

Relationship Between *Mauritia* *flexuosa* and *Eupalamides* *cyparissias* in the Peruvian Amazon

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In this paper the relationship between *Mauritia flexuosa* and an important moth pest is described.

Mauritia flexuosa L.f., commonly known in Peru as *aguaje*, is widely distributed in the north of South America, principally in the Amazon basin, in an area comprising Peru, Bolivia Colombia, Ecuador, Venezuela, Brazil, the Guayanas, and north to Trinidad and Panama (Henderson et al. 1995).

Eupalamides cyparissias Fab. (Lepidoptera: Castniidae) (also referred to as *Castnia daedalus*, *Eupalamides daedalus* and *Lapaeumides daedalus* (Howard et al. 2001)) is a moth native to South America. It is widely distributed in the entire Amazon basin including Peru, Colombia, Ecuador, Venezuela, Brazil, the Guayanas and north to Panama. In South America the species is known to be a major pest to the economically important palms *Cocos nucifera* L. and *Elaeis guineensis* Jacq. Here we report evidence of four new host palms native to Amazonia – *Mauritia carana* Wallace,

Mauritiella peruviana (Becc.) Burret, *Astrocaryum murumuru* Mart. and *A. javarense* Trail ex Drude. We report on damage caused by *E. cyparissias* to the economically important palm *M. flexuosa* (dwarf ecotype) and suggest natural factors that control the population levels of the larvae in this species.

The present work was carried out between December 2000 and September 2001 in the Peruvian Amazon near the municipalities of Iquitos, Pevás and Mazán in the State of Loreto. Field observations were made on the development stages of the nocturnal lepidopteran, *E. cyparissias* and its activity level at different times of the day, and on damage to one of its host palms, *Mauritia flexuosa*. To determine the infestation rate and patterns on the host plant we examined a total of 21 inflorescences on 16 individuals of the dwarf type of *M. flexuosa* at the three localities. Using a

bisturi and metal screen we identified and recorded the number of infestations present in the basal, middle and apical regions of inflorescences.

The host plant

Mauritia flexuosa grows naturally in swamp areas on poorly drained soils flooded by rains. It forms very dense populations in its natural habitat called *aguajales* and is often planted in agricultural production systems. The palm generally fruits at 7–8 years of age, or when the stem reaches 6–7 meters in height and the internodes measure at least 12 cm (pers. obs.).

In lowland Peruvian Amazon we have observed an ecotype of *M. flexuosa* that starts fruiting at five years, even before the stem has developed or has reached 1 m in height and the internodes are less than 6 cm. These dwarf *aguajes*, known by the Bora Indians as *shapishico aguaje*, grow on upland soils (*tierra firme*) free from the periodic or seasonal flooding characteristic of the *aguajales*. They are always found as solitary individuals and in open areas relatively free of shrubs and trees. The dwarf *aguaje* palm has between 16 and 25 fronds and flowers annually producing from four to seven inflorescences. Each inflorescence produces an average of 442 (s.d. 14.7) ovoid fruits.

Both types of the *aguaje* palm are of major socio-economic importance to the Peruvian Amazon people. The fruits are marketed and consumed directly or as pulp in drinks, popsicles and ice cream. The petiole is used in craft-making, the mat for walls and ceilings in traditional houses, and the stem hosts larvae of the *Rynchophorus palmarum* (Insecta: Curculionidae), commonly known in the region as *suri* and consumed by local people (Padoch 1986, Mejia 1986).

The pest *E. cyparissias* is reportedly found on alternative host palms including *Syagrus romanzoffiana* (Cham.) Glassman, *S. schizophylla* (Mart.) Glassman, *Hyphaene thebaica* (L.) Mart., *Livistona* sp., *L. chinensis* (Jacq.) R. Brown, *Nephrosperma* sp., *Phoenix dactylifera* L., *P. rupicola* T. Anderson, *Pritchardia pacifica* Seemann & H. Wendl., *Sabal* sp., *S. blackburniana* Glazebrook ex Schultes, *S. mexicana* Mart. and *Washingtonia filifera* (Linden) H. Wendl. (Reyne in Schuilting and Van Dinther 1980), *Attalea maripa* (Aubl.) Mart. and *Roystonea regia* (Kunth) O.F. Cook (Van Dinther in Schuilting and Van Dinther 1980), *Mauritiella peruviana* (Becc.) Burret, *Astrocaryum murumuru* Martius and *A. javarense* Trail ex Drude.

The pest

The adult of *E. cyparissias* is a nocturnal lepidopteran with a robust body measuring

140–180 mm in wingspan. Its flight activity was observed to occur between 5:30 and 6:30 in the morning and 5:30 to 7:00 in the evening. The eggs are gray, oval, with deep furrows, and measure 5–6 mm in length. The larva is 110–130 mm in length, and in its primary stages feeds on the surface of petiole, scratching the epidermis and then perforating the interior. The pupa measures 64–95 mm in length and is contained in a compact cocoon formed of fibers of the palm itself (Mariau 2000). On the dwarf *aguaje*, the pupal stage is found at the base of the petiole. The larvae of *E. cyparissias* damage the peduncle, rachis, rachillae, petiole and, rarely, the stem of the *aguaje* palm. Larval activity can be recognized externally by the presence of excrement near the feeding tunnels and by the gummy secretions emitted by the plant as a physiological response to herbivory. The larvae produce sinuous tunnels up to 2.5 m in length and 3.5 cm in diameter with irregular borders. The tunnels interrupt the flow of water and nutrients in the plant, thus causing premature senescence of the flowers or fruits whose fall is aided by light winds. When the infestation occurs at early stages of raceme development all flowers or fruits are lost. At advanced stages of development, however, fruit loss is only partial.

Of the 21 racemes observed in the three regions, 19 (90.5%) hosted the *E. cyparissias* larva. When we compare the infestation rate on racemes from the three areas we find the highest in Pevas at 100%, followed by Iquitos at 90% and Mazan at 83%. These results show that the insect pest is widely distributed and well represented in the areas studied. The small differences in infestation rate between areas sampled, none statistically different (Chi-squared = 1.76; 2 d.f.), may correspond to the behavior of *E. cyparissias* and may be an artefact of having sampled the areas during different seasons.

The distribution of damage by *E. cyparissias* along the length of the inflorescence is not significantly different (Chi-square = 1.97; 2 d.f.), although the highest rate was found in the basal region (39.7%), followed by the middle (34.9%) and apical (25.4%) regions. There is a marked preference (although not tested) for the initiation of attack at the base of the inflorescence; from there, as the larva develops, it migrates towards the inflorescence apex, even when there is enough food nearby.

Population regulation of *Eupalamides cyparissias*

In a single inflorescence several adults may oviposit at different times. Although an inflorescence may host up to eight larvae at different development stages, we suggest that only

one of these will complete its development to adulthood. While the average diameter of an *aguaje* inflorescence is greater than 10 cm, the maximum width of the feeding tunnel was only 3.5 cm. The average length of an inflorescence is 3.2 m and a single larva can burrow tunnels of up to 2.5 m in length in one year (average duration of the larval stage). When these measurements are considered, there should be a sufficient food supply in a single inflorescence for several larvae to develop to adulthood. However, we never found this to be the case; all inflorescences observed hosted only one larva. We observed that when two or more tunnels meet in the inflorescence the larva at a more advanced stage predate the smaller one. This phenomenon suggests that larval cannibalism is one factor that regulates population levels in the *aguaje* raceme. This finding is in contrast to the physical-chemical factors found at the adult level in other insect groups where, using neurophysiological mechanisms, the female chooses an adequate location for oviposition and the development of the larva (e.g., Wildermuth 1993).

These observations lead us to suggest that space, or food availability, is the limiting factor for the growth and development of multiple larvae in a single inflorescence. During this study we encountered no natural enemies associated with any developmental stage of the *aguaje* pest *E. cyparissias*; thus, natural predators and parasites do not have a major role in its population regulation. However, in plantations of *Elaeis guineensis* and *Cocos nucifera*, the wasp *Ooencyrtus* (Hymenoptera: Encyrtidae) and the ants *Odontomachus*, *Pheidole* and *Iridomyrmex* (Hymenoptera: Formicidae) were reported to parasitize and predate the eggs of *E. cyparissias* (Mariau 2000)

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