ROLE OF INSECTS IN THE DEVELOPMENT OF ERGOT IN KENTUCKY BLUEGRASS GROWN FOR SEED IN THE PACIFIC NORTHWEST, 1998

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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 *(Poa pratensis).* This is the third year of a survey conducted to evaluate insects active in fields producing Pacific Northwest Kentucky bluegrass seed just before 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 in northeast Oregon. Sample methods included use of sweep nets, Schun shaker, and black light collectors. A reference collection of insects by field and location was made for identification, along with a second collection on sticky cards using modified equipment to analyze individuals for the presence of ergot conidia.

Introduction

An understanding of the interactive dynamics of insect populations, and their association with ergot, is essential to develop and evaluate control strategies. This is especially true in development of cropping systems where field ecological relationships may vary among production systems, including nonthermal residue management. This is the third year of a 3-year project to understand host insect interaction and other disease vector relationships.

During 1996, the project focused on conducting a survey of insects active in fields producing Pacific Northwest Kentucky bluegrass seed from anthesis to harvest. This study provided an important baseline from which to compare future studies, both locally and regionally. • This information was 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 was unknown. Of particular concern is the effect of nonthermal management on populations of economically important insects that impact the crop directly, or indirectly as vectors of plant pathogens.

During 1997, insects active in Kentucky bluegrass fields of the Pacific Northwest were collected using traditional methods for identification purposes, and a second group of individuals were collected separately on sticky traps using modified equipment to prevent cross-contamination of ergot conidia between insects. Insects on sticky traps were evaluated by Steven Alderman, Plant Pathologist with the National Forage Seed Production Research Center, for the presence of ergot conidia.

The objectives for 1998 were to gather a second year of data in Kentucky bluegrass fields of the Pacific Northwest, following collection and evaluation procedures used during 1997.

Methods and Materials

Seven Pacific Northwest Kentucky bluegrass fields were sampled to identify insects active in grass seed during flowering and to determine which of these carry ergot conidia. Samples were taken just before harvest from two or three Kentucky bluegrass seed fields at each of the three locations: Rathdrum Prairie, Central Oregon and the Grande Ronde Valley. Sampling methods included the use of sweep nets, Schun shakers, black light collectors and collection of panicles. Two collections were made at each site using traditional sweep nets, Schun shakers, and black lights, and a modified set of equipment to collect insect on 6 inch x 6 inch sticky cards. Sticky cards were used to prevent cross contamination, and they enabled individual insects to be evaluated for the presence of ergot conidia by Steven Alderman, plant pathologist with the National Forage Seed Production Research Center.

Samples were collected from three fields (cv. Shamrock, Plush, and Midnight) near Rathdrum Idaho, on June 29-30, 1998, from two fields (cv. Fairfax and Nassau) near Imbler, Oregon, on July 7, 1998, and from two fields (cv. Georgetown and Coventry) in central Oregon on July 10 and 13, 1997.

Insect sweeps were taken with a standard insect net and also with a sticky trap mounted inside a cylinder-shaped, 1/4 inch mesh screen. Four replications of 20 sweeps were taken in the four quadrants of each field. Samples were stored in a cooler until being placed in a freezer to kill and preserve the insects. A representative series of each insect type was pinned and identified with the field and date of collection.

Schun shakers with methyl ethyl ketone were used to collect smaller insects from grass heads and foliage. Grass samples, consisting of 2 if grass, were taken from each of the four quadrants of the fields and placed in a Shun shaker. Insects were collected in a jar at the base of one Shun shaker, then transferred to vials containing ethyl alcohol. A second set of grass samples was placed in a modified Shun shaker with a sticky trap placed at the bottom of the straight-sided shaker. All samples were frozen to kill the insects and preserve them until processing. Insects were identified, and the number of each insect type was recorded.

One hundred panicle samples of grass were collected from each field. After samples were air dried, the number of panicles with honeydew and sclerotia and the total number of sclerotia per sample, were recorded.

A black-light moth trap with a pest strip fumigant was placed near the center of each field at dusk to collect night-flying moths. Two sticky straps were hung around the perimeter of each black-light trap. Moths were taken from the black-light traps in the morning and stored in a freezer until mounting. Moth identification was conducted by Paul Hammond, contract researcher associated with Oregon State University, Department of Entomology.

Results and Discussion

Table 1 lists the order, family, common name and characteristics for insects collected by sweeps

across the sampling area. Insects from twenty-five groups were collected during the 1998 season. Insects considered economic pests on crops in collection areas included aphids (Homoptera, Aphididae), leafhoppers (Homoptera, Cicadellidae), thrips (Thysanoptera, Thripidae), cutworm moths (Lepidoptera, Noctuidae), and pyralid moths (Lepidoptera, Pyralidae). None of the insects collected are generally considered an economic threat on Kentucky bluegrass during flowering. Thrips have been an isolated problem during flowering, aphids numbers can build during the spring, and there are some isolated concerns about sod webworm.

Beneficial insects collected were ladybird beetles (Coleoptera, Coccinellidae), big-eyed bugs (Hemiptera, Lygaeidae), damsel bugs (Hemiptera, Nabidae), and parasitic wasps (Hymenoptera, Braconidae and Ichneumonidae). With changes in management practices in Kentucky bluegrass, there is potential for changes in the spectrum of pests and insect ecology found in the Pacific Northwest.

Insects collected from sweeps were identified by location and field cultivar (Table 2). Flies (Diptera) were found at all locations. Beneficial insects found across the three locations were ladybird beetles (Coleoptera, Coccinellidae), big-eyed bugs (Hemiptera, Lygaeidae), damsel bugs (Hemiptera, Lygaeidae), and beneficial parasitic wasps (Hymenoptera, Ichneumonidae). General crop pests found in grass fields were aphids (Homoptera, Aphididae), leafhoppers (Homoptera, Cicadellidae), and pyralid moths (Lepidoptera, Pyralidae).

Insects collected with the Schun shaker were identified by location and field cultivar (Tables 3). Thrips were the dominant insect group, with extremely high numbers found in the 'Fairfax' of the Grande Ronde Valley. Leafhoppers were found in higher numbers on the Rathdrum Prairie. Aphid numbers were relatively low across all areas.

Moths collected by black light are identified by location and field cultivar in Table 4. In general, moth populations in the three growing areas sampled resemble collections from 1996 and 1997. An areas of interest is the presence of *Chortodes rufostrigata,* which appeared in numbers at both the Madras/Culver and Powell Butte locations. This species was previously a very rare species in Oregon, and was only known from wet meadows in the Blue and Wallowa Mountains of northeast Oregon, plus one isolated record from Lake County. Both the central Oregon locations are new county records and significant range extensions for this species within the state. It is not entirely clear what is happening with this species. Quite possibly the irrigation of the bluegrass
fields is duplicating the normal wet meadow habitat of this species, allowing a naturally very rare species of montane meadows to invade and successfully occupy an artificial agricultural situation.

Indeed, the irrigation of these bluegrass fields is likely responsible for the presence of this moth fauna. Most are adapted to the moist grasslands of mountain meadows and west of the Cascades under natural conditions. Today, these bluegrass fields occupy areas that were formerly a dessert grassland or sagebrush-bunchgrass steppe. However, the xeric-adapted moths that normally live in native bunchgrass habitats never appeared in these bluegrass fields. Thus, the replacement of native desert grasslands with irrigated bluegrass fields has resulted in a total replacement of

xeric-adapted desert moth fauna with mesic-montane moth fauna that has successfully invaded and occupied these agricultural lands.

The number of egot sclerotia and honeydew per 100 panicle samples for each field was provided (Table 5). The highest levels of ergot were found in the 'Coventry' field in central Oregon, followed by those in the 'Fairfax' in the Grand Ronde Valley. No ergot was found in the 'Georgetown' field in central Oregon.

Table 1. Orders, families, common names, and characteristics of 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, 1998.

Order	Family/Genus	Common Name	Characteristics
Coleoptera	Bruchidae	Seed weevils	Pests attacking beans and peas
	Carabidae	Ground beetles	Predaceous beneficials
	Chrysomelidae	Leaf beetles	Many are serious pests
	Coccinellidae	Ladybird beetles	Adults, larvae are predaceous
	Staphylinidae	Rove beetles	Most predators, some scavengers
Diptera		Flies	Mix of beneficials and pests
Hemiptera	Lygaeidae	Seed bugs (big-eyed bugs)	Both predators and pests
	Miridae	Leaf or plant bugs	Feed on plants, some serious pests
	Calocoris		
	Hoplomachus		
	Megaloceroea		
	Monosynamma		
	Stenodema		
	Nabidae	Damsel bugs	Predators
	Pentatomidae	Stink bugs	Most plant feeders, some predators
	Scutelleridae	Shield bugs	Plant feeders
Homoptera	Aphididae	Aphids	Most serious pests, some vectors
	Cercopidae	Froghoppers, Spittlebugs	Can be pests on some crops
	Cicadellidae	Leafhoppers	Many serious pests, some vectors
	Delphacidae	Delphacid planthoppers	Plant feeders
Hymenoptera	Braconidae	Braconid wasps	Parasitic larvae
	Ichneumonidae	Ichneumon wasps	Parasitic on many noxious insects
Lepidoptera	Pyralidae	Pyralid moths	Many pests of cultivated plants
	Noctuidae	Cutworms	Common foliage feeders on many crops
Orthoptera	Acrididae	Grasshoppers	Many important pests
Thysanoptera	Thripidae	Thrips	Most economic pests

Table 2. Insects collected from sweeps of Kentucky bluegrass seed fields by location and field cultivar, 1998.

Order	Rathdrum Prairie, ID			Central OR		Grande Ronde Valley, OR	
Family	Shamrock	Plush	Midnight	Coventry	Georgetown	Fairfax	Nassau
Genus	6-29	6-29	6-30	7-13	7-10	7-7	7-7
Coleoptera							
Bruchidae			x				
Carabidae	x						
Chrysomelidae							x
Coccinellidae	x		x	x	x		x
Staphylinidae						x	
Diptera	x	x	x	x	x	x	x
Hemiptera							
Lygaeidae	x	x	x	x	x	x	x
Miridae							
Calocoris			x				
Hoplomachus		x	x				
Megaloceroea		x					
Monosynamma	x	x	x				
Stenodema							x
Nabidae		x	x	x		x	x
Pentatomidae	x						
Scutelleridae	x	x	x			x	
Homoptera							
Aphididae	x	x	x	x			x
Cercopidae	x	x	x				x
Cicadellidae	x	x	x	x	x	x	x
Delphacidae	x	x		x		x	
Hymenoptera							
Braconidae					x		
Ichneumonidae	x	x	x	x		x	x
Lepidoptera							
Pyralidae	x	x	x			x	x
Orthoptera							
Acrididae				x			x

Table 3. Average number of insects collected from Schun shaker samples in seed fields of Kentucky bluegrass by location and field cultivar, 1998.

	Rathdrum Prairie, ID			Central OR		Grande Ronde Valley, OR	
Order	Shamrock	Plush	Midnight	Coventry	Georgetown	Fairfax	Nassau
Family	6-29-98	6-29-98	6-30-98	7-13-98	7-10-98	7-7-98	7-7-98
Diptera	1	0	1	1	0	1	1
Homoptera							
Aphididae	1	1	2	2	2	4	2
Cicadellidae	12	27	9	2	1	7	6
Thysanoptera							
Thripidae	9	18	16	56	5	364	5

Table 4. Moths collected from black light traps in Kentucky bluegrass seed fields by location and field cultivar during the 1998 season.

		Rathdrum Prairie, ID			Central OR		Grande Ronde Valley, OR	
		Shamrock	Plush	Midnight	Coventry	Georgetown	Fairfax	Nassau
Genus species	Characteristic	6-29	6-29	6-30	7-13	7-10	7-7	7-7
Agroperina dubitans	grass feeder							
Aletia oxygala	grass feeder							
Apamea amputatrix	grass feeder							
Crymodes devastator	grass feeder							
Leucania farcta	grass feeder							
Protagrotis obscura	grass feeder							
Xestia dolsa	herb feeder							

Table 5. The number of ergot sclerotia and panicles with honeydew per 100 panicle samples from each of the collection sites, 1998.

	Total sclerotia per sample	Total panicles per sample	
	Ergot	Ergot	Honeydew
Rathdrum Prairie, Idaho			
Shamrock	27	15	6
Plush	18	9	2
Midnight	88	33	4
Central Oregon			
Coventry	565	87	0
Georgetown	0	0	0
Grande Ronde Valley, Oregon			
Fairfax	206	73	30
Nassau	12	8	1