

**Overwintering of *Phryganidia californica* in the
Oregon Cascades and Notes on its Parasitoids
(Lepidoptera: Dioptidae)**

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Abstract. — A population of California oakworm (*Phryganidia californica* Packard) was observed for 3 yr in the Oregon Cascades. The site was 150 km inland from the coast, 44°18'N and at an elevation of 750 m. The only parasitoids reared were *Ceranthia* sp., *Hyphantrophaga virilis*, both tachinids, and an ichneumonid, *Mesochorus* sp.

The California oakworm (*Phryganidia californica* Packard) overwinters as a larva feeding on the foliage of plants in the oak family (Fagaceae). Thus, its northern distribution may be strongly influenced by the severity of winter conditions and the availability of a host with persistent (evergreen) foliage. Populations of the California oakworm have been reported to overwinter in California only as far north as southern Mendocino County (about 39°N) and there only in the areas with a maritime climate (Miller, 1987). Harville (1955) found small outbreaks outside the overwintering range of the California oakworm and suggested that vehicles or wind might carry the caterpillars or moths long distances.

In Oregon, the California oakworm has been reported from golden chinkapin, *Castanopsis chrysophylla* (Dougl.) (Furniss and Carolin, 1977). Wickman and Kline (1985) reported an outbreak that affected many acres of golden chinkapin in the southwestern Willamette Valley (elev. 150–230 m, 44°6'N). This population was observed in November 1971. No subsequent observations were reported, and they did not comment on overwintering.

Here we report on a population of the California oakworm found overwintering at 750 m elevation on the west side of the Cascade Mountains.

On 12 August 1985 we found one California oakworm larva on Oregon white oak (*Quercus garryana* Dougl.) in the H. J. Andrews Experimental Forest, Lane County, Oregon (44°13'N). On 22 August 1985 we found first and second instars to be very abundant on several golden chinkapins 1.7 km NE of the Oregon white oak site. This second site was on a SSE-facing slope, 2.2 km NE of the headquarters of the H. J. Andrews Experimental Forest. We returned to this area on 30 August and 27 September 1985, collecting many ($n > 200$) caterpillars each time. Late instars, indicating overwintering, were also found at this site on 30 April 1986. Additional larvae were collected here on 19 June 1986, 18 November 1987, and 5 May 1988.

The cold-hardiness of this population merits further study. Sibray (1947) tested the affect of temperature on a Berkeley population of California oakworm. At 10°C he found an average larval period of 178 days. At 4.4°C there was limited

development and death after 3 mo. At 1.7°C there was no feeding and negligible activity. There was no hatch of eggs at 1.7°C and 4.4°C. In the H. J. Andrews Experimental Forest, at 640 m elevation and 1.8 km SWW of our sample site, temperatures below freezing occurred each month from November 1985 to April 1986, and from November 1986 to April 1987. The coldest months were November 1985 (mean minimum air temperature -1.6°C with an absolute minimum of -9.2°C) and January 1987 (mean minimum air temperature of -1.4°C with a minimum temperature of -9.2°C).

We searched for the California oakworm in other areas of the H. J. Andrews Experimental Forest and western Oregon. Our only find was a single instar in SW Oregon (elev. 250 m, 42°44'N, Daphne Grove Campground, Coos County) on tanoak, *Lithocarpus densiflorus* (Hook and Arn.) Rehd., on 27 July 1986.

Field-collected larvae were reared to document the occurrence of parasitoids. The parasitoid species observed were: *Ceranthia* sp. (Tachinidae); *Hyphantrophaga virilis* (Aldrich and Webber) (Tachinidae); and *Mesochorus* sp. (Ichneumonidae). One pupa was found with an emergence hole of an unidentified hymenopteron parasitoid. From the collections in 1985 we reared over 200 field-collected larvae and only 14 were parasitized, all of these by *Ceranthia* sp. In addition, one of the *Ceranthia* sp. was parasitized by *Mesochorus* sp. Parasitoids emerged from 7 of 26 larvae collected on 30 April 1986 and 19 June 1986. Four of these larvae were parasitized by *Ceranthia* sp. and three by *H. virilis*.

Ceranthia sp. is a gregarious, larval, endoparasitoid. Usually one but up to three parasitoids occurred per host. The parasitoid emerged from the last and next to last instars. Parasitism was as high as 23.5% ($n = 17$, 30 April 1986).

In our study *H. virilis* acted as a larval-pupal parasitoid. They emerged from the pupae of field collected host larvae. Previously *H. virilis* has been reported to emerge from California oakworm larvae (Young, 1977). Also, *H. virilis* is recorded as a larval parasitoid of various Lepidoptera (Arnaud, 1978).

Young (1977) found only 2 (0.17%) of 1150 larvae parasitized by *H. virilis* while Harville (1955) found 6 *H. virilis* from "several thousands of *Phryganidia* larvae." Horn (1974) studied parasitism from 1969 to 1972 and found 453 of 798 field-collected pupae parasitized by various Hymenoptera but did not rear any tachinid parasitoids.

Voucher specimens have been placed in the Systematic Entomology Laboratory at Oregon State University.

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LITERATURE CITED

- Arnaud, P. H., Jr. 1978. A host-parasite catalog of North American Tachinidae (Diptera). U.S.D.A. Misc. Publ. No. 1319, 860 pp.
- Furniss, R. L., and V. M. Carolin. 1977. Western Forest Insects. U.S.D.A. Forest Service Misc. Publ. No. 1339, 654 pp.
- Harville, J. P. 1955. Ecology and population dynamics of the California Oak Moth *Phryganidia californica* Packard (Lepidoptera: Diptidae). Microentomology, 20:83-166.

- Horn, D. J. 1974. Observations on primary and secondary parasitoids of California Oakworm, *Phryganidia californica*, pupae. Pan-Pac. Entomol., 50:53-59.
- Miller, J. S. 1987. A revision of the genus *Phryganidia* Packard, with description of a new species (Lepidoptera: Dioptidae). Proc. Entomol. Soc. Wash., 89:303-321.
- Sibray, W. S. 1947. Bionomics of the California Oak Moth. M.S. thesis, Univ. California, Berkeley, 80 pp.
- Wickman, B. E., and L. N. Kline. 1985. New Pacific Northwest records for the California Oakworm *Phryganidia californica*. Pan-Pac. Entomol., 61:152.
- Young, L. C. 1977. Pupal parasites of the California Oak Moth, *Phryganidia californica* Packard: a biological and ecological study. Ph.D. thesis, Univ. California, Berkeley, 126 pp.