

ROLE OF INSECTS IN THE DEVELOPMENT OF ERGOT IN KENTUCKY BLUEGRASS GROWN FOR SEED IN THE PACIFIC NORTHWEST, 1996

Marvin Butler, Steven Alderman, Jennifer Mucha, Glenn Fisher and William Johnston

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*). A survey was conducted to evaluate insects active in seed-production fields of Pacific Northwest Kentucky bluegrass 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 the use of sweep nets, Schun shaker, blacklight collectors, and soil samples. A reference collection of insects by field and location was made using individuals collected from sweep nets and blacklight 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 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. 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 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 is unknown. Of particular concern was 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 was of particular concern because it 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 fields (cv. Shamrock, Midnight, and Plush) near Rathdrum, Idaho on June 10-11, June 25 and July 8, 1996. Samples were collected during flowering and before 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 a 'Coventry' field on June 17 and July 7, 1996 and from a 'Gnome' field June 7 and July 7, 1996. Samples from a '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-ft² 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 ft² 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 and Discussion

Table 1 provides the order, family, common name and characteristics of insects collected across the sampling area. Insect groups considered economic pests on crops in collection

areas include wireworms (Coleoptera, Elateridae), lygus (Hemiptera, Miridae), aphids (Homoptera, Aphididae), leafhoppers (Homoptera, Cicadellidae), pyralid moths (Lepidoptera, Pyralidae), cutworms and armyworms (Lepidoptera, Noctuidae), grasshoppers (Orthoptera, Acrididae), and thrips (Thysanoptera, Thripidae). None of the insects collected are generally considered pests of economic importance 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 the sod webworm.

Insect groups considered economically beneficial include ladybird beetles (Coleoptera, Coccinellidae), big-eyed bugs (Hemiptera, Lygaeidae), damsel bugs (Hemiptera, Nabidae), parasitic wasps (Hymenoptera), and green lacewings (Neuroptera, Chrysopidae). With changes in management practices in Kentucky bluegrass, there is a 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). All samples contained predatory damsel bugs (Hemiptera, Nabidae) and flies (Diptera). Insect groups found at all locations were leafhoppers (Homoptera, Cicadellidae), predatory big-eyed bugs (Hemiptera, Lygaeidae) and parasitic wasps (Hymenoptera, Ichneumonidae and Braconidae). The predaceous ladybird beetles (Coleoptera, Coccinellidae) was found at all but one location, while pyralid moths (Lepidoptera, Pyralidae) were found at all but two locations. Commonly found in many of the fields were predacious ground beetles (Coleoptera, Carabidae), lygus (Hemiptera, Miridae), and shield bugs (Hemiptera Scutelleridae). Aphids (Homoptera, Aphididae) were not common in northwest grass fields. As indicated, the insect ecology in northwest grass fields included a variety of important beneficial insects in relatively high numbers, along with other beneficial insects whose presence varied by location.

Insects collected with the Schun shaker and soil samples were identified (Tables 3 and 4, respectively). The predominant species in Schun shaker collections across the three growing areas were aphids, leafhoppers, and thrips.

Moths collected using black lights were identified (Table 5). 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.

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 were typical of moist habitats, and were 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 sagebrush-bunchgrass habitats.

Table 1. Orders, families, common names and characteristics of insects collected by sweeps, Schun shaker, black light and soil samples in Kentucky bluegrass seed fields on the Rathdrum Prairie, in central Oregon, and in the Grande Ronde Valley, 1996.

| 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 |
| | Curculionidae | Snout beetles (weevils) | Plant feeders, serious pests |
| | Elateridae | Click beetles (wireworms) | Mixed group, root-feeding larvae |
| | Staphylinidae | Rove beetles | Most predators, some scavengers |
| Collembola | Hypogastruridae | Springtails | Most are harmless to crops |
| | Isotmidae | Springtails | Most are harmless to crops |
| 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 |
| | Hoplomachus | | |
| | Lygus | Tarnished plant bugs | Pest on seed crops |
| | Megaloceroea | | |
| | Monosynamma | | |
| | Slaterocoris | | |
| | Stenodema | | |
| | Nabidae | Damsel bugs | Predators |
| | Rhopalidae | Scentless plant bugs | Plant feeders including Boxelder bug |
| | Scutelleridae | Shield 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 |
| | Ichneumonidae | Ichneumon wasps | Parasitic on many noxious insects |
| Lepidoptera | Pyralidae | Pyralid moths | Many pests of cultivated plants |
| | Noctuidae | Cutworms | Important pest across many crops |
| Neuroptera | Chrysopidae | Green lacewings | Adults, larvae feed mostly on aphids |
| Odonata | Coenagrionidae | Damselflies | Predators |
| | Lestidae | Damselflies | Predators |
| Orthoptera | Acrididae | Grasshoppers | Many important pests |
| Plecoptera | Perlidae | 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.

| Order Family | 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 | | | | | | | | | | | | | | | | | | | | |
| Hemiptera | | | | | | | | | | | | | | | | | | | | | | |
| Lygaeidae | | x | | | | | | | | | | | | | | | | | | | | x |
| Homoptera | | | | | | | | | | | | | | | | | | | | | | |
| Aphididae | x | x | x | | 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 | 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 bluegrass seed fields by location and field cultivar during the 1996 season.

| Order Family | Rathdrum Prairie, Idaho | | | | | | | | | Central Oregon | | | | | | Grande Ronde Valley, Oregon | | | | | | |
|-----------------|-------------------------|------|-----|-------------------|-------------------|------------------|----------|-------------------|------------------|----------------|-----|-------|-----|-------------------|------|-----------------------------|------------------|-------------------|------|---------|-----|---|
| | Shamrock | | | Plush | | | Midnight | | | Coventry | | Gnome | | Coventry | | Bristol | | Coventry | | Bristol | | |
| | 6-10 | 6-25 | 7-8 | 6-11 ¹ | 6-25 ¹ | 7-8 ¹ | 6-10 | 6-25 ¹ | 7-8 ¹ | 6-17 | 7-7 | 6-7 | 7-7 | 6-21 ¹ | 7-12 | 6-12 ¹ | 7-9 ¹ | 6-12 ¹ | 7-10 | 6-12 | 7-9 | |
| Coleoptera | | | | | | | | | | | | | | | | | | | | | | |
| Elaterridae | | | | | | | | x | | | | | | | | | | | | | | |
| Staphylinidae | | | | | | | | | | | | | | | | | | | | | | x |
| Collembola | | | | | | | | | | | | | | | | | | | | | | |
| Hypogastruridae | | | | | | | | | | x | | | | | x | | | | | | | x |
| Isotomidae | | | | | | | | | | | | | | | x | | | | | | | |
| Diptera | | x | | | | | | | | x | | | | | | | | | | | | x |
| Hemiptera | | | | | | | | | | | | | | | | | | | | | | x |
| Lygaeidae | | | | | | | | | | | | | | | | | | | | | | x |
| Homoptera | | | | | | | | | | | | x | | | | | | | | | x | x |
| Aphididae | x | | x | | | | | | | x | | | | | x | | | | | | x | x |
| Cicadellidae | x | | x | | | | | | | | | x | | | | | | | | | | |
| Neuroptera | | | | | | | | | | | | | | | | | | | | | | |
| Chrysopidae | x | | | | | | | | | | | | | | | | | | | | | |
| Thysanoptera | | | | | | | | | | | | | | | | | | | | | | |
| Thripidae | x | | x | | | | | x | | | x | | | x | | | | | | | x | x |

¹Collection dates without insect representation indicate samples without any individuals.

Table 5. Noctuid 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 | | | x |
| <i>Agroperina lateritia</i> | grass feeder | | | | | x |
| <i>Aletia oxygala</i> | grass feeder | | | x | x | x |
| <i>Amphipyra tragopoginis</i> | herb feeder | | | x | | |
| <i>Apamea amputatrix</i> | grass feeder | | | | x | x |
| <i>Caenurgina erechtea</i> | herb feeder | | | | x | |
| <i>Crymodes devastator</i> | grass feeder | | | x | | x |
| <i>Leucania farcta</i> | grass feeder | | | x | x | |
| <i>Malacosoma californica</i> | hardwood feeder | | | x | | |
| <i>Melanchnra picta</i> | herb feeder | | | x | | |
| <i>Oligia viotacea</i> | unknown | | | x | | |
| <i>Paonias excaecatus</i> | hardwood feeder | | | | x | |
| <i>Protogrois obscura</i> | grass feeder | x | x | x | x | x |
| <i>Smerinthus cerisyi</i> | grass feeder | | | | | x |
| <i>Xestia dolosa</i> | herb feeder | | | | x | |

78