Gillett's Checkerspot: Life in a Mountain Meadow

by Ernest H. Williams

With wings spread to absorb the sun's warmth, a Gillett's Checkerspot stands out against the dappled green of the mountain meadow behind it; conspicuous rust-orange bands cross the outer half of both fore and hindwings, with cream and rust-orange spots invading a dark background. To find these butterflies, one must search during the month of July in high meadows of the Rocky Mountains, from Wyoming through Montana and Idaho up into Alberta. Colonies are quite uncommon, however, so it is a thrill to see the distinctive and beautiful pattern of these butterflies in the field.

When first encountering Gillett's Checkerspots, one is more likely to spot a female before a male. This is unusual because males of most butterfly species are more likely to be seen than the females of those species, which are usually less conspicuous. Female Gillett's behave as if pressed for time, interspersing time for basking amid hours spent visiting flower after flower for nectar and searching in shrubs for places to lay their eggs. Females are so focused on nectar and egg-laying that they appear undisturbed by human presence. Another reason people see females more easily is because they are at or below eye-level, on flowers and shrubs. Their tameness is surprising; you can walk right up and watch one without having it fly away. More on that characteristic in a moment.

Males, on the other hand, devote themselves to a different daily schedule that makes them harder to see. They nectar infrequently, but much of the time they fly higher above the vegetation, mostly above human eye level, or perch high in surrounding conifers. Males also begin flying earlier in the morning than do females and fly more quickly. In the 20 years I've studied these butterflies in their mountain homes, the difference in visibility of the sexes has been clear; 70% of all the butterflies I've seen and followed have been females.

Why are they so tame? Gillett's Checkerspots use twinberry honeysuckle *(Lonicera involucrata)* as their common foodplant. This plant and the foodplants of other checkerspots

*Left: The color pattern of Gillett's Checkerspot is unique. Here one nectars at a ragwort (*Senecio*). July 30, 1978. 8600 ft. Beartooth Mountains, Park County, Wyoming*

Above: Gillett's Checkerspots are at home in high elevation, flower-filled meadows. July 24, 1980. 8600 ft. Beartooth Mountains, Park County, Wyoming

all contain a group of noxious chemicals, the iridoid glycosides. It is a familiar story; caterpillars ingest plant poisons as they feed and then incorporate the chemicals into their bodies for their own defense. So protected, they can be less vigilant about other animals, including humans, moving around them. Adults advertise their distastefulness with bright, warning colors that produce the beautiful pattern we find so attractive. With their white and yellow stripes against a dark chocolate background, the fully-grown caterpillars are obvious, too, although studies have not been done on their palatability.

Cold and shortness of the growing season have evoked clear responses by Gillette's Checkerspots to the mountain habitats in which they live. My first observation with these butterflies was where they laid their eggs. The eggs are placed on only the uppermost leaves of their foodplant shrubs, and most are on leaves that point to the northwest. This observation seemed odd at first, but then I discovered why they choose leaves of this orientation. The growing season is short in a mountain meadow, and eggs must hatch and the caterpillars must feed long enough to reach the second caterpillar stage (instar) for them to survive the coming

Left: The underside pattern is pretty snazzy also! July 2, 1989. Warm Lake, Valley Co. ID

Below: Eggs are straw yellow when first laid, sometimes with a slight greenish tint, and soon take on a golden hue. As they develop, they darken gradually to reddish brown, finally turning to bluish gray a day or two before hatching, a color produced by the dark head capsule showing through the translucent egg shell. The whole process takes about 4 weeks, so one can estimate the age of the eggs by their color. Aug. 4, 1979. 8600 ft. Beartooth Mtns., Park Co. WY

winter. In the coolness of a mountain meadow, where night-time temperatures regularly dip to near freezing even at the peak of summer, eggs require 3 to 4 weeks to develop. That's a long and hazardous time. So that their offspring can prepare for winter, female Gillett's Checkerspots lay their eggs on the underside of leaves that intercept morning sun. In the cool, clear air of a mountain morning, the sun shines brightly on leaves that point to the northwest — those perpendicular to the incoming rays — and warms them several degrees over air temperatures. This thermal gain is enough to shorten the development time by several days and gives the caterpillars more feeding time before the snow falls.

The choice of where to lay eggs is, therefore, a very important decision for a female. She flies to a shrub, walks up and down one of the highest leaves, flutters about the plant, flies back to the same or a different leaf, walks up and down it, flips to the underside of the leaf, flips back, and walks around some more. She may continue this process for an hour or more before finally she is satisfied with a site for her eggs. She then backs to the underside of the leaf and lays a single eggmass of 100 to 200 eggs. Given the importance of finding a leaf high on a shrub exposed to morning sunlight, a

female may choose a leaf that already has eggs on it. As a result, the best, highest leaves often have several eggmasses.

The cold climate has other effects, too. To gain solar warmth and extend the short growing season, populations found at the highest elevations and more northerly sites are all found on south-facing slopes. In some of the same locations, the growing season is simply too short to make it from an egg in one summer to an adult the next, so development continues through a second winter, and the adults emerge two years after the laying of the eggs from which they developed. They appear biennially rather than annually. Cold simply slows many life processes.

After hatching, the caterpillars eat their egg shells and then form a communal silk feeding-web around the leaf on which they emerged. Gradually, they weave in leaves from lower down the same stem to form a larger web (a "knot"). They pass the winter in this web (often, snow knocks the web off the shrub) or in the leaf litter below it. The caterpillars withstand months under snow and the flowing snowmelt of spring. As temperatures rise and day length elongates in spring, they crawl back up the woody stems to feed on new leaves just as the buds break on their foodplant shrubs.

As the caterpillars grow in size, passing from one instar to another, groups break up as the caterpillars wander off the twinberry shrubs on which they hatched to find and feed on other iridoid-containing plants. Bigger caterpillars eat much more than do smaller ones, so most of the plant poisons retained in their bodies are taken in at later stages of growth. Ah, but now a wrinkle enters the picture. The level of chemical protection varies among butterflies because caterpillars can retain only certain of the iridoid toxins that are produced by their potential foodplants. As a result, butterflies that fed as late-stage caterpillars on plants like paintbrushes (*Castilleja* spp.) or louseworts (*Pedicularis* spp.) contain plant poisons and are bad tasting, whereas butterflies that fed as late-stage caterpillars on honeysuckles (*Lonicera* spp.) are not. Iridoids produced by honeysuckles cannot be kept in caterpillar tissues. Even though the butterflies are all members of the same species, some are palatable and some are not, and the palatable ones mimic the unpalatable ones. This is termed automimicry. Despite the presence of birds, such as Gray and Stellar's Jays, that could eat butterflies in their mountain meadows, I've never seen a bird try to eat a Gillett's Checkerspot. Chemical protection works!

*Above: A caterpillar curls up with the Wyoming state flower, Wyoming paintbrush (*Castilleja linariaefolia*).*
July 25, 1982. 8600 ft. Beartooth Mtns., WY

Left: A closer look at Gillett's caterpillar.
June 11, 1981. 8600 ft. Beartooth Mtns., WY

Left: If you are hunting for Gillett's Checkerspots, you should form a search image of twinberry honeysuckle. Find twinberry honeysuckle, the plant on which Gillett's Checkerspots usually lay eggs, and you may find a colony of these hard-to-find butterflies.

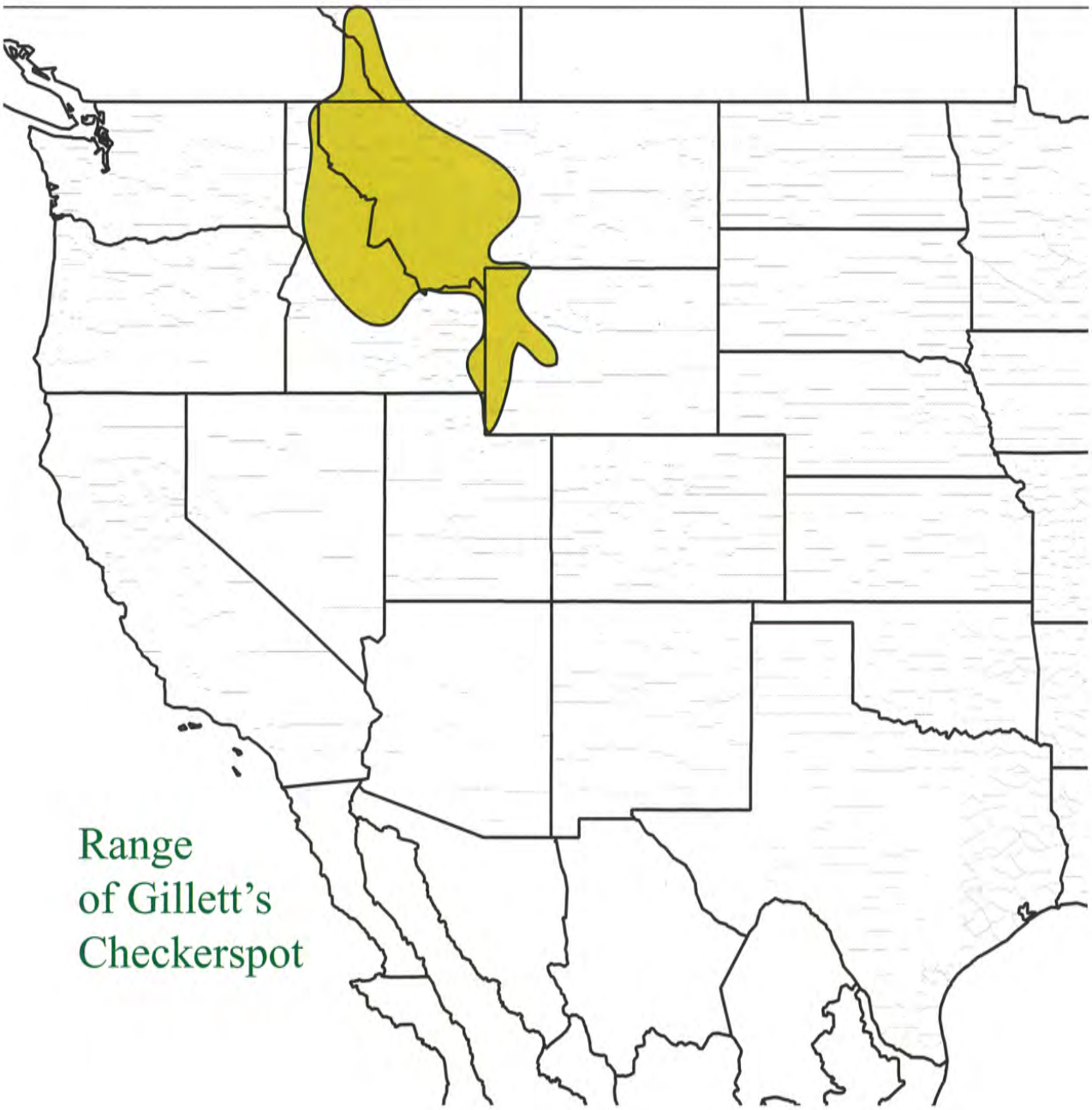
July 7, 1975. Crazy Creek, 7000 ft. Beartooth Mtns. WY

Below: Twinberry honeysuckle in fruit.

Aug. 19, 1979. 8600 ft. Beartooth Mountains, Park County, Wyoming.

Another odd aspect of their life history is that the plant they commonly lay their eggs on — twinberry honeysuckle — is not one of the plants that provide protective poisons. Why, then, should they lay their eggs on this shrub? The answer is that twinberry honeysuckle best allows the young caterpillars the chance to feed long enough to survive the coming winter. This shrub holds its large, dark leaves up to intercept sunlight, so they are warmer than the leaves of most plants. Even more importantly, twinberry retains its leaves until snow begins to cover the ground, weeks longer than other plants for possible egg-laying. Caterpillars that survive the winter build their chemical defense instead by post-winter feeding on paintbrushes and louseworts.

The chemical protection and warning coloration of Gillett's Checkerspots are good for avoiding bird predators, but life is hazardous for them in other ways. Also living in these habitats are numerous orb-weaving spiders, which catch and consume checkerspots. Plant poisons may simply not protect the butterflies against invertebrate predators. Once I faced a real dilemma. I had seen a marked female (#32) in the field most every day for two and a half weeks and had watched her lay three masses of eggs. I was delighted to see her again on the eighteenth morning, though her colors had faded through a gradual loss of scales, and her egg masses were becoming progressively smaller. She was an old friend. But then she fluttered down near the stream, hit a web, and struggled mightily for freedom as a spider quickly approached. I thought momentarily



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about freeing her, and my wife, who was helping with the field work, thought she should be rescued. But I decided that I should just watch nature, not change it. It is hard not to feel some attachment for the creatures one studies, particularly when they are as attractive and approachable as Gillett's Checkerspots. However, #32 had had a long life for a butterfly and had left many eggs to produce another generation. So I did not interfere as the spider took in nutrients for her own eggs.

There are other hazards in mountain meadows. As astonishing as it may seem, moose are predators of these checkerspots! Moose live in the same habitats, and as they browse the highest leaves of shrubs in mountain meadows, they unintentionally consume some of the eggs laid by females (6% in my study). Another threat is from parasitic wasps, which lay their eggs in many of the newly hatched caterpillars. As anyone who raises insects knows, a significant proportion of field-collected caterpillars turn

As are all butterflies, Gillett's Checkerspots are subject to predation. Here, # 32 is trapped in a spider's web.

July 27, 1980. 8600 ft. Beartooth Mountains, Park Co. WY

into wasps and flies, not into butterflies and moths.

These butterflies feed avidly from flowers and live only amid abundant nectar sources. Their favorite flowers are white asters and geraniums and yellow composites, particularly senecios; they nectar actively throughout the morning and early afternoon. In fact, the abundance of each colony is linked much more to the abundance of flowers than it is to abundance of the shrub that is their caterpillars' food. Many of the shrubs grow in the shade of surrounding pines and spruces, which makes them unusable for egg laying. The butterflies stay close to streams with abundant nectar sources in moist, sun-lit open meadows.

The mountain meadows that provide a home for Gillett's Checkerspots exist because of disturbances that have removed the forest cover or prevented the growth of trees. Most colonies of these butterflies exist along streams where fires have opened up new meadows within continuous forest. Animals that live in disturbed habitats usually colonize new sites through regular outward movement, although Gillett's Checkerspots show surprisingly low dispersal rates. They are tied very strongly to their open, moist, mountain meadows. I've been able to follow the same marked butterfly, for example, every day for 10 consecutive days while remaining within 120 yards of a stream's length and no more than 20 yards from the stream. Natural boundaries are fuzzy, however; meadows change gradually back into deep forest, and streams are usually bordered by narrow open zones. A little dispersal does take place up and down stream corridors, although it is limited. Twice, biologists have introduced Gillett's Checkerspots into meadows without these butterflies, and the colonizations have been successful over at least the short term. These studies have shown that the butterflies might be able to live in more sites than they get to naturally. But all the introduced populations have gradually died out. An introduction in Colorado declined and disappeared for unknown reasons, while an introduction in Wyoming died out because all the neighborhood twinberry shrubs washed away in heavy stream runoff.

The future of this beautiful butterfly is uncertain. It lives in highly localized colonies in isolated mountain meadows and disperses little; a patchwork of fire-burned moist habitats provides the best support for their continued existence. Their habitats are unstable over time, and their colonies are widely scattered. Biologically, this distributional pattern is described as a metapopulation, a network of habitat patches with only some patches occupied at any one time. As humans have suppressed forest fire, fewer new meadows have come

into being within their range, thus decreasing the potential abundance of the species by lessening the likelihood that establishment of new colonies can offset the rate at which old colonies die out. The best hope for the future of Gillett's Checkerspots is that they live in mountainous areas visited infrequently by people; these features make their abundance hard to monitor, of course. In a survey I did in the mid 1980's, I found that 4 known populations had died out: one from human development (a ski area), one from chance events in a very small population, and two from plant succession that over-topped or eliminated their twinberry host shrubs. (It is now time for a repeat survey). No new colonizations are known.

You can see this butterfly in several places in Glacier National Park, including Christensen Meadows on the west side of the park and Lower Two Medicine Lake on the east side. Most known populations are in national forests, but they lack the protection afforded those in national parks. Even in the densest populations, however, one may see fewer than 50 butterflies in a day. The keys to finding them are to look for moisture, lots of nectar sources, and their twinberry hosts. If successful, you'll find Gillett's Checkerspots fluttering about calmly in their mountain meadow, taking in plant poisons that deter bird predators, nectaring avidly, and using solar energy to speed up their life processes. It's a pretty cool butterfly coping with life in a cool habitat.

All photographs this article by Ernest H. Williams