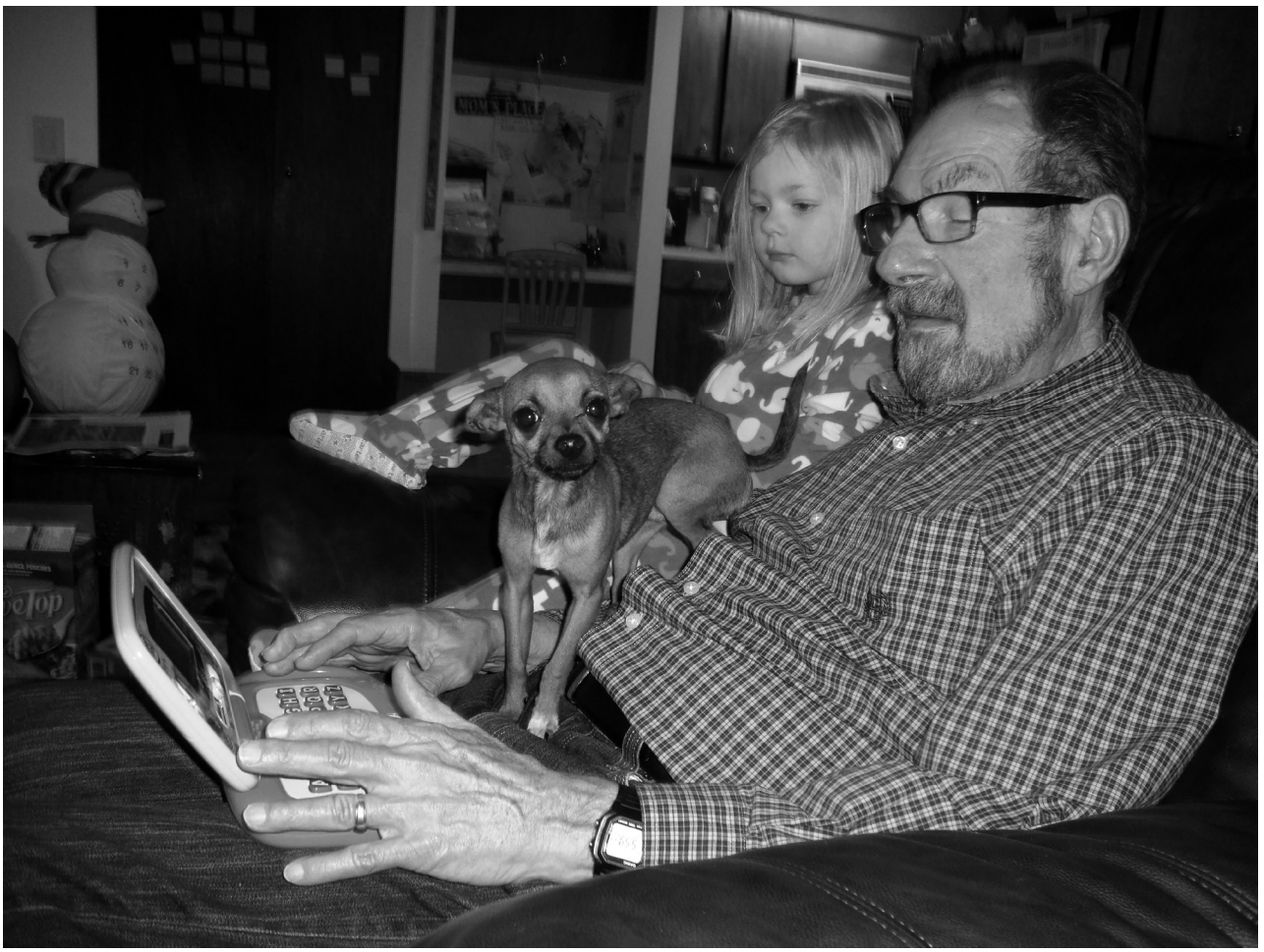

Paul writing one of his numerous papers on his new top of the line laptop. With granddaughter Oakley and Churro, December 2013.

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