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Collecting techniques for *Caurinus* (Mecoptera: Boreidae)

Loren Russell

Forty years have passed since I first found *Caurinus dectes*, and over these years I've used several techniques to collect these tiny boreids, ranging from simply bagging large grab samples of mixed bryophytes from the forest habitat and processing via Berlese funnel or wet-screening, to a much more focused concentration on the favored hosts—leafy liverworts. The most important of these hosts are *Scapania bolanderi*, growing on bark and rotting wood in coniferous associations, and *Porella navicularis*, a common epiphyte on deciduous trees and shrubs. Both of these leafy liverworts can be found growing in large patches, and both are also preferred larval hosts and oviposition sites. The distinctive dark, spindle shaped eggs, laid transversely on leaves of terminal or subterminal shoots of the hosts, make it possible to survey for *Caurinus* populations in the warmer, dry seasons when adults and larvae are absent.

Caurinus are most easily found in the rainy season—that is, October through April in Oregon and Washington, but nearly year-round in the true temperate rain forests of north coastal British Columbia and southeast Alaska. Perhaps you will join the hunt. **But remember: only the prepared will find their funnybugs.** This article is a Bug Scout's guide: How to Be Prepared, and specifically how to employ a brushing technique which has been successful for collecting *Caurinus* in all three known population areas—*C. dectes* in Oregon and Washington; *C. tlagu* in Southeast Alaska (Prince of Wales Island and Ketchikan); and a presumed new species of the genus [fide David Blades and Charlene Wood, Royal British Columbia Museum, Victoria] from the northern end of Vancouver Island in British Columbia.

My brushing technique dates from ideas shared by Mecoptera specialist Wes Bicha during his 2013 visit to Marys Peak. You can get a good idea of my technique by watching the short video posted online by Derek Sikes (<<https://vimeo.com/68819818>>), filmed during my Alaska trip, also in 2013. (While you're at it, you should check out the accompanying video to see how the funnybug hops: <<https://www.youtube.com/watch?v=UENj1XAq-H8>>.) Since

internet videos are not eternal, the take-away from my David Attenborough impression is: locate suitable hosts, here turfs of *Scapania bolanderi* growing on stumps and logs in a thinned second-growth hemlock forest. I position the beating sheet at the base of the stump and gently brush the liverworts with a soft broom or paintbrush (I prefer a very soft 4-inch paintbrush or one of the small side-handled brooms typically sold with matching dustpan). Since *Caurinus* have a typical boreid disturbance hop, very light brushing works while minimizing the accumulation of liverworts and other debris onto the sheet. I periodically stop brushing to clear debris and examine my catch. This is a job for young eyes.... These days, once I locate *Caurinus* at a site, I rarely spend much time sorting the contents of the beating sheet. It's more productive to remove the coarser debris, bag the remainder to examine at home (warmer, drier, better illumination, and a glass of cabernet all help), and finish off the samples with wet-screening or Berlese extraction. This combination of beating sheet and brush works well along roadsides and in open glades. Elsewhere, and especially where I encounter dense, often wet, undergrowth, steep slopes, and large woody debris, the beating



Scapania bolanderi, on coniferous stump, Vancouver Island, BC. Photo by Loren Russell.

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Zaid Jumean, David Blades, and Charlene Wood picking *Caurinus*, Vancouver Island, BC. Photo by Loren Russell.



"Don't look at me—I'm just another speck of dirt!" Photo by Loren Russell.

sheet is not ideal. The sheet becomes an impediment to travel, and it is easy to snag it on a branch or log and lose my samples before I can examine them. On occasion, I've nearly lost my sheet when I needed to put it down to push farther into the undergrowth. Even where it is not an impediment, a standard meter-square sheet can be too large and rigid to be positioned next to the bryophyte-covered surfaces that I am targeting.

The aggregator: To address the issues that arose when I used my beating sheet in rain forest conditions, I recently fabricated a collecting tool I call the "Russell aggregator." (My wife Flo suggests "Loren's Leaky Bedpan" is a better description.) This tool is a slightly modified paint strainer sold online and in paint and hardware stores for about \$5 under the trade name "Pro-Strain'r" (Encore Plastics, Sandusky OH. Note: there are similar paint-straining pans, but this seems to be the only one with the cutout mentioned below.). This circular, flat-bottomed tray is molded in flexible silicone plastic, and is designed to fit over the top of standard 3.5, 5, or 6-gallon [US] plastic paint buckets. The tray is

30 cm in diameter and 10 cm deep, and, conveniently for my application, it has a concave 15 cm wide cutout on one side. In its intended application, this cutout is meant to serve as a handle, but this shape fits nicely against tree trunks and other convex vertical surfaces. As purchased, the bottom of the tray is fitted with a fabric mesh with just under 2 mm square openings. Although this would work well as-is for larger insects, it just barely allows *Caurinus* to pass through, so I have covered it with a finer plastic mesh (ca. 0.8 mm diameter holes) that I found in a fabric arts store. The mesh is cut to size and cemented over the bottom of the tray with a strong flexible cement, "ShoeGoo", marketed as a shoe repair adhesive. I also used "ShoeGoo" to cement a section of a 38 mm bicycle inner tube to the cutout mentioned above. This rubber tube creates a flexible lip that better conforms to convex or irregular surfaces, thus decreasing the possibility of *Caurinus* falling between the log surface and my aggregator.



Above: modified Pro-Strain'r
Right: The Russell aggregator, ready for field work. Photos by Loren Russell.



I carry my aggregator in a very visible red paint bucket that holds the rest of my field kit: plastic bags, vials, knives and other tools, flagging, as well as bagged and tagged samples. The collecting brush (here I primarily use a small angled broom with ca. 15 cm wide sweep and 15 cm handle) fits in the aggregator. One of the plastic bags can be “active,” that is, open and folded over the lip of the pail, so that I can dump debris from the aggregator directly into it. When I want separate samples of more than one type of substrate at a site, I switch between bags using color-coded labels.

The brushing techniques described here can be very productive. In my work with the Sikes group (University of Alaska [UA]) on Prince of Wales Island (POW) in 2013, and again with the Blades group on Vancouver Island (VI), earlier this fall, we visited sites where *Caurinus* had been recovered in pitfall traps in the course of extensive ecological surveys. In each case, by locating *Scapania bolanderi* and using this brushing technique with standard beating sheets, we quickly found *Caurinus*. In 2 days on POW, we collected 37 *Caurinus*, equaling the sample size the UA group had accumulated over their 3-year pitfall-trapping study. On VI, the results were even more striking. The VI *Caurinus* were known from 13 specimens from a single subalpine site; we spent some time at the original site before finding suitable hosts, and two *Caurinus* specimens. After that, we were in a primary survey. At the end of four days we had well over 50 specimens in hand from 8–10 different sites [*Caurinus* were even present on the grounds of the AirBnB cottage that we used as our base!]. With later processing of bulk samples, the VI total has risen to about 150 specimens.

All of the POW and VI field work used beating sheets, but this exposed the limitations cited above. In my first field tests with my aggregator, I find it is not only easier to maneuver in the forest than a beating sheet but can be more productive as well. In one hour spent in a light drizzle at Marys Peak (the *C. dectes* type locality), I brought home a single small bag [ca. 3–4 liters] of debris brushed

from *Scapania bolanderi*. From this I ultimately retrieved over 80 *Caurinus*! A couple of weeks later, I used this kit to collect about 60 *Caurinus* in very wet conditions on the Stillaguamish River in Washington. On both these occasions, a beating sheet would have been useless, and in the past I would have brought back Berlese samples likely yielding no more than 10 specimens at each site.

As a closing note, I can suggest that this “aggregator” could be useful for anyone who is sampling arthropods from epiphytes and bark surfaces on stumps, tree bases, and in the canopy. I get large quantities of by-catch insects, myriapods and arachnids (especially linyphiid spiders), including a wide range of micro-arthropods (predominantly mites, Collembola and pseudoscorpions). The aggregator is light, easy to position next to or under sampling sites, and the tray is just deep enough to contain active arthropods (e.g., machilids, centipedes and the linyphiids). In addition, the smooth and hydrophobic plastic, which is meant to shed latex paint, stays clean in wet conditions, while the matte white surface makes it easy to spot the mostly dark-colored arthropods.



Loren Russell with the Russell aggregator on the upper Siletz River. Photo by Ali Sarlak.

Information on Boreids Wanted

I'd be interested to hear of any recent collections of boreids (*Caurinus*, *Boreus*, *Hesperoboreus*) in western Oregon and Washington.

Contact Loren Russell at <loren.russell@comcast.net>.

Olympus Camera For Sale

I've recently replaced my Olympus TG-2 camera and will sell my still-serviceable original cheap. With water-sealing, GPS, and very-close macro, this is a great tool for field work in wet conditions. (Derek Sikes shot the *Caurinus* videos mentioned above with its predecessor the TG-1.)

Contact Loren Russell at <loren.russell@comcast.net>.

William "Bill" Procuronoff Stephen (June 6, 1927– June 17, 2016)

Ron Lyons

William "Bill" Stephen was born to Stephen and Amalia Procuronoff in St. Boniface (now part of Winnipeg), Manitoba on June 6, 1927. He passed away at his home in Corvallis at the age of 89. His wife, Dorris Jo Stephen, passed away in 1996. Bill is survived by his 3 daughters, Dana Stephen Schaefer of Portland, Oregon, Jan Marie Boukather of Mission Viejo, California, Mary Beth Puton of Paris, France and son, W. Thaddeus Stephen of Willows, California along with ten beloved grandchildren and two great-grandchildren.

Bill received his Bachelor of Science in Agriculture (BSA) from the University of Manitoba in 1948. In 1952 he received his PhD from the University of Kansas, revising the bee genus *Colletes* (Stephen 1954).

During this time period, he held a staff position at the Dominion Entomological Laboratory/Field Crop Insect Laboratory at Brandon, Manitoba. In 1948 he reported on a preliminary survey of alfalfa insects conducted during 1947. The published summary says: "Preliminary observations indicate that the seed set in alfalfa

is directly proportional to the wild bee population of the area. All species of the leaf-cutter bees (Megachilidae) excelled in rapidity and thoroughness of tripping the alfalfa flower. ... honey bees do not exert a great influence upon the alfalfa seed yield under present conditions" (Barker 1948). At the laboratory he began studies on alfalfa pollination by wild bees (Bird 1963). The results of the work in Manitoba were summarized in Stephen (1955) in which he stressed the importance of the native bee fauna for alfalfa pollination and outlined management practices to protect their habitat.

Dr. Stephen joined the Department of Entomology, Oregon State College (OSC, now Oregon State University [OSU]) in May 1953, replacing Dr. Hermann Scullen who retired at the end of June. Dr. Ritcher (1953), then head of the department, described Dr. Stephen as "an ardent student of wild bees" and "hopes to establish their relationships by serological means."

Early in his career at OSC, Dr. Stephen undertook an extensive study of the bumble bees of western North America (southern BC, Washington, Idaho, Oregon, Utah, Nevada and California), partly in an effort to familiarize himself with the various species. During this study, he examined some 35000 specimens from a number of collections, redescribing the various species and subspecies and creating distribution dot maps (Stephen 1957). Some years later he followed this up with a review (Stephen, Bohart and Torchio 1969) that dealt with the genera of bees in the Pacific Northwest (northern California up to and including the Yukon and Alaska).

From its beginning in Manitoba, much of Dr. Stephen's work in entomology was oriented towards agriculture. While his research concerned wild bees and their biology, he concentrated on those species that had the ability to function well in agricultural settings. In 1956 he began studies of the alkali bee, *Nomia mellanderi*, as a pollinator of alfalfa that could be managed, publishing his first article on this bee in 1959. In 1959, he recognized the potential of the adventive leafcutting bee, *Megachile rotundata*, as another alfalfa pollinator that could be managed and began studies that summer (Stephen 2003: pg 48). Both bees had the ability to boost alfalfa yields significantly, and he was able to encourage both bees to nest near the fields, the former using artificial soil beds (Stephen 1959) and the latter with man-made nest holes (Stephen 1961). Studies of the biology, ecology, and propagation of both bees were published by Dr. Stephen and his students. *Megachile rotundata* eventually became the bee of choice—it was easier to manage and to transport. This bee was subsequently exported for use in a number of countries.

At the end of 1970 Dr. Stephen initiated pollination studies in Chile sponsored by the Organization of American States. The studies were designed to "determine how best to utilize wild and domestic bees in the pollination of seed and fruit crops in order to



Dr. W.P. Stephen and soda straws containing bee larvae (October 1963). Image from the Robert W. Henderson Photograph Collection (P 098), Oregon State University Libraries Special Collections and Archives Research Center.

achieve maximum yields” (Stephen 1972: p iii). *Megachile rotundata* was imported from North America for the study on alfalfa. These studies are reported in Stephen (1972).

In 1973, at the request of the governments of Argentina and the United States, he became Project Manager for a project on alfalfa productivity in Argentina for the Food and Agriculture Organization (FAO) of the United Nations. In a letter to Dr. Knudson Swenson, then head of the OSU Department of Entomology, dated June 11, 1973 soon after his arrival in Argentina, Dr. Stephen wrote: “We have at last found a place to live here [Buenos Aires] after a month in a hotel. Homes and apartments are not only scarce but extremely expensive with better places running as high as \$1000 a month. Aside from living accommodations the costs of other things are slightly less expensive than those in Corvallis, but it is hardly the place to retire on a social security income [sic]. The program itself is becoming operational with the government making its contributions without reminder or pressure. However, I am holding my breath until what we can determine what the new Peronists will do with existing agreements and obligations. Generally the feeling is that there will be little change in governmental attitude, but with the increase in violence and kidnappings it appears as though there will be a prolonged period of instability.” While the program did continue for a couple of years, at least for a while at the beginning Dr. Stephen and his family must have experienced some anxiety.

While Dr. Stephen was working in Argentina, he was also supervising a PhD candidate at OSU also working with *Megachile rotundata*. Apparently the student sent audio tapes down to Dr. Stephen detailing his progress, and experiments were conducted both in Oregon and Argentina in their respective summers as part of this research.

In 1974, chalkbrood, a fungal disease which had been present at



Megachile rotundata collected at Boardman in Morrow County, Oregon on June 13, 1963 by C. Osgood. The specimen is deposited in the Oregon State Arthropod Collection. Photo by Ron Lyons.

insignificant levels in the *Megachile rotundata* population, became a serious concern, causing high bee losses in Nevada. By 1977 the losses in Oregon were also very high. By 1978 it was widespread, resulting in large declines in bee populations and corresponding declines in alfalfa seed production (and economic consequences to producers and downstream users). Chalkbrood became a major focus of Dr. Stephen’s research efforts and that of his students at the time and remained so for a number of years.

In 2003, Dr. Stephen reviewed the work he and others had done using solitary bees, mainly *Nomia melanderi* and *Megachile rotundata*, in agricultural settings in North America. He wrote: “I hope that a critical look at commercially successful pollinators might spawn an equally critical and realistic look at the roles solitary bees might play in meeting future pollination needs in agronomic and natural ecosystems” (Stephen 2003: pg 42).

In a totally different vein, Dr. Stephen pursued his interest in serology publishing a number of papers over the years. Some of these studies included work on the behavioral responses of insects to insecticides. Apparently, an AP newspaper article in 1973 on the work he and Graham Tweedy were doing generated some public response. “The report that they were “training” cockroaches irked a lady in North Carolina, who considered hers smart enough. It was explained in a Corvallis newspaper story that the study was a follow-up to earlier findings that organophosphate insecticides cause “forgetfulness” in bees and spiders in sublethal doses” (Russell 1973).

Dr. Stephen became Professor Emeritus in the Department of Entomology in 1996. He transferred to the Department of Crop and Soil Science in 2003 when the Department of Entomology closed. In more recent years he worked with Dr. Sujaya Rao and her students on native bees, particularly bumble bees, in agricultural settings.

Dr. Stephen is listed on more than 190 publications and meeting presentations. His interest in bees, particularly wild bees, stretched back to the beginning of his career, as did his interest in their use in the pollination of alfalfa and other crops.

A special symposium is planned for the upcoming meeting of the Pacific Branch of the Entomological Society of America to honor Dr. Stephen and his work with wild bees, bumble bees, and in agriculture.

Acknowledgements

I would like to thank the personnel at the Oregon State University Special Collections and Archives Research Center for their help, especially Michael Dicianna who located the image used here and was otherwise very helpful. The quote from the 1973 letter is contained in Dr. Stephen’s papers on deposit in the Entomology Department Records. I would also like to thank Dr. Sujaya Rao for providing some unpublished material and Gwendolyn Ellen and Leonard Coop for help with the IPPC Library.

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Remembering Bill Stephen

Robbin Thorp (Distinguished Emeritus Professor, Department of Entomology and Nematology, University of California, Davis)

Bill Stephen published a review of the bumble bees of western America (Stephen 1957). This paper was timely for my studies on bumble bees starting in the late 1950s. My first publication added some new distribution records for California bumble bees building on his important contribution. We had many interactions since then, especially involving our mutual passion for bumble bees.

During a visit to his lab in the early 1960s I was impressed to see that they had produced basic techniques for rearing colonies of bumble bees from newly emerged overwintered gynes. Bill continued his interest in bumble bees beyond his retirement. He recognized the importance of a significant by-catch of bumble bees in a blue vane trap for beetles found by his colleague Sujaya Rao (Stephen and Rao 2005). His research led to this trap becoming an important sampling tool for bumble bees.

His coauthored publication on the biology of bees of northwestern America (Stephen, Bohart and Torchio 1969) is available online and I continue to use it for workshops on bee biology and identification. It was innovative in providing

illustrated keys to genera of western bees. Figures of the key characters appear in a column adjacent to the couplets in which they are mentioned.

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Enrique M. Martinez (Specialist in beekeeping and pollination, INTA¹ EEA² Hilario Ascasubi [retired])

Starting in 1972 or 1973, I developed research and extension programs exclusively in beekeeping, forming the experimental apiary of the EEA Hilario Ascasubi (province of Buenos Aires, Argentina).

During that period, I began activities under the framework of the FAO-INTA project "Recovery of the productivity of the crop of alfalfa in the Argentina," which ran during the periods 1971–1975 and 1975–1979. The first director of this project was Dr. William P. Stephen, an entomologist from Oregon State University (Corvallis, Oregon, USA).

Within this project was the "alfalfa seed production" component based at the EEA Hilario Ascasubi. This component included, among other studies, "pollination and the management of pollinators." It was in this area, that I performed research studies that were a valid contribution to our knowledge about the introduction, identification and conservation (mainly native insect fauna), and use of different pollinating species, such as the introduced leafcutter bee (*Megachile rotundata*) and the domestic bee (*Apis mellifera*) present in our area.

Later (1990s), within the framework of a Memorandum of Understanding between Oregon State University and INTA, and with the contribution of seed producers, I made 6 trips to the United States to gather information and study in order to train promoters of Cambio Rural (Rural Change program), beekeepers and alfalfa seed producers. These trips were coordinated and guided by Oregon State entomologists Drs. William Stephen and Michael Burgett. We visited areas of California, Oregon, Arizona, Idaho, Nevada and Washington. We also visited areas where the cells of *Megachile* were produced in Alberta, Canada.

During the FAO-INTA project, Dr. Stephen resided in the capital, Buenos Aires. He coordinated the first research studies, in his specialty, alfalfa pollination. Later, he was a consultant in different areas of Argentina—Noroeste Argentino (NOA), Nordeste Argentino (NEA), Centre de la Province of Buenos Aires etc. (i.e. the provinces of Rioja, San Juan, Mendoza, and Santiago del Estero, and Conesa [province of Rio Negro] and in the Valle Bonaerense del Río Colorado, Hilario Ascasubi, where *I had the great honor of acting as his counterpart and accompanied him in all the technical activities, wrote several publications, and also trained producers about alfalfa pollination.*)

Bill Stephen was a great friend and teacher for me and thanks to him I had the opportunity to set up several productive projects in the cultivation of alfalfa for seed. We participated in meetings,

symposia and congresses in different areas of the country.

We had a major impact on the production of alfalfa seed (increasing the quantity and quality) in the area of the Valle Bonaerense del Río Colorado, Hilario Ascasubi, the primary area for seed production for this forage legume in the country.

I contributed as author and co-author to technical bulletins, information pamphlets, and different books. Their bibliographies contained numerous works by Bill Stephen on the management of pollinating insects.

Within the project's framework, the EEA Hilario Ascasubi was designated as a research center on the subject pollination in alfalfa seed production.

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- Martínez, E., C. Moschetti et al. ~2010. Producción de semilla en el cultivo de alfalfa, problemática de la polinización con *Megachile rotundata* en la Argentina. unpublished report. Says: The 1970s were marked by the first importation of *Megachile* into Argentina. In the 1980s CORFO Rio Colorado also participated. In the 1990s other organizations including national cooperatives, private seed companies, INTA and other national agencies, became involved. They imported about 10 million cells of *Megachile*.

¹ INTA – Instituto Nacional de Tecnología Agropecuaria (<<http://inta.gob.ar/>>) – National Institute of Agricultural Technology.

² EEA – Estación Experimental Agropecuaria – Agricultural Experiment Station.

³ UNCPBA – Universidad Nacional de Centro de la Provincia de Buenos Aires – National University of Central Buenos Aires.

⁴ CORFO – Corporación de Fomento – Corporation of Promotion / Development Corporation.

John D. Vandenberg (Research Entomologist, USDA Agricultural Research Service)

I was a PhD student of Bill's and got my degree in 1982. I summarize and highlight work done by Bill, me, and another grad student at the time, Becky Fichter.

During the years of approximately 1980 to 1990, Bill (and the other two of us) published work on chalkbrood in the alfalfa leafcutting bee *Megachile rotundata*. We:

1. developed a rearing technique for bee larvae (Fichter, Stephen and Vandenberg 1981) that facilitated other studies,
2. determined the etiology and pathogenesis of chalkbrood in the leafcutting bee (the main work of my own thesis, Vandenberg 1982) (Vandenberg and Stephen 1982, Vandenberg and Stephen 1983a, 1983b),
3. revealed aspects of disease epizootiology (Vandenberg, Fichter and Stephen 1980, and Stephen, Vandenberg, and Fichter 1981), and
4. devised approaches to disease management (Fichter and Stephen 1987, Stephen and Fichter 1990a, 1990b).

I'm sure my experience in Bill's lab (and, I assume, a positive letter of recommendation!) helped me land my career job with the USDA, starting on honey bee disease work in Beltsville, Maryland. Later (1987–1993), I was able to resume working on leafcutting bees while stationed in Logan, Utah. During that time, Bill published some of his later chalkbrood papers with Fichter (Stephen and Fichter 1990a, 1990b). I transferred to Ithaca, New York, in 1993 and have since worked on non-bee pest insects; thus I didn't have much occasion to interact or collaborate with Bill. I saw him occasionally at ESA meetings and was able to catch up at those times.

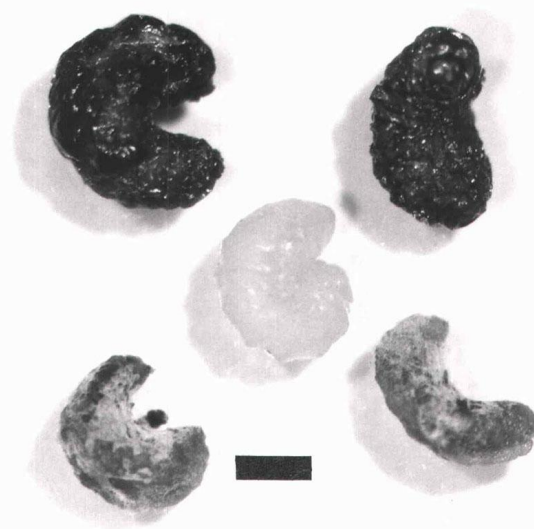
A PDF of my presentation for the special session on W.P. Stephen at the upcoming Pacific Branch meeting of the Entomological Society of America can be found at <http://odonata.bogfoot.net/oes/Portland2017vandenberg.pdf>.

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Chalkbrood cadavers (top), *Ascosphaera proliperda* cadavers (bottom) and healthy prepupa (center). Bar = 2 mm. Image © Vandenberg 1982: p. 43 Figure 5c.

Sujaya Rao (Professor, Oregon State University, Department of Crop and Soil Science)

W. P. Stephen is the reason I am now a native bee researcher. I was hired at Oregon State University (OSU) to address new pest issues in field crops; while trapping an invasive cereal pest, I serendipitously discovered that a particular blue vane trap didn't catch the pest but drew such an extraordinary diversity and abundance of native bees that I drew Bill's attention to it. The richness of the bees in the trap, in the absence of any odor, was striking, and Bill was in total disbelief. Seeing is believing, so together we conducted several experiments to further examine the unique bee attractivity of the trap, and in the process I learned about bees from Bill and expanded my research and outreach activities at OSU to include native bees. I also got to know about Bill's many achievements in the bee world such as domestication of the alfalfa leafcutting bee and the alkali bee and his FAO

assignment and work at INTA (Instituto Nacional de Tecnología Agropecuaria) in Argentina. During a recent visit to Argentina, I visited INTA where one researcher commented to me that during Bill's time there, to the alfalfa farmers in Argentina, Bill was like 'god' —thanks to Bill's leafcutting bee research they were able to increase their seed yields several fold. What a legacy! A few days before he died, Bill showed me all the data he had collected over the last decade with the blue vane trap—the new 'tool' had rekindled his passion for native bee research, and he had conducted many studies up and down the Willamette Valley. His last research paper was published in 2015 at the age of 88. I have never met a person with such dedication to the pursuit of knowledge about native bees and their behaviors!

C. J. Marshall (Curator and Collections Manager, Oregon State Arthropod Collection [OSAC])

Increasingly, our society attempts to quantify the impact of academic scholars by the number and influence of their publications and mentored students. These metrics do reflect important aspects of what academics do and in the case of Dr. Stephen certainly demonstrate how influential and worthy of praise he was. However, I write this short note to ensure that another important legacy of Dr. Bill Stephen is not overlooked, namely the impressive and important collection of bees, especially bumble bees, that he built and curated at the Oregon State Arthropod Collection over the course of his career.

Even though Dr. Stephen was not the only contributor of specimens to the OSAC bee collection, his role in building it into the research tool it is today cannot be understated. Bumble bee

specimens in the collection are routinely sought out by taxonomists, ecologists, pollination and conservation biologists who use them to help them answer a myriad of important questions. Dr. Stephen routinely worked with other museums and hymenopterists and through these contacts expanded the OSAC's holdings to include species from outside the Pacific Northwest. Quite simply, the OSAC bee collection would not be nearly as important a resource as it is today were it not for his input and collaborations.

Collections do not grow or acquire value on their own, and the investment of time and expertise required to do so goes unnoticed by many. But as the curator for the OSAC, I take notice of it. In fact, I think about it daily. Each specimen is not merely an important puzzle piece in mankind's ever-growing picture of biodiversity, evolution and ecology—but each is also a tiny frozen artifact of a person's life. Towards that end, every one of Bill's specimens records a moment when he was standing in a field swinging a net, or sitting at a lab bench carefully pinning and labeling it, or working through keys and literature to identify it... it's virtually impossible to work in the OSAC bumble bee collection without quickly coming into contact with something related to, or created by, the efforts of Dr. Stephen.

I shudder sometimes looking at the entire collection today, with nearly 3 million specimens, at all the hours it took the many people who have built this massive repository. In some cases, like Bill's, where I knew them personally, I recall my interactions with them; in others I simply wonder about who they were and what led them to collect and create a scientific specimen—but in all cases, I am grateful for their investment in this shared resource. I am thankful to have known Dr. Stephen and that his bumble bees are housed as part of our collection. I have no doubt that Bill Stephen's legacy at the Oregon State University will continue to inspire, inform and aid entomologists long into the future.



Bombus occidentalis collected 10 miles south of Palmer Alaska on August 1, 1966 by W.P. Stephen. OSAC specimen 78960. Photo by Ron Lyons.

Jeff Miller (Emeritus Professor, Oregon State University, Department of Horticulture)

In the OSU Entomology Club Newsletter Number 8 issued May 1977 under Departmental Seminars on page 21 the text reads: “Dr. William Stephen dusted off his impressive collection of cameras and other photographic equipment and showed how to take superb pictures of insects and other small or microscopic organisms.” I remember that Bill was the first in the department

to get excited about digital...early 90s. For perspective, the first consumer digital cameras came out in 2002. On another topic, Bill was the scholar in the department that incorporated evolution into his everyday thought process, something I loved because Population Genetics was one of my two minor topics for my PhD defense.

Beth Stephen Puton—Memories of Dad and His Work

Every vacation in the summer was in the family station wagon, always equipped with butterfly nets... to collect bees. All four children became very adept with catching bees, swishing them down to the end of the net, getting out the small plastic bottles and coaxing the bees into them... I don't remember ever being stung... or maybe we just got used to it. Once when my Dad was visiting me in Paris we were walking around the Luxembourg Gardens, and he couldn't help studying the bees on the flowers, saying that it was too bad he didn't have some equipment, because he was not familiar with one of the species... he must have been 70 then.

My Dad was stung so many times that he finally developed an allergic reaction to some species of bee stings. He was supposed to always carry an antidote with him at all times... I doubt that he did. He basically ignored anything that slowed him down when it came to his research, often doing a lot of the “grunt” work himself. He lifted and hauled so many “bee boards,” equipment and trailers while he was working on the domestication of the leafcutter bee that years later one doctor, looking at x-rays of his back, asked him if he was a farm laborer.

For 4 years in a row, when we were in grade school, our family went to an Experiment Station near Hermiston (eastern Oregon), and loved every minute. Dad was gone all the time working on his experiments, and we had the run of the station. We lived in a rickety old clapboard house with no air-conditioning, noisy screen doors, lots of agricultural equipment, dust, bugs, lizards, snakes, dogs and cats everywhere. It was a treat for a little kid! In the evening we would catch fireflies in glass canning jars and admire their glow. I realize now that my mother was half saint putting up with 4 little kids in that environment! I'm glad she had such a generous soul.

Concerning our family moves to Chile and Argentina, we seemed to follow all the political coups. My parents and our younger brother, Thad, moved to Chile and we three girls came a few months later. We arrived the day after Allende came into power. As US citizens, we were highly suspect, and regularly under surveillance. Our move to Argentina coincided with the return of Péron, and the apartment we so desperately needed to find was in the “Los Olivos” neighborhood... two blocks away from Péron's official residence (more surveillance). But surveillance was fine,

the real problem was kidnapping and attacks from far left guerillas.

Our apartment was on the 7th floor (because no one could throw a bomb higher than the 6th floor). There was a permanent guard at the entry to the building. We were given 2 pages of instructions from the US Embassy upon arrival of what you should and shouldn't do in order to avoid being attacked or kidnapped by extremists. Kidnappings of foreign people for ransom became standard, and even though a ransom was often paid, many times the person never returned. My mother was the director of a women's choir; I think about 4–5 women in the choir of 30 lost a family member during the three years she was their director.

My father was stopped a number of times in the countryside by guerillas with machine guns. He tried to explain that he was working with the Argentines to help improve their crop production. Of course, he never carried his US Passport, just his UN ID. But sometimes that didn't help much, as some of the guerillas had never heard of the UN. Fortunately he always came back in one piece, must have been that Stephen charm.

Our family's life and home was entwined with my father's passion for his work. Bees impaled by straight pins in our Dad's office, a garage half full of equipment from his experiments, discussions on animal behavior (and human behavior), were a regular part of our lives. As we grew older those discussions were often around a martini or two, and were always a joy.



Bill Stephen as a young man. Photo courtesy of Dana Schaefer.

Dana Stephen Schaefer—Memories of My Father

Bees were the center of my father's life, and in a typical 1950s manner, our family life revolved around my father's career. At every opportunity, the bees crept out of his home office, into the kitchen, garage, and yard. Not just the bees themselves, but broader pollination, production and farmers' issues, then the farmers, extension agents, graduate students from Chile and Germany, and later researchers from Argentina. Dad was a riveting teacher, lecturer and storyteller with a great sense of humor and unlimited charm.

Originally an engineering student at the University of Manitoba, he switched to Entomology telling his mother he thought people need food more than a bridge. While at Manitoba, he played basketball—while concurrently serving his mandatory service playing basketball for the Navy. He also delighted in getting “Overseas Pay” when the Navy team crossed the bridge to play in Sault Ste. Marie, Michigan. With great respect Dad spoke of playing an exhibition game against the original “Harlem Globe Trotters” in the late 40s.

He received his doctorate from the University of Kansas, where he met and married our mother, Dorris Jo. After a year in the far north of Canada, and with my birth the three of us moved to Oregon State University.

Dad spent his early years working with alfalfa pollinators, first with the alkali bee that nested in holes in the ground. I remember vacations spent on alkali beds in Eastern Oregon, early in the morning (as temperatures were deadly in the afternoon) netting bees—a skill all his children were taught early. He focused on the leafcutter bee (*Megachile rotundata*) as a pollinator for alfalfa, spending years finding the right nesting material that could be punched out; straw boxes, drilled timber, and then Styrofoam. The leafcutter bee became big business itself; hauled around in trailers, then boards had to be branded, then rustlers, eventually raised to sell by the gallon.

He took us to beautiful locations; catching bees at the coast, in beautiful meadows in the Cascade Mountains, on isolated Forest Service land, and in Canada, expanding the collection at Oregon State.

Corvallis offered a bounty of crops, fruits and nuts to study and impact yields through pollination, and papers were written on blueberries, pears, apples, cranberries, and red clover. I learned to identify crops from the car at 75 miles an hour—red clover, alfalfa, mint, hazelnuts, almond, berries, and fruit. Extra points were given for noting a clean field—or one with heavy seed. I am not sure if this was due to my interest or the totally desolate topography and radio in Eastern Oregon in the 1960s; as I consider the road between Bend and Burns and absolutely no speed limit—or none that my father chose to notice.

Dad was always interested in work adjacent to his field, and taught Animal Behavior, Evolution and Genetics, and Scientific Photography, in addition to Entomology. The dinner table, and later over cocktails, his work was always discussed in our home. I learned a lot over the years, parasitic wasps and chalkbrood were known nemeses to us all. And Dad would occasionally take perverse pleasure in discussing blue aspects of animal behavior at the dinner table; although fascinating, it was a bit of a sore spot with my mother.

Weekend activities occasionally included punching out bee cells, or painting “boards” or trailers with bright graphic symbols so the bees could identify home. Our refrigerator was filled with bees, alive but sluggish in cold temperatures and they would buzz when the door was opened, which elicited shock and awe from friends. In retrospect, my mother was incredibly tolerant.

Sabbatical took us to Chile for my senior year in high school where Dad worked with the OAS on alfalfa pollination, and we were exposed to unbelievable country, wonderful people, and a new culture and language. Dad already spoke English, German, rusty French, some Russian, and was becoming fairly proficient in Spanish. A year later Dad took us to Argentina working for the FAO of the United Nations developing alfalfa seed production programs, a relationship that continued through 2015 when he received an award from the FAO United Nations and INTA Argentina.

There were risks traveling in South America; Dad used to say we hit every coup in the Western Hemisphere. We had to relocate halfway through our stay in Chile, when we realized (relayed by the CIA) our home was a block from the new President Allende's home and the guns on the turrets had been trained at us. Later, in Argentina, it was hard for an American to rent an apartment due to safety issues, kidnapping of foreigners was common and Dad was intent on finding an apartment on an upper floor. He finally secured a rental from a reluctant German couple who were swayed by Dad's German ancestry and fluency. Rent was to be paid in person at their German restaurant, “ABC” in the heart of Buenos Aires; my mother refused to go after the first visit swearing it was full of Nazis complete with heel clicks. We later learned through an article in the New York Times that it was a well-known Nazi café, where Eichmann and Mengele were regularly seen dining in the 1950s, and frequented by right leaning President Juan Péron. The “ABC” restaurant is still open and has four stars on Yelp.

My last trip alone with Dad was driving in northwest Argentina, where we were stopped by a very young soldier with a submachine gun, standing in the middle of the road. It was in the middle of nowhere on land so flat and barren you could see the curvature of the earth and the soldier didn't recognize the diplomatic license plates. Dad got out of the car, at 6'3” he towered over the younger man, but laughed and talked, saying he was Canadian and

showing his diplomatic passport. Eventually the man let us pass. I don't know I ever relayed that story to Mom.

Dad continued research and teaching at Oregon State upon his return, but bees took a rare back seat for much of the 1980s and 1990s when he devoted much of his time in caring for my mother who eventually lost her battle with Lupus.

Spurred by colleague Dr. Sujaya Rao's discovery of an amazing variety of bees in a blue plastic trap he revved up his research into

native bumble bees. He would continue to set out and retrieve traps along flyways up and down the Willamette Valley, often driving and working in the the fields alone through the fall of 2015—much to our despair. He hijacked equipment, graduate students, his children and grandchildren to work on clover, blueberry and cranberry research and pollination.

He loved his work, the bees, his colleagues, good gin and set a wonderful example for his children and grandchildren to find a job you love and let it be your passion.



Left: Bill Stephen in Argentina in front of a trailer home for the alfalfa leafcutter bee, *Megachile rotundata*. A number of bees can be seen in the air around it. December 1999. Photo courtesy of Enrique Martínez.

Below: Bill Stephen in the Andes. Photo courtesy of Dana Schaefer.



Final Notes

Dr. Stephen's obituary from the Corvallis Gazette-Times can be found at http://www.gazettetimes.com/news/local/obituaries/william-p-stephen/article_8c5eecfb-1c85-5008-a7e7-bed0d0bb8fdb.html.

A special symposium titled "Honoring W. P. Stephen: Founder of west coast alkali bee, bumble bee, and leafcutting bee research" will be held at this year's meeting of the Pacific Branch of the Entomological Society of America in Portland, April 2–5.

A Note on *Bombus polaris*

The Fall 2016 issue of UCR Magazine has a nice article by Sean Nealon who accompanied researchers from the University of California, Riverside on a hunt to find *Bombus polaris*, the Arctic Bumble Bee. The full issue can be downloaded from <http://magazine.ucr.edu>. The online version of the article, also at this site, includes a link to a video.

Pacific Branch 2017 Meeting

The annual meeting of the Pacific Branch of the Entomological Society of America will take place at the DoubleTree by Hilton in Portland, Oregon on Sunday, April 2–Wednesday, April 5, 2017. For registration and program information, please visit <http://www.entsoc.org/pacific/2017-pacific-branch-annual-meeting>.

Funding Opportunities

Pacific Northwest Lepidopterists' Fund in Honor of Harold Rice

“In honor of Mr. Rice, we [the Oregon State Arthropod Collection (OSAC)] have allocated funds to support the community of Pacific Northwest lepidopterists to which Harold belonged. In particular, we hope the fund will encourage and facilitate the valuable research, work and contributions made each year by individuals, who like Mr. Rice, were not employed fulltime as lepidopterists, yet spend much of their personal time and resources collecting and studying these amazing creatures.”

– excerpted from the Fund's write-up

This fund, which provides one or two awards for up to \$500 each, is given annually to encourage activities directly related to PNW Lepidoptera and/or activities related to the improvement of OSAC's Lepidoptera collection. Past awards have gone to:

- Dana Ross to survey moths near The Dalles,
- Terry Stoddard for equipment to be used at schools,
- Matthew Campbell for equipment for the school lepidopterists' club, and
- Dana Ross to survey in Wallowa County.

More information, as well as directions for how to apply, can be found at http://osac.oregonstate.edu/PNW_LepidopteristsFund. The website now contains a sample application. For full consideration, applications must be received

by January 31; late applications will be considered if funds are still available.

If you have any questions (e.g. am I eligible?, would this project qualify?) or need some advice on writing your proposal (e.g. how specific do I need to be?), please contact Chris Marshall at OSAC, Christopher.Marshall@oregonstate.edu.

US Fish and Wildlife Service Section 6 Opportunity—Oregon

The US Fish and Wildlife Service and the Oregon Parks and Recreation Department have requested proposals for rare invertebrate research projects to be funded under their section 6 program for fiscal year 2017. Funds will be available to study federally listed, proposed, and candidate invertebrate species, and conduct status surveys for species of special concern in Oregon. Project budgets need to show 25% non-federal matching funds. The money from these grants will be used for projects in the 2018 field season, and projects are expected to be completed by December 31, 2018. Proposals, with estimated costs and match amounts, need to be submitted to Eleanor Gaines at the Oregon Biodiversity Information Center by January 16, 2017. If you are interested in submitting a proposal, please contact Eleanor at egaines@pdx.edu for information on the proposal format and the funding timeline.

OSU Department of Integrative Biology Seminars (live and online)

Seminars are held at OSU in room ALS 4001 at 3:30 pm (unless otherwise noted). Seminars are free and open to the public. If a live feed is available, you can attend online by registering/connecting to the seminar via the URL provided under the appropriate seminar up to 30 minutes prior to the official start time. Audio connections are also possible. For more information and a presentation schedule, please visit <http://ib.oregonstate.edu/smnr>.

New OSU Department of Integrative Biology Publication—BioVerse

The inaugural issue (Fall 2016) of the department's new publication, BioVerse, has 2 entomological items: A Journey of Research and Discovery in Entomology: The Trepaneleven (p. 8) and Ice Crawler *Grylloblatta chintimini* Discovered on Marys Peak (p. 12). The publication is currently available as a PDF at https://ib.oregonstate.edu/files/ib/OSU_Bioverse_2016Fall.pdf. (Note: This is a temporary web address.)

Northwest Lepidopterists' Workshop 2016

On 22–23 October 2016, over 50 people gathered in Cordley Hall on the campus of Oregon State University for the 38th annual workshop for lepidopterists of the Pacific Northwest. The meeting was hosted by Drs. Paul Hammond and David McCorkle and sponsored by the Oregon State Department of Integrative Biology and the Oregon State Arthropod Collection (OSAC).

Oral presentations were made by David Maddison, Chris Marshall, Dana Ross, Ann Potter, Steve Kohler, Paul Hammond, Jeff Miller, David Specht, Rob Fernau, Ron Lyons, David Lee Myers, and Matthew Campbell. Dr. Alma Solis led a special workshop on the Pyraloidea and gave the Saturday evening keynote address as well as a short presentation on Sunday.

David Maddison—Welcome

David Maddison welcomed the group on behalf of the Oregon State Department of Integrative Biology and the Oregon State Arthropod Collection.

He indicated that we were trying something new for the workshop this year—bringing in an outside speaker, Dr. Alma Solis from Washington DC, an expert on the Pyraloidea.

Last year David taught an undergraduate research course based on his favorite group of insects, the carabid beetles in the genus *Bembidion*, and more specifically one particular subgenus, *Trepanedoris*. This subgenus had not been worked on in a long time and David knew that there were a few undescribed species, mostly in California. David and the group were equally invested in the research, working and learning together. They went on field trips together and some of the students conducted their own explorations. They discovered two species in Oregon that David had never seen before, both also new to science. One was discovered in the Klamath Marsh National Wildlife Refuge; a followup trip to the Malheur National Wildlife Refuge to check

Lepidopterist Ron Hodges put in a surprise appearance.

In the pages that follow I (Ron Lyons) have summarized most of the presentations, as well as some of the other conversations. Chris Marshall summarized his own presentation and those of Dr. Solis. The summaries have been looked over and enhanced and/or corrected as necessary by the various speakers. Resources (in print and online) mentioned at the meeting are included with the relevant material.

The groups of Lepidoptera for emphasis this year were:

Butterflies: Satyrinae (Satyrs and Wood Nymphs)

Moths: *Hemileuca*, other day-flying moths and Pyralidae

out another possible location produced additional specimens. In addition, one of the students exploring a pond on her parents' property brought in some other specimens which turned out to be another new species! The story is written up in the premier issue (Fall 2016) of BioVerse, the Department of Integrative Biology's new publication (*temporary* web address <https://ib.oregonstate.edu/files/ib/OSU_Bioverse_2016Fall.pdf>). David said "It was the most rewarding experience in teaching I ever had."

Finally, David showed off his new belt buckle featuring an accurate (but very enlarged) representation of *Bembidion zephyrum*, a Pacific Coast carabid that lives on the upper beaches of the ocean's sandy shores. Metalsmith Jessee Smith created the design and fabricated the buckle in collaboration with David. He suggested that the group come up with a butterfly or moth species that would work similarly and suggest it to Jessee. Her Etsy website (<<https://www.etsy.com/shop/SilverSpotStudio>>) now includes the buckle as one of the items for sale.

Chris Marshall—Oregon State Arthropod Collection (OSAC) Update

(*OSAC receives NSF funds for Lepidoptera*) Chris Marshall indicated that a large collaboration of museums and institutions from around the country, of which OSAC was a part, had received National Science Foundation funding to digitize their North American Lepidoptera collections. The consortium, called LepNet, was spearheaded by OSU Alumni Neil Cobb, now at Northern Arizona State University. The grant will provide funding for 3 years with the ultimate goal to create a large Lepidoptera database and digital resource based on museum specimens. A large part of the funds coming to OSU will be used to hire Jon Shepard to coordinate the digitization effort.

Chris pointed out that digitization, in this context, referred primarily to capturing the label and taxonomic data associated with each specimen, as well as the metadata about the data capturing event. A small amount of funds were received to add exemplar images of specimens, but it will not be possible to include an image for every specimen. The limited funding for imaging means that the OSAC will be seeking volunteers or holding citizen science events around Lepidoptera imaging to provide images of as many specimens as possible.

Each record will have a unique bar code tag (catalog number) that

Northwest Lepidopterists' Workshop 2016 (cont.)

corresponds to a physical tag on each vouchered specimen. In response to a recommendation by Rob Fernau that UTM coordinates be used in preference to other systems, Chris indicated that, while UTMs are used by various government agencies, most of the national efforts to share georeference information across datasets use decimal degrees. Records for specimens with UTM data written on their labels will include the UTM data, but the primary georeference field for these records will be in decimal degrees so that these records can be mapped in conjunction with the millions of other records included in the dataset.

At some point observational records—records without a specimen in the museum such as those based on photographs and/or expert information—can be included; however, at present, LepNet only includes specimen-vouchered records.

(*OSAC donations*) Chris indicated that Jon Shepard, Paul Hammond and Dave McCorkle had contributed large portions of their collections to OSAC. He encouraged those who would like to have their specimens included in the database to contribute material also. He was particularly interested in receiving papered

material as this takes up less room and is easier to integrate into the collection.

(*New club*) Curators for the Arthropod, Herbarium and Vertebrate Collections have teamed up to create an undergraduate natural history museum club on the campus. Club members will engage in projects and activities associated with the different campus collections. They will also raise the public's awareness of the value of these collections.

(*Rice Funds 2017*) Chris reminded everyone that they can apply for funding from the Rice Fund (see the Call for Proposals on page 13) to aid their Lepidoptera work.

(*Invited Speaker*) Chris indicated that the evening's speaker, Dr. Alma Solis, was an expert on the Pyraloidea, i.e. the moth family Pyralidae and their kin. He noted that these moths are often seen but generally overlooked and hoped that her contributions at the workshop would encourage people to take a second look at these moths and begin collecting some for themselves and help the OSAC build its holdings in this diverse group.

Activity Reports—Oregon

Dana Ross summarized the material he had received and the work he had done this past season, often with Linda Kappen and/or Gary Pearson.

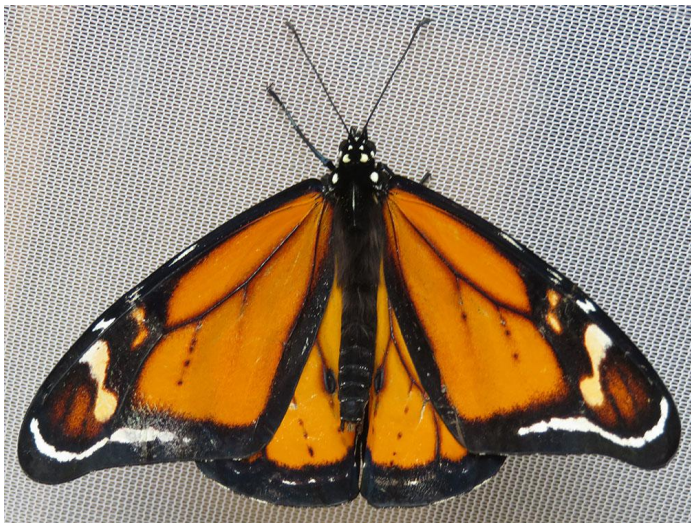
Lori Humphreys found *Erynnis pacuvius* on Percella Ridge in the Andrews Forest, Lane County. In his graduate work, Dana found that this species was very uncommon in that area.

During the butterfly bioblitz at the Oregon Caves National Monument, *Plebejus glandon* (Heather Blue) was tentatively

reported. If confirmed, this would be a new species for Oregon

Linda Kappen showed a couple pictures of a large, aberrant male Monarch that had been reared from eggs found on milkweed in Josephine County. Its fragile wings tore easily and it was a weak flyer. In an unrelated case, she also reported that a Monarch gynandromorph had also been reared in Jackson County.

Linda Kappen reported that *Ascalapha odorata* (Black Witch) had been photographed on August 25 at the Rogue River Preserve near



Aberant male Monarch from Josephine County. Photos by Linda Kappen.



Northwest Lepidopterists' Workshop 2016 (cont.)

Eagle Point in Jackson County. (Linda's article on this report can be found at <http://applegater.org/pdf/2016/v09n04/v09n04p13.pdf>.) This species does migrate—there are other records from Tillamook County and Washington, and even a record from Alaska. Records for this moth can be found on the PNW moths website, <http://pnwmoths.biol.wwu.edu/>.

In Jackson County near Ashland, Dana teamed up with Linda Kappen and Gary Pearson to survey the Sampson Creek Preserve owned by the Selberg Institute. They found 49 species of butterflies. They put out 10 light traps in 10 different spots for a single night in June, July and August collecting about 200 species of moths. Among the finds were *Apamea albina*, a noctuid pretty much known from southwestern Oregon in Josephine County and over the line into California, and the geometrid moths *Drepanulatrix navadaria* and *Eusarca* probably *falcata*, both of which are state records. They also found *Hemaris thysbe* (Hummingbird Clearwing) for which there are only 3 old Oregon records on the PNW moths website. This turned out to be a second county record however since it had been recently reported to Andy Warren via a photograph.

In early August Dana and Gary Pearson went out to Wallowa County, with Dana giving the keynote speech to the Washington Butterfly Association at their summer meeting. They collected at Minam State Recreation Area, Grizzly Ridge along the Hat Point

Road near Imnaha, the lower Imnaha River Canyon and Mt Howard, the latter over 8200' elevation. They came up with one Oregon state record (the geometrid moth *Macaria aemulataria*), 57 county records and numerous 2nd (31) and 3rd (13) county records. They found *Catocala neogama*, a big eastern underwing moth that has colonized stands of transplanted walnut trees, and *Tyta luctuosa*, a European species that is a biocontrol agent on bindweed, formerly known in Oregon only from Polk County and in Washington only from Whitman County.

In late September, Dana and Gary collected at the Umatilla National Wildlife Refuge along the Columbia River. On the Oregon side they got a second county record for *Brephidium exile* (Western Pygmy Blue) for Morrow County. They put out 15 light traps and obtained about 36 county records for moths based on the PNW moths website.

Dana indicated that the moth world is still wide open—if you can go somewhere or even stay home, you will have fun making lots of discoveries. He invited people to bring in, or send in, their unidentified material or photographs to get help with identifications from the Lepidoptera community. As an example he mentioned a moth project Linda Kappen has been running at her home in Applegate, Jackson County. Dana and Paul Hammond have been going through the material caught over the last couple of years. So far they have identified at least 168 species from around her house.

Activity Reports—Washington

Ann Potter summarized the butterfly material she had received for Washington.

John Baumann, Jeanne Dammarell and others have been doing a lot of work in eastern Washington, going to areas that have never been surveyed for butterflies. In Lincoln County, Jeanne obtained a county record for *Epargyreus clarus* (Silver-spotted Skipper) and *Callophrys affinis* (Western Green Hairstreak) and a second county record for *Polites sabuleti* (Sandhill Skipper). John found *Vanessa annabella* (West Coast Lady) in Spokane County, the second record of this butterfly there.

Callophrys gryneus (Cedar Hairstreak) was recorded for the first time in Chelan County by Bill Yake and Jeannette Barreca, and in Kitsap County by Kelly McAllister. In Skamania County, Caitlin LaBar obtained a second county record for *Incisalia mossii* (Moss's Elfin).

Bob Pyle saw a Monarch in Skagit County along the Skagit River delta. This is a second county record and the second year in a row people have reported Monarchs in western Washington, which is

very unusual.

Vanessa virginiensis (American Lady) is an extremely uncommon butterfly in Washington. First county records were obtained for Lincoln County by Jeanne Dammarell and for Snohomish County by Robert Cash. Two individuals were also reported from Yakima County by David James.

Ann ended by thanking the community of people that vet and help identify sightings.

Dana Ross and Gary Pearson visited Conboy Lake National Wildlife Refuge in late August and collected 167 species of moths. Some of the noctuid county records were *Abagrotis erratica*, *Aseptis ethnica*, and *Eosphoropteryx thyatyroides*. In late September—early October, they also visited the Umatilla National Wildlife Refuge along the Columbia River. On the Washington side, Gary got an odonate county record for *Stylurus olivaceus* (Olive Clubtail) in Benton County (see <http://odonatacentral.org/> for other distribution records).

Northwest Lepidopterists' Workshop 2016 (cont.)

Status of Western Fritillaries (*Speyeria* sp.)

Dave McCorkle has been studying *Speyeria* at several locations in the Willamette Valley over the past 50 years or so. He pointed out that a nice population of *Speyeria cybele pugetensis* (Great Spangled Fritillary) used to be present in the McDonald Forest where the larvae would feed mostly on yellow wood violets. The adults would nectar on thistles. That population is no longer there. Another population west of Monmouth is also gone. He reported that some of the forest sites he used to visit along the Coast Range have had their access reduced and herbicide is being sprayed along the roadsides in other areas, killing the thistles. Since fall nectar sources are not common, he wondered what the *Speyeria* would feed on. (On a more optimistic note, he did report his delight at learning that some Monarchs had located a small isolated pocket of habitat in the Coast Range. Maybe the *Speyeria*...)

Paul Hammond has been monitoring the populations of *Speyeria zerene hippolyta* (Oregon Silverspot) along the coast for 30 years or so, and updated the group on the status of the population on Mt Hebo in Tillamook County. This summer was more typical than last summer—the rainfall was good in the spring, it was relatively cool through the summer, and the rainfall was good. The butterfly population recovered to about 1500 individuals, moving back out into the drier areas. However, these numbers are only about 50% of what they would be on average. Some OSU climatologists predict that the hot, dry conditions experienced in 2015 will become the norm eventually so species like the Oregon Silverspot may not really have a long term future. (See the report on last year's meeting in the Winter 2015 issue of the Bulletin for more information on the Oregon Silverspot.)

In the last few years, Paul has been surveying *Speyeria* populations on the Great Plains. This past summer, in areas where he would typically find hundreds and hundreds of fritillaries, he found none or, at best, very few individuals. This applied to Iowa, but one population of *Speyeria idalia* (Regal Fritillary) was still present north of Sioux City. The really big populations of *S. idalia* he once found in South Dakota are pretty much gone. In Nebraska, the populations were gone or down to just a few. The only place with reasonably good numbers was in the Sand Hills (a wet area in the central part of northern Nebraska); it seems that the moisture in this wetland area has been enough to sustain these fritillaries. He used to find hundreds and hundreds of *Speyeria edwardsii* (Edwards' Fritillary) in the Black Hills of South Dakota, but this summer there were almost none.

Ann Potter has been revisiting historic locations for populations of *Speyeria cybele pugetensis* (Great Spangled Fritillary) and also *Speyeria zerene bremnerii* (Valley Silverspot) in Washington, mostly in the south Puget Sound area. Many of these populations are also gone. Those that are present only have a small fraction of the numbers counted in the late 90s.

A couple of potential reasons for the population declines were pointed out:

Paul indicated that the severe heat and drought on the Great Plains several years ago really decreased butterfly populations and these problems have persisted.

Wet areas seem to be important but they are also the ones most subject to invasion by non-native plants. We have lost a lot of our disturbance areas created by natural wild fires.

Research by Carol Boggs on *Speyeria mormonia* found that the fecundity of the females is strongly correlated with nutrient availability, in this case nectar (see p. 196–199 in Boggs, C.L. 2003. Chapter 9: Environmental Variation, Life Histories and Allocation. Pp. 185–206, in: Boggs, C.L., W.B. Watt and P.R. Ehrlich. 2003. Butterflies: Ecology and Evolution Taking Flight. University of Chicago Press). The same situation may exist with other fritillaries. There is a dearth of late season nectar resources, thistles being one that fritillaries particularly like. Thistles, including the native ones, are being eradicated. Ann said “everybody hates thistles,” a sentiment reiterated by others in the audience.

Dave McCorkle felt that a lot of this reduction might be because of the appearance of generalized parasitoids.

Ann indicated that just because a habitat appears to be intact to our eyes, it may not be for the butterflies of interest.



Great Spangled Fritillary (*Speyeria cybele pugetensis*) collected on July 31, 1993 in the MacDonald Forest, Benton County, by Dana Ross. OSAC specimen 309941. Photo by Ron Lyons.

Northwest Lepidopterists' Workshop 2016 (cont.)

M. Alma Solis - Pyraloidea Workshop, Keynote Address, and Lepidoptera Eggs *Chris Marshall*

This year's invited keynote speaker was Dr. M. Alma Solis from the USDA Systematic Entomology Laboratory (SEL) at the National Museum of Natural History (NMNH) in Washington, DC. Dr. Solis, a world authority on Pyraloidea (snout moths), was in Corvallis for 5 days and spent the time getting to know our PNW lepidopterists, sharing her enthusiasm for the Pyraloidea and Lepidoptera in general, and improving the status of the pyraloid moths in the Oregon State Arthropod Collection (OSAC). Over the course of the weekend, in addition to the Saturday evening keynote address, Dr. Solis also made two other presentations: a survey and review of the diversity and natural history of the Pyraloidea (delivered Saturday afternoon) and a short presentation reviewing lepidopteran eggs (on Sunday).

Brief summaries of the presentations by Dr. Solis are presented below.

Pyraloidea Workshop: In an effort to add to the NW Lepidopterists' Workshop a venue that might introduce attendees to new, or poorly known, Lepidoptera, the organizers asked Dr. Solis if she would be willing to provide an overview of the Pyraloidea to get PNW lepidopterists excited and better acquainted with these creatures. Dr. Solis brought a slide presentation as well as a few anatomical preparations to illustrate some of the important diagnostic characters for the group. Specimens from the OSAC were also on display to allow participants to ask about our local fauna.

During this session, Dr. Solis presented a detailed account of the superfamily, highlighting the anatomical features necessary to recognize the members at the family and subfamily levels. She highlighted the importance of overlooked anatomy, namely the tympanal organs (i.e. abdominal 'ears') and the scaling pattern of the head and mouthparts. In addition to these, at the species level, genitalia as well as wing venation could be important. Dr. Solis pointed out that the Pyraloidea are often overlooked given that many are small relatively inconspicuous moths, and while they are often called "micro-moths," many species are macromoths; especially in the tropics many are small, but some, such as the bamboo moth can be as large as sphingids. The caterpillars may be brightly colored, but many economically important species are drab. Leaf rolling and stem boring are common in the group, another reason the caterpillars often go unnoticed.

Dr. Solis indicated that she realized small moths were often overlooked (or avoided) by lepidopterists because they

could be difficult to spread. She recommended people carry a number of small vials, and simply place each specimen into a vial, alive, directly from the sheet. Place the vial in a dark bag temporarily. Then store the vial in a freezer until the specimen can be mounted. This technique ensures that the specimens are not destroyed by other moths or other insects, and allows the collector to work on the specimens when he or she has time (rather than field pinning).

The Pacific Northwest fauna is poorly known, and Dr. Solis noted that, while the OSAC collection did have examples of most of the subfamilies that she believed 'should' be here, the collection lacked some species and further surveys would certainly yield new



Crambidae: *Crambus praefectellus* (Zincken, 1821) (Crambinae). Image courtesy of Dr. Alma Solis.



Crambidae: *Palpita magniferalis* (Walker, 1861) (Spilomelinae). Image courtesy of Dr. Alma Solis. This species and the one above are found in the west—see Solis, M. A. 2008. Pyraloidea and their known hosts (Lepidoptera: Insecta) from Plummers Island. Bulletin of the Biological Society of Washington 15(1): 88–106.

Northwest Lepidopterists' Workshop 2016 (cont.)

discoveries in the form of distributional data and new taxa.

Dr. Solis presented a detailed overview of many fascinating pyralids and crambids. Highlights included the history and spread of *Cactoblastis cactorum*, an interesting pyralid that is a pest of cacti belonging to the genus *Opuntia*; the wax moth, *Galleria mellonella*, a pyralid with wax-eating caterpillars that are pests of honeybee colonies, and the tropical sloth-moths, *Cryptoses* species, that live exclusively in the fur of sloths. Not to be outdone, the Crambidae were equally as bizarre and fascinating. Dr. Solis showcased the Acentropinae, a subfamily of crambids that includes *Petrophila*; she showed a movie of *Petrophila avernalis* caterpillars as they moved under their silken webs on rocks underwater.

Before taking questions and showing workshop participants actual specimens, Dr. Solis concluded with a renewed call for more interest in our regional pyraloid fauna. In particular, she discussed a recently discovered acentropine from Washington. Known from only one specimen, Dr. Solis wanted more. "I sent [a Washington entomologist] a picture and location: Whitman County, Snake River, Granite Point, 1.3 km above Granite Point. He went out there—and what happens with acentropiines is that they live in ephemeral aquatic habitats, and the population moves as the water changes the topography—so, he went back out there and was unable to find the species. So I think that there are more acentropines [to be discovered] and this moth represents a new genus..., beautiful, never seen anything like it with its silver streaks and reddish basal color."

Afterwards, many participants expressed interest in trying to collect more of these moths. Some had seen them at blacklights or on flowers, but with a better idea of what they were, and how interesting they could be, they felt they might not be so quick to pass them by.

Editor's Note: The pyraloid workers from across the world maintain a website, <<http://www.pyraloidea.org>>, to keep people apprised of the current classifications (genus and species) of pyraloid moths. Their newsletter, "The Pyraloid Planet," is also available at the website. Dr. Solis is the current Editor.

Keynote talk—Path to Pyraloidea: from Texas to the

World: Dr. Solis presented an interesting account of her professional career, that began as an undergraduate student in Texas and led to leading the USDA's Systematic Entomology Laboratory (SEL) at the National Museum of Natural History in Washington DC and Beltsville, Maryland.

She was inspired by her first biology teacher, Barbara Warburton,

at Texas Southmost College in Brownsville, Texas. Barbara Warburton also created and managed Rancho del Cielo Biological Station in Tamaulipas, Mexico where Alma later did her Master's research on leafmining moths. She discussed how fellow entomologists were important to her in her early career; in particular Larry Gilbert who first showed her Opler's work on leafmining moths of California oaks and encouraged her to work on leafmining moths at Rancho del Cielo and to seek the advice of others, such as Don Davis at the NMNH. Phil Ward (who now works on ants) was also an important colleague at that time and introduced her to Richard Brown. Ron Hodges suggested she consider systematics as a field of study and made possible a summer fellowship to work on her Mexican material at the NMNH. Subsequently, she did her PhD work with Charles Mitter at the University of Maryland (with Doug Ferguson on her committee), where she focused her attention on Pyraloidea. Immediately after receiving her PhD, Dr. Solis was hired by SEL, USDA as a Research Scientist and Curator at the NMNH alongside Doug Ferguson, Ron Hodges, Robert Poole, John Burns, Don Davis, and Bob Robbins. She said she owes a great debt of gratitude to Ron Hodges who gave her the opportunity to work on moths and Doug Ferguson who took her under his wing and was very generous in sharing all he knew about pyraloids, especially caterpillars, which was substantial considering that he was known as a geometroid specialist.

The national Lepidoptera collection, which includes material from and is curated by both Smithsonian and USDA scientists, is vastly larger and better organized than when Dr. Solis came on board. Dr. Solis recounted the herculean efforts taken by herself and the other entomologists to organize the unsorted Lepidoptera material and move the Lepidoptera collection at the NMNH that eventually created the national collection's outstanding reputation it has today. Dr. Solis stepped down as Research Leader for the SEL a few years ago, a move that she said has allowed her to again focus on her pyraloid research and to give her time to do fieldwork again.

Lepidoptera Eggs: Dr. Solis presented a short, photo-rich, presentation on lepidopteran eggs during the workshop's Sunday session. The talk featured a variety of photographs of lepidopteran eggs that had been gathered from a largely diffuse and scattered literature. Dr. Solis began by discussing lepidopteran eggs in comparison to other insects, but then proceeded to move through the major lepidopteran groups, showcasing examples and discussing their interesting anatomical and/or biological features. Many interesting examples were shown, and a main point of the talk was quite clear: there exists quite a bit of beautiful and functional variation in lepidopteran eggs, and a more systematic study of them would likely yield some fascinating phylogenetic and biological patterns.

Northwest Lepidopterists' Workshop 2016 (cont.)

Activity Report—Montana

Steve Kohler has been prowling around Montana for more than 40 years and admitted that it is getting harder and harder to add new records, but he did report 6. This summer, he and photographer Jeff Phippen took a trip over to Chouteau County (northeast of Great Falls) picking up 4 new county records, *Erynnis icelus* (Dreamy Duskywing), *Incisalia iroides* (Brown Elfin), *Mitoura siva* (Cedar Hairstreak) and *Celestrina echo* (Echo

Blue). Jeff photographed *Brephidium exile* (Western Pygmy Blue) in Missoula County, the second record for the state—the first being Steve's record from Sanders County just to the north a few years ago. In a little area in Carbon County (south-central Montana in the rainshadow of the Beartooth Mountains), the closest thing to a desert that Montana has, Steve reported a new state record for *Hesperopsis libya* (Mohave Sootywing).

Jeff Miller—Flipped Over Butterflies

As Jeff has traveled the world doing his caterpillar work, he has been taking digital images of butterfly specimens in various museums. He now has over 700 compound butterfly images—images that show both dorsal and ventral views. From these, he is selecting the 150 or so most spectacular images for a new book.

In this book, among other things, he will discuss butterfly colors and patterns in general, as well as their ecological significance and how they are spread across taxa. For instance, Jeff is looking at dorsal-ventral patterns. For a given butterfly, there are 13 possible combinations of wing patterns based on which wing surfaces match, if any. The most common occurrence, about 1/3 of the butterflies he has looked at (photographed himself and seen in various books), is one in which none of the surfaces match, i.e. all 4 wing surfaces have unique patterns. None of the butterflies Jeff has seen have a criss-cross combination—one in which the dorsal

forewing matches the ventral hindwing and the dorsal hindwing matches the ventral forewing. A very uncommon combination is the one in which all the surfaces are the same. Jeff is also looking at what happens to these patterns with polyphenism, polymorphism, sexual dimorphism, mutation and hybridization.

In mimicry, he is looking at how well the mimic and the model match over the dorsal and ventral surfaces. The mimicry is usually specialized on one part of the wings or another, not the whole area.

In this effort, Jeff expressed his appreciation for Paul Hammond's help in the museum and for the OSAC resources, especially the collections donated by Harold Rice, Ann Albright and Barry Sullivan.

Dave Specht—Powell Butte 2016

Dave has been surveying butterflies and some day-flying moths at the Powell Butte Nature Park in Portland since 2005. This summer he was able to add 2 new butterflies, *Hesperia juba* (Juba Skipper) and *Mitoura grynea* (Cedar Hairstreak), to his species list for the park.

Dave discussed his efforts to educate the people responsible for the management of the park about the importance of the stinging nettle habitat for the *Polygonia satyrus* (Satyr Anglewing) population in an effort to effect brush management policies that

do not degrade or eliminate that habitat along the trails, especially the ones favored by this butterfly. Using his seasonal counts, Dave showed how the number of individuals had been affected by harvesting and/or brush cutting in critical areas in earlier years. Dave's efforts have been going on for several years but were particularly intense this past summer.

Dave's presentation stimulated a discussion about management issues involving some other plants in other areas of the Pacific Northwest.

Rob Fernau—Ecological biogeography of the butterflies of the Marble Mountain Wilderness: changes in the butterfly fauna over time

Rob discussed his long-term field research study (32 years) in the Marble Mountains Wilderness of Northern California. He has documented occurrences of 110 species of butterflies. He presented some preliminary results from his study—roughly half

of the butterfly fauna shifted their distribution during the period. Rob will continue his research in 2017 starting in late February or early March and lasting through August. He invited interested lepidopterists and botanists to join him in the field.

Northwest Lepidopterists' Workshop 2016 (cont.)

Dana Ross—Seasonal Work

Dana went over some the work he had done in areas outside the Willamette Valley this year as a contract lepidopterist. Again, he was assisted in some of these efforts by Linda Kappen and Gary Pearson.

Dana, Linda and Gary surveyed for butterflies and moths for the Selburg Institute on their property, the Sampson Creek Preserve, about 5000 acres east of Ashland near Emigrant Reservoir. The preserve has a variety of habitats including oak savanna and oak woodland, as well as conifer and riparian habitats. Over 3 sample periods of 3 days and 2 nights each in early June, July and September they documented about 250 species of Lepidoptera.

Dana taught a group of wildlife biologists and botanists from the Willamette National Forest about butterflies and butterfly habitat and took the group on a successful outing to look for *Plebejus podarce klamathensis* (Sierra Blue) which had been found in Lane County by Lori Humphreys. Dana also conducted a 2-day butterfly class at the Siskiyou Field Institute in Josephine County. Besides teaching about butterflies and butterfly biology, he led the

class on field trips to the nearby Bolan Lake area one day and to sites near the Cascade-Siskiyou National Monument the next. Dana, Linda, and Gary were also involved in a one day butterfly bioblitz at the Oregon Caves National Monument.

Dana and Gary did some more work at Conboy Lake National Wildlife Refuge in Washington to add to the list of species Dana started a couple of years ago, as well as the Umatilla National Wildlife Refuge along the Columbia on both the Washington and Oregon sides.

At the end of the summer he and Gary went out to the Wallawas where Dana was the keynote speaker at the annual meeting of the Washington Butterfly Association. That trip took them to some areas in Wallowa County which are fairly different habitats for Oregon and not all that well collected such as Minam State Recreation Area, Grizzly Ridge near Hat Point in the Hells Canyon National Recreation Area and the Lower Imnaha River. The high point of this trip was the top of Mt Howard (over 8200') reached by the gondola tram. Before the last tram down

Gary and Dana set out some moth traps at several sites. The catch is still being analyzed. Some of the expenses for this trip were covered by a Lepidoptera grant from the OSU Rice Fund.

All in all it was a good year and Dana is now spending his time at the OSAC where, with the help of Jon Shepard and Paul Hammond, he is processing and identifying the specimens collected.



Above: Moth trap at Conboy Lake National Wildlife Refuge, Washington with Mt Adams in the background. Photo by Dana Ross.

Right: Evening view looking down at the 7 Devils over in Idaho from campsite in the Hat Point area. Photo by Dana Ross.



Northwest Lepidopterists' Workshop 2016 (cont.)

Ron Lyons—Diurnal Activity of a Lorquin's Admiral Chrysalis

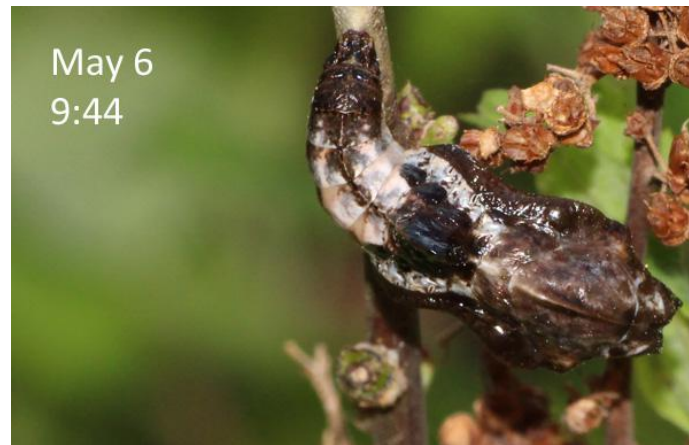
On April 30, 2016 Ron found the chrysalis of a Lorquin's Admiral on the west side of a *Spirea douglassi* plant by his home. The chrysalis was checked often between April 30 and May 21 when the adult emerged. Ron had not expected to see much in the way of noticeable changes from day to day, but rather was looking for a hints as to when the adult would emerge.

The changes he found were not the ones he expected. On overcast days the chrysalis remained oriented pretty much vertically. On sunny days, however, the orientation of the chrysalis changed—it was straight up and down in the early morning and very late in the day, while at other times, it was straight up and down, or tilted to the north, or tilted to the south, the tilts being extreme in some cases. This was not the vigorous anti-predator shaking defense occasionally seen (see internet videos); instead the chrysalis held these positions for some time. He thought the changes in the

orientation would take place gradually, but in one instance while he was watching, the chrysalis snapped quickly from one position to the next. His observation schedule was not regular enough to pin down the timing; the activity certainly wasn't periodic. Ron suspected that the changes had something to do with thermoregulation, but perhaps there is another reason.

Ron checked the internet but the only references to chrysalis motion he came across were to the disturbance/anti-predator shaking. One book did indicate that the chrysalis of a nymphalid butterfly can move back and forth laterally, but this motion was not discussed.

It seems that if one really wanted to track the movement pattern it would be necessary to perform time-lapse photography or, better yet, make a video.

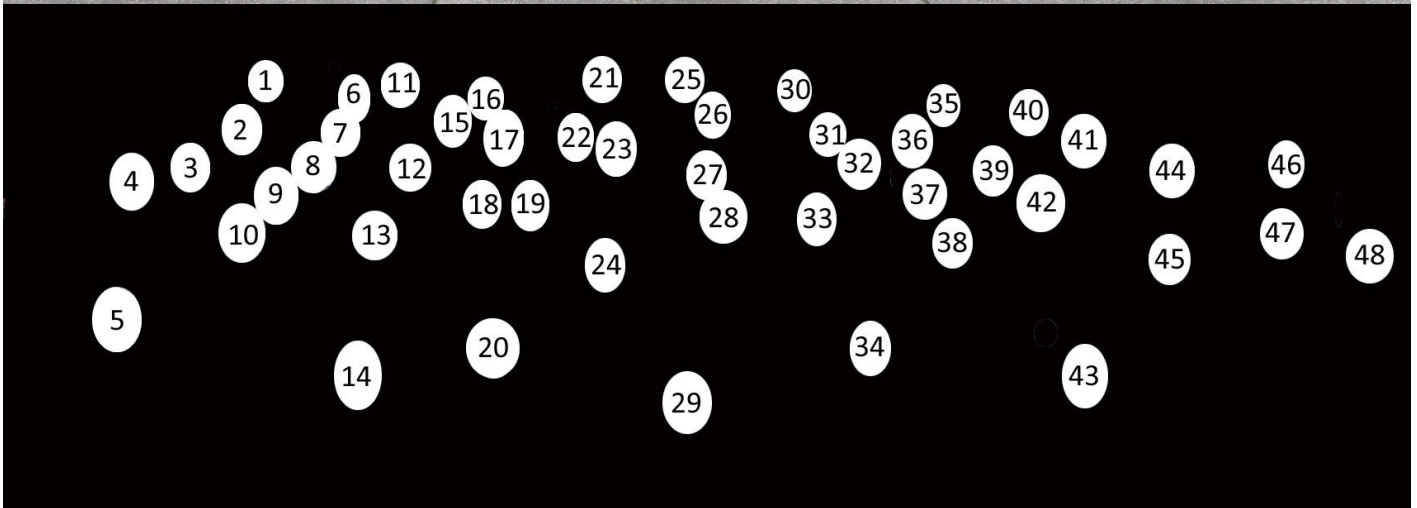


Sample images from the April 30–May 21 time period. The viewing angle varies a bit but not enough to affect one's ability to compare the images. North is on the left side in all the images; east is into the page. In the image from May 6, the orientation of the chrysalis is close to the extreme seen when the head was pointed south. Photos by Ron Lyons.

Northwest Lepidopterists' Workshop 2016 (cont.)



Ron Lyons



Northwest Lepidopterists' Workshop 2016—Participants Photo Key

- | | | | |
|--------------------|---------------------|-------------------|----------------------|
| 1 Rick Ahrens | 13 Nancy Sullivan | 25 Ross Tewksbury | 37 John Davis |
| 2 Alex Wright | 14 Chris Marshall | 26 Jon Shepard | 38 Mike Raschko |
| 3 Alison Center | 15 Jim Reed | 27 Don Severns | 39 Sue Anderson |
| 4 Ray Stanford | 16 Dennis Deck | 28 Dennis Streng | 40 Caitlin LaBar |
| 5 Ron Lyons | 17 Jonathan Pelham | 29 Dana Ross | 41 David Lee Myers |
| 6 Carol Specht | 18 Sloan Aagaard | 30 Ed Schmitt | 42 Steve Northway |
| 7 Ann Potter | 19 Rik Littlefield | 31 Rob Fernau | 43 David Maddison |
| 8 Jim Dillman | 20 Gary Pearson | 32 Jeff Miller | 44 Dave McNeese |
| 9 Dave McCorkle | 21 Matthew Campbell | 33 M. Alma Solis | 45 Robin Cushman |
| 10 Paul Hammond | 22 Terry Stoddard | 34 Ron Hodges | 46 Hunter McNeese |
| 11 Dave Specht | 23 Steve Kohler | 35 Lori Humphreys | 47 Mackenzie McNeese |
| 12 Kathleen Donham | 24 Linda Kappen | 36 Jim Anderson | 48 Trevor McNeese |

Northwest Lepidopterists' Workshop 2016 (cont.)

David Lee Myers—Some Recent Images

David is working on a new theme for some of the presentations he gives. He is emphasizing that “if you want to see more, go outside and look!” He then proceeded to show some of his butterfly photographs from the past year.

There was a nice picture of a Sleepy Orange in a seed cluster that he would have missed had he not seen it flying in. About another image showing a Western Pygmy Blue sitting on a spider web, David commented: “It is one thing to know how small and delicate our butterflies are but to see what it is perching on.” He even had an image showing a butterfly sitting on its own bar code.

David showed a couple pictures that illustrated how the color we see in a butterfly depends on the angle of illumination. There was a brief discussion of the structural nature of butterfly colors.

David indicated that it is getting easier and easier for him to get good pictures. He has trained his eye, learned the techniques, and the equipment keeps getting better.

Some of David's work can be found on his website, <<http://www.DavidLeeMyersPhoto.com>>.

Matthew Campbell—*Hyles lineata*: Collecting, Breeding and Rearing

While Matthew collects a lot of larger moths and butterflies near his home in Pendleton Oregon, what he really enjoys is rearing them all the way through their life cycle. He described his technique for raising *Hyles lineata* (White-lined Sphinx Moth).

Matthew finds that the best time to catch the adults in his yard is at dusk and dawn when they come to nectar at the honeysuckles and four o'clocks he has planted. (He finds them nectaring in the desert during the rest of the day, but rarely in his yard.) He maintains the captured adults in cages. For food, he uses a 5% honey water solution contained in a half inch deep crème brûlée dish with yellow and blue plastic flowers. After turning the lights on in the morning, the adults feed themselves and then pair naturally.

Matthew found that Virginia creeper works very well as a larval food; grape can also be used as can the commercial hornworm meal, but the latter has an unpleasant smell. When the larvae are in the prepupal stage and not moving around, he lines them up on a soft cloth and places them in a dark place to pupate. There are multiple broods in the summer.

Matthew distributes caterpillars to area elementary schools to stimulate the students' interest in what is around them and entomology in particular.

Matthew catches new breeding stock every year. It was suggested that he develop an inbred line to see what recessive genes might be triggered.

Next Year: Northwest Lepidopterists' Workshop 2017

In 2017 the groups of emphasis will be:
Butterflies: Swallowtails (*Papilio*), Pieridae in general
Moths: Erebididae in general

Acknowledgements

I would like to thank Chris Marshall for preparing his own summary and for summarizing Dr. Solis's presentations. I would like to extend my sincere thanks to all the presenters for their comments, corrections, and changes to the summaries prepared from the meeting record. I would also like to thank Dr. Solis and Dana Ross for providing images for this write-up. I know all the feedback improved the accuracy and usefulness of the material.

Thank you all very much. *Ron Lyons*