

FLIGHT HABITS OF *MORPHO THESEUS JUSTITIAE*

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The collecting season of 1961 found me deep in a mountain region with an environment rather new to me, having collected almost exclusively in the flat or slightly rolling country of the Yucatán peninsula. This, my first extensive mountain collecting, was in the Sierra Chinantla of northern Oaxaca, in southern México, a small but abrupt range running north and south between the Río Cajonos and the Río Santo Domingo and their tributaries, and reaching a maximum elevation of about 3,400 m. So abrupt are the northern slopes that the Tuxtpec-Oaxaca road that cuts through the range climbs 2,900 m. in an upward swing of 60 km. Here in an area where it is very difficult to collect insects, I had the opportunity to observe one of México's most elusive butterflies, *Morpho theseus justitiae*, Salvin & Godman.

It was quite by chance that I ran across this insect, as I had intentions of setting out trap nets for its close relative, *Morpho polyphemus luna* Butlr. I had traveled up the northern slopes of the Sierra in order to reach one of the interior valleys where a collecting group had been stationed two months previously. There, early in the month of September, were dozens of *polyphemus luna* flying everywhere in the almost inaccessible rain forest on both sides of the road, which goes up to about 700 m. elevation; but I could not stop to catch them at the moment as we were planning to transfer the collecting party to the lowlands on the gulf plain after two months of rather unsuccessful collecting in the nearby valley. I immediately made plans to go after the *Morphos* following transfer of the party to a new area. Then I would go alone armed with plenty of bananas for the trap nets which formed part of my collecting equipment. As it was, however, the business of locating a new site on the gulf plain and sampling the local fauna to see if another two months' stay would be worthwhile took longer than I expected, and it was not until the end of September that I returned to the mountains.

With the car bulging with bananas, I eagerly began the trip into the mountains. My destination was a place called Lúumo-Hmíndzáu. It is called Puerto Eligio by the Spanish-speaking people living in the lowlands, and belongs to the municipality of Comaltepec. It is at 700 m. elevation. There were three houses there, one of them unoccupied at the time, which was a vital factor in my choosing the spot. Within one-half kilometer on either approach along the road there were parts of forest

where I could have caught many *polyphemus luna*, and where trap nets could be placed. This spot also happened to be the place where we stationed the car to hike into the valley to the east two months before, some five km. away and about 500 m. below. I was sure I would come away with hundreds of *Morpho* from this spot. Imagine my surprise when arriving there I saw almost none at all where just two weeks previously the area was alive with them.

Even though I was very disappointed on seeing *polyphemus luna* had almost completely disappeared, I decided to stay at the spot to blacklight for nocturnals and see if there was anything else the trap nets would bring in. Almost nothing came to the rotten bananas except some *Euptychia*, but the night collecting with the light became so amazingly productive that I stayed until the end of October.

Another event was even more decisive in my staying on, after the original object of my trip was absent. At the beginning of October, a week of torrential 24-hour-a-day rain began. Night collecting became even better during this week, with plenty of sphingids coming in, as the light was put under one of the house's protruding eaves, and my 350-watt gasoline-driven generator was put inside the house. My greatest surprise came after the rainy spell stopped. On the first sign of the sun peeking through the clouds, I took my net and started down the road by foot to reach one of the areas where *polyphemus luna* had been swarming. I had expected another generation to be on wing after the rain, even though it would have been impossible for so large an insect to have such rapidly succeeding generations. Instead, flying everywhere at certain points along the road was *polyphemus luna's* close relative, *Morpho theseus justitiae*. I was amazed at seeing these, as now I was not presented with the spectacle of great patches of white drifting slowly down from the higher treetops as *polyphemus luna* appears to the observer, but with rich chestnut brown, yellow-tinged jewels gliding about instead. The week of rain must have brought them out. Here, however, was an insect that presented a real problem in collecting. This species has habits so singular that, along with the fact that it is probably very restricted in its range, we can quickly understand why it is so rare in collections of Mexican insects.

Morpho theseus justitiae probably is restricted to the northern, wetter slopes of the mountains in southern México on the gulf side and perhaps some of the other slopes and interior valleys where the mountains are so low as to allow a heavy rainfall to penetrate from the north and east. Where the mountains are high enough, most of the moisture condenses before reaching the summits and, therefore, little rain falls on the south-

ern slopes, consequently creating conditions unfavorable for the species. In the Sierra Chinantla, the valleys are dry to the south where they are connected with the Sierra Juárez, beyond the 3,000-m. pass along the Tuxtepec-Oaxaca road. It is quite probable that the species does not fly anywhere south of this area, nor does it reach the height of the pass on the northern side. I have seen authentic specimens in a collection from Valle Nacional, Oaxaca, 78-m. elevation, at the northern base of the Sierra Chinantla, and have observed living adults from 700- to 1,500-m. and believe that this represents a crosscut of the terrain it occupies. I did not find the insect higher than 1,500 m. F. L. Davis (1928), who spent 30 years collecting in British Honduras, mentions that *theseus justitiae* is found in the Cayo District. As there are no high mountains in the northern part of that district where he did most of his collecting, this is an indication that the species also exists locally where there are lower ranges and where rainfall is sufficient to support the biological environment that the species needs. C. C. Hoffmann (1940) mentions that the species is found in southern Veracruz in the Sierra de San Martín, and at Santecomapan. Thus the insect has a wide range from southern Veracruz and northern Oaxaca through northern Chiapas, El Petén, and into British Honduras, existing in a narrow belt along the northern slopes of the mountains and foothills. In my collection, I have specimens from British Honduras, El Petén, and Oaxaca.

Morpho polyphemus luna frequently flies down from the treetops to almost ground level, and is startled at the slightest movement of people or animals. It prefers to stay in open areas such as along shaded roads, streams, wide trails, or unobstructed parts under a forest canopy, preferring to remain in the shade. *Morpho peliedes montezuma* Guenée is rarely seen flying above treetops, will fly almost anywhere, even in very thick jungles, and tends to follow trails through any kind of thick vegetation. It is the most wary of the three species and quickly dodges into thickets at the slightest sign of people or animals. I have seen individuals fly to one side at seeing dogs or horses coming up the trails the butterflies were using. Just catching a few with a net is no small feat. Perhaps these two species are very wary because their flight patterns allow them to move near the ground and through vegetation, getting themselves into precarious positions among rocks, ravines, trees, etc., thereby making them more vulnerable to attack by predators. *M. theseus justitiae*, however, is a very curious insect. It neither flies near the ground nor startles at any slight movement, at least where I observed it; in fact, a swing with the net may only cause the butterfly to swerve around to investigate the disturbance. The fact that the species does not fly in every place it

could, but instead follows certain flyways and delves in open areas where it may be safe from predators (?), perhaps gives it a lack of concern with anything it may encounter in these areas. Perhaps there is some other reason why it acts so self-confidently and rather unpreoccupied.

As already mentioned, this species is a treetop flier. On level, unbroken terrain, I imagine it would be impossible to collect a good series. The only reason I was able to get close to this species in quantity was the abrupt slopes of the region. The road in mention climbs as it goes south. To the east there is a quick climb where no man or beast can set foot, most of the way. In some places huge overhanging rocks and trees menace the road. On top of this are trees from 20 to 50 m. high in a continuous succession until reaching the summit of a small mountain. In some places, small streams have created gullies where one can climb upwards a bit under gigantic trees, but these places are few. To the west of the road there is a quick drop-off, with some areas dropping off vertically 100–200 m. before slightly leveling off. The downward inclination continues very steep until reaching the river at the bottom of the valley. In some parts where the road has been blasted out of rock, dislodging of rocks and trees below which previously held the runoff resulting from torrential rain, now permits the water to rush down, creating a continuous series of avalanches. From another mountain, one can look back to see the road as it twists precariously around the side of the mountain behind him, observing at the same time the destruction to the forest below the road. Literally the whole side of the mountain below has slid down in some places, carrying trees and everything. Still, there are a number of unaffected parts where the trees almost reach the edge of the road. These places, where there is a continuous series of trees from the valley, and where the tops of those that come closest to the road are at the same level as the road, offer the best places in which to hunt *theseus justitiae*. Individuals coming up the slope about one to two m. above the trees apparently are unable to distinguish some roadside plants from treetops as they come near the road, and this is the place to collect them.

The way in which the butterflies come up the slope is interesting. At first I noticed they would fly close to the edge of the road, circle for about 20 to 30 m., then glide slowly downhill above the trees once more. Later I noticed there were definite hours in which the *justitiae* arrived at the height of the road, the height they would fly at any given time depending on the extent of sunlight on the lower slopes in the morning hours. As this downward slope was on the northwest side of the mountain, it was relatively late in the morning before the tops of the trees

became illuminated by sunlight. This accounts for the late appearance of the species on the northwest side. Whereas on the northeast slope it was on the wing from 9:00 A.M. onwards, on clear days, on the northwest slope where I did my collecting, the species would not fly until the sun was shining on the trees, about 10:00 to 10:30 A.M. Due to the overhanging rocks and formations above the road on the east side, the road and the vegetation along it remained in shadows longer than did the tops of the trees on the downgrade to the west. The species flew above the trees illuminated by the sunlight, flying up from the valley, almost reaching the areas still in shadows, then turning, flying a wide half-circle, and finally gliding downward again. A whole series of *justitiae* would go through this cycle, and one could only guess if they were the same individuals repeating the process after reaching the valley floor. Nevertheless, the parade was continuous. The shadows of the mountain preventing the upward flight of this species established a fact in my mind: that the species is extremely wary of shadows or dark places and does not come within five to six m. of shadows. Even the shadow of a small tree branch will cause them to fly way out of their way.

As the slope became progressively illuminated by the sun's rays in an ascending direction, the species ventured farther up the slope until arriving close to the area of shadows, only to turn and circle, then drift back down again, always staying in the bright and hot sunlight. The routes on which they ascended and descended changed from hour to hour in the same succession every morning, and I knew I could go to a certain spot at a given hour and find them close to the road. Some of the shrubs and small trees near the edge of the road would throw a shadow into an area that would suddenly be perfectly acceptable to them as soon as the sun rose higher and the position of the shadow changed, whereas previously their continuous parade would circle around through another, shadow-free area. When the sun was high enough, about 11:45 A.M., to illuminate the road and the upward slope on its east side, some of the butterflies would continue flying upward after rapidly crossing at a good height the treeless space afforded by the road, and probably would keep on going until reaching the summit of the mountain, which in this case was only about 900 m. above sea level. Where they went after that is not known, as once they crossed the road and continued upwards, few descended, meaning that the whole area was sufficiently bathed in sunlight so as not to interfere with their course of flight. At about 2:00 P.M. almost all activity ceased, as they suddenly disappeared after that hour. On certain days clouds rolled in from the gulf plain below. Whenever one of these clouds obstructed the sun momentarily, the *justitiae* would

immediately alight on the upper surface of leaves at the top of the highest trees. In no case would they settle on a branch or some of the lower leaves, where they would have to go under something. As soon as the sun came out again, they would continue gliding along their route. Even a slight haze that would not completely blot out the sun would cause them to halt. Full, bright sunlight was a necessity; and this fact, coupled with the necessity to be in an area where one can swing a net above the trees from still higher up, offers the perfect clue on how to catch a series of this species.

At times two males would encounter each other on their flyway and would engage in a short "battle." Sometimes as many as three or four would fly at each other, usually while I was just about to net one of them, with the result that all would fly away. Trying to catch them with a net tied on a pole five m. long was no help. The clumsiness of their flight, not of their gliding, made them poor aggressors; in fact, it made them look as though they were playing. Females were scarce; males made up 99% of the parade. Of the females I saw, all flew above the treetops except one which was winging around under some shrubs obviously looking for a place to oviposit. Probably the females have to fly around above the trees in order to mate, flying at lower levels afterwards where males never venture. Females were readily differentiated from the males when flying by the larger wing expanse and the greater yellowish submarginal maculation on the upperside of the wings.

All in all during 1961, I observed about 500 *justitiae* in 10 days of clear weather at the site. Observations could not be made during the rest of the month due to frequent rains. Even after learning something about the flight habits of this insect, I managed to catch very few. Those I did get were caught with many hours of patience, waiting until an individual came close enough to the road to net. But for every 20 that came close, only one could be caught, even if I was lucky. It was not that the net scared them off, but that the five-m. length of pole weighed about 20 to 25 pounds, and it was only with great difficulty that I could swing it. Taking aim was another matter, as the diameter of my net was only about 42 cm. I was not free to move any way I wished, either, as I had to balance myself on the edge of a cliff where one false step might have meant the appearance of an obituary instead of this article.

In September and October, 1962, I returned to the Sierra Chinantla with two lengths of a very lightweight, hollow, aluminum tubing, each about two m. long, which I could connect, and a net with a diameter of one m. Now that I had something lightweight to catch *theseus justitiae* with, I could get about 10 specimens on a clear day.

This species does not exhibit apprehension of a net nor of a person's movements. When an individual came close but was still out of reach of the net, I would jiggle the handle slightly and the net at the other end would bob around clumsily, actually attracting some individuals, which would immediately swerve around and circle the net to investigate. When I was using my large, lightweight net, I tied a piece of stiff wire to it and bent it so that a dead male specimen tied to the wire would rest above the center of the net. On moving the handle of the net, it would bob a bit and jiggle the dead decoy, making it look as if it were alive and available for "battle" with an oncoming male. This method of attracting other individuals worked to a certain extent, but not as much as I might have liked it to. Many males passed right by, paying no attention to the decoy.

Morpho theseus justitiae never once entered in my trap nets. In 1961 I put 12 trap nets with rotten bananas near their flyway, and surely one of the hundreds which unhurriedly glided by over the trees would have entered if it had any attraction for sweets. It would be interesting to try aerial trap nets that could be suspended from the very highest branches of a tree; however, I doubt the effectiveness of this method. During April, 1965, I managed to catch a worn male in my trap net baited with rotten bananas among some hills near Middlesex, Stann Creek District, British Honduras. Does this seem to disprove my idea that males will not fly under vegetation or do not like sweets? Of the hundreds I saw in Oaxaca, why didn't at least one enter my traps there? For other species, it is a necessity that the trap nets be hung in deepest shade for best results; at least that is my experience.

I do not recommend trying to collect *theseus justitiae* in the Sierra Chinantla of Oaxaca to people with a weak heart or those who become faint on climbing stepladders. For those who may want to try it, the many days of patiently waiting for the rain to stop and for the sun to come out will be well awarded by seeing this species in its natural habitat, an experience that will, at least in the Sierra Chinantla, cause no end to one's marvel at the exotic beauty of deep valleys, huge mountains, and great expanses of primitive rain forest stretching out for kilometers on either side below. Here lives a butterfly that offers a real challenge. To those who try it, good luck!

LITERATURE CITED

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