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NOTES

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A Tale of Homing in Zebra Heliconians

Heliconian or longwing butterflies (genus *Heliconius*) are relatively common in forested habitats throughout the American tropics. Besides sporting elongated wings, attributes include striking colors, medium-size, a slow and shallow wing beat, a diet of both nectar and protein-rich pollen, exceptionally long lives, and dependency upon a single plant family (Passifloraceae) as a larval host plant. But their signature trait is their ability to learn visual cues within their environment that enables them to return to precise locations over a period of weeks and even months. Only *H. charithonia* or "zebra heliconian" breeds consistently in the U.S.: southern Florida and southern Texas. The species has dark wings that are accented with vibrant yellow to yellow-green stripes.

My residence in Baton Rouge, Louisiana is situated on a corner lot delineated by a fronting avenue and a side street (both asphalt). The butterfly garden is oriented to the front of the house and is bordered by a sidewalk and the entrance to my driveway. The garden is stocked with native *Passiflora incarnata,* locally called "maypop." [I grow this invasive vine to encourage the breeding of two other butterflies related to *Heliconius*: Gulf Fritillary (*Agraulis vanillae*) and Variegated Fritillary (*Euptoieta claudia*).] Because I utilize my garden as an outdoor laboratory, I decided during the summer of 1999 to experiment with the learning ability of adult *H. charithonia*.

I secured a dozen eggs of the species from out-of-state and reared the larvae in a plastic "critter cage" to maximize survival. Subsequent to emergence of the adults, I used a felt-tipped pen to mark each individual with a distinct number on its left hindwing. I then released the butterflies into my garden. At first, the butterflies circled for a few minutes but soon settled to feed on select flowers such as the brilliant orange-flowered Mexican flame vine (*Senecio confusus*) and zinnias. After "breakfast," the butterflies circled again as if to learn landmarks. But within 10 minutes or so, they all departed following the avenue.

The butterflies revisited a few hours later, fed, and again departed. The next day I got to observe two females laying eggs on the tendrils of the maypop. Because I had no problem approaching the butterflies, I learned that all individuals were marked. (I left all second-generation eggs in place and did not mark the adults after they emerged.)

As summer progressed, both marked and unmarked "zebras" spent less time in my garden. However, they seemed to adopt a rather dependable schedule, showing up in midmorning and again at about four o'clock in the afternoon. At about this same period I began receiving telephone calls from fellow butterfly gardeners within 2-10 miles of my home. These friends wanted to know the name of the strange long-winged butterflies they were seeing. With detailed questioning, I concluded that the butterflies were *H. charithonia* and that they were appearing in my friends' gardens at a prescribed time. (One friend even commented that a butterfly he was photographing bore a number on its left hindwing.)

Within my own garden, I soon realized that the "zebras" habitually departed to the right, following the avenue. But the insects always returned from a different direction: They approached from the intersecting side street. The intersection was identified by a cross-tined street post and a standard red "STOP" sign. Upon reaching this intersection, the butterflies executed a ninety-degree right turn and then traveled the remaining short distance to my garden. In other words, the butterflies approached the garden from the left and by a circuitous route. This behavior—particularly the turn at the traffic and street signs—was downright uncanny.

One particular scenario remains vivid in my mind's eye. It happened that at this same time, I was engaged in remodeling the section of my house that bordered the side street. One morning I was talking with the construction crew about the economic, environmental, and psychological advantages of my unconventional, wildlife-oriented landscape. Of course, the workmen were skeptical. Therefore, I decided to use my "zebras" as a teaching tool—and to have some personal fun as

Zebra longwing on a flower is Mexican flame vine (S*enecio confusus*).

well. So at 3:45 PM, I mentioned that within a few minutes we would be seeing some unusual-looking butterflies tailing each other, flying slowly about six to eight feet above the pavement. "Each day these butterflies fly down this street to this corner, make a right turn at the STOP sign, and then fly to my front garden to feed and lay eggs," I added nonchalantly.

Within minutes I noted a "zebra" approaching. Quickly, I suggested we all walk over to the corner. "You mean the butterflies are going to stop at the sign" quipped one? I smiled: "Butterflies can't read and they can't pause in mid air like hummingbirds. But zebra heliconians are the smartest butterflies in the U.S. Just watch."

Everyone smirked. Nevertheless, all accompanied me to the corner. A procession of a dozen or so heliconians approached the corner and then veered dramatically to the right. The workmen were speechless. Questions hurled: "How did you train them?" "Do you have some sort of whistle that we can't hear?" And "What have you hidden on the signs and your mailbox?"

My explanation of "brainy" butterflies was just not acceptable. To my workmen, I had to be conjuring some trickery. So, during the remainder of our contract, near four o'clock each day the guys positioned themselves near the street signs to try to figure out my wizardry. And adding to my delight, one afternoon the wife and two small children of one of the workmen drove up to observe my "magic show."

While the homing behavior of the butterflies had to be hocus-pocus to my workmen, there is, of course, a scientific explanation: The butterflies had learned a pathway involving

Zebra longwing on a *Zinnia* flower.

streets (and likely other markers) to travel in search of appropriate food and reproductive plants. Using their version of a road map or GPS, the butterflies made their daily "rounds" much as a fisherman or hunter routinely checks his trapline. The butterflies' Methuselahesque lives provide time for this learning, and their high-octane pollen banquets furnish brain food. Be that as it may, the heliconians were entertaining to me and a lot of other folks that summer and fall.

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New Hostplant Records for Two Noctuid Species in Florida (Lepidoptera: Noctuidae)

Abstract: In Florida, a larva of Soybean looper, *Pseudoplusia includens* (Noctuidae), was found feeding and was raised to adult on *Passiflora* (Passifloraceae); a larva of *Zale aeruginosa* (Noctuidae) was collected and raised on Sparkleberry, *Vaccinium arborum* (Ericaceae).

Pseudoplusia includens (Walker), Soybean looper, is a polyphagous moth, whose hosts include members of Malvaceae, Liliaceae, Ubelliferae, Cruciferae, Leguminosae, Compositae, Cucurbitaceae, Solanaceae, Geraniceae, Convolvulaceae, Rubiaceae, Piperaceae, Gesneriaceae and Commelinaceae (Heppner et al., 2007). In July, 2008, I found a fourth instar larva on *Passiflora* var. *incense* (a hybrid between *P. incarnata* and *P. cinnicata* (Passifloraceae) and reared it through to adult. This adds another family to an already diverse array of families utilized by *P. includens* as host plants. The only other noctuid moth whose larva is recorded feeding on *Passiflora* in Florida is Granulated Cutworm, *Agrotis subterranean* (Fabricius) (Heppner et al., 2007). Since leaves of most *Passiflora* species are toxic (e. g., Hay-Roe and Nation, 2007), it is interesting to add one more species of Lepidoptera to the list of butterflies and moths (such as *Heliconius*, Dioptinae and a few others) that are capable of detoxifying cyonogenic compounds found in *Passiflora*.

Soybean looper on *Passiflora*.

Another noctuid, *Zale aeruginosa* (Guenee), was collected in April 2003 on Sparkleberry, *Vaccinium arborum* (Ericaceae), near O'Leno State Park, and reared through to adult. This is the first Ericaceae host plant recorded for the genus *Zale* in Florida, where 24 representatives of the genus *Zale* are found (Heppner et al., 2007). Sparkleberry serves as a host for Stripped Hairstreak, *Satyrium strigosum* (Lycaenidae), Walnut caterpillar, *Datana integerrima* Grote & Robinson (Notodontidae), and *Zomaria interruptolineana* (Tortricidae) (Heppner et al., 2007). According to the latter source, cultivated blueberries (also of the genus *Vaccinum*) provide food to a wide variety of Lepidoptera caterpillars, including the following Noctuidae: *Pangrapta decoralis* Hübner, *Drasteria graphica* Hübner, *Catocala gracilis* W. H. Edwards, *C. louiseae* J. Bauer, and *C. andromedae* Guenée; *Acronicata tritona* (Hübner); *Harrisimemna trisignata* (Walker); *Metaxaglaea semitaria* Franclemont; *Chaetaglaea tremula* (Harvey); *Morrisonia confusa* (Hübner); Feltia herilis (Grote); *Peridroma saucia* (Hübner); *Xestia dolosa* Franclemont, and *Xestia dilucida* (Morrison)

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Puddling on Edges of Brackish Water Lakes in High Altitude Butterflies (Lepidoptera: Papilionoidea) in Cold Desert of Ladakh, India

Abstract: Two species of butterflies, *Papilio machaon ladakensis* (family Papilionidae) and *Argynnis adippe pallid*a (family Nymphalidae), have been recorded puddling at edges of three cold-desert, high-altitude brackish water lakes in Ladakh (India). The behavior was solitary and all specimens were males. From these observations, it is concluded that as the only source of water is snow in this area, butterflies exploit brackish water to meet their need for salt content.

The terrestrial herbivorous insects, including adult Lepidoptera, fulfill their need for sodium ions and amino acids by puddling from various sources, as these essential materials are in short supply in plant nectar (Beck et.at. 1999; Smeldy and Eisner, 1995,1996).The phenomenon of puddling at carrion, excreta, soil, fresh water and marine water has been documented for adult Lepidoptera (Norris, 1936; Adler, 1982; Pola and Garcia-Paris, 2005) though some species of moths also suck from tears of closed eyelids of roosting birds (Hilgartner et.al. 2007) or of humans (Banziger, 1992). Puddling behavior is mostly carried out by males (Downes, 1973; Boggs and Jackson 1991; Sculley and Boggs 1996). The sodium intake by males affects their reproductive success, as the sodium ions are transferred to females via spermatophores and consequently enhance the reproductive success of both females and their eggs (Pivnic and McNeil, 1987). Older males visit puddles more frequently than freshly emerged males, as their sodium ions are lost through spermatophores during mating (Adler and Pearson, 1982).

Among butterflies, puddling behavior has been reported in several species. The members of familes Papilionidae and Pieridae often visit soil puddles (Sreekumar and Balakrishnan, 2001). Members of familes Nymphalidae and Lycaenidae are attracted to carrion, decaying fruits and animal excreta (Hamer et. al, 2006). Drinking water from sea coast shorelines in *Papilio polytes* has been reported by Pola and Garcia-Paris (2005). The location of puddles with appropriate salt concentration is not a simple matter for Lepidoptera, which use both visual and olfactory stimuli to locate them (Beck et. at., 1999).

Here we report observing *Papilio machaon ladakensis* Moore and *Argynnis adippe pallida* Evans puddling at edges of high altitude brackish water lakes in Ladakh (Jammu and Kashmir, India). On July 21, 2008 a male specimen of *Papilio machaon ladakensis* was observed puddling very close to the water on the bank of Tsokar Lake in the afternoon of a sunny day (2.00 - 3.00 p.m.). On July 24, 2008 at Lake Pangong Tso (2/3 of the length of this lake is in China), four male specimens of *Papilio machaon ladakensis* were observed puddling near the bank of the lake in the afternoon (11:30 - 2:30 p.m.). The specimens were puddling individually, separated by distance of 5-10 meters. The air temperature was 25.3° C and humidity was 20%. On July 26, 2008 at Tsomoriri Lake, three male specimens of *Papilio machaon ladakensis* (Fig. 1) and five male specimens of *Argynnis adippe pallida* (Fig. 2) were observed puddling at soil close to the edges of the lake (from 12:30 pm to 2:30 pm). All specimens were puddling individually. The puddling *Argynnis adippe pallida* were also basking by orientating their wings to sunlight. They were spreading their wings to dorsal bask and then orienting them at an angle, doing reflective basking. At a given site, each specimen was puddling for 2-5 minutes and then changing the spot. In general, puddling time for butterflies observed between 11.30 am. to 3.00 pm. From the condition of wing and wing colouration, all the specimens were older.

The mountain ranges in the Ladakh region were formed over a period of 45 million years by the folding of theIndian Plate into the stationary landmass of Asia. The high-altitude desert, in Ladakh was at that time covered by an extensive lake system. The remnants of this system are still found on its southeast plateau of Rupshu and Chushul, in the drainage basins or lakes of Tsomoriri, Tsokar and Pangongtso. As snowfall is the main source of water in Ladakh, the brackish water lakes are the sources of salt and sodium ion content needed for butterflies. This appears to be the first report of puddling by butterflies at brackish water lakes in cold deserts at high altitude.

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New Larval Host Plant of *Phalanta phalantha* (Drury) (Lepidoptera : Nymphalidae) with some Notes on its Life History

Bell (1909), Wynter-Blyth (1957) and Kunte (2006) have reported *Flacourtia ramontchi, Flacourtia montana, Aberia gardner, Xylosma longifolium, Smilax* and *Salix* as the larval host plants of *Phalanta phalatha* (Drury). Eliot (1992) recorded *Flacourtia* and *Salix tetrasperma*, the larval food plants of this species from Malay Peninsula. Kunte (2002) has recorded *Lantana*, *Duranta*, *Meyenia laxiflora*, *Gymnosporia montana* and thistles as nectar food plants of this species. Bell (1909), Wynter – Blyth (1957) and Eliot (1992) discussed very briefly the larva and pupa of *Phalanta phalantha* besides giving *Lantana* and *Duranta* as adult nectar food plants. Van Son (1979) while giving the life history briefly illustrated the line drawings of different life history stages of this species. In this present studies the new larval host plant and adult nectar food plants of this species have been recorded besides reporting pupal dimorphism and mistaken oviposition in the field.

During the course of the present studies, the various life history and behavioural aspects of type-species *Phalanta phalantha* (Drury) have been recorded both in field as well as laboratory in Shiwalik areas of North-West India. Some of the observations are recorded below:

Nectar food plants : *Sida rhombifolia* Linnaeus (Malvaceae); *Cosmos sulphureus* Cav, *Alstonia scholaris* Linnaeus, *Tagetus erecta* Linnaeus (Compositae) and *Verbena bonariensis* Linnaeus (Verbeniaceae).

Larval host plants : *Populus deltoides* Linnaeus (Salicaceae).

Mistaken oviposition: The incident of unusual and mistaken oviposition was observed in three female individuals of this species in the field. These females deposited the eggs haphazardly in bulk on sites such as the leaves, twigs and cut stem portion of a host plant *Populus deltoides* Linnaeus (Salicaceae). After using the latter host, the same females deposited some eggs on the blades of the grass and some other dry twigs growing in the vicinity of this host plant.

Pupal dimorphism: The Dimorphic pupae have been observed in this species. In first morph-group, the general body colour is green. The silvery addorsal tubercles are intermingled with some orange metallic colouration on each segment. The ventral surface of the pupa is transparent green. In the second morph-group, the general pupal body colour is light bluish tinged with pink. The silvery addorsal turbercles are intermingled with pink colour instead of orange and each tubercle is surrounded by prominent black patches. Though the larvae as well as the adults are similar morphologically, the pupae show remarkable dimorphism.

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Fig. 1. Dimorphism in pupae of *Phalanta phalantha.*