FY 2012 year-end report to the Virginia Wine Board

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Determination of the Abundance, Distribution and Risk Factors Associated with the Infestation of Virginia Vineyards by Grape Root Borer

Grape root borer larvae feed on roots of different wild and commercial *Vitis* species and rootstocks. During July through August, adult females deposit eggs randomly on above ground parts of vines, weeds and soil surface. The neonates, after hatching, enter the soil to find grape roots and spend ~2 years feeding inside the root before pupating and then and emerging as an adult moth. The pupal case left by an emerging adult in soil is the best indicator of the infestation status. Much remains unknown about abundance, distribution and potential risk factors that might explain the infestation status of grape root borer in Virginia vineyards.

The objectives of this study are:

Objective 1: Conduct survey (2008-2012) to quantify the important risk factors associated with grape root borer infestation within vineyards

Grape root borer pupal case survey was conducted in 10 additional blocks of 4 different vineyards in 2011. The selection and preparation of vineyard blocks occurred in May and June. The sample grid consisted of 80 vines (comprising 10 sample vines in each of 8 alternate rows). At least two blocks were selected from each vineyard. These blocks had not been treated with chlorpyriphos (Lorsban) or any other soil insecticide targeting grape root borer or other vineyards pest. A ~1m circular area around the base of each sample vine was cleaned to the soil surface using a ‘weed eater’, followed by raking. The distribution and abundance of the GRB in vineyard was estimated via pupal cases sampling. The pupal cases found around the base of each sample vine were counted and removed weekly from July – August. Between 2008 and 2011, we have surveyed 40 different blocks from 16 vineyards in Virginia (Fig. 1). Varieties included: Vidal (6), Cabernet Sauvingnon (5), Cabernet Franc (5), Chardonnay (5), Petit Verdot (4), Norton (4), Chambourcin (3), Merlot (3), Viognier (3), Riesling (1) and Sauvignon Blanc (1). Rootstocks included: 3309 (15 blocks), SO4 (6), *Vitis riperia* (4), 101-14 (3), Vidal-own root (2), Norton-own root (3), 5BB (1), and others (6). Based on the average total number of pupal cases collected per vine during the summer, we observed wide variability in terms of infestation status among the blocks surveyed (Fig. 2). Documentation of this variability is important, since one of our ultimate goals is to identify the key factor or factors that explain the infestation variability. Data on the potential risk factors (variety, rootstock, vine age, vine spacing, block size, irrigation, insecticide use, weed management, soil properties, and proximity to wild grapes) will be collected during and after final survey year (summer 2012).

Four vineyard blocks were surveyed for pupal cases from the same sample vines for 3-4 consecutive years to measure the temporal variation of larval infestation and also to estimate the total number of larvae that can be supported by individual vine during the study period (Fig. 3)

Objective 2: Pupal cases sampling versus pheromone trapping to assess grape root borer infestations in vineyards

One Delta trap baited with a grape root borer pheromone lure was deployed in each block during the first week of July. The number of male moths trapped was recorded weekly through August. The pupal case count data from Objective 1 were used for this study. Blocks from which trap and pupal case count data collected for at least 6 consecutive weeks were used. Those blocks were ranked and assigned to three infestation level groups (high, intermediate, and low) based on the total number of pupal cases collected in one year. Blocks that were within the upper, middle, and lower 25% of infestation status, based on total pupal case counts, were considered high, intermediate, and low infestation blocks, respectively. Correlation coefficient (r) was used to examine the relationship between weekly captures and pupal case counts. There was not a significant correlation between weekly pupal case count and moth captures, regardless of relative vineyard infestation level (Fig. 4). In other words, trap captures cannot predict within-vineyard infestations accurately. Captures in pheromone traps deployed within the grid of sample vines were likely affected by the response of males emerging from vines elsewhere in the vineyard and from wild vines in nearby forests. Although Delta traps are effective for determining the presence and activity periods of adult GRB, the utility of delta traps for assessing vineyard infestation status is limited.

From our weekly pupal case collection data (2008-2011), we found that ~75% of total pupal cases were collected between the 4th week of July and the 1st week of August (Fig. 5), which is the peak moth emergence period in Virginia. This finding is of practical importance in that it will enable optimized sampling/monitoring of grape root borer for management decisions.

Objective 3: To quantify spatial distribution of grape root borer within vineyards and recommend a quantitative sampling scheme

Pupal cases collected weekly from the base of vines, using a grid of 80 sample vines per vineyard block for Objective 1 were used. Ten vineyard blocks were divided into heavy (0.9-6.4 cases/vine) and light (0.2-0.4 cases/vine) infestation levels by assigning and ranking based on the total number of pupal cases collected in one year. Geostatistics were used to determine whether the larval infestation was aggregated in some portions of vineyard blocks. Based on the outcome of analyses conducted to date, we conclude that grape root borer larval infestations were aggregated in heavily infested vineyard blocks but not in lightly infested blocks. This information will be used to develop a quantitative sampling scheme.

In the 2012 field season, at least ten more blocks will be surveyed for using pupal case abundance and distribution. This will complete the dataset that will be used for assessing potential risk factors associated with grape root borer infestation in vineyards. This dataset will also be used in further analyses of the distribution of grape root borer within vineyard blocks, and thereby in the development of a quantitative sampling scheme.

We gratefully acknowledge support from the Virginia Wine Board.

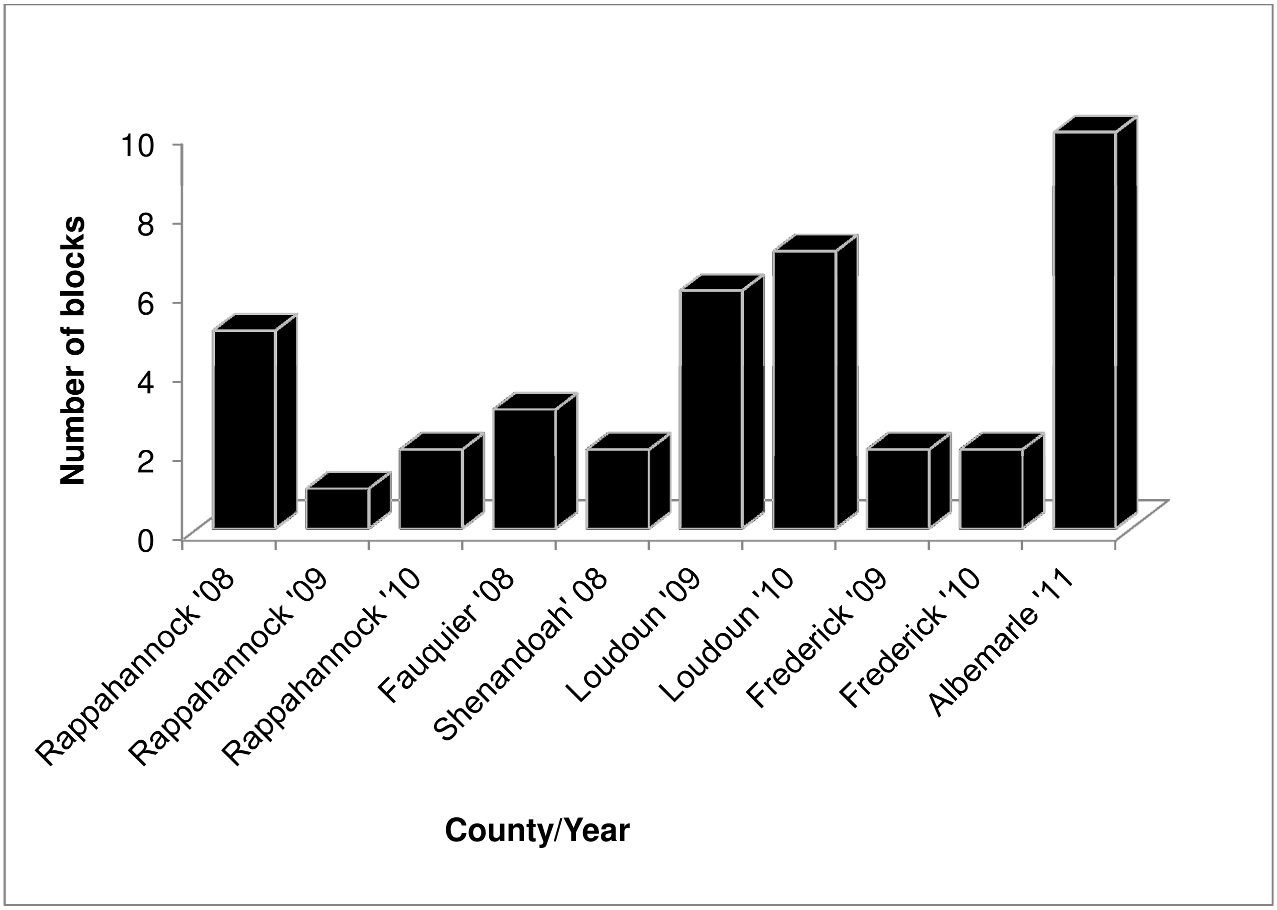

Fig. 1. Number of vineyard blocks surveyed for pupal cases from 2008 through 2011 in Virginia

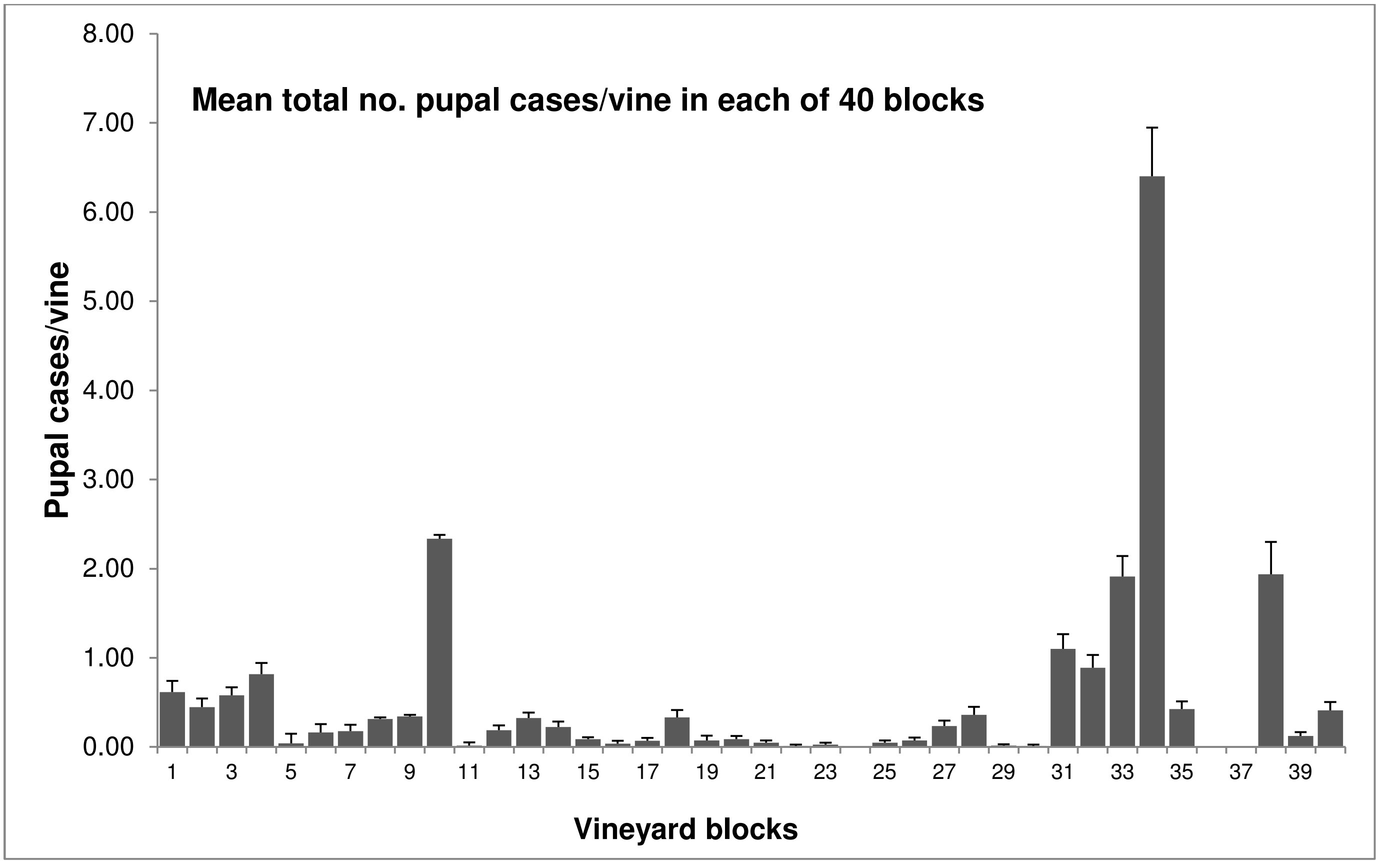

Fig. 2. Mean ± SE number of grape root borer pupal cases per vine from vineyard blocks in Virginia

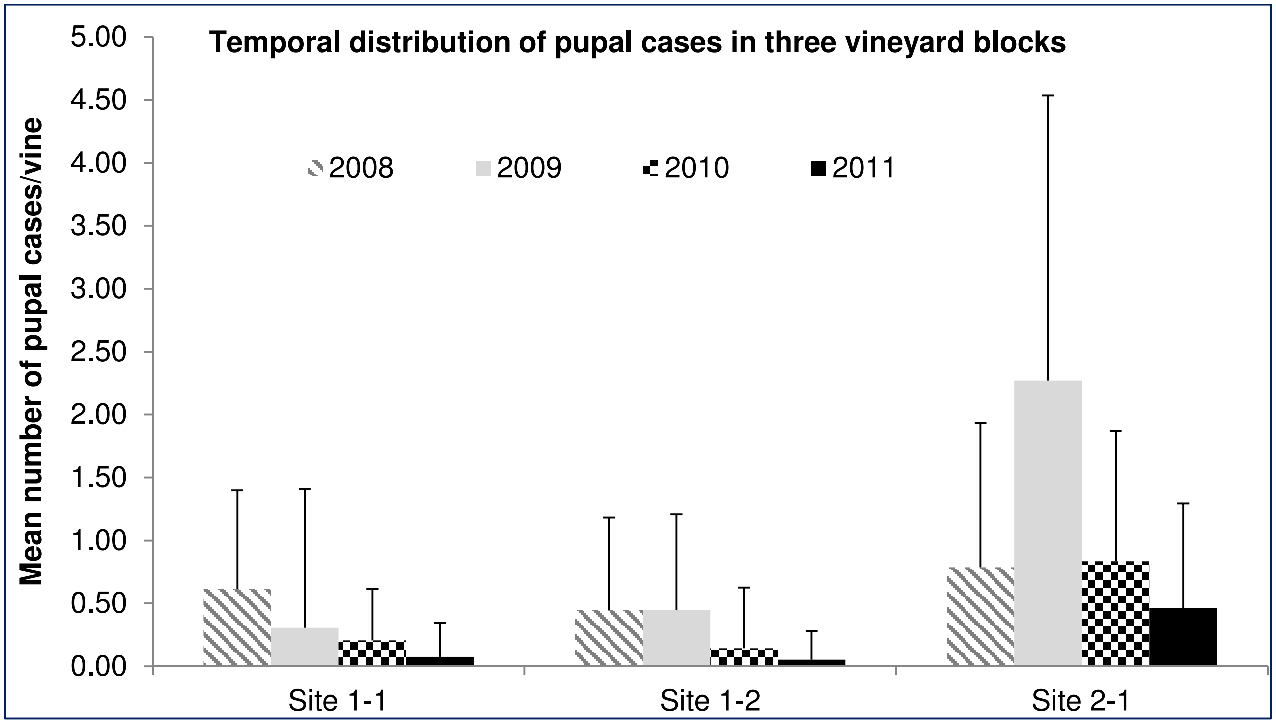

Fig. 3. Mean ±SD number of pupal cases per vine from three vineyard blocks in Virginia

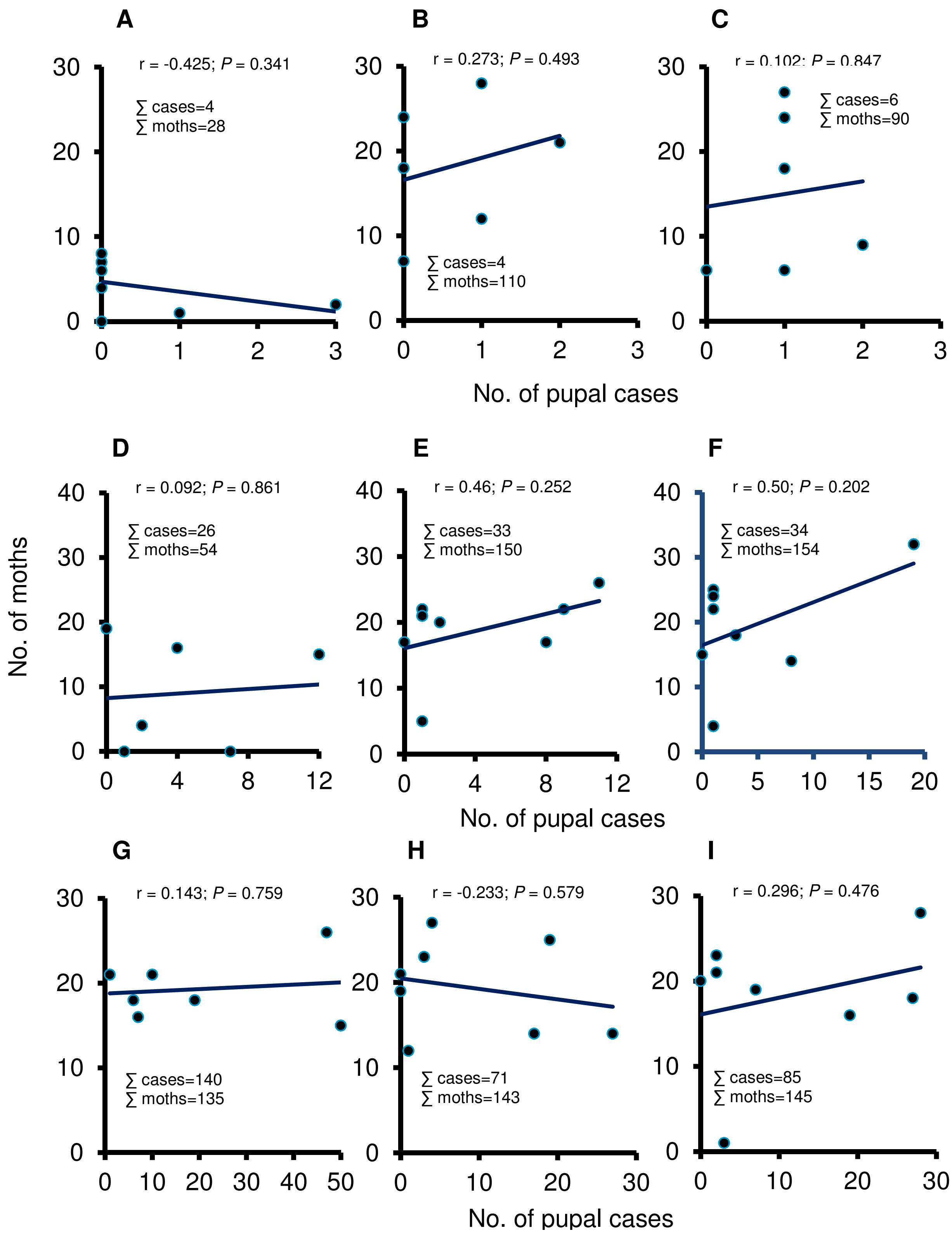

Fig. 4. Weekly GRB pupal case counts and male moth captures in vineyard blocks with low (A, B, C), intermediate (D, E, F) and high (G, H, I) infestation levels

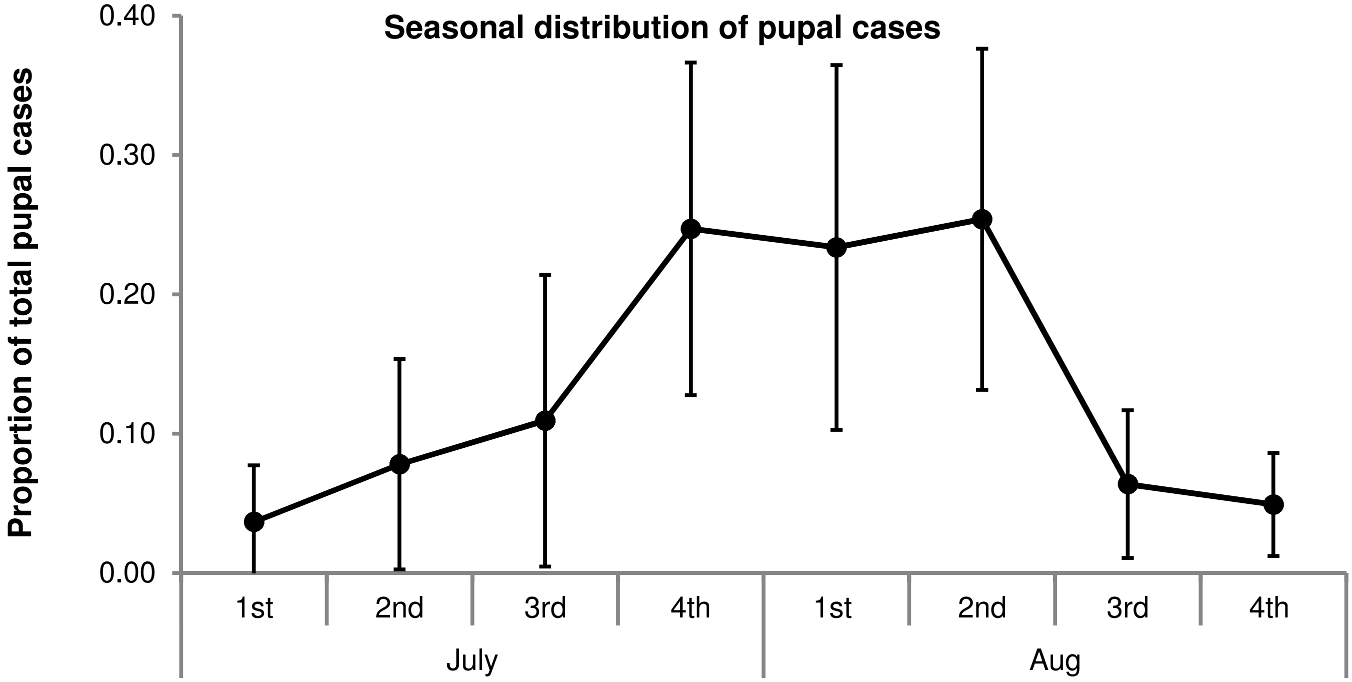

Fig. 5. Mean ± SD proportion of weekly pupal case counts from vineyard blocks in Virginia (2008-2011)