Volume 64, Number 3 Fall 2022

# NEWS OF THE LEPIDOPTERISTS' SOCIETY

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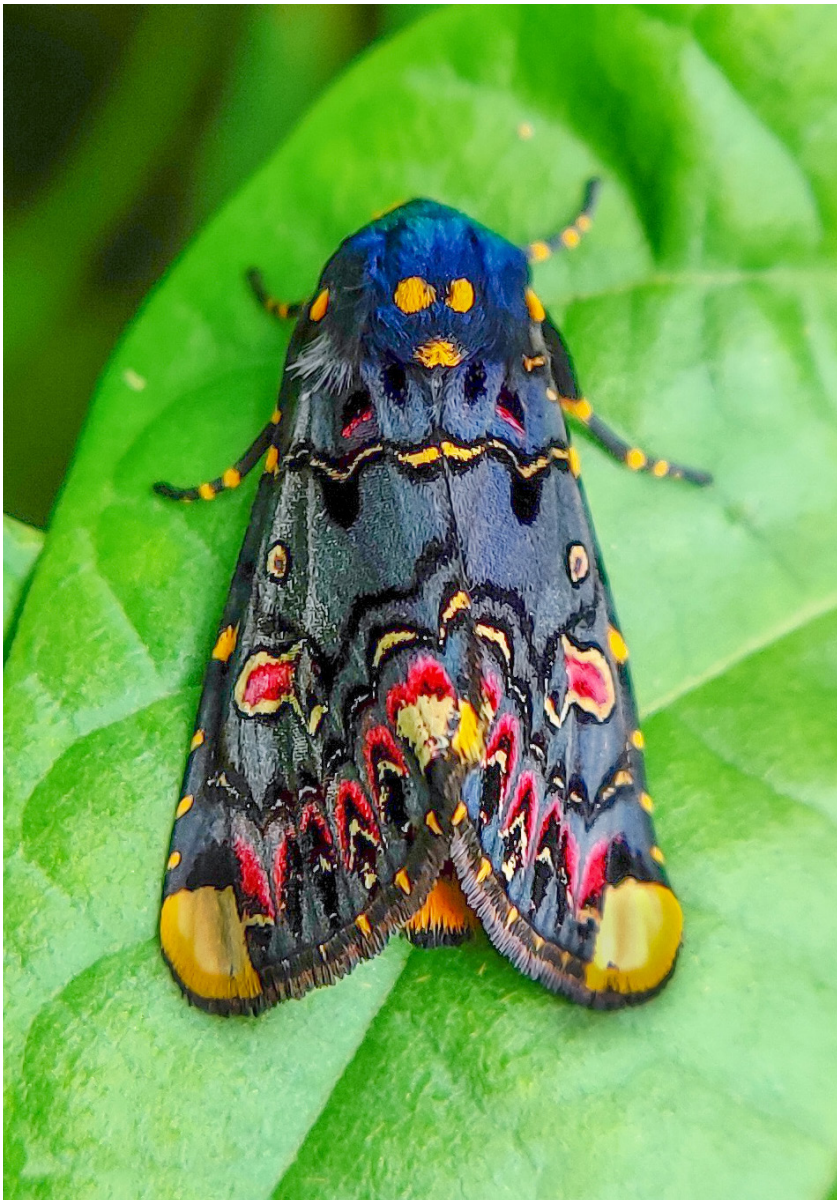

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## Front Cover:

*Polytela gloriosae*, the Lily Moth, Bhandup Pump Station, Mumbai, India, August 7, 2020. Photo used by permission from Nilesh Shidhore.

# Notes on the ecology of immature *Anaea troglodyta floridalis* (Nymphalidae)

Mark Salvato and Holly Salvato

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The federally endangered Florida leafwing, *Anaea troglodyta floridalis* F. Johnson and Comstock (Nymphalidae), historically occurred throughout the pine rocklands of southern Florida (Minno & Emmel 1993; Smith *et al*. 1994), where it is endemic. However, due to extensive habitat loss across much of its former range *A. t. floridalis* is now largely restricted to the Long Pine Key region of Everglades National Park (Salvato *et al*. 2016).

Annual abundance of the extant *A. t. floridalis* population within the Everglades varies considerably, often in response to natural disturbances (*e.g*. fire, storms) in the pine rocklands (Salvato and Salvato 2010; McElderry *et al*. 2015; Henry *et al*. 2019). In addition, various aspects of the subspecies natural history (*e.g*. predation, parasitism) also influence annual or seasonal fluctuations. Hennessey and Habeck (1991) and Salvato and Salvato (2010) tracked immature *A. t. floridalis* development monthly within the Everglades and the lower Florida Keys, to identify mortality factors. To further evaluate larval development and identify mortality factors we followed immature *A. t. floridalis*, weekly, in the field in Long Pine Key.

Briefly, as immature *A. t. floridalis* were encountered, their locations were marked and monitored weekly to determine status. *Anaea t. floridalis* larvae generally remain on the same plant throughout development allowing individuals to be followed in the field. However, the fate of larvae beyond the last instar was not determined, as these individuals often dispersed off the hostplant (*Croton linearis*, Jacq. [Euphorbiciae]) to pupate and could not be reliably followed. Additional studies are required to more thoroughly identify threats to *A. t. floridalis* from final instar through subsequent pupation and eclosion.


**Fig. 1**. *A. t. floridalis* egg parasitized by *Trichogramma* sp. near *pretiosum* (6 Feb. 2010). **Fig. 2**. Twig ant, *Pseudomyrmex pallidus* attacking a late instar *A. t. floridalis* larva (24 Dec. 2011). **Fig. 3**. Twig ant, *Pseudomyrmex gracilis* consuming an early instar *A. t. floridalis* larva (14 Feb. 2015). All images by Holly L. Salvato.

Overall, we located and followed 172 *A. t. floridalis* at various immature stages in the field from 2007 to 2016, of which at least 121 individuals (70 percent) did not survive. The majority (78 percent) of mortality occurred amongst early instars. All stages were subject to a variety of parasites and predators as discussed below.

**Eggs**

Hennessey and Habeck (1991) indicated a high level of parasitism (up to 100 percent) on *A. t. floridalis* eggs from *Trichogramma* sp. near *pretiosum* Riley, both in the Everglades and from a now-extirpated population on Big Pine Key in the lower Florida Keys. The *Trichogramma* encountered in our studies were also identified as *T.* sp. near *pretiosum*. Once parasitized, eggs turn black within 3 or 4 days (Fig. 1). Parasitized eggs produced wasps (up to 20) at approximately 20 and 33 days after oviposition.

Matteson (1930) noted ant predation of *A. t. floridalis* eggs, but did not specify the type of ants. However, as discussed below under early instars, two types of twig ants (*Pseudomyrmex* spp.), the native *P. pallidus* (F. Smith) (Fig. 2) and exotic *P. gracilis* Fabricius (Fig. 3) were frequently

observed patrolling *C. linearis* and preying or harassing early instar *A. t. floridalis* larvae. Further studies will likely indicate that these twig ant species also serve as egg predators of *A. t. floridalis*.

**Early instars**

Two species of biting midges, *Forcipomyia* (*Microhelea*) *fuliginosa* (Meigen) and *F.* (*M.*) *eriophora* (Williston) (Fig. 4) were documented as ectoparasites of early instar *A. t. floridalis* larvae (Salvato *et al.,* 2008; 2012). We reared early instar larvae parasitized by *Forcipomyia* biting midges and these individuals died in the lab.

Salvato *et al*. (2016) documented twig ant predation on early instar *A. t. floridalis* larvae. On several occasions we observed early instar *A. t. floridalis* larvae parachuting off the hostplant using a silk excretion in an attempt to evade ant predation. In some instances we observed *P. gracilis* sitting atop the larval frass chain, pulling the silk strand as the larva aggressively writhed on the other end. Clayborn and Koptur (2017) conducted extensive studies on ant distribution and abundance in south Florida and indicated *P. gracilis* and other nonnative ants represented 56 percent of all ant observations. Based on their frequency on the hostplant, often in close proximity to larvae, we suspect that twig ants, particularly exotic species, serve as substantial predators of early instar *A. t. floridalis*.

Two crab spiders, *Misumenops bellulus* (Banks) and *Mecaphesa celer* (Hentz), as well as an orb weaver, *Eriophora ravilla* (C. L. Koch), were documented to prey on early instar *A. t. floridalis* larvae. In addition, Jimi Sadle (Everglades National Park, pers. comm.) photographed early instar *A. t. floridalis* larvae being predated by green lynx *Peucetia viridans* (Hentz) and regal jumping *Phidippus regius* C. L. Koch spiders on 4 December and 30 September 2013, respectively. These spiders were observed to wait atop the larval frass chain then grab the larvae as they got closer.

**Late instars**

The tachinid fly, *Chetogena scutellaris* (Wulp.), has been documented as an endoparasite of *A. t. floridalis* for several decades (Salvato *et al*. 2009). We noted that many late instar *A. t. floridalis* larvae were frequently parasitized by *C. scutellaris*. Close examination of 4$^{th}$ and 5$^{th}$ instars often revealed small white eggs or eggshell fragments on the outer larval skin (see Fig. 4). In some instances *A. t. floridalis* larvae managed to remove the *C. scutellaris* eggs (and thereby avoid parasitism) by molting prior to maggot emergence. However, more typically dark spots were observed on the larval skin from where *C. scutellaris* maggot(s) had entered the caterpillar. Briefly, *C. scutellaris* larvae internally feed on the developing *A. t. floridalis* larvae, slowing their development. When the *A. t. floridalis* host attempt to pupate, the *C. scutellaris* maggots emerge, killing the larvae.

**FIG. 4**. A biting midge, *Forcipomyia* (*Microhelea*) *eriophora* attacking late instar *A. t. floridalis* larva. Also note the numerous white egg shells from *Chetogena scutellaris* parasitism (4 Nov. 2011). Image by Holly L. Salvato.

As discussed in Salvato *et al*. (2015), late instar *A. t. floridalis* that constructed silken shelters were still attacked by *C. scutellaris*. Unlike other *Anaea* or similar genera, shelter building is not obligatory for immature *A. t. floridalis* and was only sporadically encountered during our studies.

*Neoscona arabesca* Walckenaer, an orb weaver, was documented as a predator of late instar larvae (Salvato and Salvato 2011). However, it was unclear if these spiders directly attacked the *A. t. floridalis* larvae, or if the predated larvae we observed had simply wandered into the webs.

Parasitism from biting midges (*Forcipomyia* [*Microhelea*] spp.) was fatal to early *A. t. floridalis* instars. Conversely, older larvae observed throughout these studies appeared able to withstand the attacks. We reared older larvae that had been parasitized by biting midges and in each instance these individuals eclosed successfully. In addition, we followed late instars (n = 8) in the field that had been repeatedly parasitized by *Forcipomyia* (up to 4 biting midges on the integument at one time), which survived to at least final instar. Koptur *et al*. (2012) suggested fat reserves present in older caterpillars, but lacking in young larvae, may absorb viruses transmitted during biting midge feeding thereby allowing these late instars to survive the parasitism. In addition, biting midges may also serve as vectors of various virus or bacteria. Therefore, larvae parasitized by biting midges may pass along virus or bacterium to other individuals as they continue to feed on *C. linearis*.

All photos were taken by Holly L. Salvato in Long Pine Key, Everglades National Park (Miami-Dade County, FL).

## Acknowledgements

The authors thank the following individuals for their help identifying various parasites and predators observed during these studies: Richard Stouthamer and John Pinto (*Trichogramma*), William Grogan Jr. (biting midges), John O. Stireman III (*Chetogena*), Mark Deyrup and Marc Minno (ants) and G.B. Edwards (spiders). We thank Dennis Olle and Erica Henry for assistance in the field. We also thank the staff of Everglades National Park, particularly Jimi Sadle, for permitting and technical assistance.

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*Digital Collecting:*

# Mexico: State of Chiapas

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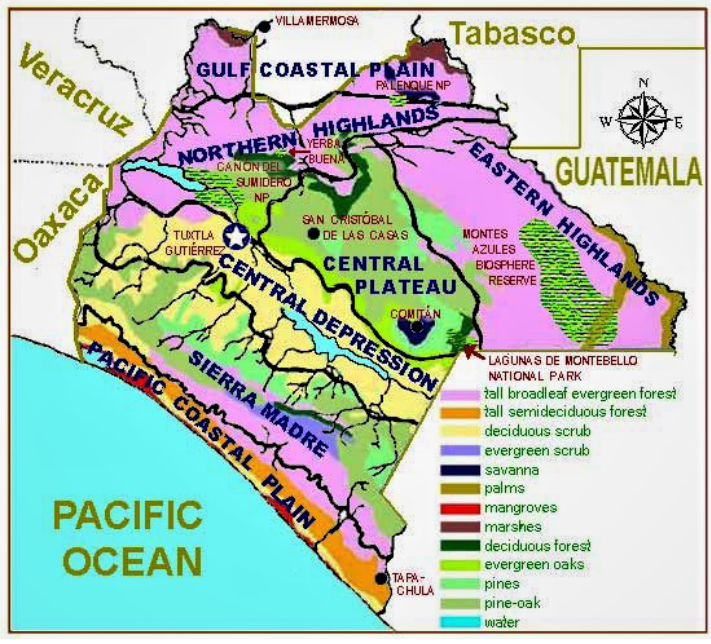
This travelogue is based on two butterfly photography holidays in the State of Chiapas Mexico. The first, July 31 – August 9, 2008, was organized by Sunstreak Tours with Jeffrey Glassberg as trip leader. The second, May 11 – May 24, 2010, was organized by Judi Ross and Kim Garwood, with Kim as trip leader. The following are locations we visited during the trips: Parque Nacional Can del Sumidero – Palenque – Cascada de Misol-Ha – Parque Nacional de Agua Azul – Campamento Rio Lacanja – Bonampak – Yaxchilan – Las Guacamayas – Lagunas de Montebello – Tapachula – Volcano Tacana – INIFAP – Finca Hamburgo – Finca Argovia.

Our fearless driver Judi picked Kim and me up in a large van at the Oaxaca airport, and then drove to the Villa del Campo hotel in town. After several days photographing butterflies in the state of Oaxaca we passed several windmill farms on our drive to Tuxtla Gutierrez in the State of Chiapas, picking up Fred Heath, with all of us staying at the Best Western Hotel.

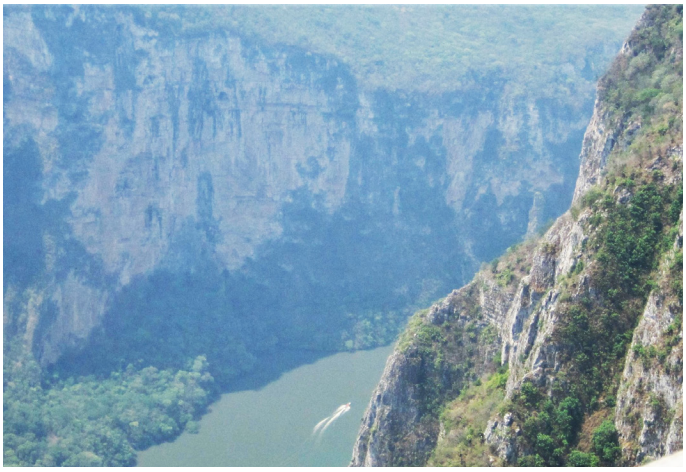
Chiapas is the southeasternmost state in Mexico, bordered to the north by the state of Tabasco, east by Guatemala, to the west by the states of Oaxaca and Veracruz, and to the southwest by the Pacific Ocean. This state has tall broadleaf evergreen forests in the Gulf Coastal Plains, eastern and northern highlands. The central plateau features evergreen oaks, deciduous, pine, and pine-oak forests. The central depression has deciduous scrub and pines. The Sierra Madre has tall broadleaf evergreen forest and scrub. The Pacific coastal plain features mangroves, marshes, and tall semideciduous forests.

Top: *Opsiphanes cassina*, imbibing sap; lower left: *Carystoides abrahami*; lower right: *Anteros carausius*.




Map of Chiapas, Mexico.

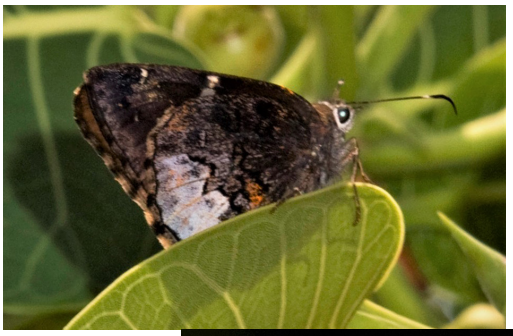
Butterfly clicks from the 2008 trip include Split-banded Owlets, *Opsiphanes cassina,* imbibing sap (17 on this tree) with various Palms as the host tree), Abraham's Ruby-eye, *Carystoides abrahami*, and Carousing Anteros, *Anteros carausius*.



Sumidero Canyon

May 12. We passed numerous patches of land with cattle grazing bordered by tall wood fences, on our way to Parque Nacional Cañón del Sumidero. Sumidero Canyon is a deep natural canyon formed by a crack in the earth's crust and subsequent erosion by the Grijalva River that has vertical walls as high as 1000m. Formation of this canyon began around the same time as the Grand Canyon. Most of the vegetation in the park is low to medium-height deciduous forest with small mixed areas of pine-oak forest and grassland.

It was very dry, and we did not see many butterflies as we travelled the 22km road inside the park. Goodies included include a long range shot of Variable Mottled Skipper (pale segregate), *Codatractus uvydixa*, Yojoa Scrub-Hairstreak *Strymon yojoa* and a well camouflaged unidentified caterpillar. The day ended with huge thunderstorms towering over the sunset.



*Codactractus uvydixa.*

*Strymon yojoa.*

Unidentified caterpillar

The next day we took Mexico 199 through San Cristobal de las Casas, south of Simojovel, where you can find Mexican or Chiapan amber that is fossilized sap of coniferous and leguminous trees formed 25 to 40 million years ago. Amber is found in relatively few places in the world with the Simojovel region being the only place in Mexico. Earthquakes and other natural occurrences buried these trees in several layers of sediment resulting in their petrification that transformed their sap into amber. Chiapan amber can vary from transparent to opaque, having a number of unique qualities, including some containing fossilized insects and plants. Colors range from white to yellow/orange to deep red but there are also some pieces with green and pink tones as well. The color depends on the makeup of the original sap as well as the minerals found in the surrounding soil and cracks that it was buried under. Qualities are comparable to Amber found in the Dominican Republic and has been worked into jewelry. Natives believed amber to have healing and protective qualities. One way to determine the authenticity of Chiapan amber is using a long wave ultraviolet lamp that shows shades of opaque greenish-blue when real.

Necklace of Chiapan amber. Left: normal lighting, right: viewed under long wave ultraviolet light.

After around 6 hours of Judi driving the corkscrew road winding through the mountains we spent the next several nights at Palenque's most upscale accommodations the Chan-Kah Resort Village. The casitas are surrounded by lush vegetation and forest with a small river running through the resort. At the resort, we got clicks of a male and female White-banded Metalmark, *Hypophylla sudias*, Yellow-based Metalmark, *Isapis agyrtus hera* (male), Banded Tigerwing, Ae*ria eurimedia pacifica (*female), Pale Owl-Butterfly, *Caligo telamonius memnon,* and the Double-spotted Owl Butterfly, *Eryphanis aesacus.*

Traveling the road back and forth to Palenque, we found female and male Starry Night butterflies, *Hamadryas laodamia,* attracted to a very ripe Guava tree that attracted many other butterflies. Additional bugs included the Bumblebee Metalmark *Baeotis zonata* and the Simple Checkerspot *Chlosyne hippodrome*.

At around 150m in elevation, with about 85 inches of rain a year, the hot and humid Palenque archaeological site was considered the crown jewel of the entire Maya world dating from around 226BC to 799 AD. After its decline it evolved into an overgrown jungle of cedar, mahogany and sapodilla trees but has since been excavated and restored. The ruins are medium sized, containing fine architecture, sculpture, roof comb and bas-relief carvings that the Mayas produced. History has been reconstructed from reading

Top row: *Hypophylla sudias* (♂ & ♀), *Isapis agyrtus hera.* Middle row: *Eryphanis aesacus, Caligo telamonius memnon, Aeria eurimedia pacifica, Chlosyne hippodrome* (below *Aeria*). Bottom Row: *Hamadryas laodamia* (♀ & ♂), *Baeotis zonata.*

Palenque, Temple of Inscriptions

the hieroglyphic inscriptions. The most famous ruler, K'inich Janaab Pakal, ascended to the throne in A.D. 615 at age 12 and lived to be 81 years old. The tomb was revealed November 28, 1952 after lifting a 5 ton slab revealing his sarcophagus in the Temple of Inscriptions.

I liked to work the jungle area S.E. of the ruins around the Otulum River, away from all the tourists. Over a period of several days (both trips) I photographed Dark Calephelis, *Calephelis velutina* (male), the very large Orion Cecropian, *Historis odius dious,* Tiger-striped Leafwing, *Consul fabius cecrops,* and the Green-patch Swallowtail *Battus laodamus copanae* (female). Using rotting bananas, we lured in the White-spotted Prepona, *Archaeoprepona amphimachus amphiktion,* and the Two-spotted Prepona, *A. demophoon gulina.*

During the first trip, Jeff and I found several spots off Hwy 199 from the Chan-Kah Resort going towards Misol-Ha and Agua Azul that produced a mating pair of Emerald-patched Cattlehearts, *Parides sesostris zestos* (see page 131), the bright orange colored Cell-barred Metalmark, *Mesene phareus* (female), the very small, erratic flying, tough to photograph Lasus Metalmark, *Perophthalma lasus* (male), Arola Ministreak, *Ministrymon arola* (=*coronta*?) (female), and the large Black Witch Moth, *Ascalapha odorata*.

Top row: *Historis odius, Consul fabius, Battus laodamus.* Middle row: *Archaeoprepona amphimachus, A. demophoon, Ascalapha odorata.* Bottom Row: *Calephelis velutina* (♂), *Mesene phareus* (♀), *Perophthalma lasus, Ministrymon arola.*

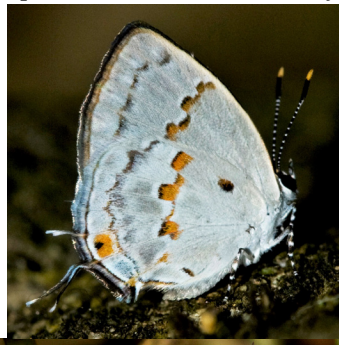
Left: Cascada de Misol-Ha. Right: The pools and falls at the Parque Nacional de Agua Azul.

May 14: While driving south on the Ruta Maya towards Misol-Ha I spotted several butterflies puddling on a rock filled island in a small river. Judi stopped the van I got out to wade across the shallow rock strewn river to the island to photograph a female Black Swallowtail *Papilio polyxenes*, not paying attention to several persons doing laundry nearby. One boy started to throw rocks at me. Startled and scared I waded across to the other side of the river. Climbing up a fairly steep grass filled bank, I crossed the path of a Coral Snake along the way while Judi was driving the van to the other side of the river to pick me up. Thankfully, no snake bite or thrown rock injuries!

The local ejidos, or communities, have learned to ask for money from the flow of tourists coming to the waterfalls, and we repeatedly ran into groups holding strings with bits of clothing hanging from them across the road, blocking our way. We said "no" and eventually they let us through.

Misol-Ha is Maya for waterfall. This cascade falls around 30 meters from an overhanging semicircular cliff down into a shimmering pool that is usually crowded with people swimming. I got clicks of a Celmus Hairstreak, *Celmia celmus*, Westwood's Satyr, *Euptychia westwoodi*, and The Great Satyr *Taygetis mermeria excavata*.

Around 60km south of Palenque Judi drove on a curvy road, behind slow trucks that could take a long time to pass, before arriving at Parque Nacional de Agua Azul. Sometimes the churning cascades of the blue-teal



Right: *Celmia celmus*. Bottom Row: *Papilio polyxenes*, *Euptychia westwoodi, Taygetis mermeria excavata*.

colored water flowing over stair-stepped limestone on the Tulija River can be seen miles away. There are always lots of people, and several drownings have occurred here.

I tried to check out the areas around the bathrooms that can attract butterflies, where I clicked Scylla Firetip, *Elbella scylla* (male), and The Broken Silverdrop, *Epargyreus exadeus cruza*. Others found in the area included Blue Lasaia, *Lasaia sula* imbibing minerals on my wide brim Tilly hat, and Astala Eighty-eight, *Diaethria a. astala*.

May 15: The four of us continued on The Carretera Fronteriza (border highway) Mexican 307 that runs from Palenque southeast along the Rio Usumacinta River Valley and the Guatemalan border to Frontera Corozal. We turned off the main highway, and turned again driving over a bridge onto the caliche road. We passed dozens and dozens of dark kite swallowtails zipping back and forth. Fred and I got out of the van trying to get pictures. The problem was that these swallowtails never landed near us. Judi and Kim continued on to the Lacandon village of Lacanja Chansayab to Rio Lacanja Campamento (320m) in Selva Lacandona (Lacandon Jungle) near Bonampak. We did not see as many butterflies as expected. The people at the lodge looked through our butterfly books and say that we were a bit early for butterflies (June is apparently the month to come). They also pointed at the images of Crackers (*Hamadryas* spp.) while making crack-crack noises. They told us and that the numbers of butterflies should increase over the next several weeks.

Judi scored a Salvin's Kite-swallowtail, *Eurytides salvini* near her cabin. Other clicks included Tailed Cecropian, *Historis archeronta,* outside the shared toilets, always a good place to check out, along with Blurred Bent-Skipper, *Ebrietas evanidus*, and Squared-bent Skipper, *Helias cama*. In nearby areas we found Short-lined Kite-Swallowtail, *Eurytides agesilaus* and the White-crescent Swallowtail, *Mimoides thymbraeus*.

Left column: *Eurytides salvini, Elbella scylla, Ebrietas evanidus, Helias cama.* Middle column: *Eurytides agesilaus, Lasaia sula, Epargyreus exadeus cruza.* Right column: *Mimoides thymbraeus, Historis acheronta, Diaethria astala astala.*

Left: Brightly colored murals in Temple 1 at Bonampak. Right: The temple at Yaxchilan.

One very memorable night while lying in bed, dozens of fireflies were flicking their "lights" on and off above. They had flown inside the cabana from an opening near the roof line above the mosquito netting.

Along the road to Bonampak, I got a click of a Zebra Cross-streak, *Panthiades bathildis,* nectaring on snow square-stem. Otherwise, there was very little butterfly activity. We paid the fee to enter the Bonampak Archaeological Zone, a modest site overall, but home to some of the best murals ever discovered. These brilliant teal, red, and multiple colored murals depict sacrifices, ritual bloodletting, and violent battle scenes. The murals pictured are located in Temple 1 at the Bonampak site. The murals have faded with time, and were damaged when the first researchers used kerosene to clean them. Although the kerosene brought out the colors, it weakened the paints adhesion and hastened the flaking and decay. The murals have since been restored. Clicks near the temples included a Tiger Beauty, *Tigridia acesta*, Mexican Sailor, *Dynamine postverta*, and Manuel's Skipper, *Polygonus savigny*.

The 2008 trip took a lancha (long canoe-like boat) from Frontera Corozal 25 kilometers down the Rio Usumacinta River bordering Guatemala to Yaxchilan, where 5 stairways are covered with hieroglyphs that venerated their dynasty. Yaxchilan's hieroglyphs provided much of the raw material that led to the deciphering of the Maya writing system. Its roots have been traced to around A.D. 320. I photographed a Dirce Beauty, *Colobura dirce,* near the ticket office for Yaxchilan.

May 17: We drove about 4-5 hours from Lacanja, making sure to gas up at Benemerito de las Americans, and then to Las Guacamayas. We listened to howler monkeys in the trees while exploring along the river to photograph a Dark Kite-Swallowtail, *Eurytides philolaus* posing nicely and a

Above: *Panthiades bathildis.* Top Right: *Tigridia acesta, Dynamine postverta.* Bottom Right: *Polygonus savigny, Colubura dirce.*

Lagunas de Montebella.

Whitened Bluewing, *Myscelia cyaniris*. On the drive we were amazed by the burning and habitat destruction over the entire area. We saw little but cattle pasture and not even many cows.

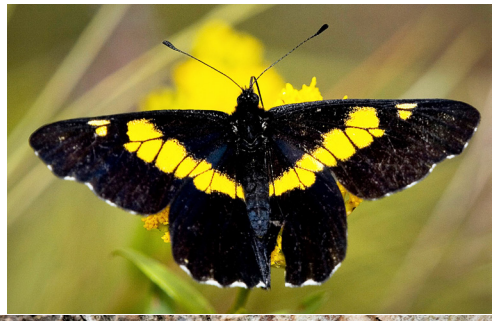
We headed west to the lakes region of Lagunas de Montebella -- there is a cluster of over 50 lakes and ponds of various shapes, sizes, and colors ranging from emerald green to cobalt blue nestled in a hilly pine forest. It is a beautiful drive around 1500m in elevation but we saw very little butterfly activity. As such, we continued on to Comitan, stopping for hot chocolate along the way where a guy told Kim he learned English while spending 3 years in jail in Atlanta, Georgia for robbery.

After a night in Comitan (1900m) we headed south taking about a 5 hour drive on some winding mountain roads to the Hotel Loma Real in Tapachula. Some of the butterflies found on the hotel grounds included the Grey Cracker, *Hamadryas februa ferentina* and Two-pupil Satyr *Cissia themis*.

The next day we headed off to explore Volcan Tacana, taking several hours to get there. Unfortunately it was quite cloudy with fog right over our heads as we hiked the trails around 1550m in elevation. I got excited observing Black-veined Leafwing, *Consul excellens* flying by but it never stopped. We did manage to get the Golden-banded Dartwhite *Catasticta teutila*, and Stub-tailed Gemmed-Satyr *Cyllopsis hedemanni*.

On the way back we stopped at INIFAP (Instituto Nacional de Investigacious Forestal, Agricolas y Pecuarias). Olivia gave us a tour of planted ornamental flowers, test plots of cacao, orchids, and many types of heliconias, where a Mangrove Buckeye *Junonia genoveva,* was nectaring. Both the guide we talked to at Volcan Tacana and Olivia told us the best time for butterflies is December to March during the dry season.

May 21: Pablo picked us up from the Hotel Loma Real in Tapachula heading north on the Ruta del Café that includes some of Chiapas largest fincas, or coffee



Top: *Catasticta teutila.* Second Row: *Eurytides philolaus, Myscelia cyaniris, Hamadryas februa ferentina.* Bottom Row: *Cissia themis, Cyllopsis hedemanni, Junonia genoveva.*

Finca Hamburgo

plantations, many of which were started by German immigrants in the late 1880's and are still run by their descendants today. This is one of the rainiest regions in all of Mexico. The paved road ends at Finca Argovia. We continued on a dirt road for another hour to Finca Hamburgo, where 3 expertly German built Pine Chalets are located along with a large fine restaurant and bar owned by the Edelmann family since 1888.

Arriving around 11:00 am we wandered around their manicured garden and discovered a lek of Red-costa Metalmarks, *Symmachia probetor championi,* a beautiful bluish/green riodinid with red edges on the hindwing.

One evening after dinner and great tasting coffee, we enjoyed a spectacular thunder and lightning show. The next morning we woke up with heavy fog but after breakfast the clouds started to break up and the sun came out. Butterflying was still slow, but we got clicks of Deep-green Hairstreak, *Theritas mavors*, Guatemalan Metalmark, *Mesene crocela*, Gold-stained Satyr, *Cissia pseudoconfusa*, Big-spiked Gemmed Satyr, *Cyllopsis pephredo*, Cryptic Skipper, *Noctuana lactifera bipuncta*, Salvin's Clearwing, *Episcada salvinia,* and Leila's Clearwing, *Ithomia leila,* nectaring on mist flower.

The last day in the field, we backtracked to Finca Argovia (700m). We had a delicious lunch, and afterwards photographed a Ruddy Daggerwing, *Marpesia petreus*, Blind Purplewing, *Eunica mygdonia*, and the hairstreaks *Iaspis castimonia* (Castimonia Hairstreak) and a *Strymon mulucha* (Mottled Scrub-Hairstreak) ovipositing. We spent the night at Hotel Loma Real in Tapachula.

May 24: Judi drove all day from Tapachula to Tuxtepec, being pulled over several times at the military checkpoints and questioned, especially driving away from Tapachula. They thought we had been in Guatemala, and were very confused by Judi's Missouri license plates, but she convinced them we weren't doing anything sneaky. We continued on, hoping to work the Valle National area the next day in the State of Oaxaca. That will be covered in a forthcoming digital collecting article.

Top Row: *Symmachia probetor championi, Theritas mavors, Mesene crocela.* Bottom Row: *Cissia pseudoconfusa, Cyllopsis pephredo, Noctuana lactifera bipuncta.*

Top Row: *Marpesia petreus,* upper- and undersides. Second Row: *Eunica mygdonia, Iaspis castimonia, Strymon mulucha.* Bottom: Kim Garwood and Fred Heath.

## Acknowledgements

Thanks to Kim Garwood for allowing me to use parts of her trip report in the narrative and supplying the picture of Salvin's Kite-swallowtail, *Eurytides salvini,* taken by Judi Ross.

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Mating pair of *Parides sesostris zestos* (see page 125).

## Grehan's *Phassus* ghost moths references, continued

*Continued from p. 137*

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# *Announcements*: Call for Season Summary Records

The Season Summary database is on the Lepidopterists' Society home page (http://www.flmnh.ufl.edu/lepsoc/). The value of the online database increases as your data gets added each year. For your 2022 field season, report range extensions, seasonal flight shifts, and life history observations. Reports of the same species from the same location provides a history. However, do not report repeated sightings of common species. Report migratory species, especially the direction of flight and an estimated number of individuals. Send this information to your Zone Coordinators -- they and their contact information appears on the inside back cover of the "News". The states covered by each zone are in the (most recent) Season Summary. Please have your data to the Zone Coordinator(s) no later than **December 31, 2022**. All of these records may be useful in the future. BE AWARE that some of these records will go IN THE DATABASE, but may NOT appear in the printed Season Summary.

## Season Summary Spread Sheet and Spread Sheet Instructions

The Season Summary Spread Sheet and Spread Sheet Instructions are available on the Lepidopterists Society Web Site at **http://www.lepsoc.org/season_summary.php.** The Zone Coordinators use the Season Summary Spread Sheet to compile their zone reports. Please follow the instructions carefully and provide as much detail as possible. Send your completed Season Summary Spread Sheet to the Zone Coordinator for each state, province or territory where you collected or photographed the species contained in your report.

## Photographs for Front and Back Covers

Please submit photos for the front or back covers of the Season Summary to the editor of the News, James K. Adams (**jadams@daltonstate.edu**). Photos can be of live or spread specimens, but **MUST** be of a species that will actually be reported in the Season Summary for this year.

Brian Scholtens and Jeff Pippen.

## Lep Soc Statement on Diversity

This is available at any time, should you need to know at: **https://www.lepsoc.org/content/statement-diversity**

## Lep Soc Statement on Collecting

The Lepidopterists' stance on collecting is discussed fully in The Lepidopterists' Society Statement on Collecting Lepidoptera. This is available online at: **https://www.lepsoc.org/content/statement-collecting**

## Searching The Lepidopterists' Society Season Summary on SCAN

Brian Scholtens and Jeff Pippen

Part of what we are now doing as a society is contributing all our Season Summary records to SCAN (Symbiota Collections of Arthropods Network), a larger effort to assemble and make available occurrence records of insects and other arthropods to the greater scientific community and the public in general. Each year we now upload all of the submitted Season Summary records to this site. In addition, several years of back records are also hosted here, and we hope to continue adding past years as that is possible.

Now that our Season Summary is available online, we provide below a simple set of instructions about how to use the SCAN database to search our available records. This process is easy, but not immediately obvious when you start exploring the site. To get started you can go directly to the SCAN site using the link below, or you can access it through The Lep Soc webpage using the link under Season Summary. Then just follow the set of instructions below to access, search and download any data from the Season Summary. The first two instructions set up the search feature to search only the Lepidopterists' Society records. If you would like to include other databases, you can select them in addition to our database. Have fun and explore a bit. There are lots of interesting datasets on the site, including quite a few from major and minor collections as well as some important personal collections. Have fun exploring our data and those in the other databases.

1) Go to: **https://scan-bugs.org/portal/collections/index.php**
2) Click on Select/Deselect All to deselect all databases
3) Scroll to near the bottom of the list and select Lepidopterists' Society Season Summary
4) Go back to the top and click on Search
5) Choose whatever criteria you would like and tell to complete search
6) Records will be displayed
7) Click on the icon in the upper right if you would like to download records
8) Click on appropriate choices – this will download comma separated or tab separated data, which can be compressed or not
9) Click Download Data

## PayPal -- the easy way to send $ to the Society

For those wishing to send/donate money to the Society; purchase Society publications, t-shirts, and back issues; or to pay late fees, PayPal is a convenient way to do so. Sign on to www.PayPal.com, and navigate to "Send Money", and use this recipient e-mail address: **kerichers@wuesd.org**; follow the instructions to complete the transaction, and be sure to enter information in the box provided to explain why the money is being sent to the Society. Thanks!

## Mix Family Award for Contributions in Lepidoptera

In honor of Nancy, John, Lin, and Joe Mix, the Lepidopterists' Society is pleased to announce the establishment of the "Mix Family Award for Contributions in Lepidoptera." This award will be used to honor an amateur lepidopterist (someone not professionally employed as an entomologist) who has contributed the most to the field of Lepidoptera in the view of the Awards Committee. Outstanding short-term or long-term accomplishments will be considered, and may include contributions to outreach and education, collaboration with colleagues, novel research and discoveries, building an accessible research collection, or leadership within the Society. Nominations are allowed from any member of the Lepidopterists' Society and the nominee must also be a member of the Society in good standing.

This annual award is funded by a very generous monetary donation from Steve Mix that is designated specifically for this award. Award recipients will receive a check for $1,000 and a plaque that will be presented at the banquet at the Annual Meeting of the Lepidopterists' Society. The award will be presented to a single recipient, and any person who receives the award is not eligible to be nominated again for at least 5 years. It is estimated that the initial donation will be sufficient to sustain this award for at least 20 years. In the event that the award fund is reduced to the point where the award cannot be sustained, the Executive Council will determine if the award will continue.

## The Ron Leuschner Memorial Fund for Research

The 2023 cycle of the Ron Leuschner Memorial Fund for Research on the Lepidoptera is now open for applications. Each year, the Society will fund up to 3(+) grants for up to $500 each to undergraduate or graduate students depending on merit. Applicants must be members of the Lepidopterists' Society. Applications are due January 15, 2023. The application must include submission of the application form, posted on the Lep Soc website at **https://www.lepsoc.org/content/awards**, a brief (500 word maximum) proposal, and a letter of recommendation or support from the student's academic advisor or major professor. Additional information about the research fund or a copy of the application can also be obtained by writing to Dr. Shannon Murphy. Submit all of the above to Shannon Murphy at **Shannon.M.Murphy@du.edu**. Snail mail applications should be sent to Shannon Murphy, Associate Prof., Boettcher West 302, Dept. of Biological Sciences, University of Denver, 2050 E. Iliff Avenue, Denver, Colorado 80208. Successful applicants will be notified by March 15. The review committee consists of members of the Lepidopterists' Society, including the previous year's successful candidates (who are thus not eligible for a new award in the subsequent year's competition). Award recipients will be expected to produce a short report for the committee at the conclusion of their year of funding, which summarizes the positive impact of the award on their research. Recipients must also acknowledge the Fund's support in any publications arising out of the funded work.

## The Southern Lepidopterists' Society invites you to join

The Southern Lepidopterists' Society (SLS) was established in 1978 to promote the enjoyment and understanding of butterflies and moths in the southeastern United States. Regular membership is $30.00. Student and other membership categories are also available. With membership you will receive four issues of the SLS NEWS. Our editor J. Barry Lombardini packs each issue with beautiful color photos and must-read articles. The SLS web page (http://southernlepsoc.org/) has more information about our group, how to become a member, archives of SLS NEWS issues, meetings and more.

Please write Marc C. Minno, Membership Coordinator, at **marc.minno@gmail.com** if you have any questions. Dues may be sent to Jeffrey R. Slotten, Treasurer, 5421 NW 69th Lane, Gainesville, FL 32653.

## Society of Kentucky Lepidopterists

The Society of Kentucky Lepidopterists is open to anyone with an interest in the Lepidoptera of the great state of Kentucky. Annual dues are $15.00 for the hard copy of the News; $12.00 for electronic copies. The annual meeting is held each year in November, at the University of KY, Lexington. This year's meeting is Nov. 4-6, 2022. Also, follow the Society's facebook page (https://www.facebook.com/societykentuckylep/) for meetings and potential field trips.

To join the Society of Kentucky Lepidopterists, send dues to: Les Ferge, 7119 Hubbard Ave., Middleton, WI 53562.

## The Association for Tropical Lepidoptera

Please consider joining the ATL, which was founded in 1989 to promote the study and conservation of Lepidoptera worldwide, with focus on tropical fauna. Anyone may join. We publish a color-illustrated scientific journal, Tropical Lepidoptera Research, twice yearly (along with a newsletter), and convene for an annual meeting, which may change venues and times year by year as the ATL often shares a venue with the Southern Lepidopterists' Society, as well as The Lepidopterists' Society, for their meetings. Dues are $95 per year for regular members in the USA ($80 for new members), and $50 for students. Regular memberships outside the USA are $125 yearly. See the troplep.org website for further information and a sample journal. Send dues to ATL Secretary-Treasurer, PO Box 141210, Gainesville, FL 32614-1210 USA. We hope you will join us in sharing studies on the fascinating world of tropical butterflies and moths.

# Biogeography of *Phassus* ghost moths and the Sonora-Mojave megashear of Mexico

John R. Grehan

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## Resumen

La especie recientemente descrita, *Phassus zapalinamensis* Grehan, Mielke & Garzon, 2022, marcó un nuevo límite de distribución en el norte de México para el género *Phassus* en la familia de las polillas fantasma, las cuales presentan usualmente un rango de distribución entre el oeste de Panamá y el norte de México. El límite norte puede estar correlacionado con el sistema de fallas Jurásico Mojave-Sonora Megashear, mientras que el límite sur está al oeste de la zona de falla del Cretácico Romeral en el noroeste de América del Sur que marca un límite tectónico entre 140 y 110 Ma. La distribución de *Phassus* se superpone con el género estrechamente relacionado *Schausiana*, que tiene su límite norte en la zona volcánica transmexicana oriental que se superpone a una zona de falla geológica del Jurásico. Estas correlaciones tectónicas indican el origen de *Phassus* y *Schausiana* a mediados del Mesozoico.

The ghost moth *Phassus zapalinamensis* Grehan, Mielke & Garzon, 2022, was recently described from the Saltillo-Monterrey region of northeastern Mexico (Fig. 1) (Grehan *et al.* 2022). The new species was first recorded in 2018 by field photos of three moths posted on iNaturalist.org. Previous to these sightings, records of the 11 previously described *Phassus* species were limited to southern Mexico and Central America. Another undescribed northern population from Choix in northwestern Mexico is referenced in Mielke & Grehan (2016) and a more recent sighting of a population from Temósachic in northwestern Mexico (iNaturalist) was posted on July 4, 2022.The known geographic range of *Phassus* thus extends between northern Mexico and Panama.

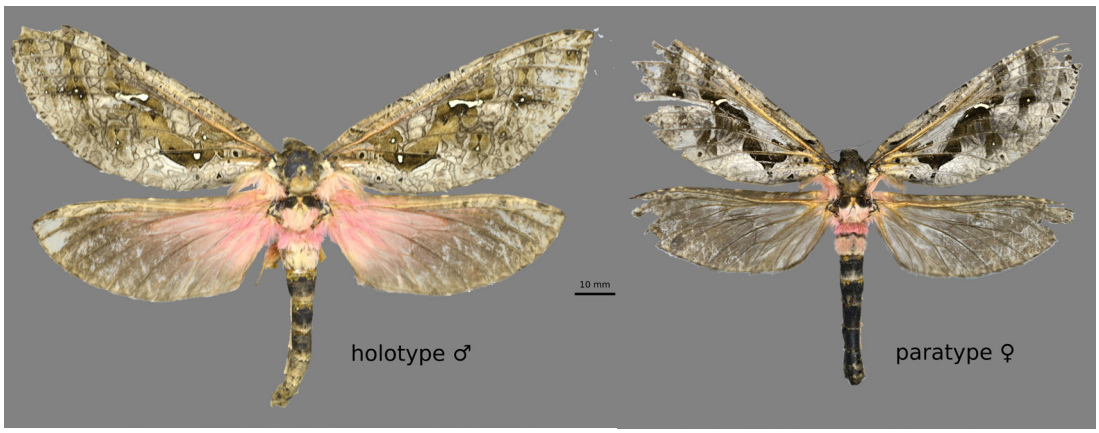


Fig. 1. *Phassus zapalinamensis*

All the northern records of *Phassus* are within, or near, mesic forest habitats. As with most other ghost moths found in Mexico and Central-South America, the larvae of *Phassus* are callus-feeding wood borers of live trees and shrubs. This larval habit sometimes attracts attention in forestry and agriculture because of resulting structural damage to the host plants (Grehan *et al.* 2021). Ghost moth eggs require very high humidity to mature successfully. Moist ambient conditions are also necessary for larval development. Within the stem of a host plant, larvae are protected from desiccation. Early instar larvae live in or on moist dead plant debris and fungi on the forest floor, and the humidity requirement precludes wood boring ghost moths from inhabiting dry, xerophytic environments. For example, in Australia the wood boring genus *Aenetus* is restricted to regions with at least 400 mm annual rainfall. In the Australian root-feeding genus *Abantiades*, a few species survive in xerophytic habitats where adult emergence coincides with seasonal rains, and larvae soon burrow deep into the ground where moist subterranean conditions prevail (Simonsen 2018).

Ecological requirements explain the survival of a species within particular environments, but this does not necessarily explain the origin of particular distribution ranges. The southern boundary of *Phassus* is western Panama, even though rainforest habitats extend across Panama and much of South America. It is possible that the genus is present in other parts of Panama, but the Colombian region has been extensively collected for nearly two centuries. While various other Hepialidae are known, there are no published or collection records of *Phassus* there. In northern Mexico, the distributional limits of *Phassus* may correspond to the northern limits of extensive mesic habitats south of the Mexico - United States border. There is also the possibility of suitable habitat in isolated high elevation forests of the 'sky islands' in northwestern Mexico and southwestern U. S. Even if the northern limit of *Phassus* is caused by the distribution of mesic habitats in Mexico, the

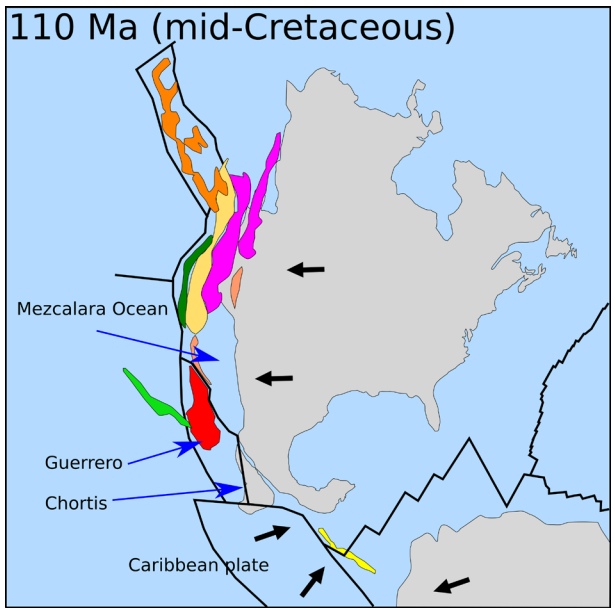


Fig. 2. Mid-Cretaceous position of the Guerrero island arc, separated from North America by the Mezcalera Ocean. Other island arc systems in different colors. Note also the position of the Chortis block forming part of the western shore of southern continental Mexico. Plate margins in heavy lines. Black arrows show relative direction of plate movement. Modified from Clennett *et al.* (2020).

habitat boundary does not explain why other mesic animal and plant taxa of Mexico are also present in the United States and Canada.

Along with much of western North and South America, the western Mexico-Central America region is a tectonic collage of oceanic terranes with geological origins that are different from those of the continental sectors. Most of western Mexico is made up of the Guerrero superterrane (Potra *et al.* 2014) that is made up of former island arcs that were present in the eastern Pacific basin from Triassic time (Clennett *et al.* 2020, Mohammadzaheri *et al.* 2022). The Guerrero superterrane originated as part of a large chain of island arcs extending between Alaska and Peru that was either amalgamated into continental North and South America as they moved west, or inserted between North and South America to form part of the Greater Antilles at the eastern boundary of the Caribbean Plate (Fig. 2). The Guerrero island arc system was originally separated from Mexico by the Mezcalera Ocean, until the latter was finally obliterated with the accretion of the Guerrero complex at about 80 Ma. The Guerrero landscape was so large that it now comprises nearly a quarter of modern Mexico, despite compression that would have taken place as the two geological sectors merged.

The continental region of Mexico also experienced considerable geological restructuring, with the Maya block (most of the Yucatán Peninsula) originally positioned in what is now the Gulf of Mexico. The Chortis block (mostly El Salvador, Nicaragua, and Honduras) was translated southeastward from its original position along the southwestern coast of southern Mexico. These geological events would have had major impacts on the distribution and differentiation of animal and plant taxa in Mexico.

Attributing distributional breaks (such as disjunctions) or geographic boundaries to historical geological events requires evidence of a historical relationship. One procedure for assessing this relationship is biogeographic-tectonic correlation, a method that identifies distributional and phylogenetic breaks that geographically coincide with tectonic structures (such as faults, spreading ridges, suture zones, magmatic arcs, subduction zones, etc.). This correlation allows a proposed historical relationship whereby the ancestral distribution may be predicted to have been affected by historical geological events involved with the origin of the existing tectonic structure. This relationship is observable and provides empirical evidence for the spatial and temporal context of species divergence. A classic example is the disjunction of taxa across a transform fault where the disjunction matches the lateral displacement of the land along the fault (see e.g. Heads 2014, 2017).

In the distribution range of *Phassus* there are two tectonic correlations of potential biogeographic interest. I say 'potential' as there is no comprehensive phylogenetic and distributional study of the genus, and only recently has there been some progress in clarifying species taxonomy (Mielke & Grehan 2016, Grehan *et al.* 2018, 2022), including a possible sister group affinity with the genus *Schausiana* Viette, 1950, of Central America and southern Mexico (Mielke *et al.* 2020). The southern limit of *Phassus* is close to the Romeral fault zone, which represents the southeastern tectonic boundary of the Caribbean plate as it became inserted between North and South America beginning about 110 Ma (Clennett *et al.* 2020) (Fig. 3). This tectonic structure is correlated with the distributional limits of many animal and plant taxa (Heads 2016).


Fig. 3. Major Mexican and South American tectonic structures correlated with the distributions of *Phassus* (yellow circles) and *Schausiana* (white circles).

The absence of *Phassus* (and Hepialidae as a whole) from the Greater and Lesser Antilles could be the result of extinction, or the absence of Hepialidae from these island arcs since the arcs' origin in the eastern Pacific. The presence of *Phassus* and other Hepialidae on the Costa Rica-Panama isthmus could represent a subsequent distributional history, possibly along the western Caribbean island arcs, before they were inserted between North and South America. A possible affinity between *Phassus*/*Schausiana* and the southeastern Brazilian genus *Phthius* (Mielke & Grehan 2017) could be attributed to fragmentation of a wider ancestral range by insertion of the Caribbean plate.

The northern distributional boundary of *Phassus* is proximate to the Mojave-Sonora megashear (or suture zone), a tectonic structure extending across northern Mexico from southern California to the Gulf of Mexico (Potra *et al.* 2014). The megashear represents a Late Jurassic fault or rift initiated during expansion of the Gulf of Mexico. The megashear extends across a region of extensive subduction related volcanic magmatic activity, followed by episodes of rifting and basin development (Campbell & Anderson 2003, Anderson & Nourse 2005, Stern & Dickinson 2010). These geological events could have constrained the ancestral dispersal of *Phassus*, and this is supported by a northern Mexico distributional boundary in other taxa such as the angiosperms Gesnerioideae (Fig. 4a), Crossosomataceae (Fig. 4b), Turneraceae (Fig. 4c), and the Troidini butterflies (Fig. 4d). These examples show that the Mojave-Sonora megashear correlation for *Phassus* is not an isolated pattern, but involves taxa with very different dispersal abilities and trans-oceanic affinities.

The northern records for *Phassus* also represent the most northern distribution of the ghost moth genera of Mexico, Central America, and South America (Fig. 5a). There are four genera in North America north of Mexico, but none show any apparent affinity with the Mexico-South America ghost moths. Three of the North American genera (*Gazoryctra*, *Phymatopus*, *Korscheltellus*) have distributions including Eurasia (but not areas south of the Tethys suture zone), while the broader affinities of the endemic North American *Sthenopis* are unresolved (see Grehan & Mielke 2018, Grehan & Knyazev 2019). This phylogenetic break between northern Mexico and the United States is comparable to the relationship between the angiosperm family Calycanthaceae (United States, eastern Asia and Australia) and the genus *Siparuna* (Central and South America).

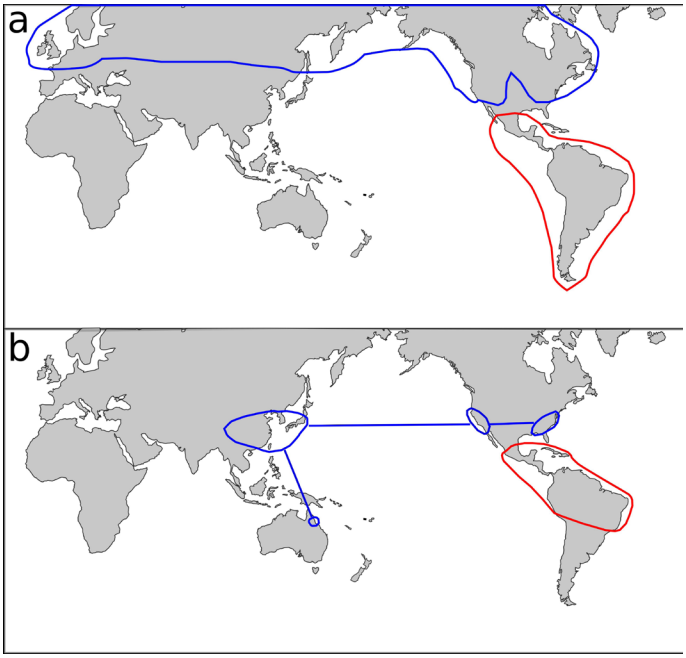


Fig. 5. Phylogenetic breaks in New World: (a) Hepialidae of Mexico-South America (red outline) and northern North America (blue outline) (from Grehan & Knyazev 2019), (b) Laurales clade with a phylogenetic break between Calycanthaceae (blue outline) and *Siparuna* (red outline) (modified from Heads 2014, fig. 3.7).

The distribution of *Schausiana* extends between Central America and the southern range of *Phassus* (Fig. 3) with the northern boundary of *Schausiana* at the trans-Mexican volcanic belt, extending west only to the south-easternmost Guerrero terrain (Fig. 3). The trans-Mexican volcanic belt formed in early Miocene time, about 19 Ma (Ferrari *et al.* 2012), but this magmatic activity was preceded by the Trans-Mexican volcanic belt lineament that was active in the Jurassic. Movement along this strike-slip fault resulted in a southeastern displacement of southern Mexico (Alaniz-Alvarez *et al.* 1996). The Miocene volcanism may explain local speciation of *Schausiana* and other taxa, but it does not explain the location of

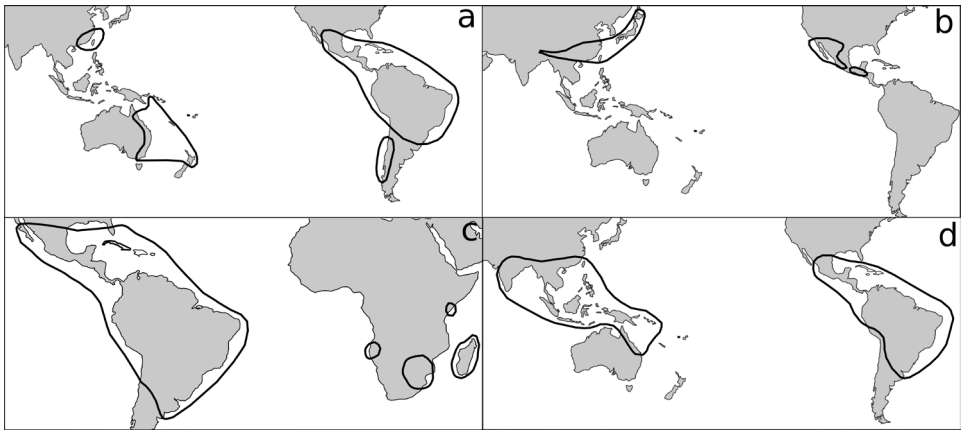


Fig. 4. Examples of trans-oceanic taxa with a northern Mexico distributional boundary: (a) Gesnerioideae (from Heads 2014, fig. 3.15), (b) Crossosomataceae (from Heads 2010, fig. 1), (c) Turneraceae (from Arbo *et al.* 2009), (d) Troidini (from Heads 2014, fig. 3.22; this *clade* in Troidini, thought to include Madagascar, has been superseded by new studies).

the northern boundary of the whole range. The preceding tectonic activity may well have promoted allopatric differentiation of *Phassus* and *Schausiana* followed by range extension by either or both genera resulting in the present day distributional overlap. The Jurassic age of the Trans-Mexican volcanic belt lineament corresponds well with the age of the Mojave-Sonora megashear and the Romeral Fault zone.

In summary, the distribution of *Phassus* is bound by two major tectonic boundaries (Mojave-Sonora meagashear and the Romeral Fault zone), while differentiation between *Phassus* and its potential sister genus *Schausiana* is correlated with the Trans-Mexican volcanic belt lineament. These correlations suggest that *Phassus* and *Schausiana* were both extant in Jurassic time, and that the marginal presence of *Schausiana* in the Guerrero terrane is due to limited dispersal following terrane accretion. Future estimates of evolutionary age that employ fossil-calibrated molecular dating may provide additional insight, but they will only falsify these tectonic correlations if a much older divergence age is found. More recent dates cannot contradict the tectonic correlations proposed here since all fossil calibrated ages are minimum estimates only, as fossils can only provide minimum dates for the age of taxa (Heads 2022).

The tectonic correlations presented here are possibilities suggested by the current geographic information for *Phassus* and *Schausiana*. A more analytical approach will only be possible through a comprehensive morphological or molecular study that provides strong evidence of sister group relationships. These will lend confidence to assessing geographic and phylogenetic divergence. And it will be important to obtain more precise distributional information on *Phassus*, particularly for the geographic gap between its northern records and those in the trans-Mexican volcanic belt region. There remains the question of whether the current northern limit for other Mexican ghost moth genera in the trans-Mexican volcanic belt represent a true biogeographic boundary or represents another collecting artifact.

## Acknowledgment

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*Conservation Matters: Contributions from the Conservation Committee*

# Lepidoptera in the Species Survival Commission: (re-)introducing the IUCN SSC butterfly and moth specialist group

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The **Common Birdwing** (*Troides helena*) is one of the most widespread birdwings, with a range that extends from India and Nepal eastward to Hong Kong, south through much of the Indo-Australian Archipelago. Its caterpillar, as do those of other birdwings, feeds on *Aristolochia*. Photo credit: Tapan Pramanik (KolKata, West Bengal, India).

When it comes to invertebrates, and especially insects, butterflies have had a comparatively long conservation history compared to many other species groups. In terms of its representation within the International Union for Conservation of Nature (IUCN), one of the world's largest global environmental organizations, the IUCN SSC Butterfly Specialist Group was established as early as 1976, and Lepidoptera have had a place within the organization since then, albeit somewhat "on and off" as described below.

But first, what is the IUCN and how do Lepidoptera and other species groups feature within it? Founded in 1948, the IUCN brings together both government and civil society organizations to "influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable." It is organized into six different commissions focusing on different aspects of nature conservation, from ecosystems to protected areas to law, social policy and education. By far the largest of the commissions, however, is the Species Survival Commission (SSC) which as the name suggests focuses on species conservation.

The SSC is a science-based network of more than 10,000 volunteer experts from almost every country in the world. This expert network is organized into 175 Specialist Groups, standalone Red List Authorities (for taxon groups without Specialist Groups), Task Forces, and Committees. Specialist Groups are mostly organized taxonomically – think African Elephant or Mollusc Specialist Group – sometimes with a regional focus (such as the South Asian Invertebrate Specialist Group). Several "cross cutting" Specialist Groups also exist, focusing on overarching themes such as climate change, invasive species, or sustainable use and livelihoods. Complex as the setup of the IUCN is, the remits of the individual Specialist Groups are well-defined.

*A brief history of Lepidoptera in the IUCN SSC*

Lepidoptera have featured within IUCN SSC history since 1976 when Bob Pyle became the initial chair of the IUCN SSC Butterfly Specialist Group. As a global advocacy group for Lepidoptera, key achievements and inputs included the designation of the monarch butterfly *Danaus plexippus* migration as the highest priority in world butterfly conservation. The group also laid the foundation for the IUCN Invertebrate Red Data Book, with the help of the World Conservation Monitoring Centre (Wells et al. 1983, Pyle 1995). This was the first time a dedicated book on the conservation status of butterflies was compiled (though of course it only focused on a selection of few invertebrates). Shortly after, this effort was followed by a dedicated Red Data Book for the world's swallowtails (Collins & Morris 1985): this showed the Queen Alexandra's birdwing, *Ornithoptera alexandrae*, the largest butterfly in the world, as one of the highest butterfly conservation priorities. (Thirty years later, the species is still one of the most threatened butterflies listed on the IUCN Red List of Threatened Species, but conservation projects have helped its status to not deteriorate further.)

After a short hiatus, the IUCN SSC Butterfly Specialist Group was revived in 1988/89 under Tim New's leadership, and the group was again quite active for several years. Notable outputs were the seminal book on "Conservation Biology of Lycaenidae" (New 1993) and a global directory of Lepidoptera conservation projects in 1990. Previous work on the Swallowtail Red Data Book was followed up with a dedicated Swallowtail Action Plan (Collins & New 1991). Following change in leadership, the group became inactive and lapsed in the mid-1990s. But the cause for butterflies within the IUCN was not entirely dead in the water – several species were assessed or reassessed in 1996 for the Red List, primarily through efforts of the IUCN Secretariat and the World Conservation Monitoring Centre.

Finally, in 2014, the IUCN SSC Butterfly Specialist Group was officially re-established under the leadership of Scott Hoffmann Black from the Xerces Society. At the time, the Zoological Society of London (ZSL) was leading a sampled assessment of 1,500 randomly chosen butterfly species for the purpose of producing a sampled Red List Index for butterflies, which led to my involvement as Red List Authority Coordinator for the group. I succeeded Scott Black as interim chair and finally chair of the group in 2016.

*The IUCN SSC Butterfly and Moth Specialist Group*

While the remit of the IUCN SSC Butterfly Specialist Group was already to include all Lepidoptera, the group's name was officially changed to IUCN SSC Butterfly and Moth Specialist Group in 2022 – rectifying the omission of the vast majority of Lepidoptera from the group's name. At the same time, Mike Jordan from Chester Zoo (United Kingdom) was confirmed as co-chair of the group, bringing vast knowledge on conservation planning and action to the table.

So where are we now? Given that there are only 1,541 Lepidoptera assessments on the Red List, there is still a large emphasis on filling the assessment gap. IUCN Red List assessments are the bread and butter of IUCN SSC Specialist Groups, as they generally provide the Red List Authority for the species under their remit. This means that any incoming Red List (and Green Status, see below) assessments for Lepidoptera will be reviewed by the Butterfly and Moth Specialist Group.

What are IUCN Red List assessments? IUCN Red List of Threatened Species assessments categorize the extinction risk of a species (or subspecies or subpopulation) along a categorical scale, on the basis of **quantitative assessment criteria**, from Least Concern to the threatened categories of Vulnerable, Endangered and Critically Endangered, to Extinct.

Since 2014, more than 1,000 Red List assessments have been published, from across families (most notably the Lycaenidae, Nymphalidae and Papilionidae). Papilionidae are currently a focus of the group, with these reassessments supported by the Zoological Society of London. With 196 species already published and another (at least) 200 species assessments drafted, the Specialist Group is looking to finalizing the assessment for the world's swallowtails in 2022 or early 2023. Our partnership with Albuquerque BioPark has led to several assessments of North American Lepidoptera, including the upcoming publication of the monarch Red List assessments. With moths seriously under-represented on both the Red List and in the current membership of the Specialist Group, plans are now forging ahead to assess selected hawk moths and grow the membership of the group.

In addition, the group has been engaging in other assessment and monitoring processes. Last year, the first IUCN Green Status of Species assessment for any Lepidoptera (the swallowtail *Troides helena*) is published on the IUCN Red List, with review and input from the group. The new Green Status of Species provides a global standard to measure how close a species is to being fully ecologically functional across its range, and how much it has recovered thanks to conservation action.

The Butterfly and Moth Specialist Group is also working to collate information from and catalyze new Lepidoptera monitoring schemes. This work stems from the need for better integration of invertebrate data into global biodiversity indicators. Working with partners at Butterfly Conservation (UK), Butterfly Conservation Europe, De Vlinderstichting (Netherlands), the Zoological Society of London (UK), eButterfly (Canada), and the UK Centre for Ecology and Hydrology, the long-term goal is to provide data on the global status of butterfly (and moth) populations.

Naturally, Red List assessments form the basis for conservation planning and action. Following the assessment of the world's swallowtails, the group aims to update conservation plans for this group by engaging with the IUCN SSC Conservation Planning Specialist Group. This group has produced and guided action plans across the taxonomic spectrum, and regularly hosts training workshops on conservation planning. IUCN SSC Butterfly and Moth Specialist Group members are currently being trained in conservation planning to increase capacity and skills within the group.

Many of our members are involved in Lepidoptera conservation and are producing positive outcomes for Lepidoptera, but these activities are difficult to track as a 'global' group. However, there are specific activities to aid conservation action that the Butterfly and Moth Specialist Group can engage in, specifically providing guidelines on conservation tools and approaches. One such example is to develop guidance on the use of Lepidoptera farming in conservation and sustainable community development, and ensure that Lepidoptera are represented in IUCN-led guidelines on insect conservation.

### *How can you become involved?*

*Become a member*

The IUCN SSC Butterfly and Moth Specialist Group is continuing to increase its membership across the world. Currently, our Specialist Group consists of 41 members representing 24 countries. The group meets relatively regularly online to exchange ideas and communicate about projects, and we are in the process to develop several working groups to drive forward work based on specific strands of our workplan or active geographic regions.

We are especially encouraging early career and youth members to join to ensure our work will be sustained into the future! As part of this, we are increasing opportunities to build capacity for Red Listing, conservation planning and other IUCN-relevant processes through training opportunities, webinars, and workshops. You can find basic information about the group and links to our reports and newsletters here: **https://www.iucn.org/commissions/ssc-groups/invertebrates/butterfly-and-moth.**

*Red Listing*

The group welcomes any suggestions for assessment priorities and has previously aided assessments compiled outside the Specialist Group (often this forms the basis for new members to join the group). Specifically, we have engaged with academics teaching their students about Red Listing and actively encourage students to compile IUCN Red List assessments as part of their coursework. Since IUCN Red List assessments are classed as online journal articles, this does not just mean that capacity for Red List assessments is increased, but also that students can enhance their CVs by engaging with the group.

*Butterfly Monitoring*

If you know of any butterfly monitoring schemes, or are yourself running such a scheme, why not reach out to see how your data can feature in global biodiversity indicators?

*Follow us on social media*

The IUCN SSC Butterfly and Moth Specialist Group is active on Twitter: follow us at @IUCNButterflySG

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# CONVERGENCE

*Diogenes Otimista de Souza*

One of my students was spreading the moths he had collected the night before*. He brought the spreading board, showed it to me, and asked:

"What genus of Sphingidae is this?", he asked

"It is not a sphingid. It is a notodontid, a *Crinodes*", I responded.

"Wow, another case of convergence?", he continued.

"Or God's lack of imagination… He started to repeat patterns. The same reason for mimicry", I replied.

"Oh", my student stated with surprise and a laugh.

"Or," I added "One more of those beasts He created on a Sunday… … His day off . . . Perhaps when the angel in charge of the 'Design Department', asked Him, on a Sunday, 'what should these guys look like?'

'Well… …Just copy the pattern of one of those we did before'."

He left with a loud laugh.

I could still hear him saying from the corridor: "You should write down your thoughts and memories…"

*Collecting and preparing specimens is the first subject I teach them when they arrive. "Learn how to do it properly, Not like the trash your professor sends to me for identification!".

Serra Bonita, 25 December 2021

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# Predation on California tiger moths by a jumping spider

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*Leptarctia californiae* is a polymorphic, diurnal tiger moth of western North America. In southern BC, May is the primary adult flight period. The forewing is grey-brown, usually lacking in conspicuous markings. The hindwing, however, is often boldly marked, and varies both in color (black with white, yellow, orange, or red), and pattern (ranging from extensive patches of color marked with black bands to mostly black). In a small sample, all local females were found to have orange-red hindwings with black markings.

The spring of 2016 in the Kootenay region of BC was milder than average, and California tiger moth adults started to emerge during the last week in April. On April 30, around 2 pm, as I walked a powerline right-of-way near my home, I began to see adult tiger moths in flight. I then noticed two dead adults on a boulder beside the trail. Looking more closely, I realized a third adult was clutched by a jumping spider - probably a *Phidippus johnsoni* female. One of the dead tiger moths was a female, and the other two (including the one held by the spider), were males.

During approximately 25 minutes of observation, at least three additional male tiger moths approached the scene. Each fluttered against the boulder but rarely landed. When one did land, it waved its antennae. Occasionally, one made physical contact with the dead female, but didn't land on it. One of the males (individually identified by its hindwing color and pattern) left for several minutes and then returned. The spider didn't capture any of these males while I watched, but it would turn to face each moth whenever it approached. At no time did it release its grip on the moth it was already holding.

The likely events preceding these observations include the initial capture of the female while she was perched on the rock, releasing pheromones, and the subsequent attraction and capture of two males that investigated the chemical stimulus. Not so clear, are answers to questions such as: How long after death does a female's pheromone plume continue to be effective? This species is known to release a foul-smelling chemical when disturbed; would this provide a short-range cue to the males that something was amiss? Does this species use male pheromones to promote lekking, as has been found in some other tiger moths? Did the red and black coloration of the spider constitute a positive visual cue to the investigating males?

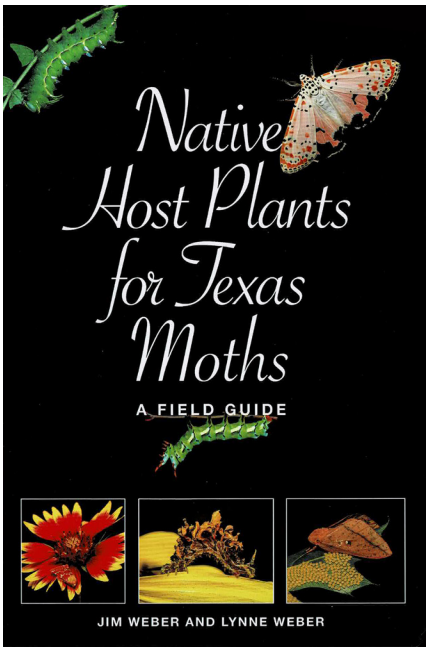
The bright colors of the wings of many species of tiger moths are assumed to be a warning to predators of their distastefulness. Apparently, the jumping spider wasn't deterred by the bright coloration of the female's hindwings – or possibly didn't see it prior to pouncing. It would likely have seen the patterns on the males' wings prior to preying on them. But in the end, I concluded that based on repeated predations and the length of time spent holding its prey, the spider did not find *L. californiae* to be distasteful. There is much still to be learned about this fascinating group of moths!

(References on previous page)


Fig. 1. Red-backed jumping spider (*Phidippus johnsoni*) with male California tiger moth (*Leptarctia californiae*). Fig. 2. Two previous victims of the jumping spider: red female California tiger moth on left; yellow male on right. Fig. 3. Live male California tiger moth, waving antennae; presumably attracted to the pheromones of the dead female. Note the variation in the amount of yellow of the different males' hindwings.

# Book Reviews

***Native Host Plants for Texas Moths: A Field Guide*** by Jim Weber and Lynne Weber. Published by Texas A&M University Press, College Station, Texas US. 2022. 288 pp. ISBN 9781623499860 & ISBN 9781623499877 e-book (soft cover) $29.95. Available from the publisher and many other retail outlets.




As soon as I learned this book was in preparation, I wanted to own a copy and review it for a wider audience. The authors point out the difficulty of paring down the number of species of plants and moths for inclusion. I can understand that the book designers and editors might make the grammatical error of using the noun "host" as an adjective. This paragraph from the Texas A&M University Press' press release tells the reader exactly what to expect. "Jim Weber and Lynne Weber are retired from the tech industry in Austin, where Lynne was a senior manager and Jim was a senior engineer. Both are certified Texas Master Naturalists and are the coauthors of Native Host Plants for Texas Butterflies: A Field Guide, Nature Watch Austin, and Nature Watch Big Bend. They live in Austin."

When I examined the book with brilliant photographs, I expected to find the name(s) of the consultant(s) moth expert(s) who helped write the text. No names were found.

The well-constructed soft-cover book is Smythe sewn to lie flat when open, a feature for which I give high praise. The serif font on glossy paper is pleasing to the eye. The 9.5" x 6.25" (24 cm x 15.8 cm) book, titled as a field guide, is too big for my field pack. Perhaps the e-book on a smart phone should be used. Although the book is soft cover the title page indicates the ISBN is "(cloth)."

This book describes more than 100 species of plants found in Texas. The species of plants are arranged by their form; herbaceous, trees, shrubs, etc. Brilliant color photographs of plants including close-ups of flowers and/or seeds often including habitat shots along with distributional black dots on the map of Texas are on 126 pages. I found photographs of 168 species of moths with their larvae. I found no information about the life history of the moths, the phenology, or how the plants are utilized by the larvae. Data about the distributions of the moths in Texas are missing. For example, the book states the larvae of *Hemileuca oliviae* eat sideoats grama grass (*Bouteloua curtipendula*) and gives a statewide distribution of the grass without mentioning that in Texas the distribution of *H. oliviae* is restricted to the northwestern corner of Texas' panhandle.

I note one uncited fact in the book. The authors state that "...moth species outnumber butterfly species by about 15 to 1." In North America, moth species outnumber butterfly species by 20 to 1 (Pohl et al. 2016), however in Texas, recorded moth species outnumber butterfly species by 10 to 1 (Knudson and Bordelon 1999).

The book begins with Acknowledgments. Whereas 172 "... incredibly talented and nature photographers..." are acknowledged for providing photographs, only about 12 lepidopterists are mentioned. The next chapter is entitled How to Use This Book, followed by the chapters Introduction and Ecoregions of Texas. The ecoregions are illustrated with excellent color photographs and a description. Each ecoregion is highlighted in a different color. This brief generalized chapter is useful for anyone unacquainted with the diversity of the very large state of Texas.

In the Introduction, I found a text written in a simplistic manner perpetuating myths that are contradicted in the natural world, such as the notion that moths have feathery or sawtooth antennae. A quick examination of most of the moths illustrated in the book shows these moths have neither feathery nor sawtooth antennae, rather they have threadlike antennae as is the case for most moths. The book describes the way some female moths attract males with pheromones and omits that many male moths, some illustrated in the book, use pheromones to attract females. I could go on.

The book does not state that lepidoptera, butterflies and moths, are annuals rather than perennials. All adult butterflies and moths die every year. There is no permanent breeding population of lepidoptera. Just like annual plants, each species is carried forward by the seeds, or in the case of lepidoptera, the eggs laid by the females. Just like annual plants that disperse many seeds greatly exceeding the required amount to continue the species, female moths lay many more eggs than are required to perpetuate the species. I suggest these facts are important to the reader to better understand how lepidopterans fit into the broader scheme of natural communities.

The book states that most moths are nocturnal therefore they are unseen. Most moths are unseen because most are much smaller than most butterflies. Many very small moths are diurnal and can be easily discovered, as I do

every day in my field excursions, yet they are unnoticed by most people because of their small size. I suggest a book like this will be more useful to introduce persons to the world of moths by including these facts in the generalized Introduction even when larval hosts are unknown.

I dislike the term "Critically Imperiled" in bright red ink, especially when the phrase is loosely defined with imprecise, unrelated, or contradictory terms e.g., "highly vulnerable to extinction due to extreme rarity, steep population declines, very restricted range, or other [undefined] factors." I worked for the Ohio Department of Natural Resources and studied moths for that agency for more than 40 years. I know from experience that most records of moths are contributed by amateur moth collectors. The phrases "rare" and "other factors" without detailed data and explanation can alarm uninformed individuals and agencies leading to restrictions on collecting and/or reporting that would otherwise contribute more data. Such restrictions, not based on scientific evidence, can hinder the sharing of important data with the agencies requiring more data. I offer the example of *Psectrotarsia hebardi* (Noctuidae) that was considered extremely rare until it was discovered by Jeffrey D. Hooper, William F. Babcock, and me that the adults do not come to light, the common method by which most species of moths are detected. The larvae can commonly be found on the larval host plant where it occurs in extreme southern Ohio and neighboring Kentucky. Without this behavioral knowledge the species could, in error, qualify for the category "Critically Imperiled" and perhaps provoke restrictions preventing further exploration on state owned lands and reporting data from private lands.

Because this book was written for the observer of plants, it would be a mistake for someone to make a claim regarding any number of nearly identical caterpillars and/or adult moths that might lead to unnecessary limits on research-collecting. No serious lepidopterist wants to see a species go extinct. Lepidopterists want to make contributions. Well-meaning casual observations when confronted with phrases lacking specificity such as the definition of "Critically Imperiled" in this book, could impede reporting observations that might otherwise help species recover from any imperiled situation.

Anybody collecting in western Texas knows collectors are unwelcome on private lands because the landowners do not want the collectors to find anything that might be construed as "Critically Imperiled." The terminology that I consider to be loosely defined does not help allay fears of Texas landowners.

The book concludes with useful tools including an appendix of moth species with common name and scientific name along with reported native host plants. The appendix is arranged by the scientific name of the moth by genus. Common names listed in bold are illustrated in the text. There are no page numbers in the Appendix that would allow easy reference back to the text. Next is a glossary of botanical technical terms. There is no glossary of terms for moths. There are two pages of references to moths, caterpillars, and plants, fifty-six percent of the references deal exclusively with plants of Texas and surrounding areas. Knudson and Bordelon (1999) and their several excellent illustrated lepidoptera books covering Texas regions are absent from the References. Ten useful websites to learn more about moths are listed. There are no websites to learn about societies dedicated to the study of moths.

Two indices conclude the book; one index is devoted to native host plants followed by an index to moth names. Self-explanatory notes tell how to use each index. There is no general index.

I support the idea of combining moths and their larval hostplants, an idea successfully put forward by David L. Wagner, with coauthors, in his five excellent publications on the subject, two of which are listed in the References by the Webers.

This is a book about some of the plants in Texas and, in my opinion, the word "moths" is used as a hook to attract a wider audience, an audience that will remain relatively uninformed about moths in Texas or almost anywhere else if this book is the source. Were the authors to include more factual information about moths, I suggest the combination of the two concepts could be met.

This book is in print and will be read by many people. I can only hope future authors will seek input from experts in the field of study and that publishers will insist on such consultation.

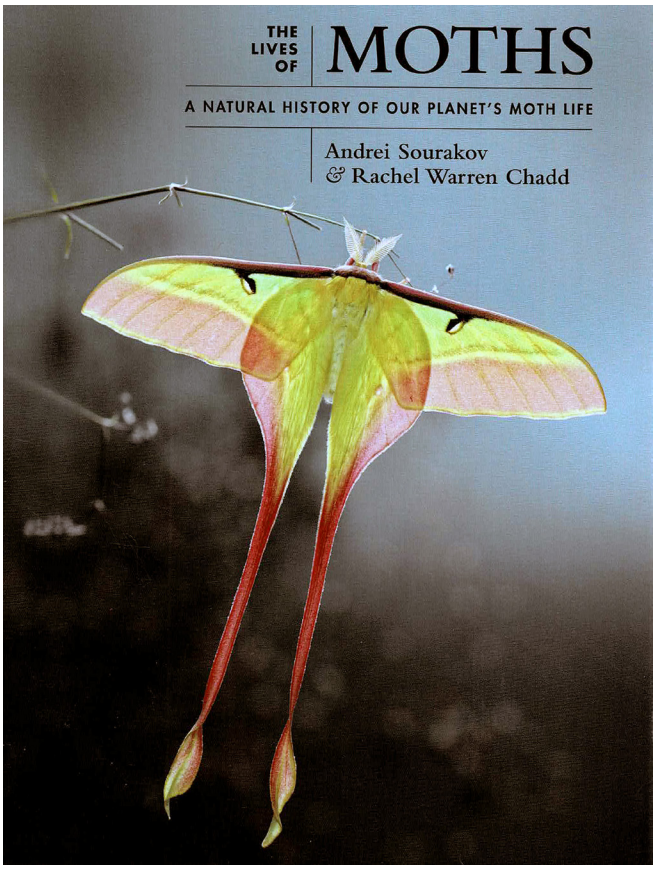
I can appreciate the desire of experts on moths, most of whom listed in the Acknowledgments, are my personal friends, to contribute photographs for a book providing more exposure for moths. I urge them to be aware of how the contributions will be interpreted. When I asked one of my friends who contributed to the book about the phrase "Critically Imperiled," the reply was "An unfortunate choice of words."

## Literature Cited:

Knudson, E. C. and C. Bordelon. 1999. *Checklist of the Lepidoptera of Texas*. Texas Lepidoptera Survey. Houston, TX 48 pp.

Pohl, G.R., Patterson, B., & Pelham, J.P. 2016. Annotated taxonomic checklist of the Lepidoptera of North America, North of Mexico. Working paper published online by the authors at ResearchGate.net. 766 pp.

***Eric H. Metzler.*** Research Associate, NMNH (Smithsonian), PO Box 45, Alamogordo NM, 88311-0045. **MetzlerEH@SI.edu**




***The Lives of Moths: A Natural History of our Planet's Moth Life*** by Andrei Sourakov & Rachel Warner Chadd. Published by Princeton University Press, Princeton New Jersey, US. April 26, 2022. 288 pp. + hundreds of color illustrations. ISBN 9780691228563 hardcover. $29.95. Available from the publisher and many other retail outlets.

I waited 66 years for this excellent book. It was worth the wait.

When I grew up in the 1950s and 1960s, I was seriously interested in insects especially butterflies and moths; however, I could not find any books about moths. I started delivering newspapers door-to-door when I was in the fourth grade. I saved every penny so that I could afford to purchase the revised edition of Holland's *The Butterfly Book* (1931). It cost $55.00 in 1956! My dad thought I was nuts. Soon thereafter a nature loving neighbor, Mrs. Doty, gave me her copy of Holland's *The Moth Book* (1941 issue). The poor color did not diminish this gift from the Great Kahuna. My interest in moths surged ahead of my interest in butterflies. When I was in high school, Mitchell and Zim published *Butterflies and Moths* (1962) thus giving me up-to-date terminology and names. Just as I graduated from high school, Dover published a reprint of Holland's *The Moth Book* (1968). In college, I was introduced to Hampson's 13 volume + 2 supplement *Catalogue of the Lepidoptera Phalaenae in the British Museum* (1898-1920), then unattainable for a poor college student. The dearth of reasonably priced general books about moths in the US remained until Himmelman's *Discovering Moths* (2002). Next came the exceedingly good Lees & Zilli *Moths: Their Biology, Diversity and Evolution* (2019), and now this wonderfully magnificent book by Sourakov & Chadd. The books get better and better, and the prices are coming down. I waited 60 years to see so many non-technical books about moths at reasonable prices written for general audiences. These books are worth my wait. Life cannot get much better.

More recent technical books for identification began with Covell (1984), the several volumes published by the Wedge Entomological Research Foundation (www.wedgefoundation.org) and Powell & Opler (2009). I confine my review remarks about Sourakov & Chadd to general books about moths, the 96% of lepidoptera nearly always given short shrift in most lepidoptera books. Sourakov & Chadd's book is like icing on a cake to be appreciatively savored and simultaneously eagerly devoured.

My wife, Pat, rarely looks at books about what she calls BBMs, a.k.a., basic brown moths. For this book, she read it from cover to cover repeatedly asking me "Hey Eric, did you know this?" As I wrote this review, she picked it up from my desk and started another reading. I was forced to tug it away from her so I could accurately describe the book.

Sourakov & Chadd's book is hardbound, Smythe-sewn to lie flat open (a necessity for any good book), richly illustrated with high quality color images of a few pinned specimens, yet mostly moths in nature doing what moths do. The serif font on glossy paper is pleasing to the eye. High quality drawings add important information. The phrase "natural history" in the title tells the reader exactly what to expect and the book delivers to perfection.

The chapters are; Introduction, What is a Moth? Moth Classification, Life Cycle, Interactions, Moths of Tropical Rainforests, Moths of Grasslands & Meadows, Moths of Deserts & Tundra, Moths of Temperate Deciduous Forests, Moths of Coniferous and Wetlands Plants, and Moths in Agroecosystems & Around Homes. The chapters are followed by a Glossary, Moth Families, Resources, Index, and Acknowledgments. Each chapter is further subdivided with specialized topics such as "The world of moths" and "Eggs and oviposition," "The ever-changing caterpillar," "Predators and defenses," etc. The subdivisions are further subdivided with exquisite illustrations and photographs from around the world.

Sourakov & Chadd's book has worldwide coverage. The main chapters: Moths of Tropical Rainforests, Moths of Grasslands & Meadows, Moths of Deserts & Tundra, Moths of Temperate Deciduous Forests, Moths of Coniferous and Wetlands Plants, and Moths in Agroecosystems & Around Homes are illustrated with detailed photographs of habitat types. The regions of the world are delineated with contrasting colored easy-to-interpret maps. Examples of the moth fauna from each region are illustrated with

beautiful photographs and drawings illustrating ova, larvae, pupae, adults, parasitoids, and diseases. The macro photography is the very best. Some illustrations are full page, others are smaller or might be examples from extremely expensive and very rare books, such as Merian (1705), or a postage stamp from Mozambique.

A person reading this book will gain knowledge unavailable in most other places.

I suggest that if you have any interest in moths, whether technical or general, this book is a required read. I'm so enthusiastic about this book I showed it with glee to my newest student whereupon I found no illustration on how to separate male and female pupae. The list of books in the list of Resources should include at least Himmelmam (2002), (mostly about the US), Leverton (2001) and Young (1997). The latter two cover Britain and western Europe.

The short length of this review is an indication of how often I had to retrieve the book from my wife (perhaps she should have her own copy), and the brevity belies my inability to find any faults with the book.

In summary this book should be on the bookshelf of everyone teaching general entomology. The book should be on the bookshelf of everyone interested in lepidoptera, and it is a must for everyone interested in moths. The book should not simply sit on the shelves. It should be read, and it can be a regular useful reference. My students will be regular readers.

If you can wait, be sure to add this book to your wish list of holiday receiving, even if you buy it for yourself.

## Literature Cited:


Covell, C.V., Jr. 1984. *A Field Guide to the Moths of Eastern North America.* [*Peterson Field Guide Series*]. Houghton Mifflin Company, Boston, Massachusetts. 496 pp. 64 pl. (32 color & 32 black and white).

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Merian, M. S. 1705. *Metamorphosis Insectorum Suriamensium*. Amsterdam. 60 pp. 60 col. plates.

Mitchell, R. T. & H. S. Zim. 1962. *Butterflies and Moths. A Golden Nature Guide*. Golden Press, New York, New York. 160 pp.

Powell, J. A. & P. A. Opler. 2009. *Moths of Western North America*. University of California Press, Berkeley, California. 369 pp, 69 col. plates.

Young. M. 1997. *The Natural History of Moths*. Poyser Natural History, London, England. 271 pp. Numerous color illustrations and drawings, tables, and graphs.


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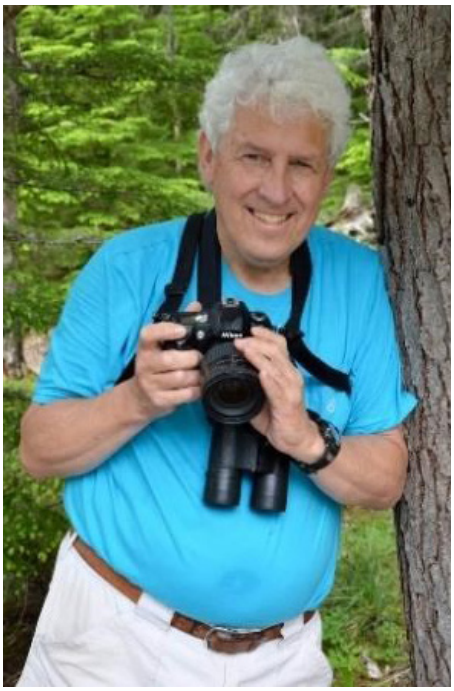
These are photos from THE LIVES OF MOTHS: A NATURAL HISTORY OF OUR PLANET'S MOTH LIFE by Andrei Sourakov and Rachel Warren Chadd. Copyright © 2022 by Princeton University Press. Reprinted by permission of Princeton University Press. Top photo: **Imperial Moth Caterpillar, Pg. 207:** Caterpillars of the Imperial Moth (*Eacles imperialis*) exhibit polymorphism —they have genetically determined color forms, each of which would provide a better camouflage and thus predator avoidance under different circumstances (lighting, background, and so on). (Photo Credit: Matt Jeppson). Bottom photo: ***Miltochrista pulchra*, Pg. 240:** *Miltochrista pulchra*—one of more than 50 species in its genus—is found from the Russian Far East and Japan to Yunnan province in China and the Korean Peninsula. It is one of many species known as lichen moths for the food preference of their larvae, or footmen for the stance of the adults at rest. (Photo Credit: Dark Egg)

# Metamorphosis

**Ranger Steven Mueller (8/13/1950 – 6/16/2022)**

Ranger Steve Mueller passed away June 16, 2022, in Cedar Springs, MI. Ranger Steve (Steven Joel) Mueller was born on August 13, 1950, to Richard and Elaine Mueller in Saginaw, Michigan. He is survived by his wife, Karen; daughters Jenny Jo (Michael) Collin and Julianne (Charlie) Lemmink; grandchildren DJ and Matilda Collin and Walden Lemmink; brothers Mike (Janet) and Tom; in-laws John (Marie), Jeff (Sally), and Steve (Betty) Duzan; as well as a niece, nephews, and many great friends. When his mentor and friend, Wakelin McNeel, was hit and killed on his bicycle, Ranger Steve became an unofficial "Big Brother" for his children, Ted, Amie, and Ross. Ranger Steve developed a keen interest in nature and conservation as a child, spending much time outside exploring. In his long career he continued to explore nature and promote conservation through his work as a park ranger, urban forester, teacher, professor, and director of multiple nature centers, including a lengthy career as director of the Howard Christensen Nature Center.



Surrounding his home, he established Ody Brook Nature Sanctuary, a preserve for enhancing biodiversity and cultivating native species. The site is a hotspot for both birds and butterflies, and harbors federally threatened American Chestnut trees, including the largest one most people have seen. With the support of the Land Conservancy of West Michigan, the sanctuary recently acquired a conservation easement ensuring that the land cannot be developed. Ranger Steve welcomed numerous visitors including many local nature groups, and he regularly guided college interns. The sanctuary not only provided purpose for his life but was essential medicine while combating Multiple Myeloma, as important as his chemotherapy treatments and bone marrow transplants.

Ranger Steve was very active in professional organizations. These included the Lepidopterists' Society, the National Association for Interpretation (park naturalists, museum and zoo educator professionals), the Land Conservancy, the National Audubon Society, and numerous other conservation and education organizations, as well as the Grand Rapids Camera Club. He served as president for multiple organizations and received several prestigious awards for his contributions and accomplishments.

Work on moths and butterflies was an important part of Ranger Steve's life. He spent many productive summers doing biodiversity work on moths and butterflies in Utah and discovered the new species, *Grammia brillians* (now *Apantesis brillians*) at Bryce Canyon National Park (the exact spot where he and Karen exchanged vows years earlier!). He led four annual butterfly counts, helped coordinate the Michigan Butterfly Atlas and coordinated NABA butterfly count data from Michigan for many years. He was a fixture at Lepidopterists' Society annual meetings and provided field trip summaries and photos for the News from 2000-2017. I'll sincerely miss having my good friend as a roommate at these events, discussing the talks, catching up on family, and enjoying his company in the field.

He published occasional articles in the News, authored 19 journal articles, over 600 popular science articles (he authored the newspaper column "Ranger Steve's Nature Niche" for many years), and made contributions to several butterfly books. Over his lifetime he amassed a Lepidoptera collection of more than 10,000 specimens, which are deposited in research facilities, universities and museums across the USA and Canada including the National Museum of Natural History, the Carnegie Museum, Michigan State University, the Milwaukee Public Museum, the Gillette Museum at Colorado State University, the Bean Museum at Brigham Young University, Bemidji State University, the Colorado Plateau Museum of Arthropod Biodiversity at Northern Arizona University, and the Canadian National Collection.

Ranger Steve considered people "a part" of nature and not "apart" from nature. In 1970, he wrote that, "people are made of the environment and are born into it; therefore, they cannot be divorced from it, even by death." More recently, he said that when he dies, he will flutter away on the gossamer wings of a butterfly and will be among us when we commune with and protect nature. He considered it a great honor to learn from and associate with great lepidopterists. He felt they all enriched his life, as he did ours.

Donations in his honor may be made to the Lepidopterists' Society, the Howard Christensen Nature Center, the Southern Utah Wilderness Alliance, or organizations of your choice that actively promote nature and conservation.

Brian Scholtens and the Mueller family

# The 70th annual Lep Soc meeting student award winners

This year's Lep Soc meeting was at Western Carolina University in Cullowhee, NC. The total number of attendees was 38+ (see back cover), which, considering post-covid online malaise and last minute time changes, was pretty decent. The presentations were on June 16-17, 2022, with a total of 15 talks (with quite a few by students). Thankfully, there were enough student talks (and posters) that we were able to provide appropriate student awards for those that were "best in show". Pictured here are the award winners. For the Alexander Klots, best poster award (only one $1000.00 award given), the winner was Kim Steese for her poster "Survey for *Papaipema eryngii* at Fort Leonard Wood, Missouri". For the Harry Clench student talk awards, there were first place ($1000.00) and second place ($500.00) awards given. The first place winner was Tanner A. Matson, for his talk "Phylogenetics and classification of North American Geometridae". The second place winner was Sopita Muadsub, for her talk "Leaf Roller Moths of the tribe Olethreutini (Tortridicae: Olethreutinae) in Thailand." Congratulations to the winners! The entire program should be available at some point on the Lep Soc website.

Be looking for upcoming information on future meetings. We hope that for future meetings that we will be able to plan for a large in person contingent, but with online options as well.

Tanner Matson, first place Clench student talk award winner, pictured with Kelly Richers (holding check) and Brian Scholtens (holding award).

Kim Steese, Klots poster award winner, pictured with Kelly Richers (holding check) and Brian Scholtens (holding award).

Sopita Muadsub, second place Clench student talk award winner, pictured with Kelly Richers (holding check) and Brian Scholtens (holding award).

# The Marketplace

IMPORTANT NOTICE to ADVERTISERS: If the number following your ad is "642" then you must renew your ad before the next issue if you wish to keep it in the Marketplace!

## Publications, Books

**Southeastern Arizona Butterflies,** by Rich Bailowitz and Jim Brock, 356 pages.

This guide is an updated sequel to the ground-breaking 1991 guide by the same two authors. This new work treats in depth all 273 species recorded in the region. It features more than 700 excellent color photographs, most of living butterflies photographed in the field. It provides more than 300 regional larval host plant records. Plus, it features color images of common nectar sources, caterpillars and habitats, range maps for all but the most common and widespread species, and an illustrated comparison guide to the difficult-to-identify duskywings.

Available from Amazon, Barnes and Noble, Discoverbooks, Thriftbooks, etc. 642

**Taxonomy, Ecology, and Evolutionary Theory of the Genus *Colias*** (Lepidoptera: Pieridae: Coliadinae). Second Edition, 2020 by Paul C. Hammond and David V. McCorkle.

This book has an 8 1/2 inch X 11 inch format with a hard cover, and is 319 pages in length. It includes 10 figures and 16 color plates that illustrate nearly all of the North American taxa including 30 newly described subspecies, plus closely related Eurasian taxa. A detailed discussion is presented of the distribution, habitat, and larval foodplants for each taxon in North America. In addition, the book explores the broader theory of evolution and adaptive radiation using *Colias* butterflies as the model, and presents the new theoretical concepts of genealogy, adaptive radiation waves, and multipartite population gene pools. $110.00. Available from Paul C. Hammond, 2435 E. Applegate St., Philomath, OR 97370. email **copablepharon@gmail.com.** 642

**Revised with corrections**: Butterflies of the Southern Rocky Mountains Area, and their Natural History and Behavior, Papilio (New Series) #27. 392 pages free pdf. Go to **https://dspace.library.colostate.edu** [which goes to Mountainscholar.org], select Colorado State University, Fort Collins, then search for Papilio (New Series), where all 32 issues are free pdfs. Related papers on butterflies such as my paper on flower visitation are also free pdfs. James Scott. 643

## Research

Canadian Wildlife Service, Prairie Region, is seeking information about observations of four species: *Melaporphyria immortua* (any obs); and *Notamblyscirtes simius*, *Hesperia pahaska*, and *Amblyscirtes oslari* (any obs from Canada, MT, ND or MN). Data will be used to help identify potential habitats and locations for future Canadian surveys and to assist with determination of Canadian at-risk status. Detailed locations do not have to be shared. Please contact Medea Curteanu, CWS Edmonton, AB; **medea.curteanu@ec.gc.ca** 642

The aim of the Marketplace in the **News of the Lepidopterists' Society** is to be consistent with the goals of the Society: "to promote the science of lepidopterology...to facilitate the exchange of specimens and ideas by both the professional and the amateur in the field,..." Therefore, the Editor will print notices which are deemed to meet the above criteria, without quoting prices, except for those of publications or lists.

We now accept ads from any credible source, in line with the New Advertising Statement at the top of this page. **All advertisements are accepted, in writing, for two (2) issues unless a single issue is specifically requested.** All ads contain a code in the lower right corner (eg. 564, 571) which denotes the volume and number of the **News** in which the ad first appeared. **Renew it Now!**

**Note: All advertisements must be renewed before the deadline of the third issue following initial placement to remain in place.**

Advertisements should be under 100 words in length, or **they may be returned for editing.** Some leeway may be allowed at the editor's discretion. Ads for Lepidoptera or plants must include full latin binomials for all taxa listed in your advertisement.

The Lepidopterists' Society and the Editor take no responsibility whatsoever for the integrity and legality of any advertiser or advertisement. Disputes arising from such notices must be resolved by the parties involved, outside of the structure of The Lepidopterists' Society. Aggrieved members may request information from the Secretary regarding steps which they may take in the event of alleged unsatisfactory business transactions. A member may be expelled from the Society, given adequate indication of dishonest activity.

Buyers, sellers, and traders are advised to contact state department of agriculture and/or ppqaphis, Hyattsville, Maryland, regarding US Department of Agriculture or other permits required for transport of live insects or plants. Buyers are responsible for being aware that many countries have laws restricting the possession, collection, import, and export of some insect and plant species. Plant Traders: Check with USDA and local agencies for permits to transport plants. Shipping of agricultural weeds across borders is often restricted.

No mention may be made in any advertisement in the **News** of any species on any federal threatened or endangered species list. For species listed under CITES, advertisers must provide a copy of the export permit from the country of origin to buyers. **Buyers must beware and be aware.**

**INFORMATION WANTED**: For a biography in preparation, I would very much like to hear from anyone with information, correspondence, anecdotes or memories on **Colin Wyatt,** entomologist, linguist, ski champion, adventurer, artist and raconteur, who was killed in a plane crash in Guatemala on the 19th of November 1975. Please e-mail ***johntennent@hotmail.co.uk*** (note, not ".com"!) or write c/o Department of Life Sciences, the Natural History Museum, London UK SW7 5BD. Thank you. 643

**WANTED: Hawkmoths for Research.** Hawkmoths can drink liquids with very different viscosities, from water to honey. We seek to understand how this is accomplished. We are requesting hawkmoths (Sphingidae) of any species (non-threatened, non-endangered species only) from Arizona, California, and New Mexico. We request dry adult hawkmoths carefully packaged to avoid broken appendages or damaged wings. We will pay shipping costs. Proboscis images will be posted on our website, and all contributors will be acknowledged.

Contact me, Alex (Alexandre Varaschin Palaoro), to arrange shipping (e-mail): **avarasc@clemson.edu.**

Website: **https://cecas.clemson.edu/kornevlab/** 642

**WANTED**: For trade or purchase, papered specimens of *Phyciodes* and *Anthanassa* (from anywhere) for a study of phenotypic and morphological variation of Saskatchewan *Phyciodes*. 5-10 exemplars per population would be desirable. I have a limited number of specimens for trade, primarily from Western Canada. Please contact Dr. Daniel Glaeske at **dmg936@usask.ca**. 643

## Equipment

**WANTED TO BUY**: Genitalia vials/stoppers. Formerly BioQuip catalog number 1133A; 4 x 10 mm plastic vials, w/stoppers, in units of 100 vials/stoppers per bag. Please send quantity and price information to: Terry Harrison, **nosirrah@consolidated.net**. 642

## Miscellany

Tony Roberts, a continuous Lep. Soc. member since 1956 with a concentration from 1987-2010 on the moth, and in particular the post-glacial microlepidopteran, fauna of immediate coastal Down East Maine, seeks suggestions, inquiries, requests regarding residual lab equipment, reagents, 20th century micro-photographic and drawing paraphernalia, fiberoptics, slides, pins, pith for double-mounts, drawing aids, etc. and, most important, an extensive library of North American books, offprints and copies of North American papers on same, PLUS many scarce Holarctic titles. Kindly contact: Michael A. "Tony" Roberts at maroberts@maineline.net, if interested in any of the above. 642

# Membership Updates

*Chris Grinter*

Includes ALL CHANGES received by August 16, 2022. Direct corrections and additions to Chris Grinter, **cgrinter@gmail.com.**

**New Members:** *Members who have recently joined the Society, e-mail addresses in parentheses. All U.S.A. unless noted otherwise. (red. by req. = address redacted by request)*

**Fernando Hernández Baz**: Circuito Gonzalo Aguirre Beltrán S/N. Zona Universitaria Facultad de Biología, Universidad Veracruzana, Xalapa, Veracruz 91500 MÉXICO (ferhbmx@yahoo.com.mx)
**Sass Bergen**: 7 Rose of Sharon Court, Waasis, NB E3B 0B8 CANADA (sassjn@gmail.com)
**Christie Caldwell**: 11408 183rd Pl. NE Apt. K3033, Redmond, VA 98052 (Lroseata@gmail.com)
**Earline G. Deutsch**: [red. by req.] (earline_g@hotmail.com)
**Alan Doyle**: 6614 Rolling Mill, Houston, TX 77088 (adoyle983@gmail.com)
**Enakshi Ghosh**: 600 W. Plum, University Village Apt 27E, Fort Collins, CO 80521
**Seyed Mozaffar Mansouri**: Graduate University of Advanced Technology, Dept. of Biodiversity, Institute of Science and High Technology, Kerman, IRAN 76318-85356 (m.mansouri.89@gmail.com)
**Charles Moore**: 515 West 110th St Apt 2G, New York, NY 10025 (charles.moore662@gmail.com)
**Charles G. Oliver**: 921 Scottdale Dawson Rd., Scottdale, PA 15683 (office@theprimrosepath.com)
**Christine Rose-Smyth**: PO Box 2818, Grand Cayman KY1-1112 CAYMAN ISLANDS (mcrscay@gmail.com)
**Dennis Vollmar**: [red. by req.] (dvollmar@hotmail.com)
**Raymond R. Wells**: 6108 Sandy Springs Ct., Saint Cloud, FL 34771 (rwells@quasny.com**)**

**Address Changes**: *All U.S.A. unless otherwise noted.*

**Emily A. Geest**: 6208 Roman Rd., Warr Acres, OK 73122 (eageest@gmail.com)
**Larry Hummer**: PO Box 2335, Davis, CA 95617 (larry-hummer@earthlink.net)
**Aimee Lynn B. Dupo**: Institute of Biological Sciences UP Los Banos, c303 Environmental Biology Division, Los Banos, Laguna 4031 PHILIPPINES (abdupo@up.edu.ph)

**www.lepsoc.org and https://www.facebook.com/lepsoc**

# Updated report on intergeneric hybrids between *Callosamia* and *Samia* (Saturniidae)

Greg A. Bingaman, Sr.[1] and Richard S. Peigler[2]

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In this paper we review intergeneric crosses between the North American *Callosamia* and the East Asian *Samia* that have been made successfully in captivity, resulting in adult moths. Hybrids involving these two genera have long been recorded in the literature, at least back to the very early 1900s (Soule 1902, 1906, 1907; Joutel 1907) and again decades later (Peigler 1978, Weast 1989). After many attempts with mating moths, the senior author finally succeeded to rear adults of these intergeneric crosses in the last few years. Hybrid specimens are in several museums, including some that are controversial because they appear to be pure *S. cynthia*. We hope to shed some more light on this result from more recent hybridization successes, in which adult hybrids of *Callosamia angulifera* ♂ × *Samia cynthia* ♀ (Figs. 1-3) and *Callosamia promethea* ♂ × *S. cynthia* ♀ (Fig. 4) were obtained using hand pairing methods. Though well recorded, the crosses that are successful among these genera are few and far between so it is interesting to compare the results of all workers. As in the past, recent attempts by Bingaman have been made with other crosses and reciprocals between the two genera to no avail. However, the two successful results confirm previous outcomes but with some variation during the process. The male hybrids of *C. angulifera* ♂ × *S. cynthia* ♀ first recorded in 1978 by Peigler, match the intermediate specimens recently recorded for the 2022 male hybrids. Successful results also match several very early reports about the disputed hybrids involving *C. promethea* ♂ × *S. cynthia* ♀ as will be discussed in more detail below.

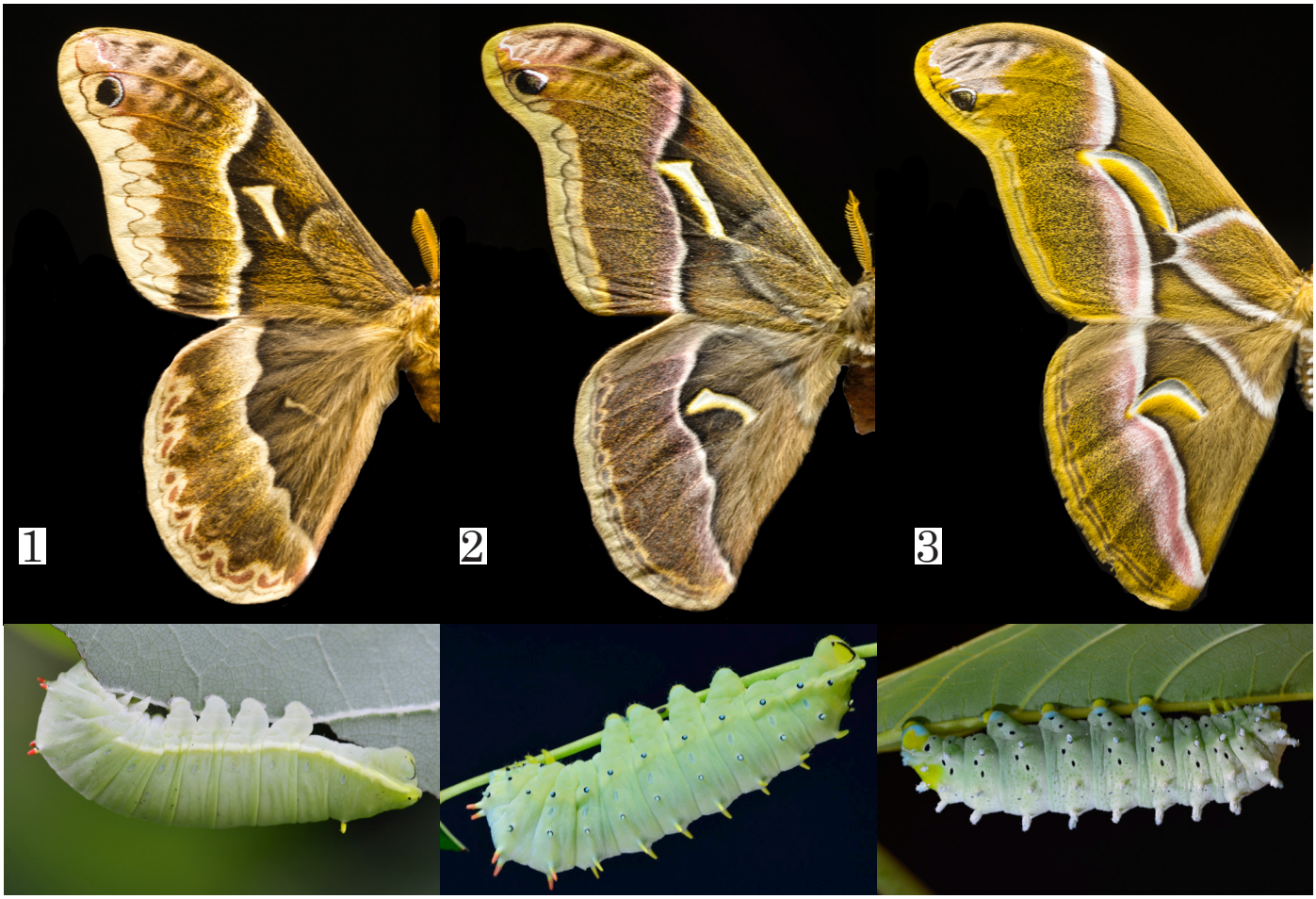



Fig. 1. Adult male and mature larva (below) of *Callosamia angulifera*. Fig. 2. Adult male and mature larva (below) of hybrid between *Callosamia angulifera* ♂ and *Samia cynthia* ♀. Fig. 3. Adult male and mature larva (below) of *Samia cynthia*.


Fig. 4. Adults of hybrids between *Callosamia promethea* ♂ and *Samia cynthia* ♀. Note lack of "*promethea*" characteristics.

As we already stated, attempts to produce intergeneric hybrids are rarely successful. A Swiss lepidopterist named Max Standfuss carried out extensive experiments to obtain and rear hybrids of European moths and butterflies. He succeeded in crossing *Saturnia pavonia* ♂ × *Graellsia isabellae* ♀, both members of the tribe Saturniini. The female laid 98 eggs of which only 7 hatched, and they died when half grown, but he figured one of the hybrid larvae in color (Standfuss 1896: 58, pl. 3, fig. 6). One poorly formed (but with wings expanded) hybrid of the cross *Hyalophora columbia* ♂ × *Attacus atlas* ♀ was reared in France by Robert Vuattoux (1992) who illustrated the pinned male, genitalia, and 6th instar larva. Carr (1984) crossed *C. angulifera* ♂ × *Hyalophora cecropia* ♀ in Ohio and this intergeneric cross proved quite viable, producing many adults, including females. More than a century ago, Laurence R. Rupert in Sardinia, New York, was able to rear two hybrid larvae to the cocoon stage of *Callosamia promethea* ♂ × *H. cecropia* ♀, but no adults were obtained (Peigler 1978). Collins and Weast (1961: 116-117) reared a brood of larvae of the cross *Hyalophora cecropia* ♂ × *Samia cynthia* ♀ to maturity, but no cocoons were obtained. Weast (1989: 42, 46-47) crossed *Hyalophora euryalus* ♂ × *Attacus atlas* ♀ but the larvae only reached the third instar. The genera *Callosamia, Samia, Hyalophora*, and *Attacus* all belong to the tribe Attacini, so are closely related. Some early authors used the incorrect generic name *Philosamia* for *Samia cynthia*. Intergeneric crosses within Attacini reported in earlier literature were tabulated by Collins and Weast (1961), Weast (1989), and Peigler and Naumann (2003) in their chapters on hybrids.

## Literature from the early 1900s

In the early 1900s a few lepidopterists were able to achieve hybrid pairings, producing some visually interesting results and some not so very visually interesting results. The latter have caused debate but now prove to be of interest after all. Caroline Gray Soule in Massachusetts and Louis H. Joutel (who was the artist for many of the color figures in Packard 1914) in New York City published their results, and hybrid specimens from these and other workers can be found in several institutions such as United States National Museum, American Museum of Natural History, and Field Museum. These lepidopterists used hand pairings and/or a set-up involving cages with calling females of the one species set next to a cage with the opposite female enclosed with the males of the first. Both methods are effective. Some authors reported easy pairings and high fertility rates, but others experienced difficulty in pairings and very low hatch rates. As determined by the early authors and the two of us, crossing the two genera can produce beautiful and healthy $F_1$ adult hybrid males, albeit rarely. Things become muddied though when one crosses *Callosamia promethea* ♂ × *Samia cynthia* ♀.

Packard (1914: 266) quoted a letter he received from Herman Strecker as "(litt., 1900)" as follows: "You know *cynthia* crosses with *promethea*, but the product of the act being done in a state of nature is widely different from that produced by pairing in confinement or by artificial inducement. The first is a curious thing; color of *cynthia*, with discal marks and shape of *promethea* ♀. Those bred in confinement produced things (♂) looking like ♀ of *promethea* nearly, only blackened, not reddish." Strecker did not mention such hybrids in his own publications. A detailed account of Strecker's books was given by Calhoun (2017). The junior author examined some hybrids in Strecker's collection in Field Museum and tried to correlate the specimens to Strecker's descriptions above, with minimal success (Peigler & Naumann 2003: 175). Ferguson (1972: 217, 236) noted that matings between *S. cynthia* and *C. promethea* happen "in captivity, but there is no evidence that this ever occurs in nature." Peigler (1978) concurred that no wild hybrids are likely, and Bingaman notes that a female *S. cynthia* that had mated a male of *Callosamia* would oviposit in nature on ailanthus (*Ailanthus altissima*), a hostplant on which the hybrid larvae would not likely survive.

Soule (1902) described two forms of larvae from a very fertile single pairing of *S. cynthia* ♂ × *C. promethea* ♀,

stressing that the *cynthia* form had great variety among them, whereas the others were very *promethea*-like. She had given eggs to a friend, Miss Ida M. Elliot, who stated she had two eggs hatch, both of which produced larvae "normal *cynthia*-looking except for in the last stage were greener." Soule states the *promethea* form spun after the 4th molt, but the *cynthia* form molted a fifth time. She reports many losses to disease but does not allude to any success of pupation or adult results. The larval stages of Soule's hybrids from this cross were shown in black & white photographs by Packard (1914: pl. 71) and a hybrid adult male from the cross *S. cynthia* ♂ × *C. promethea* ♀ was shown by Ferguson (1972: pl. 16, fig. 6). It is remarkably intermediate between the parent species, and when Peigler visited the United States National Museum, Ferguson told him that "I could not resist putting that thing in there [the 1972 book]."

Soule (1906) again published some results in which there were two hybrid pairings of *C. promethea* ♂ × *S. cynthia* ♀, and she noted both sets of eggs hatched and "the larvae did very well on wild cherry." She went on to explain that the larvae exhibited no trace of *C. promethea* in appearance, but "cocoons are more like *promethea*, being smaller, browner and more slender than usual *cynthia*" but again there was no mention of pupation. There was another pairing of *C. promethea* ♂ × *S. cynthia* ♀ and the female refused to oviposit. This was to be the first admission of re-pairing the female to a male *S. cynthia* in an attempt to get her to oviposit. The larvae resembled typical S. *cynthia* and fed on wild cherry. In total, three small *promethea*-like cocoons were harvested. Another brood of *C. promethea* ♂ × *S. cynthia* ♀ was reared by C. L. Pollard in 1908, and one of his hybrid females was illustrated by Ferguson (1972, pl. 16, fig. 7) but it appears to be pure *S. cynthia*.

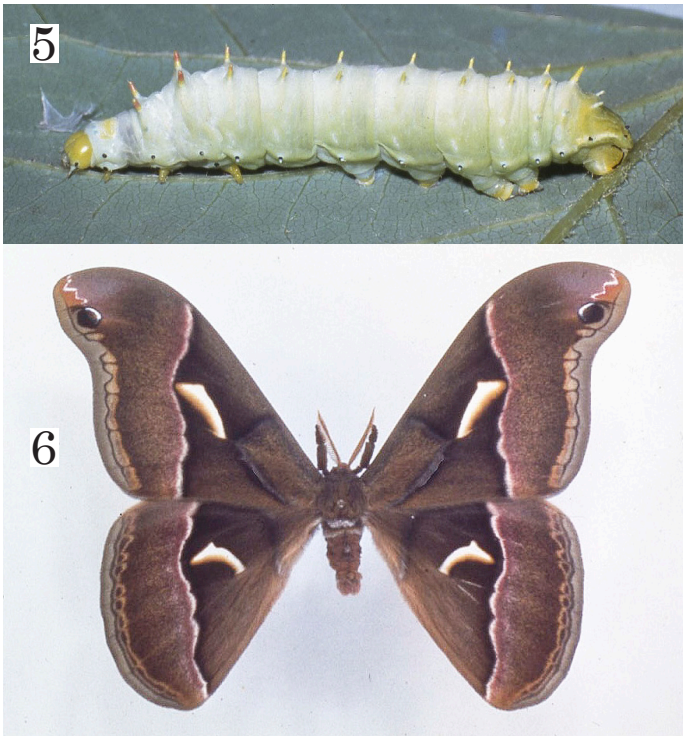
Joutel (1907) shared more information and observations of these intergeneric crosses. Here it is evident that legitimate hybrid larvae were produced from the reciprocal of Soule's work, as the female had not been re-mated. Unfortunately, Joutel reported that even after several years of attempts, "it was impossible to get larvae to reach maturity." Joutel continued trying, this time with more than 2000 cocoons, but in only a very few pairings was any fertility evident. Joutel stated in several cases the females of *S. cynthia* would not oviposit until re-paired to a male of *S. cynthia*. In these attempts all larvae, which in these cases fed on ailanthus, resembled pure *S. cynthia* as larvae and cocoons. The moths produced from using males of *S. cynthia* yielded the expected intermediate appearance, but Joutel made no mention of adults achieved from the reciprocal cross. Joutel expressed the same difficulty in getting the females of *C. promethea* to oviposit, so they too were re-paired to males of *C. promethea*. Joutel was eventually successful in obtaining fertile ova and expressed that *S. cynthia* has the greatest effect on the resulting hybrid larvae and "remains to be seen in the imago." Soon after, Soule (1907) stated that "in 1906 I had many cocoons and larvae from *S. cynthia* ♀ × *C. promethea* ♂" that emerged in 1907, but the adults were hardly distinguishable from pure *S. cynthia* and Soule lamented "The moths were as disappointing as the larvae had been in following the *cynthia* marks so closely, and confirmed my belief that *cynthia* is prepotent in cross with any other species, though I have not been able to get moths from any other cross." The resulting hybrids above were paired and produced larvae. It seems those larvae fed on cherry, all died before reaching maturity, but looked like typical *S. cynthia*.

Working in England, Watson (1912) examined these hybrids and called into question the "hybrids" that appeared to be pure *S. cynthia* and concluded some error had been made. Watson stated there were four specimens of two generations, but "could not find any trace of *promethea* blood in the specimens either shape, colour, antennal structure or cocoon." He was told these moths were raised by Joutel. Watson wrote that in his three pairings of the reciprocal (*S. cynthia* ♂ × *C. promethea* ♀) all proved infertile. Watson closed by saying he hesitated to accept these results until he had seen the larvae.

## More recent studies

From the early 1970's to present, some progress and success has been achieved, although rarely. Some of the first photos of hybrid larvae and adults began to appear. Ferguson (1972: pl. 16, fig. 6) contains images of an obvious hybrid male that was the result of *S. cynthia* ♂ × *C. promethea* ♀ for which he wrote "Source of material unknown but possibly one of the hybrids reared in 1901 by Caroline G. Soule." His Figure 7 shows what looks to be pure *S. cynthia* but according to the caption is a hybrid female resulting from the reciprocal cross. This one was reared in 1908 by C. L. Pollard, as stated earlier.

Just as the chapter on Saturniidae hybrids in Collins and Weast (1961) motivated Peigler to make hybrid crosses, the subsequent paper by Peigler (1978) inspired Bingaman to continue such experiments. Regarding the cross *Callosamia angulifera* ♂ × *Samia cynthia* ♀ Peigler reported good hatch rates using hand pairing methods from two females. The hybrid larvae were reared on tuliptree (*Liriodendron tulipifera*). In the end 14 cocoons were produced of which four hybrid males hatched. He gave a detailed description of the larvae, cocoons, pupae, and adult male. Color figures of the larval stages and adult were later shown by Peigler and Naumann (2003: figs. 96, 127-130). Here we figure a mature larva and pinned male (Figs. 5-6) from the brood reared by Peigler. Of the four pinned hybrid males (all in perfect condition), one was sent to the Natural History Museum of Los Angeles County, one to Claude Lemaire in France, and two were donated to the Denver Museum of Nature & Science (see *News Lep. Soc.*, Jan./Feb. 1991: page 3). As with Ferguson a few years earlier, Lemaire (1978: pl. 25, fig. 2) could not resist including a figure of one of these remarkably intermediate hybrids in his book.




Figs. 5 and 6. Mature larva and adult male from hybridization between *Callosamia angulifera* ♂ and *Samia cynthia* ♀ (Peigler specimen).

Also of interest is an article written by Thomas W. Carr (1984) on hybridization of *Callosamia angulifera* ♂ × *Hyalophora cecropia* ♀. This intergeneric cross proved very healthy, producing many adults, including females. Carr made some comparisons to the *Callosamia* × *Samia* crosses, leading him to believe that *Callosamia* and *Hyalophora* are more closely related than either is to *Samia*. Peigler and Liu (2022) described many similarities between *Samia* and *Callosamia* (eggs, larval structure, cocoon structure, hostplant preferences, etc.) that are not shared with *Hyalophora*, but it appears that Carr was correct based on the most recent DNA analyses (Rougerie et al. 2022).

After many years of attempting to cross *Callosamia* and *Samia*, Weast (1989) finally succeeded to rear adults of *S. cynthia* ♂ × *C. promethea* ♀, but only obtained three males. The specimens were perfect but the first one was in diapause for two years and the last two remained in diapause for three years. He showed color figures of the mature larva and living adult males, including the underside. All previously published figures of these intergeneric crosses depicted uppersides of pinned moths. Weast's text gives a lot of details of his many attempts and how he reared the hybrids, taking special care to avoid loss to disease, predators, and parasitoids, once he secured the treasured hybrid larvae! He also observed the alternating larval forms (of *C. promethea* and *S. cynthia*) between instars that Soule (1902) had seen and Packard had figured (1914). Weast also reported some interesting observations about adult behavior of the hybrids, comparing them to the parental species.

## Newly published results from the senior author

*Callosamia promethea* ♂ × *Samia cynthia* ♀

After reading about, and hearing stories of these early "hybrid" moths that have no sign of *C. promethea* genetics, like most, Bingaman assumed some kind of mistake had been made, or just nothing more than females of *S. cynthia* being re-paired to their own and therefore laid purebred *S. cynthia* ova (as admitted several times in the old literature). Weast (1989) accomplished the reciprocal giving a stunning intermediate result, so Bingaman expected something similar to come from any viable ova using a male *C. promethea*.

After several years and numerous failed attempts, June 27, 2017, one of the hand pairings of *Callosamia promethea* ♂ × *Samia cynthia* ♀ produced a few viable ova. On July 18, out of 119 eggs, 3 hatched, and were sleeve reared on *Prunus serotina* to cocoons on September 11. As with any hybrid project, the anticipation level was high, but as each larval instar passed, no *C. promethea* traits were visible, whatsoever. The senior author remained hopeful though that the three healthy pupae would give something similar to the confirmed reciprocal adult results. The cocoons (Fig. 7) and pupae were all inspected and weighed: two males and one female. Cocoon/pupae weights (grams) were 1.9/1.5 1.8/1.5 2.2/1.8, ready for diapause. They were removed from cold storage on May 1, 2018, and in July all three emerged: a male on July 8 and the other male and the female on July 10. The very first look he had at the result was one of complete disappointment followed by disbelief. How can this be? The female *S. cynthia* that was the mother of this brood was captive reared, guaranteed, a quarantined virgin, certainly not re-paired or given any chance to have contact with a male *S. cynthia* for laying purposes, knowing these reports or claims had been largely discounted for this very reason. By all accounts, Bingaman had a Cynthia moth in front of him (Fig. 4, pg. 151). Upon closer inspection of the female, it was evident she was barren. The three adults were dispatched, photographed and are currently in his personal collection.


Fig. 7. Cocoons of hybrids between *Callosamia promethea* ♂ and *Samia cynthia* ♀.

*Callosamia angulifera* ♂ × *Samia cynthia* ♀

After eight years of attempts, during the season of 2020 Bingaman hand paired many *Callosamia angulifera* ♂ × *Samia cynthia* ♀ and obtained some fertile ova. All the reciprocal attempts during this time proved infertile. Of the one batch of 2,614 eggs the females of *S. cynthia* laid, 18 of them hatched on July 20, 2020, two of which perished soon after hatching. The young larvae were kept in 32-ounce deli containers being fed on fresh cut tuliptree. He decided after finally achieving a small degree of success it was best to follow suit and use the same host Peigler (1978) used, as now was not the time for host plant experimentation. After all, *C. angulifera* feeds exclusively on it, and *S. cynthia* will accept it. Once the larvae molted to the second instar they were moved outdoors on growing host. Larvae were put singly in smaller sleeves, to isolate from disease then each re-sleeved again to prevent predation. The larvae progressed well, with a few losses to disease. By August 2, 11 larvae remained in the 4th instar. The first cocoon was constructed August 20, 2020. Compared to the larvae of *Callosamia promethea* ♂ × *Samia cynthia* ♀, these were unmistakably intermediate in appearance, resembling some larvae of the African *Epiphora* and the Chinese *Samia watsoni* (Peigler & Liu 2022) with multiple red scoli. The larvae were like those that Peigler had reared 45 years earlier in South Carolina. Here we show the mature larva (Fig. 2, pg. 150) between mature larvae of the two parental species (Figs. 1, 3, pg. 150). Likewise, the cocoons (Fig. 8) were intermediate between the parents, being dark brown like *C. angulifera* but most with peduncles like *S. cynthia*. Cocoons were weighed after pupation (11 total): 2, 1.4, 1.7, 1.8, 1.6, 1.3, 2.4, 1.9, 1.9, 1.4, and 1.3 grams. The cocoons were kept in cold storage until the spring of 2021 when they were moved outdoors in a protected enclosure. The first and only male of 2021 finally emerged on September 12, one full year after pupation, a result identical to Peigler (1978). Expecting a holdover according to Peigler's results, the cocoons were again readied for diapause. They were brought back out of cold storage on March 10, 2022. A second male appeared 14 days later, on March 24, and another male emerged one day later. The specimens were all perfect. We illustrate a living male hybrid, upperside and underside (Figs. 9-10). All six resulting males are in Bingaman's personal collection, and as of this writing, two healthy male pupae remain, but three pupae did not survive the second winter. No female pupae were produced of the 11 cocoons secured.

Fig. 8. Cocoons of hybrids between *Callosamia angulifera* ♂ and *Samia cynthia* ♀.


Fig. 9 (upperside) & 10 (underside). Adult male hybrid between *Callosamia angulifera* ♂ and *Samia cynthia* ♀.

## Discussion and Conclusion

Success in making intergeneric crosses between *Callosamia* and *Samia* is clearly very rare, despite many attempts by many workers, as indicated above. From 2,614 eggs laid by females of *Samia cynthia* that Bingaman had mated to males of *Callosamia angulifera*, only 18 hatched (0.688% hatch rate), of which two died within the first day. After careful rearing, 11 cocoons were obtained, and only six adults were obtained. Peigler had a higher rate of hatching from two females, but lost many larvae along the way, including from disease, and ended up with only four males. Similarly low rates of success of hatching and rearing were reported by Soule, Joutel, and Weast.

No females were obtained by any of these workers, except that Weast noted a female failed to pull itself out of its cocoon. Peigler (1981) noted the same problem of weak females failing to emerge in some intrageneric crosses within *Callosamia*. In most animals including humans, the sex chromosomes in males are XY and in females are XX, but

in Lepidoptera and Trichoptera, the female is the heterogametic sex (XY), which explains why female hybrids have more difficulties in development at all stages.

Another problem with these intergeneric hybrids is prolonged diapause. With the *Callosamia angulifera* ♂ × *Samia cynthia* ♀, Peigler (1978) had three males emerge a full year after pupation and the last one the following year. The remaining pupae died. Bingaman also observed prolonged diapause with the same cross, as detailed above. For the three males of *S. cynthia* ♂ × *C. promethea* ♀ obtained by Weast (1989) one remained in diapause for two years and the last two for three years. Long ago, Standfuss (1896) and other authors pointed out that pupae of hybrids may be more likely to carry over one or more winters, and we now understand that hybridization can interfere with the physiology of diapause. However, in *Hyalophora* and European *Saturnia*, pupae of the pure species sometimes hold over an additional year or even two, at least in captivity, so prolonged diapause is not unique to hybrids.

Although one of the main purposes of this report is to encourage present and future lepidopterists to attempt to achieve hybrid crosses, we wonder if the above data might be more likely to discourage instead of to encourage!

The issue of the hybrids that appear to be pure *Samia cynthia* that were reared by Soule, Joutel, and Bingaman needs to be addressed. Peigler (1978) did not believe that these could be valid hybrids after reading that the early workers would re-mate females to males of their own species to stimulate oviposition, because they behaved as if unmated after a single pairing with a male of a different species. Watson (1912) also believed that re-mating was the explanation. Peigler continued to promote this hypothesis in his discussion of hybrids in Peigler and Naumann (2003: 174-177) and he assured Bingaman that a mistake had been made, suggesting that surely the female *S. cynthia* had been re-mated to a male of *S. cynthia*. However, after Bingaman insisted that no mistake had been made, we took a fresh look at this question and found a likely solution. A European named Franz Ebner had suggested that parthenogenesis was the reason (Watson 1913) but Peigler had also rejected that in the 2003 book.

Parthenogenesis, defined as reproduction without fertilization, is well known in insects such as aphids and Hymenoptera. It is also known for some Saturniidae (Saturniinae: Micragonini) in Africa (Pinhey 1972: 113, 122) where females reproduce successfully without mating. However, in the detailed review article by Ursula Mittwoch (1978), we found something called gynogenesis in which a sperm cell enters the egg and activates it to produce the second meiotic division but does not contribute any chromosomal material, yet the embryo develops. Bingaman noted that the female he reared from the cross *Callosamia promethea* ♂ × *Samia cynthia* ♀ was barren, suggesting a true hybrid origin despite not showing any traits of *C. promethea*.

Fig. 11. Adult male *Callosamia angulifera* mating with *Samia cynthia* females.

Perhaps the most intriguing question of all is why is it that when a female *S. cynthia* is mated to a male of *C. angulifera* (Fig. 11), obvious intermediate hybrids are produced, but if mated to a male of *C. promethea*, gynogenesis results in offspring that resemble pure *S. cynthia*? Although the number of observations is low, both of the above results have been found consistently by more than one worker.

## Acknowledgments

It is important to recognize the early lepidopterists who laid the groundwork to inspire us for much of what we are still studying today. Bingaman would like to thank all his good friends and family for their lifelong support of his interest in Saturniidae and his wife Deb for her encouragement and help through the years. Bingaman also thanks Peigler for encouragement to publish his recent results.

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# Elation via Cynthia and sericulture

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After reading the recent article in Lep Soc News by Richard S. Peigler and colleague Zhengyun Liu about discovery of Samia wangi in ancient art in the Palace Museum in Beijing China, I reflected on my own experience with rearing *Samia cynthia* to study its life cycle and metamorphosis. What an elation to learn of a painting on silk of next to kin *Samia wangi* pictured in great detail by a gifted artist active some 900 years ago! Attributed to an unknown artist active during the Song Dynasty in the middle ages, the sterling painting verifies the highly developed schools of painting, on silk yet, evidence of well developed sericulture way back then (984AD - 1104 AD).

A deeper appreciation comes as we learn in their paintings how early Song dynasty artists showed their ardor in the finest way, depicting flora, fauna and geography, who prized expensive pigments and raw materials like azurite and malachite to enhance their ancient works of Art. So evident is their zeal for colorful silk garments that we find their people dressed in fashionable colors, like we seek in illuminated manuscripts of Europe, those of Islamic Asia minor, and Mughals of India. These paintings originate so remote from the days of the industrial revolution, when daily life saw much hardship, and the flames or war loomed too close to home. We learn from the pen of Luce Boulnois in her prized book "The Silk Road" and subsequent wikipedia sources how fantastic is a story dating to well before 1500 BC that led legendary Lady Leizu to watch a silkworm (Bombix mori), spinning its cocoon, and after a cocoon fell into her hot cup of tea, she watched the cocoon unravel into a long silk thread! That led directly to flourishing sericulture and the silk industry in Shantung province, courtesy mulberry leaves for the larvae, later becoming the source of expanding the Chinese empire when Emperor Chang Ch'ien traded silk for coin and goods with European traders (fig. 1).

Very fortunate to grow up with parents dedicating their lives to the fine arts, I fashioned a pastel with a wooden Chinaman carved in exquisite detail, from mother Eleanor's collection of Asian cultural effigies. Noticing a deliberate space in the upheld hand, I inserted the narrow stem holding the living cocoon & moth, and voila! (Fig. 2) In his ramblings as a bibliophile my father Leonard Hansen knew I liked oriental art, and added to his fertile library the book entitled " Art Treasures of the Peking Museum" by Francois Fourcade. This volume inspired me to follow my flare for illustration of lepidoptera, birds, and fish. Seeing this breathtaking depiction of *Samia wangi* painted in detail in accurate hues uplifted my spirits. I made several renderings in pastel and colored pencils, of *S. walkeri* (*cynthia*) and other silk moths, including species *Attacus atlas*. I am pleased to share my findings


in thought, research, and pictorial artwork.

To find Cynthia cocoons during grade school and junior high years I took long walks along the borders of New York Central Railroads in Bergen County, Northern New Jersey. Canvasing the railroad bordering trees and shrubs as far as Fairview and Union City, I grew familiar with the biorhythms and metamorphosis of Cynthia. Reflecting on past articles in Natural History magazine and back issues of Lep-Soc News, authors reveal the decline of Cynthia in metropolitan northeast. This imported *S. cynthia* (not *S. ricini*), a native to China, was naturalized to Patterson, New Jersey, along with its favorite larval food tree Ailanthus, with intention to provide a silk industry here that failed. These silk cocoons were too difficult and costly to unravel, and threads broke easily.

South of Englewood into Hudson County industry expanded its footprint changing landscapes, altering the wetlands, including polluting the Passaic River Way, setting the stage for Cynthia to radiate out into the wastelands and neglected industrial parks. Here is a great case for deploying the phrase "…gone to benign weedy neglect …" heartily advocated by author Robert Michael Pyle. The absence of birds may indicate a natural selection favoring the moths, where polluted air and water discourage avian predators. Ailanthus was considered a weed tree, and was left to proliferate and flourish, providing shelter for Cynthia in little groves of younger trees, say under 10-15 feet high, often flourishing beside train trestles and under highway overpasses. I located cocoons suspended mostly on short silken petioles, where the larva overlays silk to secure a link to the ailanthus petiole. I'd often find 5 - 10 cocoons with varying petiole length from a few inches to sometimes one foot long strands (fig. 3), spun to anchor the cocoon to a main stem weathering winter winds (perhaps a built-in flood precaution). Several cocoons I likened to "sacred amphora" were found in the leaf litter where thrifty efforts failed a holdfast. Due to Cynthia's extraordinary beauty, I became determined to rear some back in 2002-'03. I reared three generations on Ailanthus, much scarcer on Cape Cod, and sought to photograph the remarkable stages of metamorphosis. The genus Samia has a unique trait, the distinct white tufts (fig. 4) that adorn the abdomen, as if some master designer had gone to extra measures to depict such stunning creations. I did amass a slide show of the life-cycle and metamorphosis of Cynthia. By the inbred F-3 generation, they exhibited declining vigor as the moths became smaller, without much phenotypic variation, except in all moths the lovely pink wing scales in shaded margins of post median lines became white, losing the pink hues.

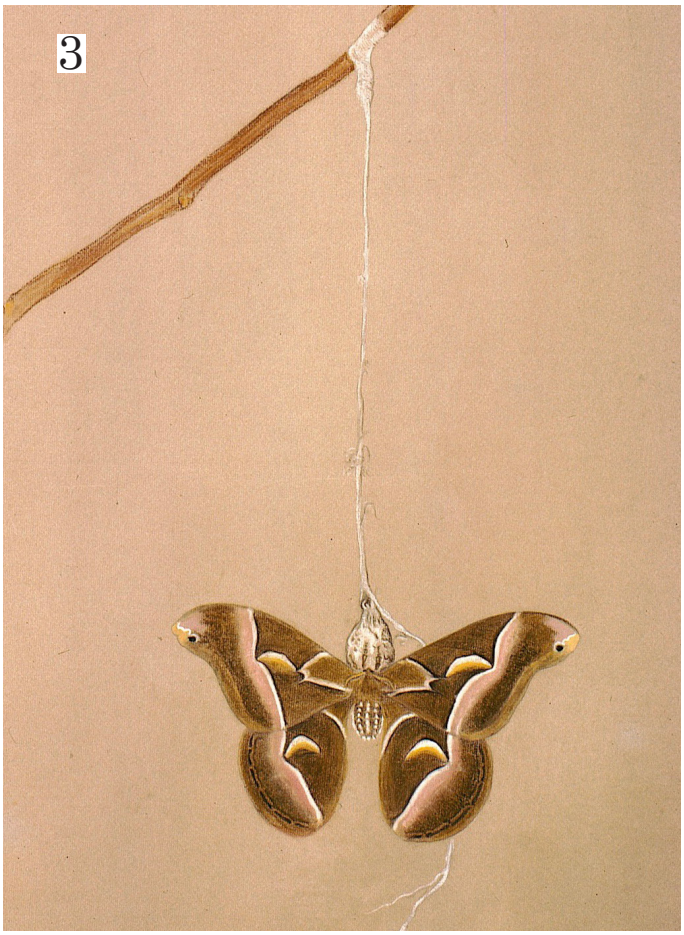


Fig. 3. Pastel painting by Tor Hansen, showing long petiole of cocoon.

Fig. 4. Female of *Samia cynthia*, showing diagnostic white tufts on the abdomen.

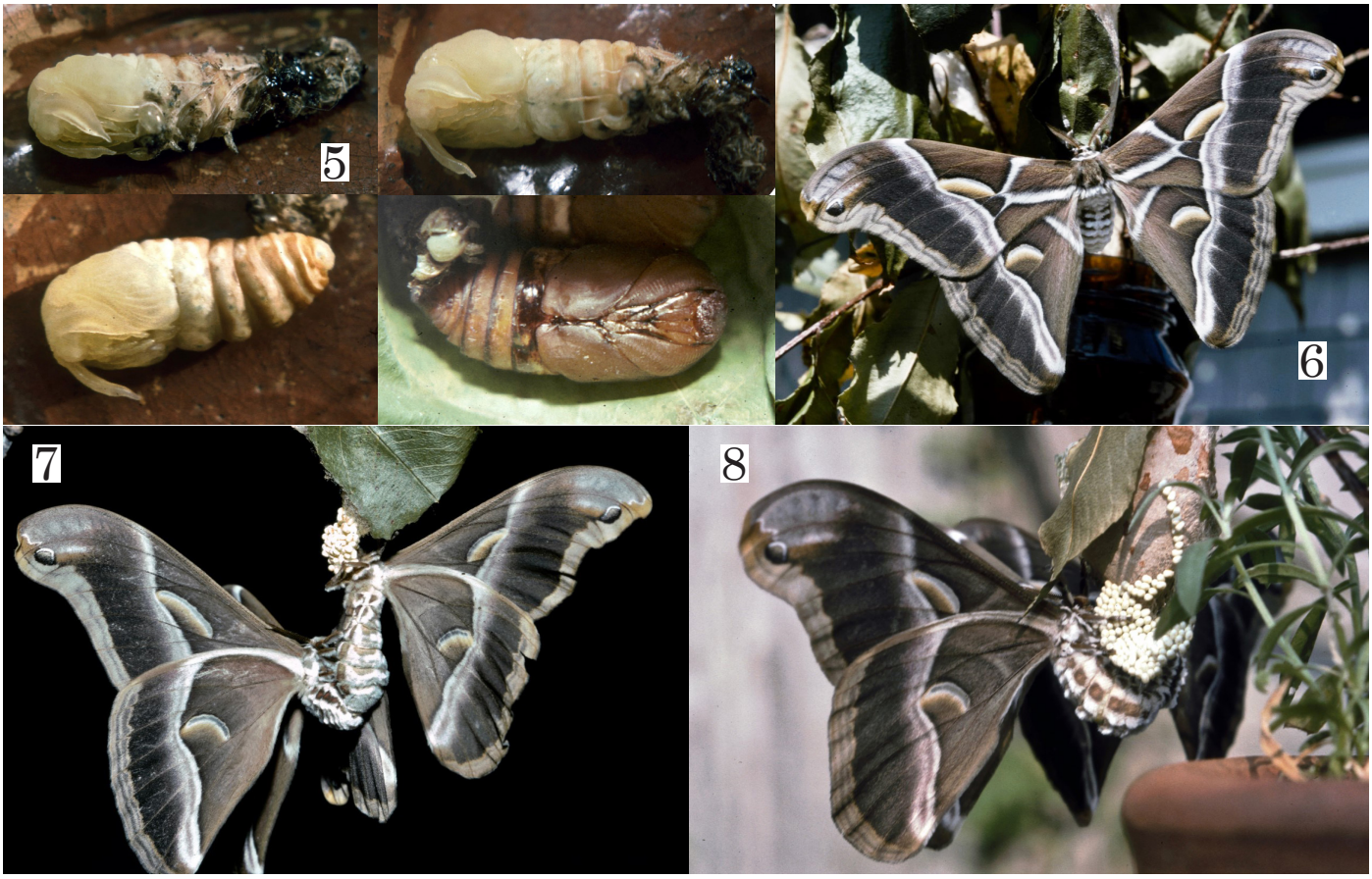
A species in the same genus is quite similar. This is the darker *S. ricini* (Figs. 6-8), from Assam, Nepal and other northern regions of India. Its larvae are similar to those of Cynthia, as is their life cycle, but *ricini* spins open cocoons (Fig. 5), and are commercially exploited producing Eri silk, a fine grade much in use for supple clothing and financial sustenance. The outer wide wing margin distal to the post median line is a deeper brown throughout. Like S. cynthia, it's larvae feed on ailanthus, but here in New Jersey and Cape Cod, *S. ricini* larvae prefer privet despite the waxy texture. I was able to complete several generations using cuttings from a tall bushy untrimmed privet growing wild in sandy soil dunes (rolling glacial sand plain) of North Truro, Cape Cod, and by trimming hedges in suburban

Englewood New Jersey well into the cooling frosty days of October when Ailanthus leaves were gone. I strongly advocate planting privet bushes in open spaces where they may grow fully branched with no trimming, so in full flower they can attract over 10 species of butterflies ranging from monarchs to viceroys, red spotted purples, hummingbird moths, ants, bees, wasps, pollinating syrphid flies, and 5 species of skippers, provided you plant flora for their larvae as well!

Reviewing the map (Peigler & Naumann), *S. wangi* is the more southerly in distribution in China, and *S. cynthia* is more northern including Korea. What an asset that privet (genus *Ligustrum*) grows naturally in China also, and expands the range of some Saturniids despite encroaching industry. Worldwide over 30 to 50 species of privet are known (privet is not native to North America).

I show here photos of Cynthia, tracing the wonder of metamorphosis beginning with a hand-held female laying eggs on a finger (fig. 9), to instar 5 larvae in characteristic copy-cat or matching posture, and 5th instar larvae with stubby blue tubercles spinning cocoons, and moths emerging, often simultaneously (figs. 10-21). The forewings fill out first; the hind wings expand last. Moths emerged in morning hours, and mated that night all from my own stock, remaining paired for 24 hours (similar to *S. ricini*). In fact, at first glance the two species look almost identical, with the darker brown of *S. ricini* suggesting just phenotypic variation. Larvae are dissimilar. I obtained no hybrids between *cynthia* and *ricini* since broods were reared in separate years. For more detailed notes on *S. ricini*'s sericulture and Eri silk, refer to Wikipedia and the econotes of Dr. Nidhi Garg. In the industrial tri-state area *S. cynthia* has found a certain "widespread niche", though it may be difficult to convince leaders of industry to refrain from removing Ailanthus trees!

A butterfly house like Magic Wings in So. Deerfield, MA can satisfy that urge to compare large silk moths with other species, and allow examination of the living spectacular giants. A striking novelty in *Attacus* larvae is that they have evolved long powdered tubercles, suggesting thorns, formidable at first but harmless to the touch (figs. 22-24). Might more inquiry into their internal chemistry enlighten us about the hidden properties that guide their survival? I look forward to learning more in research that goes beyond imaginal discs, structures that indicate centralized cellular control of metamorphic changes. (See thesis by Robert Pyle, Harvard, for such studies in *Callosamia promethea*). Although they too feed on Ailanthus, they proved harder to rear. I did get two into cocoons but no moths emerged. One can watch this stunning eclosure at the emergence cage at Magic Wings!

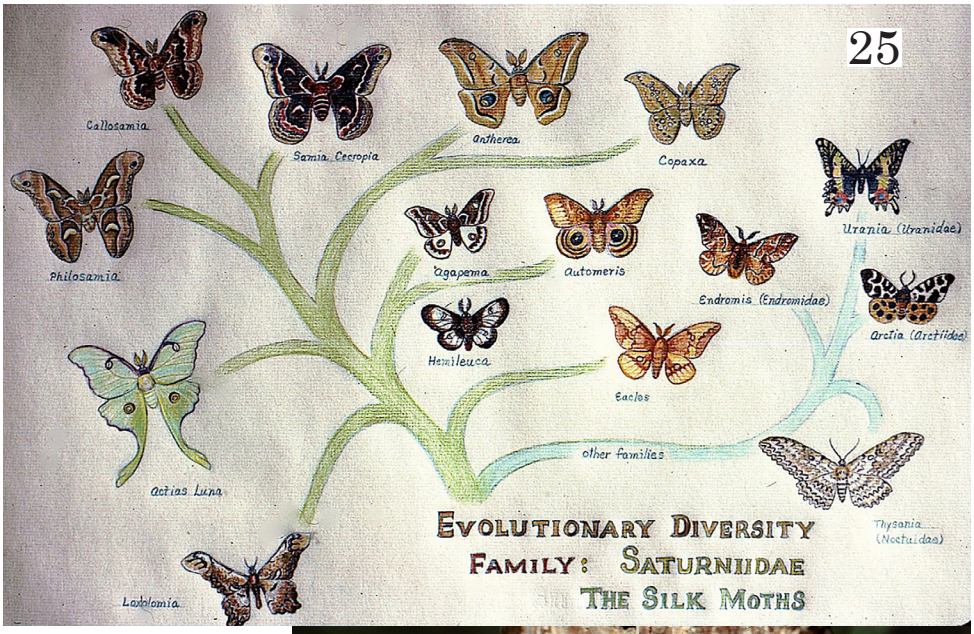



Figs. 6-9. *Samia ricini*. Fig. 6. Newly formed pupa hardening. Fig. 7. Newly emerged adult. Fig. 8. Mating pair, with female hanging on eggs already laid by another female. Fig. 9. Female laying more eggs.

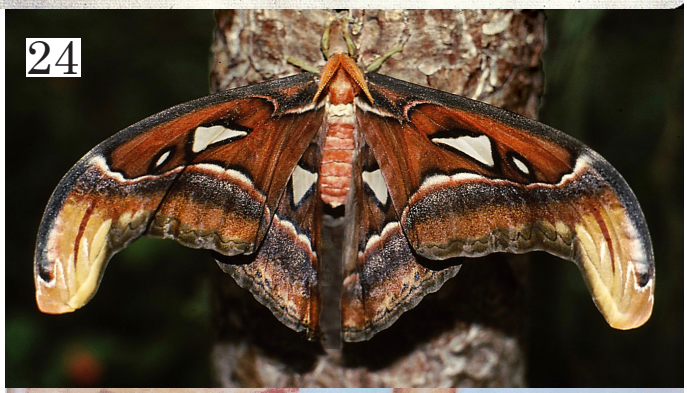
In my own collection of purchased papered specimens, courtesy of Herbert & Irene Glanz and their now extinct Butterfly Co. in Far Rockaway, New York, are specimens of various forms. An example is the genus *Attacus*, mentioned above. My riker mounts feature a*tlas, formosa, gladiator, lorquinii*, and some day the exceptional *edwardsi*. With so many untold millennia linking their ongoing evolution, one can indulge in


Figs. 9-21. *Samia cynthia*, laying egg, forming cocoons, emerging from cocoons and expanding, and newly emerged adult.

how continental drift affected their speciation, adaptive radiation, and diversification. One may enjoy musing my fanciful cladogram designed before computers offered cladistic studies (fig. 25). While studying desert biology at the Univ. of Arizona in 1971, from a papered specimen I drew this Atlas moth perched on stick of bamboo I made into a flute (fig. 26); I still enjoy fluting. Tracing their morphological changes stirs a certain zeal to pursue species continuity, as the various continents carry forth their own gene pools in their continental dance through time, like the elation of diving into a cooling swimming pool! Speculating on matters of divergent evolution are always in high regard because they lead to nice discoveries along the way. Hail Cynthia!!







Figs. 22-24. *Attacus*, larvae and adults. Fig. 26. Original drawing by Tor Hansen, *Attacus* on flute.

# New locality records of butterflies on the islands of Catanduanes and Samar, Philippines

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**Abstract**: Five new locality records of butterfly species were documented on Catanduanes and Samar islands. These butterflies belong to four families and five genera: *Appias nero* and *Parantica vitrina* on Catanduanes island, while *Burara gomata*, *Pyroneura liburnia*, and *Caleta roxus* on Samar island.

**Keywords:** *butterflies, Catanduanes, new island records, Samar*

Currently, the Philippines has 927 species and 939 subspecies of butterflies, of which 377 or 41% are endemic to the archipelago (Treadaway & Schroeder 2012). Different species and subspecies of butterflies have been described recently from various islands after the 2012 checklist such as *Arhopala hayashihisakazui* Seki & Treadaway 2013 from Luzon, *Delias diaphana treadawayi* Badon & Jakusch 2016 from Panay, *Jamides abdul mantalingenis* Schroeder & Saito 2019 from Palawan, *Appias nephele emmeli* Badon & Treadaway 2019 from south Negros, *Appias phoebe nuydai* Badon & Miller 2020 from south Negros, *Ptychandra negrosensis angelalcalai* Badon & Nuyda 2020 from Panay, and *Zethera pimplea marissae* Nuyda & Badon 2021 from Zambales, Luzon. New butterfly range extensions and locality records in the Philippines have been recorded by Harrison and Badon, 2020, Mape *et al.* 2021, Badon and Lohman 2020, Salaga *et al.* 2018, Badon and Treadaway 2019, and Badon 2014, thus expanding the knowledge on the biology and distribution of species. This paper presents new locality records of five species of butterflies in the islands of Catanduanes and Samar based on photographic evidence documented with the help of citizen scientists.

## Catanduanes Island

***Appias nero* (Fabricius 1793)**
Family Pieridae; Subfamily Pierinae

A single individual, identified as a male, was observed puddling on wet pavement at around 1:00 PM at Purok 2, San Vicente, Municipality of Virac (13.5935°N, 124.2524°E; 6.9 masl) on April 3, 2021 (Figure 1). The species was identified as *Appias nero* (Fabricius 1793) by having orange underside wings to nearly orange-red, upperside wings orange-red narrowly margined with black, upperside forewings with black veins, and forewings somewhat acute at the apex (Yata *et al.* 2010). According to Yata *et al.* (2010), *A. nero* is widely distributed in Sundaland and the Philippines but replaced in the Sulawesi region by *A. zarinda* (Boisduval 1836). In the Philippines, eight subspecies of *A. nero* are recognized: the ssp. *palawanica* Staudinger 1889 occurs in Palawan and Balabac, ssp. *domitia* (C. & R. Felder 1862) occurs in Babuyan, Batanes, Luzon, and Marinduque, ssp. *fleminius* Fruhstorfer 1911 occurs in Mindoro, ssp. *zamboanga* (C. & R. Felder 1862) occurs in Bohol, Dinagat, Leyte, Mindanao, Panaon, and Samar, ssp. *corazonae* Schröder & Treadaway 1989 occurs in Bongao, Sanga-Sanga, and Sibutu, ssp. *soranus* Fruhstorfer 1910 occurs in Cebu, Masbate, Negros, Panay, and Sibuyan, ssp. *tibericus* Fruhstorfer 1910 occurs in Basilan, and ssp. *flavius* Grose-Smith 1892 occurs in Turtle Island (Yata *et al.* 2010; Treadaway & Schroeder 2012).

***Parantica vitrina* (C. & R. Felder 1861)**
Family Nymphalidae; Subfamily Danainae

This Philippine endemic species was spotted at Tubli National High School, Sabangan, Municipality of Caramoran (13.9268°N, 124.1516°E; 5.0 masl) at around 9:00 AM of April 8, 2021. Only one individual was observed flying low near the ground and resting on the leaves (Figure 2). The species was identified as *Parantica vitrina* (C. & R. Felder 1861). Two subspecies of *P. vitrina* are recognized in the country: the nominate subspecies *vitrina* (C. & R. Felder 1861) occurs in Babuyan, Batanes, Luzon, Marinduque, and Mindoro while ssp. *oenone* (Butler 1865) occurs in Bohol, Cebu, Leyte, Mindanao, Negros, Panay, and Samar.


Fig. 1. *Appias nero.* Fig. 2. *Parantica vitrina.* Both from Catanduanes Island, Philippines.

## Samar Island

***Burara gomata* (Moore 1866)**
Family Hesperiidae; Subfamily Coeliadinae

The first reported sighting of *Burara gomata* (Moore 1866) (Figure 3) in Samar Island was on August 1, 2021. It was found resting upside down on a leaf at 11:45 a.m. in a lowland riparian forest along a rocky creek at Brgy. Lipata, Municipality of Allen in Northern Samar (12.538889°N, 124.271389°E; 55.85 masl). When disturbed, the skipper tends to fly from leaf to leaf, perching on the underside. It was identified as *B. gomata* by the narrow white band of the underside hindwing, starting from the base through the cell to margin and split in space 4–5 by the darkening along vein 5 (de Jong & Treadaway 2007; 2008). *B. gomata* is distributed in Asia, particularly in the Philippines, China, India, Vietnam, Myanmar, Laos, Malaysia, and Indonesia. In the Philippines, two subspecies are now recognized: the ssp. *lorquini* (Mabille 1876) occurs in Luzon, Mindoro, Marinduque, Leyte, and Negros while ssp. *minda* Chiba & Tsukiyama 2009 occurs in Mindanao (Chiba, 2009).

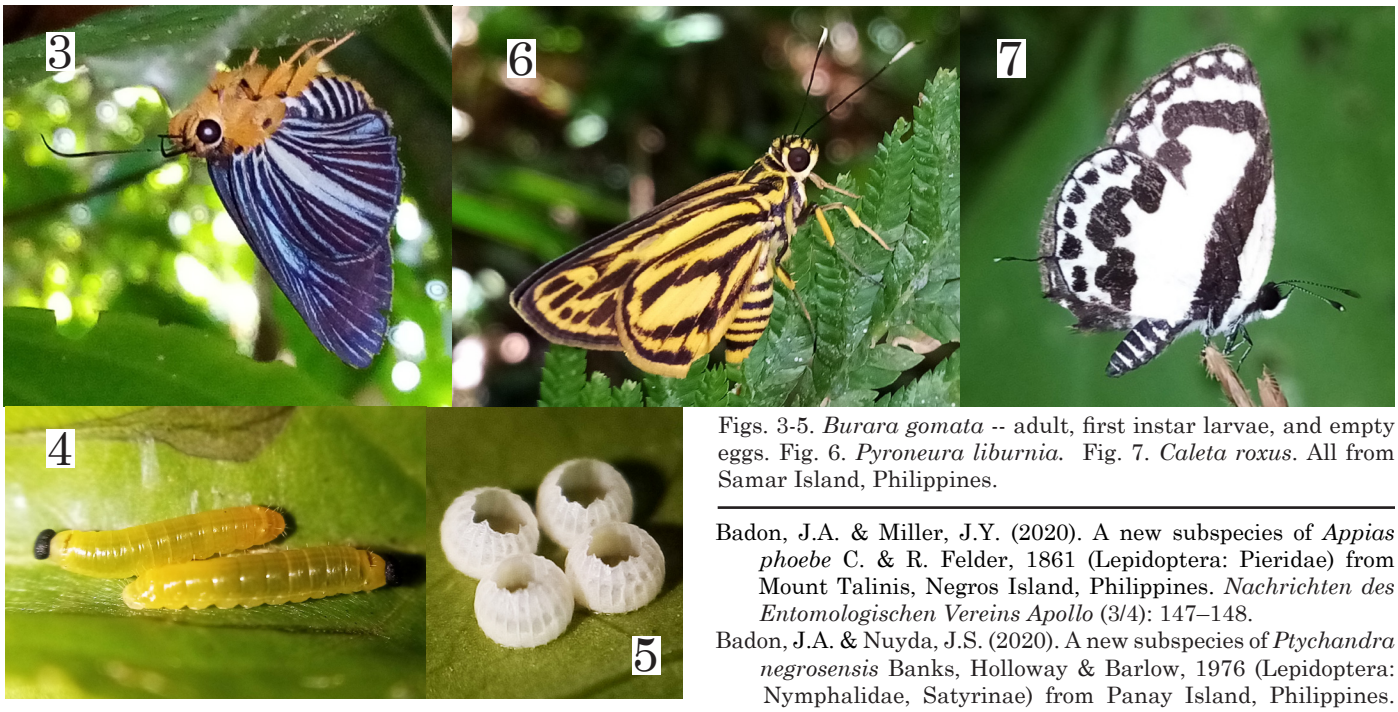
On August 27, 2021, two other sightings of *B. gomata* were recorded at Brgy. Buenos Aires, Municipality of Victoria also in Northern Samar. Four early instar larvae were encountered eating leaves of *Schefflera* sp. at Zone 5 of the mentioned barangay (12.4649°N, 124.2904°E; 5.9 masl) at around 11:00 a.m. The larvae were reared and only two individuals made it to the adult stage which pupated on September 3 and emerged on September 17 at 7:40 p.m. On the same day at about 3:00 p.m., the third observation of *B. gomata* was reported near a rice field at Zone 7 in the same barangay, where 20 empty eggs, together with the supposed newly hatched larvae, were found on the leaves of *Polyscias nodosa* (Blume) of the family Araliaceae, a new host plant. On September 1, 2021, the site was revisited, and eight larvae at their 3rd instar were found sheltered inside the folded leaves. The larvae were reared using *P. nodosa* leaves and reached the 4th instar on September 5, but after five days they were released back to their larval host plant as some of the larvae were dying. Then, on September 24, 2021, about 55 meters away from where the first reported observation of this species was documented, two 1st instar larvae (Figure 4) were found eating the leaves of *P. nodosa* together with four empty eggs (Figure 5). However, the larvae were not reared due to the unavailability of the larval hostplant outside the riparian forest.

***Pyroneura liburnia* (Hewitson, 1868)**
Family Hesperiidae; Subfamily Hesperiinae

On October 1, 2021, at about 11:30 a.m., a single individual of the species identified as the Philippine endemic *Pyroneura liburnia* (Hewitson, 1868) (Figure 6) was seen near the creek where *B. gomata* was first discovered (12.538889°N, 124.271111°E; 55.85 masl). The skipper tends to fly from leaf to leaf when disturbed. The second observation was recorded on November 2, 2021, around 1:00 p.m. at the same site. The species was identified as *P. liburnia* by the underside hindwing with a yellow streak in addition to the discal band, antennae club whitish under, and underside hindwing yellow streaks in spaces 1b and 1c not reaching beyond halfway to termen (de Jong & Treadaway 2007; 2008). Currently, seven subspecies are present in the Philippines: the ssp. *divinae* Schroeder & Treadaway 1987 occurs in Panay, Romblon, and Sibuyan; ssp. *dora* De Jong & Treadaway 1993 occurs in Mindoro and Lubang; ssp. *liburnia* Hewitson 1868 occurs in Luzon, Marinduque, and Polillo; ssp. *minda* Evans 1941 occurs in Homonhon, Leyte and Mindanao; ssp. *palawa* de Jong & Treadaway 2007 occurs in Palawan; ssp. *rosa* de Jong & Treadaway 1993 occurs in Negros; while ssp. *wita* de Jong & Treadaway 1993 occurs in Tawi-Tawi.

***Caleta roxus* (Godart, 1824)**
Family Lycaenidae; Subfamily
Lycaeninae

On January 4, 2022, at exactly 2:42 p.m., a single specimen identified as *Caleta roxus* (Godart, 1824) (Figure 7) was encountered beside the forest trail in Lipata, Municipality of Allen in Northern Samar (12°32'21" N 124°16°16° E; 55.85 masl). This butterfly is the second recorded species of the genus *Caleta* in the island. The current distribution of *C. roxus* is Bongao, Calamian, Cebu, Camiguin de




Figs. 3-5. *Burara gomata* -- adult, first instar larvae, and empty eggs. Fig. 6. *Pyroneura liburnia.* Fig. 7. *Caleta roxus*. All from Samar Island, Philippines.

Mindanao, Dinagat, Luzon, Marinduque, Masbate, Mindoro, Mindanao, Palawan, Panay, Sanga Sanga, Sibutu and Tawitawi, and is now recorded in Samar Island. The species was identified as *C. roxus* by its simple and bold dark brown spots and bars. Integrating the expanding citizen science work provides a powerful tool for butterfly monitoring especially understanding species occurrence, and geographic distribution. It is expected that more additional species and new island records will be recorded if extensive studies will be conducted on the whole island and other isolated areas.

## Acknowledgements

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# Life history notes of *Callizygaena* Felder 1874 (Lepidoptera: Zygaenidae) from Negros Island, Philippines

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**Abstract:** The immature stages of the moth *Callizygaena* Felder 1874 are described and illustrated from specimens documented feeding on *Medinilla* (Melastomataceae) on Negros island, Philippines.

**Key words:** Negros, *Callizygaena, Medinilla*, immature stages, larva, pupa, adult

The Skeletonizer moth genus *Callizygaena* was described by Felder in 1874 from type specimens of *Callizygaena nivimacula*. There are four recognized species in the Philippines: *Callizygaena flaviplaga* Hering 1928, *C. glaucon* (Semper 1898), *C. luzonensis* (Schultze 1925), and *C. semperi* (Druce 1885).

This paper describes the life history notes of *Callizygaena* cf. *glaucon* (Figures 8-11) from Negros island, Philippines.

## Immature stages description

**Early larval instars.**

The early larval stage has a distinct semi-translucent yellow-green body coloration with black spikes protruding all over its body except the underside (Figures 3-6). The black spikey structures are visible in 6 rows from side to side in top view. Spikes in the lateral rows are much lighter in coloration. Hairs are also visible coming from the black spikes. A pattern of brown spots forming a circle with a white line at the center can be seen in the top center of the body and is situated between the spikes.

**Late larval instars.**

As the larva develops into the late larval stages the size greatly increases and the coloration of the larva darkens. The spikes of the larva also darken and produce a fluid substance that enabled them to be protected from unwanted predators. The pattern of brown spots forming a circle with the white line in the center are more visible in between the spikes at the top (see Figures 4 and 6).

**Prepupa.**

When the larva reaches the prepupal stage it stops eating and will find a safe place to pupate (Figure 7). The larva will spin around and cover itself with thick silk and will then settle down.

**Pupa.**

The pupa/cocoon (Figure 7) can attach itself to any surface. It has a light brown coloration which blends in with branches, dried leaves or tree bark.

**Habitat**

The specimens were found in the Casaroro area as well as in Balinsasayao Twin Lakes Natural Park, Negros Island, Philippines.

**Hostplant**

The host plant is *Medinilla* sp. (Figures 1-2) for Negros Island. *Medinilla* Gaudich. (Melastomataceae) is native to the Old-World Tropics including the Philippines. There are approximately 400 species, with a large number occurring in the Malesian region (Bodegom and Veldkamp, 2001). The Philippines, one of the centers of diversity for *Medinilla*, hosts about eighty species (Regalado, 1995). *Medinilla* species are usually epiphytic or terrestrial shrubs, exhibiting brightly colored flowers and red-purple fruits. With that, they are commonly pollinated and dispersed by insects and animals (Kimura *et al.* 2009).

## Acknowledgements

The first author would like to thank Jean Henri Oracion and Leandro Cabrera for their assistance during the irregular visitations to Mount Talinis (especially the Apolong Trail), and the Local Government Unit (LGU) of Valencia for allowing us to study the insects of Mount Talinis on the Valencia side. The Research and Development Center through Enrique Oracion, Ph.D. provided the grants to conduct fieldwork in Balinsasayao Twin Lakes Natural Park, and Shen-Horn Yen, Ph.D. assisted in the identification of the moth.

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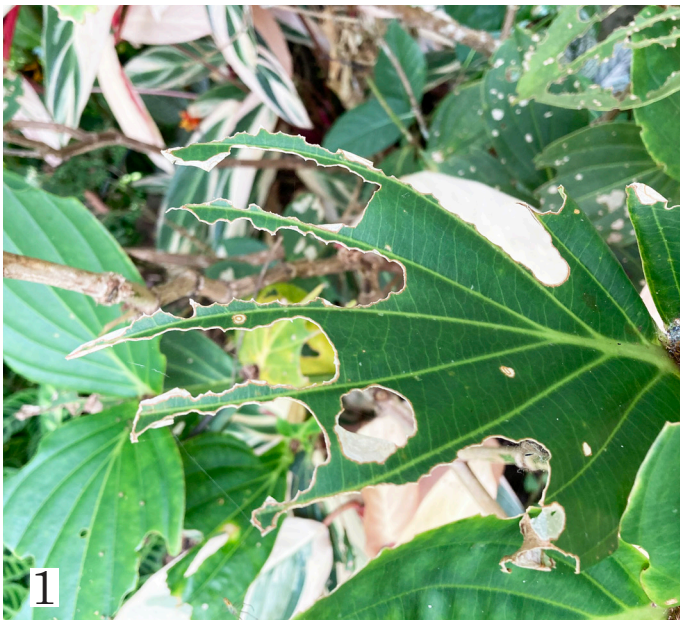
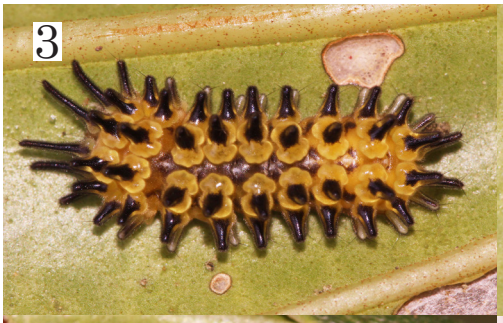
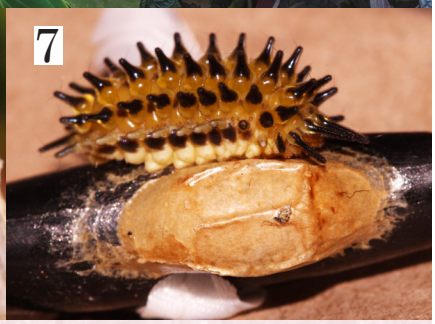




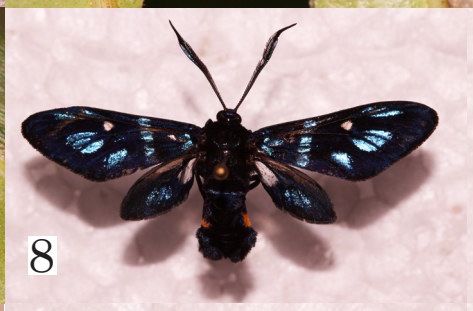
Figures 1-2. Feeding damage pattern of *Callizygaena* on *Medinilla*. Figures 3-6. Larvae. Figure 7. Pre-pupa and a pupa/cocoon. Figures 8-11. Two adults, uppersides above undersides, of the same individuals.















## Membership

The Lepidopterists' Society is open to membership for anyone interested in any aspect of lepidopterology. The only criterion for membership is that you appreciate butterflies and/or moths! To become a member, please send full dues for the current year, together with your current mailing address and a note about your particular areas of interest in Lepidoptera, to:

Kelly Richers, Treasurer
The Lepidopterists' Society
9417 Carvalho Court
Bakersfield, CA 93311

### Dues Rate

| | |
|---|---|
| Active (regular) | $ 45.00 |
| Affiliate (same address) | 10.00 |
| Student | 20.00 |
| Sustaining | 60.00 |
| (outside U.S., for above add 5$ for Mexico/Canada, and 10$ elsewhere) | |
| Life | 1800.00 |
| Institutional Subscription | 60.00 |
| Air Mail Postage, **News** ($30.00 outside North America) | 15.00 |

Students must send proof of enrollment. Please add $5.00 to your dues if you live in Canada/Mexico, $10.00 for any other country outside the U.S. to cover additional mailing costs. Remittances must be in U.S. dollars, payable to "The Lepidopterists' Society". All members receive the **Journal** and the **News** (each published quarterly). Supplements included in the News are the Membership Directory, published in even-numbered years, and the Season Summary, published annually. Additional information on membership and other aspects of the Society can be obtained from the Secretary (see address inside back cover).

## Change of Address?

Please send permanent changes of address, telephone numbers, areas of interest, or e-mail addresses to:

Chris Grinter, Assistant Secretary
The California Academy of Sciences
55 Music Concourse Drive,
San Francisco, CA 94118
cell: 847-767-9688
***cgrinter@gmail.com***

## Our Mailing List?

Contact Chris Grinter for information on mailing list rental.

## Missed or Defective Issue?

Requests for missed or defective issues should be directed to Chris Grinter. Please be certain that you've really missed an issue by waiting for a subsequent issue to arrive.

## Memoirs

**Requests for** Memoirs of the Society should be sent to the Publications Manager, Ken Bliss (address opposite).

**Submissions of** potential new Memoirs should be sent to:

Kelly M. Richers
9417 Carvalho Court
Bakersfield, CA 93311
(661) 665-1993 (home)
***kerichers@wuesd.org***

## Journal of The Lepidopterists' Society

Send inquiries to:

Keith Summerville
(see address opposite)
***ksummerville@drake.edu***

## Book Reviews

Send book reviews or new book release announcments to either of the following (do NOT send new books; authors will be put in contact with reviewers):

James K. Adams
(see address opposite)
***jadams@daltonstate.edu***

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## Submission Guidelines for the News

Submissions are always welcome! Preference is given to articles written for a non-technical but knowledgable audience, illustrated and succinct (under 1,000 words, but will take larger). Please submit in one of the following formats (in order of preference):

1. Electronically transmitted file and graphics — in some acceptable format — via e-mail. Graphics/figures should be at least 1200 x 1500 pixels/inch$^2$ for interior use, 1800 x 2100 for covers.

2. Article (and graphics) on disk or thumb drive in any of the popular formats/platforms. Indicate what format(s) your disk/article/graphics are in, and call or email if in doubt. The InDesign software can handle most common word processing software and numerous photo/graphics software. Media will be returned on request.

3. Color and B+W graphics; should be high quality images suitable for scanning. Original artwork/maps should be line drawings in pen and ink or good, clean photocopies. Color originals are preferred.

4. Typed copy, double-spaced suitable for scanning and optical character recognition.

## Submission Deadlines

Material for upcoming volumes must reach the Editor by the dates below:

| Issue | | Date Due |
|---|---|---|
| 64 | 4 Winter | November 15, 2022 |
| 65 | 1 Spring | February 15, 2023 |
| | 2 Summer | May 12, 2023 |
| | 3 Fall | August 15, 2023 |

Be aware that issues may ALREADY BE FULL by the deadlines, and so articles received close to a deadline may have to go into a future issue.

Reports for Supplement S1, the Season Summary, must reach the respective Zone Coordinator (see most recent Season Summary for your Zone) by Dec. 15. See inside back cover (facing page) for Zone Coordinator information.

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# Season Summary Zone Coordinators

Refer to Season Summary for Zone coverage details.

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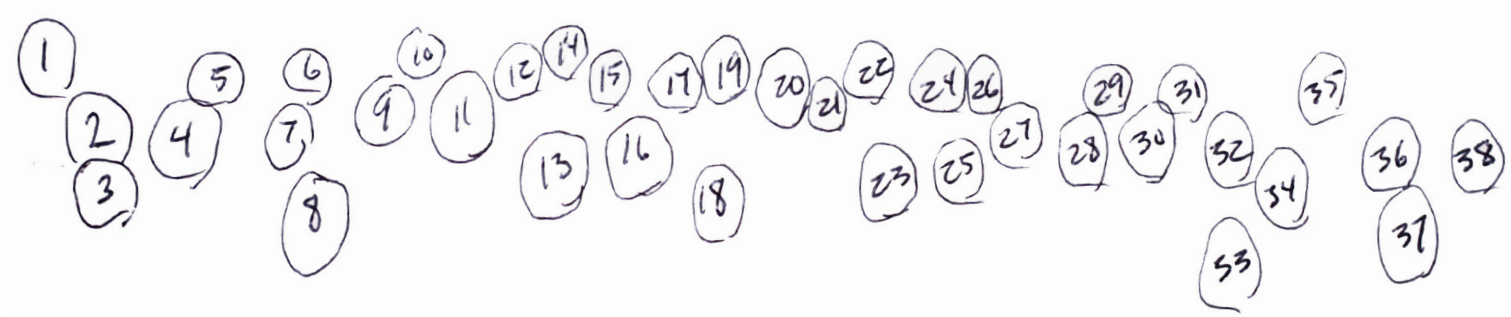


**Attendees at the 70th Annual Meeting of the Lepidopterists' Society, Western Carolina University, June 15-17, 2022:**

1. Charles Haynes, 2. Franca Haynes, 3. Kim Steese, 4. Steve Nanz, 5. Bill Russell, 6. Alex Palaoro, 7. Debbie Matthews, 8. Suellen Pometto, 9. David Arhenholz, 10. David Fine, 11. John Shuey, 12. Fred Myers, 13. John Peacock, 14. JD Turner, 15. David Lee Myers, 16. Alma Solis, 17. Terry Lott, 18. Supita Muadsub, 19. Wayne Wehling, 20. Richard Brown, 21. Tim Bonebrake, 22. Steve Roble, 23. Don Tangren, 24. Richard Teper, 25. Megan Kobiella, 26. Steve Mix, 27. Stuart Marcus, 28. Kevin Keegan, 29. Dave McCarty, 30. Nick Grishin, 31. Hugh McGuinness, 32. John Beck, 33. Evelyn Tello, 34. Rick Gilmore, 35. Tanner Matson, 36. Brian Scholtens, 37. Megan McCarty, 38. Karl Gardner