

SCYMNUS CERVICALIS MULSANT, A PREDATOR OF
GRAPE PHYLLOXERA, WITH NOTES ON *S. BRULLEI*
MULSANT AS A PREDATOR OF WOOLLY APHIDS ON ELM
(COLEOPTERA: COCCINELLIDAE)¹

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ABSTRACT

On Presque Isle and at North East, Erie Co., Pennsylvania the coccinellid *Scymnus cervicalis* Mulsant was found preying on the leaf form of grape phylloxera, *Daktulosphaira vitifoliae* (Fitch), on wild grapes, *Vitis riparia* Michx. Eggs were laid near the entrance to phylloxeran galls, early-stage larvae lived within galls and fed by deflating eggs of the phylloxeran, and 3rd-4th-stage larvae fed on eggs by inserting their heads into gall openings on the upper leaf surface. Pupation occurred on grape foliage, and at 20-22°C the pupal stage lasted an average of 8.1 days. It is estimated that 3 generations were produced from June until phylloxeran eggs became scarce in September-October. *Scymnus brullei* Mulsant is briefly mentioned as a predator of woolly elm aphid, *Eriosoma americanum* (Riley), and the woolly aphid, *Tetraneura ulmi* (L.), on elm at Harrisburg, Pennsylvania.

Scymnus cervicalis Mulsant is a scymnine coccinellid known from Ontario and New England south to Florida and west to Kansas and Texas, with isolated populations recorded from Arizona and California (Stevenson 1967, Gordon 1976). This species belongs to the subgenus *Pullus* Mulsant and is one of 81 North American species currently recognized in the genus *Scymnus*, a group once characterized as "a wilderness" (Bowditch 1902), but which has now been placed on a firm taxonomic basis by Gordon (1976). Biologically, however, the group remains virtually unknown, and many of the brief references to habits of *Scymnus* can never be referred with certainty to currently recognized species. Davidson's (1923) work in California on the aphid predator *S. loewii* Mulsant (cited as *S. nubes* Casey) represents the most thorough study of the life history of any North American *Scymnus*.

Although scymnines, including *Diomus terminatus* (Say), have long been known as predators of grape phylloxera, *Daktulosphaira vitifoliae* (Fitch) (Shimer 1866, Riley 1874), information on the habits of *S. cervicalis* is lacking. Böving (1917) described and figured the last-stage larva but did not include biological data. Gaines (1933) listed this species as an aphid predator in Texas, and in Ontario Stevenson (1967) noted rearing two adults from larvae found in phylloxeran galls on wild grape.

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In this paper we summarize our observations on *S. cervicalis* as a predator of the leaf-infesting form of grape phylloxera on wild grape at Presque Isle, Erie Co., Pennsylvania, and report its occurrence at North East, Erie Co., in hedgerows bordering commercial vineyards. The presentation of our fragmentary notes on life history and habits may stimulate further work on this potentially useful predator of a pest that is becoming increasingly important on wine grapes in Pennsylvania (Jubb 1976).

Because of the paucity of data on the food habits of *Scymnus* species, we are including notes on *S. brullei* Mulsant. This species was found abundant at Harrisburg, Pa., in September 1978, and was associated with eriosomatid aphids on elm.

Scymnus cervicalis Mulsant

Observations on wild grape: On July 27, 1978, *S. cervicalis* was found associated with grape phylloxera on wild grape, *Vitis riparia* Michx., growing on Presque Isle, Erie Co., Pennsylvania. The gall-forming stage of the phylloxeran was present on approximately 5-10% of the foliage. One or more white, wax-covered larvae of a *Scymnus* species, later identified as *S. cervicalis*, were conspicuous on infested leaves, with some harboring 10 or more larvae. Most were found on the upper leaf surfaces with their heads buried in the openings of the galls (Fig. 1), and all appeared to be either 3rd or 4th stage larvae. Several adults were observed on infested foliage, and 5-6 additional specimens were beaten from the vines.

On August 1 the relative abundance of the coccinellid was estimated by collecting 25 gall-infested leaves at random and under a stereoscopic microscope counting all stages present. A total of 54 larvae, 2 pupae, and 4 adults were recovered, with 1 heavily infested leaf (100+ galls) containing 13 larvae and another, 12. The average of slightly more than 2 larvae/infested leaf undoubtedly is a conservative estimate. It was discovered that the 1st- and 2nd-stage larvae live within the galls, and many probably were missed because of the difficulty of opening each gall on heavily infested leaves and the probability of overlooking the 1st instars.

Larvae were scarce and adults noticeably more abundant when the vines were examined on August 30. During an hour's observation, 40-50 adults and 2 late-stage larvae were found. Infested foliage brought back to the laboratory yielded 2 additional larvae and a pupa. By mid-September adults had become scarce and larvae were no longer present. The phylloxeran population also had declined; many of the galls were empty and few contained eggs.

Laboratory observations: Although oviposition was not observed in laboratory cultures, 2 eggs were found on a grape leaf with an adult of *S. cervicalis*. Davidson's (1923) description of the egg of *S. loewii* (i.e., "broad, short oval" and laid singly, usually hidden) matches these eggs rather closely. The egg is amber, 0.46 mm long, 0.28 mm wide at the middle, or nearly the same dimensions as given for the egg of *loewii*, and has the surface finely granulate. One egg was laid at the entrance to a gall (Fig. 2); the second was hidden within leaf pubescence a few mm away.

First- and 2nd-stage larvae live within galls and normally are seen only when galls are broken open. It was not uncommon to find 2 or even 3 early instars in a gall, along with their cast skins. The waxy coating is



Figs. 1-2, *Scymnus cervicalis*: 1, late-stage larva with head in opening of grape phylloxera gall; 2, egg (at arrow) laid at entrance to gall.

generally not as conspicuous on the early instars and was sometimes restricted to the abdomen. Early-stage larvae appeared to limit their feeding to phylloxera eggs, which they quickly deflated by sucking the contents (Fig. 3). An egg was usually consumed within a few seconds, leaving



Figs. 3-4, *Scymnus cervicalis*: 3, early-stage larva feeding on eggs of grape phylloxera within gall; 4, pupa.

only the shell as evidence of predation. Larvae moved quickly from egg to egg, and 2 larvae were observed to destroy an entire egg mass (100 + eggs) within 2 hours. Early instars sometimes probed mature females but feeding was not observed.

Third- and 4th-stage larvae feed on phylloxeran eggs and occasionally mature females by inserting their heads into the opening of a gall on the upper leaf surface. One mature larva fed on a pupa of its own species.

Pupation usually takes place on either upper or lower surface of grape leaves, but one pupa was found inside a large gall. It is doubtful, however, whether the eggs of one gall can support complete larval development. More likely is the possibility that a 2nd- or 3rd-stage larva entered after having initiated feeding in another gall. At 20-22°C the pupal stage lasted an average of 8.1 days (range 7-9, $n = 7$).

The pupa (Fig. 4) is similar to that described for *S. loewii* by Davidson (1923). It is 2.20 mm long and 1.28 mm wide with blackish setae, longest (0.1 mm) on the lateral margins of the head and on the prothorax. It is perhaps a brighter yellow than the pupa of *S. loewii*, and the cast larval skin generally surrounds only the caudal segments, not the entire pupa as Davidson noted occasionally in pupae of *S. loewii*.

Teneral adults remain under or near their pupal skin for 24 hours or more before becoming active. Adults also feed on eggs and mature females of grape phylloxera.

Occurrence in hedgerows bordering vineyards: As part of a study of the beneficial arthropods associated with a grape (*Vitis labrusca* L. cultivar Concord) ecosystem in Erie Co., Pennsylvania (Jubb and Masteller 1977), predators were collected from *V. riparia* growing in a hedgerow bordering a commercial vineyard located along the lake front in North East Township. From June 16 to September 2, 1975, weekly counts were made of predators found on and within 100 phylloxeran galls on each of 100 leaves chosen at random from a height of 1-3 m above the ground. In addition nylon sleeve cages were placed over infested shoots on July 15; all arthropods that had emerged were removed and placed in vials of alcohol on August 18.

In 1975 *S. cervicalis* was infrequently encountered during sampling, possibly because of the standard insect spray program in effect in the adjacent vineyard. Larvae first appeared in the June 30 sample and were not taken again until July 28. An adult and a pupa were found in late August. Thirty to forty adults were found in the sleeve cages when they were examined on August 18. A small population of *S. cervicalis* was again present on *V. riparia* when this vineyard hedgerow was revisited in late August 1978.

Although the details of the life history remain to be discovered, the collection of mature larvae in late June, late July, and late August, plus absence of larvae by mid-September, suggest that *S. cervicalis* produces 3 generations on wild grape. Adults probably move into grape vines when phylloxeran eggs become available soon after the initiation of shoot growth in late May or early June and leave in late September or October when phylloxeran eggs become scarce.

Scymnus brullei Mulsant

Scymnus (Pullus) brullei Mulsant is one of the most commonly collected North American species of the genus (Gordon 1976). It is known from southern Canada south to northern Florida and west to eastern Texas. Gordon (1976) described the various color forms of this species. Except for the remark by Gaines (1933) that *S. brullei* (cited as *S. haemorrhous* LeConte) feeds on aphids, nothing is known of its habits.

A population of several hundred adults was discovered on various tree species at Harrisburg, Dauphin Co., Pa. on September 19-20, 1978. They were most numerous within leaves of slippery elm (*Ulmus fulva* Michx.) curled by woolly elm aphid, *Eriosoma americanum* (Riley), although the aphids had already emerged from the curled leaves. Some leaf rolls harbored from 5 to 10 coccinellid adults, and nearly all contained cast skins of *Scymnus* larvae. An adult of *S. brullei* was observed feeding on an alate woolly elm aphid.

Adults of *S. brullei* were still common on October 13, and several were seen feeding on alate females of the woolly aphid, *Tetraneura ulmi* (L.), that were swarming over the elm trees. Following several nights of sub-freezing temperatures, the population of *S. brullei* had left the slippery elms by October 16. Near the same trees, an overwintering adult had been collected in January 1972 from a duff sample taken beneath a Norway spruce (*Picea abies*(L.) Karst.).

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