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SCIENTIFIC NOTE

Hispine-like Herbivore Damage in *Canna bangii* (Zingiberales: Cannaceae) by *Anopsilus* Weevils (Curculionidae: Baridinae)

One suggested but unconfirmed plant-herbivore association is the interaction between weevils in the genus *Anopsilus* (Curculionidae: Baridinae) and plants in the genus *Canna* (Cannaceae: Zingiberales) (Vaurie 1953). The genus *Anopsilus* is comprised of 27 described species distributed from Mexico to Argentina (O'Brien and Wibmer 1982; Wibmer and O'Brien 1986). The family Cannaceae includes only the new world genus *Canna*. The estimated number of *Canna* species ranges from 10 to 50, all distributed throughout tropical and subtropical America (Maas 1985; Maas and Maas 1988; Gentry 1996).

Species of *Anopsilus* have been collected from several Brazilian species of *Canna*, suggesting that this is a specialized plant-herbivore interaction (Vaurie 1953; J. Prena pers. comm.). However, no records exist of *Anopsilus* weevils actually feeding on the plants from which they were collected. Combining field observations, feeding experiments, and examination of herbarium specimens, the objectives of this research were to 1) test if *Canna bangii* Kraenzl is a suitable host plant for an undescribed species of *Anopsilus* and 2) determine if this interaction potentially occurs in other species of *Canna* from South America.

Field data were collected during March 2006 in a tropical montane forest in the Peruvian Andes, Departamento del Cusco, Municipio de Aguas Calientes, at 2,400 m (S 13°9′W, 72°32′). In this area, the terrestrial herb *C. bangii* is common in open areas and along the borders of roads (Fig. 1a). Young rolled leaves of *C. bangii* form tubes where insects can frequently be found (Fig. 1b).

To record *Anopsilus* weevil presence in *C. bangii*, we surveyed both old and young rolled leaves in 12 plants and collected all weevils therein. Adult insects were brought to the laboratory for further feeding experiments. To determine the amount of herbivory and the characteristics of the damage produced on the leaf blade by *Anopsilus* feeding, we offered one 1.5 × 1.5 cm section of fresh *C. bangii* leaf tissue to each weevil. After 12 hours, we measured the area consumed using a 1 mm transparent grid and the shape of the damage produced on each leaf section.

To determine if the relationship between *Canna* and *Anopsilus* weevils is potentially present throughout a broad geographic range, we examined all *Canna* herbarium specimens from South America that are deposited in the Missouri Botanical Garden Herbarium. For each herbarium specimen we recorded the collection locality and presence of any herbivory patterns similar to those observed during the prior *Anopsilus* weevil feeding experiments.

During our field observations, we found only *Anopsilus* weevils inside the scroll formed by the young rolled leaves of *C. bangii*. In total, we collected 24 *Anopsilus* individuals of an undescribed species (Fig. 1d, Vouchers C. García-Robledo No 129–131 deposited in the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Peru; 132–135 deposited in the National Museum of Natural History, Smithsonian Institution, hereafter ***Anopsilus* n. sp.**). Individuals were observed feeding and mating inside the rolled leaves. The number of weevils found inside rolled leaves varied from zero to a maximum of six (mean ± SD = 2 ± 1.5).

During the feeding trials, a total of 14 individuals of ***Anopsilus* n. sp.** fed on *C. bangii*. The mean amount of herbivory damage per leaf section was 6.5 mm^2 ± SD 6.5 mm^2 (minimum = 1 mm^2, maximum = 21 mm^2). Weevils fed on the leaves in a very characteristic linear fashion, scraping the surface tissue of the leaf between adjacent secondary veins (Fig. 1c). This feeding pattern is described as strip-mining herbivory (Strong 1977).

We reviewed a total of 244 herbarium specimens from 12 *Canna* species. Ten species of *Canna* displayed herbivory patterns similar to those recorded in our feeding experiments (Fig. 1c). Herbarium specimens displaying potential damage by *Anopsilus* were collected from Argentina, Bolivia, Brazil, Colombia, Ecuador, Paraguay and Peru.

The strip-mining herbivory described for ***Anopsilus* n. sp.** was formerly attributed only to rolled-leaf beetles (Chrysomelidae: Hispinae), a group of herbivore specialists of plants from the order Zingiberales (Wilf *et al.* 2000). Strip-mining herbivory has been recorded in fossils

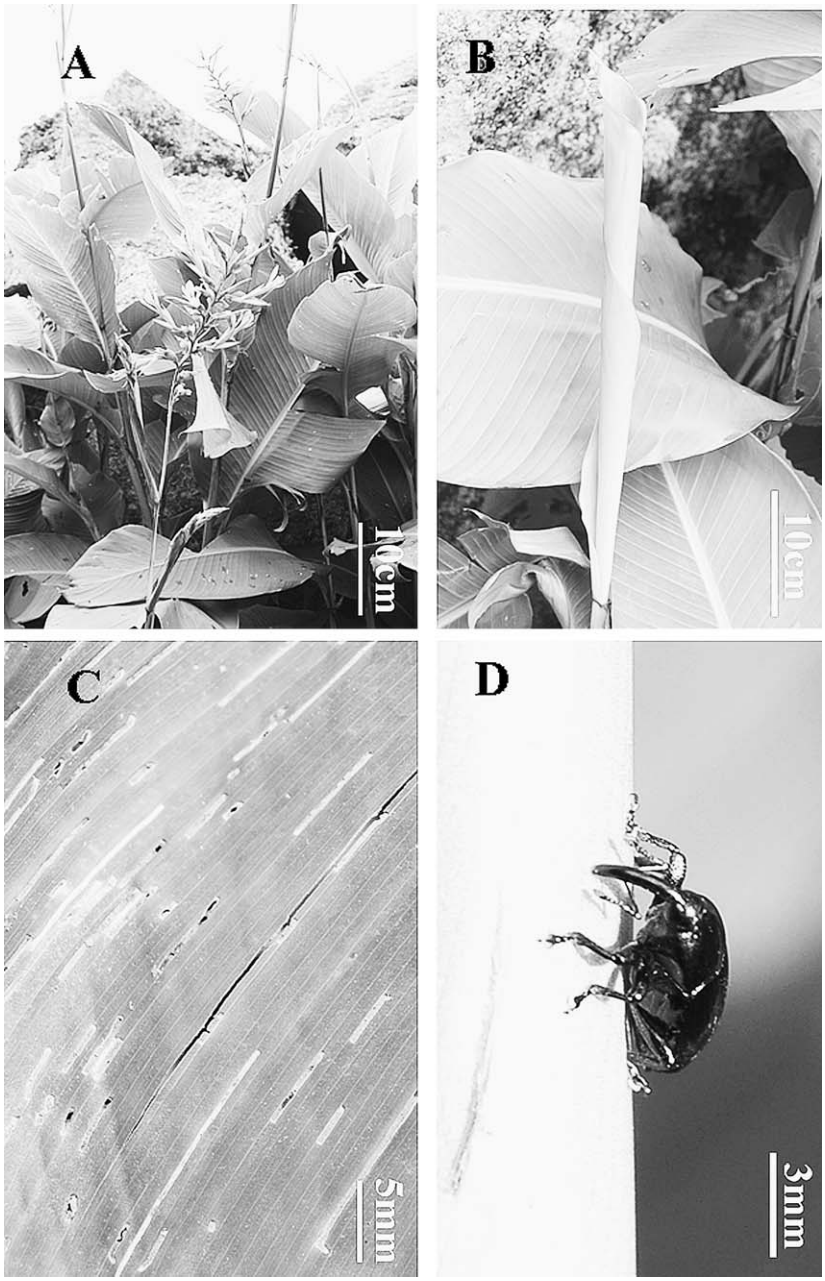

Fig. 1. *Canna bangii* (Cannaceae) and its herbivore *Anopsilus* n. sp. (Curculionidae). **A)** *Canna bangii* habit; **B)** young rolled leaf; **C)** herbivore damage; **D)** *Anopsilus* n. sp.

of Zingiberales from the late Cretaceous and early Eocene and has been attributed to hispine beetles (Wilf *et al.* 2000; McKenna and Farrell 2006).

Leaves of plants from the order Zingiberales frequently contain inorganic salt crystals and sclerified vascular bundles (Auerbach and Strong 1981). These features may predispose plants to attack by strip-mining, epidermal-feeding insects (Auerbach and Strong 1981). At least in one plant species, *Heliconia imbricata* (Kuntze) Baker (Heliconiaceae: Zingiberales), strip-mining herbivory by small species of Lepidoptera and non-hispine Coleoptera has been recorded (Auerbach and Strong 1981).

Our results confirm the plant-herbivore interaction between at least one species of *Canna* and an *Anopsilus* weevil. Review of herbarium specimens suggests plant-herbivore interactions among several *Canna* species throughout a broad geographic range. Further research will determine if *Anopsilus* weevils, hispine beetles, or other herbivores are producing the characteristic strip-mining herbivory that we have recorded for several *Canna* species.

Acknowledgments

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