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Front Cover:

Axia margarita (Cimeliidae [formerly Axiidae]), Algarve region of southern Portugal, 26th February 2015 (photo by Eduardo Marabuto)

Species diversity and temporal distribution in a community of fruit-feeding Nymphalidae in a west Mexican neotropical garden

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KEYWORDS: tropical seasonal dry forest, temporal feeding activity, resource partitioning, fruit-feeding Nymphalidae, Elf Owl predation.

Studies of fruit-feeding tropical butterflies of the family Nymphalidae (often captured with banana baited traps) have provided a wealth of knowledge about: (1) species richness and abundance, (2) vertical distribution of species from the forest floor to the forest canopy, (3) differences in seasonality and among years, and (4) variation among forest types. In the Neotropics, most studies have been made in relatively unperturbed tropical rainforest (DeVries, *et.al.*, 1997; DeVries, *et al.*, 1999; and DeVries, & Walla, 2001).

This study of fruit-feeding nymphalids was made at a suburban location in an anthropogenically, severely disturbed region, formerly a part of an extensive western Mesoamerican (Eoearth, 2013) seasonal tropical dry forest in Mexico. Few studies of fruit-feeding nymphalid communities have been made in this forest type, whether pristine or degraded (Torres, *et al*., 2009).

This forest biome is in urgent need of conservation. In Mexico only 0.2% of this unique forest type has some sort of protection. A large protected area is the 19,200 ha Biosphere Reserve of Chamela-Cuixmala in the State of Jalisco administered by the National Autonomous University of Mexico (Chamela, 2013). Costa Rica has a protected area of tropical dry forest in the 47,000 ha Guanacaste National Park where "islands" of forest in pasture land have been tied together in a concerted effort to regenerate the original closed canopy forest (Janzen, 1988). Outside of the protected areas, most of the once vast dry forest has been converted to urban development and agriculture, including pasture.

The observations reported here describe the diversity, seasonal feeding activity, feeding time of the day, and other feeding behaviors of a guild of Mexican fruit-feeding butterflies. We discuss their species diversity as compared to what might be expected based on historic data from private and museum collections (Llorente *et al*., 2004) and range maps (Glassburg, 2007). Moreover, we point out differences in seasonal and daily feeding times that suggest partitioning of scarce fruit resources, and make observations that suggest Elf Owl predation.

MATERIALS AND METHODS

STUDY SITE

This research was conducted from 2 November 2013 to 1 April 2014 at a villa compound in La Peñita de Jaltemba in the State of Nayarit, western Mexico. Observations took place at a banana-feeding station in a small rectangular (10.5 x 14 m) "Jungle Garden" (Fig. 1a) surrounded on two sides by high concrete walls and on the other two sides by a house and an opening to a courtyard.

Fig. 1a. The "Jungle Garden." Note banana feeding tray and the shrub, *Piper* sp. (on lower right), a host plant for the Tiger Leaf-wing (*Consul fabius*). Fig. 1b. The banana feeding tray.

The "Jungle Garden" and a similar nearby garden had a dense cover of palms, broad-leafed trees and shrubs (including native *Piper* and *Cecropia*), some of which are the larval host plants of fruit-feeding nymphalid butterflies, the subject of this study. The area surrounding the study site is severely disturbed (due to urban development) tropical dry forest (Figure 2). For additional information on the study area and its vegetation, see Einem and Adkins (2010, 2014). During this study the dry season began on 1 December 2013 and continued over the course of this study, through 1 April 2014 when the study ended, and beyond.

Fig. 2a. A satellite image [Google Earth] of La Peñita de Jaltemba and the location of the "Jungle Garden" at Villa Chuparosa (red balloon **"A"** marker) one kilometer inland from Jaltemba Bay. Fig. 2b. The "Jungle Garden" below and left of the white "**A**" marker and an undeveloped lot (left of the red balloon **"A"** marker). Most undeveloped lots are cut with a machete and burned once every one to three years. Many such lots contain host plants for larval fruit-feeding Nymphalids.

STUDY GUILD

Adult butterflies of the family Nymphalidae, that are attracted to and feed upon the juices of fruits, are often referred to as "fruit-feeding nymphalids" (DeVries & Walla, 2001). The proboscises of these fruit feeders are morphologically unique as compared to those of nectar-feeding nymphalids in having a long tip-region with densely arranged sensilla forming a flat brush (Krenn *et al.*, 2001). This guild includes butterflies belonging primarily to the subfamilies Charaxinae, Morphinae, Brassolinae, and Satyrinae, and certain genera of the Limenitidinae. Fruit-feeding butterflies are attracted to bananas, and when baited and trapped in tropical forests may comprise 40 to 55% of the species richness of the nymphalid fauna (DeVries, 1987).

FIELD METHODS

In the "Jungle Garden," butterflies were provided with bananas at a single site, an orange colored plastic tray, 43 cm in diameter, mounted on a pedestal that supported the tray 33 cm above the ground level (Fig. 1b). Bananas at various stages of ripeness were obtained locally and placed on the tray early every morning. Four to seven bananas (depending on their size) were cut in half lengthwise and the pulp mashed or cut leaving the skin intact. Banana pulp or skins from the previous day's feeding were left on the tray, however, nocturnal mammals often consumed all or most of those leftovers. The tray was inspected four or five times each day and the number of each species, the date, the exact time, the weather characteristics, and feeding behaviors were recorded.

Butterfly species at the tray were classified as "fruit-feeding nymphalids" if the proboscis was extended and touched a banana. All of the butterflies seen at the tray fit this description. A few butterflies were captured for taxonomic determinations and released, or kept as specimens; however, most butterflies were identified without being disturbed because it is not known if disturbance would cause them not to return to the feeding station later on the same day or even on later days. Most species were photographed with a digital camera as a record for illustration, confirmation of identification, and for a record of feeding behaviors.

Butterflies were not marked for future identification. Therefore the number of "sightings" of two or more individuals of the same species may include butterflies observed previously. However, our "sighting frequency" may be a good measure of the relative amount of time each species fed at the tray.

ENVIRONMENT

Nymphalids, feeding on bananas, sometimes were disturbed by insects, birds, and the weather. Fruit-feeding adult insects, especially those of the orders Diptera and Hymenoptera (wasps and ants), sometimes disturbed the nymphalids, which reacted with one or more abrupt wing beats causing the intruding insect to move or fly away. Approaching birds (up to six at one time), including the Orchard Oriole (*Icterus spurious*) and the Streak-backed Oriole (*Icterus pustulatus*), caused all the butterflies to fly off; they did not return until the birds left the tray. Birds feeding at the tray were never seen attacking or preying on the butterflies, although many of the butterflies had "beak

marks" on the hindwing margin. During November and December, migrant Elf Owls often vocalized in the Jungle Garden around dawn and dusk.

The fruit-feeding nymphalids were rarely present at the feeding tray during a period of intermittent, often record-breaking rainfall near the end of the wet season. Days with exceptionally high temperatures and precipitation were noted at the feeding station between 2 November and 30 November and corroborated by data collected 15 kl south at San Poncho Weather Station.

RESULTS

SPECIES DIVERSITY

Over the five month study, from the November-December 2013 wet season through the January-March 2014 dry season, 23 species of fruit-feeding Nymphalidae were seen feeding on bananas (Table I & the pictorial guide). The number of species sighted for each of the six nymphalid subfamilies was as follows: Nymphalinae (1), Limenitidinae (6), Charaxinae (10), Morphinae (1),

Table I. 23 butterfly species observed feeding on bananas in the Jungle Garden at *"Villa Chuparosa"* in La Peñita, Nayarit, western Mexico; observation period: 2 Nov. 2013 – 1 April 2014

Family: ***Nymphalidae***		***Sighting Dates:*** ***(Sex not determined for all dates)***
Subfamily: ***Nymphalinae***		
1 *Siproeta stelenes biplagiata**	(Malachite)	**Common.**
Subfamily: ***Limenitidinae***		
2 *Historis odius dious**	(Orion Cecropian)	**8, 11, 12, 16, 24 Feb.; 3, 4, 12 Mar.**
3a *Smyrna blomfildia datis**	(Blomfild's Beauty)	**Common.**
3b *Smyrna blomfildia datis* [male]*	(Blomfild's Beauty)	
4 *Colobura dirce dirce**	(Small Beauty)	**Common**.
5 *Hamadryas guatemalena marmarice**	(Guatemalan Cracker)	**23, 24, 26 Nov.; 23 Dec.; 15, 55 Feb.; 17, 30 Mar.**
6 *Adelpha phylaca phylaca**	(Cecropia Sister)	**2, 21, 23, 24 Nov.; 3 Dec.; 24 Jan.; 20 Feb; 25 Mar.**
7 *Temenis laothoe quilpayunia**	(Orange Banner)	**3 Dec.**
Subfamily: ***Charaxinae***		
8 *Archaeoprepona demophon occidentalis**	(One-spotted Prepona)	**6 Dec.; 26 Jan.; 16, 19 Feb.; 11, 15 Mar.**
9 *Archaeoprepona demophoon mexicana**	(Two-spotted Prepona)	**3, 7, 8, 9 Mar.**
10 *Prepona laertes octavia**	(Feathered Prepona)	**31 Dec.; 2, 3 Jan.; 9 Mar.**
11 *Zaretis callidryas*	(Ghost Leafwing)	**27 Nov.**
12 *Zaretis ellops anzuletta**	(Holey Leafwing)	**16 Dec.; 6, 8 Jan.; 21 Mar.**
13 *Siderone galanthis**	(Red and Black Leafwing)	**3 Nov.; 1, 10, 16 Dec.; 1, 30, 31 Mar.**
14a *Fountainea eurypyle glanzi* [male]*	(Pointed Leafwing**)**	**3 Nov.; 1, 10, 16 Dec**
14b *Fountainea eurypyle glanzi* [female]*	(Pointed Leafwing)	**3 Jan.; 25, 28 Feb.; 30, 31 Mar.**
15 *Memphis pithyusa pithyusa**	(Pale-spotted Leafwing)	**3 Nov.; 1 Dec.; 12, 23 Feb.; 7, 25, 27 Mar**.
16 *Consul fabius cecrops**	(Tiger Leafwing)	**3 Nov.; 13, 23 Dec.; 7, 25, 27 Mar.**
17 *Anaea glycerium*	(Angled Leafwing)	**8 Mar.**
Subfamily: ***Morphinae***		
18 *Morpho polyphemus polyphemus**	(White Morpho)	**3, 4, 14, 23 Nov**.
Subfamily: ***Brassolinae***		
19a *Opsiphanes cassina fabricii* [male]*	(Split-banded Owlet)	**Common**.
19b *Opsiphanes cassina fabricii* [female]*	(Split-banded Owlet)	**Common.**
20 *Opsiphanes tamarindi tamarindi*	(Heliconia Owlet)	**6, 13 Dec.**
21 *Opsiphanes boisduvallii**	(Orange Owlet)	**2, 24, 29, 30 Nov.; 1, 4 Dec.**
Subfamily: ***Satyrinae***		
22 *Hermeuptychia sp.**	(Satyr)	**Common.**
23 *Taygetis uncinata**	(Hook-lined Ur-Satyr)	**20 Dec.; 3, 9, 11 Jan.; 25 Feb.; 8 Mar.**

*** indicates an image in the Pictorial Guide on the following pages, photographed by Gerald Einem.**

Pictorial Guide to some of the fruit-feeding ***Nymphalidae.*** Butterflies photographed feeding on bananas in the Jungle Garden at "Villa Chuparosa" in La Peñita de Jaltemba, Nayarit, Western Mexico; numbers match the numbers in Table 1.

Subfamily: ***Nymphalinae***

1 *Siproeta stelenes biplagiata* (Malachite); feeding with wings closed, it displays translucent green wing patches that resemble surrounding patches of dappled sunlight.

Subfamily: ***Limenitidinae***

2 *Historis odius dious* (Orion Cecropian)

3 *Smyrna blomfildia datis* (Blomfild's Beauty)

3b *Smyrna blomfildia datis* [Male]; ejecting fluid from the anus while feeding on a wet banana.

4 *Colobura dirce dirce* (Small Beauty)

5 *Hamadryas guatemalena marmarice* (Guatemalan Cracker)

6 *Adelpha phylaca phylaca* (Cecropia Sister)

7 *Temenis laothoe quilpayunia* (Orange Banner)

Subfamily: ***Charaxinae***

8 *Archaeoprepona demophon occidentalis* (One-spotted Prepona)

9 *Archaeoprepona demophoon mexicana* (Two-spotted Prepona)

10 *Prepona laertes octavia* (Feathered Prepona)

12 *Zaretis ellops anzuletta* (Holey Leafwing)

13 *Siderone galanthis* (Red and Black Leafwing)

14a *Fountainea eurypyle glanzi* [Male]; Butterfly on the left.

14b *Fountainea eurypyle glanzi* [Female] (Pointed Leafwing)

15 *Memphis pithyusa pithyusa* (Pale-spotted Leafwing)

16 *Consul fabius cecrops* (Tiger Leafwing)

Subfamily: ***Morphinae***

18 *Morpho polyphemus polyphemus* (White Morpho)

Subfamily: ***Brassolinae***

19a *Opsiphanes cassina fabricii* [male] (Split-banded Owlet)

19b *Opsiphanes cassina fabricii* [female] (Split-banded Owlet); as seen here, this species often fed while lying on its side.

21 *Opsiphanes boisduvallii* (Orange Owlet)

Subfamily: ***Satyrinae***

22 *Hermeuptychia sp.* (Satyr)

23 *Taygetis uncinata* (Hook-lined Ur-Satyr)

Brassolinae (3) and Satyrinae (2). A similar census the following season (2014-2015) added two additional species: *Danaus gilippus* (Queen) subfamily Danainae and *Historis acheronta* (Tailed Cecropian) subfamily Limenitidinae.

Although, throughout this study, a nearby flower garden with zinnias and lantana was very attractive to a wide variety of nectar and pollen-feeding butterflies including Nymphalidae, none of these fed at the banana feeding station. Conversely, none of the 25 species of fruit feeding butterflies fed at the flowering plants, with the exception of *Danaus gilippus*.

FEEDING ACTIVITY:

SEASONAL

The banana-feeding nymphalids sighted most frequently and during every month of this study were: *Colobura dirce* seen during 38% of the visits, *Siproeta stelenes* 36%, *Smyrna blomfildia* 20%, and *Hermeuptychia sp.* 6% and *Opsiphanes* 23% (Table II). The number of butterfly sightings per visit to the feeding station for each species/genus increased slightly from November through March except for the owlets, especially *Opsiphanes cassina*, with numerous sightings in November, which rapidly declined in December and remained infrequent from January to the end of March when the census was concluded.

Sightings of other fruit-feeding nymphalids, primarily Charaxinae, were uncommon or rare, with eight or fewer sightings from November through March. Therefore it may be premature to speculate about their seasonality (Table I). An exception was *Morpho polyphemus* whose fruit-feeding ended abruptly in late November near the end of the wet season two years in a row. During December and the dry season months, January through March, this species was not observed feeding at the bananas. Moreover, its feeding activity was within the flight-time (May-November) reported by De la Maza (1987).

TABLE II. *Seasonality*. The average number of sightings per visit of the most frequently observed species/genera of fruit-feeding nymphalids[1]

TIME (Month):		Nov	Dec	Jan	Feb	Mar	TOTAL
		[Wet Season]		[Dry Season]			
No. of Visits/Month:		**149**	**136**	**190**	**334**	**297**	**1106**
Siproeta stelenes							
Sightings:	Avg./Visit	0.28	0.31	0.31	0.36	0.47	0.36
	Total	**27**	**40**	**52**	**79**	**97**	**295**
Smyrna blomfildia							
Sightings:	Avg./Visit	0.20	0.24	0.30	0.48	0.28	0.20
	Total	**19**	**31**	**50**	**105**	**57**	**262**
Colobura dirce							
Sightings:	Avg./Visit	0.07	0.19	0.34	0.53	0.52	0.38
	Total	**7**	**24**	**56**	**116**	**108**	**311**
Hermeuptychia							
Sightings:	Avg./Visit	0.05	0.04	0.11	0.03	0.07	0.06
	Total	**5**	**5**	**18**	**6**	**15**	**49**
Opsiphanes (3 species) [2]							
Sightings:	Avg./Visit	0.96	0.28	0.11	0.12	0.10	0.23
	Total	**91**	**36**	**14**	**28**	**20**	**189**

[1] Individual butterflies may have been counted more than once at different times of the same day or on different days because butterflies were counted without taking specimens. Total visits to the feeding station: 1106.
[2] A sample (N=11) of *Opsiphanes*, captured and released, were identified as follows: *Opsiphanes cassina*, 9; *O. boisduvallii*, 1; *O. tamarindi*, 1.

FEEDING ACTIVITY:

TIME OF THE DAY

Frequent observations, during the daylight hours over 151 consecutive days, showed some species specific feeding times among fruit-feeding Nymphalidae. This was most notable for the crepuscular owlets, *Opsiphanes cassina fabricii* and *Opsiphanes tamarindi*, that fed primarily during morning twilight; however, the feeding increased again, but to a lesser extent, during evening twilight (Table III). Nevertheless, the owlet *Opsiphanes boisduvallii* was not observed feeding during the morning or evening twilight surge in crepuscular owlet numbers. Our *O. boisduvallii* feeding times ranged from 08:40 h to 15:20 h.

To determine the early morning arrival time of crepuscular owlets at the feeding tray, the observer (G.E.) was stationed at the tray in the dark, before dawn each day. For example, on 12 December the first butterflies to arrive were four *O. cassina fabricii* seen with a flashlight circling low above the bananas and landing near dawn between 05:55 h and 06:01 h. During November and December crepuscular owlets left the bananas by 08:30 h and during this time seldom shared the fruit with other species except the satyrs *Taygetis uncinata* and *Hermeuptychia sp. Taygetis uncinata* was observed feeding on 20 December at 07:00 h and *Hermeuptychia sp.* on 16 and 19 December at 07:45 h and 07:00 h respectively.

During November and December a second, but much smaller surge in the number of sightings of crepuscular owlets began at about 16:20h (Table III). For example, on 14 November two *O. cassina fabricii*, first seen feeding in the evening twilight at 17:22 h, fed continuously until 17:58 h, about one hour after dusk. The satyr, *Taygetis uncinata*, is also both crepuscular and nocturnal. One observed feeding on 9 January at 16:55 h, during evening twilight, fed continuously until after dark at18:59 h when it flew away. Moreover, the satyr *Hermeuptychia sp.* fed on 20 March until 17:52h. Both species of Satyrinae also fed periodically throughout the daylight hours.

In summary, of the 23 species of fruit-feeding Nymphalidae observed, at least two species, *Opsiphanes cassina* and *Taygetis uncinata*, were crepuscular and nocturnal, feeding after evening twilight. Four nymphalids (*Smyrna blomfildia, C. dirce, O. tamarindi* and *Hermeuptychia sp.)* were crepuscular but not nocturnal. However, 17 species, primarily *Charaxinae,* fed on the bananas sometime after sunrise but before sunset.

DISCUSSION

SPECIES RICHNESS

A comparison of the 23 banana-feeding species of nymphalid species observed during this five month study (2013-2014) to the number of species expected based on historic data from museum or private collections (Lorente *et al*., 2004) or range maps (Glassburg, 2007), shows some differences as follows:

(1) **Nymphalinae,** we sighted one species (*Siproeta stelenes*). Many of the 19 species (based on range maps) in this subfamily may not be fruit-feeding.

(2) **Limenitidinae,** we sighted six species but the potential number is not known because the fruit-feeding habits of many species are unknown. However, based on range maps, 30 or fewer species belonging to this subfamily are found in this region.

Table III: Time of day banana feeding by three species of Owlet Butterflies (Genus *Opsiphanes*) by sightings

Time	06:00-08:00h	08:00-10:00h	10:00-12:00h	12:00-14:00h	14:00-16:00h	16:00-18:00h
Total Visits[1] [B]	36	20	15	28	24	17
Visits[1] -- Owlets Absent	4	13	12	23	22	9
Visits[1] -- With one or more Owlets present	32	7	3	5	2	8
Total Owlet Sightings[2] [A]	92	11	4	5	3	12
Average No. Of Owlets Per Visit -- A/B = [C]	2.56	0.55	0.27	0.18	0.125	0.71

Observations were made from 2 November to 11 December 2013 (40 days).
The feeding station was visited 3 or 4 times each day.
Crepuscular owlet butterflies primarily *O. cassina fabricii* and two *O. tamarindi*, fed from 06:00h to 08:00h and then again from 17:00h to 18:00h.
Almost all of the owlets feeding between 09:00h and 13:00h were *O. boisduvallii*.

[1] Observation Visits to the feeding tray
[2] Owlet sightings may include the same butterfly seen again at a different time of the day or on a different day.

(3) **Charaxinae**, we sighted 10 species or 71% of those known from Nayarit, or 77% of those expected based on range maps.

(4) **Morphinae,** we sighted one species or 100% of those expected.

(5) **Brassolinae,** we sighted three species or 100% of those expected.

(6) **Satyrinae,** we sighted only two species, 8% of the 27 species known from Nayarit, or 13% of species based on range maps.

Fruit-feeding nymphalids known from the State of Nayarit but not sighted at the feeding station may reside in different geographic areas, *i.e.*, mangrove or mountainous areas rather than the hilly coastal area, where this study took place. For example, based on range maps, *Smyrna karwinskii* might be expected to appear at the feeding tray in the Jungle Garden; however, in the winter this species roosts gregariously at higher altitudes and was absent from both the garden and the feeding station. Nevertheless, its similar looking congener *S. blomfildia* roosted and fed on the bananas in the Jungle Garden (Einem & Adkins, 2010). Others, especially Satyrinae, may be so restricted to closed forest that they are unable to make their way across open areas between tiny remnant forest patches.

Some missing species may have been extirpated by habitat degradation causing a loss of larval host plants or native fruit suitable for consumption by adult butterflies. However, microhabitats within the hilly coastal plain that provide a more hospitable environment than our study site, might harbor some of the missing fruit-feeders. Moreover, if a nymphalid's flight-time is limited to a period between April and October, outside of the months of this study, it would not have been seen.

Despite the degradation of the tropical dry forest there remains at this site a modest representation of the historic fruit-feeding butterfly fauna, represented here by at least 70% of expected *Charaxinae* or leaf butterflies and all of expected *Morphinae* and *Brassolinae*. Conservation of the current butterfly fauna could be enhanced by integrating larval host plants into residential landscaping as has been done at the Jungle Garden; however, nearby vacant lots, ripe for development, pose a threat because they harbor the host plants that sustain most of the current butterfly populations.

TEMPORAL RESOURCE PARTITIONING

Fruit-feeding Nymphalidae, residents of the tropical dry forest, are in competition with each other for scarce fruit resources. However, competition may be reduced by sex-dependent seasonal feeding activity (Torres *et al*., 2009) or, as suggested by our observations, by either seasonal (wet and dry) or diel (time of day) feeding activity. In this study, for example, *Morpho polyphemus* abruptly stopped feeding at the end of November, probably an adaptation to, at least in part, increased competition during an ensuing fruit scarce dry season. Moreover, crepuscular *Opsiphanes* and *Taygetis* may partition scarce fruit resources by feeding primarily during morning and evening twilight while most of the other 23 nymphalids fed after sunrise and stopped feeding well before dusk. In Costa Rica, DeVries (1987) found that *Taygetis* exhibits diversity in feeding activity including some individuals that may be nocturnal.

OWLETS AND ELF OWLS

In November the crepuscular owlet butterflies (primarily *Opsiphanes cassina fabricii*) were the most frequently sighted nymphalids at the feeding station; however, sightings declined rapidly during December and January (Table III). The decline corresponded with the arrival of migrant Elf Owls (*Micrathene whitneyi*) which winter in southwestern Mexico, including the State of Nayarit, and breed in New Mexico, Arizona, and northern Mexico. From mid-November to mid-January this tiny owl was frequently heard calling from the Jungle Garden around dawn, when

the first owlet butterflies arrived each morning, and again after dusk (the end of twilight) or early in the evening at which time the last owlets departed from the feeding station each night.

The Elf Owl is nocturnal and crepuscular and feeds mostly around dawn and after dusk on arthropods, mainly insects (Ligon, 1968). We suspect that predation by the Elf Owl is at least partly responsible for the rapid decline in owlet butterfly sightings in December and January, with predation occurring around dawn or dusk when the crepuscular owlet butterflies are arriving at or leaving the feeding station to return to a nocturnal roost. However, Elf Owls were never seen preying on owlets in the garden or at the banana feeding tray, suggesting they may prey on them during early morning twilight, late evening twilight, or at night when they could not be seen but were often heard.

Our observation of *Opsiphanes boisduvallii* show that it is not crepuscular in its feeding habits. This species fed primarily around midday suggesting that it may avoid Elf Owl predation that way. Nevertheless, *O. boisduvallii* may be preyed upon when roosting at night. A surge in *O. boisduvallii* sightings that began on 28 November declined by 5 December during a period of almost daily dawn and dusk Elf Owl vocalization in or near the Jungle Garden.

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"I came across these gaudy arctiine moths in mid-February 2015 as they mated on the gravel path in the morning as I hiked up Sierra Chincua in search of the Monarch butterfly overwintering site at the top of the mountain. They are *Chrysocale principalis* (Walker, 1864), also called the Princely Tiger Moth, and they have been reported in Mexico, Guatemala, and Texas. One source classifies them as belonging to the subtribe Euchromiina, but that is all that seems to be published about this species. The male in my photograph is facing to the right, identified by the feathery plumose antennae." Photo by Carol A. Butler, **cabutler1@verizon.net.**

Windows for butterfly nets

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Many of the fabrics used for butterfly nets obscure the view of what we've caught. So, putting in a window seemed to make sense. For a first try I used clear mylar. This was fairly satisfactory but often had bothersome reflections, especially after the net had been used a bit and the mylar became crinkly (Fig.1).

Figure 1. Snowberry Checkerspot (*Euphydryas colon* W. H. Edwards) through mylar window.

As a second approach, I used a very fine nylon mesh, labeled "Matte Tulle Black" at the fabric store and having about 25 strands per inch. It solves the reflections problem but shows up in photos (Fig. 2). For a while I left both mylar and mesh windows in the net. But the mylar often created a reflective background when photos were taken through the mesh. Butterflies don't snag themselves on the fine mesh, and so far there's been no problem of the light mesh getting snagged or torn on shrubbery.

Figure 2. Lorquin's Admiral (*Liminitus lorquini* Boisduval) through mesh window.

Both approaches are great for identifying what you've caught and sharing it with others. (Our Washington Butterfly Association is mostly a catch-and-release group, typically putting a butterfly in a specimen jar to facilitate identification and sharing, then releasing it. A window can often shortcut this.) Because butterflies tend to crawl away from a window, it is probably good to make it as wide as the flattened net is near its tip, reducing the likelihood that they'll crawl out of sight.

Mead specimen provenance, including *Hesperia colorado*

Continued from p. 181

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Papaipema aweme, Minnesota: Roseau County, N 49.9997, W 95.8500, 29-VIII-2015, specimen and photo from J. Vargo. Thanks to Kyle Johnson for discovering this near-the-Canadian-border, difficult-to-reach location for this species.

Announcements:

ZONE COORDINATOR NEEDED!

Due to a retirement there is one Season Summary Zone Coordinators position open. Thanks to Thomas Jantscher for taking over the Midwest, and Crispin Guppy for taking over the Far North. The following Zone is the one that still needs a coordinator.

Zone 5: Great Plains: Saskatchewan, Manitoba, North Dakota, South Dakota, Nebraska, Kansas & Oklahoma.

If you are interested in becoming a Season Summary Zone Coordinator, please contact the Season Summary Editor, Leroy C. Koehn at **Leptraps@aol.com,** for a complete description and requirements.

PLEASE send Zone 5 records directly to Leroy Koehn if you haven't already done so. Your Season Summary records are already due, as of Dec. 1, 2015. If you don't have your records in to your Zone Coordinator yet, please get them in **IMMEDIATELY**.

Photographs for Front and Back Covers of the Season Summary

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 is actually reported in the Season Summary.

Leroy C. Koehn, Season Summary Editor, 3000 Fairway Court, Georgetown, KY 40324-9454, **Leptraps@aol.com**

The 65th Annual Meeting of The Lepidopterists' Society, July 6-10, 2016, at Florissant, Colorado

The 2016 Annual Meeting of The Lepidopterists' Society will be held from Wednesday, July 6, to Sunday, July 10, at The Nature Place, a superb conference center sponsored by the Colorado Outdoor Education Center and located near the tiny town of Florissant at 8800 feet elevation, a few miles west of Pikes Peak in the Colorado Rockies. Beautiful facilities, an incredible mountain environment of flower-filled meadows and pine-fir forests, an amazing diversity of Lepidoptera, and cool summer weather combine to make a perfect meeting site where you can step out your front door to be immersed in Nature while enjoying a fantastic meeting in a most relaxing and fun-filled atmosphere with your fellow lepidopterists.

The setting is exceptional, the food is superb, and The Nature Place staff will help to make this an outstanding meeting, one that your family will enjoy and one in which you can collect, photograph, and watch many of Colorado's almost 300 species of butterflies around you while walking to the spacious lodge or spending each night at the moth sheets with well over 1,000 species of nocturnal Lepidoptera potentially flocking to your lights.

The organizing committee, including Tom Emmel, Jackie Miller, Charles Covell, Andrei Sourakov, Andy Warren, and Todd Gilligan (and growing daily) is already planning an outstanding program of papers and field trips. So set these dates aside now for the "Lep Soc Meeting" in your 2016 calendar and travel plans. We will be doing a direct mailing in late September to every Lepidopterists' Society member (and several other lepidopterist organizations that are interested in participating jointly), which will include full information for early registration, facilities available, activities, and an invitation to participate in the program. These items will also be placed online for ease of reference and access. It is anticipated that travel grants and student support will be available by application so that younger members especially can be encouraged to pursue attending this meeting where as many as 200 avid, knowledgeable and highly enthusiastic lepidopterists will be helpful mentors! Come one, come all! Plan now to attend.

Corrections to items in the Fall 2015 News (vol. 57:3)

In the last issue of the News, the article on the first record of *Lethe creola* in Florida inadvertently contained the wrong figure. The correct figure and caption are below:

Fig.1. First confirmed record of *L. creola* in Florida: Nassau Co., 26.VIII.2012, RSMSF (Bill Berthet).

Need curriculum ideas to teach youngsters about leps? -- *Carol Butler*

There are plenty of high quality lesson plans and materials available for getting students interested in Lepidoptera before they go to high school or college. Please share this material- it is suitable for classrooms and home schooling as well as for nature center and museum classes. Some of the material uses the general interest in monarchs as a starting point, but the content includes all the basic aspects of insect biology and behavior. We want more students to become future Lepsoc members, so let's help get them started.

A national 4-H curriculum that was developed with the Florida Museum of Natural History for grades 4-8 includes a youth guide and a leader guide as well as an interactive website. Check out **https://www.flmnh.ufl.edu/wings/Doc/WINGS_4H_overview.pdf**

Karen Oberhauser's "Monarchs and More: An Inquiry and Arthropod Based Curriculum" is a series of three thick, spiral-bound manuals that contains a wealth of information, activities, suggestions for field trip record-keeping, drawings and designs that can be copied for student handouts, and an extensive series of detailed lesson plans about ecology, systematics, experiments, life cycle, and many more areas of interest. There is a version for middle school, grades 3 to 6, and for K to 2. Produced by Monarchs in the Classroom, University of Minnesota. **http://monarchlab.org/store/monarchs-and-more-curriculum-guides-4th-edition**

Ba Rea and Karen Oberhauser produced a beautifully illustrated field guide to the invertebrate community in the milkweed patch, "Milkweeds, Monarchs and More", that is useful for all grades. **http://monarchlab.org/store/milkweed-monarchs-more**

There is also an "enlarged and updated version" that contains larger photos, a glossary, and an expanded milkweed section that includes more species. **http://monarchlab.org/store/second-edition-milkweed-monarchs-more**

"Learning from Monarchs: A Teachers' Handbook" also looks promising. **http://monarchlab.org/store/learning-from-monarchs-a-teachers-handbook**

The Joan Mosenthal DeWind Award

The Xerces Society is now accepting applications for two $3,750 awards for research into Lepidoptera conservation.

SUBMISSION REQUIREMENTS

The DeWind Awards are given to students who are engaged in research leading to a university degree related to Lepidoptera conservation and who intend to continue to work in this field. All proposals must be written by the student researcher. Proposed research should have a clear connection to Lepidoptera conservation and must be completed within one year from receiving funds. Applicants may be graduate or undergraduate students; however, please note that all but one awardee, to date, have been pursuing graduate research. Applications from countries outside the United States will be considered but must be written in English and international applicant work cannot involve work in the United States.

The submission deadline is Sunday, December 27, 2015 at 11:59 PM PDT. Award winners will be announced by March 31, 2016, with the awards given by May 2016.

Instructions for Submitting the Proposal:

All proposals must be submitted by email to dewind@xerces.org. The proposal should be attached as a single file in PDF format. The subject line of the email should read "DeWind Award Proposal 2016."

Proposal Format (all text should use **12 pt font** and **one inch margins**)

1. Cover page (1 page)
   a. Title. List the title in Bold.
   b. Contact information. Provide the name and contact information for the applicant and his or her major advisor. Include institutional affiliations, complete mailing address, and country. Also provide an email address and telephone number (include country code if outside the United States).
   c. Abstract. Include a project summary immediately following the title and contact information. The summary should be limited to 100 words and should not exceed one paragraph.

2. Proposal body (2 pages). Begin with a clear statement of the problem or objectives, follow with a clear methods section, and end with a substantial conclusion. The proposal should include a discussion of potential conservation applications and results, and what products, if any, will result from this work.

3. Additional information. On separate pages, please include all of the following information: cited literature, detailed project budget, project timeline, and a short (2 pages or less) CV. It is the goal of the DeWind Award that the funds be used for direct research-related expenses; overhead and/or administrative fees are considered ineligible.

4. Please include all of the materials as a single attachment. No other attachments or supporting materials should be included.

For more information, to download a PDF of the submission guidelines, and to read summaries of previous award winning projects, please visit **http://www.xerces.org/joan-dewind-award/**.

The Xerces Society for Invertebrate Conservation
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Assessing specimen provenance through the writings of Theodore L. Mead, with notes on his specimens of *Hesperia colorado* (Hesperiidae)

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One of the greatest challenges facing historical entomologists is determining the provenance of old specimens. This is especially important when they are holotypes, or part of a type series that represents the concept of a taxon as perceived by its author(s). Unraveling the history of a single specimen can sometimes have a profound impact on our understanding of a named taxon. It is also a lot of fun to uncover new information about old specimens.

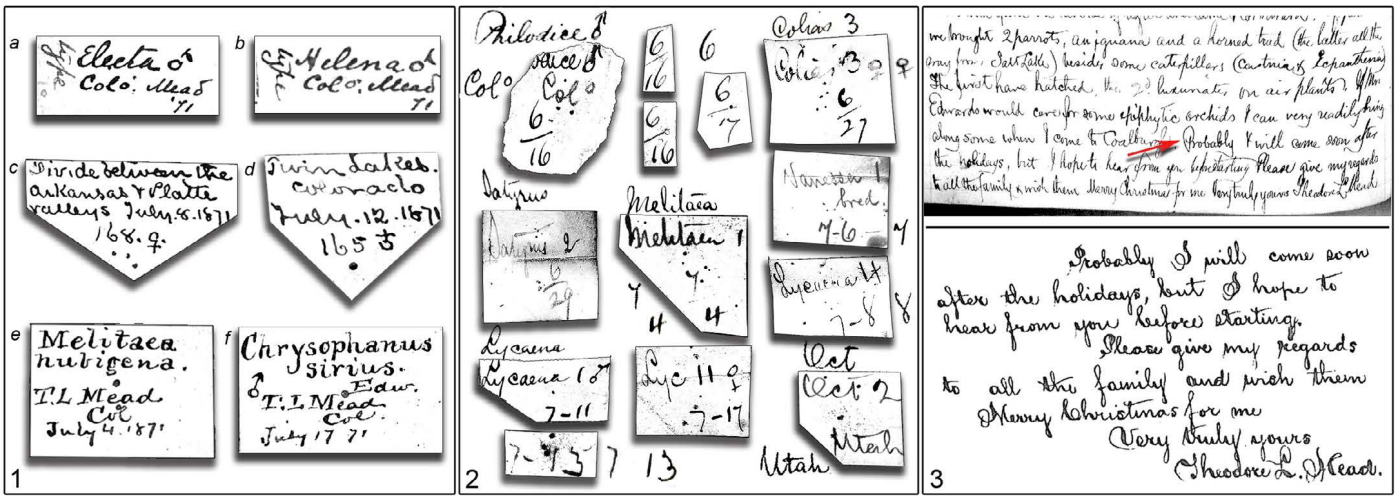
Labels associated with old specimens can potentially reveal much about who collected and examined them. However, labels do not always include the collector's name, so a bit of detective work may be required. I am often faced with this dilemma, forcing me to consult other resources to solve the mystery. I encountered this problem during my extensive research of the travels of the naturalist Theodore L. Mead (1852-1936). In 1871, Mead spent several months exploring the western states, especially Colorado. He collected thousands of butterflies, which he sent back to the prominent lepidopterist William H. Edwards in West Virginia. All the specimens that Mead collected during his trip were sent to Edwards in paper envelopes, which Mead folded as we do today, resulting in a triangular shape (Calhoun 2015a). Mead wrote the date of capture on each envelope, which evidently contained a single specimen. Upon receipt, Edwards kept Mead's specimens in their original envelopes, assuring Mead that he would not remove most of them "further than to make sense of the species." After grouping them by species, Edwards inserted the specimens, still in their field envelopes, into larger letter envelopes, which were then placed into "strongly scented" cigar boxes to deter mold and insect pests (Calhoun 2015a). There is no evidence that Edwards permanently removed any specimens from Mead's field envelopes until he mounted them. The sheer volume of Mead's material was daunting, totaling over 4,000 specimens. Referring to just one shipment, Edwards wrote that he "could not think of spreading such a lot, and of duplicates there would be no need to." Edwards mounted a selection of species from each shipment, and sent a few duplicates in Mead's original envelopes to the California lepidopterist Henry Edwards for his opinion about their identity. William H. Edwards described a number of new taxa based on Mead's specimens.

Shortly after Mead returned home, he and W. H. Edwards divvied up all the specimens that had been collected. Mead retained most of his share in their original envelopes, which made it easier to sell or exchange them with correspondents. Edwards mounted what he wanted of his share, then sold and exchanged what remained of the papered material in his possession. He possibly also returned papered specimens to Mead. In 1884, Mead's collection was purchased by the lepidopterist William J. Holland, who purchased Edwards' collection the following year. In 1898 (not 1896-1897 as sometimes reported), Holland's collection was transferred to the Carnegie Museum (now the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania; CMNH), where he served as director from 1898 to 1926. Holland also served as the curator of entomology during the early years of the museum. He retained ownership of his collection for some time after it arrived at the museum.

Before sending Mead's specimens to Holland, Edwards prepared labels that usually included the species' name and a reference to the state in which the specimen was collected (e.g. "Col^{o}" =Colorado). He sometimes also added Mead's name and the collection year (e.g. "71" =1871) (Fig. 1; a, b). Edwards had previously prepared similar labels for mounted specimens that he sent to correspondents. In addition to those at CMNH, a large number of Mead's specimens are preserved in other museums, including the Museum of Comparative Zoology (Harvard University, Cambridge, Massachusetts; MCZ) and the Peabody Museum of Natural History (Yale University, New Haven, Connecticut; PMNH). Many of those specimens possess labels that were prepared by Mead's correspondents, such as Herbert K. Morrison (Fig. 1; c, d) and Charles P. Whitney (Fig. 1; e, f).

Envelope notations

Affixed to many of Mead's specimens from 1871 are small clippings of paper that typically include a handwritten genus name and date (Fig. 2). The late lepidopterist F. Martin Brown deduced that such clippings were cut from Mead's original field envelopes. Evidence indicates that after acquiring Mead's collection, Holland began to mount the papered material. The bulk of the specimens were probably mounted after they were transferred to CMNH, when Holland could assign the task to assistants at the museum. Mead's notations were cut from the envelopes and placed onto the pins of the corresponding specimens. Similar clippings on Mead's specimens at MCZ reveal that the Massachusetts entomologist Samuel H. Scudder also



Figs. 1-3. Handwriting examples (color removed and contrast enhanced; not to scale). 1) Labels from Mead's specimens: a, b, W. H. Edwards (CMNH); c, d, H. K. Morrison (MCZ*); e, f, C. P. Whitney (PMNH: YPM ENT799979, YPM ENT 74689). 2) Envelope clippings from Mead's specimens (CMNH and MCZ*), with corresponding samples of Mead's handwriting. 3) Letter to W. H. Edwards, 21.xii.1871. Top: Mead's copy (RC); bottom: letter received by Edwards (WVSA). Arrow indicates the beginning of the passage shown in the letter below. (*© President and Fellows of Harvard College).

used Mead's envelope notations as makeshift data labels (Calhoun 2015a).

To confirm Brown's assessment of the envelope clippings, I compared their notations with known samples of Mead's handwriting. I frequently use this method of direct comparison to identify handwriting on labels, books, and documents. Fortunately, I have access to a wealth of Mead's documents, including letters and copy letters that he wrote during the period 1869-1882, when he was most entomologically active. The bulk of these manuscripts are preserved at Rollins College (Winter Park, Florida). In addition, I possess Mead's personal journal from 1871, which details his trip to Colorado (Calhoun 2010, 2015a).

Like most of us, Mead's penmanship was extremely variable, depending upon urgency, purpose, size, writing implement, paper, medium (ink or graphite), and his age (Fig. 3). The type and quality of the pen nibs that he used also impacted his writing. He sometimes composed in a very formal calligraphic style. At other times, when precision was less important, his writing was scarcely legible (Fig. 3, top). He often incorporated multiple writing styles within the same document, switching back and forth as the mood struck him, or to draw attention to a particular passage. Letters that he mailed to his lepidopterist correspondents were usually written with a more deliberate flair, a form of Spencerian Script, which was a common writing style during the late nineteenth and early twentieth centuries (Fig. 3, bottom). When he embarked on his trip in 1871, he was only 19 years old. His handwriting exhibited youthful enthusiasm, creativity, and a maturing style. Despite this variation, Mead's script exhibits certain unique physical characteristics and patterns that he retained for the remainder of his life. Like fingerprints, such combinations of features help to distinguish his longhand. After examining thousands of examples of Mead's writing, I have concluded that the notations on the specimen clippings are indeed consistent with his hand (Figs. 2, 3). The quality and color of the inks that Mead used varied, and some have faded more than others. When he used the same type of ink for both his journal entry and envelope, it was inclined to fade equally.

Mead routinely recorded data on his envelopes during the evenings. As Mead explained to Edwards in 1871, "As you see I only put the date on each paper because a good days catch takes four hours or more to put away and label and I keep an accurate record of my whereabouts." His "accurate record" was his personal journal. Mead's habit of writing dates on his envelopes soon after capture, and shipping the specimens to Edwards at regular intervals, increases the likelihood that the data he recorded is accurate.

During June and early July of 1871, Mead had a tendency to format the dates on his envelopes as "6/29" (i.e. June 29), positioned vertically with the month above and the day below (Fig. 2). During the rest of his 1871 trip to Colorado and beyond, he usually wrote the dates as "7-17" (i.e. July 17). He mentioned this format in a letter to Edwards, advising him to "look carefully at the date given on the paper . . . ," such as "'10-1 10-2' etc." Referring to dated specimens that he had sent to Edwards from Colorado, Mead informed Edwards where he had collected on specific dates, such as "7-7 Fairplay," "7-8 Arkansas divide," and "7-20 Cal[a] Gulch." He occasionally wrote dates on his envelopes using an abbreviated month (e.g. "Aug. 28"), which is how he generally dated his letters. If a species was unknown to him, he indicated the genus name on the envelope with a number (e.g. "*Melitaea* 1") to distinguish it from other unknown species of the same genus, which he identified with a different number (e.g. "*Melitaea* 2"). William H. Edwards often referred to these notations in letters to Henry Edwards.

In addition to analyzing the handwriting on the envelope clippings, the notations themselves can be evaluated against Mead's 1871 itinerary and other information. The clippings listed below, from specimens deposited in MCZ and CMNH, are shown in Figure 2. Adjacent to many of the figured clippings are examples of Mead's handwriting, taken from various manuscripts. With the exception of one from Utah, all the figured clippings are from envelopes that contained specimens from Colorado.

1. A male specimen of *Colias philodice* Godart (the lectotype of *Colias hagenii* W. H. Edwards) at CMNH bears a portion of Mead's field envelope that reads "[*Phil*]*odice* ♂ / Colº / 6/16" (Fig. 2, upper left). All but the word "Colº" is written in the same dark brown ink as Mead's journal entry on that date, when he recorded that he found "many *Colias*" (Calhoun 2015a). The notation "Colº" is written in graphite in Mead's hand (probably at a later date, but undoubtedly when the specimen was still in papers). Clippings with the same date are affixed to a few of Mead's other specimens; all written in the same format (vertically, month over day) using the same type of ink (Fig. 2, top center).

This specimen is recognized as a summer phenotype of the subspecies *C. p. eriphyle* W. H. Edwads, though some recent authors (e.g. Dwyer et al. 2015) treat *eriphyle* as a separate species (i.e. *Colias eiphyle*). As noted by Fisher (2012), the summer form of this butterfly typically emerges later in the season at the elevation where Mead collected on 16 June 1871 (around Kenosha Pass, Park County, Colorado). However, this form occurs during June at lower elevations in Colorado, and those adults conceivably disperse to higher elevations, at least occasionally. Local weather conditions in 1871 also may have contributed to the premature presence of this phenotype at higher elevations. An observation by Mead hints at yet another possibility. Referring to specimens that would later be described as *C. hagenii*, he remarked that "if there could be such a thing as a yellow *Eurytheme*, this was it" (Calhoun 2015a). Scott (1986) mentioned the existence of rare yellow males of *Colias eurytheme* Boisduval, which he thought were "probably mutants." Yellow *C. eurytheme* have been documented a number of times in California (A. M Shapiro pers. comm.). The supposed hybrids discussed by Fisher (2012), in which specimens of *C. p. eriphyle* in Colorado have a "fully yellow wing color" on individuals with "otherwise distinct *eurytheme* wing characteristics" may actually be genetic variants of *C. eurytheme*. However, the "warmer" yellow coloration of the *C. hagenii* lectotype resembles laboratory backcrosses between *C. p. eriphyle* and *C. eurytheme* (A. M. Shapiro pers. comm.). Such an influence by *C. eurytheme* would help to explain this specimen's alleged collection date of 16 June. Adults of *C. eurytheme* tend to be more vagile than *C. p. eriphyle*. They reach high elevations in Colorado as early as mid-June, and all represent the summer phenotype (Brown et al. 1956, A. D. Warren pers. comm.). Although it is remotely possible that the envelope clipping was affixed to the wrong specimen, I have not encountered any similar mix-ups among Mead's specimens. Based on available evidence, I do not believe this record can be disproved with certainty.

2. The notation "6/17" on the clipping affixed to a male specimen of *Hesperia nevada* (Scudder) at MCZ (Fig. 2, top center) is written in the same dark brown ink as his journal entry on that date. Another clipping on this specimen reads "Mr. B.," written by Mead using identical ink on comparable paper, suggesting that it was cut from the same envelope. On 17 June 1871, Mead collected butterflies with Samuel M. Blair, a relative of the proprietor of Kenosha House, a stage stop where Mead was lodging at that time. Mead ([1876]) stated that this species was "quite common, in June, in the mountains about the South Park." Kenosha House was located just north of Kenosha Pass near South Park (Calhoun 2015a).

3. Affixed to a female specimen of *Colias alexandra* W. H. Edwards at MCZ is a clipping that reads, "*Colias* 3 ♀ / "6/27" (Fig. 2, top right), written in the same faded brown ink as Mead's journal entry on that date. A male specimen of *C. alexandra* at MZC bears a similar clipping that reads "Colias 3 / 6/26." Both specimens bear small printed labels, undoubtedly placed by a subsequent curator at MCZ, which erroneously attribute them to the Allen Expedition of 1871. In a letter to W. H. Edwards, dated 5 July 1871, Mead mentioned that he had previously captured "*Colias* 3." Presumably based on specimens at CMNH, Brown and Brown (1996) associated "*Colias* 3" with *Colias scudderi* Reakirt, but Mead sometimes confused that species with *C. alexandra*.

4. Affixed to a male specimen of *Aglais milberti* (Godart) at MCZ is a clipping that reads, "*Vanessa* 1 / bred / 7-6" (Fig. 2, center right). Mead informed Edwards on 2 June 1871 that he had found larvae of a species of "*Vanessa*" on stinging nettles around Denver. He later referred to this species as "*Vanessa* 1," noting that by 3 July the adults had begun to emerge. Mead ([1876]) recalled that almost every stinging nettle around Denver "had upon it many caterpillars of *V. Milbertii*," adding, "Some of the larvae were reared, the perfect insects emerging early in July."

5. A female specimen of *Icaricia icarioides* (Boisduval) at MCZ bears a clipping that reads "*Lycaena* 4 / 7-8" (Fig. 2, center right) in the same dark brown ink as Mead's journal entry on that date. A male specimen of this species at MCZ bears a clipping that reads "*Lyc.* 4 / 7-13" in graphite. In his letters, W. H. Edwards identified specimens that Mead marked "*Lycaena* 4" as "*L. lycea*," which is now recognized as the subspecies *I. icarioides lycea* W. H. Edwards. This corresponds to the name "*Lycea*" that Edwards scribbled in pencil on these envelopes, just above Mead's notations (not shown in the image in Fig. 2).

6. Affixed to one male and two female specimens of *Hesperia juba* (Scudder) at MCZ are clippings that read "Oct 2 / Utah," which are written in the same dark blue ink as

Mead's journal entry on that date (Fig. 2, bottom right). On 2 October 1871, Mead collected butterflies in the vicinity of Salt Lake City, Utah. Mead ([1876]) wrote of this species, "All my specimens were taken near Salt Lake City, Utah, early in October."

7. A female specimen of *Lycaena heteronea* Boisduval at MCZ bears a clipping that reads "*Lyc* 11 ♀ / 7-17" (Fig. 2, bottom right), written in the same faded black ink as Mead's journal entry on that date. On 14 July 1871, Mead informed W. H. Edwards that *Lycaena* 11 was common around Twin Lakes, Colorado, where he also collected on 17 July. Mead ([1876]) remarked that this species was abundant "at Twin Lakes early in July." At MCZ is a specimen of this species from the collection of H. K. Morrison, who labelled it "July 13, 1871" from "Twin Lakes Colorado."

8. A clipping that reads "*Lycaena* 1 / ♂ / 7-11" (Fig. 2, bottom left) is affixed to a male specimen of *Plebejus melissa* (W. H. Edwards) (the lectotype of *Lycaena melissa*) at MCZ. In a letter to W. H. Edwards, Mead indicated that *Lycaena* 1 was abundant around Twin Lakes, Colorado, where he collected on 11 July 1871. Several specimens of this species from Mead's collection at CMNH also possess clippings dated "7-11." On that date, Mead collected around Twin Lakes, Lake County, Colorado, where he found this species to be abundant (Mead [1876]).

9. A male specimen of *Erebia epipsodea* Butler at MCZ bears a clipping that reads "*Satyrus* 2 / 6/29" (Fig. 2, left center). Additional specimens from Mead's collection at CMNH, including the lectotype of *Satyrus rhodia* W. H. Edwards, are identified as "*Satyrus* 2." The correspondence of W. H. Edwards reveals that he originally intended to describe specimens that Mead had identified as "*Satyrus* 2" using the name "*Erebia meadii*," but he ultimately settled on *Erebia rhodia*, which is now recognized as a synonym of the subspecies *E. epipsodea brucei* Elwes. Edwards realized this synonymy in late 1871, admitting, "The larger of the 2 Erebias of Mead is probably *Epipsodea*."

10. A clipping affixed to a male specimen of *Euphydryas anicia* (E. Doubleday) (the lectotype of *Melitaea eurytion* Mead), from Mead's collection at CMNH, reads "*Melitaea* 1 / 7/4" in the same purple ink as Mead's journal entry on that date (Fig. 2, center). On 4 July 1871, Mead collected near Kenosha Pass, Park County, Colorado. In addition, there are other specimens of this species, collected on the same date, which are credited to Mead (Calhoun 2015a).

11. Two male specimens of *Hesperia colorado* (Scudder) (the lectotype and a paralectotype of *Pamphila colorado*) at MCZ have clippings with the date "7-13" written in graphite (Fig. 2, bottom left). Other specimens that Mead collected on 13 July 1871 (MCZ and CMNH) bear clippings with dates written in graphite in the same format. These include a male *I. icarioides* (see above), as well as the male lectotype and eight paralectotypes of *Chrysophanus sirius* Edwards (=*Lycaena rubidus sirius*). On 13 July, Mead collected at Twin Lakes, Lake County, Colorado. Scudder (1874) figured the two dated males of *H. colorado* as having been "collected July 13, by T. L. Mead." I examined the types of *P. colorado* at MCZ in July 2015; the figures of the lectotype in Calhoun (2015a) and Warren and Calhoun (2015) are accurate representations.

It was recently suggested to me that the clippings dated "7-13" on Mead's specimens of *H. colorado* are dubious, which would jeopardize the identity and status of the lectotype. I therefore offer additional evidence to consider when assessing the validity of this record.

Firstly, although specimens of *H. colorado* were collected near Twin Lakes in mid-August 1971 (Scott 1975), this does not mean that adults cannot occur there during mid-July. The peak flight period of the alpine subspecies, *H. colorado sublima* Warren & Calhoun, is mid-July to early August, with the first males emerging during early July, or possibly late June. The peak flight period of the three subspecies of *H. colorado* that are found below timberline in Colorado (including Mead's specimens, which represent *H. c. colorado*) is mid-August to early September, yet there are numerous records at various elevations from throughout the month of July, as well as a few seemingly valid records from June (Brown et al. 1956, MacNeill 1964, Scott & Scott 1980, Warren & Calhoun 2015). This includes a record of 27 July 1903 from Leadville, Lake County, which is located 11 mi north of Twin Lakes. Extraordinarily early or late records of butterflies (i.e. several weeks outside the expected flight period), triggered by weather and other factors, are not uncommon. Early adults tend to be males, which usually begin to emerge before females. I have personally encountered males of other hesperiid species nearly four weeks earlier than anticipated. Both of Mead's specimens of *H. colorado* from 13 July are males in fresh condition (Fig. 4) (the paralectotype is broken, but not worn, and was probably damaged when it was mounted by S. H. Scudder). Furthermore, these specimens closely agree with the phenotypes of *H. colorado* that occur in the vicinity of Twin Lakes (Fig. 4). Mead spent over a week at Twin Lakes (9-19 July), significantly increasing his chances of encountering early individuals of *H. colorado*, which is a locally common species in that area.

Secondly, Mead ([1876]) did not indicate that he found *H. colorado* at Twin Lakes during July, but such a discrepancy is not surprising given the history of this publication. Mead began work on his report for the Wheeler Survey in early 1874 (Calhoun 2013), just as S. H. Scudder was finishing his treatise on the genus *Pamphila*, in which he would describe *Pamphila* (=*Hesperia*) *colorado*. During the course of his research, Scudder examined all the relevant material in the possession of Mead and W. H. Edwards, and acquired a number of specimens from both of those collections. On 25 March 1874, Scudder read a draft of his paper at a meeting of the Boston Society of Natural History.

Fig. 4. Specimens of H. colorado (all images taken with a flash using the same camera). Top: Lectotype (left; dorsal/ventral) and paralectotype (right; ventral) of Pamphila colorado, 13 July [1871], [9250', Twin Lakes, Lake Co., CO] (MCZ). Bottom: More recent specimens from the vicinity of Twin Lakes. Left (dorsal/ventral), about 3 mi southeast of Twin Lakes (16.viii.1971, 9100', 1.6 mi N of Granite, Lake Co., CO, leg. J. A. Scott, MGCL). Right (ventral), about 5 mi northeast of Twin Lakes (16.viii.1971, 9400', Mt. Massive Trout Club, Lake Co., CO, leg. J. A. Scott; MGCL). Specimens resembling the types occur at both of these localities.

On 5 April 1874, Scudder asked Mead for more information about the species of *Pamphila* that he had collected in Colorado. Mead responded on 16 April: "Not being able to separate the species in the field, my notes upon these Hesperians are rather meagre. I give them below just as they are written out for my report." Included were his notes on "*Pamph Colorado* Scudder MS," which read, "This species, with the following appears late in the season; specimens were taken on the Georgetown and South Park roads during the latter part of August." With only a minor change in punctuation, Mead ([1876]) repeated this account in his published report. In early 1874, however, Mead was still struggling to identify his Colorado Hesperiidae, and he lacked data from the specimens that Scudder had acquired from W. H. Edwards. In essence, he knew little about this species beyond the name that Scudder intended to use.

Based on Mead's butterflies and "meagre" observations, Scudder (1874) stated that Mead collected *Pamphila colorado* "about the Georgetown and South Park Roads," adding that the species "probably appears during the second week in July and continues to emerge from the chrysalis until nearly the end of August, for Mr. Mead took fresh specimens during the second week of August, and of the female throughout the entire month; some individuals must therefore continue part way into September. . . .These statements are based on the condition of the specimens collected by Mr. Mead, all of which I have seen, every specimen labelled with the date of capture." Of course, Scudder did not know that Mead was at Twin Lakes in mid-July and reiterated the only locality information that Mead had provided. By the time Scudder's description of *P. colorado* appeared in print in December 1874, Mead had already submitted his report for publication (Calhoun 2013). Mead subsequently inserted references to Scudder's (1874) descriptions (most likely when he received the proofs in November 1875), but was unable to replace his write-up of *P. colorado* to acknowledge the additional dates mentioned by Scudder, or incorporate the corresponding localities. Simply stated, Scudder's concept of *P. colorado* ultimately exceeded Mead's understanding of this species when he composed the account for his survey report.

Many facts combine to support the validity of the clippings affixed to Mead's male specimens of *H. colorado*: 1) Upon receipt from Mead, W. H. Edwards retained all the unmounted Colorado butterflies in their original field envelopes, upon which Mead had recorded their dates of capture; 2) not just one, but two of Mead's specimens are involved, both of which bear analogous clippings from Mead's field envelopes, reading "7-13" in his hand; 3) within three years of their capture, these specimens were figured by Scudder (1874), who stated that they were collected by Mead on 13 July, while confirming that they were "labelled with the date of capture"; 4) the clippings on these specimens match those dated "7-13" on multiple specimens of other species that were collected by Mead, which were mounted by different people many years apart, and are now deposited in two separate museums; 5) Mead's two males of *H. colorado* agree with other specimens from the vicinity of Twin Lakes, Colorado; and 6) historical specimen data infers that a collection date of 13 July is plausible. Based on available evidence, this record cannot be disproved.

Specimen labels

Thanks to F. M. Brown, we have long known about Mead's envelope notations, yet few recognize his specimen labels. No examples are included among the exhaustive catalog of label images in *Collectiones entomologicae* by Horn et al. (1990). Nonetheless, I suspected that the labels on some of Mead's specimens were personally prepared by him. Again, I revisited Mead's manuscripts in search of similar handwriting. I found that Mead sometimes wrote in a very structured manner, combining cursive and block lettering to produce more sharply defined characters, which match exactly the labels in question (Fig. 5). This style is similar to that of C. P. Whitney (Figs. 1e, f), but with distinctive differences in the form of individual letters and overall structure. Mead was also inclined to capitalize the species name, whereas Whitney capitalized only the genus.

Figure 5 illustrates six of Mead's labels from specimens that he collected in Colorado in 1871, along with one from a specimen that he collected in Utah in 1878 (the lectotype of *Lycaena annetta* W. H. Edwards). To the right of the labels are numerous examples of the same unique style that I gleaned from Mead's manuscripts.

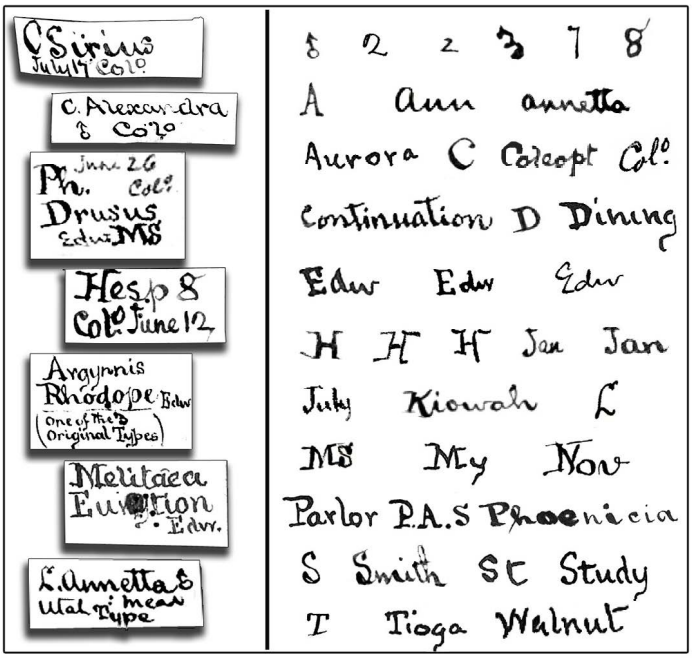


Fig. 5. Labels prepared by Mead (CMNH and MCZ*) (color removed and contrast enhanced; not to scale). At right are examples of Mead's handwriting in alphabetical order. (*© President and Fellows of Harvard College).

The dated label reading "*Ph. Drusius*" is from the male lectotype of *Phyciodes nycteis* var. *drusius* W. H. Edwards (=*Chlosyne nycties drusius*) at CMNH. The undated label reading "*Melitaea Eurytion*" (=*Euphydryas anicia eurytion* (Mead)) is from a female paralectotype of this nominal taxon at CMNH (Calhoun 2015a). The dated label that reads "*Hesp* 8" is from the male lectotype of *Pamphila* (=*Hesperia*) *nevada* Scudder at MCZ. This label was obviously prepared prior to the description of this taxon in 1874. (I previously referred to this label as a dated clipping from mead's field envelope.). The label implies that this specimen was mounted when Scudder acquired it, most likely from Mead himself. Mead mounted the remainder of his papered Hesperiidae by March 1874. The abbreviation "*Hesp*" does not refer to *Hesperia*, but rather to "Hesperian," a term that Mead often used in reference to species of Hesperiidae. During much of the 1870s, the genus *Hesperia* was used for skippers that are now included in the genus *Pyrgus*. The genus *Pamphila* was used for species that are now included in *Hesperia*.

Brown (1965) identified the writing on the label affixed to the lectotype of *Argynnis rhodope* W. H. Edwards (=*Speyeria hydaspe rhodope*) (Fig. 5, third from bottom) at CMNH as the "early handwriting" of William J. Holland. This label, however, was actually written by Mead, and the specimen obviously originated from his collection. The lectotype of *A. rhodope* was collected by the English entomologist George R. Crotch, who traveled to North America in 1872 and explored parts of California, Oregon, and British Columbia during the spring and summer of 1873 (Calhoun 2015b).

Acknowledgements

I thank Catherine Weisel (MCZ), Lawrence F. Gall (PMNH), and John E. Rawlins (CMNH) for their kind permission to reproduce images of labels and envelope clippings. Wenxian Zhang and Darla Moore (Rollins College) granted access to the manuscripts of T. L. Mead. Jacqueline Y. Miller and Andrew D. Warren (MGCL) hosted my visits to examine specimens and manuscripts under their care. Violetta Wolf (Museum of Science, Boston) provided scans of Mead's letters to S. H. Scudder. John Rawlins fielded questions about Mead's specimens at CMNH, and Arthur M. Shapiro offered insight and literature on butterflies of the genus *Colias*.

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Continued on p. 173

Are there caterpillars on butterfly wings?

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The wings of insects predate those of other animals. They have had 400 million years to adapt to changing conditions and diversify to bear the vast array of patterns we see today. The great naturalist Henry Walter Bates famously noted that butterfly wing patterns provide a window to the past, writing more than a century ago: "... on these expanded membranes Nature writes, as on a tablet, the story of the modifications of species, so truly do all changes of the organization register themselves thereon...". Duke University zoologist Fred Nijhout brought some order to our understanding of a broad assortment of wing patterns among the 18,000 or so species of butterflies in his book, *The Development and Evolution of Butterfly Wing Patterns* (1991). He continues to study the evolution and development of pigment patterns in butterflies, and many others are active in butterfly evo-devo research (e.g., Paul Brakefield, Patrícia Beldade, Chris Jiggins, Marcus Kronforst, Jim Mallet, W. Owen McMillan, Antónia Monteiro, and Robert Reed).

In a recent conversation, DW (an artist who has worked with butterflies and birds and has been involved in encouraging partnerships between scientists and artists) pointed out to PE (who has also been involved in encouraging such collaborations) that certain butterfly wing-pattern elements seem to resemble larvae. We decided to take a closer look. Here we consider the connection between the patterns of some larvae and adults, and ask if the apparent resemblances are coincidental, especially given the amount of variation in patterns, or adaptive. Examples you might consider appear in Figures 2 - 5 (page 183):

Dorsal or ventral hindwing pattern that resembles a larva of the same species:

* *Parides photinus* (Pink-spotted Cattleheart)
* *Papilio glaucus* (Tiger Swallowtail)
* *Emesis mandana* (Variable Emesis)

Dorsal forewing and/or hindwing margins that resemble a larva of a different species:

* *Danaus plexippus* (Monarch) and a larva of *Battus philenor* (Pipevine Swallowtail)

In the winter and spring of 2015 we surveyed numerous "expanded membranes", comparing photographs of pinned specimens and larvae in the *Butterflies of America* website (Warren, et al., 2012), for resemblances. Tendencies emerged. Nijhout had identified a ground plan comprising three bands that extend vertically from forewing to hindwing, which he called the basal, central and border symmetry systems. We found that most resemblances appear on the ventral hindwing portion of Nijhout's border symmetry system (Fig. 1), in an area we coin as the "larval band". Why there? Many butterflies hold their wings closed while resting, leaving their ventral hindwings exposed, so it is possible that the patterns comprise signals to predators. Future research should be able to confirm if ventral larval bands displaying resemblances are evenly distributed among toxic and palatable adults and larvae. In some cases, resemblances were located on the dorsal hindwing larval band, such as those in *Papilio*, whose larvae may be chemically protected by their osmeteria, and patterns that occasionally extend to the lower portion of the forewing (Fig. 3), or on wing margins featuring likely chemically protected larvae of another species (Fig. 5). Only in a few cases did we find resemblances on the dorsal surface closer to the body.

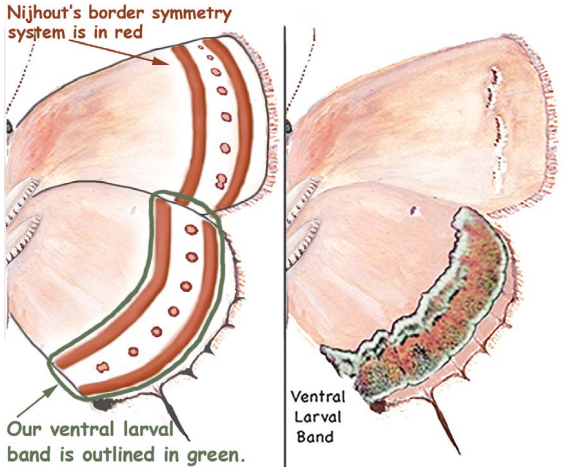

Fig. 1. Left: modified drawing by DW, with computer generated overlay, after Nijhout (1991); right: drawing by DW, with photographic overlay of modified larval band.

We know that complexities arise when identifying similarities. The process is, of course, subjective and the perception of similarities may vary from individual to individual observer as it did between the authors, one of whom, as noted, is an artist and the other a red-green colorblind scientist! Color perception in *Homo sapiens* even varies from season to season (Welbourne et al., 2015). We also know that the avian visual system is very different from the human visual system as is that of lizards and other predators. And we know that perception of similarities may vary from individual to individual predator and from a variety of conditions, each of which adds complications. (For an insightful discussion of the avian visual system, defensive

Four Examples of Apparent Resemblances

Fig. 2. Adult and aposematic larva thought to be chemically protected. The pink markings of the adult male *Parides photinus* (Pink-spotted Cattleheart) are limited to the body and the larval band. The larvae feed on *Aristolochia grandiflora* and *A. asclepiadifolia* (Pelican Flower). It is reported that consuming terpenes in *A. grandiflora* makes the larvae unpalatable. The plant also contains the poisonous compound aristolochic acid. Note that the larva in the photograph has been extracted from the background and modified into a shape similar to the marks on the hindwing (lower right). [Left and upper right] © 2007, 2009 Luc Legal, Jerome Albre and Oscar Dorado.

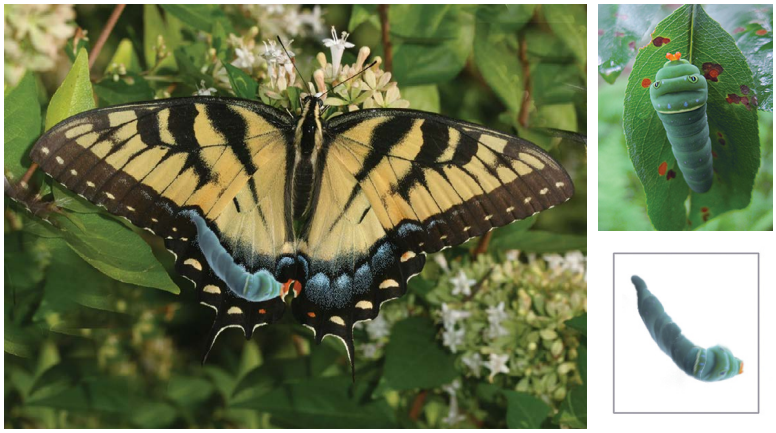

Fig. 3. Adult and larva with chemically protective osmeteria and false eyespots. Under perceived threat the larvae of *Papilio* spp (swallowtail butterflies) may assume a warning posture and evert their fleshy osmeteria. Here a *P. glaucus* (Tiger Swallowtail) larva has partially everted its osmeteria. The bluish-greenish dorsal hindwing larval band with its large terminal orange spot seems to resemble a larva with osmeteria partially everted (a second orange spot is concealed by the forewing.). Note that the larva in the photograph has been extracted from the background, modified (lower right) and superimposed over the left hindwing. The blue-green coloration of the overlay has been adjusted for effect. [Left] © Jeff Pippen; [Upper right] © Michael Singer.

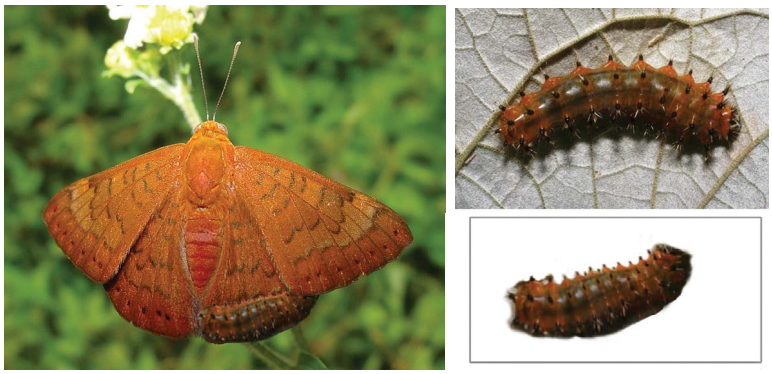

Fig. 4. Adult and edible mimic of urticating larva (those with defensive bristles that cause itching and irritation). *Emesis mandana* (Variable Emesis) larvae are among hundreds of possible mimics of urticating caterpillars, which visually hunting predators apparently learn to avoid. Might predators be warned off adult Variable Emesis, too? Note that the larva (penultimate instar) has been extracted from the background, modified (lower right) and superimposed over the right hindwing. [Left] © Kim Garwood, **www.neotropicalbutterflies.com** [Upper right] © D. Janzen and W. Hallwachs, voucher code: 05-SRNP-63174 **http://janzen.bio.upenn.edu/caterpillars/database.lasso**

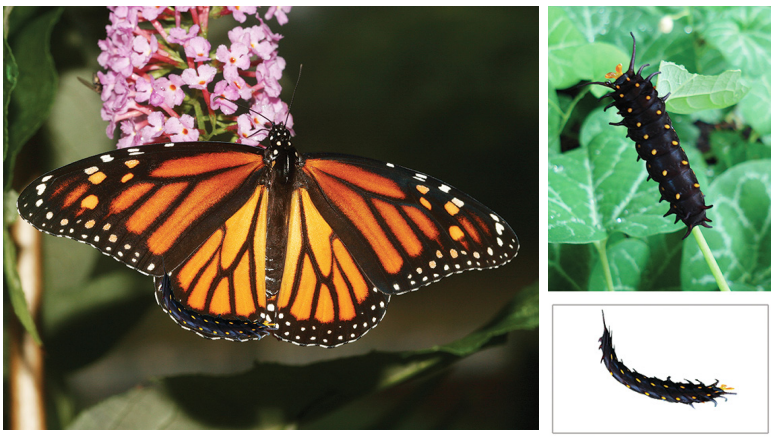

Fig. 5. Adult and co-occurring but unrelated chemically protected larva. The wings of *Danaus plexippus* (Monarch) do not include elements that resemble the often chemically protected Monarch larva, but in some geographic areas adults typically migrate beyond the range of predators that could have learned to avoid the larval pattern. Monarch adults might, however, benefit from the dot pattern on their wing margin if predators learn to avoid dot-patterned larvae like those of *Battus philenor* (Pipevine Swallowtail) (upper right) that feed on toxic pipevine species, sequestering poisonous aristolochic acid. Note that the larva in the photograph has been isolated, modified (lower right) and superimposed over the left hindwing. Also note that while the dots on the pipevine larva are orange and those on the Monarch are generally white, if viewed in low light—when birds are apt to forage—the color mismatch may go undetected. [Left] © Bill Bouton; [Upper right] © 2008 Wanda Smith.

visual mimicry and examples of how well mimics match models see Stoddard 2012.).

We also know that complexities arise when assessing predator avoidance and determining whether a potential butterfly prey was avoided or got away. For example, as noted in the caption for the Monarch (Fig. 5), a number of chemically protected larvae have a dot-like pattern (e.g., *B. philenor* [Pipevine Swallowtail]) that might deter predators and a number of adults have a dot pattern along the wing margin that might also deter predators. In some cases, however, a dot pattern along wing margins may attract rather than deter predators, encouraging them to snap at the periphery, not the body, leaving the adult with little more than a torn wing or beak mark, as evidenced by numerous torn or marked specimens in collections. In Appendix 2 we present photographs of 17 butterfly specimens showing a dot pattern on the wing margins. There are, of course, many other patterns along the wing margins. In his aforementioned book, Nijhout provides a figure cataloging 36 forms found in the border ocelli in nymphalids and the frequency of their occurrence (See Nijhout, 1991, Fig. 2, page 89.).

John Hessel, in correspondence with us, raised an essential issue noting that the precision in eyespot mimicry found on butterfly wings, which may include pupillary highlights and reflections, is often lacking in larval resemblances. We think those differences in precision might be explained by predator reaction time: Ideally, perceiving eyespots would lead a predator to act immediately, often as a hard-wired reaction as Janzen, Hallwachs, and Burns discuss in their excellent and persuasively-illustrated paper on eyespots in Costa Rican larvae (Janzen et al., 2010), or as an immediate, experience-based decision, both of which may save the butterfly. In contrast, perceiving a larva presents a less pressing choice, and the resemblance would only need to be sufficiently similar to a toxic, unpalatable, or urticating (producing a nettle-like stinging) prey for the predator to choose to avoid sampling it.

The first step in determining if adult-larval resemblances are sufficiently widespread and not merely coincidences requires a broader survey of species that evaluates similarities between adults and as many larval instars as possible. (See, e.g., *News of the Lep Soc.,* 56:3, p. 109-110, and compare Fig. 24 with the margin of Fig. 33.) In our preliminary online search we found what we believe to be resemblances in all six butterfly families, although examples among pierids were very sparse and may well be coincidental. Appendix 1 presents photographs of 25 larval/adult pairs.

There are, however, many gaps in the online pictorial record that will constrain a resemblance survey. In our inspection, for example, the larval band on a number of adults looked promising, (e.g., *Magnastigma hirsuta* [Hirsuta Hairstreak], *Perisama alicia*, and *Zaretis pythagoras*), but images of larvae were unavailable. Considering the growing interest in butterfly photography and the ease of using smart phone cameras this seems an ideal time and a resemblance survey seems an ideal project for observational "citizen science."[1] Butterfly collectors and photographers, nature photographers, science artists, other naturalists and students around the world could dramatically expand the pictorial archive. They could compare larval and adult patterns in species they photograph in the field or find in online databases and submit image, foodplant and location information of promising examples to a central online "resemblance" database that is curated, maintained and linked to key organizations such as the North American Butterfly Association (NABA).

Some Benefits of a Citizen Science Larva/Adult Resemblance Project

***increase our knowledge of butterfly life-histories** (by focusing more attention on immatures and foodplants; the emphasis now is still disproportionately on adults)

***increase our knowledge of butterfly behavior** (by comparing larval foraging patterns, pupation site selection, etc., Do aposematic larvae feed in more exposed positions than cryptic ones?; Are aposematic pupae attached to more exposed positions than cryptic ones?)

***increase our knowledge of butterfly population dynamics** (by comparing abundances related to proportions of mimics and models)

***increase our knowledge of predator memory and behavior** (by assessing how much avoidance behavior is learned and how much is hard-wired)

***provide citizen scientists opportunities to interact with scientists in the field** and experience how careful observation, note-taking and data analysis can reveal patterns that provide answers as they "do" science

***provide citizen scientists opportunities to help educate others about how science is done.**

For information on the Citizen Science project, see: **http://web.stanford.edu/group/stanfordbirds/cit_sci/Resemblances.html**

If resemblances prove widespread, an extensive area for future research would open up, investigating such things as the frequency of geographic co-occurrence of adult-larval resemblance; opportunities for exposure of both larval

[1]Online databases include, for example, BOLD <http://www.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=162755>; Butterflies of America <http://www.butterfliesofamerica.com/>; EOL (Encyclopedia of Life) <http://eol.org/pages/29472815/overview> and MCZBase - Harvard University <http://mczbase.mcz.harvard.edu/TaxonomySearch.cfm >

and adult patterns to the same predators; differences and similarities in the presence of defensive compounds; the possible influence of interspecies inter-stage resemblances, and so forth. The questions raised would be open-ended. Educators could gain new examples to convey the intricacy of evolution, and conservationists could show how the protection or the loss of a population of one species could influence the conservation status of another in ways not previously recognized.

Some important issues have been raised in correspondence with us by University of South Carolina evolutionary biologist Ward Watt, including the question of comparing the real segmentation in larvae with the appearance of segmentation in wing patterns. Even taking this into consideration the aposematic warning cues in adults that had been present in chemically protected larvae seem more likely adaptive than circumstantial, since adults and larvae share their genome and their available pigment pathways are correlated. That the larval "mimics" on the wings are not just carry-overs from larval segmental patterns is also suggested by their discrete shapes and restricted positions on the wings. Notice, for example, how the terminal larval segment in *P. glaucus* (Tiger Swallowtail) appears separately, but perfectly aligned, on the forewing (Fig.3).

Raising the visibility of butterflies through a citizen science program is apt to raise the visibility of conservation efforts, and that increased attention is apt to be a key to the success of both. In this regard, collaboration among scientists and artists will help artists provide faithful—and inspired—renderings while providing scientists with access to skilled visual observers and communicators, whose depictions can, among other things, help expand the corps of citizen scientists and the reach of their findings. Scientifically accurate artwork, when evocative and presented as Science Art (that is, when accompanied by a caption that provides a science lens), can help convey time-sensitive information. While photography is essential for resemblance comparisons, in the case of suboptimal photographs, photorealistic artwork can reduce or eliminate distracting imperfections and be used in displays, presentations and publications especially when local projects require community involvement. Access to time-sensitive visual resources is also important when public debate lingers at the fringe, as it does, for instance, in discussions of evolutionary biology and climate change where science remains under constant assault by anti-evolutionists and climate change deniers.

As the photographic record expands to include the instars of more larvae it will become easier to select species that are good candidates for assessing predator reactions and other behaviors that will allow evolutionary biologists to test whether any given inter-stage resemblance is adaptive or merely an eye-catching "spandrel." (Gould and Lewontin, 1979)

ACKNOWLEDGEMENTS

We thank, especially, James K. Adams, and Carol Boggs, Gerardo Ceballos-Gonzales, Gretchen Daily, John Hessel, Daniel Janzen, Peter Raven, Alison Ravenscraft, and Ward Watt for their valued comments. We also thank the following photographers for allowing us to include their excellent photographs: Jerome Albre, Bill Bouton, Jim P. Brock, Kim Davis, Oscar Dorado, Kim Garwood, Nick V. Grishin, Dan Hardy, Winnie Hallwachs, Daniel Janzen, Ken Kertell, Luc Legal, Berry Nall, Kenji Nishida, Rayner Nuñez, Jeff Pippen, David Robacker, Michael Singer, Wanda Smith, Andrei Sourakov, Mike Stangeland, Todd Stout, Jeff Trahan, and Andrew D. Warren. We are especially grateful to those whose photos we altered in the text and appendices.

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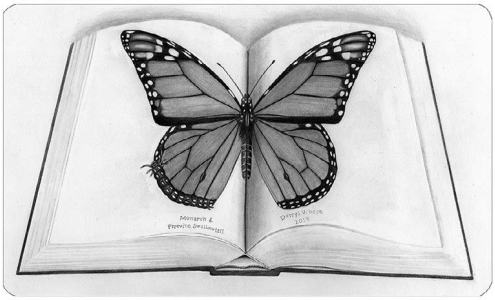


MONARCH II ©2015 Darryl Wheye, pencil, Private collection. A Pipevine Swallowtail larva overlays the left hindwing margin.

Lep Soc members and others:

Any examples of larval/adult resemblances in your collection? Have you seen any in other collections, online or in photos taken in the field? It would be wonderful if you could send jpgs to the resemblance database.

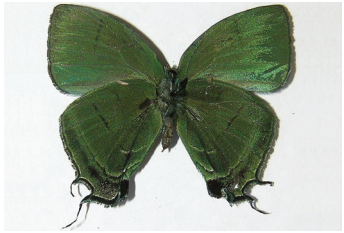
It would also be wonderful if you could help lead and/or advise the citizen science resemblance program. Please let us know.

Links to the appendices (and image enlargements), contact information and a query/registration/image submission form are here: **http://web.stanford.edu/group/stanfordbirds/cit_sci/Resemblances.html**

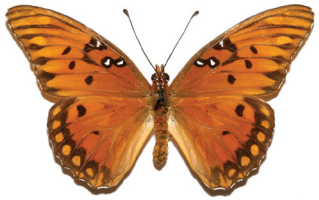
Appendix 1. Twenty-five Examples of Larva/Adult Resemblances

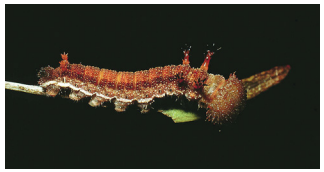
A yellow and/or black outline highlights the resemblance in the "Outlined Resemblance" column. The "Adult Caption" column notes the resemblance. The "Larva Caption" column provides available instar and foodplant information.

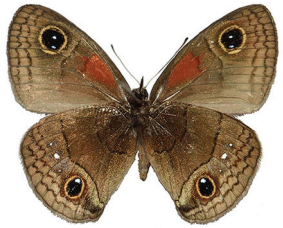
#		Adult	Outlined Resemblance	Adult Caption	Larva	Larva Caption
Papilionidae (3)						
1	*Heraclides anchisiades idaeus* ♀ (Ruby-spotted Swallowtail)	 © 2007 Andrew Warren		The pink and black dorsal hindwing larval band resembles early instar larvae, which are gregarious.	 © 2007 Dan Hardy	The instar is not noted on the photograph. Later instars are darker.
2	*Papilio glaucous* ♀ (Eastern Tiger Swallowtail)	 © 2008 Kim Davis, Mike Stangeland, and Andrew Warren		This example is from our text. The lower end of the pale blue green dorsal hindwing larval band has an orange spot that resembles the partially everted orange osmiteria that larvae display defensively. When alive, forewings cover the upper hindwing orange spot and complete the larval resemblance.	 © Michael Singer	This photo is from a study of herbivore diet breadth vs. bird predation. Read more at: http://phys.org/news/2014-07-eaters-eaten.html#j. The instar is not noted on the photograph.
3	*Parides photinus* ♀ (Pink-spotted Cattleheart)	 © 2008 David Robacker		This example is from our text. The pink marks on the ventral hindwing larval band and white marks on the wing edge resemble, to a degree, the pink and white larval spines.	 © 2009 Luc Legal, Jerome Labre & Oscar Dorado	The foodplant is Aristolochia *splendens*. The instar is not noted on the photograph.
Pieridae (1)						
4	*Anthocharis sara thoosa* ♀ (Sara Orangetip)	 © 2009 Jim P. Brock		The pale orange "tip" of the dorsal forewing and the black mark on the discal cell edge seems to parallel pairing of the orange larva and its black eyes.	 © 2010 Jim P. Brock	First instar is orange with a few bristles.

Lycaenidae (4)						
5	*Theritas mavors* ♂ (Deep-green Hairstreak)	 © 2010 D.H. Janzen and W. Hallwachs voucher code 09-SRNP-71199, http://janzen.bio.upenn.edu/caterpillars/database.lasso		There is a fairly strong resemblance between the color and shape of the larva and the ventral hindwing "larval band."	 © 2010 D.H. Janzen and W. Hallwachs voucher code 04-SRNP-41639, http://janzen.bio.upenn.edu/caterpillars/database.lasso	Last Instar. The food-plant is *Conostegia xalapensis*.
6	Callophrys mcfarlandi ♀ (Sandia Hairstreak)	 © 2009 Jim P. Brock		The pale yellowish-greenish ventral hindwing "larval band" resembles a larva.	 © 2010 Jim P. Brock	The instar is not noted on the photograph. Coloration might be influenced by camera and available light (note the black background).
7	*Euphilotes ellisii ellisii* ♀ (Ellis' Blue)	 © 2008 Kim Davis, Mike Stangeland and Andrew Warren		The orange-pink ventral hindwing "larval band" resembles the larva, but some photos the larvae are very pale.	 © 2011 Nicky Davis	The larva is on *Eriogonum corymbosum*. The instar is not noted on the photograph.
8	*Euphilo euphilotes spaldingi* ♀ (Spalding's Blue)	 © 2008 Todd Stout		The orange ventral hindwing "larval band" resembles, to a degree, prediapause a 4th instar larva.	 © 2008 Todd Stout	The 4th instar, pre-diapause larva is pale orangish-pinkish-reddish with darker marks.

Riodinidae (5)						
9	*Euselasia pellonia pellonia* ♂ (Red-rimmed Euselasia)	.  © 2014 Jim P Brock		The aposematic orange-red ventral hindwing "larval band" with black spots and white marks resembles, to a degree, a black-spotted, greenish-orange larva.	 © 2010D.H. Janzen and W. Hallwachs voucher code 04-SRNP-2598, http://janzen.bio.upenn.edu/caterpillars/database.lasso	This instar is greenish-orange with black spots and pale bristles. The foodplant is *Vochysia guatemalensis.*
10	*Hades noctula* ♂ (White-rayed Metalmark)	 © 2010 D.H. Janzen and W. Hallwachs voucher code 01-SRNP-2576.03, http://janzen.bio.upenn.edu/caterpillars/database.lasso		The outer half of the black and white "ray" patterned ventral hindwing resembles, to a degree, a last instar larva. This pattern seems consistent with Nijout's "intervenous stripe system".	 © 2010 D.H. Janzen and W. Hallwachs voucher code 01-SRNP-2576, http://janzen.bio.upenn.edu/caterpillars/database.lasso	The last instar has long bristles and black/whitish-greenish "rays". The foodplant is *Tapirira mexicana*.
11	*Esthemopsis pherephatte pherephatte* ♂ (Godart's Metalmark)	 © 2010 D.H. Janzen and W. Hallwachs voucher code 01-SRNP-2685, http://janzen.bio.upenn.edu/caterpillars/database.lasso		The aposematic yellow patch on the blackish blue ventral forewing resembles a last instar larva, minus the black dots.	 © 2010 D.H. Janzen and W. Hallwachs voucher code 01-SRNP-2685, http://janzen.bio.upenn.edu/caterpillars/database.lasso	Last instar larvae are yellow with black bristles (that look like dots from above) and long pale bristles along the edge. The foodplant is *Trichospermum grewiifolium.*
12	*Pirascca tyriotes* ♂ (Golden-banded Metalmark)	 © 2010 D.H. Janzen and W. Hallwachs voucher code 08-SRNP-72467, http://janzen.bio.upenn.edu/caterpillars/database.lasso		The aposematic orange patch on the black dorsal hindwing resembles a penultimate instar larva.	 © 2011 D.H. Janzen and W. Hallwachs voucher code 08-SRNP-72573, http://janzen.bio.upenn.edu/caterpillars/database.lasso	The penultimate instar is orange with long pale bristles along the edge. The foodplant is *Miconia argentea*.

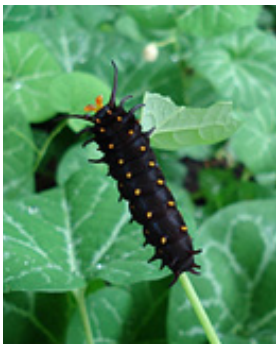
13	*Emesis mandana* ♂ (Variable emesis)	 © 2010 Kim Davis, Mike Stangeland and Andrew Warren		This example is from our text. The resemblance is seen along both dorsal wing margins.	 © 2011 Daniel Janzen and W. Hallwachs voucher code 05-SRNP-63174, http://janzen.bio.upenn.edu/caterpillars/database.lasso	Penultimate instar is greenish orange with irritating bristles growing from short black spines that resemble the black dots on the wing margins. The foodplant is *Croton yucatanensis*.
Nymphalidae (9)						
14	*Agraulis vanillae incarnata* ♀ (Gulf Fritillary)	 © 2009 Jim P. Brock		The orange and dark brown dorsal hindwing "larval band" resembles, to a degree, a last instar larva.	 © 2010 D.H. Janzen and W. Hallwachs voucher code 00-SRNP-16240, http://janzen.bio.upenn.edu/caterpillars/database.lasso	The last instar of this orange and black larva has long black spines with black bristles. The foodplant is *Passiflora foetida*.
15	*Dione juno huascuma* (Juno Longwing)	 © 2005 Kim Davis and Mike Stangeland <kimandmikeontheroad.com>		The orange and black dorsal hindwing "larval band" resembles, to a degree, a last instar larva. This is more evident in some photographs than in others.	 © 2011 Kenji Nishida	The last instar is orange and purplish-brown with black spines and bristles. The larva is on *Passiflora edulis*.
16	*Heliconius sara theudela* ♀ (Sara Longwing)	 © 2009 Kim Davis, Mike Stangeland and Andrew Warren		The brown ventral hindwing has red dots near the body. The dark segmentation lines on the white "larval band" resembles, to a degree, the segmentation pattern and might even call to mind the long black spines of a third instar larva.	 © 2011 Rudy Dodero	Third instar larvae are whitish with black spines.

17	*Adelpha tracta* (Tracta Sister)	 © 2011 D.H. Janzen and W. Hallwachs voucher code 05-SRNP-35693, http://janzen.bio.upenn.edu/caterpillars/database.lasso		The rusty pinkish-mauve patterned ventral hindwing "larval band" resembles a penultimate instar larva.	 © 2010 D.H. Janzen and W. Hallwachs voucher code 02-SRNP-23504, http://janzen.bio.upenn.edu/caterpillars/database.lasso	The penultimate instar matches the adult relatively well. The foodplant is *Viburnum venustum*.
18	*Hamadryas guatemalena marmarice* ♀ (Guatamalan Cracker)	 © 2011 Andrew D. Warren		The black and white patterned ventral hindwing margin is probably aposematic and, to a degree, resembles the larva.	 © 2010 Jim P. Brock	This white, black and yellow -- and presumably aposematic -- larva has black spines and black bristles. The instar is not noted on the photograph. It was photographed on *Dalechampia*.
19	*Vanessa annabella* ♀ (West Coast Lady)	 © 2009 Andrew Warren		The complex beige, bright and pale orange, pale blue, black, light and dark brown pattern on the ventral hindwing "larval band" resembles, to a degree, the complex pattern of the larva.	 © 2009 Jim P. Brock	The instar of this bright and pale orange and black larva with grey bristles is not noted on the photograph.
20	*Chlosyne fulvia coronado* ♀ (Fulvia Checkerspot)	 © 2009 Jim P. Brock		The dark brown, orange, pale orange, and white dorsal hindwing "larval band" resembles the larva.	 © 2009 Kim Davis and Mike Stangeland <kimandmikeontheroad.com>	This blackish-brown, pale orange and white larva has black-spines and black-bristles. The instar is not noted on the photograph.

21	*Poladryas minuta minuta* ♂ (Dotted Checkerspot)	 © 2010 Andrew D. Warren		The basically orange ventral hindwing "larval band" has some dark dots and resembles the black-dotted, black-spined larva.	 © 2011 Jim P. Brock	The instar is not noted on the photograph.
22	*Calisto muripetens* ♂ (Muripetens Calisto)	 © 2014 Rayner Nuñez		Except for the rust-ringed false eye, the pale brown ventral hindwing "larval band" with black, cream, and beige marks resemble, to a degree, the brown-patterned larva.	 © 2014 Rayner Nuñez	The instar is not noted on the photograph.
Hesperiidae (3)						
23	*Aguna asander asander* ♀ (Gold-spotted Aguna)	 © 2009 Kim Davis, Mike Stangeland and Andrew Warren		The light mauve, rust, white, cream and beige ventral hindwing "larval band" is bordered on one end by a rust-colored triangle and resembles, to a degree, a last instar larva	 © 2011 D.H. Janzen and W. Hallwachs voucher code 06-SRNP-56548, http://janzen.bio.upenn.edu/caterpillars/database.lasso	The last instar larva has rust-colored eyes and a cream-colored body. It was photographed on *Bauhinia ungulata*.
24	*Zestusa dorus* ♂ (Short-tailed Skipper) (Northern Zestusa)	 © 2009 Andrew D. Warren		The light grey and creamy-grey ventral hindwing "larval band" resembles a penultimate instar larva.	 © 2010 Jim P. Brock	The penultimate instar is creamy-grey with pale yellow stripes. A greenish cast—the color of the leaf--seems to show through the skin.
25	*Eantis papinianus* ♂ (Cuban Sicklewing)	 © 2009 Kim Davis, Mike Stangeland and Andrew Warren		The whitish pale bluish ventral hindwing "larval band" resembles the fifth instar larva.	 © 2010 Andrei Sourakov	The fifth instar has a pale bluish-green cast showing through the skin. The pale yellow stripes and cream-colored head seem similar to the pale patch on the ventral hindwing. First instar larvae have a dark head. Larva photographed on Citrus.

Appendix 2. Seventeen Examples of Dot Patterns on Wing Margins

In some cases a wing margin dot pattern might deter a predator by resembling a larva it considers unpalatable, chemically protected or capable of shedding irritating hairs. In others, the pattern might attract a predator that does not associate the pattern with a warning.

1	*Danaus plexippus plexippus* ♀ (Monarch)	 © 2011 Andrew D. Warren Wing with larval overlay 	This example is from our text. The resemblance is not with a Monarch larva, but with a *Battus philenor* (Pipevine Swallowtail) larva. Note the double dotted pattern is seen on both fore- and hindwings. The larva was isolated from the background in the photograph (right) and modified to show the resemblance with the wing margin pattern (left).	 © 2008 Wanda Smith
Papilionidae			**Pieridae**	
2	Papilio victorinus victorinus ♀ (Victorine Swallowtail)	 © 2008 Kim Davis, Mike Stangeland and Andrew Warren	3	Catasticta nimbice nimbice ♀ (Mexican Dartwhite)  © 2010 Kim Davis, Mike Stangeland and Andrew Warren
Nymphalidae				
4	Danaus eresimus Montezuma ♂ (Soldier)	 © 2011 Andrew D. Warren	5	Danaus gilippus thersippus ♂ (Queen)  © 2009 Jim P. Brock
6	Lycorea halia atergatis ♂ (Tiger Mimic-Queen)	 © 2011 Andrew D. Warren	7	Olyras theon ♀ (Rusty Tigerwing)  © 2009 Kim Davis, Mike Stangeland and Andrew Warren

8	Scada zibia xanthine ♀ (Zibia Tigerwing)	 © 2009 Kim Davis, Mike Stangeland and Andrew Warren	9	Mechanitis lysimnia labotas ♀ (Lysimnia Tigerwing)	 Image courtesy of Smithsonian Institution and Nick V. Grishin
10	Godyris zavaleta caesiopicta (Variegated Clearwing)	 © 2009 Kim Davis, Mike Stangeland and Andrew Warren	11	Dryadula phaetusa (Banded Longwing)	 © 2009 Jim P. Brock
12	Eueides procula asidia ♂ (Darkened Longwing)	 © 2009 David Robacker	13	Eueides tales pythagoras	 © 2011 Kim Garwood Specimen courtesy of Universidade Federal do Paraná, Curitiba, Brasil (UFPR)
14	Speyeria idalia occidentalis ♀ (Regal Frittilary)	 © 2011 Andrew D. Warren	15	*Limenitis archippus watsoni* ♂ (Viceroy)	 © 2008 Jim P. Brock
16	Hamadryas amphinome mazai ♂ (Red Cracker)	 © 2008 Jim P. Brock	17	Eresia ithomioides poecilina ♀ (Variable Crescent)	 © 2010 Kim Davis, Mike Stangeland and Andrew Warren

The Marketplace

IMPORTANT NOTICE to ADVERTISERS: If the number following your ad is "573" then you must renew your ad before the next issue if you wish to keep it in the Marketplace!

New Advertising Statement: The News of The Lepidopterists' Society accepts advertising related to Lepidoptera and consistent with the purposes of the Society free of charge. Other types of advertising will not be accepted, regardless of the source. Acceptability of advertisements for publication is at the discretion of the News editor.

Research Requests

WANTED: Observations, photos, specimens of larvae and adults of the Spotted Tussock Moth, *Lophocampa maculata*, from all areas of North America, recent or old data. Records from far northern Canada, the desert SW, southern Appalachians and Pacific Coast are especially needed to define range. Records of early or late season observations are particularly valuable. All larval photographs are useful, especially if they show unusual patterns of coloration. Specimens are desired for future genetic analysis. Contact Ken Strothkamp, Lewis & Clark College and Portland State University (**kgs@lclark.edu** or **kstrot2@pdx.edu**) for more information on the project. 573

WANTED: Buckeye butterflies (genus *Junonia*) of all 3 *Junonia* species from the Florida counties of Collier, Broward, Monroe, and Miami-Dade for a Masters project trying to reconstruct the invasion history of tropical buckeyes into Florida. Historical material of any vintage very valuable to our study. 1990's currently under-sampled by the project, but all dates needed. We genotype using DNA from single legs, so if desired precious specimens can be returned largely intact. Jeffrey Marcus, Dept. Biological Sciences, Univ. Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; 1-204-474-9741; **marcus@cc.umanitoba.ca** 582

Livestock

Hyalophora cecropia cocoons **FOR SALE**. $6.00 each plus shipping. Contact Ben McAllister at **ben.d.mcallister@gmail com.** 573

Equipment

FOR SALE: Light Traps: 12 VDC or 120 VAC with 18 inch vanes (15 & 32 Watt) and 24 inch (40 Watt). Rigid vanes of Stainless Steel, Aluminum, or Plexiglass. Rain Drains and beetle screens to protect specimens from damage.

Collecting Light: Fluorescent UV 15, 32 & 40 Watt. Units are designed with the ballast enclosed in a weather tight plastic enclosure. Mercury Vapor: 160 & 250 Watt self ballast mercury vapor with medium base mounts. 250 & 500 Watt self ballast mercury vapor with mogul base mounts. Light weight and ideal for trips out of the country.

Bait Traps: 15 inch diameter and 36 inches in height with a rain cloth top, green Lumite plastic woven screen, and supported with 3/16 inch steel rings. A plywood platform is suspended with eye bolts and S hooks. Flat bottom has a 3/16 inch thick plastic bottom that will not warp or crack. Bait container is held in place by a retainer.

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.**

Cornell Drawers: Leptraps now offers Cornell and California Academy Storage Drawers. Drawers are made of Douglas Fir, Hardboard Bottom and Glass Top. Finished in Clear Satin Gloss Varnish. A single Card Holder with Pull or two Card Holder with a Knob Pull. Foam pinning bottom is available.

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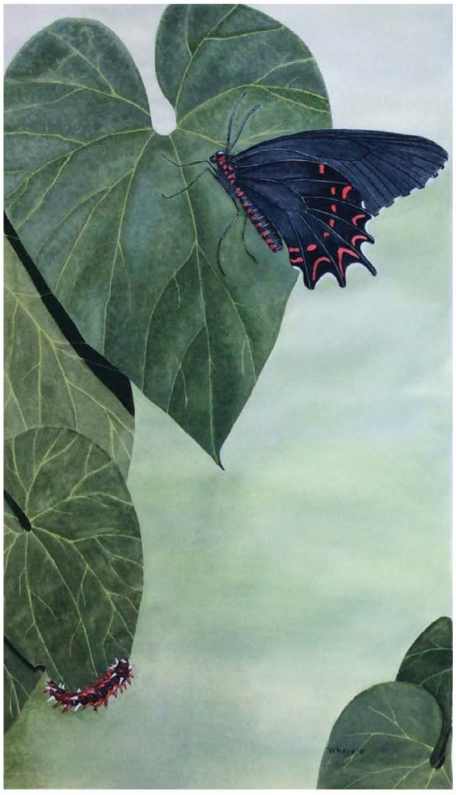
FOR SALE: Cornell Drawers, in various quality and condition. Would like to ship in quantities of 6 to take advantage of packaging and shipping crates that hold six drawers. For more information, photos and prices please contact Glenn Morrell; **woodsskier@hotmail.com**. 574

Artwork



FOR SALE: Original art, prints and notecards of butterflies and larvae showing apparent resemblance.

Contact: darryl.wheye@gmail.com

Examples of art by DW: http://web.stanford.edu/group/stanfordbirds/GreenLibrary/Wheye.html

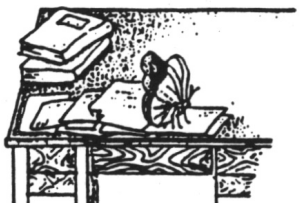
Please see: Wheye and Ehrlich, "Are there caterpillars on butterfly wings?" this issue, pp. 182-193.

Parides photinus (Pink-spotted Cattleheart) adult and larva on *Aristolochia grandiflora*. Resemblance on ventral hindwing. (unframed 19¾ x 11¼", watercolor and gouache on paper, 2015).

Papilio glaucus (Eastern Tiger Swallowtail) adult and larva (with osmeteria partially everted) on *Sassafras albidum*. Resemblance on dorsal hindwing. (unframed 19¾ x 11¼", watercolor and gouache on paper, 2015).

Books

FOR SALE: *English* version of Seitz ***Macrolepidoptera of the World***—the complete series on the butterflies (does *not* include the moth volumes): Volume 1: Palearctic butterflies; Volume 5: American butterflies; Volume 9: Indo-Australian butterflies; Volume 13: African butterflies; Palearctic butterflies supplement (last volume from the library of Francis Hemming). Asking $5000.00. PLUS: Entire set of B. D'Abrera's ***Butterflies of the World*** volumes for an extra $3,000. These include all volumes on the butterflies except the last two (of three) of the new revised Afrotropical volumes. The set includes all three editions of the ***Butterflies of the Australian Region***. If purchased together with Seitz, total price: $7,300. Also available: ***Butterflies of California*** by John Comstock, $150.00 and 23 volumes (fascicles) of ***MONA*** (***Moths of North America***) Shipping costs to be borne by purchaser. Contact: Rosser Garrison at **rosser.garrison@cdfaca.gov** for more details. 574



From the Editor's Desk

James K. Adams

As we enter winter and start processing photos and specimens, don't forget to send images, both live and spread, to me as fillers for the News, and ESPECIALLY send me images of anything you think is of interest from records you have contributed to the Season Summary. I need pictures for the covers of the Season Summary, and everybody loves to see their photos on the cover of a publication.

Have a joyful holiday season, and spend it with those loved ones you neglected during the photography/collecting season!

Digital Collecting:

Bolivia part I -- November - December 2013

Kim Garwood

721 N Bentsen Palm Dr #40, Mission, TX 78572 **kimgrwd@sbcglobal.net**

If you want to see more live photos, look on my flickr site under Bolivia - **https://www.flickr.com/photos/kgarwood/sets**. Scroll down past Southeast Brazil and Peru to the 5 Bolivia albums. Also, for more on butterfly photography tours, check out David Geale's new website at **http://www.mariposabutterflytours.com/.**

We did 2 butterfly photography trips to the Yungas in Bolivia in late 2013, primarily looking for skippers in the Pyrrhopygini, the firetips. Years ago I had spent time at Olaf Mielke's fabulous Hesperiidae collection in Curitiba, Parana, Brazil and kept seeing specimens of spectacular firetips, mostly collected in the Yungas, so I had always wanted to go. While the area has been much cut over and is nothing like it must have been 20 to 30 years ago, we still had lots of fabulous big skippers, and some other good stuff as well.

The logistics were handled by David Geale of Tanager Tours (dichrozona@gmail.com) who has become a wonderful butterfly photographer and organizer. He's also big time into baiting, and usually carries bottles of rotten shrimp and pee, so he's a big asset. I highly recommend hiring him to help with any photography trips you might want to put together, especially for Colombia or Peru. He and I had both been to Bolivia for birds a long time ago, so this was sort of a scouting trip.

Bolivia is a very poor country, probably the poorest in South America. Outside of the main city of Santa Cruz, which is in the eastern lowlands, the people are poor, especially in the Andes. Many of the farmers who used to grow fruit and vegetables have changed to the far more profitable crop of coca, and that is what you see being grown everywhere. Piles of coca leaves are spread out for drying in many open, sunny spots, school yards, by roadways, everywhere.

We flew into La Paz and left immediately for Chulumani in Sud Yungas. It's only 73km from La Paz, down the infamous Road of Death after the pass at 4,670m, and it is very slow and dusty. We stopped several times, sometimes due to road construction or broken down trucks, and found different species at every elevation. One of the favorites was the gaudy *Polygrapha tyrianthina*. Tony Hoare got some lovely shots.

We stayed at Tarapari Biodiversity Garden, a simple B&B about 1750m. We walked the roads around the neighborhood, but the best place was about 20-30 minutes down the dusty road to the small stream at about 1550-1600m. There was a bridge over the stream and a fancy large house that looked like a place for seminars or a small hotel, going up the stream to the right. Shortly past the bridge, on the left towards the stream there was a small pullout where local guys wash their pickup trucks. It was just big enough for 1 small pickup backed down to the river's edge. This spot turned out to be fabulous for firetips and many other butterflies. We had been there an hour or so when some guy pulls in and backs his truck down. We thought our photography was over, but no, the butterflies were clearly used to this activity and kept landing all around while the guy poured buckets of water over his truck.

Polygrapha tyrianthina; upperside by Tony Hoare, underside by Dan Wade.

Maybe 50-100 meters down the road there was another casual car wash on the right side of the road, where a small waterfall came down the hill, and this was also an excellent spot. Both these places were lined with trash, so it was far from a pristine environment, but that gave the butterflies lots to come to. Apparently, many people had

People photographing butterflies at the truck wash, Nov. 9, 2013

peed here, I'm sure, and women came and did laundry, producing all sorts of attractive goodies. The two spots were oriented to the sun at different angles, so one would be more in full sun while the other was mostly shaded, which meant different species between the spots.

These were great spots to use the famous lift the hindwing with a stick technique, as on many of the *Pyrrhopyge* you need to photograph both sides for a chance at an id.

Because they were so intent on feeding on the trash, and they were used to lots of movement around them, the firetips were amazingly cooperative with us manipulating and lifting their wings.

At the end of one day most of the people were back in the van, ready to head back to the hotel, when the driver pointed out to me one of my favorites, *Oxynetra semihyalina*. It was under the van, but we managed to get it out for photos. Everybody piled out and we spent another 15-20 minutes with it.

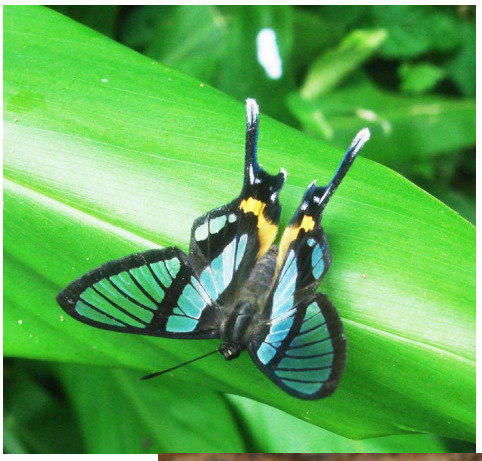
We spent several days at these small spots, plus you could take a trail up the dark ravine, around the left side of the large house, rock hop over the stream and get into a completely different habitat that was cool, dark and wet. Here we had a number of Ithomiinae and different species

Chalypyge zereda rufinucha, *Pyrrhopyge amyclas denticulata* by Kim Garwood.

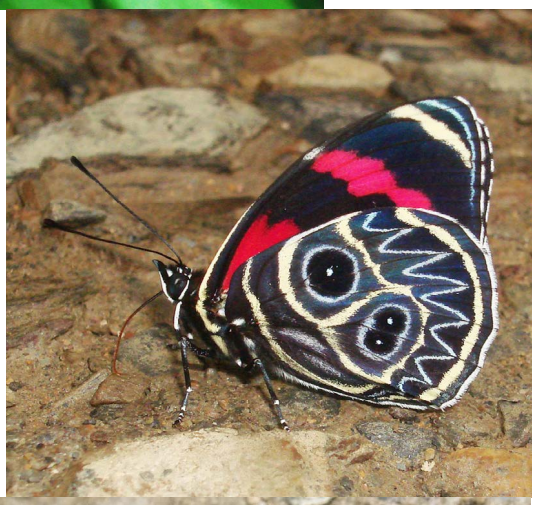
Pyrrhopyge arax, dorsal and ventral by David Geale; *Pyrrhopyge kelita,* ventral by Kay Wade.

Pyrrhopyge phylleia delos, dorsal and ventral by David Geale; *Oxynetra semihyalina,* dorsal by Kim Garwood.

from what we saw out in the sun at the car wash spots. We were told this house was built by Karl Barbi, a famous Nazi who came here after the war, so we called this the Nazi house trail. There is a spot over the creek where there was always a *Chorinea sylphina* on territory, as we saw one there every day. Moving between these three spots kept us busy for 3 different days, and we kept finding new species everytime we went back. Lots of Nymphalidae too, and we got good photos of *Callicore sorana* and *Cybdelis boliviana*, and many others, including *Perisama*s, *Catasticta*s, and *Dalla*s.



Chorinea sylphina; by Kim Garwood.



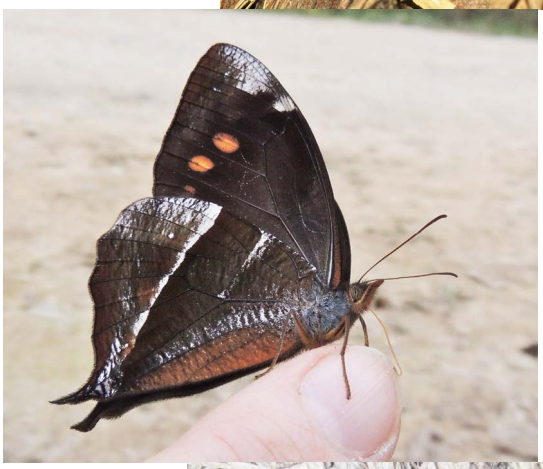
Callicore sorana horstii; by Dan Wade.

Cybdelis boliviana; by Kim Garwood.

We also drove up to the San Isidro forest, back through the town of Chulumani and uphill to the pass at 2500m, then walked back down. This is satyrland, so we had lots of *Corades*, *Pedaliodes* and other high elevation satyrs. Driving past a rock wall we flushed a cloud of butterflies, parked and ran back to see what they were. There were so many satyrs crammed into a crack in the rock we couldn't see what they're feeding on at first, but eventually we saw a 8" long owl pellet, regurgitated by what must have been a big owl.

One of the different looking satyrs that we saw up here is *Pherepedaliodes pheretiades*, id'ed by Tomasz Pyrcz. A new *Corades* for me was *C. argentata* which posed nicely on Kay's finger. We did see some different Memphis and a fresh *Epiphile latifasciata*.

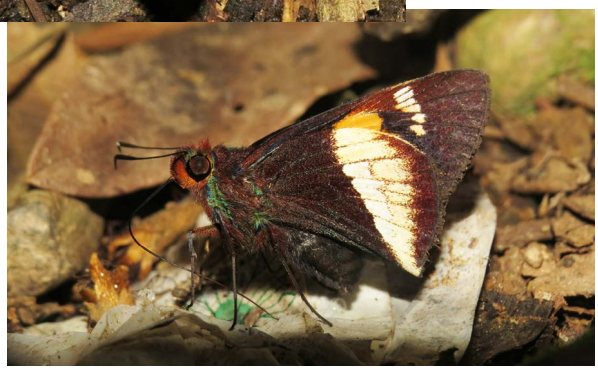
Pherepedaliodes pheretiades; by David Geale.



Corades argentata; by Kay Wade.

Epiphile latifasciata; by Kim Garwood.

We moved to a new location, at Apa-Apa lodge; not too far but on the other side of Chulumani. The lodge is scruffy and quite worn, tiny rooms and not very comfortable. It is an old hacienda owned by the same family for hundreds of years, and they have a reserve up the hill which we had heard good things about. They have a nice, open dining room with a great breeze, so that's where we spent most of our time working on our computers, reading and eating when we weren't in the field, . But then we were bitten by flies, the kind you can't feel but get huge swollen areas on any exposed surface. The most spectacular butterfly species we find here is a new skipper for me, *Sacrator polites*. It hid down in the bottom of a ravine below the farmhouse but it came to spitwads for some good photos.



Sacrator polites pilla; by David Geale. Left: decent in flight capture; below: underside.

The food was simple in the area, without enough fruit and veggies, so we went into town one day looking to buy some. But we couldn't find anything, just liters of soft drinks, packaged chips and junk food. This area used to be famous for avocados and citrus, but not any more. Now it is just coca. It was difficult for us to find bottled water, too. Many of the little shops were boarded up; this was not a prosperous looking place. There aren't any gas stations, so our driver had to find someone selling gas from their home. Don't ask how much it costs. It is subsidized in Bolivia, and in La Paz it sold for about US $2/gallon (back in November 2013), but in Chulumani it was at least three times as much. They are supposedly building a new gas station, but it has been under construction for quite a while, and they had a long way to go.

After several days we headed over to Coroico to stay at La Finca for several days. This hotel was quite an improvement from Apa apa, bigger rooms, hot showers, no flies, and tasty food. There were only a few rooms at Apa Apa, so we all had to double up, but here we got single rooms. We had tasty lasagna and wonderful bread our first night for dinner. We asked the owner if the bread is from a local bakery, and he laughed and said no, it came from La Paz, back up the bad, dusty road. The location for La Finca is about 7-8 km outside of town, and we looked up from the hotel gardens to mountains on both sides. You can see where the people have cleared the land as far up the hillsides as they can go. (see photo, back cover)

We walked the road but didn't see too much, so we drove back to check out several waterfalls, where again we didn't see much. Too many people racing around the waterfalls, even though it was a Monday. The best place we found was 7 km down a Y to Vacantes, to the left if you're coming from town. This is down a steep, dirt road to a river at the bottom of the ravine at about 1200m, with several beaches along the river. This turned out to be a great spot, no traffic and lots of bugs, so we spent a couple of days coming back to this spot.

This seemed to be typical in Bolivia. Our driver told me that the area was cleared for coca 10 years ago, and now the ground has been exhausted and can't produce coca any more, or anything else. So it is just scruffy grass and a few cows. We managed to find little spots here and there where we could still find butterflies, but overall it is quite damaged.

Some of my favorites from here were *Phocides yokhara charonotis*, one of the orange *Phocides*. These mimic the orange firetips; the easy way to separate them is by their antennae. Why do they mimic, and which is the mimic?

Top: *Phocides yokhara charonotis*, by Dan Wade.
Bottom: *Mimardaris sela periphema*, by Kim Garwood.

Are one or both of the groups distasteful to predators? The more common *Phocides* are the blue and white striped ones, mimicking *Jemadia*. Bill Berthet gets a good shot of both side by side. The *Phocides* have straight antennae, on the right, while the firetips, the *Jemadia* on the left, have the 'golf-club' antennae, with a big hook in them.

While we concentrated on Hesperiidae on this trip, we also had plenty of species from the other families. The Riodinidae were good, especially *Baeotis*. We had several similar species that were difficult to sort out. These included *Baeotis elegantula* from below Chulumani, and *Baeotis bacaenita, B. creusis* and *Baeotis staudingeri* from Vagantes. Another one of my favorirte Riodinids was *Emesis neemias*, a very metallic looking *Emesis* unlike many of the "usual" orange and brown species.

After Coroico we headed back up the death road to La Paz, where some people flew back the US and some new new folks came in for the 2nd part of the trip. The scenery was spectacular on the way back up the pass (see back cover). We had a flat so we had to stop to change the tire, and while the driver was dealing with that we walked back down the road a bit, and found a very fresh *Lasiophila regia* warming up on a rock at about 3,333m (11,000'), a nice butterfly to end the first part of our trip. Be looking for the second part of the Bolivia extravaganza in an upcoming issue of the News.

Jemadia (left) and *Phocides* (right); by Bill Berthet.

Lasiophila regia; by Dan Wade.

Baeotis elegantula, by David Geale; *Baeotis creusis,* dorsal by Bill Berthet, ventral by Tony Hoare.

Baeotis bacaenita, by Tony Hoare; *Baeotis staudingeri,* by David Geale; *Emesis neemias,* by Dan Wade.

So you think conservation is a relatively recent concern . . .

A conservation concern from the 1870s

Ernest H. Williams

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"In the name of all lovers of nature, who are also influenced to some extent by feelings of respect for local peculiarities and curiosities, I would try to raise my voice and pen against the wholesale destruction of [a] singular local variety of butterfly." Adam White, 1874.

A population of butterflies may decline in abundance so much that it disappears, and the reason is almost always habitat change. In my own work, I've documented the loss of several populations of *Euphydryas gillettii* due to forest succession and warming conditions that changed the habitat (J. Lep. Soc. 66:147-155). One may wonder, too, about the direct effects of humans; people can cause changes in habitat, but could overcollecting contribute to the loss of a population? The answers I've heard from a number of Lepidoptera researchers are consistent in stating that no cases are known in which collecting was a cause of extirpation. Of course, extensive collecting in a local area might interact with habitat degradation, and a combination of factors could lead to such a loss.

This concern has been on my mind because in looking through an antiquarian bookshop, I was surprised to find a copy of a letter published in the U.K. in 1874 that pointed to overcollecting as causing the disappearance of a lycaenid from the Edinburgh region. The author, Adam White, said the loss was not from average collecting or loss of foodplant: "its destruction is caused by no wandering boys or girls hunting after butterflies; it is not from any want of pretty yellow rock roses, the foodplant of its caterpillar…that it is now so scarce." Instead, his concern was for large scale or commercial collecting: "Some collectors have taken hundreds, if not tens of hundreds, of this little rarity. One person has supplied the cabinets of foreign entomologists with it, and it is believed has formed, and is engaged in making, a large collection of European Lepidoptera, principally by exchange. Now, such conduct seems to me to be unfair." In a marginal note of the copy I found, he had written the name of one particular large-scale collector, a dentist in Edinburgh. The letter is entertaining to read; he stated concern about the "locust-like rapacity of some collectors" and worried about "collectors, working like so many beagles."

No evidence was given about why this butterfly had disappeared locally; rather, White was simply suspicious that heavy collecting was the cause. Knowing little about British perceptions of their butterflies, I was surprised that conservation concerns were being expressed so long ago. But Bob Pyle, who has studied butterfly conservation in Britain, recently told me that claims of overcollecting were published frequently in the nineteenth-century entomological press. Even so, I find this example noteworthy.

The background of this case is as follows. The title of the letter was "The Gradual Extinction of the Artaxerxes Butterfly on Arthur's Seat," and it was published in the Portobello Gazette. Portobello is now a suburb of Edinburgh. Arthur's Seat is a high hill within the city of Edinburgh (just the sort of place I would go to look for butterflies); legend has it named after King Arthur. The species was the northern brown argus, *Aricia artaxerxes,* currently a priority species for conservation because of loss of habitat across its range due to grazing and tree plantations (**www.ukbutterflies.co.uk**). Thus, the recent decline of the species is attributed to habitat change. I don't know if it is currently found on Arthur's Seat. Adam White was a Scottish naturalist who worked in the zoological department of the British Museum from 1835 to 1863. He was a member of the Linnean Society and the Entomological and Botanical Societies of London; though he specialized on crustaceans and insects (a beetle is named for him), he was quite knowledgeable about plants and even wrote books on birds and mammals (Oxford Dictionary of National Biography, 2004). As expressed clearly in his letter, he held strong conservation views. His letter makes me want to visit Edinburgh and climb up on Arthur's Seat to see what's flying there now.

More Announcements:

Continued from page 175

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. We are a very active organization. We have two or three field meetings every year. Annual dues are $15.00.

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

PayPal is the easy way to send money 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. The process is simple: 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!

Ghost moths of the world website
http://www.johngrehan.net/index.php/hepialidae/

John Grehan

Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, PA 15213 **Calabar.John@gmail.com**

The 'Hepialidae (ghost moths) of the World' website reflects a lifelong interest of mine and represents an effort to make this relatively obscure group of moths more accessible to a wide audience. Ghost moth larvae are secluded feeders living in tunnels made from host tissues, other substrates, or silk webbing, and they have host plant associations that often involve a developmental transition from mycophagy/detritophagy to phytophagy. Adults are short lived due to their lack of functional mouthparts. In regions such as Australasia and South America the family is represented by many genera and species and includes some species that are sufficiently numerous to be regarded as major agricultural pests. In many other regions the family attracts much less notice, particularly where the moths are infrequently attracted to light.

The website provides a global list of currently recognized ghost moth genera and each is linked to an individual page where all species are listed, and each is illustrated by a photograph of a mounted specimen wherever possible. A general summary for each genus includes notes on distribution, systematics, habitat, and biology. Where sufficient information and illustration is available, individual species are also given separate pages. The main page also includes links to former and current hepialid research, hepialid biology, and hepialid systematics. Although the principal focus is on the family Hepialidae, links are also provided for other exoporian families. A taxonomy page lists taxonomic works over the last decade or so including studies by Carlos Mielke, Mirna Casagrande (Latin America), Svyatoslev Knyazev & Victor Dubalotov (central Asia), Ted Edwards, Ken Green, Mike Moore, Thomas Simonsen (Australasia), Weichun Li & Hongyi Wei, and Zhi-Wen Zou et al. (China).

The ghost moth site was initially developed through institutional web resources, and is now a standalone site thanks to the kind guidance of Malte Ebach. Further development of the site was made possible through collaborations with a range of enthusiasts including Victor Gashtarov, Carlos Mielke, John Nielsen, John Rawlins, Thierry Salesne, Nick Temby, and the kindness and generosity of many other researchers and amateurs throughout the world, particularly for providing images of adults and larvae (including the recent contribution to the Newsletter by David Fischer). The web project has helped me keep in touch with new developments in hepialid research, including, in Australia, the entomological equivalent of the storm chasers who endure the hazards of ticks, mozzies, and roos and other dangers to chase down weather correlated ghost moth emergence (see John Nielsen's blog at **https://australianhepialidae.wordpress.com/)**. Also there are technological applications such as time-lapse photography of emergence (Peter McKenzie), and video records of courtship behavior (John Turner).

To further expand the content of this site I am always interested in additional images, particularly habitat and habitus illustrations, as well as new information. I also encourage further collecting and photography of ghost moths in various parts of the world, particularly where there is currently relatively little information, if any, in places such as the Celebes and the Lesser Sunda, the central Andes of northern Peru, and northern East Africa such as Kenya and Ethiopia (no records yet from the latter). Much of East Asia is poorly sampled, with many records being limited to a few scattered specimens. In such regions photographs are always welcome, but identification usually requires a specimen. Even in places such as Costa Rica that have been extensively surveyed for their high biodiversity, the ghost moth fauna is poorly known.

Lastly, I should mention that while species illustration is very extensive on the website, some groups have major gaps, particularly for South African and Asian species. I would be pleased to provide information to any readers who have the opportunity and inclination, the location of type specimens or other material that could be photographed at institutions such as the Natural History Museum (London), the Senckenberg Research Institute and Natural History Museum (Frankfurt) and the Ditsong National Museum of Natural History (Pretoria) to name a few.

My thanks to James Adams for encouraging this article.

Zelotypia stacyi (Australia). Photo by John Nielsen

Left to right: *Endoclita signifer* (India), photo by Vijay Ismaval; *Aepytus guarani* (Brazil), photo by Elyana Joerke; *Aenetus virescens* 'albo extremus' morph (New Zealand), photo by John Grehan; Carlos Mielke with collectioni of *Rosela tesselatus* (Brazil), photo by Elyana Joerke.

Aenetus cohici (New Caledonia), photos by Thierry Salesne. Clockwise from upper left: female green form; male green form; male blue-gray form; emerging adult; mature larva.

Left: Nick Temby with *Trictena* sp., photo by Nick Temby; Right, below: John Nielsen with some Australian hepialids and poster of micros, photo by John Nielsen.

Book Reviews

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

The genus *Eucosma* is a very diverse genus in North America and their identification has been difficult for numerous species. Many of the descriptions were in scattered references, types were misinterpreted, and species were over and under described especially in the west. Most species treated in this book were traditionally placed in the genus *Thiodia* and then later *Phaneta*, and this book uses the most recent placement following work by the same authors from the previous year.

The book opens with a concise introduction to the little that is known of the natural history of *Eucosma* with a detailed account of the taxonomic history of this group and morphological terminology used. The bulk of the book is dedicated to species accounts, with the majority conveniently divided up into species groups. Nine new species are described in this book and the descriptions are not only well done and thorough, but they fit seamlessly into the rest of the text.

Each of the 133 species accounts are concise and clearly state how to separate the species from similar ones. A full synonymy is given and in many species a concerted effort was made to determine the holotype from a series of cotypes, or neotypes were designated. In more difficult groups the discussion is lengthy but useful in conveying the challenge of delineating species boundaries.

The adult and genitalia plate numbering is consistent with the species accounts, making association easy. The adult plates are excellent where numerous examples are typically illustrated for each species and structured for easy comparison. The genitalia plates show the artistic mastery and scientific perfection that are comparable to their previous publications but on a much larger scale. One thing that is incredibly helpful but rarely seen in large treatments like this is drawings of the extent of variation in genitalia structures for most species.

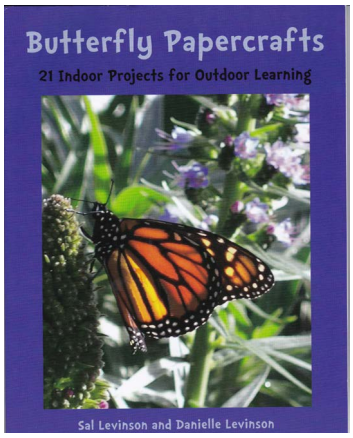
Overall Wright and Gilligan's book has made a very difficult group accessible to everyone. The amount of work and expertise that went into it are immense and they managed to produce something that is practical and very useful in identifying *Eucosma*. Another strength is that they clearly identify difficult groups that still need work, not just in vague terms but with enough information that future researchers can use it as a starting point. It is hard to pick out imperfections in this volume, but there are two things that I would have liked to see, though admittedly they are more reflective of my personal preferences. Firstly, having the adult specimens illustrated to scale would have been useful, however the measurements are given in the text. Range maps would have also been nice to supplement the geographic ranges described in the text, but as is stated in the introduction, most species are too poorly known to do this in a meaningful way.

This book is a necessity for anyone identifying North American tortricids and I am sure I am not the only one anxiously awaiting the next volume on the equally difficult genus *Pelochrista*.

Jason J. Dombroskie, Department of Entomology, Cornell University, **jjd278@cornell.edu**

Butterfly Papercrafts by Sal and Danielle Levinson, $5.90

This attractive, inexpensive book by a mother/daughter team contains 21 paper-cutting projects that will interest children of any age. Coupled with content about each project, children are invited to make a butterfly egg, a caterpillar, a chrysalis, as well as flower projects, a flip book, and other attractive constructions.



The cutting is too difficult for a very young child, but most of the projects are relatively simple and will interest 5 to 12 year olds. Each cut-out design is on the right facing page, with instructions and information on the left facing page. My grandchildren (ages 7 and 9) would take one look at this book and run for the crayons and scissors, immediately ready to dive in and cut up the book. But if they cut directly from the book, the instructions for the following project (on the back of the pattern page) would be destroyed. The book recommends that the crafts are copied onto heavier paper or card stock, and hopefully the adult using the book will have noted this suggestion and will have a copier and heavy paper on hand. This necessary preparation is the only limitation I found on this otherwise valuable addition to the educational literature.

Carol A. Butler, **cabutler1@verizon.net**

Entomology museum volunteer Jeff Smith honored by UC Davis

Jeff Smith, a volunteer at the UC Davis Bohart Museum of Entomology for 27 years, was honored October 2, 2015, with an Award of Distinction from the university's College of Agricultural and Environmental Sciences.

The award is presented annually during a "College Celebration" event to honor those whose contributions and achievements enhance the college's ability to provide cutting-edge research, top-notch teaching, and innovative outreach. Smith was acknowledged as a "Friend of the College."

"Jeff has made major contributions in his work with the museum collections and his tremendous public outreach and education efforts," said museum director and entomology professor Lynn Kimsey. "For him it's a labor of love. For us he's the best thing that ever happened."

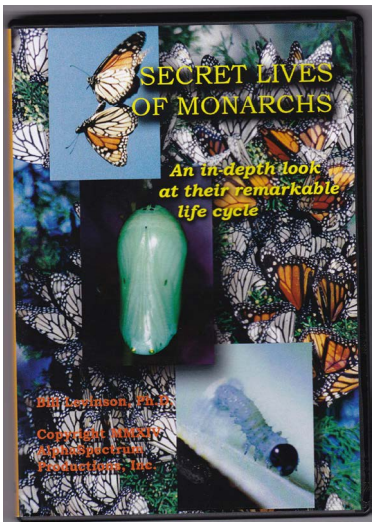
Over the years Smith took on curation of the museum's collection of Lepidoptera, the taxonomic order of butterflies and moths. He completely reorganized the collection, which contains more than 400,000 specimens. He spent an estimated 33,000 hours treating thousands of field-collected specimens with humidifying chambers to spread the insects' wings and reveal their features. This skill has helped integrate thousands of donated specimens into the museum's collection.

About a decade ago, Smith began assembling specimen drawers from kits, which substantially lowered curatorial costs. More recently he's applied his expert woodworking skills to scrap lumber to make the drawers himself — more than 2,000 drawers so far at no cost to the university. He also makes smaller specimen boxes for students to use in entomology field classes.

Jeff Smith in his element!

Smith has a phenomenal knowledge of urban insect and spider pests, and frequently fields questions about them. He is a familiar face at open houses and interacts easily and enthusiastically with children and adults. He and his wife have also made financial contributions toward the museum's endowment.

(Media contacts: John Stumbos, College of Agricultural and Environmental Sciences, UC Davis, 530-754-4979, **jdstumbos@ucdavis.edu;** Robin DeRieux, College of Agricultural and Environmental Sciences, UC Davis, 530-752-8244, **rderieux@ucdavis.edu)**



The Secret Lives of Monarchs: An in-depth look at their remarkable life cycle, DVD by Bill Levinson, $9.95; downloads $1.99 to rent, $2.99 to purchase.

This video is fascinating. Its close-up images of the transitions from stage-to-stage are the best I have ever seen. We see a tiny larva eating its way out of its egg, a caterpillar pulsating and shedding its skin, a fifth instar larva forming a chrysalis, and a butterfly emerging. The images and accompanying explanations have the power to enthrall both children and adults.

The simple music and no-frills video technique are perfect complements to the detailed content, although I felt that the flat narration was out of sync with the dramatic, exciting images. The video is only 17 minutes long, and I think Levinson found a good balance between staying with the gradual transitions and yet not dwelling on them so long that he risked boring some viewers. I wanted the video to be longer so that the detailed images of the enfolding transitions could be less condensed, but even with the necessary editing it is an amazing view of biological phenomena that most people never have the opportunity to observe.

Carol A. Butler, **cabutler1@verizon.net**

New Publications

Butterflies of Alaska, A Field Guide. Kenelm W. Philip (Posthumous) and Clifford D. Ferris. 104 pages, spiral bound with durable covers; 8.5" x 11". The known 79 resident and 5 casual species are illustrated in full color. Each species entry includes information on geographic distribution, habitat, basic biology, flight period, diagnostic characters, and field behavior. A species index and plant index are included. $30 plus postage. ISBN 978-1-944242-71-8. Available after 1 December, 2015 from Alaska Entomological Society at **http://www.akentsoc.org/documents/field-guide-to-alaska-butterflies.**

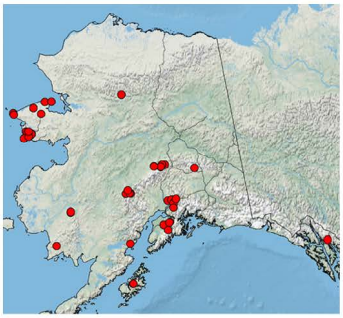
Diagnostic characters. Expanse: 52 mm. *P. phoebus* is distinguished from *eversmanni* as noted above for the latter species. The sexes are slightly dimorphic. The females have a darker and more dusky appearance than the males and the red spots are larger and more prominent. In females of *apricatus* the two large mid-wing red spots typically have pale centers, while in *golovinus* the spots are solid red. The hind wing red spots in *golovinus* are larger than those in *apricatus*.

Male V

Male D

Female V

Female D

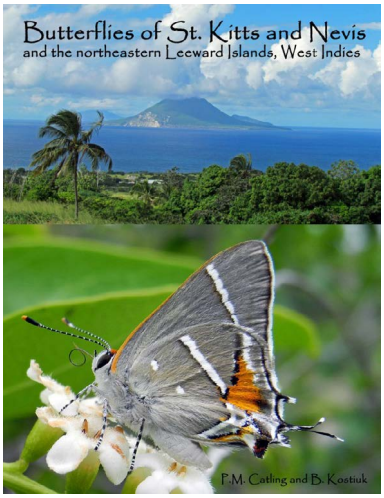


Parnassius phoebus apricatus

Sample page from Butterflies of Alaska, A Field Guide.

Field notes. *Parnassius phoebus* is a relatively lazy flier. The males patrol a foot to several feet above the ground surface searching for females. They settle frequently on soil/gravel patches with wings expanded to gain heat from the sun (dorsal basking) and on flowers to take up nectar. The females are more sedentary and spend much of their time in the understory with wings expanded (as shown in the accompanying field photo). When startled, however, they are rapid and determined fliers. Generally these butterflies are found in close proximity to their larval host plant.

Butterflies of St. Kitts and Nevis, Paul M. Catling and Brenda Kostiuk, 98 pages. Available June, 2015 from Nevis Historical and Conservation Society, Alexander Hamilton Museum, P.O. Box 563 Charlestown, Nevis, West Indies.



Concept: Butterflies play an important role in the environment through interactions with other organisms and they can serve as valuable environmental indicators. Popularity of butterfly watching and photography has recently increased, as better equipment and help with identification has become available. "As well as making information accessible, we decided that we wanted to make a guide that would be of both scientific value to biologists and of popular interest so that it could be used in schools and by teachers, as well as by both tourists and residents". "This work was inspired by the spirit of cooperation that has existed between people of Canada and the people of St. Kitts and Nevis."

Description: This 98 page guide, based on a survey in 2013 and 2014, covers most of the approx. 70 species of butterflies in the northeastern Leeward Islands and all 49 species found on St. Kitts and Nevis. For each species, notes are provided on natural history, classification, identification, and historical records. Most species are illustrated. Ninety-two color plates are included. The butterfly fauna of the two islands is an interesting admixture of species that have arrived from the Greater Antilles to the north and from the Lesser Antilles to the south. The butterflies contribute to an understanding of the origins and evolution of the Caribbean flora and fauna. Due to isolation on islands and island chains, some species and subspecies are known only from the West Indies, or only from the Lesser Antilles, and some are restricted to the northeastern Leeward Islands. The introduction provides information on historical factors likely influencing the butterfly fauna, larval foodplants, habitats and habitat monitoring using butterfly counts, differences between butterflies and moths, protective coloration, butterfly stamps, references, and online resources.

About the Authors: Brenda Kostiuk is an avid wildlife photographer and expert trip organizer. She works with great enthusiasm in activities aimed at biodiversity education. Paul has served conservation through his work with the Nature Conservancy of Canada (NCC), the Canadian Botanical Association (CBA), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). He has received many awards and has written books on a variety of subjects including Canadian floral emblems, medicinal crops, local flora, birds, dragonflies, grasshoppers and butterflies.

Additional notes on the butterflies of St. Kitts and Nevis

Paul M. Catling and Brenda Kostiuk

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Our most recent trip to St. Kitts and Nevis (13 June to 4 July 2015) resulted in a number of observations that extend the information in our recent field guide "Butterflies of St. Kitts and Nevis, and the northeastern Leeward Islands, West Indies":

1. Larval foodplant for *Danaus plexippus megalippe,* Monarch

We noted previously that the abundance of Monarchs was a puzzle since the likely foodplant, *Asclepias curassavica*, is uncommon and we had not seen larvae on the naturalized African tree milkweed *Calotropsis procera* (which is common in disturbed habitats along roads and conspicuously green in the dry season). However, in June 2015, on both St. Kitts and Nevis we found larvae and chrysalids (both occupied and vacated) on low regrowth from cut plants and on lower leaves of young plants at 10 locations on St. Kitts and 4 on Nevis. This explains the abundance of Monarchs despite the scarcity of *Asclepias curassavica*. It may also provide yet another example of a native butterfly using an alien plant, although *Calotropis procera* may have spread naturally by long distance dispersal as well as being introduced as a garden plant or accidentally with cargo from Africa. Both of these foodplants have been reported previously (Riley 1975, Smith et al. 1994). The Large Milkweed Bug (*Oncopeltus fasciatus*) has established on the north side of St. Kitts and feeding *C. procera*. Its potential impact on the plant and on the Monarch is unclear.

2. Distributions of *Junonia evarete* and *Junonia genoveva,* two buckeyes

We had hypothesized on the basis of few observations and reports from elsewhere that *J. evarete* would be locally common in some coastal areas whereas *J. genoveva* would occur throughout at all elevations. We now have observations of *J. evarete* at 6 localities on St. Kitts. All of which are on the coast: 15 at Half Moon Pond on 14 June and 10 there on 18 June; 11 at Majors Bay Salt Pond on 15 June and 8 there on 19 June; 4 at W end of Salt Pond at Frigate Bay on 16 June; 4 at Bird Rock W of Frigate

Bay on 16 June; 5 at Muddy Pond on 18 June; 5 at a salty pond at NE end of Great Salt Pond, Christophe Harbour on 19 June. Our additional observations of *J. genoveva* include over 100 individuals from 10 localities of varying elevation but only one in coastal saltmarsh. All of the *J. evarate* were within 5 yards of Black Mangrove, the larval foodplant (shown in the field guide). We noticed that the antennae clubs of *J. evarete* are dark brown or black on the unscaled part below and mostly brown above with brown scales (and scaleless areas) whereas those of *J. genoveva* are pale yellowish below and mostly pale whitish above with white as well as brown scaling. The dirty brown under hindwings of J. *evarete* (see Catling & Kostiuk p. 38) seemed distinctive and we did not have difficulty in separating the two taxa.

3. *Papilio demoleus*, Lime Swallowtail

Although this alien species was predicted and illustrated in the field guide based on its occurrence on nearby St. Eustatius (Statia), there were no records for St. Kitts and Nevis until mid-June 2015 when three were seen on St. Kitts: SW of Monkey Hill, Trinity and Fairview Estate. These locations are approx. 4 km apart in the middle south side of the island. It has only recently spread to the West Indies (see Catling & Kostiuk 2015) and it is not included in Riley (1975) or Smith et al. (1994).

4. *Eunica monima*, Dingy Purple Wing

This species is often uncommon, but sometimes abundant and migratory, in its West Indian range. It has not been reported from the Lesser Antilles, although it does occur on Puerto Rico (Smith et al. 1994). We saw 4 along the Wingfield River on St Kitts. The white forewing markings on one of these were very obscure but more clear on the one figured (Figure 1). The specimens from St. Kitts were less prominently marked than others we have seen in illustrations but it is considered variable and no subspecies are recognized. Its habitat on St. Kitts is rainforest with small glades. If it was included in the guide it would follow *Marpesia* and precede *Hypolimnas*.

Literature Cited

Catling, P.M. and B. Kostiuk. 2015. A field guide to the Butterflies of St. Kitts and Nevis, and the northeastern Leeward Islands, West Indies. Privately produced. 98 pp.

Riley, N.D. 1975. A field guide to the butterflies of the West Indies. Collins. London. 224 pp.

Smith, D.S., L.D. Miller and J.Y. Miller. 1994. The butterflies of the West Indies and south Florida. Oxford University Press, New York. 264 pp.

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

Metamorphosis

Chris Grinter

Steven James Prchal died in Tucson, Arizona on April 17, 2015 at the age of 64 after a month in hospice care. He was a passionate environmental activist, mentor, friend, teacher, father, old-school naturalist and desert rat. Born on May 20, 1950 to Ken and Betty Prchal in Chicago, IL, his family moved to Tucson, AZ when he was four.

The desert wildlife captivated his imagination, adventurous spirit and curiosity. Many camping trips in Mexico and throughout Arizona fueled this passion. *Coloradia prchali*, (Saturniidae), named in his honor was discovered on one of these trips.

His love for the environment and desert ignited his career at the Arizona-Sonora Desert Museum in 1970 starting as a laborer and advancing to Assistant Curator of the small animal department. In 1986, he founded Sonoran Arthropod Studies Institute promoting educational programs about insects and their relatives. One of SASI's projects was starting the Invertebrates in Captivity Conference (now Invertebrates in Environment and Conservation Conference) supporting zoo and museum professionals. Steve along with Janet Bardwell and SASI hosted the 42nd annual meeting of the Lepidopterists' Society in 1991 in Tucson. That same year SASI published Butterflies of Southeastern Arizona by Richard Bailowitz and Jim Brock.

In 2002, Steve visited Costa Rica and moved to Dos Brazos del Rio Tigre on the Osa peninsula in 2004. His work in this new community fostered a police station, a municipal water system, conservation work to stop gravel harvesting in local rivers, and founding a new conservation foundation, Ventanas en Corcovado. Steve's passion, expertise and knowledge inspired many people in the zoo and museum field, insect enthusiasts, conservation community, and others.

On a personal note, Steve was a great friend, mentor and companion on numerous forays into the wilds of Sonora, Mexico. Numerous other entomologists and lepidopterists accompanied him on these trips which were always full of adventure, surprises and discoveries. Prchal was a meticulous camper paying great attention to details. We always had ice, shelter and good food, even after a week's time. Meals were always accompanied by locally made Sonoran quesadillas and often punctuated by poontang, a mix of tequila and tang with a twist of Mexican lime. The times, the bugging and the nights by the black lights will be missed. We truly lost one great entomologist and one of my dearest friends. *[contributed by Jim Brock]*

John Howard "Jack" Masters (26 May 1936 - 23 August 2015). Jack was a Life Member of the Society, first joining in 1961. Best known in the butterfly world for organizing collecting trips, mostly to Central America and Alaska. He was particularly interested in Ithomiine butterflies. Founded the Association of Minnesota Entomologists in 1966, which published a Newsletter (later named Bulletin, or B.A.M.E.) and the Mid-Continent Lepidoptera Series. He had served the Society as a Member-at-Large of the Executive Council, 2006-2009, and was greatly interested in promoting membership in the Society. *[contributed by Julian Donahue]*

Membership Updates

Chris Grinter

Includes ALL CHANGES received by 12 November 2015

New Members: Members who have recently joined the Society. All U.S.A. unless noted otherwise.

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Lost members: Publications returned - "left no address", "addressee unknown".

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Conservation Matters: Contributions from the Conservation Committee

Flying towards recovery: conservation of Fender's Blue Butterfly

Cheryl B. Schultz

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In 1980, Fender's blue butterfly (*Plebejus = (Icaricia) icarioides fenderi (*Macy)) was a little known butterfly. It was noticed by a mailman, Kenneth Fender, in 1937, and soon thereafter was forgotten and thought to have gone extinct. That all changed. In 1988, Paul Severns, 12, collected half a dozen Fender's blue, but his guide included Fender's blue so he did not consider the sighting noteworthy. The following year Paul Hammond, a lepidopterist, was searching for Fender's blue in the small and dwindling fragments of Willamette Valley prairie, and found a cluster in the hills near Corvallis in western Oregon. His encounter made the New York Times.

Today both Pauls are part of the effort to conserve and restore Fender's blue, and all of the native species that inhabit Willamette Valley prairies. Over the last two decades, a dedicated group of scientists, managers and landowners have worked collaboratively to find the butterfly, identify its needs, develop recovery strategies, and work towards its recovery. In a nutshell, Fender's blue has gone from a few dwindling, isolated remnants of prairies, to a systematic network of sites with growing populations that have the potential to achieve the recovery goal.

Fender's blue (federally endangered) is a small univoltine butterfly. Males have iridescent blue wings and females have rich rusty brown wings. They are found exclusively in prairies that maintain its larval hostplant, Kincaid's lupine (*Lupinus oreganus = L. sulphureus spp. kincaidii*, federally threatened), spur lupine (*L. arbustus*) and occasionally sickle keel lupine (*L. albicaulis*). The adults fly in May, females oviposit, and pre-diapause larvae feed until its hostplant senesces in late June. The following March, individuals emerge from diapause, feed on newly developing lupine leaves, pupate in April, and eclose as adults again in May.

Fender's blues' prairies have almost disappeared. Less than 1% of the Willamette Valley prairies remain, and most of the remnants are small, isolated and dominated by invasive plants. The landscape is a mosaic of pastoral vineyards, orchards, and grass-seeds farms, interspersed with the small to large cities of Corvallis, Eugene, Salem and Portland. Public land is scarce. As a consequence, conservation of the prairie ecosystem has required a concerted and collaborative effort to engage landowners and the public from across a spectrum of backgrounds.

My part in this story is as a scientist who grew from a green graduate student to a tenured faculty member now at Washington State University with Fender's blue as my focal story. As a naïve young and idealistic graduate student of 24, I was looking for a system in which I might have an opportunity to make real contributions to conservation. As a college student in the years of the Northern Spotted Owl debate, I was wary of environmentalists painting issues as black and white, or good and evil. Instead, I saw science as a path to construct solutions that would both protect the environment in balance with needs of people living in that environment. This led to my overall approach to science. Each project I embark on stems from the basic question of how to integrate ecological theory with natural history of species-at-risk to address questions we need answered to take steps forward.

Here are a few stories to highlight this wedding of science with application. The question that motivated my thesis work was "Will corridors work?" In this case, the West Eugene Wetlands Partnership was interested in constructing a corridor of lupine along the narrow banks of a diversion dike which led from Eugene to Fern Ridge Lake, a reservoir constructed by US Army Corps of Engineers in the 1930s. The West Eugene Wetlands was then a partnership of the City of Eugene, The Nature Conservancy, and Bureau of Land Management (BLM), and now includes many other partners. To answer this question, I needed to figure out 1) if a butterfly would stay in a corridor, and 2) do they fly fast enough to get between isolated patches in their lifetimes, whether inside or outside of a corridor. By the time I was done, I'd figured out that stepping stones would be a much better option for the butterfly (Schultz 1998, in Schultz and Crone 2015). And, the stepping stones were a much more practical option because a network of stepping stones has a lot of flexibility in terms of where land is restored and the size of each stepping stone. The managers, biologists, and agencies liked this approach because it gave them guidance without being too proscriptive.

While in graduate school, I started working with Elizabeth Crone, then an NSF postdoctoral fellow, now a Professor at Tufts University. She is a theoretical ecologist gifted with the creativity and ingenuity to find methods to answer questions in ways that are unique in the field. Together we tackled the question, "Burning for Butterflies?" to ask if fire would lead to net costs or net benefits for this endangered butterfly. With a combination of very limited experimental data and a quantitative model, we found that fire kills the larvae, but enhances the habitat and leads to more eggs – such that the benefit far outweighs

the costs (Schultz and Crone 1998, in Schultz and Crone 2015). Here, too, we could give some practical guidance. You can't burn everywhere, because it would singe all the larvae. Instead, burning about 1/3 of the occupied area of a site every couple of years gives the best overall benefit, but there are many good ways to apply the strategy.

Fast forward to today. We spent the next two decades in discussions about how to use science to find practical "rules of thumb" that would help conservation, and most of our collaborative work uses Fender's blue as a model species. Thus, our work, in concert with active discussions from biologists, managers, property owners and the public, led to framing questions that would help advance Fender's blue conservation and answering questions with the intention of providing flexible guidance that people could use on-the-ground and in their work.

Part of our work has been integrating research into the development of recovery criteria for Fender's blue. These criteria are the standards USFWS uses to judge if a species is recovered and therefore can be downlisted to threatened or delisted and taken off the list. We just published the full story in a "Practitioner's Perspective" in Journal of Applied Ecology (Schultz and Crone 2015). In a nutshell, we developed three "rules of thumb" that integrate ecology and natural history of Fender's blue into criteria to guide recovery. First, patches should be about 2 km apart for functional connectivity. This came directly from my thesis work that included dispersal-based studies to quantify how far a butterfly might fly if it spent its entire lifetime outside of lupine patches. This is admittedly an unrealistic assumption – butterflies always spend time in lupine when they first eclose as an adult – but it gives the maximum distance they might fly if they left their natal patch as soon as they eclosed.

Second, Fender's blue requires a minimum of 6 hectares of high quality lupine habitat to support a population if in isolation from other suitable sites. This both relates to core habitat needs as well as movement behavior such that the butterflies need large enough habitat patches to stay long enough to lay enough eggs to replace themselves. Resources are clearly important, and our work has contributed to setting target goals for resources based on the relationship between resources and population size. However, this criterion emphasizes that the marriage of resources, behavior and population dynamics, not just resources, is critical to evaluating patch size requirements.

Third, we measure recovery by minimum (not average) population size for the acceptable level of extinction risk set by US Fish and Wildlife Service (USFWS). For Fender's blue this minimum is 1000 butterflies in each network (not each patch) and 9 networks across the full range of Fender's blue. This is based on population dynamics of the butterfly and theoretical predictions about extinction risk grounded not in the average population sizes, but degree of variability in population size from year to year and ensuring the population never falls below the minimum in any given year. As with other criteria, flexibility is built into the framework. We worked with agency biologists to create a "look-up" table in the Recovery Plan with combinations of sites and population sizes to reach this minimum.

This criterion has met the most resistance of the three because it requires network population size be maintained above the minimum every year for 10 years. As part of this, it requires surveys in every year, even poor weather years, because extinction risk is most sensitive in the low years. In addition, it means that if we discover a new population, it can't "count" towards recovery until we have monitored for 10 years without dropping below 1000. This is quite important given the inherent variability in Fender's blue population sizes, which is a similar feature across many butterfly species. For example, a new site was discovered a few years ago with almost 2000 butterflies. In the time since discovery, it has plummeted to less that 500 butterflies. Similarly, a newly reintroduced site just suffered a setback when an August 2015 summer fire scorched dozens of acres near the heart of the reintroduction area. However, the need for annual population assessments has also led to development of a systematic monitoring protocol that can be applied across the species' range but is flexible enough to focus limited financial resources on sites and networks that will "count" towards recovery as well as sites in which we have active research to improve our ability to restore and manage Fender's blue and its habitat. The work to develop and implement the new monitoring protocol was led by Greg Fitzpatrick and Tyler Hicks, two private consultants, in close collaboration with USFWS.

These setbacks are far outweighed by the positive trends we see today. We estimated fewer than 3,000 butterflies throughout its range in the early 1990s. In 2014, we estimated more than 17,000. Although some of this increase is likely due to a switch in monitoring methodology in 2012, much of it reflects recent restoration and management efforts. With a Recovery Plan in place, and the cooperative and collaborative effort of many, we are now seeing successes across in multiple locations. Given focal restoration efforts, in part guided by rules of thumb to select size and location of important sites, populations are flourishing. At one site, The Nature Conservancy's Willow Creek Natural Area, a 12-hectare old hayfield was restored "from scratch" to native prairie and the population has recently climbed to over 700 butterflies. At BLM's Fir Butte area, the site had plentiful hostplant lupine but was overrun with weeds and nectar resources were scarce. Diligent work over the last decade to reduces weeds and enhance nectar is just now starting to pay off. The population dropped to just a few dozen butterflies in the 1990s, but has since grown to 1600 butterflies in 2014 and we estimate over 2200 butterflies in 2015. A key lesson from both of these is that restoration takes time. The work at Willow Creek took years to discover how to augment the supply of Kincaid's lupine seed, which is also a listed species, and then another decade of experimental work to learn how to implement

large scale plantings. At Fir Butte, Tom Kaye at the Institute for Applied Ecology, has worked closely with Sally Villegas, a biologist with BLM, to experimentally investigate aggressive management techniques followed by concentrated nectar plantings that took nearly a decade to establish.

Similarly, USFWS is working with interested private landowners to enhance and protect habitat. They use the range of regulatory and incentive tools within their toolbox to find the right tool to work with interested parties. This includes Safe Harbor Agreements, Habitat Conservation Plans, easements and much more. Mikki Collins, lead Fender's blue biologist for USFWS, and Steve Smith, a recently retired Private Lands biologist for USFWS, have been at the helm of working creatively across numerous parties, interests and people to achieve conservation goals that are rooted in science across the Willamette Valley. For example, a new site with significant potential was discovered in the early 2000s. The site is privately owned and within dispersal distance of a USFWS refuge with an important population Fender's blue butterfly. The site had lupine, but little nectar. The landowner was able to work with Steve Smith to put regulatory protections in place and then substantially enhance nectar. The site is just now seeing those efforts translate into butterflies increasing at the site.

Other successes include involvement across the community. In one sphere, 2015 saw the largest planting of Kincaid's lupine to date. As part of the Sustainability in Prisons-Oregon Project, a partnership of USFWS, Institute for Applied Ecology and USFWS, women at the Coffee Creek Correctional Facility raised and planted over 20,000 Kincaid's lupine seedlings at two National Wildlife Refuges. In another sphere, Willamette Partnership and USFWS are working with Willamette Valley vineyards to augment Fender's blue habitat within the vineyard landscape and craft an ecolabel certification process that will enhance visibility and marketability of participating vineyards.

The story of Fender's blue is a story of many people dedicated to butterflies and conservation and the confidence that science can help us advance conservation in a human-dominated landscape. As a result, Fender's blue is flying towards recovery.

Cheryl Schultz is an Associate Professor at Washington State University. She is a conservation biologist and has been working with Fender's blue butterfly and other prairie butterflies for over two decades. She is co-leader of USFWS Recovery Team for Western Oregon and SW Washington Prairie Species, which includes Fender's blue butterfly.

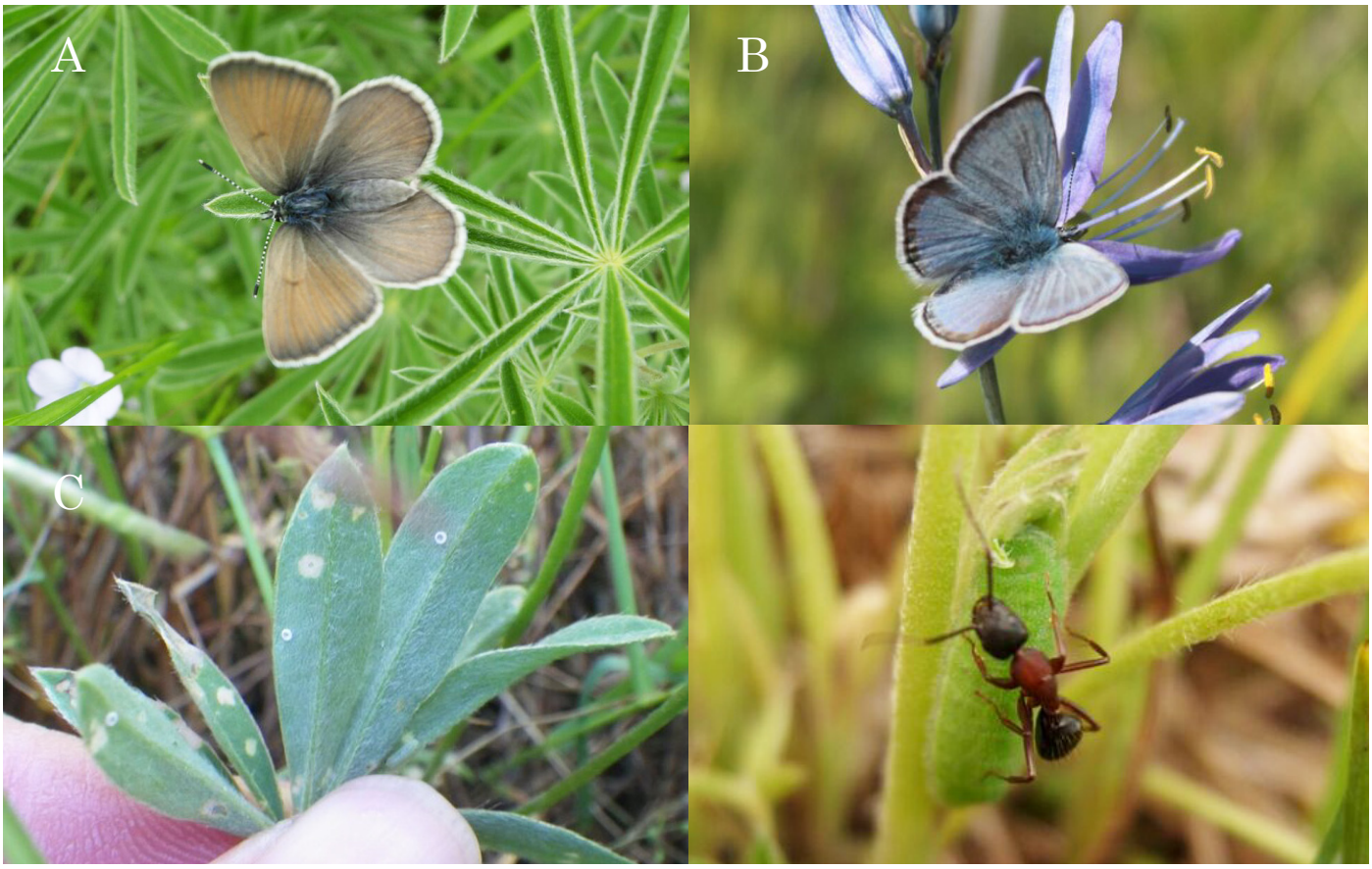

Fig. 1. Fender's blue butterfly a) Female perched atop a Kincaid's lupine leaf, b) Male basking on camass (*Camassia quamash*), a favorite nectar species in the early part of the season, c) Fender's blue hatched eggs and pre-diapause larvae (near tip of thumb), and d) post-diapause larva tended by an ant.

Fig 2. Cheryl Schultz and research crew at a site near Corvallis, OR in 2008. From left are Alexa Carleton, Alan Kirschbaum, Angela Little, Cheryl Schultz, Alex Martin, Michele Hansen, and Aldina Franco.

Fig. 3. Research at Baskett Slough Nat'l Wildlife Refuge, one of the largest remaining populations. Clumps of hostplant lupine across the prairie in early spring when post-diapause larvae are active. By late spring, when adults are flying, invasive tall grasses overtop hostplant lupines and nectar sources at most sites.

Figure 4. Restored prairie at The Nature Conservancy's Willow Creek Natural Area.

Literature Cited

Schultz, C.B., and E. E. Crone. 2015. Minimum patch size, minimum population size, and maximum inter-patch distance: Using ecological theory to develop recovery criteria for an endangered butterfly. *Journal of Applied Ecology* 52: 1111-1115.

Membership

The Lepidopterists' Society is open to membership from 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
Illinois Natural History Survey
1816 S. Oak Street, Champaign,
IL 61820-0904; 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 Publications Manager, Ken Bliss (address opposite).

Submissions of potential new Memoirs should be sent to:

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

Journal of The Lepidopterists' Society

Send inquiries to:

Keith Summerville
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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):

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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.

2. Article (and graphics) on diskette, CD 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 wordprocessing software and numerous photo/graphics software. Media will be returned on request.

3. Color and B+W graphics should be good quality photos suitable for scanning or, as indicated above, preferably electronic files in TIFF or JPEG format at least 1200 x 1500 pixels for interior use, 1800 x 2100 for covers.

4. Typed copy, double-spaced suitable for scanning and optical character recognition. Original artwork/maps should be line drawings in pen and ink or good, clean photocopies. Color originals are preferred.

Submission Deadlines

Material for Volumes 58 must reach the Editor by the following dates:

	Issue	Date Due
58	1 Spring	Feb. 15, 2016
	2 Summer	May 20, 2016
	3 Fall	Aug. 15, 2016
	4 Winter	Nov. 15, 2016

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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Coroico, Bolivia, Nov., 2013. View from the gardens of La Finca Lodge up into the mountains, by Kim Garwood (see related article, page 196).

Spectacular scenery along the death road between Coroico and La Paz, Bolivia, Nov. 2013, by Kim Garwood (see related article page 196).

Left: *Elbella* sp., Chulumani, Bolivia 1540m, Nov. 9, 2013, by Dan Wade; Right: *Phocides yokhara charonotis*, underside, Chulumani, Bolivia 1540m, Nov. 11, 2013, by Kim Garwood (see related article page 196).