Section IV: Field Crop Pests (includes cereals and vegetables)

INSECT ABUNDANCE AND ITS ASSOCIATION WITH ERGOT DISEASE OF GRASS SEED CROPS

Navneet Kaur[1], Jeremiah K.S. Dung[2], Robert A. Cating[1], Stephen C. Alderman[3], Darrin L. Walenta[4], Silvia I. Rondon and Philip B. Hamm[1]
[1]Hermiston Agricultural Research and Extension Center, Hermiston, OR
[2]Central Oregon Agricultural Research Center, Madras, OR
[3]USDA-ARS National Forage Seed Production Research Center, Corvallis, OR,
[4]Oregon State University, Union County Extension Service, La Grande, OR
Navneet.Kaur@oregonstate.edu, Jeremiah.Dung@oregonstate.edu, Robet.Cating@oregonstate.edu, Aldermas@onid.orst.edu, Darrin.Walenta@oregonstate.edu, Silvia.Rondon@oregonstate.edu, Philip.B.Hamm@oregonstate.edu

Ergot, a seed replacement disease caused by a fungal pathogen *Claviceps purpurea*, is a great challenge for Kentucky bluegrass (KBG) and perennial ryegrass (PRG) seed producers in the Columbia Basin region of Oregon and Washington. This disease reduces yield, hinders seed certification efforts, and has been particularly difficult to manage even with multiple fungicide applications. The fungus infects the unfertilized flowers and results in the production of conidia carried in a sugary exudate known as honeydew which is believed to attract feeding insects and thus may contribute to disease spread. The ovarian content is replaced by fungal mycelium resulting into sclerotia formation instead of seed. Growers' concerns and inadequate information about insect vectors prompted the initiation of this study to understand the role of insects in ergot dispersal. Furthermore, insect population structures may shift with changes in climate and crop management practices over the years. Therefore, the first year of a multiyear survey was conducted to study insect population dynamics and seasonal diversity in PRG and KBG field.

Arthropod diversity was monitored in KBG fields during the 2006-2008 growing season. Sampling methods included pitfall traps, sweep netting, and sod sampling. Coleopterans (beetles) were the most abundant group (44% of total insects collected) closely followed by dipterans (flies, 22%) and hemipterans (true-bugs, 16%) (http://cropandsoil.oregonstate.edu/seed-ext/Pub/2007/18-Rondon.pdf). An additional survey was carried out to monitor the relative abundance of insects in both KBG and PRG field during April-June 2009. The species composition (Fig.1) indicated that higher populations of beneficial insects, including ground beetles occurred in KBG fields consistent to our previous results. In contrast, higher numbers of hymenopterans and flies were present in PRG fields. The difference in the population structure in these two crops could be due to the differences in the crop, management practices or food availability. Therefore, a subsequent study was done to determine the population dynamics and association of insects with ergot infection.

Insect abundance was monitored in four commercial KBG and PRG fields each from May to June 2014. The sampling techniques included universal black light traps, delta traps, yellow sticky cards, and modified sweep netting. Insects were sorted, counted and stored at −20ºC until microscopic examination for the presence of fungal spores. Ergot presence in or on insects was confirmed using a high-fidelity polymerase chain reaction (HF-PCR) developed in this study. Ergot incidence in the commercial fields was calculated based on the number of infected seed heads out of 100 seed heads collected from each quadrant of field sampled. Correlations between ergot incidence and insect abundance were calculated.

Dipteran insects comprised 60% of the total insect collected during the sampling period (Fig. 2) indicating that muscid flies comprised a larger proportion of the insect community in grass seed crops. These results confirm our previous findings in 2009 as higher population of *Fannia canicularis* (L.) (Muscidae), the lesser house fly occurred in PRG fields, suggesting the favorability of food resources. A significant positive association existed between insect abundance and ergot incidence in PRG fields surveyed (Fig. 3). However no association could be established in KBG fields because ergot incidence was negligible (data not shown). Microscopic examination revealed the presence of ergot conidia in the insect gut which was then confirmed with HF-PCR. Representative samples were cloned and sequenced to confirm *Claviceps purpurea*. Up to 35% of flies and 27% of moths tested positive (Fig. 4) for ergot using HF-PCR. Understanding the importance and the mechanism of insect-mediated ergot dispersal may aid in developing new strategies to manage this disease.

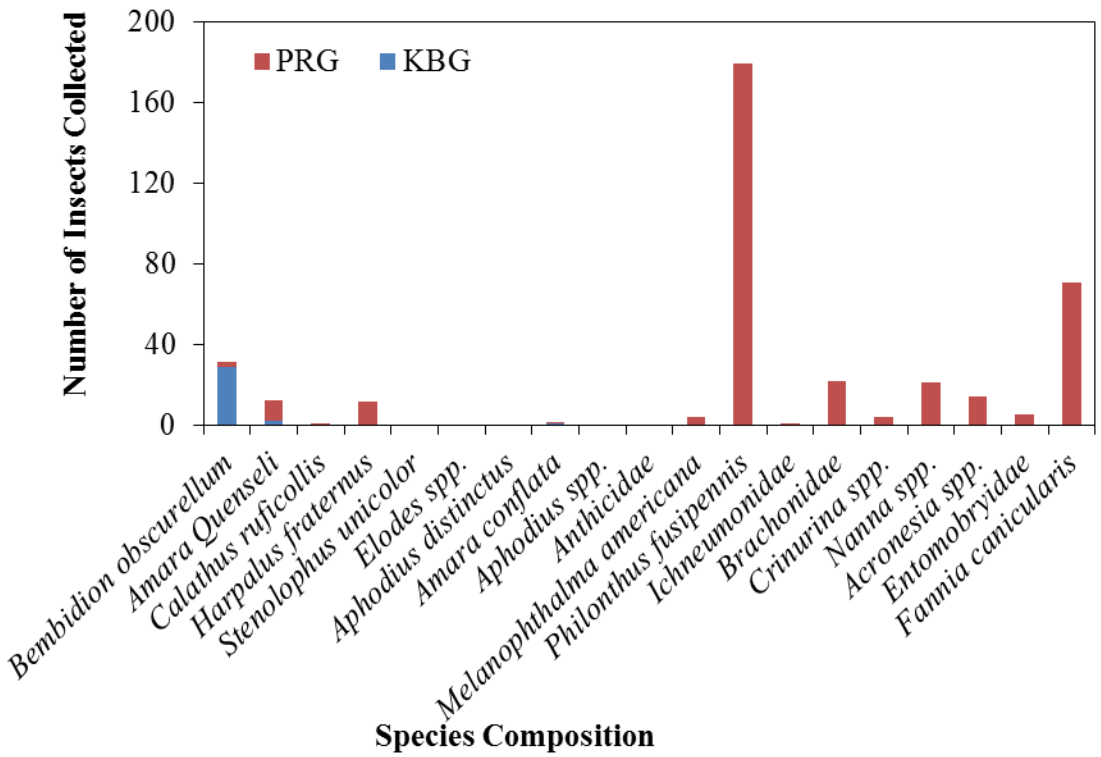

Fig. 1. Species abundance in perennial ryegrass and Kentucky bluegrass fields between April and June 2009.

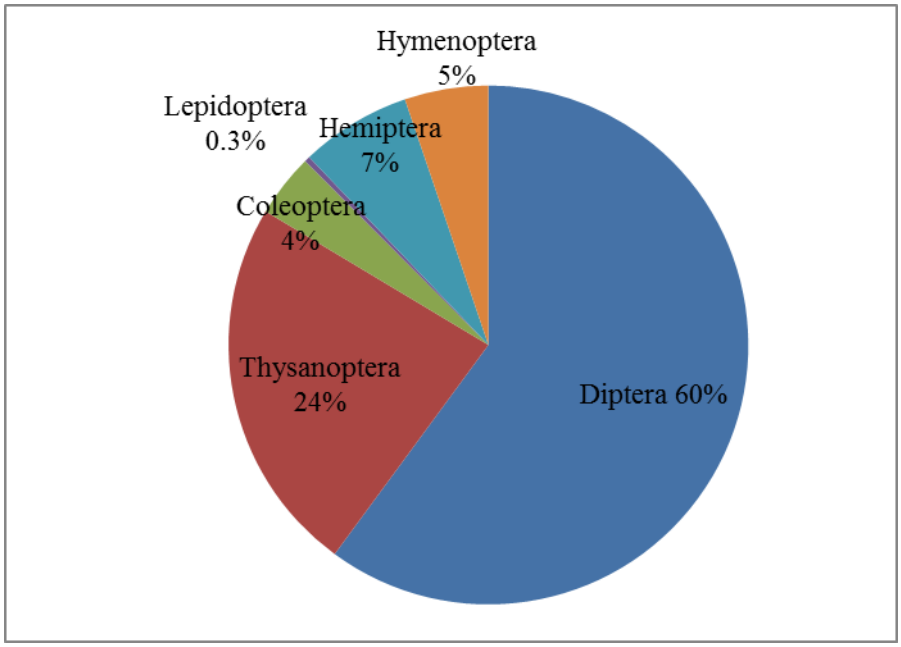

Fig. 2. Relative abundance of insect groups collected from commercial Kentucky bluegrass and perennial ryegrass seed fields during May and June 2014.

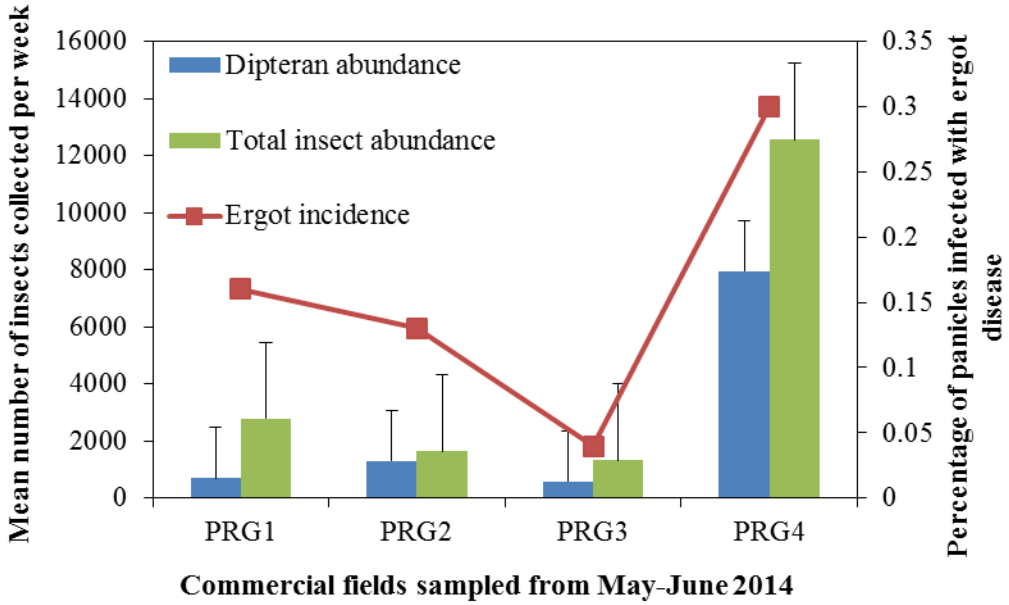

Fig. 3. A significant positive correlation ($r = 0.9$, $P < 0.05$) existed between insect abundance and ergot incidence in four commercial perennial ryegrass (PRG) fields during May and June 2014.

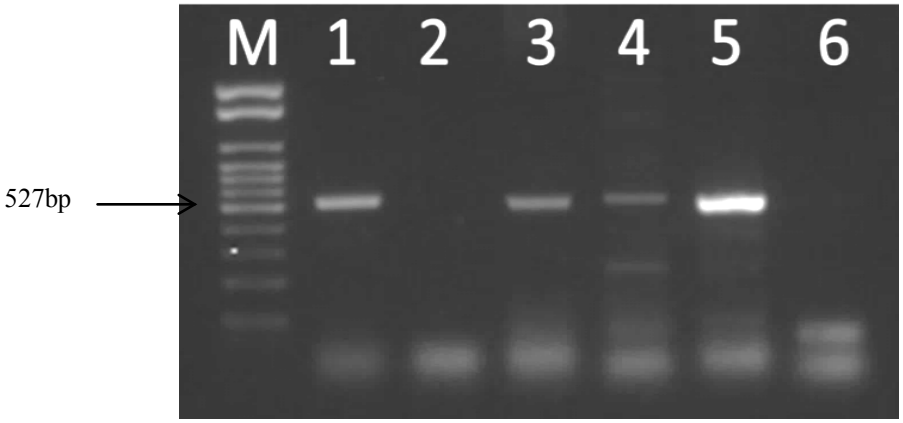

Fig. 4. Agarose gel results obtained from a high-fidelity polymerase chain reaction used to detect the presence of ergot on/in insects. M= molecular marker; Lane 1 = positive control; Lane 2 = negative control; Lanes 3-6 = insect samples collected from perennial ryegrass fields with ergot. The ergot beta-tubulin gene amplification product occurs at ~527bp length.