A Reevaluation of the Host Range and Geographical Distribution of *Claviceps* Species in the United States

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ABSTRACT

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A listing of host and state reports and distribution maps for 11 taxa of *Claviceps* occurring in the United States, including *C. africana*, *C. cinerea*, *C. grohii*, *C. nigricans*, *C. paspali*, *C. pusilla*, *C. purpurea* var. *purpurea* and var. *spartinae*, *C. tripsaci*, *C. yanagawensis*, and *C. zizaniae*, was prepared based on literature citations and examination of specimens from herbaria. The occurrence of *C. ranunculoides* is questioned based on examination of conidia and sclerotia from archived specimens. Collections of *C. purpurea* var. *purpurea* from grasses in the Panicoideae were referred to other *Claviceps* spp. based on occurrence of macroconidia and microconidia. *C. purpurea* var. *purpurea* was found on 165 grass species within the continental United States and Alaska. The size of conidia of *C. purpurea* var. *purpurea* was found to be relatively stable across host and geographical regions. However, conidia of *C. purpurea* var. *purpurea* from hosts in the Aveneae and Meliceae (generally associated with wet habitats) were more variable in size and generally larger than those from other tribes in the Pooideae. *Claviceps* spp. in the continental United States occurred in diverse habitats, including temperate grasslands of the middle to northern latitudes (*C. purpurea* var. *purpurea*, *C. nigricans*) to the middle to southern latitudes (*C. pusilla*), coastal habitats (*C. purpurea* var. *spartinae*, *C. zizaniae*), northern wetlands (*C. grohii*), southern temperate to subtropical grasslands (*C. africana*, *C. paspali*, *C. tripsaci*, *C. yanagawensis*), and arid southwestern grasslands (*C. cinerea*).

Additional keywords: disease assessment, disease distribution, ergot, host–pathogen index

The genus *Claviceps* includes species adapted to a variety of niches in habitats ranging from marine to desert and subtropical to arctic. Most species of *Claviceps* have a host range limited to a genus or several genera of grasses. The exception is *Claviceps purpurea* var. *purpurea* (Fr.:Fr.) Tul., a common pathogen of temperate grasses in the Pooideae. The host range of *C. purpurea* var. *purpurea* is reported to include up to 200 species in the United States (40,136). Langdon (96), in his 1954 study of *Claviceps*, recognized 25 species. Since then, 15 additional species have been described (3). Hosts reported susceptible to *Claviceps* spp. were summarized by Brady (18) and Kawatani (88).

However, the occurrence of *Claviceps* spp. and their host and geographical distribution within the United States is not clearly defined.

Claviceps spp. are floral pathogens that infect the ovaries of susceptible hosts. Each infected ovary is replaced by a single sclerotium. During infection, macro- and/or microconidia (and in some cases also secondary conidia), depending on the *Claviceps* sp., are produced. Conidia are responsible for secondary spread of *Claviceps*. The sclerotium and the disease are commonly referred to as ergot. Sclerotia of many of the *Claviceps* spp. contain toxic alkaloids, and their presence in feed or in pasture grasses can cause poisoning in animals. Sclerotia of *Claviceps* spp. can be collected with seed during harvest. *C. purpurea* var. *purpurea*, in particular, is a generally known contaminant of harvested cereal grains and grass seed. There is potential for introducing new *Claviceps* spp. into the United States with seed, although the impact of such an introduction would vary depending on the *Claviceps* sp. imported and the hosts affected. Of significance is the recent introduction of *C. afri-*

cana, which is now an important problem in U.S. sorghum production (11). Recognition of new or emerging *Claviceps* spp. in the United States requires an understanding of the geographical and host distribution of *Claviceps* spp. currently in the country.

Claviceps species are differentiated by morphological features of the ascostroma, including color, distribution of perithecia within the stroma, dimensions of perithecia, asci, and ascospores, characteristics of the stipe, sclerotial and conidial morphology (3,96), or by molecular genetic differences (120). Unfortunately, ascostromata are rarely observed in nature, and most collections include only ungerminated sclerotia. Nevertheless, morphology of sclerotia and conidia can be helpful in differentiating species of *Claviceps*. Sclerotial forms include the black to purple-black, elongated sclerotia of *C. purpurea*; the roughly textured, spherical, tan to brown sclerotia of *C. paspali* F. Stevens & J.G. Hall; the large, horse-tooth shaped, gray-white sclerotia of *C. gigantea* S.F. Fuentes, Ullstrup, & Rodriguez; the greenish sclerotia of *C. viridis* Padwick & Azmatullah; and the oblong, purple sclerotia of *C. zizaniae* (Fyles) Panidou (3). Although morphology of sclerotia may be helpful in differentiating some species of *Claviceps*, sclerotia of other species, e.g., *C. digitariae* Hansford, *C. nigricans* Tul., *C. pusilla* Cesati, and *C. ranunculoides* Möller, are similar in appearance to *C. purpurea*. Characteristics such as size and shape of macroconidia, microconidia, and secondary conidia are morphological features that can be used to further delimit *Claviceps* spp. (100). *C. pusilla*, for example, has characteristic triangular conidia (96) which appear to be unique among *Claviceps* spp. Host range also may be helpful in *Claviceps* spp. recognition. Species such as *C. grohii* J.W. Groves, *C. nigricans*, and *C. zizaniae* are believed to be restricted to a single host genus. Thus, recognition of many *Claviceps* species, in the absence of ascostromata, may be possible based on combined characteristics of conidia, sclerotia, and host range.

Although the concept of varieties of *C. purpurea* has not been widely accepted,

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recent arguments for a *Claviceps* sp. found on *Spartina* as a distinct variety of *C. purpurea*, *C. purpurea* var. *spartinae*, based on morphological, physiological, ecological, and host range differences (34), are convincing. Because of its wide host range, *C. purpurea* var. *purpurea* is often assumed to be a causal agent of *Claviceps* infection. For example, *Androgon* spp. are listed as hosts of *C. purpurea* var. *purpurea* (23,61,97,125,129), presumably based on occurrence and appearance of sclerotia. However, when sclerotia from *Andropogon* spp. in Iowa were germinated (157), the ascostromata resembled *C. pusilla* and not *C. purpurea* var. *purpurea*. In another case, *C. zizaniae* was listed as *C. purpurea* var. *purpurea* until studies of Pantidou (117) established it as a different species. Further investigations may differentiate additional species of *Claviceps* from pathogens now identified as *C. purpurea* var. *purpurea*.

Listings of grass hosts for *Claviceps* spp. are complicated by the many recent changes in grass nomenclature. Differences among grass taxonomists concerning the synonymy of species can create confusion in citations. For example, Farr et al. (40) included the grass species *Agrostis alba* L. and *A. palustris* Huds. as synonyms of *A. stolonifera* L. Kartesz (87), on the other hand, listed *A. alba* as a synonym of *A. gigantea* Roth.

Studies of speciation, host range, and geographical distribution in the genus *Claviceps* require details of the host, site where the collection was made, and location of any corresponding voucher specimens. Most of the records of *Claviceps* were established from plant disease surveys during the 1930s through 1950s. For many of these records, specimens were sent to the herbarium of the USDA National Fungus Collection. However, collections in other herbaria may represent additional sources for host and geographical information for fungi in the genus *Claviceps*.

The objectives of this study were to: (i) compile an updated listing of grass species reported as natural hosts of *Claviceps* spp. based on published reports, inclusion in the USDA National Fungus Collection, or examination of herbarium collections in which hosts could be identified; (ii) summarize the listing with updated grass synonymies; (iii) map the distribution of *Claviceps* species in the United States with respect to host occurrence; (iv) evaluate the validity of conidia size as an attribute for comparing *Claviceps* spp.; and (v) identify questionable *C. purpurea*-host associations.

MATERIALS AND METHODS

An extensive literature search for reports of ergot in the United States was conducted. Reports in which species of *Claviceps* were not defined or host identities were uncertain were excluded. Cita-

tions of ergot on the cereal grains, especially wheat and rye, are numerous, and citations included in this report serve primarily as examples for state occurrence. *C. purpurea* var. *purpurea* is generally recognized as occurring throughout the United States on wheat and rye (9,136). Reports of *C. microcephala* (Wallr.) Tul. were included under *C. purpurea* var. *purpurea* since the species are considered synonymous (3,96).

Only original citations, where possible, were included in the host-species listing. Curators of U.S. herbaria listed in *Index Herbariorum* (81) were consulted for information on records of *Claviceps* in their collections. Herbaria from which collections were obtained included: Herbarium, Botany Department, Field Museum of Natural History, Chicago, IL [F]; Farlow Herbarium of Cryptogamic Botany, Harvard University, Cambridge, MA [FH]; Herbarium, University of Florida, Gainesville [FLAS]; Herbarium, U.S. National Fungus Collection, Beltsville, MD [BPI]; Herbarium, Center for Biodiversity, Illinois Natural History Survey, Champaign, IL [ILLS]; Ada Hayden Herbarium, Botany Department, Iowa State University, Ames [ISC]; Herbarium, University of Michigan, Ann Arbor [MICH]; Herbarium, Botany and Plant Pathology Department, East Lansing, MI [MSC]; Herbarium, Biological Sciences Division, University of Montana, Missoula [MONTU]; Bessey Herbarium, University of Nebraska State Museum, Lincoln [NEB]; Herbarium, New York Botanical Garden Herbarium, New York [NY]; Herbarium, Botany and Plant Pathology Department, Corvallis, OR [OSC]; Rocky Mountain Herbarium, University of Wyoming, Laramie [RM]; University Herbarium, University of California, Berkeley [UC]; Herbarium, Botany Department, University of Wisconsin, Madison [WIS]; and Herbarium, Plant Pathology Department, Washington State University, Pullman [WSP]. Letters in brackets correspond to herbarium codes listed in *Index Herbariorum* (81). Except for BPI, records from herbaria were included in host listings and state reports only after specimens were examined and verified for presence of *Claviceps* and verification of host identities. Collections that included only sclerotia were excluded. Data were summarized as the occurrence of host-*Claviceps* combinations within each state. The number of duplicate records at any given location was not tallied. New collections were deposited at herbarium OSC.

Conidia were examined from specimens obtained from herbaria or collections made during the course of this study. Collections of *Claviceps* spp. occurring outside the United States were also obtained and examined. Conidia were gently washed from individual sclerotia by placing the sclerotium in a small drop of water on a glass

slide for about 30 to 60 s. Conidia were examined at $\times 1,000$, and tracings of the first 25 conidia encountered were made with a drawing tube attached to an Olympus microscope. The taxonomic placement of grass genera into subfamilies and tribes was based on Watson and Dallwitz (161). Current nomenclature of grass genera/species followed that presented by Kartesz (87).

RESULTS

C. africana was reported from GA, KS, MS, and TX as a pathogen of *Sorghum bicolor* (L.) Moench and *Sorghum halepense* (L.) Pers. (Table 1, Fig. 1). Macroconidia were ellipsoidal-oblong, $14 \times 5 \mu\text{m}$ (Table 2). Microconidia were spherical, about $3 \mu\text{m}$ in diameter (Table 2).

Claviceps cinerea was reported from AZ, OK, NM, and TX as a pathogen of *Hilaria* spp. (Table 1, Fig. 1). Macroconidia of *C. cinerea* were fusiform, $20\text{--}25 \times 4\text{--}5 \mu\text{m}$. Microconidia were ellipsoidal, $6\text{--}8 \times 0.5\text{--}0.7 \mu\text{m}$ (Table 2).

C. grohii was reported on *Carex* spp. in MI, OR, and WA (Table 1, Fig. 1). Conidia of *C. grohii* were ellipsoidal-oblong, $11\text{--}16 \times 4\text{--}5 \mu\text{m}$ (Table 2).

Claviceps junci was listed by Greene (61) as occurring in WI on *Juncus nodosus* (Table 1). *C. junci* is an invalid name because it is based on only the conidial stage. Conidia from collections of *Claviceps* on *Juncus* spp. from CA and Canada were similar in size and shape, ellipsoidal-oblong, $12\text{--}13 \times 4 \mu\text{m}$ (Table 2).

C. nigricans occurred on *Eleocharis* spp. primarily in the Midwest, but its distribution extended to SC and CA (Table 1, Fig. 1). Conidia of *C. nigricans* from collections of *Eleocharis* spp. from CA were $9\text{--}11 \times$ about $4 \mu\text{m}$ (Table 2).

C. paspali was distributed from MD to FL, along the Gulf States, and across to California (Fig. 1). *C. paspali* was confined to the genera *Paspalum* and *Axonopus* (Table 1). Conidia were ellipsoidal, $12 \times 4\text{--}5 \mu\text{m}$ (Table 2).

Most hosts for *C. purpurea* var. *purpurea* occurred in the subfamily Pooideae. Mean conidial lengths for specimens in the Aveneae and Meliceae were more variable and generally larger than those from hosts in the Bromeae, Poeae, or Triticeae, where conidia were 5.5 to 7.9×2.5 to $3.9 \mu\text{m}$ (Table 2). Most hosts of *C. purpurea* var. *purpurea* occurred in the northern half of the United States, although *C. purpurea* var. *purpurea* has been reported from all states in the continental United States. One hundred fifty-nine species were identified as susceptible to *C. purpurea* var. *purpurea* (Table 3), excluding host reports from panicoid grasses. The greatest host species diversity occurred in the midwestern and northwestern states (Fig. 2). More than 50 species of grasses were reported susceptible to *C. purpurea* var. *purpurea* in IA, ND, and WA. Relatively few (10 or fewer)

Table 1. List of plants reported as susceptible to *Claviceps* species, other than *C. purpurea* var. *purpurea*, among U.S. states, based on published reports or specimens in herbaria^a

Host	Source
Bambusoideae	
Diarheneae	
<i>Claviceps</i> sp.	
<i>Diarrhena americana</i> Beauv. = <i>Diarrhena diandra</i> (Michx.) A.W. Wood	KS (MIN); MO (BPI)
Oryzeae	
<i>Claviceps zizaniae</i>	
<i>Zizania aquatica</i> L.	IA (53, 136); ME (BPI, NY, 136); MD (136); MN (91, 136); MO (BPI, 9); NE (136); ND (BPI, NY, WSP; 136, 162); WA(BPI); WI (61, 136, 159);
<i>Zizania palustris</i> L. var. <i>palustris</i> = <i>Zizania aquatica</i> var. <i>angustifolia</i> Hitchc.	IA (9); ME (BPI, FH, 9); MD (9); MN (OSC, 9, 127); MO (9); NE (9); ND (9); WI (9)
Chloridoideae	
Chlorideae	
<i>Claviceps cinerea</i>	
<i>Hilaria belangeri</i> var. <i>longifolia</i> (Vasey) A.S. Hitchc.	AZ (9); TX (BPI)
<i>Hilaria cenchroides</i> Kunth	AZ (67, 136)
<i>Hilaria jamesii</i> (Torr.) Benth.	NM (BPI)
<i>Hilaria mutica</i> (Buckl.) Benth.	AZ (BPI, NY, WSP, 9, 67, 136); NM (BPI, 9, 99, 136); OK (9, 41, 126, 136); TX (BPI, FH, 9)
<i>Claviceps purpurea</i> var. <i>spartinae</i> ^b	
<i>Spartina alterniflora</i> Loisel	AL (36); CT (BPI); DE (BPI, NY, 9, 36, 136); FL (36, 4); GA (BPI, 36); LA (BPI, 9, 36, 136); ME (BPI, WIS, 9, 136); MD (BPI, 36); MA (BPI, MSC, 9, 36, 69, 136); MS (BPI, 9, 35, 36, 110, 118, 136); NH (36); NJ (BPI, 9, 34, 36, 136); NY (BPI, 9, 136); NC (BPI, 36, 49, 54); RI (36, 47, 48); SC (OSC, 36); VA (36)
= <i>Spartina stricta</i> (Ait.) Roth. var. <i>glabra</i> (Muhl.) Gray	FL (BPI, 9); IA (115); MS (36); NE (BPI); NY (9, 136)
= <i>Spartina alterniflora</i> var. <i>pilosa</i> (Merr.) Fern.	CA (BPI, F, MSC, WIS); VA (BPI)
= <i>Spartina glabra</i> Muhl.	CA (BPI); LA (BPI); ME (BPI); MA (BPI);
<i>Spartina cynosuroides</i> (L.) Roth	ME (BPI); MD (BPI, 9, 136); MA (BPI, FH); MS (36); NY (NY); NC (54); TX (BPI)
<i>Spartina foliosa</i> Trin.	CT (BPI); IA (53, 136); MN (127); MT (BPI, OSC, NY, 9, 136); NE (NEB, 136); OK (9, 41, 136); SD (BPI, 9, 106, 136)
<i>Spartina maritima</i> (M.A. Curtis) Fern.	
= <i>Spartina stricta</i> (Aiton) Roth	
<i>Spartina patens</i> (Ait.) Muhl.	
<i>Spartina pectinata</i> Link	
= <i>Spartina michauxiana</i> Hitchc.	
<i>Claviceps yanagawensis</i> ^b	
<i>Zoysia japonica</i> Steudal	FL (4); VA (BPI)
<i>Zoysia matrella</i> (L.) Merrill	DC (BPI)
= <i>Zoysia pungens</i> Willd.	
Panicoideae	
Andropogoneae	
<i>Claviceps africana</i>	
<i>Sorghum bicolor</i> (L.) Moench	GA (160); KS (160); MS (166); TX (OSC, 83, 160)
<i>Sorghum halepense</i> (L.) Pers.	GA (160); KS (160); TX (82, 160)
<i>Claviceps pusilla</i>	
<i>Andropogon gerardii</i> Vitman	IA (ICS, 52); NM (BPI)
= <i>Andropogon furcatus</i> Muhl. in Wild.	
<i>Andropogon hallii</i> Hack.	IA (ICS, 52); OK (BPI)
<i>Bothriochloa ischaemum</i> (L.) Keng	IA (116); TX (BPI)
= <i>Andropogon ischaemum</i> L.	
<i>Schizachyrium scoparium</i> (Michx.) Nash	IA (52)
= <i>Andropogon scoparius</i> Michx.	
<i>Claviceps</i> sp. ^b	
<i>Andropogon gerardii</i> Vitman	GA (9); KS (BPI, NY, 9); NE (129); NM (BPI); OK (BPI, 97, 125, 136); TX (BPI, 9, 23, 136); WI (61, 136)
= <i>A. furcatus</i> Muhl. in Willd.	NE (129); OK (BPI, 41, 97, 125, 136); TX (23, 136)
<i>Andropogon hallii</i> Hack.	FL (9); MS (9); OK (9)
<i>Andropogon virginicus</i> L.	TX (BPI)
<i>Bothriochloa ischaemum</i> L. var. <i>ischaemum</i>	
= <i>Andropogon ischaemum</i> L.	
<i>Bothriochloa saccharoides</i> (Sw.) Rydb.	TX (BPI, 9, 30)
= <i>Andropogon saccharoides</i> Sw.	
= <i>Amphilophis torreyanus</i> (Steudall) Nash	
<i>Ischaemum muticum</i> L.	OH (121)
= <i>Andropogon repens</i>	
<i>Saccharum alopecuroides</i> (L.) Nutt.	AL (136); OK (9, 126, 136)
= <i>Erianthus alopecuroides</i> (L.) Ell.	
<i>Schizachyrium scoparium</i> (Michx.) Nash	OK (BPI, 125, 136)
= <i>Andropogon scoparius</i> Michx.	
<i>Schizachyrium tenerum</i> Nees	OK (41)
= <i>Andropogon tener</i> (Nees) Kunth	
<i>Sorghastrum nutans</i> (L.) Nash	IA (ICS); KS (BPI, 9, 136); OK (9, 41, 125, 97, 136); TX (BPI, 9, 23, 136)
<i>Spodiopogon sibiricus</i> Trin.	DC (BPI)
<i>Themeda forskalii</i> Hackel ex Duthie	DC (BPI)

(Continued on next page)

^a Herbaria were inventoried for ergot during 1996 to 1998. Herbarium codes are those listed in *Index Herbariorum* (81).

^b Some reports list *C. purpurea* or *C. sp.*

Table 1. (Continued from preceding page)

Maydeae	
<i>Claviceps tripsaci</i> ^b	
<i>Tripsacum dactyloides</i> (L.) L.	DC (BPI) GA (9, 136, 153); MD (BPI, NY, UC, 9, 136); MS (9, 118, 136); NC (BPI, 9, 54, 136, 153); OK (9, 41, 126, 136); VA (BPI, 9, 99, 136)
Paniceae	
<i>Claviceps paspali</i> (= <i>C. rolfii</i>)	
<i>Axonopus compressus</i> (Sw.) Beauv.	GA (BPI)
<i>Axonopus fissolius</i> (Raddi) Kuhl.	DC (BPI); FL (BPI, 9, 99); GA (9, 99); LA (BPI); TX (BPI)
= <i>Axonopus affinis</i> Chase	
<i>Axonopus furcatus</i> (Fluegge) A.S. Hitchc.	MD (BPI)
<i>Panicum anceps</i> Michx.	AR (29)
<i>Paspalum alnum</i> Chase	VA (BPI, 99)
<i>Paspalum caespitosum</i> Fluegge	FL (99, 136)
<i>Paspalum dilatatum</i> Poir.	AL (BPI, 9, 99, 136); AR (BPI, WIS, 99, 136); CA (9, 12, 104); FL (BPI, 9, 99, 136); GA (21, 98, 99, 136); HI (128, 136); LA (BPI, 99, 136); MD (FH, 9, 136); MS (BPI, 20, 99, 110, 118, 124, 136); NC (BPI, FH, 54, 99, 136, 153); OK (9, 41, 126, 136); SC (BPI, UC, 77, 99, 136); TN (BPI); TX (BPI, 9, 99, 136); VA (BPI, 99, 136); MD to FL (9)
<i>Paspalum chapmani</i> Nash	GA (BPI)
<i>Paspalum distichum</i> L.	LA (BPI); MS (110, 136); OK (41, 126, 136); SC (136); VA (99, 136)
<i>Paspalum exaltatum</i> J.&C. Presl.	MS (BPI)
<i>Paspalum floridanum</i> Michx.	AR (132); FL (BPI, 99, 136); GA (BPI, 99, 136); MD (BPI); MS (BPI); NC (54, 136); OK (41); VA (99, 136)
= <i>Paspalum floridanum</i> var. <i>glabratum</i> Engelm. ex Vasey	
= <i>Paspalum giganteum</i> Baldwin ex Vasey	
<i>Paspalum intermedium</i> Munro ex Morong	GA (98); VA (BPI, 99, 136)
<i>Paspalum laeve</i> Michx.	AR (BPI, 132, 136); DC (BPI); DE (BPI); GA (98); MD (BPI, 114, 136); MS (BPI, FH); NC (BPI, 54, 136, 153); OK (BPI, 41, 126, 136); PA (NY); VA (BPI, CUP, WIS, 99, 136); WV (BPI, 39); widespread through its' range (9)
= <i>Paspalum longipilum</i> Nash	GA (98); VA (BPI, 99, 136)
<i>Paspalum langei</i> (Fourn.) Nash	TX (99, 136)
<i>Paspalum monostachyum</i> Vasey	AZ (99, 136); DC (BPI); FL (FLAS, 99, 136); GA (BPI, 99, 136); LA (BPI, 99, 136)
<i>Paspalum notatum</i> Fluegge	FL (BPI, UC, 99, 136); LA (136); TX (BPI, 136); widespread through its range (9)
<i>Paspalum plicatulum</i> Michx.	GA (98, 136); TX (136); VA (BPI, 99, 136)
<i>Paspalum pubiflorum</i> Rupr. ex Fourn.	VA (BPI, 99, 136)
<i>Paspalum quadrifarium</i> Lam.	HI (128, 136)
<i>Paspalum scrobiculatum</i> L.	
= <i>Paspalum orbiculare</i> G. Forster	
<i>Paspalum setaceum</i> Michx.	AR (BPI); FL (BPI, FLAS, 99, 136); GA (98, 136); VA (BPI, 99, 136); widespread through its range
= <i>Paspalum ciliatifolium</i> Michx.	
= <i>Paspalum longepedunculatum</i> Le Conte	
= <i>Paspalum pubescens</i> J. Presl	
= <i>Paspalum supinum</i> Bosc ex Poiret	
<i>Paspalum urvillei</i> Steud.	FL (9, 99, 136); GA (98); LA (9, 99) MD (136); NC (54, 99, 136); OK (126, 136); TX (136); VA (BPI, 9, 99); VA to FL (9)
<i>Claviceps</i> sp. (reported as <i>Claviceps ranunculoides</i>)	
<i>Setaria macrostachya</i> Kunth	AZ (BPI, 9, 99, 136); NM (136); TX (BPI, 9)
<i>Claviceps</i> sp. ^b	
<i>Anthraenantia rufa</i> (Nutt) J.A. Schultes	MS (9)
<i>Anthraenantia villosa</i> (Michx.) Beauv.	MS (9)
<i>Antheophora pubescens</i> Nees	DC (9)
<i>Brachiaria platyphylla</i> (Munro ex Wright) Nash	FL (136)
= <i>Brachiaria extensa</i> Chase	
<i>Digitaria eriantha</i> Steud.	DC (BPI)
<i>Pennisetum ciliare</i> (L.) Link = <i>Cenchrus ciliaris</i> L.	TX (27)
<i>Setaria valpiseta</i> (Lam.) Roemer & Schultes	TX (FH)
<i>Setaria viridis</i> (L.) P. Beauv.	AZ (BPI); NM (BPI, 9, 77, 136)
= <i>Chaetochloa viridis</i> (L.) Scribn.	
<i>Setaria macrostachya</i> Kunth	NM (BPI, NY, 9, 136); TX (FH, ISC)
= <i>Chaetochloa composita</i> Scribn.	
Cyperaceae	
<i>Claviceps nigricans</i> ^b	
<i>Eleocharis erythropoda</i> Steud.	IN (BPI, 9); WI (58, 61)
= <i>Eleocharis calva</i> Torr.	
<i>Eleocharis obtusa</i> (Willd.) J.A. Schultes	MT (144)
<i>Eleocharis palustris</i> (L.) Roem. & Schult.	CA (BPI, CUP, NY, UC); IA (ICS, 51); KS (BPI, FH); NE (BPI); NV (UC); SC (9); NY (NY); ND (BPI, 9, 19); SD (BPI, 9); VT (NY); WA (133); WI (BPI, WIS, UC, 9, 31); WY (9)
= <i>Eleocharis macrostachya</i> Britt.	CA (UC)
= <i>Eleocharis smallii</i> Britt.	CA (BPI, UC); MI (9); NY (CUP)
<i>Eleocharis quinqueflora</i> (F.T. Hartman) O. Schwarz	
<i>Eleocharis rostellata</i> (Torr.) Torr.	
<i>Claviceps grohii</i>	
<i>Carex microptera</i> Mackenzie	WA (133)
<i>Carex tribuloides</i> Wahlenb.	MI (BPI, 9)
<i>Carex</i> sp.	OR (OSC)
Juncaceae	
<i>Claviceps</i> sp. (reported as <i>C. junci</i>)	
<i>Juncus nevadensis</i> Wats.	CA (WIS)
<i>Juncus nodosus</i> L.	WI (WIS, 61)

species were associated with *C. purpurea* var. *purpurea* in the southern states and the Atlantic coast states. Nearly all hosts susceptible to *C. purpurea* var. *purpurea* occurred in the subfamily Pooideae, with some exceptions in the Arundinoideae (Table 3). The report of *C. purpurea* var. *purpurea* on the bambusoid grass *Diarhena* is questionable. Sclerotia from *Diarhena* were slightly flattened but triangular

in cross section, with collections brown to blue-black or gray to blue-black. *C. purpurea* var. *purpurea* was also considered doubtful on panicoid host genera, including *Andropogon*, *Bothriochloa*, *Brachiaria*, *Digitaria*, *Saccharum*, *Schizachyrium*, *Setaria*, *Sorghastrum*, and *Spodiopogon* based on the presence of macroconidia and microconidia. Collections from *Andropogon*, *Digitaria*, *Setaria*, and *Sorghastrum*

were observed with microconidia and macroconidia (Table 2).

Claviceps purpurea var. *spartinae* occurred on *Spartina* spp. within the range of growth of *Spartina* along the Atlantic, Pacific, and Gulf Coast states and the Midwest. Conidia were ellipsoidal, oblong, or allantoid, 10.2 to 12.7 μm .

C. pusilla was reported from IA, OK, NM, and TX. Hosts included *Andropogon*

Fig. 1. For each *Claviceps* species, the number of grass species on which the particular *Claviceps* species was reported for each state is recorded.

Table 2. Conidial attributes of *Claviceps* species within subfamilies and tribes of grasses (Poaceae), sedges (Cyperaceae) and rushes (Juncaceae)

Species	Location	Conidial type	Conidial length (µm)	Conidial width (µm)	Conidial shape	Source
Arundinoideae						
Danthonieae						
<i>Claviceps</i> sp.						
<i>Danthonia spicata</i>	WI		9.5 ± 1.4	4.2 ± 0.5	Ellipsoidal-oblong	BPI 633839
Stipeae						
<i>Claviceps purpurea</i>						
<i>Achnatherum lettermanii</i>	WY		5.8 ± 0.8	3.1 ± 0.4	Ellipsoidal	RM 26100 (labeled <i>Stipa lettermanii</i>)
<i>Achnatherum nelsonii</i>	UT		5.8 ± 0.9	3.2 ± 0.4	Ellipsoidal	BPI 634439 (labeled <i>Stipa columbiana</i>)
<i>Achnatherum scribneri</i>	CO		7.1 ± 0.9	3.2 ± 0.4	Ellipsoidal	NY: S. Boulder canyon, 7,000 ft, 1912, Ex Herb. Arthur (labeled <i>Stipa scribneri</i>)
<i>Nasella viridula</i>			7.2 ± 1.2	3.3 ± 0.4	Ellipsoidal	ISC 318665 (labeled <i>Stipa viridula</i>)
<i>Oryzopsis asperifolia</i>	NY		5.7 ± 0.6	2.7 ± 0.3	Ellipsoidal	CUP 17762
<i>Piptatherum miliaceum</i>	DC		8.1 ± 0.9	3.5 ± 0.5	Ellipsoidal-oblong	BPI 633193 (labeled <i>Oryzopsis milacea</i>)
	(Australia)					
Bambusoideae						
Diarrheneae						
<i>Claviceps purpurea</i> ?						
<i>Diarrhena americana</i>	KS		6.0 ± 1.1	2.4 ± 0.8	Ellipsoidal-oblong	MIN 615560
<i>Diarrhena americana</i>	MO		5.7 ± 0.8	2.5 ± 0.4	Ellipsoidal-oblong	BPI 633842 (labeled <i>D. diandra</i>)
<i>Diarrhena americana</i>	MO		5.5 ± 0.8	2.3 ± 0.3	Ellipsoidal-oblong	BPI 633841 (labeled <i>D. diandra</i>)
Oryzeae						
<i>Claviceps zizanea</i>						
<i>Zizanea aquatica</i>	ND		11.2 ± 1.6	4.2 ± 0.5	Ellipsoidal-oblong	NY: near Fargo, 1900, Brenckle Fungi
						Dakotensis 453. col. O.A. Stevens
<i>Zizanea aquatica</i>	ME		11.9 ± 1.7	4.7 ± 0.9	Ellipsoidal-oblong	NY: Orono, 1942, col. F.H. Steinmetz
<i>Zizanea aquatica</i>	MN		12.7 ± 2.9	4.6 ± 0.4	Ellipsoidal-oblong	OSC 97749
Chloridoideae						
Chlorideae						
<i>Claviceps cinerea</i>						
<i>Hilaria jamesii</i>	NM	Macro:	20.2 ± 4.6	5.0 ± 0.7	Fusiform ellipsoidal	NY: near Newkirk, 1941, col. D.A. Savage, det. W.W. Ray, A&M Herb. 2872
		Micro:	7.5 ± 1.3	4.0 ± 0.7		
<i>Hilaria mutica</i>	AZ	Macro:	22.2 ± 3.7	5.1 ± 0.5	Fusiform ellipsoidal	NY: 1900, West American Fungi 97, David Griffiths
		Micro:	6.4 ± 1.1	3.7 ± 0.5		
<i>Hilaria mutica</i>	TX	Macro:	25.6 ± 2.9	4.8 ± 0.5	Fusiform ellipsoidal	FH: Sterling Co., 1944, col. A.F. Bratton, Texas Ag. Exp. Stn. 46102
		Micro:	7.6 ± 1.1	4.2 ± 0.4		
<i>Claviceps citrina</i>						
<i>Distichlis spicata</i>	Mexico		5.5 ± 0.7	3.6 ± 0.4	Ellipsoidal	PRM 842966
<i>Claviceps purpurea</i> var. <i>spartinae</i>						
<i>Spartina alterniflora</i>	MA		10.2 ± 1.4	3.9 ± 0.5	Oblong-allantoid	MSC: Woods Hole, 1881, W. Trelease (labeled <i>S. stricta</i>)
<i>Spartina alterniflora</i>	SC		12.7 ± 2.4	3.8 ± 0.5	Oblong-allantoid	OSC 12011 (labeled <i>Spartina</i> sp.)
<i>Spartina pectinata</i>	MT		17.1 ± 3.0	3.9 ± 0.6	Oblong	OSC 69007 (labeled <i>S. michauxiana</i>)
<i>Spartina patens</i>	NY		11.8 ± 4.3	4.3 ± 0.5	Ellipsoidal-oblong	NY: Ex. NYS 27916
Panicoideae						
Andropogoneae						
<i>Claviceps</i> sp.						
<i>Andropogon gerardii</i>	IA	Macro:	11.8 ± 1.0	4.7 ± 0.5	Ellipsoidal	ISC 319388 (labeled <i>A. furcatus</i>)
		Micro:	3.9 ± 0.6	3.0 ± 0.2	Spherical-ellipsoidal	
<i>Andropogon gerardii</i>	NM		6.3 ± 2.9	3.2 ± 0.8	Spherical-oblong	BPI 633703 (labeled <i>A. furcatus</i>)
			range: 2-13	range: 2-5		
<i>Andropogon hallii</i>	IA	Macro:	11.4 ± 1.4	4.8 ± 0.7	Ellipsoidal-oblong	ISC 319389
		Micro:	3.6 ± 0.6	3.0 ± 0.4	Spherical-ellipsoidal	
<i>Andropogon hallii</i>	OK	Macro:	10.0 ± 1.2	4.5 ± 0.7	Ellipsoidal-oblong	BPI 633706
		Micro:	3.6 ± 0.6	3.1 ± 0.4	Spherical-ellipsoidal	
<i>Sorghastrum nutans</i>	TX	Macro:	8.3 ± 0.9	3.5 ± 0.5	Ellipsoidal-oblong	BPI 634253
		Micro:	3.6 ± 0.5	3.1 ± 0.2	Spherical-ellipsoidal	
<i>Claviceps africana</i>						
<i>Sorghum bicolor</i>	TX	Macro:	14.0 ± 1.5	4.9 ± 0.5	Ellipsoidal-oblong	OSC 97751
		Micro:	3.3 ± 0.5	3.0 ± 0.3	Spherical	
<i>Claviceps gigantea</i>						
<i>Zea mays</i>	(Mexico)	Macro:	24.7 ± 5.1	4.3 ± 0.7	Fusiform	NY: near Mexico City, 1960, col. J.S. Niederhauser, det. C.T. Rogerson
		Micro:	4.9 ± 0.9	2.7 ± 0.5	Ellipsoidal	
<i>Claviceps tripsaci</i>						
<i>Tripsacum dactyloides</i>	MD	Macro:	26.6 ± 5.6	5.4 ± 0.8	Fusiform	NY: near Chevy Chase, 1920, A. Chase
		Meso:	11.4 ± 1.6	3.8 ± 0.6	Ellipsoidal-oblong	
		Micro:	4.3 ± 0.8	2.5 ± 0.4	Spherical-ellipsoidal	
Paniceae						
<i>Claviceps digitareae</i>						
<i>Digitaria eriantha</i>	DC	Macro:	11.7 ± 1.3	4.6 ± 0.7	Ellipsoidal-oblong	BPI 633148
	(S. Africa)	Micro:	4.2 ± 0.5	3.2 ± 0.3	Spherical-ellipsoidal	

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Table 2. (Continued from previous page)

Species	Location	Conidial type	Conidial length (µm)	Conidial width (µm)	Conidial shape	Source
<i>Digitaria valida</i>	DC (S. Africa)	Macro: Micro:	11.7 ± 2.1 3.9 ± 0.4	4.8 ± 1.0 3.0 ± 0.4	Ellipsoidal-oblong Spherical-ellipsoidal	BPI 633035
<i>Claviceps fusiformis</i> <i>Pennisetum</i>	(Rhodesia)	Macro: Meso: Micro:	20.5 ± 2.5 5.5 ± 0.7 3.3 ± 0.8	4.9 ± 0.6 4.0 ± 0.7 2.5 ± 0.5	Fusiform Spherical-ellipsoidal Spherical-ellipsoidal	IMI 110729
<i>Claviceps maximensis</i> <i>Panicum maximum</i>	(Puerto Rico)	Macro: Micro:	15.8 ± 4.7 5.1 ± 1.2	5.9 ± 0.9 2.9 ± 0.4	Ellipsoidal-oblong Ellipsoidal	BPI 634487
<i>Claviceps paspali</i> <i>Paspalum dilatatum</i>	AR		12.2 ± 1.7	4.0 ± 0.6	Ellipsoidal-oblong	WIS: Little Rock, 1957, col. G. Templeton, det. M.S. Pavgi
<i>Paspalum plicatum</i> <i>Claviceps</i> sp.	FL		12.3 ± 1.4	4.6 ± 0.5	Ellipsoidal-oblong	UC 669553
<i>Setaria macrostachya</i>	NM		8.4 ± 1.15	3.9 ± 0.6	Ellipsoidal	NY: Carlsbad, 1902, Plants of the Gulf States, col. S.M. Tracy (labeled <i>Chaetachloa composita</i>)
<i>Setaria macrostachya</i>	NM		7.5 ± 1.3	3.3 ± 0.5	Ellipsoidal-oblong	NY: Carlsbad, 1902, Plants of the Gulf States, col. S.M. Tracy (labeled <i>S. composita</i>)
<i>Setaria macrostachya</i>	TX	Macro: Micro:	14.7 ± 2.7 4.9 ± 1.2	4.4 ± 0.6 3.1 ± 0.3	Oblong-allantoid Spherical-ellipsoidal	ICS 415193
<i>Setaria valpiseta</i>	TX	Macro: Micro:	18.0 ± 2.1 4.7 ± 0.6	6.1 ± 0.9 3.7 ± 0.5	Oblong-allantoid Spherical-ellipsoidal	FH 46065 (labeled <i>S. macrostachya</i>)
Pooideae						
Aveneae						
<i>Claviceps purpurea</i> <i>Agrostis exerata</i>	OR		8.5 ± 1.1	4.1 ± 0.5	Ellipsoidal	NY: Warrenton, 1935, col. F.D. Bailey, det. S.M. Zeller
<i>Agrostis stolonifera</i>	IL		8.6 ± 1.6	4.1 ± 0.5	Ellipsoidal	ILLS 33788 (labeled <i>A. alba</i>)
<i>Agrostis stolonifera</i>	OR		7.5 ± 1.1	3.6 ± 0.4	Ellipsoidal	OSC 10722 (labeled <i>A. alba</i>)
<i>Alopecurus geniculatus</i>	ND		8.3 ± 1.1	4.0 ± 0.5	Ellipsoidal	RM 18886
<i>Alopecurus pratensis</i>	MI		9.3 ± 1.3	4.2 ± 0.6	Ellipsoidal-oblong	MSC: Walton Cr, Traverse Co., 1889
<i>Alopecurus pratensis</i>	OR		9.1 ± 1.3	3.8 ± 0.6	Ellipsoidal-oblong	NY: Astoria, 1936, R.S. Sprague
<i>Ammophila breviligulata</i>	NY		6.5 ± 1.1	3.6 ± 0.5	Ellipsoidal	NY: Ex NYS 27934
<i>Ammophila breviligulata</i>	NY		9.9 ± 2.8	4.1 ± 0.7	Ellipsoidal-oblong	BPI 633717
<i>Anthoxanthum odoratum</i>	NY		7.0 ± 1.6	3.1 ± 0.4	Ellipsoidal-oblong	NY: Ulster Co., 1988, Fungi of New York 571, col. R. Lowen
<i>Avena sativa</i>	NY		7.2 ± 1.0	3.4 ± 0.4	Ellipsoidal	CUP 37862
<i>Calamagrostis canadensis</i>	AK		11.9 ± 1.8	4.3 ± 0.6	Ellipsoidal-oblong	WIS: Matanuska, 1956, col. J.G. Dickson
<i>Calamagrostis canadensis</i>	AK		10.1 ± 1.6	4.3 ± 0.5	Ellipsoidal-oblong	WSP 51546
<i>Calamagrostis canadensis</i>	ME		10.3 ± 1.6	3.8 ± 0.5	Ellipsoidal-oblong	CUP 32951
<i>Calamagrostis canadensis</i>	MN		11.6 ± 2.3	4.7 ± 0.8	Ellipsoidal-oblong	MSC: Minneapolis, 1883, Herb. W.J. Beal labeled (<i>Deyeuxia canadensis</i>)
<i>Calamagrostis canadensis</i>	MN		8.5 ± 1.0	4.0 ± 0.5	Ellipsoidal	WIS: Waterville, 1905, J.H. Kearnen
<i>Calamagrostis canadensis</i>	NY		10.4 ± 1.8	4.4 ± 0.5	Ellipsoidal-oblong	CUP 23904
<i>Calamagrostis canadensis</i>	WA		11.2 ± 1.6	4.0 ± 0.5	Ellipsoidal-oblong	UC 620739 (labeled <i>Deschampsia atropurpurea</i>)
<i>Calamagrostis stricta</i>	ND		9.3 ± 2.0	4.0 ± 0.7	Ellipsoidal-oblong	NY: Kulm, 1908, North Dakota Fungi, col J. F. Brenckle (labeled <i>C. neglecta</i>)
<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>	MN		10.8 ± 2.1	4.7 ± 0.4	Ellipsoidal-oblong	WSP 46641 (labeled <i>C. inexpansa</i>)
<i>Cinna latifolia</i>	AK		11.7 ± 0.9	4.2 ± 0.6	Ellipsoidal-oblong	WSP 51116
<i>Cinna latifolia</i>	Canada		10.0 ± 1.8	3.9 ± 0.8	Ellipsoidal-oblong	CUP 19159
<i>Holcus lanatus</i>	OR		8.5 ± 1.1	4.1 ± 0.4	Ellipsoidal	OSC 1790
<i>Holcus lanatus</i>	WA		8.9 ± 1.5	3.8 ± 0.4	Ellipsoidal-oblong	CUP 33142
<i>Koeleria macrantha</i>	AZ		7.2 ± 1.0	3.2 ± 0.4	Ellipsoidal	WIS: Bradshaw Mts., 1892, J.W. Tourmey (labeled <i>K. cristata</i>)
<i>Phalaris arundinacea</i>	IA		9.0 ± 1.8	4.6 ± 0.8	Ellipsoidal	ISC 318625 (labeled <i>Koeleria cristata</i>)
<i>Phalaris arundinacea</i>	MA		8.8 ± 1.4	3.4 ± 0.5	Ellipsoidal-oblong	NY: Hadley, 1978, col. H.E. Ahlees, det M.E.B.B.
<i>Phalaris arundinacea</i>	MA		9.1 ± 0.8	4.1 ± 0.5	Ellipsoidal-oblong	FH: Newton, 1935, P.L. Rusdon (labeled <i>Calamagrostis cinnoides</i>)
<i>Phalaris arundinacea</i>	MI		8.6 ± 1.2	3.8 ± 0.4	Ellipsoidal-oblong	MICH: Chelsea, 1927, D.M. Benedict
<i>Phalaris arundinacea</i>	VA		8.6 ± 1.1	3.8 ± 0.4	Ellipsoidal-oblong	FH: Paris, 1923, col. C. drechsler, det. V.K. Charles
<i>Phalaris arundinacea</i>	NY		9.3 ± 1.5	4.1 ± 0.4	Ellipsoidal-oblong	CUP 10007
<i>Phalaris arundinacea</i>	VA		8.8 ± 1.8	3.4 ± 0.6	Ellipsoidal-oblong	CUP 13671
<i>Phleum pratense</i>	IL		6.9 ± 0.9	3.6 ± 0.5	Ellipsoidal	F 1166637
<i>Phleum pratense</i>	OR		7.9 ± 0.8	3.6 ± 0.4	Ellipsoidal	OSU 10014

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Table 2. (Continued from previous page)

Species	Location	Conidial type	Conidial length (µm)	Conidial width (µm)	Conidial shape	Source
<i>Phleum pratense</i>	OR		9.1 ± 1.8	4.1 ± 0.6	Ellipsoidal-oblong	OSC 1731
<i>Phleum pratense</i>	WI		9.4 ± 1.6	4.3 ± 0.5	Ellipsoidal	CUP 4750
Bromeae						
<i>Claviceps purpurea</i>						
<i>Bromus carinatus</i>	CA		6.4 ± 0.8	3.9 ± 0.4	Ellipsoidal	F: Oxford Tract, Berkeley, 1949, Fungi of CA, col. A. R. Kruckeberg (labeled <i>B. marginatus</i>)
<i>Bromus carinatus</i>	ID		6.4 ± 0.8	3.6 ± 0.4	Ellipsoidal	WSP 16633
<i>Bromus carinatus</i>	WA		6.2 ± 1.4	3.5 ± 0.4	Ellipsoidal	WSP 21509
<i>Bromus carinatus</i>	WA		5.6 ± 0.7	2.8 ± 0.3	Ellipsoidal	WSP 13385
<i>Bromus commutatus</i>	IL		6.7 ± 1.0	3.6 ± 0.4	Ellipsoidal	ILLS 27874 (labeled <i>B. secalinus</i>)
<i>Bromus inermis</i>	IL		6.9 ± 1.0	3.6 ± 0.6	Ellipsoidal	ILLS 29117
<i>Bromus inermis</i>	WA		5.8 ± 0.7	3.2 ± 0.4	Ellipsoidal	WSP 19934
Meliceae						
<i>Claviceps purpurea</i>						
<i>Glyceria borealis</i>	MI		10.8 ± 1.9	4.7 ± 0.7	Ellipsoidal-oblong	MICH: McCargo Cove, 1930, col. C.A. Brown, det. E.B. Mains
<i>Glyceria septentrionalis</i>	IA		10.5 ± 0.9	3.7 ± 0.4	Ellipsoidal-oblong	ISC 318655
<i>Glyceria × Laxa</i>	Canada		10.1 ± 1.7	3.9 ± 0.6	Ellipsoidal-oblong	FH 18139 (labeled <i>Glyceria canadensis</i>)
<i>Glyceria borealis</i>	NY		10.7 ± 1.8	4.3 ± 0.6	Ellipsoidal-oblong	CUP 35966
<i>Glyceria fluitans</i>	Germany		8.7 ± 1.1	3.7 ± 0.4	Ellipsoidal-oblong	OSC 37892
<i>Glyceria fluitans</i>	Canada		11.3 ± 1.2	4.2 ± 0.7	Ellipsoidal-oblong	CUP 4516
Poeae						
<i>Claviceps purpurea</i>						
<i>Dactylis glomerata</i>	IA		7.2 ± 1.0	3.6 ± 0.5	Ellipsoidal	ICS 318613
<i>Dactylis glomerata</i>	IL		5.9 ± 0.7	3.4 ± 0.5	Ellipsoidal	ILLS 25945
<i>Dactylis glomerata</i>	MI		5.9 ± 0.8	3.1 ± 0.4	Ellipsoidal	MSC: East Lansing, 1930, J. P. Kienholz
<i>Dactylis glomerata</i>	NY		6.5 ± 1.2	3.0 ± 0.4	Ellipsoidal	CUP 35966
<i>Dactylis glomerata</i>	WI		7.4 ± 1.5	3.8 ± 0.6	Ellipsoidal	WIS: Madison, 1919, J.J. Davis
<i>Lolium multiflorum</i>	OR		7.5 ± 0.9	3.8 ± 0.5	Ellipsoidal	OSC 1743 (labeled <i>Lolium italicum</i>)
<i>Lolium multiflorum</i>	OR		5.9 ± 0.7	3.3 ± 0.3	Ellipsoidal	OSC 10744
<i>Lolium multiflorum</i>	OR		6.0 ± 0.5	3.3 ± 0.4	Ellipsoidal	OSC 10698
<i>Lolium perenne</i>	MA		6.9 ± 1.2	3.4 ± 0.5	Ellipsoidal	NY: Amherst, 1967, col. H.E. Ahles, det. M.E.B.B.
<i>Lolium perenne</i>	OR		6.8 ± 0.9	3.7 ± 0.3	Ellipsoidal	OSC 39275
<i>Lolium perenne</i>	WY		7.1 ± 0.9	3.6 ± 0.5	Ellipsoidal	NY: Corvallis, 1915, H.C. Gilbert
<i>Lolium pratense</i>	MA		6.9 ± 1.2	3.3 ± 0.6	Ellipsoidal	NY: Amherst, 1967, Col. H.E. Ahles, det. M.E.B.B. (labeled <i>Festuca elatior</i>)
<i>Lolium arundinaceum</i>	NY		6.0 ± 0.7	3.0 ± 0.5		CUP 9955 (labeled <i>Festuca elatior</i>)
<i>Poa fendleriana</i>	UT		7.6 ± 1.3	3.9 ± 0.4	Ellipsoidal	NY: Fungi Columbiani 2317, E. Bartholomew (labeled <i>Poa longiligula</i>)
<i>Poa secunda</i> ssp. <i>juncifolia</i>	CA		5.7 ± 0.9	3.1 ± 0.4	Ellipsoidal	WSP 25499 (labeled <i>Poa nevadensis</i>)
<i>Poa pratensis</i>	OR		8.5 ± 0.8	3.3 ± 0.3	Ellipsoidal-oblong	OSC 97750
<i>Poa secunda</i>	ID		5.8 ± 0.6	3.3 ± 0.4	Ellipsoidal	WSP 42803 (labeled <i>Poa ampla</i>)
<i>Poa secunda</i>	UT		6.9 ± 1.0	3.6 ± 0.4	Ellipsoidal	WSP 13383 (labeled <i>Poa scabellia</i>)
Triticeae						
<i>Claviceps purpurea</i>						
<i>Agropyron cristatum</i>	WA		6.8 ± 1.1	3.7 ± 0.5	Ellipsoidal	NY: Mycobiota of North America 304, 1948, col. & det. J. Meiners
<i>Elymus canadensis</i>	IL		6.0 ± 0.6	2.8 ± 0.3	Ellipsoidal	ILLS 30054
<i>Elymus canadensis</i>	KS		6.1 ± 0.9	3.2 ± 0.8	Ellipsoidal	NY: Rooks, Co. 1902, Ellis and Everhart's Fungi Columbiani 1614
<i>Elymus canadensis</i>	OR		6.2 ± 0.8	3.6 ± 0.4	Ellipsoidal	OSC 1804
<i>Elymus canadensis</i>	SD		6.2 ± 1.1	3.8 ± 0.5	Ellipsoidal	NY: Farmer, 1927, G.F. Weber
<i>Elymus canadensis</i>	WI		6.1 ± 0.7	2.9 ± 0.5	Ellipsoidal	WIS: Trempealeau, 1914, R.H. Denniston
<i>Elymus canadensis</i>	WI		6.0 ± 0.8	3.4 ± 0.4	Ellipsoidal	WIS: Madison, 1893, Fungi of the T.A. Williams Collection
<i>Elymus caninus</i>	IA		5.6 ± 0.7	3.0 ± 0.3	Ellipsoidal	ICS 386395 (labeled <i>Agropyron caninum</i>)
<i>Elymus caninus</i>	MI		7.9 ± 1.4	3.4 ± 0.6	Ellipsoidal-oblong	MSC: Ag. Coll., 1889 (labeled <i>Agropyron caninum</i>)
<i>Elymus glaucus</i>	OR		6.2 ± 0.7	3.4 ± 0.5	Ellipsoidal	OSC 13669
<i>Elymus glaucus</i>	OR		5.6 ± 0.6	3.3 ± 0.4	Ellipsoidal	WSP 21022
<i>Elymus glaucus</i>	WY		6.2 ± 0.7	3.5 ± 0.4	Ellipsoidal	RM 26034
<i>Elymus lanceolatus</i>	WY		5.9 ± 0.7	3.8 ± 0.4	Ellipsoidal	NY: Mycoflora Saximontanensis Exsiccata 122, 1935, W.G. Solheim (labeled as <i>Agropyron dasystachyum</i>)
<i>Elymus × Agrohordeum macouni</i>	NE		6.8 ± 0.9	3.9 ± 0.6	Ellipsoidal	NEB 158700 (labeled <i>Elymus macouni</i>)
<i>Elymus macounii</i>	WA		5.9 ± 0.6	3.5 ± 0.4	Ellipsoidal	WSP 13384

(Continued on next page)

Table 2. (Continued from previous page)

Species	Location	Conidial type	Conidial length (µm)	Conidial width (µm)	Conidial shape	Source
<i>Elymus repens</i>	NE		5.8 ± 1.0	3.4 ± 0.4	Ellipsoidal	NEB 158701 (labeled <i>Agropyron pseudorepens</i>)
<i>Elymus virginicus</i>	IA		5.8 ± 0.8	2.5 ± 0.4	Ellipsoidal-oblong	UC: Awana, 1925, B. Shimek
<i>Elymus virginicus</i>	IL		6.1 ± 1.1	2.8 ± 0.5	Ellipsoidal	ILLS 22045
<i>Elymus virginicus</i>	NE		6.0 ± 1.2	2.8 ± 0.3	Ellipsoidal	NY: Red Cloud, 1906, Fungi Columbiani 2216, E. Bartholomew
<i>Elytrigia intermedia</i>	KS		7.2 ± 1.3	3.3 ± 0.7	Ellipsoidal	NY: Rockport, 1892, Kansas Fungi, E. Bartholomew (labeled <i>Agropyrum glaucum</i>)
<i>Elytrigia repens</i>	IL		6.5 ± 1.0	3.4 ± 0.4	Ellipsoidal	ILLS 28732 (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	MA		6.2 ± 1.2	3.6 ± 0.5	Ellipsoidal	NY: Amherst, 1925, Massachusetts Fungi 3012, T.T. Ayres & W.L. Doran (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	OR		5.9 ± 0.8	3.2 ± 0.4	Ellipsoidal	NY: Hood River, 1936, J.R. Kienholz (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	NY		6.9 ± 0.9	3.9 ± 0.5	Ellipsoidal	NY: Ex NYS 1041 (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	PA		6.1 ± 1.4	3.1 ± 0.2	Ellipsoidal	WSP1094 (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	VT		6.4 ± 1.0	3.9 ± 0.5	Ellipsoidal	FLAS F46374 (labeled <i>Agropyron repens</i>)
<i>Elytrigia repens</i>	WI		6.3 ± 0.9	3.3 ± 0.5	Ellipsoidal	WIS: Butternut, 1911, J.J. Davis (labeled <i>Agropyron repens</i>)
<i>Elytrigia smithii</i>	MA		6.4 ± 0.9	3.7 ± 0.4	Ellipsoidal	NY: Amherst, 1966, H.E. Ahles (labeled <i>Agropyron smithii</i>)
<i>Hordeum vulgare</i>	WA		6.5 ± 1.3	4.3 ± 0.6	Ellipsoidal	WSP 1114
<i>Leymus cinereus</i>	WA		6.0 ± 0.8	3.3 ± 0.4	Ellipsoidal	WSP 16443
<i>Leymus cinereus</i>	CO		6.7 ± 0.9	3.4 ± 0.4	Ellipsoidal	OSC 6339 (labeled <i>Elymus</i> sp.)
<i>Leymus cinereus</i>	OR		5.5 ± 0.7	3.6 ± 0.5	Ellipsoidal	OSC 10694 (labeled <i>Elymus condensatus</i>)
<i>Leymus cinereus</i>	UT		5.6 ± 0.7	3.3 ± 0.5	Ellipsoidal	NY: Weber Co., 1985, C.T. Rogerson (labeled <i>Elymus cinereus</i>)
<i>Leymus cinereus</i>	ID		5.4 ± 0.5	3.2 ± 0.3	Ellipsoidal	WSP 46010 (labeled <i>Elymus cinereus</i>)
<i>Leymus cinereus</i>	WY		6.3 ± 0.6	3.5 ± 0.5	Ellipsoidal	UC 201420 (labeled <i>Elymus cinereus</i>)
<i>Leymus condensatus</i>	CO		6.6 ± 0.8	3.9 ± 0.3	Ellipsoidal	RM 14584 (labeled <i>Elymus condensatus</i>)
<i>Leymus condensatus</i>	OR		5.7 ± 0.7	3.4 ± 0.5	Ellipsoidal	NY: Echo, 1937, R. Sprague (labeled <i>Elymus condensatus</i>)
<i>Leymus condensatus</i>	WY		5.6 ± 0.7	3.3 ± 0.4	Ellipsoidal	NY: Fungi Columbiani 3704, E. Bartholomew (labeled <i>Elymus condensatus</i>)
<i>Leymus condensatus</i>	WY		6.3 ± 0.9	3.6 ± 0.4	Ellipsoidal	RM 140953 (labeled <i>Elymus condensatus</i>)
<i>Leymus triticoides</i>	OR		5.9 ± 0.9	3.5 ± 0.4	Ellipsoidal	WSP 46004 (labeled <i>Elymus triticoides</i>)
<i>Leymus triticoides</i>	OR		5.5 ± 0.7	3.4 ± 0.4	Ellipsoidal	OSC 10689 (labeled <i>Elymus triticoides</i>)
<i>Pascopyrum smithii</i>	MT		7.2 ± 1.2	3.8 ± 0.4	Ellipsoidal	OSC: Fungi Columbiani 4311, E. Bartholomew (labeled <i>Agropyron occidentale</i>)
<i>Pascopyrum smithii</i>	NE		6.4 ± 0.9	3.5 ± 0.5	Ellipsoidal	NEB 1508705 (labeled <i>Agropyron occidentale</i>)
<i>Pascopyrum smithii</i>	NE		6.2 ± 0.8	3.7 ± 0.4	Ellipsoidal	NEB 158693 (labeled <i>Agropyron smithii</i>)
<i>Pascopyrum smithii</i>	IA		6.0 ± 1.2	2.9 ± 0.5	Ellipsoidal	NY: W. Okaboju, 1932, G.W. Martin (labeled <i>Agropyron smithii</i>)
<i>Pascopyrum smithii</i>	KS		5.2 ± 0.7	2.9 ± 0.5	Ellipsoidal	NY: Ellis and Everhart's Fungi Columbiani 1816, E. Bartholomew (labeled <i>Agropyron occidentale</i>)
<i>Secale cereale</i>	ND		5.8 ± 1.1	3.2 ± 0.4	Ellipsoidal	NY: Fungi Dakotenses 328, J.F. Brenckle
<i>Secale cereale</i>	NY		6.5 ± 0.9	3.1 ± 0.0	Ellipsoidal	CUP 2891
<i>Triticum aestivum</i>	NY		5.4 ± 0.5	3.3 ± 0.3	Ellipsoidal	CUP 19373
Cyperaceae						
<i>Claviceps nigricans</i>						
<i>Eleocharis macrostachya</i>	CA		9.5 ± 2.0	3.8 ± 0.5	Ellipsoidal-oblong	RM 38811
<i>Eleocharis macrostachya</i>	CA		10.4 ± 0.9	3.6 ± 0.4	Ellipsoidal-oblong	CUP 47305
<i>Eleocharis palustris</i>	CA		11.2 ± 2.1	3.6 ± 0.6	Ellipsoidal-oblong	NY: CA Fungi 764, 1949, M.A. Nobs & S.G. Smith
<i>Eleocharis rostellata</i>	CA		11.1 ± 1.5	3.6 ± 0.4	Ellipsoidal-oblong	CUP 36613
<i>Claviceps grohii</i>						
<i>Carex</i> sp.	OR		16.4 ± 1.9	5.2 ± 0.6	Ellipsoidal-oblong	OSC 1852
<i>Carex brunnesens</i>	Canada		11.2 ± 1.3	3.8 ± 0.3	Ellipsoidal-oblong	DOAM 13621
<i>Carex canescens</i> spp. <i>arc-taeformis</i>	Canada		13.2 ± 2.1	4.5 ± 0.5	Ellipsoidal-oblong	DOAM 105889
Juncaceae						
<i>Claviceps</i> sp.						
<i>Juncus nevadensis</i>	CA		12.1 ± 1.5	4.4 ± 0.6	Ellipsoidal-oblong	WIS: Modoc Co., 1958, col. L.C. Anderson, det. H.C. Green
<i>Juncus ensifolius</i>	Canada		13.8 ± 2.1	4.4 ± 0.4	Ellipsoidal-oblong	NY: DOAM 214361
<i>Juncus articulatus</i>	Canada		12.7 ± 1.7	4.1 ± 0.4	Ellipsoidal-oblong	FH: DOAM 184499

gerardii Vitman, *A. halli* Hack., *Bothriochloa ischaemum* (L.) Keng., and *Schizachyrium scoparium* (Michx.) Nash. Yellow stipes and capitula observed in a collection from *B. ischaemum* from TX (BPI 633256) were consistent with descriptions of *C. pusilla*. However, in examination of specimens of *Andropogon* spp. from IA (Table 2), conidia were ellipsoidal, and the triangular conidia unique to *C. pusilla* were not seen.

C. ranunculoides was reported from AZ, NM, and TX on *Setaria macrostachya* Kunth, although the occurrence of *C. ranunculoides* in the United States is questioned (Table 1). Sclerotia of *Claviceps* on *Setaria* from TX and NM were cream to buff-brown to gray, with the upper half generally darker than the lower half, elongate, curved, slightly flattened, with a single longitudinal furrow on each flattened side and a relatively smooth texture. The specimens, labeled as *C. ranunculoides*, differed from blue-black sclerotia of the type description of *C. ranunculoides* (112), but they were somewhat similar to descriptions of *C. sulcata* Langdon from *Bracharia* spp. (102). *C. sulcata* is not known to occur in the United States.

Claviceps tripsaci was reported from GA, DC, MD, MS, NC, OK, and VA. *C. tripsaci* is known only from *Tripsacum dactyloides* (L.) L. Three conidial types were recovered from sclerotia: fusiform macroconidia, $27 \times 5 \mu\text{m}$, ellipsoidal mesoconidia, $11 \times 4 \mu\text{m}$, and spherical-ellipsoidal microconidia, $4 \times 3 \mu\text{m}$.

Claviceps yanagawensis is known from FL and VA on *Zoysia japonica* Steudal. Conidia were not observed in sufficient numbers for size determination.

C. zizaniae was reported from IA, ME, MD, MN, MO, NE, ND, and WI. *Zizania aquatica* L. and *Z. palustris* L. var. *palustris* are the only known hosts. Conidia of *C. zizaniae* from *Zizania* were ellipsoidal to oblong, $11\text{--}12 \times 4\text{--}5 \mu\text{m}$, with ends more tapered than rounded (Table 2).

DISCUSSION

The occurrence and distribution of *Claviceps* spp. in the United States reflects adaptation of *Claviceps* to a diversity of habitats, ranging from marine to arid and subtropical to northern temperate. Most *Claviceps* spp. have a narrow host range, including one to several closely related genera. The exception is *C. purpurea* var. *purpurea*. The vast majority of hosts for *C. purpurea* var. *purpurea* are in the Pooideae, with some hosts reported in the Arundinoideae. Genera in the Panicoideae are not considered hosts for *C. purpurea* var. *purpurea* (96), and our observations support this concept. The distribution of *C. purpurea* var. *purpurea* in the United States closely follows the distribution of the Pooideae, which include primarily cool season, temperate grasses. *C. purpurea* var. *purpurea* requires a period of several

weeks of cold, near-freezing temperatures to induce fructification (111) and is therefore adapted to temperate climatic conditions. In addition, sclerotia of *C. purpurea* var. *purpurea* were reported susceptible to microbial decay under warmer conditions in the southeastern United States (28). However, *C. purpurea* var. *purpurea* may survive in the southeastern United States in the conidial state.

Because *C. purpurea* var. *purpurea* has such a wide host range and genetic diversity, it is often assumed to be the causal agent when floral sclerotia are found on a grass host. Confirmation of *C. purpurea* var. *purpurea*, especially on hosts outside the Pooideae, should be based on examination of sclerotia, ascostromata, and conidia, or through the determination and analysis of ITS and/or other sequences. Loveless (100,101) found evidence for restricted host range among *Claviceps* spp. based on conidial morphology. We found conidial size to be a relatively stable attribute among species of *Claviceps*. However, consistently larger conidia developed on hosts in the tribes Aveneae and Meliceae than on hosts in other tribes in the Pooideae. Loveless and Peach (103) found conidial size to be under host genotype control, which suggests adaptation of strains of *C. purpurea* var. *purpurea* to specific hosts. However, Pazoutova et al. (119) found strains of *C. purpurea* var. *purpurea* adapted to various habitats, with larger conidia associated with hosts in wet habitats. Variation in habitat may account for the variability in conidial size observed in *C. purpurea* var. *purpurea* found on grasses in the Aveneae and Meliceae. Many of the grasses in the Aveneae (*Calamagrostis*) and Meliceae (*Glyceria*) on which large conidia of *C. purpurea* var. *purpurea* were found occur in wetland habitats. Some grass species (*Calamagrostis canadensis*, *Cinna latifolia*), associated with a large variation in size of conidia of *C. purpurea* var. *purpurea*, grow in both wetland and upland sites.

In our examination of *Claviceps* from the Panicoideae, tribe Andropogoneae, collections from *Andropogon* and *Sorghastrum* differed from *C. purpurea* var. *purpurea* by the presence of both macroconidia and microconidia, which clearly separated them from *C. purpurea* var. *purpurea*. In addition, sclerotia from the Andropogoneae were light in color compared with the dark colored sclerotia of *C. purpurea* var. *purpurea*. We agree with Langdon (96) that hosts in the panicoid grasses are likely not susceptible to *C. purpurea* var. *purpurea*. From an ecological perspective, this makes sense since the cold requirement for germination of sclerotia of *C. purpurea* var. *purpurea* would not be met by the subtropical habitat of many of the panicoid grasses.

A *Claviceps* sp. on *Setaria* from TX formed macroconidia and microconidia.

Collections from NM were similar except that clearly differentiated macroconidia were not observed. Since sclerotia were similar and unique in coloration and morphology, it is likely that macroconidia production was not as great in collections from NM. The *Claviceps* sp. on *Setaria* remains unidentified.

C. paspali was originally described from *Paspalum* in the United States by Stevens and Hall (153). It is widespread in the southern states, and it is an important pathogen of *Paspalum* spp. grown there for seed.

The earliest record found for *C. pusilla* was by Pammel and Weems in 1900 (116). Tiffany (157) identified *C. pusilla* on *Andropogon* spp. based on examination of ascromata from germinated sclerotia. Examination of a collection from TX (BPI) revealed yellow capitula characteristic of *C. pusilla*. However, in collections of Tiffany, labeled as *C. pusilla*, triangular conidia characteristic of this species were not present. Additional collections need to be examined to confirm the presence of *C. pusilla* in the United States. *C. pusilla* has a wide geographical distribution, is known from *Andropogon* spp., and likely occurs on *Andropogon* spp. in the United States. However, we consider reports of *C. purpurea* var. *purpurea* on *Andropogon* spp. to be incorrect.

C. ranunculoides was first described by Möller (112) on *Setaria* in Brazil. In the United States, it was reported on *S. macrostachya* from AZ, NM, and TX, but we consider these reports erroneous. The sclerotia from U.S. collections were gray in color and clearly differed from the dark, purple-black color described for sclerotia of *C. ranunculoides*. Therefore, the occurrence of *C. ranunculoides* in the United States is questionable. *Setaria* is a member of the Panicoideae, which includes hosts susceptible to several subtropical to tropical species of *Claviceps*. However, *Setaria* spp. are not considered hosts of *C. purpurea* var. *purpurea*.

C. tripsaci was first described from NC by Stevens and Hall (153) in 1910. Few reports of *C. tripsaci* occur, few collections are available, and little is known about this species beyond the original technical description of Stevens and Hall (153).

In the case of *Claviceps* on *Zizania*, studies of Fyles (46), Pantidou (117), and Steinmetz and Wright (152) clearly demonstrated that *C. zizaniae* and not *C. purpurea* is the pathogen of *Zizania*. In our examination of collections of *Claviceps* from *Zizania* in ND, ME, and MN, the oval-elongate conidia were typical for *C. zizaniae* and considerably larger than conidia of *C. purpurea* var. *purpurea*. In addition, the less dense, more elliptically shaped sclerotia of *C. zizaniae* clearly differ from the generally tapered sclerotia of *C. purpurea* var. *purpurea*.

Table 3. List of grasses reported as hosts of *Claviceps purpurea* in the United States, based on published reports, inclusion in the National Fungus Collection database, or other herbaria, after examination and confirmation of host^a

Host	Source
Arundinoideae	
Arundineae	
<i>Phragmites australis</i> (Cav.) Trin. ex Steud. = <i>Phragmites phragmites</i> (L.) H. Karst = <i>Phragmites communis</i> Trin.	DC (BPI); IA (ISC, 9, 53, 116, 136); NJ (9, 136); ND (136, 162); OK (9, 41, 126, 136)
Danthonieae	
<i>Danthonia paryii</i> Scribn.	CO (136)
<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & Schult.	MI (MICH, 9, 123, 136); WI (BPI)
<i>Molinia caerulea</i> (L.) Meonch	DC (BPI)
Stipeae	
<i>Achnatherum lemmonii</i> (Vasey) Barkworth = <i>Stipa columbiana</i> Macoun	ID (WSP, 136); IN (9); UT (BPI, WSP, 9, 136); WA (9)
<i>Achnatherum lettermanii</i> (Vasey) Barkworth = <i>Stipa lettermanii</i> Vasey	WA (WSP, 9, 136, 147); WY (RM)
<i>Achnatherum nelsonii</i> (Scribn.) Barkworth = <i>Stipa columbiana</i> var <i>nelsonii</i> (Scribn.) Hitchc.	UT (BPI); WA (136, 148)
<i>Achnatherum nelsonii</i> (Scribn.) Barkworth ssp. <i>dorei</i> (Barkworth & J.R. Maze) Barkworth = <i>Stipa minor</i> (Vasey) Scribn.	IN (105)
<i>Achnatherum robustum</i> (Vasey) Barkworth = <i>Stipa robusta</i> (Vasey) Scribn.	MT (99, 136)
<i>Achnatherum scribneri</i> (Vasey) Barkworth = <i>Stipa scribneri</i> Vasey	CO (NY)
<i>Heterostipa comata</i> (Trin. & Rupr.) Barkworth = <i>Stipa comata</i> Trin. & Rupr.	MT (MONTU); ND (136, 162)
<i>Heterostipa spartae</i> (Trin.) Barkworth = <i>Stipa spartea</i> Trin.	ND (136, 162); WI (WIS, 63)
<i>Nassella viridula</i> (Trin.) Barkworth = <i>Stipa viridula</i> Trin.	IA (ICS, 52, 157); MN (9, 45, 127, 136); ND (BPI, 9, 44, 136, 162); SD (106)
<i>Oryzopsis asperfolia</i> Michx.	NY (CUP)
<i>Oryzopsis racemosa</i> (Sm.) Ricker ex A.S. Hitchc.	WI (61)
<i>Piptatherum miliaceum</i> (L.) Cosson = <i>Oryzopsis milacea</i> (L.) Asch. & Schweinf.	DC (BPI)
Chloridoideae	
<i>Bouteloua curtipendula</i> (Michx.) A. Gray	NE (9, 136); OK (136)
<i>Bouteloua gracilis</i> (Kunth) Lag. ex. Steud.	OK (125, 136)
<i>Buchloe dactyloides</i> (Nutt.) Engelm.	OK (BPI)
<i>Cynodon dactylon</i> (L.) Pers.	OK (25, 26)
<i>Distichlis spicata</i> (L.) Greene	DC (BPI); MD (136); MS (9, 118); WA (FH, UC, 9, 136)
Pooideae	
Aveneae	
<i>Agrostis canina</i> L.	IA (ICS, 52, 157)
<i>Agrostis capillaris</i> L. = <i>Agrostis tenuis</i> Sibth. = <i>Agrostis vulgaris</i> With.	DC (BPI); IA (116); OR (BPI, 2, 9, 135, 136); WA (BPI, 17, 136); WI (WIS)
<i>Agrostis exarata</i> Trin.	AK (22, 136); OR (BPI, NY, OSC, 9, 135, 136); UT (NY)
<i>Agrostis hyemalis</i> (Walter) B.S.P.	ND (9, 162); OK (9, 41); WI (9, 61)
<i>Agrostis scabra</i> Willd.	ND (136); OK (125, 136); WI (BPI, 136)
<i>Agrostis stolonifera</i> L. = <i>Agrostis alba</i> L. = <i>Agrostis alba</i> var. <i>ovularies</i> = <i>Agrostis palustris</i> Huds.	CO (BPI); DC (BPI); IA (ICS, 9, 53, 136, 157); IL (ILLS, 16, 74, 136); MI (BPI, MSC, 9, 123); MN (127, 136); ND (9, 136, 162); OH (BPI, 9, 76); OR (BPI, OSC, NY, WSP, 2, 9, 135, 136); PA (9); SD (FH); WI (45, 149); PA to IA (9)
<i>Alopecurus borealis</i> Trin. = <i>Alopecurus alpinus</i> Sm. = <i>Alopecurus occidentalis</i> Scribn. & Tweedy	MT (BPI); WY (BPI)
<i>Alopecurus geniculatus</i> L.	ND (RM, 9, 136, 162)
<i>Alopecurus pratensis</i> L.	IN (9, 105); IA (ICS, 52, 157); MI (MSC, 9); MT (BPI; 9, 44, 136); ND (136, 162); OR (BPI, NY, 9, 44, 135, 136); SD (106)
<i>Ammophila arenaria</i> (L.) Link	MI (BPI, MICH); OH (NY); WI (BPI, WIS, 136)
<i>Ammophila breviligulata</i> Fern.	IN (9); MI (BPI, 9, 105); NY (BPI, NY); NC (54); OH (9); WI (WIS, 61)
<i>Anthoxanthum odoratum</i> L.	NY (NY)
<i>Arctagrostis latifolia</i> (R. Br.) Griseb.	AK (BPI, 22)
<i>Arrhenatherum elatius</i> (L.) J. Presl & C. Presl	IN (9, 105); IA (ICS, 52, 157); KY (9, 73); MO (BPI, 9, 99, 136); MT (9, 44, 136); NE (BPI); OH (9, 99, 136); OR (9, 44, 135, 136); WI (9, 45, 61, 136); WV (BPI, 39)
<i>Arrhenatherum elatius</i> var. <i>bulbosum</i> (Willd.) Spenner = <i>Arrhenatherum tuberosum</i> (Gilib.) F.W. Schultz	IA (52, 157)
<i>Avena sativa</i> L.	CO (9, 136); DC (BPI); IL (16); IA (BPI, 9, 52, 53, 136); KS (9, 108); MI (9); MN (9, 85, 127); NY (9); ND (9, 85, 108, 136, 162); OH (37); OK (9, 41); SD (106); WA (9, 75, 136); scattered in east (136).

(Continued on next page)

^a Herbaria were inventoried for ergot during 1996 to 1999. Herbarium codes are those listed in *Index Herbariorum* (81).

^b Most reports of Sprague et al. prior to 1958 of fungi on *E. condensatus* belong under *E. cinereus* (139).

Table 3. (Continued from previous page)

Host	Source
<i>Calamagrostis canadensis</i> (Michx.) Beauv. = <i>Calamagrostis canadensis</i> var. <i>scabra</i> (Presl) Hitchc. = <i>Calamagrostis canadensis</i> var. <i>acuminata</i> Vasey ex Shear & Rydb.	AK (BPI, WIS, WSP, 136); IL (BPI); IA (ICS, 53, 115, 116, 136, 157, 158); ME (BPI, CUP, 9, 136); MA (FH); MI (BPI, 9, 136); MN (BPI, MSC, WIS, 45, 85, 127, 136, 149); MT (FH); NH (BPI); NY (BPI, CUP); OR (136); SD (106, 164); WA (UC, 9, 136); WI (BPI, WIS, 45, 60, 61, 136); ME to MN (9)
<i>Calamagrostis canadensis</i> (Michx) Beauv. var. <i>langsдорffii</i> (Link) Inman = <i>Calamagrostis langsдорffii</i> (Link) Trin.	AK (BPI, 22)
<i>Calamagrostis coarctata</i> (Torr.) Eat. = <i>Calamagrostis cinnoides</i> W. Bart.	MA (BPI)
<i>Calamagrostis epigeios</i> Roth	IA (ICS, 52, 157, 165)
<i>Calamagrostis hyperborea</i> Lange	ND (162)
<i>Calamagrostis koeleroides</i> Vasey	CA (UC)
<i>Calamagrostis nutkaensis</i> (J. Presl) J. Presl ex Steud. = <i>Calamagrostis aleutica</i> Trin.	AK (BPI, 22, 136); OR (135, 136)
<i>Calamagrostis purpurascens</i> R. Br.	CO (BPI)
<i>Calamagrostis rubescens</i> Buckley	MT (WSP, 138)
<i>Calamagrostis stricta</i> (Timm.) Koel. = <i>C. neglecta</i> (Her) Gaertn., B. Mey. & Schreb.	MN (75, 127); NE (NEB); ND (BPI, OSC, NY, 19, 136); WI (56, 61, 136)
<i>Calamagrostis stricta</i> (Timm.) Koel. ssp. <i>inexpansa</i> (A. Gray) C.W. Greene = <i>C. inexpansa</i> A. Gray = <i>C. inexpansa</i> var. <i>brevior</i> (Vasey) Stebbins	MN (WSP, 9, 127, 142); MT (9, 136, 147); ND (OSC, 9, 44, 136); SD (FH, 106); WI (WIS, 66).
<i>Cinna arundinacea</i> L.	WI (WIS, WSP, 61, 136)
<i>Cinna latifolia</i> (Trev. ex Goepp.) Griseb.	AK (144)
<i>Deschampsia caespitosa</i> (L.) Beauv.	IA (ICS, 52, 157); OR (9, 44, 136)
<i>Deschampsia caespitosa</i> ssp. <i>holiciformis</i> (C. Presl) W.E. Lawrence = <i>Deschampsia holiciformis</i> C. Presl	DC (BPI); WA (WIS)
<i>Hierochloa odorata</i> (L.) Beauv.	CT (ICS); ND (136, 162)
<i>Holcus lanatus</i> L.	OR (BPI, OSC, NY, 9, 135, 136); WA (BPI, CUP, WIS, WSP, 9).
<i>Keoheria macrantha</i> (Ledeb.) J.A. Schultes = <i>Koeleria cristata</i> (L.) Pers.	AZ (BPI, WIS, 9, 136); ID (WSP, 9, 136, 147); IA (BPI, 9, 53, 136); KS (9, 136); MN (127); MO (136); MT (WSP, 6, 24, 136); ND (136, 162); OK (9, 41, 126, 136); UT (10); WI (BPI, WIS, 9, 60, 61, 136)
<i>Phalaris aquatica</i> L. = <i>Phalaris tuberosa</i> L.	IA (ICS)
<i>Phalaris arundinacea</i> L. = <i>Phalaris arundinacea</i> var. <i>picta</i> L.	CA (12); CT (BPI, WIS); DE (NY); IL (BPI, 99, 136); IN (MICH); IA (ICS, 52, 157, 158); KS (BPI); ME (BPI, 136); MD (BPI); MA (BPI, GH, NY); MI (MICH); MN (85, 127, 136); MT (6, 9, 24, 136); NY (BPI, CUP, WIS, 9, 136); ND (136, 162); OK (9, 41, 126, 136); PA (BPI, 76, 79, 93, 108); SD (106, 164); VA (BPI, CUP, FH, 136); WI (BPI, WIS, 5, 60, 61, 136); ME to VA (9, 136);
<i>Phalaris californica</i> Hook. & Arn.	IA (ICS, 52, 157)
<i>Phalaris canariensis</i> L.	IA (52, 157); MI (9, 123, 136); MN (9, 127, 136)
<i>Phalaris caroliniana</i> Walt.	IA (ICS, 52, 58)
<i>Phleum pratense</i> L.	AK (BPI, 9, 22, 136); CT (BPI, 136); DC (BPI); IL (BPI, F, NY); IN (MIN, 105); IA (BPI, 53, 113, 116, 136, 157); KY (9, BPI); ME (9, BPI); MI (BPI, MSC, NY, 123); MN (BPI, 9, 45, 85, 127, 136, 155); NY (NY); ND (136, 162); OK (41); OR (BPI, OSC, 9, 135, 136); PA (BPI); SD (NY, 106); TX (BPI); WA (9); WI (BPI, CUP, UC, WSP, 45, 61, 116, 136); ME to KY (9); scattered in the east (136)
<i>Trisetum canescens</i> Buckley	ID (WSP, 9, 148, 136)
Bromeae	
<i>Bromus anomalus</i> Rupr. ex Fourn.	WY (RM)
<i>Bromus carinatus</i> Hook. & Arn. = <i>Bromus marginatus</i> Nees ex Steud. = <i>Bromus polyanthus</i> Scribn.	CA (BPI, F, WIS); ID (WSP, 44, 136); IN (105, 136); IA (ICS, 52, 107, 157); KY (73); MT (9, 44, 136); NV (9); NH (BPI); OR (WSP, 135, 136); UT (RM, NY, 136); WA (WSP, 9, 44, 136); WY (BPI, RM, 136, 147); MT to NV (9)
<i>Bromus ciliatus</i> L.	MT (9, 44, 136); WI (WIS, 61, 136)
<i>Bromus commutatus</i> Schrad.	IL (ILLS); IA (52, 157)
<i>Bromus erectus</i> Huds.	DC (BPI); MN (9, 99, 127, 136); MT (9, 44, 136); NY (BPI, 9)
<i>Bromus erectus</i> subsp. <i>condensatus</i> (Hack.) Ascher. & Graebn. = <i>Bromus condensatus</i> Hack.	ID (45)
<i>Bromus inermis</i> Leyss.	AZ (136); CO (15, 136); DC (BPI, 136); ID (BPI, WSP, 136, 147); IL (ILLS, 16, 99, 136); IN (BPI, 105); IA (BPI, 53, 86, 107, 108, 136, 157); KS (BPI, 86, 131); KY (72, 73); MD (136); MA (NY); MI (MSC, 13, 71, 136); MN (BPI, WIS, NY, 45, 56, 75, 99, 127, 136, 155); MO (BPI, 99, 136); MT (WSP, 99, 136); NE (BPI, NEB, 1, 86, 136); NH (92); NY (BPI); ND (BPI, WSP, 19, 44, 75, 99, 136, 162); OK (41); SD (BPI, NY; 44, 106, 136); UT (BPI); WA (BPI, WIS, WSP, 42, 136); WV (BPI, 38); WI (BPI, WIS, 5, 45, 56, 60, 61 82, 99, 136); WY (BPI, 14, 136); wide-spread (9); general eastward (136)
<i>Bromus inermis</i> Leyss. var. <i>pumpellianus</i> (Scribn.) C.L. Hitchc. = <i>Bromus pumpellianus</i> Scribn.	AK (WIS); MN (127, 136); MT (136)
<i>Bromus japonicus</i> Thunb. ex Murray	IA (52, 107, 157)

(Continued on next page)

Table 3. (Continued from previous page)

Host	Source
<i>Bromus kalmii</i> Gray = <i>Bromus purgans</i> L. <i>Bromus secalinus</i> L.	IA (ICS, 52, 107, 157) IL (ILLS); IA (ICS, 52, 157); IN (9, 105, 136); KY (9, 73); MO (F); WA (WSP, 136, 148); WV (BPI, 38) KS (BPI)
<i>Bromus tectorum</i> L.	ID (BPI, 136); ME (BPI, 136); MI (MICH, 136); NY (CUP); WI (BPI, F, 32, 60, 61, 136) ME (BPI, 136)
Meliceae	IA (53, 115, 116); WI (WIS, 9, 45)
<i>Glyceria borealis</i> (Nash) Batch.	IA (136); ND (136, 162); WI (63)
<i>Glyceria canadensis</i> (Michx.) Trin.	IA (ISC, 9); IN (9, 136); WI (9, 61, 136) OK (9, 41, 126, 136); WA (9, 136); WI (BPI, 9, 61, 136)
<i>Glyceria fluitans</i> (L.) R. Br. = <i>Panicularia fluitans</i> (L.) Kuntze	
<i>Glyceria grandis</i> S. Watson ex A. Gray = <i>Panicularia grandis</i> (S. Wats.) Nash	
<i>Glyceria septentrionalis</i> A. S. Hitchc.	
<i>Glyceria striata</i> (Lam) A.S. Hitchc. = <i>Glyceria nervata</i> (Willd.) Trin.	
Poeae	
<i>Arctophila fulva</i> (Trin.) Rupr. ex Andress.	AK (22, 136) DC (BPI)
<i>Briza media</i> L.	AK (BPI, 22, 136); AZ (136); CA (12); CT (136); IL (ILLS); IN (BPI, 105); IA (BPI, ICS, 52, 107, 113, 157); KS (BPI); KY (73, 99, 136); ME (BPI, 9, 136); MD (84); MI (MSC, 70, 71, 136); MN (45, 127, 136); MT (99, 136); NH (92); NY (BPI, CUP, MIN, 163); ND (162); OK (9, 41, 126, 136); OR (BPI, 2, 44, 135, 136); TN (BPI, 99, 136); VA (9); WA (UC, WIS, WSP, 9, 136); WV (BPI); WI (BPI, WIS, 5, 45, 60, 61, 136); ME to VA (9); general in the east (136) MO (99)
<i>Dactylis glomerata</i> L.	MN (45, 85, 127)
<i>Festuca arvernensis</i> Auquier, Kerguelen & Markgr.-Dannenb. = <i>Festuca ovina</i> var. <i>glauca</i> (Lam.) W.D.J. Koch	ID (9, 44, 148, 136); MT (WSP, 136); ND (136); OR (WSP, 9, 148, 136); WY (BPI) CO (136, 147); UT (BPI); WY (WSP, 136, 147)
<i>Festuca heterophylla</i> Lam. = <i>Festuca rubra</i> var. <i>heterophylla</i> (Lam.) Mutel	AK (WIS); ID (140); IA (ICS, 52, 157); MD (BPI, 9); MO (9, 136); WI (BPI, WSP, 61, 136) AK (BPI, 22); DC (BPI); IA (52, 157); KY (9, 136); MA (WIS); MN (9, 127, 136); NY (9, 136); ND (BPI, 136); OR (44, 136); SD (106); WA (44, 136); NY to KY and MN and Pacific Northwest (9) KY (73, 136); ND (136); OR (2); WA (44, 136).
<i>Festuca idahoensis</i> Elmer	WI (WIS; 65)
<i>Festuca kingii</i> (S. Wats.) Cassidy = <i>Festuca confinis</i> Vasey	CA (12); CT (BPI); FL (4); IL (ILLS); IN (105); IA (ICS, 52, 157); KY (72, 73, 136); ME (BPI, 136); MD (BPI); MA (BPI); MN (45, 127); NY (BPI; CUP, 75, 163); NC (54); ND (136, 162); OK (41, 126, 136); OR (2, 44, 135, 136); PA (BPI, 108); VT (BPI); VA (BPI, CUP, 136); WA (WSP, 136, 145); WV (BPI); WI (WIS, 45, 64); general (9); ME to VA (136) DC (BPI)
<i>Festuca ovina</i> L.	CA (9, 44, 136); KY (9, 72, 73, 136); OK (9, 41, 125, 136); OR (BPI, OSC, WSP, 9, 44, 135, 136); WA (BPI, OSC, WSP, 9, 93, 136) CA (BPI, 9, 44, 136); CT (BPI); DC (BPI, WIS, WSP); ID (9, 136); IL (ILLS); IA (52, 157); KS (9, 136); MD (BPI, 9, 136); MA (NY); MI (9, 71, 136); MN (9, 127, 136); NE (9, 136); ND (136, 162); OK (9, 41, 125, 136); OR (OSC, 2, 9, 44, 135, 136); PA (BPI); SD (9, 136); VA (9, 136); WA (BPI, WSP, 9, 93); WV (BPI, 9, 136); WI (BPI, WIS, 59, 61, 136); WY (NY) DC (BPI); MA (NY); MN (45); VT (BPI)
<i>Festuca rubra</i> L.	CA (WSP, 140)
<i>Festuca rubra</i> ssp. <i>falax</i> Thuill. = <i>Festuca rubra</i> var. <i>commutata</i> Gaud.	IA (116); MO (136); OK (9, 41, 126, 136) ND (9, 136, 148)
<i>Festuca subverticillata</i> (Pers.) Alexeev. = <i>Festuca obtusa</i> Biehler	IL (ILLS, 16); IN (105); IA (ICS, 52, 157); KY (9); MN (85, 127, 136); MO (136); MT (9, 99, 136); ND (136, 162); OK (9, 41, 124, 126, 136); SD (164); WA (WSP, 9, 136, 148); WI (BPI, 45, 61, 136); northeastern and north central states to KY (9) CO (9); ND (9); UT (BPI, NY, 136); WA (9); ND to CO (9)
<i>Lolium arundinaceum</i> (Schreber) Darbysh = <i>Festuca arundinacea</i> Schreb. = <i>Festuca elatior</i> L. = <i>Festuca elatior</i> var. <i>arundinacea</i> (Schreb.) Wimm.	WA (44, 136) WY (136) IN (105); MN (127, 136); ND (BPI, 9, 44, 134, 136); SD (106, 136)
<i>Lolium giganteum</i> (L.) Darbysh. = <i>Festuca gigantea</i> (L.) Vill.	
<i>Lolium multiflorum</i> Lam. = <i>Lolium italicum</i> A. Braun	
<i>Lolium perenne</i> L.	
<i>Lolium pratense</i> (Hudson) Darbysh. = <i>Festuca pratensis</i> Huds.	
<i>Lolium rigidum</i> ssp. <i>lepturoides</i> (Boiss.) Sennen & Maurico = <i>Lolium subulatum</i> Vis.	
<i>Poa annua</i> L.	
<i>Poa arida</i> Vasey	
<i>Poa compressa</i> L.	
<i>Poa fendleriana</i> (Steud.) Vasey = <i>Poa longiligula</i> Scribn. & Williams	
<i>Poa nemoralis</i> L.	
<i>Poa nervosa</i> (Hook.) Vasey	
<i>Poa palustris</i> L.	

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Table 3. (Continued from previous page)

Host	Source
<i>Poa pratensis</i> L.	AK (WSP, 143); IL (BPI); KY (9, 73, 99, 136); IA (BPI, 85, 113, 116, 136, 157); MI (BPI, MSC); MN (45, 85, 127, 136); MO (BPI); MT (9, 44, 136); NY (136); ND (136, 162); OH (136); OK (9, 41, 126, 136); OR (OSC, 2); PA (136); SD (164); UT (FH, 136); WA (136); WI (5, 45, 61, 82, 136); WY (WSP, 136); north eastern and north central states to KY (9)
<i>Poa pratense</i> L. × <i>Poa arachnifera</i> Torr.	IA (52, 157); MO (BPI, 99, 136)
<i>Poa secunda</i> J. Presl	CO (9); ID (WSP, 136, 147, 148); MT (99, 136); ND (9, 134, 136); OR
= <i>Poa canbyii</i> Vasey	(BPI, WSP, 135, 136, 145); UT (WSP, 136, 145); WA (WSP, 9, 43, 44, 136); WY (BPI, 136); ND to CO (9)
= <i>Poa gracillima</i> Vasey	
= <i>Poa juncifolia</i> Scribn.	
= <i>Poa longifolia</i> Trin.	
= <i>Poa nevadensis</i> Vasey	
= <i>Poa scabrella</i> (Thurb.) Benth.	
<i>Poa secunda</i> J. Presl ssp. <i>nevadensis</i> (Scribn.) Soreng	DC (BPI); ID (44, 136); MT (99, 136); NC (BPI); ND (134, 136, 148); WA
= <i>Poa ampla</i> Merr.	(42, 43, 44, 136)
<i>Poa stenantha</i> Trin.	WA (44, 136)
<i>Poa tibetica</i> Munro ex Stapf.	DC (BPI)
<i>Puccinellia nutkaensis</i> (J. Presl) Fern. & Weatherby	AK (WSP, 143)
<i>Puccinellia distans</i> (Jacq.) Parl.	WA (9, 44, 136)
<i>Torreyochloa pallida</i> (Torr.) Church var. <i>pauciflora</i> (J. Presl) J.I. Davis	AK (22, 136, 143)
= <i>Glyceria pauciflora</i> Presl	
<i>Vulpia octoflora</i> (Walt.) Rydb.	MI (9, 136)
= <i>Festuca octoflora</i> Walt.	
Triticeae	
<i>Agropyron cristatum</i> (L.) Gaertn.	DC (BPI); IN (105, 136); IA (ICS, 52, 157); KY (73); MA (BPI); MI (71, 136); MN (85, 127, 136); MT (BPI, WSP, 44, 99, 136); ND (BPI, 44, 136); OR (BPI, NY, 135, 136); SD (44, 99, 106, 136); WA (BPI, NY, 44, 136); WY (WIS, 14, 136); general (9)
<i>Agropyron desertorum</i> (Fisch. ex Link) J.A. Schult.	MD (BPI); MI (71, 136); MN (85, 127); ND (136); SD (106); WA (136, 146); WY (RM; 50)
<i>Agropyron fragile</i> (Roth) Candargy ssp. <i>sibiricum</i> (Willd.) Melderis	DC (BPI); MI (70, 71, 136); MN (127, 136); MT (BPI; 136); ND (BPI, 44, 136); general (9)
= <i>Agropyron sibiricum</i> (Willd.) P. Beauv.	DC (BPI); ND (136)
<i>Agropyron michnoi</i> Roshev.	WI (BPI, 57, 61)
<i>Agropyron trachycaulum</i> ssp. <i>subsecundus</i> (Link) A. & D. Love	
= <i>Agropyron trachycaulum</i> (Link) Malte var. <i>glaucum</i> (Pease & Moore) Malte	
<i>Elyhordeum</i> × <i>Agrohordeum macounii</i> (Vasey) Lepage	IA (BPI); MN (75, 127); MT (BPI, 44, 136); NE (NEB, 18); ND (BPI, 44, 136, 162); SD (BPI, 106); WA (WSP, 136, 145)
= <i>Elymus macounii</i> Vasey	NE (NEB); WY (BPI)
<i>Elymus</i> × <i>Pseudorepens</i> (Scribn. & J.G. Sm.) Barksworth & Dewey	
= <i>Agropyron pseudorepens</i>	
<i>Elymus alaskanus</i> (Scribn. & Merr.) A. Love ssp. <i>alaskanus</i>	MT (7)
= <i>Agropyron violaceum</i> (Hornem.) Lange	
<i>Elymus canadensis</i> L.	CO (BPI); ID (136); IL (BPI, ILLS); IA (BPI, WIS, 8, 53, 116, 136, 158);
= <i>E. canadensis</i> var. <i>robustus</i> (Scribn. & J.G. Sm.) Mackenzie & Bush	KS (BPI, FH, NY, 89, 131); MI (71); MN (45, 127, 136); MO (BPI, 136);
= <i>E. robustus</i> Scribn. & Smith	MT (ICS); NE (BPI, NEB, 1, 136); NM (BPI, 136, 150); ND (136, 162);
	OH (NY); OK (41, 97, 125, 136); OR (OSC, 135, 136); SD (BPI, NY, 102, 106, 136, 164); TX (BPI, 23, 136); UT (BPI, 136); WA (136); WI (BPI, WIS, 43, 45, 136); WY (BPI, 14, 136, 151). general in the east (136); general (9)
<i>Elymus caninus</i> (L.) L.	IA (BPI, ISC, 53); MI (MSC, 70, 71, 136); MN (45, 85); ND (136); SD
= <i>Agropyron caninum</i> (L.) Beauv.	(NEB, 164); WA (44, 136); WI (45)
<i>Elymus dahuricus</i> Turcz. ex Griseb.	ND (9, 148, 136); WA (9, 44, 136)
<i>Elymus dahuricus</i> Turcz. ex Griseb. ssp. <i>excelsus</i> (Turcz. ex Griseb.) Tzvel.	
= <i>Elymus excelsus</i> Turcz. ex Griseb.	WA (9, 44)
<i>Elymus elymoides</i> (Raf.) Swezey	AZ (BPI); MT (BPI); OR (WSP, 9, 44, 136)
= <i>Sitanion hystrix</i> (Nutt) J.G. Sm.	
= <i>E. sitanion</i> Schultes	
<i>Elymus glaucus</i> Buckley	CA (BPI; 136); ID (136, 147); IA (BPI, 52, 157); MI (MICH); MT (WSP);
	ND (44); OR (BPI, OSC, WSP, 44, 80, 135, 136); WA (44, 136); WY
	(BPI, RM, UC, 50, 136); general (9)
<i>Elymus glaucus</i> ssp. <i>virescens</i> (Piper) Gould	IN (105)
= <i>E. virescens</i> Piper	
<i>Elymus hystrix</i> L.	IA (ISC, 9, 53, 115, 116, 136); IN (9, 105, 136); MN (127); ND (136, 162);
= <i>Hystrix hystrix</i> (L.) Millsp.	WI (ICS)
= <i>Hystrix patula</i> Meonch.	
= <i>Asprilla hystrix</i> Humb.	
<i>Elymus interruptus</i> Buckl.	TN (BPI)
<i>Elymus lanceolatus</i> (Scribn. & J.G. Sm.) Gould	ID (WSP, 136, 147); MT (44, 99, 136); ND (44, 136, 148); SD (106); WA
= <i>Agropyron dasystachyum</i> (Hook.) Scribn.	(44, 136); WY (NY, UC, 50, 136); Northern Great Plains and Pacific
= <i>Agropyron riparium</i> Scribn. & J.G. Smith	Northwest (9)
<i>Elymus lanceolatus</i> (Scribn. & J.G. Sm.) Gould ssp. <i>albicans</i> (Scribn. & J.G. Sm.) Barksworth & Dewey	ND (136)
= <i>Agropyron albicans</i> Scribn. & J.G. Sm.	

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Table 3. (Continued from previous page)

Host	Source
<i>Elymus multisetus</i> M.E. Jones	OR (WSP)
<i>Elymus semicostatum</i> (Nees ex Steud.) A. Love	MI (71, 136); ND (136); WA (136)
= <i>Agropyron striatum</i> (Nees ex Steud.) Hook.	
= <i>Agropyron semicostatum</i> (Nees ex Steud.) Boiss.	
<i>Elymus trachycaulus</i> (Link) Shinnars	AK (137); AZ (136); ID (136); IA (ICS, 52, 136, 157, 158); MI (MSC), MN (BPI, 127); MT (44, 99, 136, 147); NM (136); ND (44, 136); OR (44, 135, 136); SD (BPI, 99, 106, 136); UT (BPI, 136, 147); WA (44); WI (136); WY (BPI, WSP, 50, 136); general (9)
= <i>Agropyron trachycaulum</i> (Lk.) Malte	
= <i>Agropyron pauciflorum</i> (Schwein.) Hitchc.	
= <i>Agropyron gamelinii</i>	
<i>Elymus trachycaulus</i> (Link) Gould ex Shinnars ssp. <i>subsecundus</i> (Link) A.&D. Love	ID (136, 147); IA (WSP, 136); MI (136); MN (136); MT (WSP, 136, 147); SD (136); UT (BPI, WSP, 136); WA (44, 136); WI (UC, 61); general (9)
= <i>Agropyron subsecundum</i> (Lk.) Hitchc.	
= <i>Agropyron trachycaulum</i> var. <i>unilaterale</i> (Cassidy) Malte	
<i>Elymus trachycaulus</i> (Link) Gould ex Shinnars ssp. <i>trachycaulus</i>	IA (53); MI (MICH); MN (45, 85); NM (BPI); ND (162); SD (BPI, 164); WI (45)
= <i>Agropyron tenerum</i> Vasey	
<i>Elymus villosus</i> Muhl. ex Willd.	IA (ICS); WI (61)
<i>Elymus virginicus</i> L.	IL (BPI, ILLS); IN (105); IA (BPI, UC, 53, 115, 116, 136, 157); KS (BPI, FH, NY, 131, 136); LA (BPI); MI (71, 136); MN (45, 85, 127); MO (BPI, 99, 136); NE (BPI, 1, 136); NY (CUP); ND (BPI, 19, 136, 162); OK (BPI, 41, 97, 125, 136); SD (NEB, 106); TX (BPI, 23, 136); WI (BPI, 45, 63); general (9); general eastward (136)
= <i>Elymus striatus</i> Willd.	
<i>Elymus virginicus</i> var. <i>submuticus</i> Hook	KS (116)
<i>Elytrigia intermedia</i> (Host) Nevski	IA (ICS, 52, 115, 157); KS (BPI); KY (73); MN (85, 127); MT (BPI); NE (BPI); ND (136); SD (106, 136, 164); WA (44, 136)
= <i>Agropyron intermedium</i> (Host) Beauv.	
= <i>Agropyron glaucum</i> (Desf.) Roemer & Schultes	
= <i>Agropyron trichophorum</i> (Link) Richt.	
<i>Elytrigia pogens</i> (Pers.) Tutin	MT (99); WA (BPI)
= <i>Agropyron pungens</i> (Pers.) Roem. & Schult.	
<i>Elytrigia repens</i> (L.) Nevski	CT (BPI); DC (BPI); IL (BPI, ILLS); IN (105); IA (BPI, 53, 107, 108, 113, 115, 116, 136, 157, 158, 165); KS (136); KY (73); ME (BPI, FH); MD (BPI, 78, 79); MA (BPI, NY, 99, 136); MI (MSC, 13, 71, 75, 136); MN (BPI, 45, 74, 75, 85, 99, 127, 136, 155); MO (136); MT (WSP, 136); NE (BPI, NEB, 74, 136); NH (BPI, WIS); NY (BPI, 75, 78, 99, 136); ND (BPI, 19, 44, 136, 162); OH (BPI, 136); OK (UC, 41, 125, 136, 163); OR (BPI, NY, 135, 136); PA (BPI, WSP, 76, 79, 94, 108); SD (BPI, 44, 106, 136); VT (BPI, FLAS); VA (BPI); WA (136, 148); WV (BPI, 38, 136); WI (BPI, WIS, 5, 45, 60, 61, 82, 99, 136); general (9)
= <i>Agropyron repens</i> (L.) Beauv.	WY (BPI)
<i>Eremopyrum triticeum</i> (Gaertn.) Nevski	
= <i>Agropyron triticum</i> Gaertn.	
<i>Hordeum brachantherum</i> Nevski	AK (BPI, 9, 22, 136); CO (136); MN (9, 45, 127, 136, 148); WA (136)
= <i>Hordeum nodosum</i> L.	
= <i>Hordeum nodosum</i> var. <i>boreale</i> (Scribn. & Sm.) Hitchc.	
= <i>Hordeum boreale</i> Scribn & J.G. Sm.	
<i>Hordeum jubatum</i> L.	IA (BPI, 9, 136); MT (9, 44, 136); NE (129); ND (136, 162); OK (9, 41, 126, 136); OR (9, 44, 136); WA (BPI, 9, 136); WI (9, 45, 136)
= <i>Hordeum jubatum</i> var. <i>caespitosum</i> (Scribn. ex Pammel) A.S. Hitchc.	WA (9)
<i>Hordeum murinum</i> L.	CO (15, 108, 136); DC (BPI); ID (78, 136); IL (77, 108); IN (74, 79, 85, 93); IA (BPI, 45, 53, 79, 85, 108, 113, 125, 149); MA (79); MI (74, 79); MN (BPI, 45, 95, 77, 78, 79, 85, 108, 127, 136, 149, 155); MO (85, 136); MT (136, 149); NE (BPI, 1, 77, 129); ND (BPI, 13, 77, 79, 93, 108, 136, 149); OH (79); OK (41, 125, 136); OR (135, 136); SD (106); VA (130); WA (136); WI (45, 74, 79, 85, 93, 108, 113, 149); WY (130, 136, 151); general (9); general in east (136)
<i>Hordeum vulgare</i> L.	MT (44, 136)
<i>Leymus ambiguus</i> (Vasey & Scribn.) Dewey	
= <i>Elymus ambiguus</i> Vasey & Scribn.	
<i>Leymus angustus</i> (Trin.)	ND (BPI)
= <i>Leymus angustus</i> (Trin.) Pilger	
<i>Leymus chinensis</i> (Trin.) Tzvel.	MT (99, 136, 163)
= <i>Elymus pseudoagropyron</i> (Trin. ex Griseb.) Turcz.	
<i>Leymus cinereus</i> (Scribn. & Merr.) A. Love	CA (WSP, 139); CO (OSC, 136, 147); ID (BPI, WSP, 136); MT (WSP, 44, 133, 136); NV (UC); ND (136); OR (BPI, OSC, 44, 135, 136); UT (NY, 136, 147); WA (WSP, 42, 44, 136); WY (BPI, OSC, UC, WIS, 44, 136)
= <i>Elymus cinereus</i> Scribn. & Merr. ^b	CA (BPI, UC); CO (RM); IN (105); IA (ICS, 52, 157); MI (MSC); MT (BPI, 24, 90, 99); OR (NY); UT (BPI); WY (BPI, NY, RM, 50); general (9)
<i>Leymus condensatus</i> (J. Presl) A. Love	OR (BPI, OSC, 135, 136)
= <i>Elymus condensatus</i> Presl.	
<i>Leymus flavescens</i> (Scribn. & J.G. Sm.) Pilger	
= <i>Elymus arenicola</i> Scribn. & Smith	
<i>Leymus innovatus</i> (Beal) Pilger	WA (WSP, 141)
= as <i>Elymus innovatus</i> Beal	
<i>Leymus mollis</i> (Trin) Hara ssp. <i>mollis</i>	AK (BPI, WIS, WSP, 22, 136, 137); OR (BPI, 135, 136); WA (CUP, 1); general (9)
= <i>Elymus mollis</i> Trin.	ND (44, 136)
<i>Leymus paboanus</i> (Claus) Pilg.	
= <i>Elymus salsuginosus</i> (Griseb.) Turcz. ex Steud.	
<i>Leymus racemosus</i> (Lam.) Tsvelev	DC (BPI); IA (ICS, 52, 157); MO (109), ND (136); WA (44, 136)
= <i>Elymus giganteus</i> Vahl.	

(Continued on next page)

Table 3. (Continued from previous page)

Host	Source
<i>Leymus triticoides</i> (Buckl.) Pilger = <i>Elymus triticoides</i> Buckl.	CA (BPI, 44, 136); CO (NEB); IN (105); NV (BPI, 136, 154); OR (BPI, OSC, WSP, 135, 136); WA (44, 136); general (9).
<i>Pascopyrum smithii</i> (Rydb.) A. Love = <i>Agropyron smithii</i> Rydb. = <i>Agropyron occidentale</i> (Scribn.) Scribn	AZ (136); CO (BPI, WSP, 136); DC (BPI); IN (105); KS (BPI, NY, OSC); IA (BPI, NY, 52, 53, 107, 136, 157, 158); KY (73); MA (NY); MI (71, 136); MN (45, 75, 85, 127, 136); MO (136); MT (BPI, OSC, WSP, 44, 99, 136); NE (BPI, NEB, 1, 136); NM (BPI, 136, 150); ND (BPI, MSC, 19, 99, 136, 162); OK (BPI, 23, 41, 97, 125, 136); SD (BPI, FH, OSC, 99, 106, 136, 156); TX (BPI, 23, 136); UT (FH); WA (WSP, 42, 136); WI (BPI, UC, 5, 45, 55, 61, 136); WY (BPI, WSP, 14, 44, 50, 136) MT (44, 136); ND (WSP, 44, 136); WA (WSP, 136, 147); general (9)
<i>Psathyrostachys juncea</i> (Fisch.) Nevski = <i>Elymus junceus</i> Fisch.	
<i>Pseudoroegneria spicata</i> (Pursh) A. Löve = <i>Agropyron spicatum</i> (Pursh) Scribn. & Sm. = <i>Agropyron divergens</i> (Nees ex Steud.) Vasey = <i>Agropyron inerme</i> (Scribn. & Smith) Rydb.	CO (BPI); ID (136, 147); IN (105); IA (ICS, 52, 116, 136, 157); MT (BPI, WSP, 116, 24, 44, 99, 136); NE (NEB); ND (136, 148); OR (WSP, 44, 136); UT (BPI, 136); WA (WSP, 44, 136); WY (136); northern great plains and pacific northwest (9)
<i>Secale cereale</i> L.	AR (45, 74, 149); CO (15); CT (77); DC (149); FL (4); GA (74); ID (76, 108); IL (45, 74, 78, 85, 93, 108, 149); IN (45, 77, 93, 105, 149); IA (BPI, 45, 53, 74, 75, 76, 77, 85, 93, 108, 125, 149); KS (74, 85); KY (45, 74, 76, 77, 108, 149); LA (74); MD (79, 84); MA (74, 79, 93); MI (45, 74, 75, 76, 77, 79, 85, 108, 149); MN (BPI, 45, 74, 75, 76, 77, 78, 79, 93, 127, 148, 149); MO (45, 74, 93, 149); NE (45, 74, 93, 149); NJ (74, 76, 77, 93, 108); NY (45, 74, 77, 93, 108, 149); NC (54); ND (19, 45, 74, 77, 78, 79, 85, 93, 108, 149, 162); OH (45, 76, 77, 78, 79, 93, 108, 149); OK (41); OR (79, 135, 149); PA (45, 74, 79, 93, 149); RI (149); SD (45, 76, 77, 93, 105, 108, 149, 156); UT (45, 76, 77, 108, 149); VA (45, 77, 108, 149); WA (149); WV (45, 85, 149); WI (BPI, 45, 57, 74, 79, 85, 108, 149); WY (33); general in U.S. (9, 13)
<i>Triticum aestivum</i> L. and <i>T. durum</i> Desf.	AZ (45, 93, 136); DC (BPI); ID (79); IL (BPI, 45, 74, 78, 85, 108, 149); IN (BPI, 78, 79, 85, 93, 105); IA (53, 78, 125, 136); KS (136); KY (45, 78); ME (BPI); MI (78, 79, 108); MN (45, 74, 75, 76, 77, 78, 85, 93, 108, 127, 136, 149); MO (136); MT (BPI); NE (45, 74, 76, 78, 149); NY (75, 78, 136); NC (149); ND (45, 74, 75, 76, 77, 78, 79, 85, 93, 108, 136, 149, 162); OH (78, 108, 136); OK (41, 125, 136); OR (135, 136); PA (78, 136); SD (76, 78); UT (45); VA (77, 149); WA (BPI); WV (78); WI (BPI, 45, 61, 74, 78, 85, 93, 136, 149); WY (33)

Fig. 2. Number of grass species reported within each state as a host of *Claviceps purpurea* var. *purpurea*.

C. grohii is rare in the United States but has been reported from MI, OR, and WA (Table 1). *C. grohii* was originally described from *Carex* in Canada (68).

C. purpurea var. *purpurea* was reported on *Cynodon* (25,26). However, Porter et al. (122) suggest that a *Claviceps* responsible for toxin production in *Cynodon dactylon*

in the southeastern United States may differ from *C. purpurea* var. *purpurea*. *Claviceps cynodontis* has a wide distribution, extending from India through Burma to the Philippine Islands, Africa, and Europe but has not been reported from the United States. *C. cynodontis* is believed to have a monogenic host range restricted to

Cynodon spp. (95). Additional studies are needed to determine if *Cynodon* spp. serve as hosts to *C. purpurea* var. *purpurea* in nature. Other species or varieties of *Claviceps* likely are present in the United States, especially on grasses in the Panicoideae. Pammel and Weems (116) found yellow capitula on germinated sclerotia of *Claviceps* from a *Poa* species in Iowa. Yellow capitula are not known to occur in *C. purpurea* var. *purpurea*.

The taxonomy of grass species is currently undergoing major change. Criteria for separation of genera or species are expanding beyond morphological features or structures, especially in relation to the spikelet, and now include aspects of genetics, physiology, microanatomy, and development. It is likely that present taxonomic relationships and nomenclature of the grasses will continue to change. Therefore, as a base of reference, the names and authorities of grasses as originally listed were retained as synonyms in Tables 1 and 3, and cited in Table 2.

Collections of specimens and hosts of *C. purpurea* in herbaria were helpful in evaluating the host reports of *Claviceps* species in the United States. The relatively stable attribute of conidial size proved useful in identifying collections with questionable affinity to *C. purpurea*. Additional studies concerning identification of *Claviceps* spp. should be conducted with fresh collections

and should focus on features of ascostromata; chemical attributes such as alkaloids present; physical attributes such as sclerotial density, texture, and color; and molecular analyses, including ITS, β -tubulin, or other sequence determination.

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