



Passiflora

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The *Passiflora* Bee...

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The Passionflower Bee: *Anthemurgus passiflorae*

John L. Neff

Central Texas Melittological Institute, 7307 Running Rope, Austin, Texas 78731

The striking diversity in floral form among *Passiflora* species is related, at least in part, to the diversity of their pollinators. Passionflower pollinators include bats, hummingbirds, butterflies, wasps and bees. While relatively few of the roughly 350 passion flower species have had their pollination biology studied in any detail, bees appear to be the most important pollinator group. The vast majority of the bees associated with passionflowers are generalists, bees that collect pollen and nectar from a variety of flowers in different plant families. Oligolecty, the restriction of pollen collection by a particular bee species to a single plant family, genus or species, is actually quite common among bees. Nonetheless, the Passifloraceae is not a favorite among specialist bees. In fact, among the 16,000 or so described species of bees, only a single species, *Anthemurgus passiflorae*—the passion flower bee, is known to restrict its pollen collection to the Passifloraceae. This may be a simple reflection of geography. The Passifloraceae is primarily a tropical family while oligolecty is most commonly seen in bees of the Temperate Zone.

Anthemurgus passiflorae is a small (7.5-8.5 mm long), black, andrenid bee that occurs from central Texas to North Carolina and north to Illinois. The only known pollen host for *A. passiflorae* is the wild yellow passionflower, *Passiflora lutea*. *Anthemurgus passiflorae* is, like most bees, ground nesting and solitary. Each female constructs her own nest in open areas of well-packed soil, sometimes in loose aggregations of ten or more nests. Each nest consists of a more or less vertically descending main burrow (15-45 cm deep), off of which the female constructs short laterals each of which terminates in a solitary, oval brood cell. *Anthemurgus passiflorae* is somewhat unusual among solitary bees in that the burrows are often reused by females of succeeding generations. Each cell has a secreted, wax-like lining and is provisioned with five to six loads of *Passiflora* pollen. When sufficient pollen is accumulated, the female molds the pollen, along with some extra nectar, into a flattened sphere. She then lays an egg on the pollen mass and closes the cell with a spiral, earthen plug. The egg hatches several days after oviposition and the white, legless, maggot-like larva begins to feed on the pollen mass. The larva will go through a series of molts as it grows and consumes the pollen mass, but

changes little in form. *Anthemurgus passiflorae* is partially bivoltine, meaning it may have one or two generation per year. Upon completing feeding, the mature larva may immediately pupate and transform into a winged adult, or it may enter a resting phase as an overwintering prepupae (defecated larvae) which delays pupation until the following spring (or perhaps several years later if conditions are unfavorable).

The host plant, *Passiflora lutea*, typically flowers from May through October in Central Texas, the only area where *Anthemurgus passiflorae* has been studied in detail, with peak flowering in June and July. The flight period of *A. passiflorae* is also extended, lasting from May through July. As noted above, the long flight season reflects multiple generations since individual adults live for only a month or so. Females of *A. passiflorae* tend to have a consistent and rather unusual behavior at flowers of *Passiflora lutea*. Typically a female lands on the corona and moves forward to sip nectar from the hidden nectarial ring. She then climbs up the androgynophore and hangs beneath an individual anther where she scrapes the pollen out of the individual thecae with her mandibles. The pollen is then transferred to the thoracic venter, and later to the sparse scopal hairs of the hind legs where it will be mixed with regurgitated nectar to form an agglutinated pollen load. On average, it takes the pollen of seven flowers to complete a pollen load. If not disturbed, a female commonly moves around the flower, extracting pollen from each anther. An undisturbed visit is not the rule for female *A. passiflorae*. *Anthemurgus passiflorae* males patrol *P. lutea* vines, often perching near the flowers. Encountering a female at a flower, a male will quickly mount her and attempt to mate. The female continues to forage on the flower with the mounted male, but usually dislodges him before moving to another flower.

The significance of *Anthemurgus passiflorae* as a passionflower pollinator is unclear. Its' foraging constancy, and ability to locate the small, pale, weakly scented flowers of *Passiflora lutea* suggests *A. passiflorae* may be a highly effective pollinator. However, *A. passiflorae* is infrequently collected and probably is a rare bee. Most populations of *P. lutea* probably have to rely on the mix of medium sized

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1: *Passiflora lutea* flower, staminate phase; **2:** *Anthemurgus passiflorae* female collecting pollen of *P. lutea*. Note scopal load of moistened pollen on hind legs; **3:** Male *Colletes latitarsis*, a medium sized bee and occasional *P. lutea* pollinator. Note nototribic pollen deposition on thoracic dorsum of bee; **4:** *Phyciodes tharos* visiting *P. lutea* flower. Photos 1-3 (plus front cover) by John L. Neff; 4 by Phil Schappert.



a few too many roadside stops to examine the tangling flora that climbed over lush vegetation, which constantly seemed to mock us by showing us just how many climbers there are in these forests with leaves that seem to mimic the leaf shapes of *Passiflora* species. Then we got lost, so it wasn't until midday that we reached the gates of the Park.

We passed the first two checkpoints without incident but the track/road leading into the forest was gated. After frantic negotiations with the Park Warden we were forced to accept his decision, he considered the track only suitable for large four-wheeled drive vehicles and definitely not a people carrier or minibus on account of the very heavy rains that we had during the last couple of days, which had turned normally small streams that trickle across the track into fast flowing rivers one or two feet deep and 20 or 30 feet wide. I suppose this should have been expected, after all this was the rainy season! So if we wanted to proceed, the only way was on foot.

Our problem was that the point where *P. wilsonii* and *P. parakensis* had previously been recorded was 25-27 km along this track. In spite of our enthusiasm the prospect of a 50km walk, in only, at the most, six hours was less than realistic. So we decided to walk the track looking for the elusive vine as we went and at 4pm on the dot turn around and head back no matter how far we had walked.

It wasn't far along the track before we reached the first river. Perhaps it would have been too risky to drive our two wheel drive people carrier through it, but I think Oom would have made it, he didn't seem to know the meaning of the word defeat, but there again he didn't speak much English. So it was off with our shoes and socks and paddling/wading time for us all, this seemed to be the procedure at regular intervals every few kilometres. However we did have a very exciting false alarm mid-way through the afternoon and it was some minutes before we spotted our mistake. We were looking at juvenile foliage, and when we examined mature stems it was evident that our specimen was not a *Passiflora* but some other vine that climbed with the aid of tendrils. At 3.20 pm with still no Passion flower in the bag, Penny, Anders and I decided to make a last fast push to get as far up the track as we could before we would have to turn around at 4 pm.

A few minutes into this march the road became very steep and our progress was reduced to a crawl, and our conversation ceased to save breath. This was probably the reason that we, well actually Anders, almost stepped on a King cobra that was sunbathing on the road. I'm not sure who was the most surprised, the snake or Anders, but the cobra appeared angry at having his sleep disturbed and rose up tall, flattened its hood, just like in the

movies, a truly beautiful sight. Well at least I thought so, but you see I was behind Anders. I asked him to keep it occupied while I got my camera out, but my multilingual friend only muttered abuse in several languages which I took as meaning no, because he allowed the snake to slide away into the undergrowth.

One last push took us exhausted to 1933 ft (611m) altitude to a clearing on the side of the hill looking out on a wonderful view of distant forested hills and the treetops of the deep velvet green forest below. After a few photographs and one last look we turned for a long and weary trek back. But "fortune favours the brave" because within a few minutes we heard the grumbling engine of a large vehicle coming from behind us. Thai people deserve their reputation as being amongst the most friendly people in the world. A big earth-moving lorry stopped as if it were expecting us and we were welcomed to clamber on board. To people in the city a Cadillac is travelling in style but in a Thai forest the soil filled back of a working truck was all the style we needed.

This was the end of our field trip and all we had found was lots of two varieties of *P. foetida*, possibly the progeny of *P. foetida* var. *hirsute* and *P. foetida* var. *hispida* but *P. foetida* has been wild in Asia for so long, and there has undoubtedly been natural hybridisation, that it is difficult to make a positive identification. Perhaps these Asian taxa should now be considered varieties in their own right. A week or so later we visited islands off the west coast of Thailand known as the Island of the Golden Buddha and the mountainous Ko Ra Island but after several forest walks we still hadn't seen a native *Passiflora*, but we did record yet another population of *P. foetida*.

May I leave you with this thought, "It is better to have looked in vain, than never to have looked at all!" Thank you Hap and Anders for a wonderful trip!

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bees and wasps known to visit the self-incompatible flowers for pollinator services. While some contact with the stigmas occurs when foraging for pollen, the small size of *A. passiflorae* means individuals only infrequently contact *P. lutea* stigmas while nectaring. Additionally, the high efficiency of *A. passiflorae* females in stripping the anthers of pollen before the stigmas have descended may reduce the potential for pollen dispersal. While a male alone probably fares no better than a female as a pollinator, his combined height, when mounted on a foraging female, is sufficient to contact both anthers and stigma, thus facilitating the classic nototribic method of pollen transfer seen in many bee pollinated passionflowers.