PEST ASSESSMENT: Vine Moth, *Lobesia botrana* (Dennis and Schiffermuller), (Lepidoptera: Tortricidae)

USDA-APHIS-PPQ-CPHST-PERAL/NCSU

Section A: Species Information

Scientific name: *Lobesia botrana*

Order: Lepidoptera

Family: Tortricidae

Common Name: Vine moth, grape moth, grape berry moth

Source: Fowler and Lakin, 2002

Figure 1. *Lobesia botrana* larva (A) chrysalis (B), adult (C) and damage (D) (Coutin R. / OPIE 1998).

Description: (From Fowler and Lakin , 2002)

Eggs: The eggs are flat and elliptical (Crop Protection Compendium 2000). Egg dimensions are approximately 0.8 mm X 0.6 mm (0.03 inches X 0.02 inches). Eggs are laid singly or in groups of 2-3.

Larvae: There are 5 instars. Laval size ranges from 1 mm to 15 mm (0.04 inches X 0.59 inches). Larval color ranges from light green to brown depending on nutrition.

Pupae: Pupa size ranges from 4 mm to 9 mm (0.16 inches X 0.35 inches). Pupa coloration is initially light brown and later changes to dark brown.

Adult: Adult body length ranges from 6 mm to 8 mm (0.24 inches X 0.31 inches) and the wingspan ranges from 10 mm to 13 mm (0.40 inches X 0.51 inches). Body coloration is cream with black marks. The legs exhibit alternating white and brown bands. The forewings exhibit a mosaic pattern of black, brown, white, blue and red. The hind wings are brownish gray.

Life History: (From Fowler and Lakin, 2002)

Lobesia botrana is a pest of grapes (Crop Protection Compendium 2000). Alternate hosts for *L. botrana* include: cherry, Chinese gooseberry, carnation, persimmon, blackthorn, pomegranate, red currant, gooseberry, plum, black currant and olive. *Lobesia botrana* damages grapes by feeding on flower buds and fruits. Feeding results in external damage, internal damage and subsequent rotting due to fungal pathogens. One of the most serious infections is gray rot, which is caused by *Botrytis cinerea* (Fermaud 1990). This damage results in lower crop yield, lower grape quality and bad bouquet flavor in the case of wine grapes. The life cycle is as follows:

1. Adult *L. botrana* emerge from pupation and mate. Moths are active at dusk. (Crop Protection Compendium 2000). The females typically mate once while males are capable of mating multiple times (Torres-Villa *et al* 1995, Torres-Villa *et al*. 1997).
2. 3 days after mating, eggs are laid singly or in groups of 2-3 on host reproductive organs (Crop Protection Compendium 2000).
3. Eggs hatch 7 to 10 days after oviposition.
4. Newly hatched larvae are highly mobile and invade the host inflorescences. Older larva will tie several inflorescences together with silk for protection. The structures (glomerules) are clearly visible and can be used in detection. As the larvae mature they move from the inflorescences to the fruits to feed. Initial feeding occurs on the surface of the fruit. Later the larva will penetrate the fruit and feed internally. Larval development requires 20 to 28 days.
5. Non-diapausing pupation occurs on the host leaves and requires 12 to 14 days. Diapausing pupation occurs under the host bark or in surrounding wood crevices (R. Roehrich, INRA, France personal communication).

6. Adults emerge at the end of winter and the beginning of spring (Gabel and Roehrich 1990). There can be 2 to 5 generations per year depending on temperature and photoperiod (Crop Protection Compendium 2000).

Larvae and eggs are capable of becoming dormant under extreme temperature conditions (Tzanakakis *et al*. 1988).

Prediction Model:

A generic insect degree day model was used to predict the potential of *L. botrana* infestation in the United States with temperature accumulations above the low developmental threshold as the main weather factor controlling the pest insects' biology. The template is based on the time of development for a generation of *L. botrana* with degree days accumulated above the lower developmental threshold of 10 C for all stages and individual stage degree day (DD) requirements from Touzeau (1980). The upper developmental threshold has been reported as being 34 C (Briere et al. 1999). It was necessary to estimate the length of the pre-oviposition period for the adult female, as none was previously reported. This period has been observed to be 3 d post mating, and was estimated to be 28 DD in the model template and placed in the adult category of the template. In the template the oviposition section does not represent the length of oviposition time by the adult, but rather the number of degree days required for an egg to develop and hatch following deposition. At present in the template there is no adjustment for diapause inducing conditions which would reduce the potential number of generations per season for *L. botrana*.

Results. The risk probability maps generated for *L. botrana* (Figure 2) are for a specified time period, June 1-7, which was selected arbitrarily, but adequately represents a period when many of the crops of interest are actively growing. The model parameters for each selected generation (overwintering, first, second or third) were examined by individual year in a 30 year historical national weather database. The data is interpreted as the number of times the model parameters (accumulated degree days (DD) between temperature thresholds) occur within the selected timeframe (i.e. if the designated DD accumulations for a specific location occur 10 years out of 30 than there is a 30% probability of occurrence or 3 out of 10 years). The crop maps were generated from county data for acres grown (1997 Census of Agriculture). The number of generations of *L. botrana* in the southern areas of the US would be greater, as indicated by the smaller distance between generation probability bands in Figure 2 B-D. To more accurately predict potential damage from a specific stage crop phenology data would be necessary.

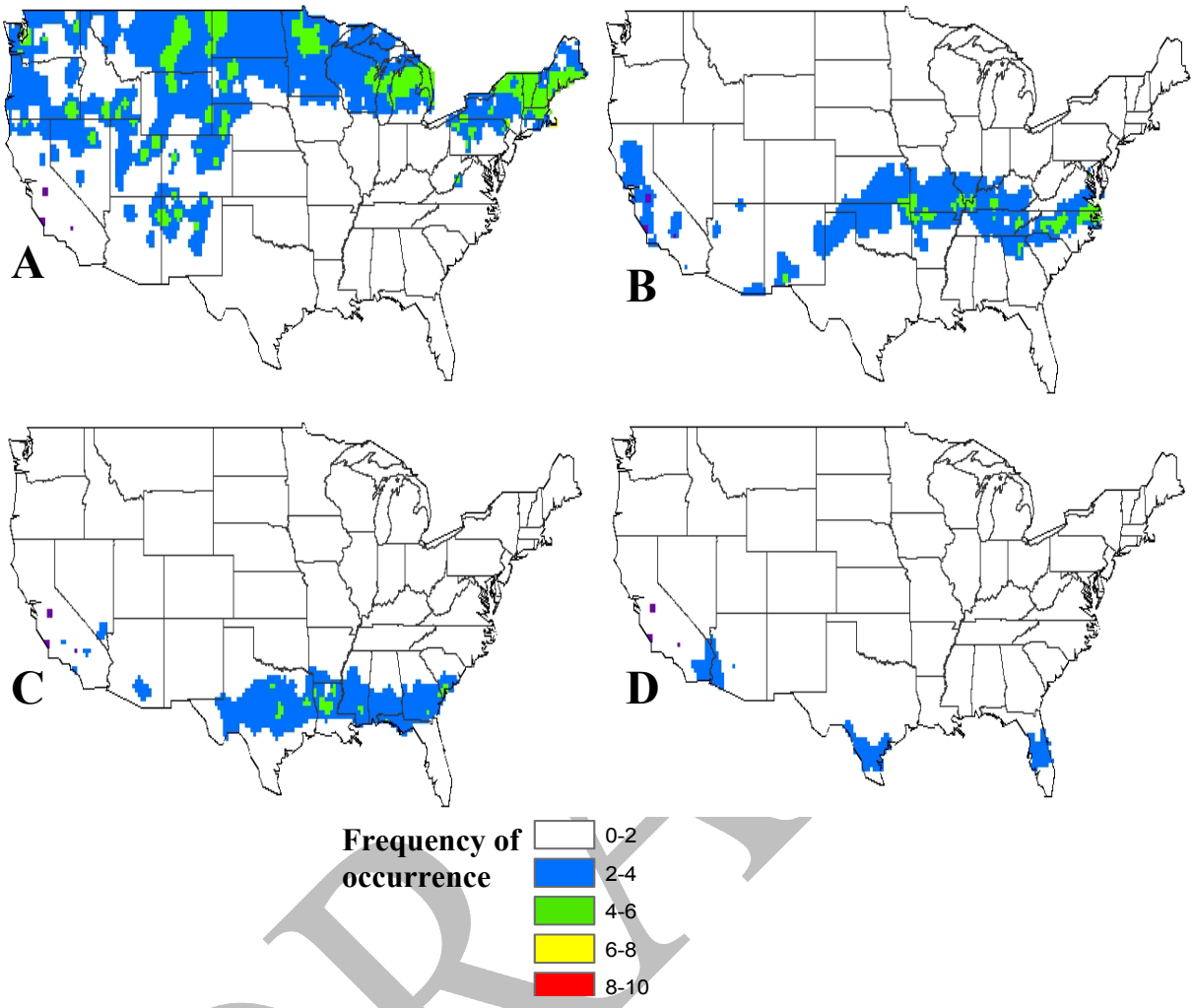

Figure 2. Probability maps of adult *L. botrana* emergence during the period of June 1-7 for overwintering, first, second and third generations (A-D), respectively, represented by frequency of occurrence out of 10 years. Maps generated from 30-year climactic data.

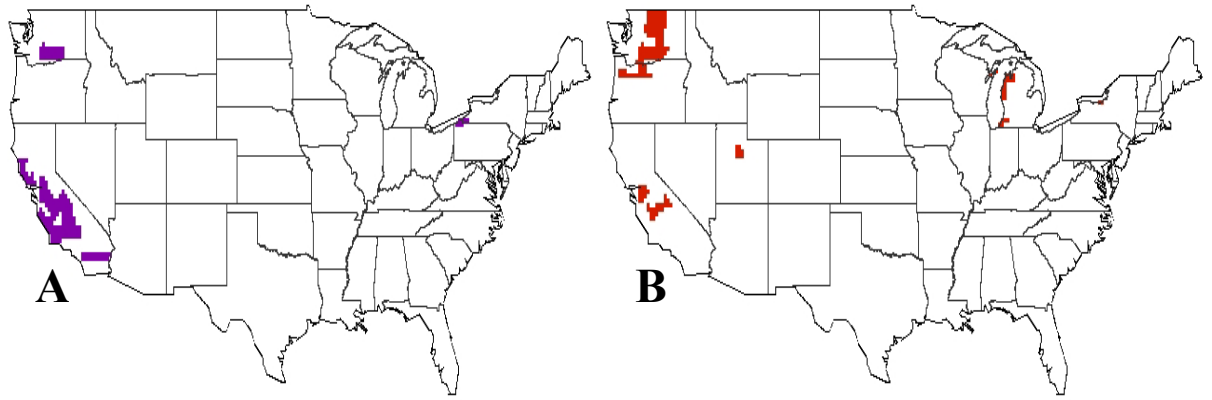

Figure 3. Counties in United States where greater than 10,000 acres of grapes (A) or 1,000 acres of cherries (B) are grown. (Census of Agriculture. 1997).

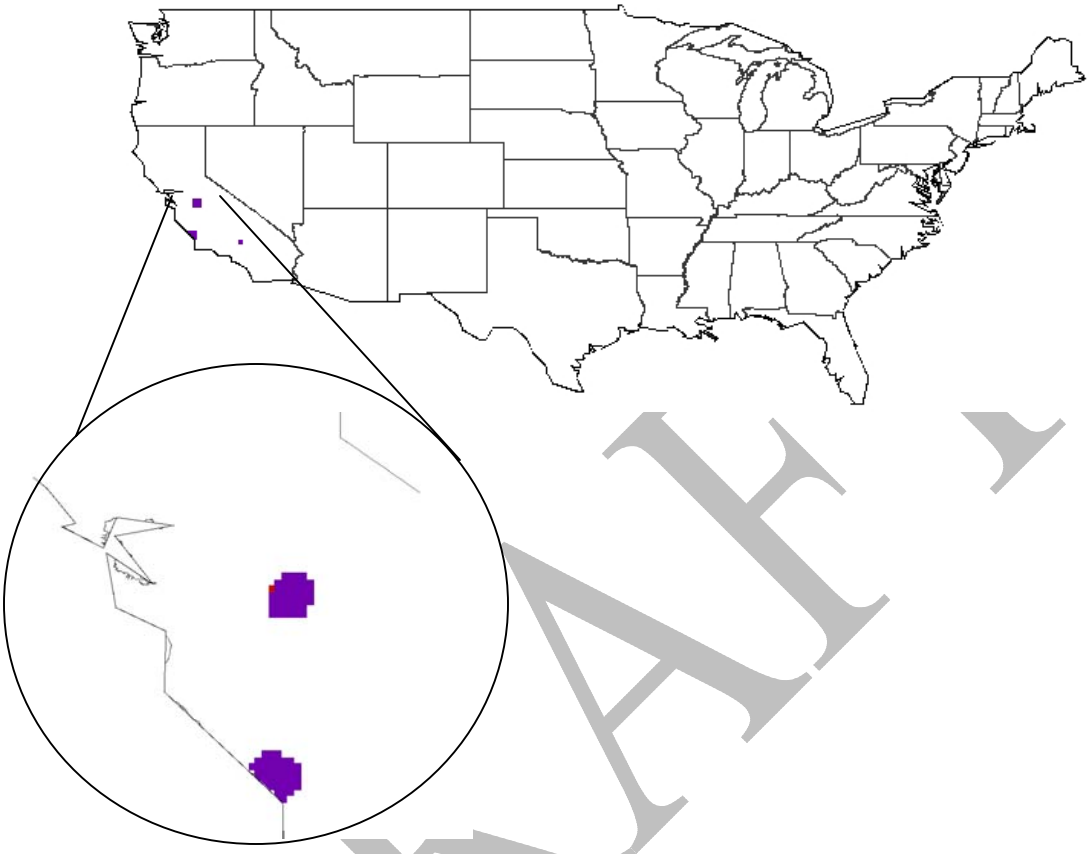

Figure 4. Regions of crops depicted in Figure 3 and > 3 years out of 10 occurrence of first generation *L. botrana* adult from June 1-7 (Inset enlarged for detail).

Authors: Daniel M. Borchert, Roger D. Magarey and Glenn A. Fowler

Section D:

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Table 1. Biological Parameters used for modeling phenology of grape vine moth, (*Lobesia botrana).*

Lobesia botrana Generations	Insect Stage	Low Dev Thres. 10C		Upper Dev. Thres. 34C
	p	130	0	130
Overwintering	a	28	131	159
1	e	75	160	235
	l	170	236	406
	p	130	407	537
	a	28	538	566
2	e	75	567	642
	l	225	643	868
	p	130	869	999
	a	28	1000	1028
3	e	75	1029	1104
	l	225	1105	1330
	p	130	1331	1461
	a	28	1462	1490
4	e	75	1491	1566
	l	225	1567	1792
	p	130	1793	1923
	a	28	1924	1952
5	e	75	1953	2028
	l	225	2029	2254
	p	130	2255	2385
	a	28	2386	2414
6	e	75	2415	2490
	l	225	2491	2716
	p	130	2717	2847
	a	28	2848	2876
7	e	75	2877	2952
	l	225	2953	3178
	p	130	3179	3309
	a	28	3310	3338
8	e	75	3339	3414
	l	225	3415	3640
	p	130	3641	3771
	a	28	3772	3800