NOTES AND COMMENTS

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INSECT MORTALITY IN *Spathodea campanulata* BEAUV. (BIGNONIACEAE) FLOWERS

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The African tulip tree, *Spathodea campanulata*, native of West African tropical forests, has been widely introduced as an ornamental plant in several regions of tropical America. In Brazil it is frequently used in urban forestry. Portugal-Araujo (1963) found more than 200 dead insects (meliponine bees, flies and ants) in flowers of one inflorescence of *S. campanulata* in West Africa. He suggested that the mucilage into the young flowers and buds would be dissolved in the nectar, and is responsible for the insects' death. The use of this plant in Brazil is controversial, since it could cause serious losses to beekeepers of native bees (Nogueira-Neto, 1970).

Flowers of *S. campanulata*, in their original region, are pollinated by non-hovering birds (Gentry, 1974) and perhaps by lemurs (Sussman & Raven, 1978); in Panama, bats pollinated them (Ayensu, 1974). No record about the mortality of pollinators was verified. The aim of this research was to seek the mortality causes of insects in *Spathodea* flowers, and suggest what evolutionary forces lead to this phenomena.

To study insect mortality in Brazil, flowers of *S. campanulata* were observed on five trees in the vicinity of the Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, during March and April 1982. Large buds were marked, one day before the anthesis. Every 24 hours dead insects were counted and identified. Recording was kept until the flowers fell off (about 5 days after anthesis). Mucilage was collected directly from the buds and diluted 1:1 directly in 50% sucrose solution, giving a 25% sucrose solution or used pure, without dilutions. These sugar solution diets were given to freshly emerged *Scaptotrigona postica* Latr. (Apidae: Meliponinae) to bioassay whether the mortality of insects was related to chemicals of the mucilage. For each test, 20 individuals of *S. postica* were kept in a box (10 x 10 cm), with two tubes of 1 ml, one with the diet and the other with distilled water. The number of dead individuals in each diet was recorded every 24 hours. Controls were 25% sucrose and distilled water (see also Zuccoloto, 1976).

In 445 flowers examined, 345 dead insects were found (97.0% Meliponinae – mostly *S. postica*; others included 1.7% Diptera and Vespidae, 1.0% Formicidae and 0.3% Orthoptera – the Hymenoptera and Diptera had small length, 0.5-1.0 cm, and Orthoptera about 2 cm length). Additional collections in other trees in the Ribeirão Preto region also revealed many dead *S. postica* in the flowers.

The highest mortality was found just after anthesis (334 dead insects - 96.8%); on the second day after the flowers were opened only 8 dead insects (2.3%) were found, and only one (0.3%) from the third to fifth days. All dead *S. postica* had pollen on their bodies. One individual of *S. postica* was observed perforating and entering in a large bud. In open flowers, a large number of *S. postica* were observed collecting nectar; no deaths and no behavior modification was seen. The analysis of pollen grains by acetolysis (see Kearns & Inouye, 1993) from a colony of *S. postica* five meters far from the trees did not show any *S. campanulata* pollen, showing that pollen was not collected in open flowers. The hummingbird *Eupetomena macroura* (Trochilidae) was observed also frequently visiting *Spathodea* flowers. That bird showed two types of nectar-collecting behavior: (1) introducing their bill into the open flower, and (2) more frequently, perforating the base of the corolla (robbing nectar). Bioassays with 25% mucilage reduced the survival of freshly-emerged *S. postica* by 52.9% in relation to the sucrose control and the pure mucilage 95.2% (Table 1). The latter data is ambiguous, since there is no evidence that the insects consumed the diet; if the insects did not feed on pure mucilage, their survival is the same of the distilled water (94.9% reduction).

The large number of dead insects found in the frst day after anthesis, the perforation and penetation behavior of *S. postica*, nectar collection by bees without death or change in their behavior, and the lack of *Spathodea* pollen in the *S. postica* colony, suggest that *Spathodea* flowers might have a defense system that protects the buds from the pollen and nectar robbers. Janzen (1975) and other authors reported tropical bees as illegitimate resource removers (see Roubik 1989), but *Scaptotrigona* were not observed as such.

TABLE 1
Longevity of *Scaptotrigona postica* imagos (n = 20) fed with mucilage from *Spathodea campanulata*.

Diets	Longevity (days) $X \pm S$[a]	Reduction in longevity (%)[b]
Sucrose control 25%	21.95 ± 2.96	–
Water control	1.15 ± 0.49**	94.9
Mucilage which cover the buds		
25%	10.33 ± 1.70**	52.9
100%[c]	1.05 ± 0.22**	95.2

[a] t-test (each diet related to sucrose control): ** $P < 0.01$.
[b] reduction in mean longevity relative to sucrose control.
[c] bees probably did not fed on pure mucilage.

If *Spathodea* did not have some kind of defense, the pollen and nectar would be robbed before the anthesis by *Scaptotrigona* or other efficient pollen robbers, reducing or preventing pollination by vertebrates. Since diets containing *Spathodea* mucilage drastically reduced the survival of insects, the defense system in this mucilage might be chemical (perhaps toxical substances), or mechanical; the mucilage on the buds might “suffocate” the bees. The chemical protection could also not be related to the pollen and/or nectar robbers, but to the protection against herbivory in flowers, since the production of these are costly to the plant (see Zangerl & Bazzaz, 1992).

As the plant is introduced in Brazil, a comparative study in its original region is necessary for further elucidation of these possibilities.

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