

Dipteran internal feeders in underground parts of *Viola*

In early June 2024, M. Zappa made the original observation of an unknown insect tunneling in a *Viola* petiole here: <https://www.inaturalist.org/observations/220815991> to which C. Eiseman alerted me.

Subsequent investigations of *Viola* plants* in my yard in summer 2024 revealed fly larvae belonging to two different species, feeding in the underground parts of the plants. Affected plants showed dark, shallow minelike tunnels just under the outermost layers of the plant tissue, many of them moving from petioles of wilted leaves into the underground parts. Larvae extracted from these tunnels mostly appeared to belong to the same type with posterior spiracles black and knoblike and anterior spiracles in an elongate fan shape. This first type of larva eventually established deeper, wider tunnels in the underground parts in which they completed their feeding. The second type of larva was mostly found in deeper, externally obscure tunnels in the underground parts, but it was unclear to what extent they had manufactured the tunnels, although it seemed certain they were feeding on healthy plant tissue like the first species. Larvae of the second species had less conspicuous posterior spiracles undifferentiated in color and sclerotization from the surrounding body tissue, and less elaborate anterior spiracles in a compact fan shape.

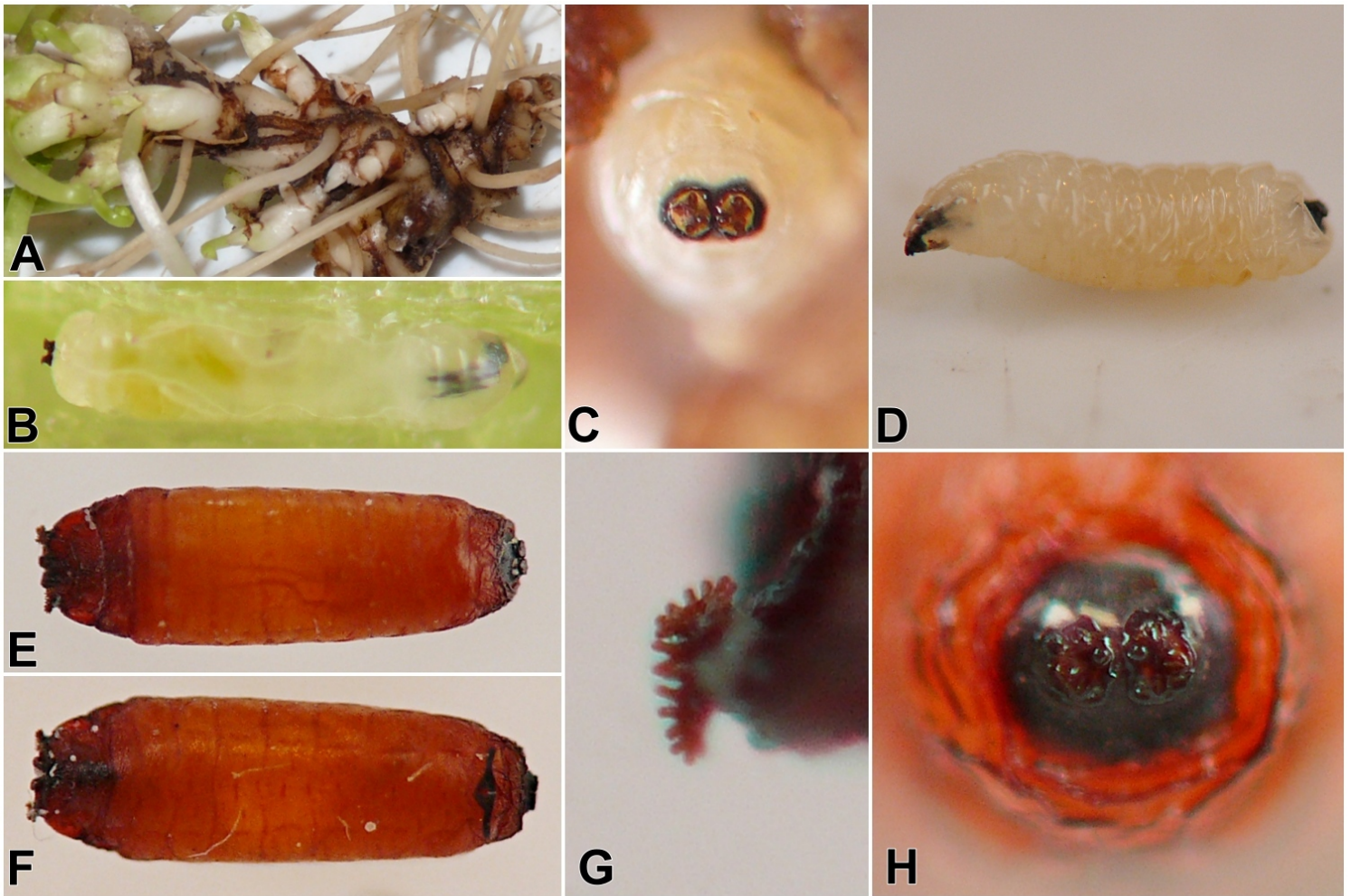
Puparia of both types were obtained via rearing. The second type appears to be typically formed inside the plant material. An adult chloropid fly (<https://bugguide.net/node/view/2389775>) emerged from a puparium of the second type in early August, about two and a half weeks after it was collected as a nearly mature larva in mid-July. Adults of the first type have not yet been reared as of early 2025.

Puparia of the first type—which species is evidently the one responsible for the petiole mines/tunnels from M. Zappa's observation as well as the subsequent observations in my yard—show similarities with certain muscoid families (e.g., Anthomyiidae, Scathophagidae) and it seems likely the fly belongs to this superfamily. No adults emerged from reared puparia of this species in the growing season during which they were formed, suggesting that the puparium may at least sometimes be the overwintering stage. In one case, a nearly mature larva was extracted from its tunnel in the underground parts for photography, and then reintroduced into a new tunnel poked into fresh plant material with the end of a thick wire. Shortly thereafter, this larva formed its puparium inside the new tunnel. It is unclear if the puparium is typically formed inside the plant material, but the first batch of *Viola* underground parts collected from the author's yard in early summer contained spent puparia of the chloropid along with tunnels apparently formed by the ?muscoid, but no ?muscoid puparia (either intact or spent) were present, suggesting its typical pupation location could be in the soil.

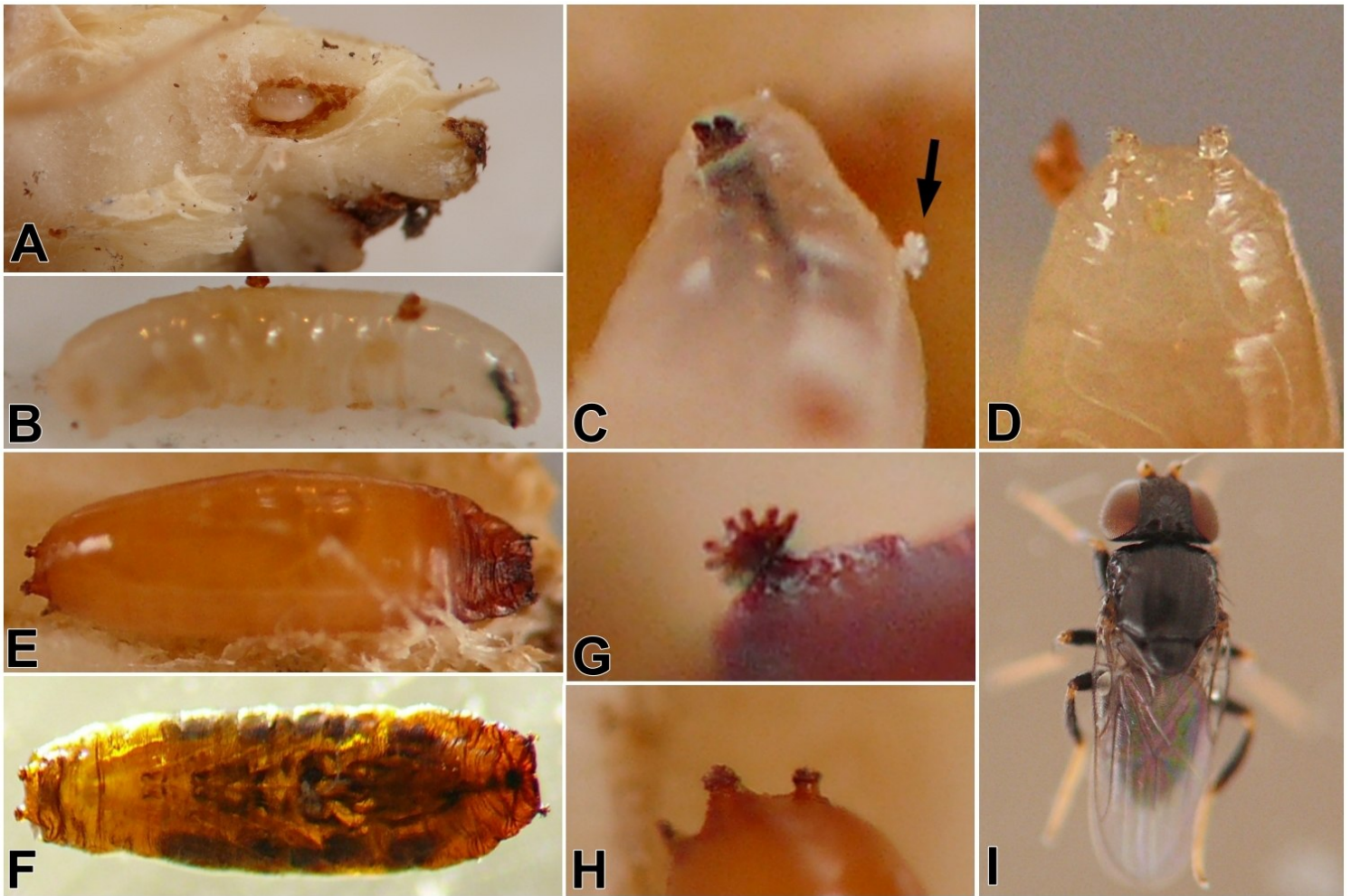
Thank you to M. Zappa for posting his original observation that led to these investigations, and to C. Eiseman for passing along Mathew's observation to me.

J. van der Linden
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* The *Viola* sp. involved a large one, with basal leaf petioles reaching up to 12" or so, and leaf blades up to ~4"-5" across.



Unidentified dipteran miner/borer in underground parts of Viola. A: Tunnels in ?rhizome; B: Young larva, extracted from tunnel in petiole; C: posterior spiracles of middle-aged larva; D: mature larva. E: Puparium, dorsal; F: puparium, ventral; G: anterior spiracle of puparium; H: posterior spiracles of puparium.



Chloropidae ex underground parts of *Viola*. A: Larva in plant material; B: larva; C: anterior end of larva, showing mouthhooks and anterior spiracle (arrow); D: posterior spiracles of larva; E: puparium; F: aging puparium with pupa visible; G: anterior spiracle of puparium; H: posterior spiracles of puparium; I: adult.