

**Life-history Notes on the Fern-mining Endemic
Hyposmocoma (Euperissus) trivitella Swezey 1913
(Lepidoptera: Cosmopterigidae)
from Kauai and a Report of Associated Parasitoids
(Hymenoptera: Bethyloidea)**

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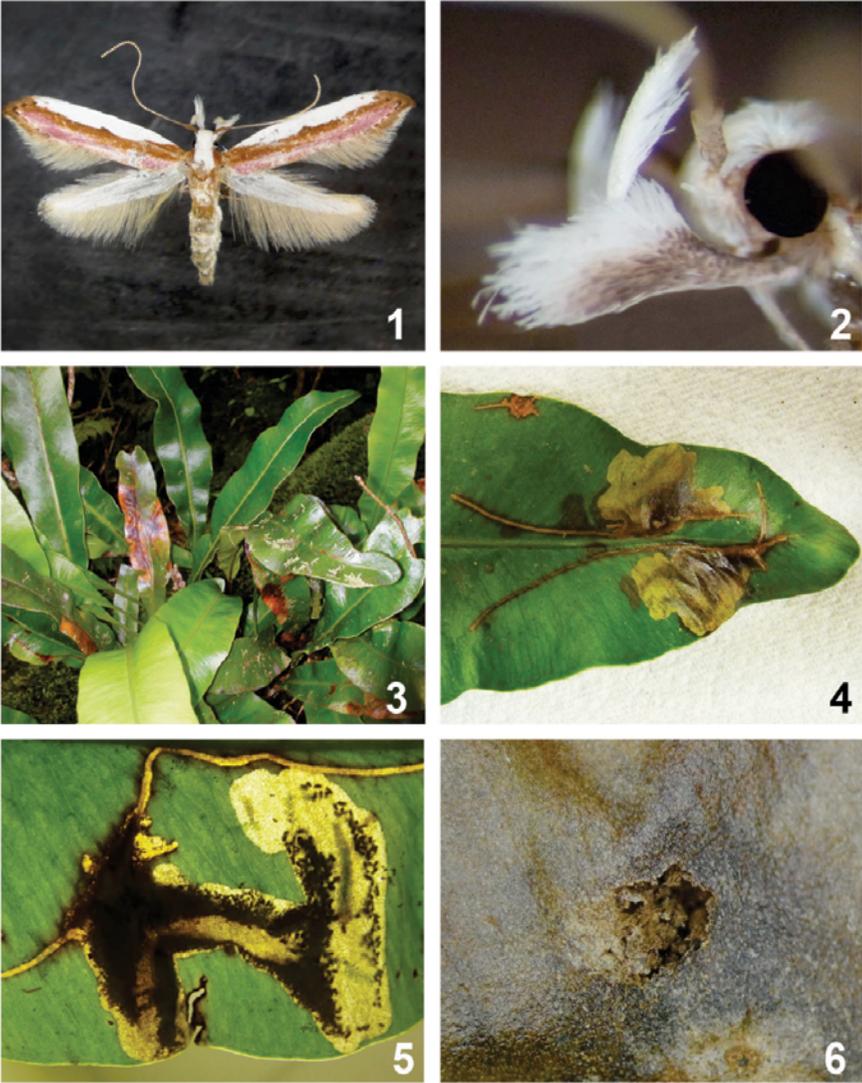
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The cosmopterigid genus *Hyposmocoma* Butler 1881 includes two subgenera, *Euperissus* (Butler 1881) and *Hyposmocoma* Butler 1881, totaling approximately 350 described species, all of them endemic to the Hawaiian archipelago. Larvae of all known *Hyposmocoma* sensu stricto are case-bearing (Walsingham 1907, Zimmerman 1978, Schmitz and Rubinoff 2011a) and their life-histories are now becoming well-documented based on recent efforts (e.g. Rubinoff and Haines 2005; Schmitz and Rubinoff 2008, 2009, 2011a, b). Larvae of *Euperissus*, however, are poorly studied, and those species that are known are nearly all stem borers (Zimmerman 1978). Species of *Euperissus* are thought to lack cases entirely, providing an immediate distinction between it and the case-bearing subgenus *Hyposmocoma*. Because larval life histories of so few *Euperissus* species have been documented, it is important that the larvae and life histories of species in this subgenus are described.

Hyposmocoma (Euperissus) trivitella is a spectacular pink and white moth (Fig. 1). Its life history is unusual within *Hyposmocoma* in that it is the only species known to mine in leaves. Moreover, it is only one of two *Euperissus* species known to feed on ferns. The other is *H. (E.) ekaha* Swezey, which feeds on the leaves of *Asplenium nidus* L. (Apleniaceae). Swezey (1913) described the larva and the adult of *H. (E.) trivitella* from six specimens collected in March, 1912 from Lihue, Kauai. He noted that unlike other *Hyposmocoma*, adults of *H. (E.) trivitella* have a long, sharp labial palpus (Fig. 2).

Swezey reported the host to be Creeping Tonguefern, *Elaphoglossum gorgoneum* (Kaulf.) and Royal Tonguefern, *E. reticulatum* (Kaulf.) (Dryopteridaceae). While Swezey described the larva and adult, he did not describe the mine in detail nor did he present an image of the adult. Swezey (1913: 278) simply wrote: “Six specimens reared from mines in the fronds of ferns.” Here we report the mining pattern and adult image of *H. (E.) trivitella* Swezey from the upper region of Limahuli Gardens and Preserve, near the Northwestern coast of Kauai, and from the Alakai Plateau, near Halapaakai Stream. These are the first reports of this species from these parts of Kauai.

Mining was observed on *Elaphoglossum crassicaule* Copeland, the Tall Tonguefern (Fig. 3). The mining pattern of *H. (E.) trivitella* is very distinctive in that it has one to six long slender tunnels extending from a central blotch mine (Fig. 4). At least one of these long “tunnels” of the mine typically extends along the midrib of the leaf and bends laterally to the leaf edge. The larva deposits its frass along the edges of the mine wall (Fig. 5). Pupation takes place inside the mine, in an area surrounded by frass. The presence of a small hole cut on the abaxial surface of the leaf (Fig. 6) suggests that the long labial palpus may be used for breaking through the leaf when the adult exits the mine. Thus, the labial palpus in *H.*



Figures 1–6. 1. Adult of *Euperissus trivitella* Swezey. 2. Adult head of *E. trivitella*, showing the long labial palpus. 3. *Elaphoglossum crassicaule* from Limahuli Garden and Preserve, Kauai. 4. Mines of *E. trivitella* Swezey on *E. crassicaule*. 5. Close-up image of a young mine showing frass deposition and the active larva inside. 6. Exit hole on abaxial of leaf, created by the adult when exiting the mine.

(*E. trivitella*) may have the same function as the “cocoon cutter” of Gracillariidae (Davis 1994, Kawahara et al. 2009), a function that is (as far as we are aware) unreported from Gelechioidea. The hole is found approximately 2–5 mm away from pupa, and the head of the pupal exuviae is facing the direction of the hole. Unlike gracillariids and other leaf miners, the pupal skin is not extruded from the mine after the adult emerges, suggesting that the adult emerges from the pupa inside the mine, and may need to use its palps to puncture the leaf epidermis to exit. When leaves were folded in rearing containers, some larvae exited the mine and began feeding externally between the folded portions of the leaf. We observed and collected a total of 53 mines, which resulted in nine adults (two male, seven female) and 34 parasitoid wasps of *Sierola* sp. (Bethyliidae). All specimens of both moths and wasps are deposited in the University of Hawaii Insect Museum (Manoa) along with their mines. Vouchers of both moths and parasitoid wasps were frozen for future molecular analysis. Little has been studied on the evolution of leaf-mining *Hyposmocoma*, and we encourage future studies to examine evolutionary transitions in this group, as done with other Lepidoptera (e.g., Gracillariidae, Kawahara et al. 2011).

The Limahuli Gardens and Preserve (LGP), from which most mines were collected, is a conservation focused nature preserve. Because of such conservation efforts, we were able to rediscover a moth that has not been reported since its initial discovery in 1913. The conservation efforts of LGP, and their support of basic research, are an ideal model for conservation programs in Hawaii. Their efforts to protect the plants, herbivores, and, in turn, parasitoids preserves an import element of the endangered and fragile native Hawaiian tropical rainforest. It is hoped that other conservation programs follow the model set forth by the LGP.

Collection Information

Specimens were collected by NT from ferns growing at the following localities: (1) Kauai, Hanalei District, Upper Limahuli Preserve, hanging valley to the West of Limahuli falls, a native wet-mesic transitional forest dominated by *Dicranopteris* and *Metrosideros*, 22°12.045'N 159°35.048'W, elevation: 1932 ft, March 30, 2011. (2) Kauai, Hanalei District, Upper Limahuli Preserve, West stream drainage, from a single *E. crassicaule* plant growing on the log of a *Metrosideros* in the sate of invasive grasses growing along the stream, 22°11.745'N 159°35.010'W, elevation: 2160 ft. April 21, 2011. (3) Kauai, Alakai Plateau, near USGS Bog and Halepaakai Stream, 22°04.513'N 159°32.535'W, elevation: 4577 ft, May 2–3, 2011.

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