New Chemistry Insecticide Seed Treatments to Control Hessian Fly, *Mayetiola destructor*

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Abstract

The Hessian fly (HF), *Mayetiola destructor* (Say), has been a periodical pest in Kansas for the past 100+ years (Dean and McCulloch, 1915). Plant resistance and insecticide seed treatments are the best and most consistent grower-controlled management tools and conventional insecticide seed treatments have been very effective (Wilde et al. 2001). However, new chemistries are periodically needed to retard resistance and it must be determined if these new chemistries are as effective as those that are commercially available. The treatments tested in this experiment did not provide effective or acceptable control of HF larvae. Because the HF is an important pest of wheat worldwide, the development and screening of these new insecticides will help Kansas wheat producers as well as wheat producers in all wheat producing regions of the world (Stuart et al., 2012).

Purpose

The purpose of this research was to test new chemistry insecticide seed treatments to determine if they provide control of *M. destructor* larvae.

Questions, Hypotheses, and Predictions

Question:
Are *M. destructor* larvae controlled by the new chemical seed treatments? Also, which treatments have the best efficacy for mitigating the pest?

Hypothesis:
New chemistry seed treatments can be used to effectively control *M. destructor* larvae.

Prediction: Seed treatments will be highly efficacious and will have commercial applicability.

Methods and Experimental Design

This experiment was conducted in the Kansas State University Greenhouses. On Nov. 1, 2017 seeds treated with new chemistry insecticides were planted into 0.5m by 0.4m (0.1m deep) flats. The 9 seed treatments and untreated check were randomly arranged in each flat and there were 4 replications (flats). After one week, when wheat was at the 2 leaf stage, each flat was placed in a 0.6m by 0.6m square (0.9m high) cage (Bioquip®). Approximately 36 gravid female HFs were introduced into each cage via an aspirator. Flats were left in cages for 5 days to allow HF females to deposit eggs. On Nov. 27, 2017, wheat plants were individually harvested and the number of HF larvae on each plant recorded. Data were analyzed using SAS 9.4 , PROC GLM procedure.

Left photo: HF females being aspirated and placed in cages containing wheat plants.

Right photo: peeling back the leaf sheath to check for HF larvae

Hessian fly developmental stages – from left to right: larvae, pupae, and adult

Results

Seed Treatment	Mean No. of HF larvae/plant
1	3.7 b
2	6.9 a
3	4.7 b
4	4.0 b
5	5.2 a
6	2.4 c
7	4.6 b
8	4.4 b
9	4.0 b
Untreated Check	4.8 b

Treatment means followed by the same letter are not significantly different ($P \leq 0.05$)

Study System

The Hessian fly is an important pest of wheat worldwide. In Kansas, adult flies deposit eggs on young winter wheat, *Triticum aestivum* L., in the fall. Emerging larvae move to the base of the plant and feed between leaf sheaths. Larval feeding negatively impacts plants and can lead to additional plant stress, yield loss, and winter kill (Ratcliffe and Hatchett 1997). The goal of systemic insecticide seed treatments is to kill larvae as they begin feeding, thus mitigating further damage to wheat.

Conclusions

In this experiment, seed treatment no. 6 had significantly fewer larvae than the untreated check or any of the other seed treatments. However, there was still an average of over 2 larvae per plant, which may still result in severe stress or death of seedling wheat plants. Seed treatments no. 2 and 5 had significantly more HF larvae than the untreated check. Overall, the results indicate that none of these new chemistry insecticide seed treatments are efficacious against HF larvae and therefore may not have commercial applicability.

Future Directions

- ❑ Seed treatment no. 6 may warrant further investigation (higher rates).
- ❑ Lack of efficacy of these seed treatment insecticides does not negate the need for new chemistry, which is important in delaying the development of resistance and for further testing on new chemicals that would have higher efficacy.
- ❑ Further studies could also determine where insecticide is expressed in the plant, especially around tissues where early instar HF larvae are feeding.

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