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Scientific Note

Life Cycle and Floral herbivory of the weevil *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) on a widespread Neotropical orchid

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Abstract. Orchid collections worldwide are increasingly threatened by specialist herbivores inadvertently transported through plant trade, yet basic biological information on these species is often lacking. We describe the natural history of the baridine weevil *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) infesting cultivated and naturally occurring *Catasetum* orchids in Brazil (Southeast, North, and Central-West regions). By dissecting damaged flowers and rearing adults from inflorescences, we document larval feeding within perianth, ovary, and pedicel tissues. Larvae exit flowers 7–10 days after hatching from eggs, pupate in soil, and emerge as adults 18–30 days later (total development approximately 25–40 days). The host range is expanded to multiple *Catasetum* species and two artificial hybrids (*Catasetum* Grigorio Leao and *Clowesetum* Leprechaun). In male flowers, infestation was frequent: 52% (54/104) in *Catasetum fimbriatum* and 100% (8/8) in *Catasetum macrocarpum*; from *Catasetum fimbriatum* we recovered 107 larvae, mainly from the labellum and column. Among dissected female flowers (n = 53), 3.8% contained live larvae, while additional flowers showed feeding scars. We propose practical management measures: prompt removal and destruction of damaged flowers, post-outbreak substrate replacement or sterilization, and quarantine of newly acquired plants to interrupt development and reduce spread.

Keywords: Baridinae, Floral damage, Natural history, Ornamental horticulture.

Orchids (Orchidaceae), with approximately 28,000 species, are appreciated worldwide for their ornamental variety. Beyond captivating enthusiasts and growers, this plant family has served as a classical model for plant-insect studies. While most research emphasizes specialized pollination mutualisms, where flowers offer nectar, scents, or brood sites for precise pollen transfer (Ackerman et al. 2023), studying antagonistic interactions is crucial because they threaten the biosecurity and conservation of cultivated orchids.

While some weevils (Coleoptera: Curculionidae) also pollinate orchids (Girón et al. 2018; Nunes et al. 2018), most orchid-weevil interactions are antagonistic, and multiple curculionid genera have been intercepted in orchid collections worldwide (Swezey 1945; Prena 2017; Sánchez-Soto & Córdova-Ballona 2022). Among these, several genera within Bariditae (sensu Prena et al. 2014) are recurrent pests frequently dispersed through the global orchid trade. Larvae of *Orchidophilus* Buchanan, 1935, native to Southeast and East Asia and now globally dispersed, bore into pseudobulbs and inflorescences of *Dendrobium*, *Phalaenopsis*, and *Vanda*, causing bud drop and significant damage (Mau 1983; Prena 2008). Species of the *Stethobaris* LeConte, 1876 complex are among the most frequently observed weevils on wild and cultivated orchids in the Neotropics, with almost 50 species across more than 30 orchid genera, inducing premature bud drop and floral disfiguration (Rivera-Coto & Corrales-Moreira 2007; Prena & O'Brien 2011; Prena 2017). Another Neotropical genus, *Stethobaroides* Champion, 1908, has been recorded on 17 orchid species, predominantly *Gongora* and *Catasetum* (Prena 2025). Prena & O'Brien (2011) first noted the association of *S. nudiventris* Champion, 1908 with *Catasetum*; Morales-Báez et al. (2016) and Sánchez-Soto & Córdova-Ballona (2022) subsequently documented its larval development in flowers of *Catasetum integerrimum* Hook in Mexico. More recently, *Stethobaroides scutellatus* Casey, 1922 was documented damaging flowers of 13 *Catasetum* species in southern Amazonia, Brazil (Garlet et al. 2025).

Despite the growing number of weevil-orchid records, biological data remain severely under-represented, hampering pest management and biosecurity strategies (Swezey 1945; Rivera-Coto & Corrales-Moreira 2007). Within *Stethobaroides*, a genus with eight described species, *S. scutellatus* is the only species recognized from Brazil; despite its broad distribution (Prena 2025) and recurrent records on *Catasetum* flowers (Garlet et al. 2025), its biology and life cycle remain unstudied. Here, we provide a detailed description of *S. scutellatus* infesting flowers of *Catasetum fimbriatum* (C. Morren) Lindl. and *Catasetum macrocarpum* Rich. ex Kunth in Brazil: (i) confirming the weevil's close association with these hosts and reporting seven additional host associations, including two artificial commercial hybrids; (ii) describing adult and larval behavior and developmental stages from egg to adult; and (iii) quantifying the frequency and severity of floral damage under both natural and nursery conditions, filling a critical gap in the natural history of this orchid pest.

Observations were conducted on naturally occurring epiphytic *Catasetum* on host trees and cultivated specimens maintained by orchid collectors during flowering in December 2021 to January 2022, December 2024 and March 2026. Curculionid beetles were surveyed through systematic inspection, with photographic documentation and collection of specimens for identification. In natural populations, the life cycle was documented on flowers of *C. fimbriatum* and *C.*

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macrocarpum in southeastern and northern Brazil, respectively. Cultivated plants included *Catasetum pileatum* Rchb.f., *Catasetum hookeri* Lindl., *Catasetum osculatum* K.G.Lacerda & V.P.Castro, *Catasetum denticulatum* F.E.L.Miranda, *Catasetum complanatum* F.E.L.Miranda & K.G.Lacerda, and two artificial hybrids: an interspecific hybrid (*Catasetum* Grigorio Leao) and an intergeneric hybrid (*Clowesetum* Leprechaun), all grown in a private orchid collection in São Miguel do Guaporé, Rondônia, northern Brazil (11°41'37"S, 62° 42'41"W, 205 m). Additionally, *Clowesetum pileatum* and *Clowesetum spitzii* Hoehne were cultivated in Goiânia, Goiás, central-western Brazil (16°40'48.82"S, 49°15'23.23"W, 749 m) (Fig. 1).



Figure 1. Study sites for *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) overlaid on *Catasetum* occurrences from GBIF. Red triangles: study sites; pale-green circles: *Catasetum* spp. occurrences in South America (GBIF2025).

The life cycle was studied on flowers of *C. fimbriatum* at the campus of ESALQ-USP, Piracicaba, São Paulo, southeastern Brazil (22°42'30"S, 47°38'30"W, 546 m), in a seasonal semideciduous forested urban area, and on *C. macrocarpum* in an urban area of Ananindeua, Pará, northern Brazil (1°22'19"S, 48°23'46"W, 20 m), an enclave within the Amazon Forest.

Catasetum is a Neotropical epiphytic orchid genus with ca. 205 described species (Pridgeon 2009) – 122 throughout Brazil (Petini-Benelli 2012) – and dioecious, sexually dimorphic flowers (Romero & Nelson 1986). At study sites, flowering occurred from December to March, with female flowers being naturally scarcer than male flowers. Individuals of *C. fimbriatum* were found growing on *Cenostigma pluviosum* (DC.) Gagnon & G.P.Lewis, *Paubrasilia echinata* (Lam.) Gagnon, H.C.Lima & G.P.Lewis (Fabaceae), and *Syagrus romanzoffiana* (Cham.) Glassman (Arecaceae), and those of *C. macrocarpum* on *Delonix regia* (Bojer ex Hook.) Raf. (Fabaceae).

Adult weevil specimens were identified by Jens Prena (Rostock, Germany), compared with the original species description (Casey 1922) and the recent generic revision (Prena 2025). Ten adult specimens were prepared as double mounts, labeled, and deposited in the entomological collection of the Luiz de Queiroz Entomology Museum (MELQ–ESALQ/USP) (voucher numbers ESALQENT002573–82). *Catasetum fimbriatum* was identified using Petini-Benelli (2012), and the voucher deposited in the ESA herbarium (voucher 147116).

To document weevil presence and adult behavior, we monitored 18 individuals of *C. fimbriatum* (6 females and 12 males) and two individuals of *C. macrocarpum* (1 female and 1 male) during peak flowering. Flowers were inspected in the late morning (10:00–12:00 h) and afternoon (14:00–16:00 h). Newly opened flowers with visible feeding damage were removed, dissected under a stereomicroscope, and examined for eggs. To characterize larval behavior and damage, flowers were sampled five to seven days post-anthesis. We dissected 53 female and 104 male *C. fimbriatum* flowers and two female and eight male *C. macrocarpum* flowers, noting larval presence, number, and location (stem, sepals, petals, labellum, column). Infestation rate was calculated as the percentage of dissected flowers containing eggs or larvae. For adult rearing, 20 flowers of *C. fimbriatum* and eight of *C. macrocarpum* containing one or more larvae were placed in plastic containers with sterilized soil (ca. 10 cm depth) and monitored periodically for newly emerged adults.

Weevils sampled from *Catasetum* flowers at all localities were identified as *S. scutellatus*. Adults were observed primarily on male flowers at anthesis (Fig. 2B, C; Fig. 4A), and on female flowers (Fig. 2D, E) and floral buds (Fig. 2A) of all sampled species, both naturally occurring and cultivated. They moved actively on and within flowers, engaged in copulation (Fig. 2A), or pierced floral tissues with their rostra, presumably to feed and to locate oviposition sites. Adults were consistently more numerous during afternoon inspections (14:00-16:00 h) than during late-morning inspections (10:00-12:00 h).

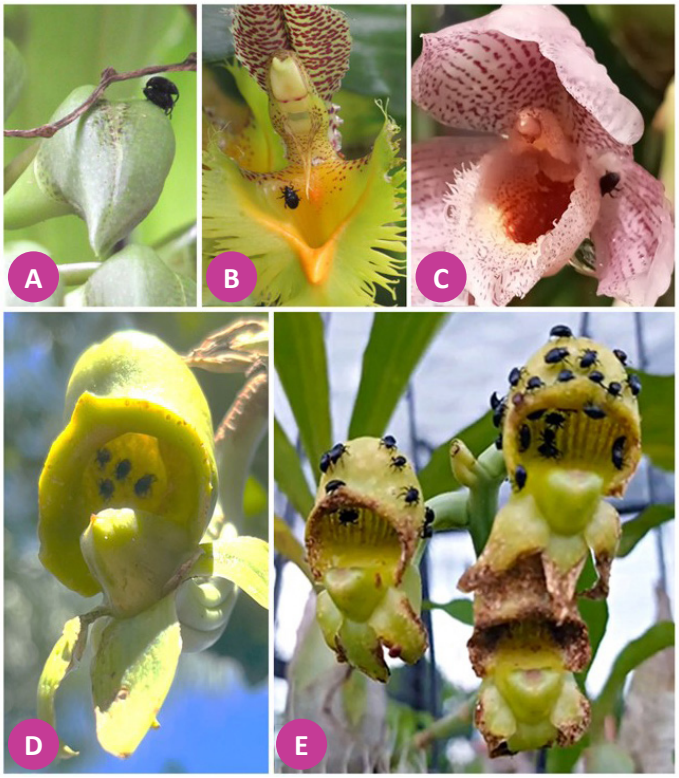


Figure 2. Adults of *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) on buds and flowers of *Catasetum*. (A) Adults copulating on floral buds of *C. fimbriatum*. (B) Adult inside a male flower of *C. fimbriatum*. (C) Adult on a male flower of the intergeneric hybrid *Clowesetum* Leprechaun. (D) Adults on female flowers of *C. fimbriatum*, Piracicaba. (E) Adults on female flowers of *Catasetum* sp., Goiás.

Only one egg was observed inside each oviposition hole (Fig. 4B), but multiple larvae of different developmental stages could co-occur within a single flower. After hatching, larvae consumed first the labellum (Fig. 3B; Fig. 4C) before migrating to other floral structures, including the column (Fig. 3A, D), less frequently the petals (Fig. 3C) or, more rarely, the pedicel (Fig. 4D), excavating tunnels between parts. Approximately 7–10 days after hatching, mature larvae exited the flower to construct a pupal chamber in soil (Fig. 3E; Fig. 4E). Adults from *C. fimbriatum* in southeastern Brazil emerged 25–30 days after pupation (n = 10), and those from *C. macrocarpum* in the equatorial zone after 18–20 days (n = 4). Total development time from egg hatch to adult emergence ranged from 25 to 40 days. No natural enemies of *Stethobaroides* spp. have been reported to date.

Flowers of all studied species, including the intergeneric commercial hybrid, sustained damage by both adults and larvae of *S. scutellatus*. All male *C. fimbriatum* flowers (n = 104) exhibited damage; 54 contained larvae (up to eight per flower), an infestation rate of 52%. A total of 107 larvae were recovered, mostly from the labellum (81), but also in the column (24) and pedicel (2). Of 53 dissected female *C. fimbriatum*

flowers, 16 showed no apparent damage, 35 exhibited bite marks, and only two contained at least one living larva (infestation rate 3.8%). Larvae in female flowers occurred in the column (2), labellum (1), and pedicel (1). All male *C. macrocarpum* flowers (n = 8) were infested by two larvae each (100% infestation rate), all sixteen developing in the column. No damage or larvae were observed in female *C. macrocarpum* flowers (n = 2). Although adults damaged flowers of both sexes, larvae completed development almost exclusively in male flowers. We hypothesize that the natural abscission of male flowers at the end of anthesis provides a passive route for mature larvae to reach the soil, whereas female flowers remain attached to the plant and to the developing fruit, hindering larval transfer to the substrate.

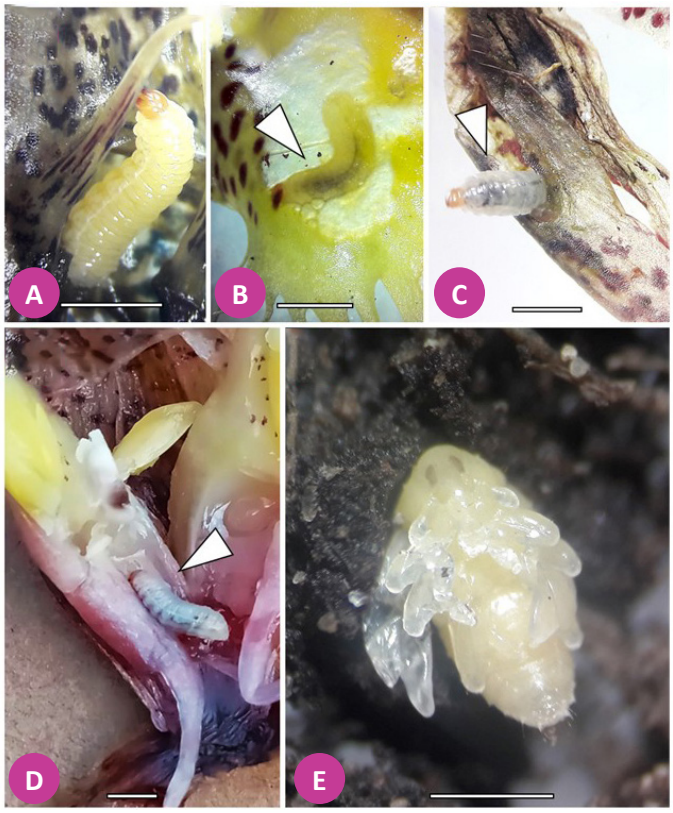


Figure 3. Larvae of *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) feeding on floral tissues of *Catasetum*. (A) Larva on the column of a male *C. fimbriatum* flower. (B) Early-instar larva within the labellum of a male *C. fimbriatum* flower. (C) Larva on the petal of a male *C. fimbriatum* flower. (D) Larva within the column of a male *Catasetum* Grigorio Leao flower. (E) Pupa of *S. scutellatus* reared from *C. fimbriatum*. Scale bars: 1 mm.

The reproductive phases of *C. fimbriatum* and *C. macrocarpum* coincide with the presence of all developmental stages of *S. scutellatus*, a co-occurrence consistent with close phenological coupling that may enable rapid weevil population growth under favorable conditions. Similar host–herbivore synchrony has been documented for *S. nudiventris* on *C. integerrimum* in Mexico (Morales-Báez et al. 2016; Sánchez-Soto & Córdova-Ballona 2022), where high infestation rates caused substantial floral loss. Comparable outbreaks could occur across multiple *Catasetum* species and hybrids in greenhouse or nursery settings, as reported by growers in northern and central Brazil.

Originally described from the Brazilian Amazon (Casey 1922), *S. scutellatus* was recently recorded from Mato Grosso associated with 13 *Catasetum* species in a university nursery (Garlet et al. 2025). Our findings expand the host range to five additional species and two artificial hybrids, an interspecific (*Catasetum* Grigorio Leao) and an intergeneric (*Clowesetum* Leprechaun), indicating its potential to infest further cultivated hosts. The potential interception of adult *S. scutellatus* on packaged *Catasetum* shipments could replicate the global dispersal of *Orchidophilus aterrimus* (Waterhouse) and congeners via the orchid trade (Prena 2008), opening pathways for establishment in protected culture and potentially in the wild (Prena & O'Brien 2011).

With 122 species, 93 endemic, Brazil represents the center of *Catasetum* diversity (Petini-Benelli 2012; Dhanda et al. 2022). Should *S. scutellatus* track multiple host flowering periods, this breadth could yield year-round breeding sites and a pest metapopulation network; seasonal resource continuity of this kind enables high densities and rapid host colonization in florivorous insects (Lewis et al. 1997), elevating risks to both wild populations and the nursery industry.

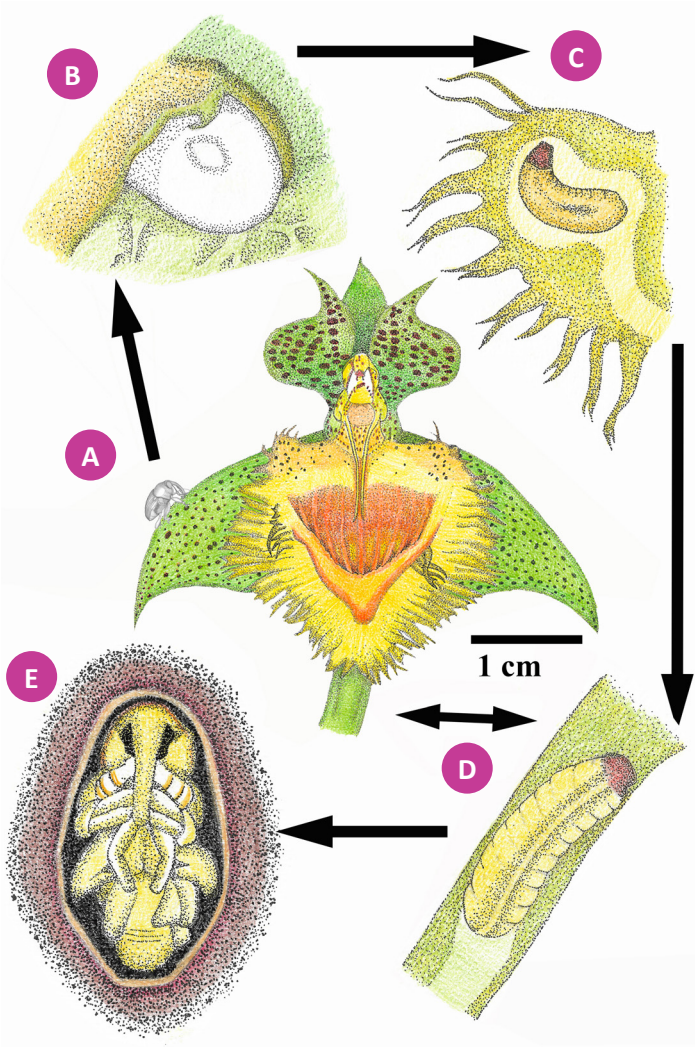


Figure 4. Life cycle of *Stethobaroides scutellatus* Casey, 1922 (Coleoptera: Curculionidae) on *Catasetum fimbriatum*. (A) Female weevil ovipositing in the labellum of a newly opened flower. (B) Egg within the labellum. (C) Larva hatching and feeding within the labellum. (D) Larva migrating to other flower parts (column or pedicel); (E) dropping from the flower to pupate in soil.

This study provides the first detailed natural-history account of *S. scutellatus* on *C. fimbriatum* and *C. macrocarpum*, confirming obligate larval development on floral tissues and tight synchrony with host flowering. High infestation rates in natural and cultivated settings underscore the need for routine monitoring of flowering individuals, prompt removal and destruction of infested blooms, substrate sterilization after outbreaks, and quarantine of incoming plant material. Future research should delineate the full host range, elucidate natural-enemy complexes for biological control, and evaluate cultivar resistance to develop integrated pest-management strategies for this emerging orchid pest.

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Authors' Contributions

ASM: Conceptualization, Investigation, Writing – original draft, Visualization. PASV: Conceptualization, Investigation, Data Curation, Writing – original draft. MS: Conceptualization, Supervision, Writing – Review & Editing. APB: Writing - Review. FFM: Writing - Review & Editing, Supervision, Funding acquisition. LP: Conceptualization, Validation, Visualization, Writing - Review & Editing. All authors read and approved the manuscript.

Conflict of Interest Statement

The authors declare no conflicts of interest.

Ethical Approval

Not applicable.

Data Availability

All data supporting the findings are included in the article/figures. The GBIF layer used in Fig. 1 is cited with DOI in the caption; underlying images/notes are available from the corresponding author.

Generative AI Statement

No generative artificial intelligence tools were used in the preparation of this manuscript.

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