Poinsettia (*Euphorbia pulcherrima*) cultivar-mediated suitability to *Bemisia tabaci* (biotype B) (Hemiptera: Aleyrodidae) and impact on *B. tabaci* life history traits

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Abstract

Greenhouse trials were conducted to evaluate the performance and preference of the silverleaf whitefly, *Bemisia tabaci* (Gennadius) biotype B, on nine poinsettia cultivars, *Euphorbia pulcherrima* Willd. ex Klotzsch. The objective was to identify varieties that show different levels of suitability for whitefly attack. Our ultimate goal is to identify potential tolerance/resistance traits that could be used for production of future cultivars. Plant susceptibility to *B. tabaci* was compared among cultivars in choice and no-choice experiments. In the choice experiment the number of whitefly adults settling on the cultivars was used to assess preference. In the no-choice experiment whitefly F1 oviposition, nymph developmental time, and survivorship was measured and used to develop life tables and obtain the net replacement rate of whitefly populations growing in each cultivar. Significantly more whiteflies preferred settling on Early Prestige Red compared to Prestige Red, which was the less preferred cultivar. Fecundity of F1 was significantly greater on Freedom Red, Freedom White, Early Prestige Red, and Peterstar White compared to Prestige Red and Enduring Red. Among the cultivars accumulating more dry matter were Early Prestige Red, Peterstar White, and Prestige Red. Early Prestige Red and Prestige Red had opposite whitefly responses, but similar dry matter accumulation, suggesting differences may be due to traits other than rapid growth.

Introduction

Poinsettias, *Euphorbia pulcherrima* Willd. ex Klotzsch, rank as the nation's top selling potted ornamental. The most important and prevalent insect pest attacking poinsettias is *Bemisia tabaci* (Van Driesche and Lyon 2003) Gennadius Biotype B. This insect feeds from the stems and leaves weakening the plant and often causing aesthetic problems. A previous study where the response of the greenhouse whitefly, *Trialeurodes vaporariorum*, was evaluated on sixty-eight cultivars suggested that the greenhouse whitefly preferred infesting white bracts versus red bracts (Fischer and Shanks, 1999).

Unfortunately, in recent years there have not been any studies evaluating *B. tabaci* preference for current poinsettias cultivars. Thus the industry could benefit from an in depth analysis of whitefly preferences for particular poinsettia cultivars. Our overall objective was to determine the preference and performance of *B. tabaci* to nine cultivars of poinsettias through the use of choice and no-choice tests. Our future goal is to find resistance traits that could potentially be incorporated in pest management programs in greenhouses.

Materials and Methods

Insect and host plants. *B. tabaci* were obtained from a colony reared on poinsettias and located at the Entomology Department OSU/OARDC. Nine poinsettia cultivars were provided by commercial growers as rooted cuttings. Plants were fertigated using a mixture of 20-10-20 and 15-5-15 for all cultivars.

Choice preference test. *B. tabaci* preference was measure by counting the number of whiteflies settling on poinsettia plants after a 24 h exposure. A mesh cage (70x70x40 cm) containing nine randomly placed plants (one from each cultivar) was used and 180 whitefly pairs were released by placing them at the center of the cage. The experiment was replicated 5 times.

No-choice test. A separate group of 45 plants were used for this experiment. We placed three clip cages per plant, each containing six pairs of whiteflies which were left to oviposit for 24 h.

Upon egg hatching, egg mortality was assessed and six nymphs per plant were marked to measure nymph developmental time. Observations were taken at two-day intervals until emergence (Fig.2). After adults emerged, we selected 3 recently emerged females and placed them inside a clip cage on a poinsettia leaf for 7 days to measure F1 fecundity. Dry weight of leaves for each cultivar was measured.

Design and data analysis. A randomized complete block design was used. All data was analyzed using ANOVA (SAS Institute, 2005). Mean separation analysis was done using the Waller-Duncan K-ratio test. Nymph development was analyzed using life tests.

Fig. 1. *B. tabaci* and a poinsettia damaged by a large whitefly population.

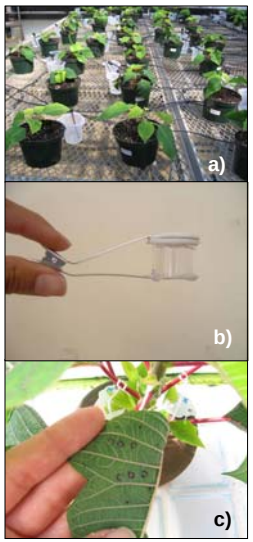

Fig. 2 . No-choice test.
a) Randomized complete block design;
b) Clip cages with 6 whitefly pairs each;
c) Leaf showing marked whitefly nymphs.

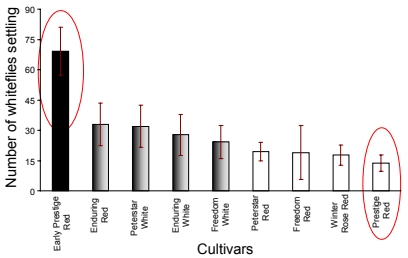

Fig. 3. Choice test. Average number of whitefly pairs settling on the cultivars ± SEM after a 24 h exposure. Columns black and white are significantly different at an alpha= 0.05. Data analyzed via RCB ANOVA and Waller-Duncan K-ratio test. Columns in gray are not significantly different from either black or white columns.

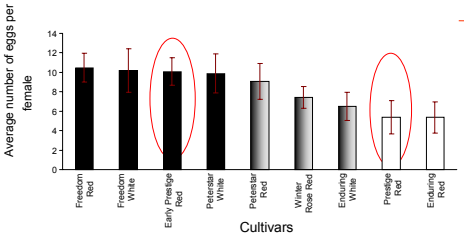

Fig. 4. No-Choice test. Fecundity of F1 females ± SEM on nine poinsettia cultivars. Columns black and white are significantly different at an alpha= 0.05. Data analyzed via RCB ANOVA and Waller-Duncan K-ratio test. Columns in gray are not significantly different from either black or white columns.

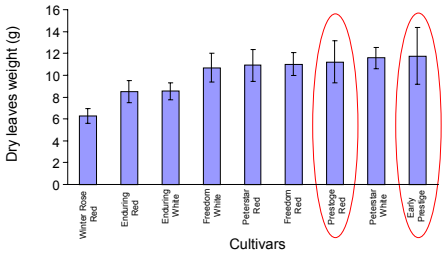

Fig. 5. Average ± SEM leaf dry weight from nine poinsettia cultivars attacked by *B. tabaci*.

Conclusions

- Whiteflies preferred settling more on Early Prestige Red and less on Prestige Red.
- Fecundity of F1 was significantly greater on Freedom Red, Freedom White, Early Prestige Red, and Peterstar White compared to Prestige Red and Enduring Red, suggesting favorable traits for development of whiteflies.
- Among the cultivars accumulating more dry matter were Early Prestige Red, Peterstar White, and Prestige Red.
- Early Prestige Red and Prestige Red had opposite whitefly responses, but similar dry matter accumulation, suggesting differences may be due to other traits than rapid growth.
- Whiteflies survival was significantly greater in Early Prestige Red compared to other cultivars, thus no differences were observed in developmental time.

Results

- There was a significant effect of cultivars on the settling preference of *Bemisia tabaci* (F= 2.93, df= 8,24, P= 0.0196). More whiteflies preferred Early Prestige Red (Fig. 3).
- Freedom White, Peterstar White, Enduring White and Red, did not differed significantly from all other cultivars (α> 0.05; Fig. 3).
- Freedom Red and White, Early Prestige Red, and Peterstar White had an effect on whitefly F1 fecundity (F= 2.76, df= 8,32, P= 0.0207) receiving higher egg oviposition than Prestige Red and Enduring Red (α= 0.05; Fig. 4).
- No differences were observed in nymph emergence among all cultivars (F= 1.12, df= 8,32, P= 0.3765).
- The dry leaves' weight indicate Early Prestige Red accumulated the most dry matter (Fig. 5).
- Survival distribution function was significantly higher for Early Prestige Red compared to Freedom Red and Prestige Red (Log-Rank X^2=49.16, df=8, P < .0001).

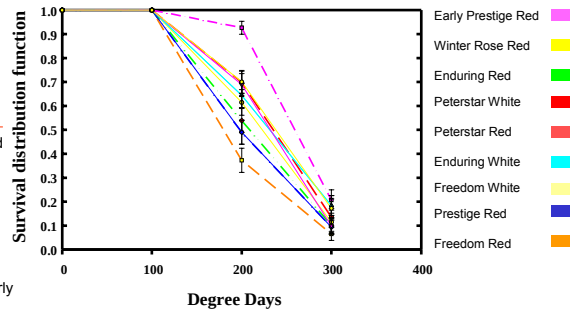

Fig. 6. Survival distribution function of whiteflies growing on nine poinsettia cultivars. Silver leaf whitefly survivorship was significantly greater on Early Prestige Red (log-rank statistics= 49.16, P < .0001).

Discussion

The growth differentiation balance model predicts that resource availability impacts constitutive secondary metabolism by means of tradeoffs between growth and storage processes and secondary metabolism pathways (Herms and Mattson, 1992). If growth and storage are stimulated without affecting photosynthesis, it is possible for secondary defenses to decline. This may be one explanation why whiteflies did much better on Early Prestige Red, in general, compared with the other cultivars, but further analyses will be needed to confirm this hypothesis. Notice, Early Prestige Red and Prestige Red had opposite whitefly responses, but had almost the same dry leaf matter accumulated, suggesting differences may not be due to rapid growth of plants, but due to other traits. Furthermore, the survival distribution function indicates whiteflies survived more on Early Prestige Red, supporting the observations found in the choice and no-choice tests.

Acknowledgements

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