

SCIENTIFIC NOTE

Trichogramma papilionis* (Nagarkatti), the First Recorded *Trichogramma* Species to Parasitize Eggs in the Family Limacodidae*Patrick Conant¹, Clyde K. Hirayama¹, Christopher M. Kishimoto² and Arnold H. Hara³**

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Abstract. *Trichogramma papilionis* (Nagarkatti) was found parasitizing eggs of *Darna pallivitta* (Moore). This is the first confirmed record of an identified species of *Trichogramma* attacking Limacodidae eggs. Rates of parasitism and biology of *T. papilionis* are reported as well as its potential efficacy as a biological control agent in Hawaii. This is also the first record of *T. papilionis* from the Island of Hawaii.

Key words: *Trichogramma papilionis*, Limacodidae

Trichogramma are known occur in a variety of habitats worldwide and attack the eggs of beetles, true bugs, flies, lacewings, and even other wasps, although they primarily parasitize the eggs of butterflies and moths (Knutson, 1998). *Trichogramma* are among the most successful forms of insect biological control in the world, being released on 32 million hectares (79.1 million acres) of forest land and agriculture crops each year (Li, 1994).

In September 2001, the nettle caterpillar *Darna pallivitta* (Moore) (Limacodidae) was accidentally introduced into Hawaii (apparently from a shipment of *Rhapis excelsa* palm seedlings from Taiwan) and quickly became an invasive pest (Conant, et al. 2002). Surveys were initiated to determine whether there were any natural enemies of *D. pallivitta* including *Trichogramma* spp. that already occur in Hawaii.

Seventy sentinel egg surveys were carried out from September 2003 until December 2004. Surveys were made in and around the Panaewa area (119° 39 min. 13 sec. N, 155° 3 min. 19 sec. W) located approximately 5 miles (8 km) outside of Hilo town on the Island of Hawaii. Sentinel egg surveys were made by placing four to six week old sorghum (*Sorghum bicolor*) seedlings in six inch diameter pots with mated female *D. pallivitta* adults. Females were allowed to oviposit on the seedlings overnight and the seedlings were placed in the field at 4 sites in Panaewa where *D. pallivitta* infestations were known to occur—H. Eunice Nursery (HEN) (19° 38 min. 55 sec. N, 155° 3min. 19 sec. W / elev. 333 feet (101.5 m)), Hawaii Nurseries Incorporated (HNI) (19° 38 min. 8 sec. N, 155° 3 min. 27 sec. W / elev. 339 feet (103.3 m)), Waiakea Research Station (WRS) (19° 38 min. 38 sec. N, 155° 4 min. 47 sec. W / elev. 604 feet (157 m)) and one location in Waiakea Uka, at a private residence (Mr. Taka) (19° 39 min. 44 sec. N, 155° 5min. 33 sec. W / elev. 525 feet (160 m)). HEN is approximately 1.5 miles (2.4 km) from WRS and the private residence was approximately 1.75 miles (2.8 km) from WRS. Seedlings were brought back to the lab within four days to observe the eggs for parasitism. Eggs from the field were kept under ambient conditions 72°–92°F (22.2°–33.3°C) with 75% RH at HDOA with ambient light supplemented by overhead fluorescent light from 0700h through 1600h each day.

Table 1. Results of sentinel egg surveys positive for parasitism by *Trichogramma papilionis* with number of eggs placed in the field, resulting number parasitized and percent parasitism.

Date	Placement location	Placed (no.)	Eggs	
			Parasitized (no.)	Parasitized (%)
09/04/2003	H. Eunice Nursery	75	30	40.0
11/04/2003	H. Eunice Nursery	135	95	70.0
11/05/2003	H. Eunice Nursery	67	67	100.0
11/06/2003	Hawaii Nurseries Inc.	54	4	7.4
11/07/2003	H. Eunice Nursery	181	162	89.5
11/10/2003	Waiakea Research Station	116	2	1.7
02/02/2004	H. Eunice Nursery	160	1	0.6

Sentinel egg surveys revealed *T. papilionis* parasitizing *D. pallivitta* eggs. Identification of *T. papilionis* was made by Hawaii State Department of Agriculture (HDOA) Entomologist Patrick Conant and was confirmed by HDOA Insect Taxonomist Bernar Kumashiro. Out of the 70 sentinel egg surveys that were conducted, eggs parasitized by *T. papilionis* were found on seven occasions. Sentinel egg surveys detected *T. papilionis* in three locations – HNI, WRS, and HEN; all located in Panaewa. Six of the seven surveys that recovered *T. papilionis* were from HEN. The number of eggs per survey that were parasitized ranged from 1 egg to 162 eggs. Parasitism rates reached 100% (n = 67 eggs) in early November 2003, but parasitism of *D. pallivitta* eggs by *T. papilionis* continued for only a two month period (early September 2003 – early November 2003). A sentinel survey conducted in early February 2004 yielded one egg parasitized at HEN but subsequent surveys yielded no further parasitism. Parasitized eggs turned black within 2-3 days after being retrieved. Up to six adult *T. papilionis* would emerge from each parasitized egg within 10-12 days after oviposition.

Six placements of individual sorghum plants with sentinel eggs were set out in the Hilo area by Conant and Hirayama in March 2006 but no additional *Trichogramma* have ever been recovered. These placements were made to coincide with an outbreak of *Herpetogramma licarsisalis* (Walker) moth adults seen at the time, as the eggs of this species are parasitized by *T. papilionis*.

Trichogramma papilionis was the only species found parasitizing *D. pallivitta* eggs. The finding of *T. papilionis* parasitizing *D. pallivitta* eggs is only the third worldwide record of *Trichogramma* attacking limacodid eggs (Wei, 1985 and Hoong and Hoh, 1992) and represents the first positively identified species of *Trichogramma* to parasitize limacodid eggs. *Trichogramma* tend to be polyphagous (Hirose, et al, 1976 and Cock, et. al, 1987) and it is likely numerous species of *Trichogramma* exist in close proximity with many limacodid species. Although Cock, et al. (1987) theorize that the flattened shape of limacodid eggs might be a reason for lack of parasitism, observed rates of parasitism of up to 100% (Table 1) in this survey show that egg shape does not prevent oviposition by *T. papilionis*. Conant (unpublished data) has also reared *T. papilionis* from *Herpetogramma licarsisalis* on the island of Maui. This crambid moth also lays flat, thin eggs. Our results suggest *D. pallivitta* does not appear to be a preferred host of *T. papilionis*. Possibly, an increase in population of

another lepidopteran species which was a preferred host caused an increase of *T. papilionis* populations, allowing parasitization of *D. pallivitta*, normally not a host of *T. papilionis*. Prior to its discovery parasitizing *D. pallivitta* eggs, in the State of Hawaii, *T. papilionis* was only known to occur on the Islands of Oahu (Nishida, 2002) and Maui (Conant, unpublished data).

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