

ROLE OF INSECTS IN THE DEVELOPMENT OF ERGOT IN KENTUCKY BLUEGRASS GROWN FOR SEED IN THE PACIFIC NORTHWEST

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Abstract

*The relationship of insects to the spread of ergot (*Claviceps purpurea*) is of particular concern because ergot is an important pathogen of Kentucky bluegrass. A survey was conducted of insects active in seed-production fields of Pacific Northwest Kentucky bluegrass (*Poa pratensis*) from anthesis to harvest. Locations included the Rathdrum Prairie near Post Falls, Idaho, the Madras and Culver areas of central Oregon, and the La Grande and Imbler areas of the Grande Ronde Valley, Oregon. Sampling methods included use of sweep nets, Schun shaker, black light collectors, and soil samples. A reference collection of insects by field and location was made using individuals collected from sweep nets and black light collectors; it is being maintained at the Central Oregon Agricultural Research Center, Madras, Oregon.*

Introduction

An understanding of the interactive dynamics of the insect populations and their association with ergot (*Claviceps purpurea*), is essential to development and evaluation of control strategies. This is especially true in development of cropping systems where field ecological relationships may vary among production systems, including nonthermal residue management. Results of this study may be useful in understanding host insect interaction or other disease-vector relationships.

For the 1996 season, the project focused on conducting a survey of insects active in seed production fields of Pacific Northwest Kentucky bluegrass (*Poa pratensis*) from anthesis to harvest. This study provides an important baseline from which to compare future studies, both locally and regionally. This information is an essential prerequisite to understand the role of insects in current production systems in the Pacific Northwest. The effect of alternative management approaches, e.g., nonthermal, on insect population and species abundance is unknown. Of particular concern is the effect of nonthermal management on populations of economically important insects, which impact the crop directly or indirectly as vectors of plant pathogens.

The relationship of insects to the spread of ergot is of particular concern because this is an important pathogen of Kentucky bluegrass. The current survey information will be instrumental to identify individuals fitting the profile for spore-carriers, which may have a significant impact in the spread of ergot. To be initiated during the 1997 season is the portion of the project involved with collecting and identifying individuals that carry spores of ergot; this portion will include established methods for collecting insects as separate individuals or groups to prevent cross-contamination.

Methods and Materials

During 1996, nine fields of grass seed planted across the Pacific Northwest were sampled at the initiation of anthesis and before harvest to identify insects active in the fields from flowering through harvest. Three Kentucky bluegrass seed fields were sampled at each of three locations: Rathdrum Prairie, Idaho, central Oregon and the Grande Ronde Valley, Oregon. Sampling methods included the use of sweep nets, Schun shakers, black-light collectors and soil samples.

Three sets of samples were collected from three field (cv. 'Shamrock', 'Midnight', and Plush) near Rathdrum, Idaho on June 10-11, June 25 and July 8, 1996. Samples were collected during flowering and prior to harvest from three locations (cv. 'Bristol' and 'Coventry') near Imbler, Oregon on June 12 and July 9-10, 1996. In central Oregon samples were collected near Madras from the 'Coventry' field on June 17 and July 7, 1996 and from the 'Gnome' field June 7 and July 7, 1996. Samples from the 'Coventry' field near Powell Butte, Oregon, were collected on June 21 and July 12, 1996.

Insect sweeps included 10 replications of 10 sweeps in an hour-glass pattern across the field. Samples were stored in a cooler until being placed in a freezer to kill the insects. Insects were manually separated from foreign material including pollen and seed. A representative series of each insect type was pinned for each field and identified by location and date of collection.

A Schun shaker with methyl ethyl ketone was used to collect smaller insects from grass heads and foliage. Four, 1 if samples were collected from the four quadrants of each field and placed in the shaker. Insects were collected in a jar at the base of the shaker, then transferred to vials containing ethyl alcohol. Identifications were made and numbers of each insect type recorded.

Soil samples of 1 & were also collected from the four quadrants of each field. Samples were placed in zip-lock bags and refrigerated until placement in Berleze funnels. Samples were collected at the base of the funnels in jars containing ethyl alcohol. Insects were manually separated from soil particles and other material using 20, 40 and 60 mesh sieves, then transferred to vials containing ethyl alcohol.

A black-light moth trap with a pest-strip fumigant was set in the center of each field at dusk for collection of night-flying moths, with the exception of the first sample dates at each location. A random sample of moths was retrieved the following morning from the traps. A representative series of individuals from each location was mounted and identified.

Results

Table 1 provides the order, family, common name and characteristics for insects collected by sweeps across the sampling area. Of the 31 insect groups collected 13 are considered

beneficial, 12 are considered pests, and 6 are considered neutral. Insect groups considered economic pests on grass seed include wireworms (Coleoptera, Elateridae), pyralid moths (Lepidoptera, Pyralidae), and cutworms/armywounds (Lepidoptera, Noctuidae). Some insects not considered economic pests in Kentucky bluegrass are important pests of other crops. With changes in management practices in Kentucky bluegrass, there is a potential for changes in the spectrum of pests. Insect groups considered economically beneficial include ladybird beetles (Coleoptera, Coccinellidae), minute pirate bug (Hemiptera, Anthocoridae), big-eyed bug (Hemiptera, Lygaeidae), and the parasitic wasps (Hymenoptera).

Insects collected from sweeps are identified by location and field cultivar in Table 2. One hundred percent of the fields sampled contained predatory damsel bugs (Hemiptera, Nabidae), ninety percent contained flies (Diptera) and leafhoppers (Homoptera, Cicadellidae), over seventy percent had predaceous lady bird beetles (Coleoptera, Coccinellidae) and lygus bugs (Hemiptera, Miridae), and sixty-two percent of the fields contained predatory big-eyed bugs (Hemiptera, Lygaeidae). Trends of significant insect groups indicate that the general predators, big-eyed bug and green lacewing, were more prominent in central Oregon than the other growing areas. On the Rathdrum Prairie the predatory ichneumon wasp was more abundant during the early collection and the minute pirate bug numbers were high during the later collection.

Insects collected with the Schun shaker and soil samples are identified by location and field cultivar in Tables 3 and 4, respectively. The predominant species across fields in the three growing areas were aphid, leafhopper, and thrips.

Most of the moths captured in bluegrass fields in all areas were functional grass-feeders. A few moths feeding on herbs or hardwoods were also captured, but these were probably strays from outside the fields. The herb-feeders were likely straying from other crops or weedy areas surrounding the grass field.

Of the grass-feeders, the most common species at all sites was *Protagrotis obscura*. This is a generalized cutworm that feeds on both grasses and herbs. It is often extremely abundant in agricultural lands throughout central and eastern Oregon but is scarce or absent in natural habitats. This species was dominant at the 'Plush' and 'Shamrock' sites on the Rathdrum Prairie and the 'Bristol' site in the Grande Ronde Valley. However, the cutworm comprises less than half the moths at the 'Coventry' site in the Grande Ronde Valley and the 'Coventry' site in Central Oregon.

In terms of species diversity, the Rathdrum prairie yielded only two species of moths, while the Oregon sites yielded 4-6 species per site. With the exception of *Protagrotis obscura*, all of the grass-feeding moths collected are typical of moist habitats, and are very common in higher elevations of the Blue Mountains and Cascade Range. An interesting feature of this moth fauna in bluegrass fields was the total absence of species found in more desert grasslands such as the sagebrush-bunchgrass habitat.

Table 1. Orders, families, common names and characteristics for insects collected by sweeps, Schun shaker collection, and soil samples in Kentucky bluegrass seed fields on the Rathdrum Prairie, in central Oregon, and in the Grande Ronde Valley.

Order	Family	Common Name	Characteristics
Coleoptera	Bruchidae	Seed beetles	Pests attacking beans and peas
	Carabidae	Ground beetles	Predaceous beneficials
	Chrysomelidae	Leaf beetles	Many are serious pests
	Coccinellidae	Ladybird beetles	Adults, larvae are predaceous
	Curculionidae	Snout beetles (weevils)	Plant feeders, serious pests
	Elateridae	Click beetles (wireworms)	Mixed group, root-feeding larvae
	Ostomidae	Bark-gnawing beetles	Most innocuous, some grain feeders
	Straphylinidae	Rove beetles	Most predators, some scavengers
Collembolia	Hypogastruridae	Springtails	Most are harmless to crops
	Isotmididae	Springtails	Most are harmless to crops
Diptera		Flies	Mix of beneficials and pests
Hemiptera	Anthocoridae	Minute pirate bug	Predaceous beneficials
	Lygaeidae	Seed bugs (big-eyed bug)	Both predators and pests
	Miridae	Leaf or plant bug (lygus)	Feed on plants, some serious pests
	Nabidae	Damsel bug	Predators
	Rhopalidae	Scentless plant bugs	Plant feeders including Boxelder bug
	Scutelleridae	Shield-backed bugs	Plant feeders
Homoptera	Aphididae	Aphids	Most serious pests, some vectors
	Cicadellidae	Leafhoppers	Many serious pests, some vectors
	Delphacidae	Delphacid planthoppers	Plant feeders
Hymenoptera	Braconidae	Braconid wasps	Parasitic larvae
	Chalcididae	Chalcidid wasps	Parasitic larvae
	Cynipidae	Cynipid wasps	Some parasitic, some gall-forming
	Ichneumonidae	Ichneumon wasps	Parasitic on many noxious insects
Lepidoptera	Pyralidae	Pyralid moths	Many pests of cultivated plants
Neuroptera	Chrysopidae	Green lacewings	Adults, larvae feed mostly on aphids
Odonata	Coenagrionidae	Damselflies	Predators
	Lestidae	Damselflies	Predators
Orthoptera		Grasshoppers	Many important pests
Plecoptera	Acrididae	Stoneflies	No economic importance
Thysanoptera	Thripidae	Thrips	Most economic pests

Table 3. Insects collected from Schun shaker samples, in seed fields of Kentucky bluegrass by location and field cultivar, 1996 season.

	Rathdrum Prairie, ID									Central OR						Grande Ronde Valley, OR					
	Shamrock			Plush			Midnight			Coventry		Gnome		Coventry		Bristol		Coventry		Bristol	
	6-10	6-25	7-8	6-11	6-25	7-8	6-10	6-25	7-8	6-17	7-7	6-7	7-7	6-21	7-12	6-12	7-9	6-12	7-10	6-12	7-9
Diptera	x	x												x		x					
Hemiptera																					
Lygaeidae																					x
Homoptera																					
Aphididae	x	x	x		x	x		x						x	x		x	x		x	x
Cicadellidae	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
Thysanoptera																					
Thripidae	x	x	x		x	x	x	x		x	x	x	x	x	x	x		x			x

Table 4. Insects collected from soil samples in Kentucky blue grass seed fields b location and field cultivar during the 1996 season

	Rathdrum Prairie, Idaho									Central Oregon						Grande Ronde Valley, Oregon					
	Shamrock			Plush			Midnight			Coventry		Gnome		Coventry		Bristol		Bristol		Bristol	
	6-10	6-25	7-8	6-11'	6-25'	7-8'	6-10	6-25'	7-8	6-17	7-7	6-7	7-7	6-21'	7-12	6-12'	7-9	6-12'	7-10	6-12	7-9
Coleoptera																					
Elateridae							x														
Staphylinidae																					x
Collembola																					
Hypogastruridae										x				x							x
Isotomidae														x							
Diptera										x											x
Hemiptera																					x
Lygaeidae																					x
Nabidae																					
Homoptera																					
Aphididae	x		x							x				x							
Cicadellidae	x		x										x								
Neuroptera																					
Chrysopidae																					
Thysanoptera																					
Thripidae	x		x				x			x											

'Collection dates without insect representation indicate samples without any individuals.

Table 5. Moths collected from black light traps in Kentucky bluegrass seed fields by location and field cultivar during the 1996 season.

Genus species	Characteristic	Rathdrum Prairie, ID		Central OR	Grande Ronde Valley, OR	
		Shamrock 7-8	Plush 7-8	Coventry 7-12	Bristol 7-9	Coventry 7-10
<i>Agroperina dubitans</i>	grass feeder	x				x
<i>Agroperina lateritia</i>	grass feeder					x
<i>Aletia oxygala</i>	grass feeder					
<i>Amphipyra tragopoginis</i>	herb feeder					
<i>Apath ea amputatrix</i>	grass feeder					
<i>Caenurgina erechtea</i>	herb feeder					x
<i>Crymodes devastator</i>	grass feeder					
<i>Leucania farcta</i>	grass feeder					
<i>Malacosoma californica</i>	hardwood feeder					
<i>Melanchra picta</i>	herb feeder					
<i>Oligia violacea</i>	unknown					
<i>Paonias excaecatus</i>	hardwood feeder					
<i>Protagrotis obscura</i>	grass feeder	x				x
<i>Smerinthus cerisyi</i>	grass feeder					
<i>Xestia dolosa</i>	herb feeder					