QUARANTINE TREATMENTS FOR *CRYPTOPHLEBIA* IN HAWAIIAN LYCHEE AND LONGAN

Peter A. Follett*, Suzy Sanxter & Bob Lower
USDA-ARS Tropical Fruit, Vegetable & Ornamental Crop Research Lab
PO Box 4459, Hilo, Hawaii 96720

The lion's share of quarantine research in Hawaii has focused on tephritid fruit fly pests of tropical fruits. However, many other insect and mite pests are classified as regulatory pests and their appearance has equal clout with fruit flies in interrupting export shipments. Several of these arthropods are pests on multiple tropical fruits and floriculture products, while others are unique to specific crops. We are exploring various approaches, including irradiation and heat treatments, to ensure quarantine security for tropical fruits considering the pest complex. Regulatory insect pests currently of interest include the mango seed weevil, *Cryptorhynchus mangiferae*; white peach scale, *Pseudocaspis pentagona*; pink hibiscus mealybug, *Maconellicoccus hirsutus*; green scale, *Coccus viridis*; and *Cryptophlebia* moth.

Two species of *Cryptophlebia* attack fruits in Hawaii: *Cryptophlebia illepida*, a native species known as the koa seedworm, and *Cryptophlebia ombrodelta*, an Australian import known as the litchi fruit moth. Both species infest litchi and longan. *Cryptophlebia* eggs are laid singly on the fruit surface and newborn larvae bore through the skin and feed at the skin/pulp interface. Older larvae will feed on the pulp, and large larvae can be found boring into the seed at the center of the fruit.

Quarantine regulations prevent the shipment of lychee and longan from Hawaii to the US mainland if fruit are infested with *Cryptophlebia*. A hot water immersion treatment of 49°C for 20 min. is an accepted quarantine treatment for fruit flies in these fruits, and our data show that this treatment also disinfests fruit of *Cryptophlebia*. In fact, in dose response tests, all larvae of all ages and pupae were killed after only 12 min. at 49°C.

We are examining the use of irradiation as a quarantine treatment. Irradiation with a minimum absorbed dose of 250 Gy is an accepted treatment to disinfest Hawaii-grown lychee of fruit flies before export. Dose response tests suggest that irradiation treatment with a dose of 250 Gy is an effective treatment for *Cryptophlebia*, as well. *Cryptophlebia* eggs, larvae, and pupae of various ages were treated with an irradiation dose of 0 (control), 62.5, 125, 250 or 400 Gy (table 1). Late (4th and 5th) instars were the most tolerant lifestages that occur in or on fruit. After receiving a dose of 125 Gy, one late instar out of 126 survived to adult . At the 250 Gy treatment, there were no survivors to adult out of 150 larvae. Confirmatory tests at 250 Gy with late instars are in progress.

Table 1. Survivorship of late instar *Cryptophlebia* after irradiation.

Trmt	reps	n	# pupated	# adults	# adults w/ eggs	# eggs	# neonates
control	4	74	69	51	10	480	386
62.5 Gy	4	102	90	43	4	91	1
125 Gy	4	126	105	1	0	0	0
250 Gy	4	150	85	0	0	0	0
400 Gy	4	174	67	0	0	0	0

We are also interested alternative approaches to developing quarantine treatments for pests of lychee and longan. The probit 9 standard for quarantine security (maximum 32 survivors in a million treated individuals) was initially recommended with heavily infested fruit in mind. This standard may be too stringent for commodities that are rarely or poorly infested. The "alternative treatment efficacy" approach measures risk as the probability of a mating pair, gravid female, or parthenogenic individual surviving in a shipment. This will be a function of many factors including infestation rate, culling and other post-harvest removal of infested fruit, shipping and storage conditions and the mortality they exact on the pest, shipment volume, and other biological and nonbiological factors. The main quantitative argument for deviating from probit 9 is low infestation rate of the commodity.

Field and laboratory tests, and pest surveys, are being conducted to examine host suitability and infeststion rate of lychee and longan for fruit flies and *Cryptophlebia*. Although *Cryptophlebia* readily lays eggs on lychee and longan, and larvae can complete development in fruit, mature fruit in the field are seldom infested with late instars. Therefore, in theory, the alternative treatment efficacy approach might apply. Most lychee and longan fall within the 15-20 g range, an order of magnitude less than most tropical fruits. The size of the shipment is a key parameter in determining the level of commodity quarantine treatment mortality needed to prevent shipment of a mating pair. Assuming an infestation level of 1 *Cryptophlebia* in 1000 fruit, a shipment of 100 kg (5555 fruit at 18 g per fruit) would require a treatment efficacy of 96.2% (probit 6.8), whereas a shipment of 4000 kg (222,200 fruit) would require a treatment efficacy of 99.91% (probit 8.2). If the infestation rate is higher, say 1 *Cryptophlebia* in 100 fruit, the required treatment efficacy approaches the probit 9 standard. The alternative treatment efficacy approach, while intuitively appealing, may be difficult to apply in practice to Hawaiian lychee and longan.