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SHORT COMMUNICATIONS

NOTES ON ADULT BEHAVIOR AND EMERGENCE OF *PALTOTHEMIS LINEATIPES* KARSCH, 1890 (ANISOPTERA: LIBELLULIDAE)

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P. lineatipes has the broad hindwing of glider anisopterans but the behavior of both fliers and perchers. The habitat is typically small rocky hill streams in brushlands and forest up to 2000 m elevation. Feeding flights are more sustained in females than in males. Males are on territory in the morning when they perch on rocks in gentle rapids, occasionally making a patrol flight covering up to 15 m of the stream. Copulation occurs in flight and the female oviposits alone. The larvae live between rocks in moving water. Transformation occurs at night and the adults fly as soon as they are able. A one day sample of 188 exuviae contained 70.7% females. Dorsal abdominal spines were present in 100% of the exuviae on segment 6, 97.9% on 7, 0.5% on 8, and in none on 9.

INTRODUCTION

Although the monotypic libellulid *Paltothemis lineatipes* is common in the southwestern USA, its habits have not been described. This species is interesting in that it combines the broad hindwing of glider dragonflies with the behavior of both fliers and perchers. The ratio of the maximum width of the hindwing to its length is about 1:2.7 in *P. lineatipes*. I measured this ratio in 4 species of *Tramea* and 2 species of *Pantala* and found ratios of 1:2.2 to 1:2.8.

The habitat of *P. lineatipes* is small rocky streams exposed to the sun, although females will oviposit along shaded sections of the streams. The species occupies hill or mountain streams in Oak Woodland, Chaparral, Pine Forest, and sometimes desert surroundings. In central California, USA, they occur up to an elevation of 2000 m in the Pine Zone. East of Mazatlan, Sinaloa, Mexico, I

found them in the Pine Zone of the Sierra Madre Occidental but not on rocky streams in the Tropical Deciduous Forest Zone.

ADULT BEHAVIOR

Paltothemis lineatipes glides in both feeding and male sex patrol flights, but gliding is not done as routinely as in *Pantala* and *Tramea*. I have seen only female *P. lineatipes* engage in sustained feeding flights. They hunt at a height of 0.6-3 m with a rapid erratic flight at any time from early morning to dusk. At dusk the flight is restricted to a beat a few m long in small clearings among bushes or along the edges of thickets over either land or water. The one occasion I found males engaged in feeding flights was during the afternoon. The male feeding flight was similar to the females', but they perched between flights of less than a minute duration.

P. lineatipes nearly always perches on rocks. The dull red body of the male contrasts with grey rocks but the mottled grey female blends very well into the background. Only once did I see one perched on a twig, a male at the top of a tree. Mature males are at water in the morning, rarely in the afternoon. They perch on rocks in the stream most of the time but every few minutes perform a patrol flight which is generally 0.2 m above the water but which ranges up to 2 m above the water. Male patrol flights cover a section of stream up to 15 m in length primarily along those place where the stream trickles between rocks. Copulation occurs entirely in flight within a small area of the male's territory. The female oviposits alone with dips at 1 sec intervals from about 12 cm above the water. She keeps moving between dips. In one case, after copulation the male guarded the female with a fast erratic flight 0.3 m above her. The females oviposit in small pockets of still water, and along the edges of rocks, grass, or a sandy shoreline; but occasionally also in the open water of a pool. The eggs are large and nearly round, with a longest diameter of about 0.57 mm excluding the jelly covering. Eggs taken from 2 females began hatching in 16 and 17 days.

EMERGENCE

A substantial emergence of *P. lineatipes* occurred on 17 VI 1977 from Big Creek where it enters Pine Flat Reservoir in the Sierra Nevada foothills of Fresno Co., California. After nightfall, at least during the period 2200-2400, many larvae were found transforming. The sequence of emergence was timed in one individual and found to be 7 minutes from the first split of the thorax to the hanging back stage with all legs free of the exuviae, 24 more minutes to flexing up and grasping the exuviae, and 28 more minutes to full wing expansion. Soon after spreading the wings, the tenerals briefly wingwhirred and then took flight. This occurred in bright starlight but without moonlight. Other nocturnally

emerging anisoptera usually wait until dawn for their maiden flight. I think that my lantern did not cause premature maiden flights because emerging specimens left alone while I investigated other areas were found to be gone on my return.

On the morning of 18 VI 1977 I collected 188 exuviae from about 100 m of Big Creek. The exuviae were concentrated where the water tumbles gently through rocks. Evidently the larvae live between the rocks in these areas of the swiftest current. Extensive sampling in pools and pockets of water for anisoptera larvae on this same stream segment 19 II 1977 using a long handled sieve (Needham scraper) accumulated only 13 *P. lineatipes* larvae, none in the last instar. The exuviae were nearly all on the sides of rocks surrounded by water from water level to about 10 cm above waterline.

The *P. lineatipes* exuviae collected were examined for (1) Sex, (2) Height of teeth on the anterior margin of the palpal lobes of the labium, (3) Dorsal spines on the posterior 5 abdominal segments, (4) Length of the epiproct relative to the paraprocts, and (5) Color pattern of the ventral abdominal surface. The deeply cut palpal teeth and lack of a dorsal spine on abdominal segment 9 distinguish the larvae of *P. lineatipes* from those of *Brechmorrhoga mendax* Hagen which have shallowly cut palpal teeth and a dorsal spine on 9. The larvae of these two species are adequately described in MUSSER (1962). In my sample of 188 exuviae of *P. lineatipes* I found all had the palpal teeth deeply cut except for one female which had one normal palp and one with shallowly cut teeth. Abdominal dorsal spines were always present on segment 6. The dorsal spine on 7 varied from a prominent projection to no spine at all in two males and two females (4/188 or 2.1% of the sample). One female had a vestigial spine on 8, the rest had no spine on 8. None had any dorsal spine whatsoever on 9 or 10. The epiproct was subequal in length to the paraprocts except in 3 females and 2 males (5/188 or 2.7%) in which the epiproct was slightly shorter and in 1 male in which it was a little longer. The ventral surface of the abdomen was generally unmarked but in a few of both sexes black pigment was concentrated to form interrupted median and lateral lengthwise stripes as in some species of *Leucorrhinia*. The sex ratio of the sample is very unbalanced with 133 female : 55 male or 70.7% : 29.3%. While the sample probably includes an accumulation from several days emergence, relatively more males might emerge at some other time during the emergence season.

REFERENCE

MUSSER, R.J., 1962. Dragonfly nymphs of Utah (Odonata: Anisoptera). *Univ. Utah biol. Ser.* 12: 1-71.