

Light Brown Apple Moth – Our Latest Invasive Pest

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Many of you have heard that the Light Brown Apple Moth (LBAM) has landed on the shores of California to become our latest exotic intruder that could become a vineyard pest. It is important we are all aware of this potential pest. Furthermore there are some lessons to be learned from LBAM's introduction. First let's learn a little bit about its biology and how to identify it.

The scientific name of LBAM is *Epiphyas postvittana* (Walker) and it is in the family Tortricidae. Tortricidae is a very large family of small moths that contains not only some important agricultural pests, such as Codling Moth and Omnivorous Leafroller (OLR), but also contains some very important forest pests, such as the Eastern and Western Spruce Budworm. LBAM is native to eastern Australia, where it occurs in Queensland, New South Wales, South Australia, Victoria, and Tasmania. Unfortunately, it has made its way to New Zealand, Hawaii, and England. It has been in the later two locations for over 80 years. Somehow it founds its way to the San Francisco Bay Area fairly recently.

Adult LBAM are not quite a half inch long (10mm) and their color and markings can vary quite a bit. However, the basic color is yellowish-brown with the front part of the wings a lighter color than the rear part, sometimes markedly so. This color pattern is the opposite of the similar sized OLR moths, where the front parts of the wings are darker than the rear parts. Like all Tortricid moths, when LBAM are at rest the wings are folded so that only the front pair of wings, the fore wings, are the visible and are in the shape of a bell. Unfortunately, LBAM larvae are pretty non-descript and it takes an expert to be able to tell it from other similar Tortricid larvae. The head of the extremely small first instar larva is brown, while it is a fawn color in all other instars. The body of a mature larva is medium green with a dark green central stripe and two side stripes.

LBAM's life cycle is very similar to that of the OLR. Eggs are laid in masses on the foliage of a host plant. The eggs are very flat and look like overlapping scales. As one might expect, these egg masses look just like those of OLR. The newly hatched larvae actively search over the leaf surfaces looking for a good place to start feeding. Often they settle on the underside of a leaf, near a vein, where they spin a protective shelter of fine webbing. Later instar larvae feed either between two leaves they have tied together with silk, between a leaf and fruit, in leaves of an opening bud, or in a single leaf they roll up with silk. Sound familiar? OLR larvae feed in a very similar way. The mature larva pupates in this shelter and the adult moth emerges later. In its native environment in Australia, LBAM does not go through any resting stage or diapause. It slows down its rate of development when the weather turns cold but at no time does development actually stop. What this means is that the warmer the climate in which it lives the more generations it will go through in a year. In central New Zealand there are three generations with a partial fourth in some years, while in England it goes through two generations.

One important characteristic of LBAM to be aware of is that it can successfully feed and reproduce on a very wide range of plants. The official statistics are that it will feed on plants in over 120 genera in 50 families. For example, in Australia it will feed on both *Eucalyptus* and pine seedlings, where it is the most common insect to be found on seedlings of both in green houses and tree nurseries. Pine is not native to Australia so LBAM did not evolve in its presence and the leaf chemistry of pine is very different to that of *Eucalyptus* yet it will readily feed and reproduce on both. In fact one of my fond memories as a research scientist for CSIRO in Canberra, Australia was squishing LBAM larvae with my fingers because they regularly infested my experimental *Eucalyptus* seedlings growing in the greenhouse.

What Damage Will LBAM Cause to Vineyards in California?

It is extremely important for everyone to realize that the most immediate problem with LBAM is to prevent its spread outside the current area of infestation. Therefore, even though the government requirements for preventing this spread may be onerous to some, it is essential that they be followed. The short term economic impact of LBAM is related to trade issues with areas that are LBAM-free. Therefore we must keep it where it is now and make an attempt to eradicate it.

The first question most winegrape growers will want an answer to is “If it cannot be eradicated will it be a problem in my vineyard?” The honest answer is that we will not know that until it becomes established in vineyards. However, if LBAM cannot be eradicated, I do not think it will in the long run be any more or less of a problem than OLR. In fact it, in terms of its interactions with winegrapes LBAM what is called an ecological homologue of OLR. An ecological homologue is a species in one ecosystem that occupies the same ecological niche as a different species in a different ecosystem. Therefore the type of damage caused by LBAM to winegrapes is exactly the same as that cause by OLR and the insect behaves in exactly the same way. So every grower who has had experience with OLR knows what to expect from LBAM. The direct damage to the vine is minimal. The problem comes from the larvae damaging fruit that then becomes infected with *Botrytis* and/or sour rot.

When one reads the pest management guidelines for dealing with LBAM in Australian vineyards (e.g. Bernard et al. 2007), the problems are the same as those encountered when dealing with OLR in California. It is hard to monitor for in the leaves and fruit because larvae are hard to find. There is an effective pheromone for it but numbers of males caught in the pheromone traps are not indicative of LBAM larval numbers on the vines. So it is very hard to figure out if a treatment should be made because it is so hard to determine the level of its population in the vineyard.

On the positive side of things, there are several parasites in Australian vineyards that help keep LBAM under biological control and growing certain cover crops can enhance their effectiveness (Bernard et al. 2007). If LBAM does become permanently established in California and moves into the major grape growing regions it is very possible that the parasites for OLR may also be effective against LBAM because the insects are so similar

in size and behavior. Time will only tell. Furthermore, it may be possible to import the parasites of LBAM from Australia to the US if it becomes a serious pest.

Unlike some invasive exotic pests that have come to this country where little or nothing is known about it in its native country, there is a lot known about LBAM. It has been the subject of many studies over several decades in Australia and the scientific literature on it is extensive. We therefore do not need to do a lot of work on it to figure out how to manage it. Even though it has such a wide host range it appears that apple orchards and vineyards are where it is the most significant problem in its native environment.

Lessons to be Learned from the LBAM Invasion

The most obvious lesson is that we need to continue to be vigilant at the points of entry into the United States where food and other natural products are brought in to prevent accidental introductions of pests like LBAM. I am pretty sure all of us recognize the importance of this but we must continue to remind the policy makers of the importance of continuing to fund quarantine programs. Unfortunately, the willingness of government to fund quarantine has declined alarmingly. Moreover, the recent press around the contamination of toothpaste, pest food and paint on toys coming from China has brought light to the fact that the federal government's abilities to check imported food, as well as other products that can affect our health, is woefully inadequate.

Another lesson is that it is essential we retain professionals that have the ability to recognize insect and disease pests so when they do become established in the US they are noticed right away. As I mentioned earlier, LBAM larvae are very non-descript and similar to other related larvae and to the untrained eye the moth looks like a lot of other Tortricid species. It turns out that the person to discover that LBAM was in the San Francisco Bay Area was Dr. Jerry Powell, an emeritus Professor of Entomology at University of California Berkeley and a highly respected insect taxonomist. Tortricidae is one of the families of insects that Dr. Powell has a particular interest and expertise in and it is lucky for us that he still maintains a passionate interest in collecting moths, despite being retired. A few months ago he was collecting moths in the Bay Area using a black light at night, which is a great way to collect certain groups of insects like moths. Having spent time in Australia studying Tortricids, among other insects, he was familiar with LBAM moths and readily spotted them in his collecting efforts in Berkeley. He immediately contacted the California Department of Food and Agriculture and they quickly obtained the LBAM pheromone so they could set traps up to find out the extent of the infestation. The rest, as they say, is history.

The take home message about LBAM is that we should not panic because it has been found. If it turns out that it cannot be eradicated it is important to remember that it operates very similarly to a pest, OLR, that many of us have experience in managing. Extensive research in its native country tells us that although monitoring for it is difficult, it can be readily managed using IPM (Bernard et al. 2007).

Bernard, M., P. A. Horne, and D. Papacek. 2007. Guidelines for environmentally sustainable winegrape production in Australia: IPM adoption self-assessment guide for growers. *The Australia & New Zealand Grapegrower & Winemaker* March 2007, pp. 24-35.