

NOTE

Cecidomyiidae (Diptera) as Insect Parasitoids

The family Cecidomyiidae (Diptera), commonly known as gall midges, includes, in addition to mycophages and phytophages, arthropod predators and endoparasites. The insect predators usually feed on mites and small homopterans such as aphids and scale insects but a few also attack holometabolous insects (Gagné 1994). Apparently no study has demonstrated larval development on a single arthropod host, resulting in the death of the host, a characteristic of insect parasitoids (Kuris and Lafferty 2000).

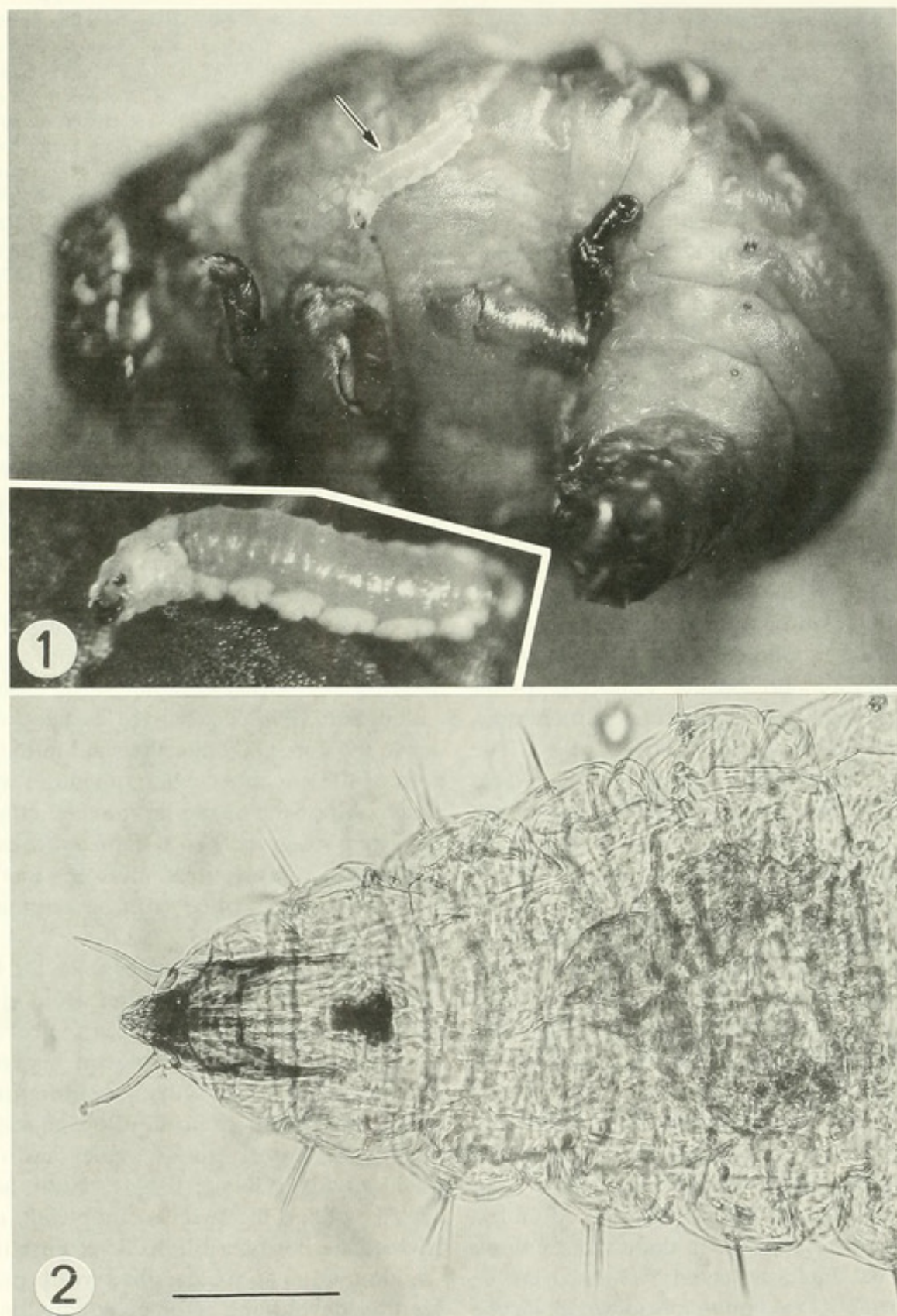
During an ecological study of insect-plant associations along the Oregon coast, the author encountered a population of the rare chrysomelid beetle, *Timarcha cerdo* Stål., feeding on the native salmonberry, *Rubus spectabilis* Pursh (Rosaceae). The genus *Timarcha* is primarily Old World with only two known species from North America, both restricted to areas west of the Rocky Mountains. The rarer of the two, *T. cerdo*, is known only from several populations in Oregon. It and its close relative, *T. intricata* Haldeman, are the only species of the genus able to develop on Rosaceae, although some populations of the latter species also develop on Ericaceae (Poinar et al. 2002).

Larvae of *T. cerdo* are fairly large and feed completely exposed on leaves of the host plant. During the spring of 2001 and 2002, cecidomyid larvae were noted on the bodies of these larvae in dune woods along the coast. Field-collected *Timarcha* larvae supporting very young cecidomyid larvae were brought to the laboratory and reared individually on leaves of *R. spectabilis*. Cecidomyiid eggs or eggshells were never found on the beetle larvae so either the females oviposit in the proximity of the host or the eggshells dropped off the beetle. The

cecidomyiid larva remained on the surface of the beetle, usually between the thoracic and abdominal segments (Fig. 1), throughout its complete developmental period. Usually only one but occasionally two cecidomyiid larvae occurred on a single beetle larva, puncturing the host's cuticle and feeding on the released hemolymph. The parasites would often be semi-immersed in a pool of the host's hemolymph. There was no evidence of melanization of the hemolymph while the cecidomyids were present. As they matured, the larvae would sometimes migrate to other locations on the beetle, at which time, a zone of melanized subdermal tissue would surround the original feeding site. Upon completion of their development, the cecidomyiid larvae would leave the host and enter the sand in the bottom of the container where pupation would occur. All of the beetle larvae died after the cecidomyiid larvae had completed their development. Dissections showed that the body cavity was filled with bacteria at the time of death.

From larval specimens (Fig. 2), Dr. Raymond J. Gagné identified the cecidomyids as belonging to the *Lestodiplosis grassator* group of the tribe Lestodiplosini, supertribe Cecidomyiidi, subfamily Cecidomyiinae. Members of this group develop on various arthropods, mostly mites, scales and other cecidomyids (Gagné, 1994). Until adults are reared and the species completely identified, it is not possible to determine if the cecidomyid is an undescribed form specialized for developing ectoparasitically on leaf beetle larvae or if it is a generalist, acting both as a predator and ectoparasite depending on the potential hosts in the environment.

Parasitism of Coleoptera by cecidomyids is rare. Baylac (1987) described *Lestodi-*



Figs. 1-2. 1, Mature larva of *Lestodiplosis* sp. on the abdomen of the chrysomelid, *Timarcha cerdo*. Insert shows detail of mature *Lestodiplosis* sp. larva. Actual length of cecidomyiid larva = 1 mm. 2, Detail of head and anterior body region of a mature larva of *Lestodiplosis* sp. removed from the body surface of *Timarcha cerdo*. Bar = 50 μ .

plosis gagnei Baylac feeding on the larvae of the oil palm pollinating weevil, *Elaeiodobius subvittatus* (Faust) in Colombia. However, in the above case, it is not known whether the cecidomyids are predators on several hosts or can complete their development on a single larva. The larvae of *E. subvittatus* are much smaller than those of *T. credo* and therefore the behavior of *L. gagnei* may be predaceous.

The present study, which is the first report of a cecidomyid attacking a member of the Chrysomelidae, represents a new type of association between gall midges and insects, namely where the gall midge serves as an ectoparasite. Ectoparasitism is a fairly common habit among parasitic Hymenoptera but is unusual for entomogenous Diptera (Clausen 1962). This association also falls under the definition of ecto-parasitoidism, where an individual consumer attacks only one host that dies after the parasitoid has completed its development (Kuris and Lafferty 2000).

Because of its rarity, *T. credo* could be considered an endangered species with the few remaining populations threatened by habitat destruction through land development. Any type of parasitism, including that by the cecidomyid described here, will add more stress to their dwindling populations.

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