Distribution of *Claviceps purpurea, Gloeotinia temulenta,* and *Anguina agrostis* Among Grasses Grown for Seed in Oregon in 1989

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ABSTRACT

During the summer of 1989 a survey was initiated to determine the distribution of the grass seed diseases ergot (*Claviceps purpurea*), blind seed (*Gloeotinia temulenta*), and seed gall (*Anguina agrostis)* in the Willamette Valley of Oregon, USA. Grasses included in the survey were colonial bentgrass (*Agrostis tenuis* Sibth.), creeping bentgrass (*A. palustris* Huds.), Kentucky bluegrass (*Poa pratensis* L.), chewings fescue (*Festuca rubra* subsp. *cummutata* Gaud.), tall fescue (*Festuca arundinaceae* Schreb.), annual ryegrass (*Lolium multiflorum* Lam.), perennial ryegrass (*L. perenne* L.), and orchardgrass (cocksfoot) (*Dactylis glomerata* L.). A total of 476 fields were examined. The percentages of fields infested with ergot were 13% in colonial bentgrass and 1-8% in creeping bentgrass, bluegrass, chewings fescue, and tall fescue. Blind seed was observed in 19% of perennial ryegrass fields and 3-8% of fields of creeping bentgrass, bluegrass, chewings fescue, tall fescue, and annual ryegrass. Seed gall was observed in 5 and 3% of colonial and creeping bentgrass fields, respectively. Ergot was observed throughout the Willamette Valley. Blind seed was detected in all but the northeastern range of the Willamette Valley. Seed gall was detected only in the central-eastern area of the Willamette Valley. In annual ryegrass and tall fescue growing as weed grasses, blind seed incidence among sites sampled was 9 and 2%, respectively. Seven percent of fields in the Agency Plains and the Little Agency Plains region were infested with ergot; blind seed and seed gall were not detected.

Additional index words: **blind seed, disease survey, ergot, seed gall nematode, herbage grass seed production.**

INTRODUCTION

The fungi *Claviceps purpurea* (Tul.), casual agent of ergot; *Gloeotinia temulenta* (Prill & Delcr.) Wilson, Noble & Gray), casual agent of blind seed; and the nematode *Anguina agrostis* ((Steinbuch) Filipjev), commonly known as the seed gall nematode, are important flower infecting pathogens of grasses grown for seed in the Willamette Valley of Oregon. The pathogens replace seed with reproductive propagules, resulting in reduced seed yields.

Assessments of blind seed disease levels in the Willamette Valley were conducted by Hardison between 1941 and 1979 (Hardison, 1957, 1980). Between 1965 and 1979 blind seed was present at trace levels in less than 12% of the perennial ryegrass fields in the Willamette Valley.

In a comprehensive field survey conducted during 1988 (Alderman, 1988) low levels of blind seed were present in about a third of the ryegrass and tall fescue fields of the Willamette Valley. The survey also defined the distribution of ergot and seed gall, and the distribution of ergot in grasses growing as weeds outside commercial fields in the Willamette Valley. However, the distribution of blind seed among weed grasses was not established.

In addition to the Willamette Valley, grasses are grown for seed east of the Cascade mountains in the Agency Plains and Little Agency Plains region. Levels and distribution of ergot, blind seed, and the seed gall nematode in this region have not been quantified.

The objectives of this study were to determine the distribution of ergot, blind seed and the seed gall in the Willamette Valley during 1989, to determine the distribution of ergot and blind seed in the Agency Plains region and in annual ryegrass and tall fescue growing as weed grasses in the Willamette Valley.

MATERIALS AND METHODS

A computer data base containing a listing of grass seed production fields was obtained from the Oregon Seed Certification Service. Grasses included in the survey were colonial bentgrass (*Agrostis tenuis* Sibth.) cv. 'Highland'; creeping bentgrass (*A. palustris* Huds.) cv 'Penncross'; Kentucky bluegrass (*Poa pratensis* L.); chewings fescue (*Festuca rubra* subsp. *cummutata* Gaud.) cv. 'Cascade' and 'Koket'; tall fescue (*Festuca arundinaceae* Schreb.) cv. 'Bonanza', 'Falcon', 'Fawn' and 'Rebel II'; annual ryegrass (*Lolium multiflorum* Lam.); perennial ryegrass (*L. perenne* L.) cv. 'Linn' and 'Pennfine'; and orchardgrass (cocksfoot) (*Dactylis glomerata* L.) cv. 'Potomac' and 'Hallmark'. Lists of fields of selected cultivars for each of the grass species were generated from the data base. For annual ryegrass and Kentucky bluegrass all registered cultivars grown in the Willamette Valley were considered for sampling. Fields were located and sampled as previously described (Alderman, 1988).

During July 1989, a survey of bluegrass fields was initiated in the Agency Plains and Little Agency Plains region, which is east of the Cascade mountain range. Sixty

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Kentucky bluegrass fields were sampled. Field selection and sampling protocol were identical to that used in sampling fields in the Willamette Valley.

During August 1989, a survey of ergot and blind seed in weed grasses growing throughout the Willamette Valley was initiated. One hundred township-range-sections, representing 1.6 km square areas, were selected at random. A randomly chosen site within each section was identified. A sampling site was defined as a 120 m long by 3 m wide section on each side of a roadway transversing the section. About 20 minutes were allocated to search each site for ergot infected grasses. For blind seed assessment in weed grasses 100 tall fescue and 100 annual ryegrass plants were collected at random from each site, if sufficient numbers of heads were available. Seed was hand threshed from the heads and examined for blind seed conidia as described by Alderman (1988).

RESULTS

In colonial bentgrass, ergot, blind seed, and seed gall nematode were detected in 13, 0, and 5% of the fields, respectively (Table 1). In creeping bentgrass, ergot, blind seed and seed gall were detected in 5, 3, and 3% of the fields, respectively. Most of the colonial and creeping bentgrass fields sampled were located in the central-eastern range of the Willamette Valley. There was no apparent clustering of diseased fields.

In Kentucky bluegrass, ergot, blind seed, and seed gall were detected in 6, 6, and 0% of the fields, respectively (Table 1). Of 34 bluegrass fields sampled in the Willamette Valley, only two were observed with ergot. Of 60 fields sampled in the Agency Plains and Little Agency Plains region the percentage of fields with ergot, blind seed, or seed gall were 7, 0, and 0%, respectively. Ergot infested fields were clustered in the south-central area of the region (Fig. 1).

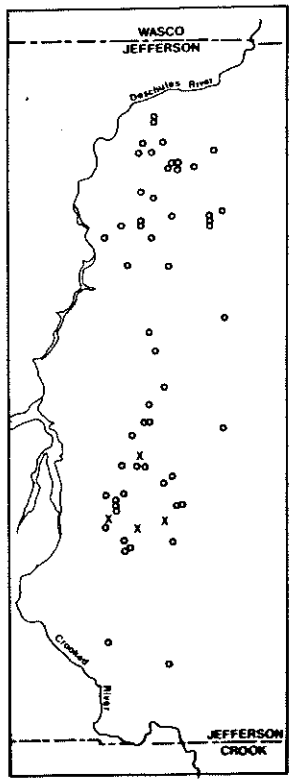

Figure 1.
Distribution of ergot among Kentucky bluegrass fields in the Agency Plains and Little Agency Plains region of Oregon during 1989. X and O represent sites where ergot was found and not found, respectively.

Table 1. Number and percentage of total fields sampled and percentage of fields with ergot, blind seed, and seed gall nematode in various grasses in the Willamette Valley in 1989.

Grass type	Number of fields sampled	% of registered fields[1]	% fields with ergot	% fields with blind seed	% fields with seed gall nematode
colonial bentgrass	38	31	3 ± 9[2]	0	5 ± 6
creeping bentgrass	37	37	5 ± 6	3 ± 5	3 ± 5
bluegrass	34	47	6 ± 6	6 ± 6	0
chewings fescue	71	38	8 ± 5	3 ± 3	0
tall fescue	130	26	1 ± 2	8 ± 4	0
annual ryegrass	25	28	0	8 ± 9	0
perennial ryegrass	63	19	0	19 ± 9	0
orchardgrass	78	26	0	0	0

[1] based on total registered fields for the cultivars sampled.
[2] ± values are 95% confidence intervals.

In chewings fescue, ergot, blind seed, and seed gall were observed in 8, 3, and 0% of the chewings fescue fields sampled, respectively (Table 1). Except for a field in Polk county, all of the chewings fescue fields sampled were located in the central-eastern area of the Willamette Valley. There was no apparent clustering of diseased fields.

In tall fescue, ergot, blind seed, and seed gall were observed in 1, 8 and 0% of the fields sampled. Tall fescue fields were sampled throughout the Willamette Valley. Blind seed was detected in all but the northeastern area of the Valley (Fig. 2A).

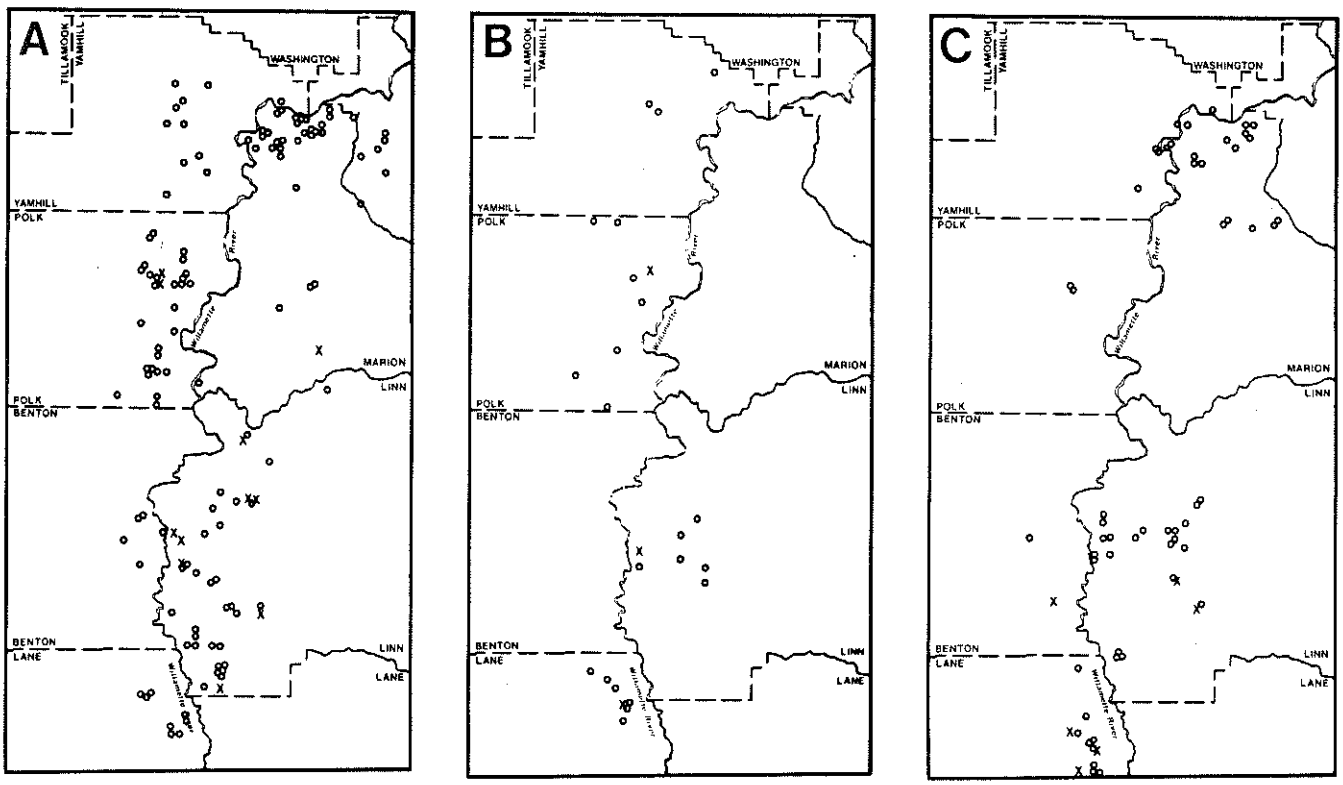

Figure 2.
Distribution of blind seed among A) tall fescue, B) annual ryegrass, and C) perennial ryegrass fields in the Willamette Valley of Oregon in 1989. X and O represent sites where blind seed was found and not found, respectively.

In annual ryegrass, ergot, blind seed, and seed gall were observed in 0, 8, and 0% of the fields, respectively (Table 1). Blind seed was observed in the central and south-central area of the Willamette Valley (Fig. 2B).

In perennial ryegrass, ergot, blind seed, and seed gall were observed in 0, 19, and 0% of the fields, respectively (Table 1). In perennial ryegrass blind seed was observed only in the southern range of the Willamette Valley (Fig. 2C). In orchardgrass, ergot, blind seed, and seed gall were observed in none of the fields sampled.

In weed grasses ergot was observed throughout the Willamette Valley (Fig. 3). Annual ryegrass and perennial ryegrass were found throughout the valley as weed grasses. Blind seed was detected in weed grasses growing in the southern area of the valley (Fig. 4A, 4B). Of 102 sites examined, the number of sites in which ergot was detected in annual ryegrass, tall fescue, quackgrass (*Agropyron repens* (L.) Beauv.), perennial ryegrass, oatgrass (*Arrhenatherum elatius* (L.) Presl.), and orchardgrass, was 19, 16, 4, 3, 2, and 1, respectively.

DISCUSSION

Hardison (1962) reported that bentgrass, Kentucky bluegrass, chewings fescue, tall fescue, annual ryegrass, and perennial ryegrass were susceptible to blind seed while orchardgrass was not. Results from the field survey of Alderman (1988) and the present study corroborate the finding of Hardison (1962) that orchardgrass is not susceptible to *Gloeotinia temulenta.*

Blind seed was not detected in the north eastern area of the Willamette Valley. This area is hilly, has a more friable soil and a greater diversity of agricultural crops, such as vegetables and fruits. In addition, many growers in this part of the valley rotate grasses with non-host species. Crop rotation has been reported to control blind seed disease (Hardison, 1948). By contrast, soil in the central Willamette Valley is heavier in texture and a higher proportion of agricultural land is planted to grass for seed production. The intensity of grass production in the central area of the valley may contribute to a greater incidence of blind seed infested fields in these areas.

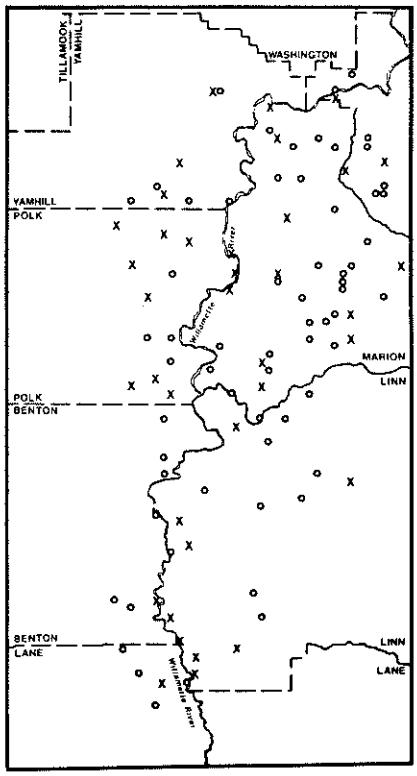

Figure 3.
Distribution of ergot among weed grasses in the Willamette Valley of Oregon during 1989. X and O represent sites where ergot was found and not found, respectively.

Few seed gall nematode infested fields were observed in 1988 (Alderman, 1988) and 1989. It is not known if environmental conditions regulate the population levels of *Anguina agrostis*. The disease does not appear at this time to be widespread among bentgrass fields.

The Agency Plains region receives less rainfall than the Willamette Valley and seed crops are generally irrigated. Levels of ergot can range from slight to heavy, depending on the year, although this is the first study to quantitatively assess ergot incidence in this region. Yearly variation in incidence and severity of ergot in the Willamette Valley can also occur.

Fewer fields were observed with ergot and blind seed in 1989 compared with 1988 (Alderman, 1988). Factors affecting the yearly variation in disease incidence and severity of ergot and blind seed are not well understood, although rainy conditions at the time of flowering are believed to promote ascospore production and subsequent infections (Calvert and Muskett, 1945; Harper and Seaman, 1980; Johnston, Matthews and Harrison, 1964; Mantle and Shaw, 1976). Additional studies are needed to quantify the effects of factors such as environmental conditions which may regulate the regional extent of ergot and blind seed.

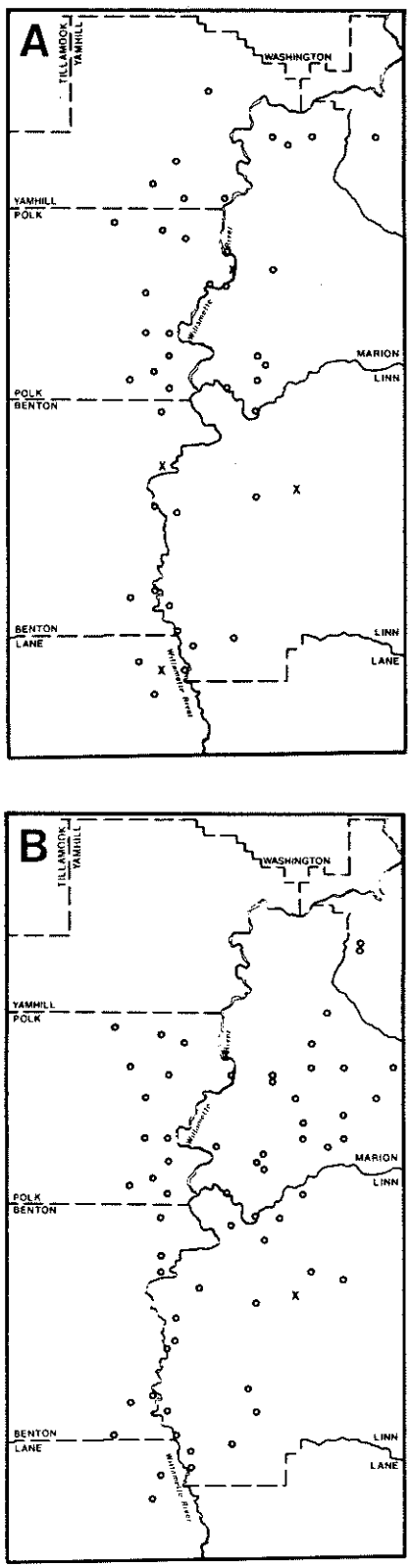

Figure 4.
Distribution of blind seed among A) annual ryegrass, and B) tall fescue growing as weed grasses in the Willamette Valley of Oregon during 1989. X and O represent sites where blind seed was found and not found, respectively.

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