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Discovering the Life History of *Neophasia menapia* in Utah.

Ever since 30 Jul 1988, when Steve Sommerfeld and I traveled to Price Canyon, Carbon County, Utah, to collect adults of *Neophasia menapia menapia*, I have been intrigued at the prospect of rearing this butterfly. The following article describes the many years of attempts, failures and ultimate success to try to witness the life history of this butterfly.

30 Jul 1988-30 Jul 1998: 10 Years of Futility:

My first attempt to rear *Neophasia m. menapia* occurred on 30 Jul 1988, which was the very first day we collected them. After having collected a few females, Steve set up a cage with some fresh cuttings of Ponderosa Pine in order to entice females to oviposit. Unfortunately, he had no success. The following summer, I thought I might try another approach--finding larvae in the field.

One might think that finding larvae of Pine Whites on *Pinus ponderosa* stands that grow past 100' in height would be an absolutely hopeless prospect. In fact, Steve commented that I would probably have better luck finding *Callophrys siva* larvae on branches of *Juniperus osteosperma*. What intrigued me was Figure 28 of Garth and Tilden's "California Butterflies," which depicted a diagram of a mature larva lowering itself by a silken thread from a Pine tree in order to pupate. Seeing that, I thought that I might have some success seeking out mature larvae seeking pupation that were attached to these long, conspicuous silken threads from large pine trees.

In early July of 1990, before the main flight of Pine Whites, I returned to Price Canyon to make the attempt. To my despair, I found absolutely no evidence of mature larvae lowering themselves from a silken thread. Strike Two.

Considering that *Neophasia m. menapia* overwinter as ova, my next attempt to obtain immatures was to return to Price Canyon late in the fall of 1990 to hopefully find overwintering ova on shorter trees. Strike Three. (Fortunately for me, I was not playing baseball.)

In spite of previous failures, I again convinced myself that the key to getting immatures was somehow to get females to oviposit. I again made several attempts, this time between July of 1992, 1996, and 1997 to get live females to oviposit in a tricot sheer sleeve on a live *Pinus ponderosa* branch. In spite of my persistence, I suffered the same result--no eggs. The

problem with sleeving live females in filtered sunlight is that they would die a few hours after having been placed in the sleeve.

Little did I know that my luck in figuring out how to raise *Neophasia menapia* would start to change exactly 10 years and 1 day after my initial success in collecting them on the wing.



Figure 1— *Neophasia menapia* male drying its wings after recent eclosion. Photographs by Todd L Stout.



Figure 2-- *Neophasia menapia* female pupa two days before eclosion.

1 Aug 1998: The Start of the Turnaround

After my latest failure in 1997, it was suggested to me that I might want to seek out some larger colonies of *Neophasia menapia* in Sevier County, Utah, where the butterfly is using the much shorter *Pinus edulis* (Pinyon Pine.) So, on 1 Aug 1998, I traveled to suitable habitat south of Hogan's Pass along Utah Hwy 72 (Round Spring Draw) in order to seek out live females.

However, because 1998 was a late year, the only Pine Whites on the wing that afternoon were ultra-fresh males—too early. Later that afternoon, after having collected about 6 very fresh males, I returned to my vehicle to call it a day. As I was packing away my collecting gear, I noticed, on a lone Pinyon Pine tree that just happened to be adjacent to my car, two fresh landed males. These males, as they rested, looked odd. As it turned out, they both were freshly emerged specimens drying their wings!

After coaxing the males onto my fingers and into a larger container to finish drying their wings, I sought out to find their empty pupal cases. After all, it was my intention not only to obtain reared specimens for my collection, but also to learn as much as I could about their life history—including preferences for pupation. (I had read and heard that they pupate on the bark of the tree or even on the ground.)

After examining some cuttings of Pinyon Pine, I finally found two empty pupal cases fastened right on a pine needle. That was my first discovery! So, they don't pupate exclusively on the bark of Pine trees. My next finding came a few minutes later when I encountered two more pupae that hadn't emerged! I had assumed that since females lay eggs in groups of approximately 5-15, I might find more "siblings" of these two males that were drying their wings.

After 10 years of painstaking effort, I found it ironic that the first immatures of *Neophasia menapia* to be found in the field would be pupae!

My second major breakthrough with regards to raising Pine Whites happened two and a half weeks later after I had collected 4 females on 15 Aug 1998 at the same location where I had found pupae two weeks earlier. On or around 19 Aug 1998, I finally was able to get females to lay eggs in captivity!

In a nutshell, the key to enticing females to oviposit is to feed them regularly and **expose them only to dim light!** That is the key! Filtered sunlight in lab conditions appears to be too harsh! Sooner or later, if they have eggs to lay, and they haven't been stressed by too much heat or luminosity, they will oviposit. The following e-mail sent to Bruce Walsh in 1999 explains the very painstaking effort I suffered through to get my first females to lay eggs. (Bear in mind that the proceeding procedure could easily be simplified considerably, and would not be recommended for the sane lepidopterist. Nevertheless, for me, at that time, the ends justified the means.)



Figures 3,4— *N. menapia* female ovipositing on *Pinus edulis* (Pinyon Pine.) This particular female was somewhat comical when she fell off the hostplant laying her last egg because she ran out of slack trying to secure her legs on the end of the needle. (Would somebody *please* teach me how to focus close-up photography?)

...I would put live females on cuttings (15-20" high) of Pinyon Pine trees out in the open air. (No cage and no sleeve.) THE CATCH. I WOULD HAVE TO BE THERE TO BABYSIT THEM FOR AS LONG AS I WOULD HAVE THEM OUT IN THE OPEN AIR. AND, IT TAKES MULTIPLE SESSIONS TO START TO HAVE SUCCESS. However, once a female finally lays her first string of eggs on a needle, it is much easier to get her to lay another and yet another string.

Phase I--Wait 48 hours

As quickly as possible after capture, place the live females in a cage or paper towel lined container that can be placed inside of a cooler so that they can become cool and dormant on your trip back to the lab. Then, place the females in a totally dark air conditioned room or closet where they can remain dormant for at least 48 hours. (Let them get used to captivity and let their ovipositors argue with them a little bit.)

Phase II- Tame Your Females (Takes about 45-60 minutes)

Take the females out of the closet and place them on the pine cuttings that would have no other light source except a 60 watt light bulb lamp at a distance of several feet. I had my best luck at night. I would give them enough luminosity to encourage activity; but not enough to really get them hyper.

You may ask, "Well, wouldn't it drive you crazy to have them fly off of the pine cuttings and all over the room?" And it's true. They do that a little bit at first. They're not used to being in captivity, and they want to fly all over the room. But, as you repeatedly take the females and put them back on the cuttings, something seems to happen. They become more tame. Their propensity to want to fly off becomes less and less. And, another thing happens. They don't act spooked when being handled. You just put them on the cuttings and they either rest or they start walking around the plant. This propensity to walk around the plant can try your patience as well; but, start of the process by which they are gaining interest in laying eggs.

At this point, some females still insist on not staying on the plant. If some females still fly off of the plant 30 minutes into this exercise, then place them back in your dark closet and deal with them in another 12 or so hours. They are not at all ready to lay. You see, as females crawl in and around the plant, you will be able to start to tell how ready to lay they are. For example, if their ovipositor is not lifting up whatsoever as they walk, they are not at all ready to lay and are still a day or even longer away starting their interest. Save yourself further frustration and just deal with them later. Put them back in the dark closet.

I should say that during phase II, most of your females should be "semi ready to lay." That is, as they walk around the pine needles they will partially lift their ovipositor as they walk. You're getting closer. After walking, sometimes they feel the need to become dormant. Don't be afraid to grab them by the wings and separate them from the needle and then quickly put them back in order to stimulate activity. At this point, this should not spook them at all. (Just be careful not to damage their legs.)

After 45 minutes to an hour of this, put your females back into your dark, cool closet.

I have to be honest. 98 percent of the time, I have obtained no eggs during Phase II; but it is an essential introductory part of the process.

Phase III-- Twelve hours later

Repeat phase two. Females that still fly off of the plant 4 or 5 times still are a full day away from laying. Put them back in the dark closet. Some of your females are now getting ready to lay. I usually get my first string of eggs within 30 to 45 minutes of Phase III. Here's how you tell that the females are getting serious about laying. Instead of trekking around the pine needles with their ovipositor partly up, they start walking around with it fully lifted--as if actually laying an egg--and touching needles. This event can sometimes be haphazard with their ovipositor hitting and missing needles. This can continue for 10 or so minutes. (It can also try your patience) If a female EVER shows this behavior and then stops to rest or flies off of the plant, pick her up and place her back. She is ready to lay. If you coax her a little bit, you are going to get your first string of eggs. (Strings range from 4 to 14 eggs.)

Continuing on. As the female is exhibiting this ovipositor-fully-lifted behavior, you know that eggs are going to be laid when she finally aligns herself with one needle and she starts rubbing her ovipositor on that needle back and forth as to size up the length of the needle and how much room she'll have to deposit her string of eggs. When she has finished sizing up the length of the needle, she will jerk and I really mean JERK her ovipositor back to a resting position.

Once THIS has happened, there is a 95 percent chance that you will see your first egg laid within the next 20 seconds. She will then lift her ovipositor on the needle and lay the first egg and return it to a resting position. (Unlike *Chlosyne*, *Phycodes*, or *Euphydryas* females, she will not keep her ovipositor in place and deposit the eggs all together, they will be laid one at a time.)

She will then repeat the previous step making sure she places the second egg flush and parallel to the first.

When she is done with her string, she will then rest. What's nice about arriving to this point is obvious. Number one, you finally started to get eggs out of one of your females and two, getting more eggs out of this particular female will definitely become a lot easier. (She's now a lot more tame about laying more strings.)

Sometimes, 5 minutes of rest is all a female may need to start back to walking around the needles with her ovipositor in a lifted mode as if to want to lay again. She may lay another string as early as 15 minutes after her first string or she may wait an entire day--depends on the female.

Phase IV--6 to 12 hours later Repeat Phase III

At this point, you should really be getting a feel for which females are ready to lay and which ones need to rest. It is usually during Phase IV that I get the "exponential effect" of getting eggs as most females are active in the laying/dormant cycle. Getting females to lay becomes easier, and more are laying. Sometimes, as I go to work, some females can't wait to lay as they wait in the dark/cool closet and they lay eggs on the screen of the cage. (In the dark!) One time last week, I wasn't paying attention as well as I should and one female flew off of the plant and laid a string of eggs on my wall. I should say that, unfortunately, some females start dying during Phase III and Phase IV. It's interesting to note that as these females approach death, their propensity to lay becomes more intense--even when they appear to be too skinny to have any eggs left.

Winter 1999: Raising Larvae from Females

During August of 1998, utilizing the methodology stated above, I was able to obtain approximately 300 ova from wild-collected females. I thought it a wonderful project to be able to rear *N. menapia* during the winter months, and learn more about their life history. Therefore, on 1 January, 1999, I took all of the ova out of the cold in order to stimulate hatching. About 10 days later, most of the ova started to develop; nevertheless, for some reason, roughly 40 percent of the 300 ova that were exposed to 4 months of cold hatched.

The first lesson I learned from rearing hatchlings is that feeding on their empty eggshell seemed to be imperative to their survival. (The first several hatchlings that were taken away from their empty egg shell did not initiate feeding on a pine needle and ultimately starved to death.)

The second lesson that I noticed was the larval feeding pattern for first through fourth instars. Based upon my understanding of the description of larval feeding habits found in other lepidoptera publications, I didn't realize that gregarious larvae parallel each other on a pine needle feeding simultaneously in their "pie-chart section" of the top of the needle—See Figure 6. That was quite a sight to behold. On one occasion, I observed one larva trying to "squeeze" himself into a group of five other third instars that had the needle completely surrounded. In spite of its efforts, that larva would not be allowed to squeeze in and join the group. It ultimately crawled to another needle and died.

The third lesson I learned from rearing these hatchlings was more perplexing. For some reason, even though I was obtaining healthy cuttings of *P. edulis* that seemed quite adequate and lush for lab rearing—even though it was winter--most of the larvae were dying to an unknown virus even though they were being reared in an open aquarium. Also, the larvae that were surviving were smaller than normal. (Unfortunately, I was only able to get about 15 larvae through to pupation.)



Figure 5-- *Neophasia menapia* young hatchlings feeding on their empty eggshells before setting up their feeding position on a pine needle.



Figure 6-- *Neophasia menapia* fourth instar larvae feeding communally.

An Unusual Discovery:

One day, while taking care of the last 15 or so fourth and fifth instar larvae, it became necessary for me to replace the host plant. While searching for the larvae, I confirmed the fact about how well camouflaged these larvae are against pine needles--even large ones confined in a 10 gallon terrarium. (I knew I had 15 in there; but, after long, hard searching, I could only spot 10 or so.)

For some inexplicable reason, I experienced an intuition to mist spray the host plant with water. In response, every single larva in the terrarium bobbed backed and forth vehemently as if being irritated by a predator. At first, I didn't give much thought to this idiosyncrasy; except for the fact that it made it incredibly easy to find larvae. Then I thought, **this technique might actually be somewhat productive for someone trying to find larvae out in the field—especially on smaller trees!**



Figure 7-- *Neophasia menapia* last instar larva camouflaging itself against its host—*Pinus edulis*



Figure 8-- *Neophasia menapia* last instar larvae camouflaging themselves against the hostplant.

On 24 June 2000, I tested my theory of possibly finding post-diapausal larvae by rigging a 3-gallon garden sprayer with water and returning to Round Spring Draw, UT. After pumping and spraying for two solid hours, I was able to locate 3 bobbing last instar larvae using this method. Although the method didn't yield as many larvae as hoped for, I was able to send off one of these larvae to someone who does know lepidoptera close-up photography—Jim Brock.

Todd L. Stout

Governor Leavitt asks President Bush to kill San Rafael Swell National Monument plan

Editor's Note: This article is a recent reprint from the Deseret News. Many Utah lepidopterists are actually breathing a sigh of relief from this news as their collecting efforts down in Buckhorn Wash and the San Rafael Swell will not be legislated—at least not for now. Reprinted with permission.

It's a bitter pill to swallow, but Utah Gov. Mike Leavitt put an end to the proposed San Rafael national monument issue by formally asking President Bush to terminate the process. The move doesn't come as a surprise because Leavitt vowed he would honor the wishes of Emery County voters, 53.3 percent of whom opposed the monument proposal in a nonbinding referendum in November.

He made this proposal at the request of Emery County Commission and the Public Lands Council, and his willingness to be engaged has always been dependent on local support," said Natalie Gochnour, the governor's spokeswoman.

In a letter to President Bush on Wednesday, Leavitt said although he was disappointed in the outcome of the ballot referendum, "Because of my commitment to the local citizens, I now respectfully request that you terminate the process." Leavitt announced in his January State of the State address that he would seek 620,000 acres in the San Rafael Swell as a national monument, a task that requires presidential approval.

"I wrote to you last April inviting you to consider creating a national monument in the San Rafael Swell, a choice expanse of land in Emery County, Utah, loved and used by many," Leavitt wrote Bush. "As part of my request, I indicated the importance to Utah of engaging in a thorough public process before any monument designation is considered."

"I am sorry to report to you that the citizens of Emery County recently voted by ballot referendum to end the process," he continued. "While I am disappointed with this outcome, I am grateful for your personal attention to our state and the good will you have shown by your willingness to foster public participation in land-management decisions."

When Leavitt made the announcement to begin the process of designating the San Rafael Swell a monument, it came as a surprise to some Emery County residents who immediately fought the plan, fearful a monument designation would close the gates on off-road vehicles.

Mark Williams, president of the Southeastern Utah OHV Club, headed a petition drive that landed the measure on the ballot. Williams, who could not be reached for comment by press deadline, previously told the Deseret News that the measure was partly defeated because people were still fuming over President Bill Clinton's surprise designation of the Grand Staircase-Escalante National Monument.

The monument proposal suffers a defeat not unlike the fate of countless other proposals from previous governors to resolve public lands conflicts in southern Utah.

But Leavitt isn't giving up. He still plans to move forward on such thorny issues as establishing county ownership over the tens of thousands of dirt roads under a 19th century law known as RS2477. "It has always been about process," Gochnour said. "He wanted to give some certainty and local people a seat at the table," she added. "This office emphasis will move toward resolving the RS2477 issue and continue with land trades."

By Donna Kemp Spangler
Deseret News

More Pictures of *Neophasia menapia* immatures



Figure 9-- *Neophasia menapia* male pupa minutes before eclosion.



Figure 10-- *Neophasia menapia* third instar larvae feeding communally.

No Such Luck with *Neophasia terlooti* in SE Arizona

On 19 Aug 2000, my wife, Sheryl and I ventured down to Southeast Arizona's Garden Canyon in search of larvae of *Neophasia terlooti* in an attempt to duplicate the luck I had had with finding *Neophasia menapia* immatures using a garden mist sprayer. In spite of four arduous hours of spraying on some of the shorter trees of *Pinus ponderosa* with water, the only bobbing larvae that I could encounter were moth caterpillars that mimicked the bark of the Ponderosa Pines as opposed to its needles.

I concluded that either *Neophasia terlooti* larvae do not react the same way that *N. menapia* does when being mist sprayed with water; or, the fall flight of 2000 was going to be poor, or most of the larvae were up in the canopy. Either way, I had absolutely no luck.

I was, however, able to have some fun with the garden sprayer with many of the inquisitive naturalists with binoculars hiking the Sawmill Canyon trail who kept inquiring as to what the sprayer was for. I would then spray my wife with water and tell them it was to keep her from overheating. (She was not amused.)

Todd L. Stout