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.

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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. africana*, 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, & Rodriquez; 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,

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. Citations 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 ×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 × 5 µm (Table 2). Microconidia were spherical, about 3 µm 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, 20-25 × 4-5 µm. Microconidia were ellipsoidal, 6-8 × 0.5-0.7 µm (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, 11-16 × 4-5 µm (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, 12-13 × 4 µm (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 9-11 × about 4 µm (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 × 4-5 µm (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 µm (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	
Claviceps sp.	
Diarrhena americana Beauv. = *Diarrhena diandra* (Michx.) A.W. Wood	KS (MIN); MO (BPI)
Oryzeae	
Claviceps zizaniae	
Zizania aquatica 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);
Zizania palustris L. var. *palustris* = *Zizania aquatica* var. *angustifolia* Hitchc.	IA (9); ME (BPI, FH, 9); MD (9); MN (OSC, 9, 127); MO (9); NE (9); ND (9); WI (9)
Chloridoideae	
Chlorideae	
Claviceps cinerea	
Hilaria belangeri var. *longifolia* (Vasey) A.S. Hitchc.	AZ (9); TX (BPI)
Hilaria cenchroides Kunth	AZ (67, 136)
Hilaria jamesii (Torr.) Benth.	NM (BPI)
Hilaria mutica (Buckl.) Benth.	AZ (BPI, NY, WSP, 9, 67, 136); NM (BPI, 9, 99, 136); OK (9, 41, 126, 136); TX (BPI, FH, 9)
Claviceps purpurea var *spartinae*[b]	
Spartina alterniflora Loisel = *Spartina stricta* (Ait.) Roth. var. *glabra* (Muhl.) Gray = *Spartina alterniflora* var. *pilosa* (Merr.) Fern. = *Spartina glabra* Muhl.	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)
Spartina cynosuroides (L.) Roth	FL (BPI, 9); IA (115); MS (36); NE (BPI); NY (9, 136)
Spartina foliosa Trin.	CA (BPI, F, MSC, WIS); VA (BPI)
Spartina maritima (M.A. Curtis) Fern. = *Spartina stricta* (Aiton) Roth	CA (BPI); LA (BPI); ME (BPI); MA (BPI);
Spartina patens (Ait.) Muhl.	ME (BPI); MD (BPI, 9, 136); MA (BPI, FH); MS (36); NY (NY); NC (54); TX (BPI)
Spartina pectinata Link = *Spartina michauxiana* Hitchc.	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)
Claviceps yanagawensis[b]	
Zoysia japonica Steudal	FL (4); VA (BPI)
Zoysia matrella (L.) Merrill = *Zoysia pungens* Willd.	DC (BPI)
Panicoideae	
Andropogoneae	
Claviceps africana	
Sorghum bicolor (L.) Moench	GA (160); KS (160); MS (166); TX (OSC, 83, 160)
Sorghum halepense (L.) Pers.	GA (160); KS (160); TX (82, 160)
Claviceps pusilla	
Andropogon gerardii Vitman = *Andropogon furcatus* Muhl. in Wild.	IA (ICS, 52); NM (BPI)
Andropogon hallii Hack.	IA (ICS, 52); OK (BPI)
Bothriochloa ischaemum (L.) Keng = *Andropogon ischaemum* L.	IA (116); TX (BPI)
Schizachyrium scoparium (Michx.) Nash = *Andropogon scoparius* Michx.	IA (52)
Claviceps sp.[b]	
Andropogon gerardii Vitman = *A. furcatus* Muhl. in Willd.	GA (9); KS (BPI, NY, 9); NE (129); NM (BPI); OK (BPI, 97, 125, 136); TX (BPI, 9, 23, 136); WI (61, 136)
Andropogon hallii Hack.	NE (129); OK (BPI, 41, 97, 125, 136); TX (23, 136)
Andropogon virginicus L.	FL (9); MS (9); OK (9)
Bothriochloa ischaemum L. var. *ischaemum* = *Andropogon ischaemum* L.	TX (BPI)
Bothriochloa saccharoides (Sw.) Rydb. = *Andropogon saccharoides* Sw. = *Amphilophis torreyanus* (Steudall) Nash	TX (BPI, 9, 30)
Ischaemum muticum L. = *Andropogon repens*	OH (121)
Saccharum alopecuroides (L.) Nutt. = *Erianthus alopecuroides* (L.) Ell.	AL (136); OK (9, 126, 136)
Schizachyrium scoparium (Michx.) Nash = *Andropogon scoparius* Michx.	OK (BPI, 125, 136)
Schizachyrium tenerum Nees = *Andropogon tener* (Nees) Kunth	OK (41)
Sorghastrum nutans (L.) Nash	IA (ICS); KS (BPI, 9, 136); OK (9, 41, 125, 97, 136); TX (BPI, 9, 23, 136)
Spodiopogon sibiricus Trin.	DC (BPI)
Themeda forskalii 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	
Claviceps tripsaci[b]	
Tripsacum dactyloides (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	
Claviceps paspali (= *C. rolfsii*)	
Axonopus compressus (Sw.) Beauv.	GA (BPI)
Axonopus fissolius (Raddi) Kuhlm. = *Axonopus affinis* Chase	DC (BPI); FL (BPI, 9, 99); GA (9, 99); LA (BPI); TX (BPI)
Axonopus furcatus (Fluegge) A.S. Hitchc.	MD (BPI)
Panicum anceps Michx.	AR (29)
Paspalum almum Chase	VA (BPI, 99)
Paspalum caespitosum Fluegge	FL (99, 136)
Paspalum dilatatum 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)
Paspalum chapmani Nash	GA (BPI)
Paspalum distichum L.	LA (BPI); MS (110, 136); OK (41, 126, 136); SC (136); VA (99, 136)
Paspalum exaltatum J.&C. Presl.	MS (BPI)
Paspalum floridanum Michx. = *Paspalum floridanum* var. *glabratum* Engelm. ex Vasey = *Paspalum giganteum* Baldwin ex Vasey	AR (132); FL (BPI, 99, 136); GA (BPI, 99, 136); MD (BPI); MS (BPI); NC (54, 136); OK (41); VA (99, 136)
Paspalum intermedium Munro ex Morong	GA (98); VA (BPI, 99, 136)
Paspalum laeve Michx. = *Paspalum longipilum* Nash	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)
Paspalum langei (Fourn.) Nash	GA (98); VA (BPI, 99, 136)
Paspalum monostachyum Vasey	TX (99, 136)
Paspalum notatum Fluegge	AZ (99, 136); DC (BPI); FL (FLAS, 99, 136); GA (BPI, 99, 136); LA (BPI, 99, 136)
Paspalum plicatulum Michx.	FL (BPI, UC, 99, 136); LA (136); TX (BPI, 136); widespread through its range (9)
Paspalum pubiflorum Rupr. ex Fourn.	GA (98, 136); TX (136); VA (BPI, 99, 136)
Paspalum quadrifarium Lam.	VA (BPI, 99, 136)
Paspalum scrobiculatum L. = *Paspalum orbiculare* G. Forster	HI (128, 136)
Paspalum setaceum Michx. = *Paspalum ciliatifolium* Michx. = *Paspalum longepedunculatum* Le Conte = *Paspalum pubescens* J. Presl = *Paspalum supinum* Bosc ex Poiret	AR (BPI); FL (BPI, FLAS, 99, 136); GA (98, 136); VA (BPI, 99, 136); widespread through its range
Paspalum urvillei 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)
Claviceps sp. (reported as *Claviceps ranunculoides*)	
Setaria macrostachya Kunth	AZ (BPI, 9, 99, 136); NM (136); TX (BPI, 9)
Claviceps sp.[b]	
Anthaenantia rufa (Nutt) J.A. Schultes	MS (9)
Anthaenantia villosa (Michx.) Beauv.	MS (9)
Anthephora pubescens Nees	DC (9)
Brachiaria platyphylla (Munro ex Wright) Nash = *Brachiaria extensa* Chase	FL (136)
Digitaria eriantha Steud.	DC (BPI)
Pennisetum ciliare (L.) Link = *Cenchrus ciliaris* L.	TX (27)
Setaria valpiseta (Lam.) Roemer & Schultes	TX (FH)
Setaria viridis (L.) P. Beauv. = *Chaetochloa viridis* (L.) Scribn.	AZ (BPI); NM (BPI, 9, 77, 136)
Setaria macrostachya Kunth = *Chaetochloa composita* Scribn.	NM (BPI, NY, 9, 136); TX (FH, ISC)
Cyperaceae	
Claviceps nigricans[b]	
Eleocharis erythropoda Steud. = *Eleocharis calva* Torr.	IN (BPI, 9); WI (58, 61)
Eleocharis obtusa (Willd.) J.A. Schultes	MT (144)
Eleocharis palustris (L.) Roem. & Schult. = *Eleocharis macrostachya* Britt. = *Eleocharis smallii* Britt.	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)
Eleocharis quinqueflora (F.T. Hartman) O. Schwarz	CA (UC)
Eleocharis rostellata (Torr.) Torr.	CA (BPI, UC); MI (9); NY (CUP)
Claviceps grohii	
Carex microptera Mackenzie	WA (133)
Carex tribuloides Wahlenb.	MI (BPI, 9)
Carex sp.	OR (OSC)
Juncaceae	
Claviceps sp. (reported as *C. junci*)	
Juncus nevadensis Wats.	CA (WIS)
Juncus nodosus 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 *Diarrhena* is questionable. Sclerotia from *Diarrhena* 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*, *Sorgastrum*, 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*

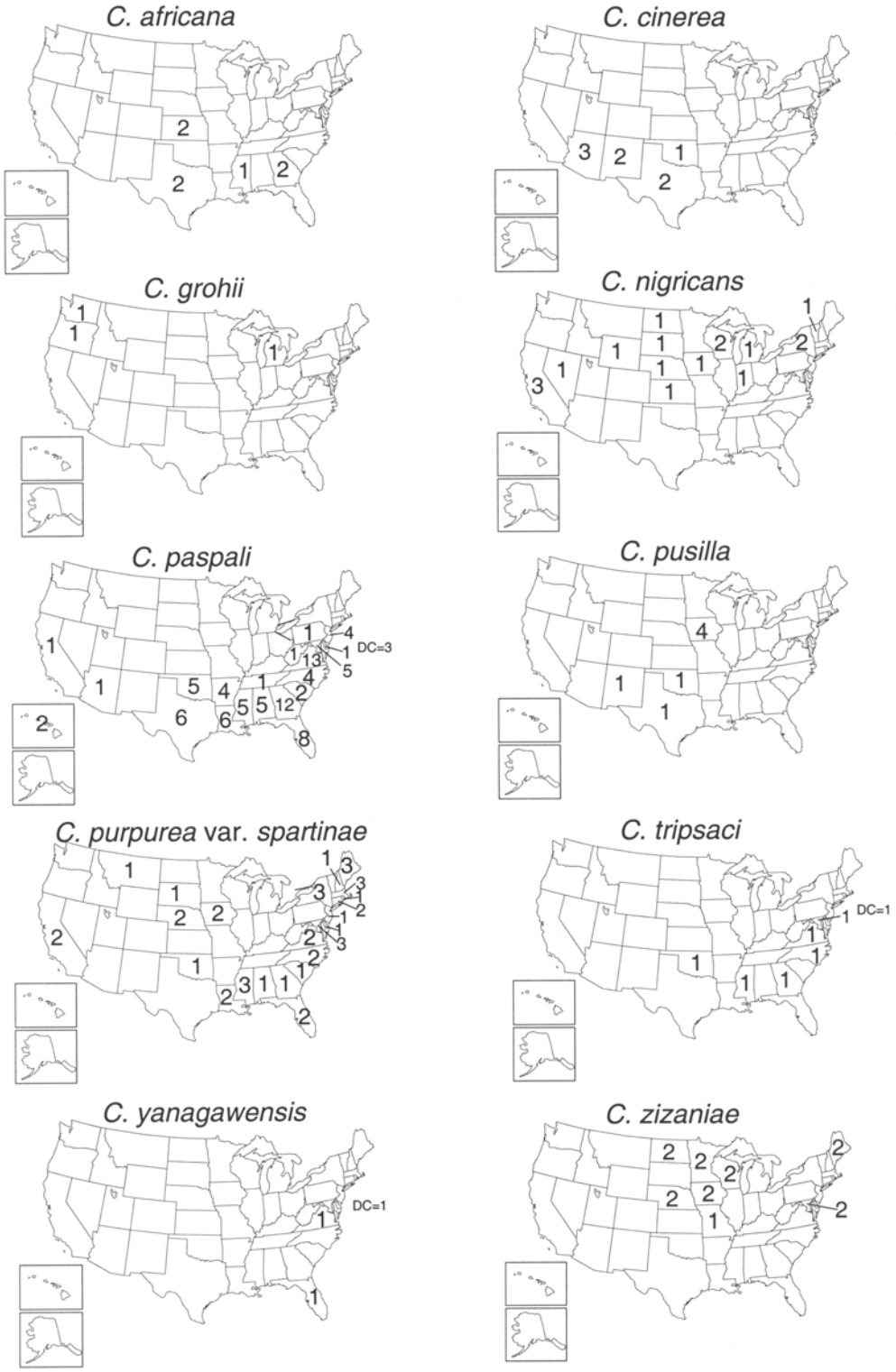

Fig. 1. For each *Claviceps* species, the number of grass species on which the particular *Claviceps* species was reported for each state is recorded.

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						
Claviceps sp.						
Danthonia spicata	WI		9.5 ± 1.4	4.2 ± 0.5	Ellipsoidal-oblong	BPI 633839
Stipeae						
Claviceps purpurea						
Achnatherum lettermanii	WY		5.8 ± 0.8	3.1 ± 0.4	Ellipsoidal	RM 26100 (labeled *Stipa lettermanii*)
Achnatherum nelsonii	UT		5.8 ± 0.9	3.2 ± 0.4	Ellipsoidal	BPI 634439 (labeled *Stipa columbiana*)
Achnatherum scribneri	CO		7.1 ± 0.9	3.2 ± 0.4	Ellipsoidal	NY: S. Boulder canyon, 7,000 ft, 1912, Ex Herb. Arthur (labled *Stipa scribneri*)
Nasella viridula			7.2 ± 1.2	3.3 ± 0.4	Ellipsoidal	ISC 318665 (labeled *Stipa viridula*)
Oryzopsis asperfolia	NY		5.7 ± 0.6	2.7 ± 0.3	Ellipsoidal	CUP 17762
Piptatherum miliaceum	DC (Australia)		8.1 ± 0.9	3.5 ± 0.5	Ellipsoidal-oblong	BPI 633193 (labeled *Oryzopsis milacea*)
Bambusoideae						
Diarrheneae						
Claviceps purpurea?						
Diarrhena americana	KS		6.0 ± 1.1	2.4 ± 0.8	Ellipsoidal-oblong	MIN 615560
Diarrhena americana	MO		5.7 ± 0.8	2.5 ± 0.4	Ellipsoidal-oblong	BPI 633842 (labeled *D. diandra*)
Diarrhena americana	MO		5.5 ± 0.8	2.3 ± 0.3	Ellipsoidal-oblong	BPI 633841 (labeled *D. diandra*)
Oryzeae						
Claviceps zizanea						
Zizanea aquatica	ND		11.2 ± 1.6	4.2 ± 0.5	Ellipsoidal-oblong	NY: near Fargo, 1900, Brenckle Fungi Dakotensis 453. col. O.A. Stevens
Zizanea aquatica	ME		11.9 ± 1.7	4.7 ± 0.9	Ellipsoidal-oblong	NY: Orono, 1942, col. F.H. Steinmetz
Zizanea aquatica	MN		12.7 ± 2.9	4.6 ± 0.4	Ellipsoidal-oblong	OSC 97749
Chloridoideae						
Chlorideae						
Claviceps cinerea						
Hilaria jamesii	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		
Hilaria mutica	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		
Hilaria mutica	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		
Claviceps citrina						
Distichlis spicata	Mexico		5.5 ± 0.7	3.6 ± 0.4	Ellipsoidal	PRM 842966
Claviceps purpurea var. *spartinae*						
Spartina alterniflora	MA		10.2 ± 1.4	3.9 ± 0.5	Oblong-allantoid	MSC: Woods Hole, 1881, W. Trelease (labeled *S. stricta*)
Spartina alterniflora	SC		12.7 ± 2.4	3.8 ± 0.5	Oblong-allantoid	OSC 12011 (labeled *Spartina* sp.)
Spartina pectinata	MT		17.1 ± 3.0	3.9 ± 0.6	Oblong	OSC 69007 (labeled *S. michauxiana*)
Spartina patens	NY		11.8 ± 4.3	4.3 ± 0.5	Ellipsoidal-oblong	NY: Ex. NYS 27916
Panicoideae						
Andropogoneae						
Claviceps sp.						
Andropogon geradii	IA	Macro:	11.8 ± 1.0	4.7 ± 0.5	Ellipsoidal	ISC 319388 (labeled *A. furcatus*)
		Micro:	3.9 ± 0.6	3.0 ± 0.2	Spherical-ellipsoidal	
Andropogon gerardii	NM		6.3 ± 2.9 range: 2-13	3.2 ± 0.8 range: 2-5	Spherical-oblong	BPI 633703 (labeled *A. furcatus*)
Andropogon hallii	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	
Andropogon hallii	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	
Sorghastrum nutans	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	
Claviceps africana						
Sorghum bicolor	TX	Macro:	14.0 ± 1.5	4.9 ± 0.5	Ellipsoidal-oblong	OSC 97751
		Micro:	3.3 ± 0.5	3.0 ± 0.3	Spherical	
Claviceps gigantae						
Zea maydis	(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	Ellipsiodal	
Claviceps tripsaci						
Tripsacum dactyloides	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						
Claviceps digitareae						
Digitaria eriantha	DC (S. Africa)	Macro:	11.7 ± 1.3	4.6 ± 0.7	Ellipsoidal-oblong	BPI 633148
		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
Digitaria valida	DC (S. Africa)	Macro:	11.7 ± 2.1	4.8 ± 1.0	Ellipsoidal-oblong	BPI 633035
		Micro:	3.9 ± 0.4	3.0 ± 0.4	Spherical-ellipsoidal	
Claviceps fusiformis						
Pennisetum	(Rhodesia)	Macro:	20.5 ± 2.5	4.9 ± 0.6	Fusiform	IMI 110729
		Meso:	5.5 ± 0.7	4.0 ± 0.7	Spherical-ellipsoidal	
		Micro:	3.3 ± 0.8	2.5 ± 0.5	Spherical-ellipsoidal	
Claviceps maximensis						
Panicum maximum	(Puerto Rico)	Macro:	15.8 ± 4.7	5.9 ± 0.9	Ellipsoidal-oblong	BPI 634487
		Micro:	5.1 ± 1.2	2.9 ± 0.4	Ellipsoidal	
Claviceps paspali						
Paspalum dilatatum	AR		12.2 ± 1.7	4.0 ± 0.6	Ellipsoidal-oblong	WIS: Little Rock, 1957, col. G. Templeton, det. M.S. Pavgi
Paspalum plicatum	FL		12.3 ± 1.4	4.6 ± 0.5	Ellipsoidal-oblong	UC 669553
Claviceps sp.						
Setaria macrostachya	NM		8.4 ± 1.15	3.9 ± 0.6	Ellipsoidal	NY: Carlsbad, 1902, Plants of the Gulf States, col. S.M. Tracy (labeled *Chaetachloa composita*)
Setaria macrostachya	NM		7.5 ± 1.3	3.3 ± 0.5	Ellipsoidal-oblong	NY: Carlsbad, 1902, Plants of the Gulf States, col. S.M. Tracy (labeled *S. composita*)
Setaria macrostachya	TX	Macro:	14.7 ± 2.7	4.4 ± 0.6	Oblong-allantoid	ICS 415193
		Micro:	4.9 ± 1.2	3.1 ± 0.3	Spherical-ellipsoidal	
Setaria valpiseta	TX	Macro:	18.0 ± 2.1	6.1 ± 0.9	Oblong-allantoid	FH 46065 (labeled *S. macrostachya*)
		Micro:	4.7 ± 0.6	3.7 ± 0.5	Spherical-ellipsoidal	
Pooideae						
Aveneae						
Claviceps purpurea						
Agrostis exerata	OR		8.5 ± 1.1	4.1 ± 0.5	Ellipsoidal	NY: Warrenton, 1935, col. F.D. Bailey, det. S.M. Zeller
Agrostis stolonifera	IL		8.6 ± 1.6	4.1 ± 0.5	Ellipsoidal	ILLS 33788 (labeled *A. alba*)
Agrostis. stolonifera	OR		7.5 ± 1.1	3.6 ± 0.4	Ellipsoidal	OSC 10722 (labeled *A. alba*)
Alopecuris geniculatus	ND		8.3 ± 1.1	4.0 ± 0.5	Ellipsoidal	RM 18886
Alopecuris pratensis	MI		9.3 ± 1.3	4.2 ± 0.6	Ellipsoidal-oblong	MSC: Walton Cr, Traverse Co., 1889
Alopecuris pratensis	OR		9.1 ± 1.3	3.8 ± 0.6	Ellipsoidal-oblong	NY: Astoria, 1936, R.S. Sprague
Ammophila breviligulata	NY		6.5 ± 1.1	3.6 ± 0.5	Ellipsoidal	NY: Ex NYS 27934
Ammophila breviligulata	NY		9.9 ± 2.8	4.1 ± 0.7	Ellipsoidal-oblong	BPI 633717
Anthoxanthum odoratum	NY		7.0 ± 1.6	3.1 ± 0.4	Ellipsoidal-oblong	NY: Ulster Co., 1988, Fungi of New York 571, col. R. Lowen
Avena sativa	NY		7.2 ± 1.0	3.4 ± 0.4	Ellipsoidal	CUP 37862
Calamagrostis canadensis	AK		11.9 ± 1.8	4.3 ± 0.6	Ellipsoidal-oblong	WIS: Matanuska, 1956, col. J.G. Dickson
Calamagrostis canadensis	AK		10.1 ± 1.6	4.3 ± 0.5	Ellipsoidal-oblong	WSP 51546
Calamagrostis canadensis	ME		10.3 ± 1.6	3.8 ± 0.5	Ellipsoidal-oblong	CUP 32951
Calamagrostis canadensis	MN		11.6 ± 2.3	4.7 ± 0.8	Ellipsoidal-oblong	MSC: Minneapolis, 1883, Herb. W.J. Beal labeled (*Deyeuxia canadensis*)
Calamagrostis canadensis	MN		8.5 ± 1.0	4.0 ± 0.5	Ellipsoidal	WIS: Waterville, 1905, J.H. Kearnen
Calamagrostis canadensis	NY		10.4 ± 1.8	4.4 ± 0.5	Ellipsoidal-oblong	CUP 23904
Calamagrostis canadensis	WA		11.2 ± 1.6	4.0 ± 0.5	Ellipsoidal-oblong	UC 620739 (labeled *Deschampsia atropurpurea*)
Calamagrostis stricta	ND		9.3 ± 2.0	4.0 ± 0.7	Ellipsoidal-oblong	NY: Kulm, 1908, North Dakota Fungi, col J. F. Brenckle (labeled *C. neglecta*)
Calamagrostis stricta ssp. *inexpansa*	MN		10.8 ± 2.1	4.7 ± 0.4	Ellipsoidal-oblong	WSP 46641 (labeled *C. inexpansa*)
Cinna latifolia	AK		11.7 ± 0.9	4.2 ± 0.6	Ellipsoidal-oblong	WSP 51116
Cinna latifolia	Canada		10.0 ± 1.8	3.9 ± 0.8	Ellipsoidal-oblong	CUP 19159
Holcus lanatus	OR		8.5 ± 1.1	4.1 ± 0.4	Ellipsoidal	OSC 1790
Holcus lanatus	WA		8.9 ± 1.5	3.8 ± 0.4	Ellipsoidal-oblong	CUP 33142
Koeleria macrantha	AZ		7.2 ± 1.0	3.2 ± 0.4	Ellipsoidal	WIS: Bradshaw Mts., 1892, J.W. Tourmey (labeled *K. cristata*)
Phalaris arundinacea	IA		9.0 ± 1.8	4.6 ± 0.8	Ellipsoidal	ISC 318625 (labeled *Koeleria cristata*)
Phalaris arundinacea	MA		8.8 ± 1.4	3.4 ± 0.5	Ellipsoidal-oblong	NY: Hadley, 1978, col. H.E. Ahlees, det M.E.B.B.
Phalaris arundinacea	MA		9.1 ± 0.8	4.1 ± 0.5	Ellipsoidal-oblong	FH: Newton, 1935, P.L. Rusdon (labeled *Calamagrostis cinnoides*)
Phalaris arundinacea	MI		8.6 ± 1.2	3.8 ± 0.4	Ellipsoidal-oblong	MICH: Chelsea, 1927, D.M. Benedict
Phalaris arundinacea	VA		8.6 ± 1.1	3.8 ± 0.4	Ellipsoidal-oblong	FH: Paris, 1923, col. C. drechsler, det. V.K. Charles
Phalaris arundinacea	NY		9.3 ± 1.5	4.1 ± 0.4	Ellipsoidal-oblong	CUP 10007
Phalaris arundinacea	VA		8.8 ± 1.8	3.4 ± 0.6	Ellipsoidal-oblong	CUP 13671
Phleum pratense	IL		6.9 ± 0.9	3.6 ± 0.5	Ellipsoidal	F 1166637
Phleum pratense	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
Phleum pratense	OR		9.1 ± 1.8	4.1 ± 0.6	Ellipsoidal-oblong	OSC 1731
Phleum pratense	WI		9.4 ± 1.6	4.3 ± 0.5	Ellipsoidal	CUP 4750
Bromeae						
Claviceps purpurea						
Bromus carinatus	CA		6.4 ± 0.8	3.9 ± 0.4	Ellipsoidal	F: Oxford Tract, Berkeley, 1949, Fungi of CA, col. A. R. Kruckeberg (labeled *B. marginatus*)
Bromus carinatus	ID		6.4 ± 0.8	3.6 ± 0.4	Ellipsoidal	WSP 16633
Bromus carinatus	WA		6.2 ± 1.4	3.5 ± 0.4	Ellipsoidal	WSP 21509
Bromus carinatus	WA		5.6 ± 0.7	2.8 ± 0.3	Ellipsoidal	WSP 13385
Bromus commutatus	IL		6.7 ± 1.0	3.6 ± 0.4	Ellipsoidal	ILLS 27874 (labeled *B. secalinus*)
Bromus inermis	IL		6.9 ± 1.0	3.6 ± 0.6	Ellipsoidal	ILLS 29117
Bromus inermis	WA		5.8 ± 0.7	3.2 ± 0.4	Ellipsoidal	WSP 19934
Meliceae						
Claviceps purpurea						
Glyceria borealis	MI		10.8 ± 1.9	4.7 ± 0.7	Ellipsoidal-oblong	MICH: McCargo Cove, 1930, col. C.A. Brown, det. E.B. Mains
Glyceria septentrionalis	IA		10.5 ± 0.9	3.7 ± 0.4	Ellipsoidal-oblong	ISC 318655
Glyceria × *Laxa*	Canada		10.1 ± 1.7	3.9 ± 0.6	Ellipsoidal-oblong	FH 18139 (labeled *Glyceria canadensis*)
Glyceria borealis	NY		10.7 ± 1.8	4.3 ± 0.6	Ellipsoidal-oblong	CUP 29423
Glyceria fluitans	Germany		8.7 ± 1.1	3.7 ± 0.4	Ellipsoidal-oblong	OSC 37892
Glyceria fluitans	Canada		11.3 ± 1.2	4.2 ± 0.7	Ellipsoidal-oblong	CUP 4516
Poeae						
Claviceps purpurea						
Dactylis glomerata	IA		7.2 ± 1.0	3.6 ± 0.5	Ellipsoidal	ICS 318613
Dactylis glomerata	IL		5.9 ± 0.7	3.4 ± 0.5	Ellipsoidal	ILLS 25945
Dactylis glomerata	MI		5.9 ± 0.8	3.1 ± 0.4	Ellipsoidal	MSC: East lansing, 1930, J. P. Kienholz
Dactylis glomerata	NY		6.5 ± 1.2	3.0 ± 0.4	Ellipsoidal	CUP 35966
Dactylis glomerata	WI		7.4 ± 1.5	3.8 ± 0.6	Ellipsoidal	WIS: Madison, 1919, J.J. Davis
Lolium multiflorum	OR		7.5 ± 0.9	3.8 ± 0.5	Ellipsoidal	OSC 1743 (labeled *Lolium italicum*)
Lolium multiflorum	OR		5.9 ± 0.7	3.3 ± 0.3	Ellipsoidal	OSC 10744
Lolium multiflorum	OR		6.0 ± 0.5	3.3 ± 0.4	Ellipsoidal	OSC 10698
Lolium perenne	MA		6.9 ± 1.2	3.4 ± 0.5	Ellipsoidal	NY: Amherst, 1967, col. H.E. Ahles, det. M.E.B.B.
Lolium perenne	OR		6.8 ± 0.9	3.7 ± 0.3	Ellipsoidal	OSC 39275
Lolium perenne	WY		7.1 ± 0.9	3.6 ± 0.5	Ellipsoidal	NY: Corvallis, 1915, H.C. Gilbert
Lolium pratense	MA		6.9 ± 1.2	3.3 ± 0.6	Ellipsoidal	NY: Amherst, 1967, Col. H.E. Ahles, det. M.E.B.B. (labeled *Festuca elatior*)
Lolium arundinaceum	NY		6.0 ± 0.7	3.0 ± 0.5		CUP 9955 (labeled *Festuca elatior*)
Poa fendleriana	UT		7.6 ± 1.3	3.9 ± 0.4	Ellipsoidal	NY: Fungi Columbiani 2317, E. Bartholomew (labeled *Poa longiligula*)
Poa secunda ssp. *juncifolia*	CA		5.7 ± 0.9	3.1 ± 0.4	Ellipsoidal	WSP 25499 (labeled *Poa nevadensis*)
Poa pratensis	OR		8.5 ± 0.8	3.3 ± 0.3	Ellipsoidal-oblong	OSC 97750
Poa secunda	ID		5.8 ± 0.6	3.3 ± 0.4	Ellipsoidal	WSP 42803 (labeled *Poa ampla*)
Poa secunda	UT		6.9 ± 1.0	3.6 ± 0.4	Ellipsoidal	WSP 13383 (labeled *Poa scabella*)
Triticeae						
Claviceps purpurea						
Agropyron cristatum	WA		6.8 ± 1.1	3.7 ± 0.5	Ellipsoidal	NY: Mycobiota of North America 304, 1948, col. & det. J. Meiners
Elymus canadensis	IL		6.0 ± 0.6	2.8 ± 0.3	Ellipsoidal	ILLS 30054
Elymus canadensis	KS		6.1 ± 0.9	3.2 ± 0.8	Ellipsoidal	NY: Rooks, Co. 1902, Ellis and Everhart's Fungi Columbiani 1614
Elymus canadensis	OR		6.2 ± 0.8	3.6 ± 0.4	Ellipsoidal	OSC 1804
Elymus canadensis	SD		6.2 ± 1.1	3.8 ± 0.5	Ellipsoidal	NY: Farmer, 1927, G.F. Weber
Elymus canadensis	WI		6.1 ± 0.7	2.9 ± 0.5	Ellipsoidal	WIS: Trempealeau, 1914, R.H. Denniston
Elymus canadensis	WI		6.0 ± 0.8	3.4 ± 0.4	Ellipsoidal	WIS: Madison, 1893, Fungi of the T.A. Williams Collection
Elymus caninus	IA		5.6 ± 0.7	3.0 ± 0.3	Ellipsoidal	ICS 386395 (labeled *Agropyron caninum*)
Elymus caninus	MI		7.9 ± 1.4	3.4 ± 0.6	Ellipsoidal-oblong	MSC: Ag. Coll., 1889 (labeled *Agropyron caninum*)
Elymus glaucus	OR		6.2 ± 0.7	3.4 ± 0.5	Ellipsoidal	OSC 13669
Elymus glaucus	OR		5.6 ± 0.6	3.3 ± 0.4	Ellipsoidal	WSP 21022
Elymus glaucus	WY		6.2 ± 0.7	3.5 ± 0.4	Ellipsoidal	RM 26034
Elymus lanceolatus	WY		5.9 ± 0.7	3.8 ± 0.4	Ellipsoidal	NY: Mycoflora Saximontanensis Exsiccata 122, 1935, W.G. Solheim (labeled as *Agropyron dasystachyum*)
Elymus × *Agrohordeum macouni*	NE		6.8 ± 0.9	3.9 ± 0.6	Ellipsoidal	NEB 158700 (labeled *Elymus macouni*)
Elymus macounii	WA		5.9 ± 0.6	3.5 ± 0.4	Ellipsoidal	WSP 13384

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Table 2. (*Continued from previous page*)

Species	Location	Conidial type	Conidial length (µm)	Conidial width (µm)	Conidial shape	Source
Elymus repens	NE		5.8 ± 1.0	3.4 ± 0.4	Ellipsoidal	NEB 158701 (labeled *Agropyron pseudorepens*)
Elymus virginicus	IA		5.8 ± 0.8	2.5 ± 0.4	Ellipsoidal-oblong	UC: Awana, 1925, B. Shimek
Elymus virginicus	IL		6.1 ± 1.1	2.8 ± 0.5	Ellipsoidal	ILLS 22045
Elymus virginicus	NE		6.0 ± 1.2	2.8 ± 0.3	Ellipsoidal	NY: Red Cloud, 1906, Fungi Columbiani 2216, E. Bartholomew
Elytrigia intermedia	KS		7.2 ± 1.3	3.3 ± 0.7	Ellipsoidal	NY: Rockport, 1892, Kansas Fungi, E. Bartholomew (labeled *Agropyrum glaucum*)
Elytrigia repens	IL		6.5 ± 1.0	3.4 ± 0.4	Ellipsoidal	ILLS 28732 (labeled *Agropyron repens*)
Elytrigia repens	MA		6.2 ± 1.2	3.6 ± 0.5	Ellipsoidal	NY: Amherst, 1925, Massachusetts Fungi 3012, T.T. Ayres & W.L. Doran (labeled *Agropyron repens*)
Elytrigia repens	OR		5.9 ± 0.8	3.2 ± 0.4	Ellipsoidal	NY: Hood River, 1936, J.R. Kienholz (labeled *Agropyron repens*)
Elytrigia repens	NY		6.9 ± 0.9	3.9 ± 0.5	Ellipsoidal	NY: Ex NYS 1041 (labeled *Agropyron repens*)
Elytrigia repens	PA		6.1 ± 1.4	3.1 ± 0.2	Ellipsoidal	WSP1094 (labeled *Agropyron repens*)
Elytrigia repens	VT		6.4 ± 1.0	3.9 ± 0.5	Ellipsoidal	FLAS F46374 (labeled *Agropyron repens*)
Elytrigia repens	WI		6.3 ± 0.9	3.3 ± 0.5	Ellipsoidal	WIS: Butternut, 1911, J.J. Davis (labeled *Agropyron repens*)
Elytrigia smithii	MA		6.4 ± 0.9	3.7 ± 0.4	Ellipsoidal	NY: Amherst, 1966, H.E. Ahles (labeled *Agropyron smithii*)
Hordeum vulgare	WA		6.5 ± 1.3	4.3 ± 0.6	Ellipsoidal	WSP 1114
Leymus cinereus	WA		6.0 ± 0.8	3.3 ± 0.4	Ellipsoidal	WSP 16443
Leymus cinereus	CO		6.7 ± 0.9	3.4 ± 0.4	Ellipsoidal	OSC 6339 (labeled *Elymus* sp.)
Leymus cinereus	OR		5.5 ± 0.7	3.6 ± 0.5	Ellipsoidal	OSC 10694 (labeled *Elymus condensatus*)
Leymus cinereus	UT		5.6 ± 0.7	3.3 ± 0.5	Ellipsoidal	NY: Weber Co., 1985, C.T. Rogerson (labeled *Elymus cinereus*)
Leymus cinereus	ID		5.4 ± 0.5	3.2 ± 0.3	Ellipsoidal	WSP 46010 (labeled *Elymus cinereus*)
Leymus cinereus	WY		6.3 ± 0.6	3.5 ± 0.5	Ellipsoidal	UC 201420 (labeled *Elymus cinereus*)
Leymus condensatus	CO		6.6 ± 0.8	3.9 ± 0.3	Ellipsoidal	RM 14584 (labeled *Elymus condensatus*)
Leymus condensatus	OR		5.7 ± 0.7	3.4 ± 0.5	Ellipsoidal	NY: Echo, 1937, R. Sprague (labeled *Elymus condensatus*)
Leymus condensatus	WY		5.6 ± 0.7	3.3 ± 0.4	Ellipsoidal	NY: Fungi Columbiani 3704, E. Bartholomew (labeled *Elymus condensatus*)
Leymus condensatus	WY		6.3 ± 0.9	3.6 ± 0.4	Ellipsoidal	RM 140953 (labeled *Elymus condensatus*)
Leymus triticoides	OR		5.9 ± 0.9	3.5 ± 0.4	Ellipsoidal	WSP 46004 (labeled *Eylmus triticoides*)
Leymus triticoides	OR		5.5 ± 0.7	3.4 ± 0.4	Ellipsoidal	OSC 10689 (labeled *Elymus triticoides*)
Pascopyrum smithii	MT		7.2 ± 1.2	3.8 ± 0.4	Ellipsoidal	OSC: Fungi Columbiani 4311, E. Bartholomew (labeled *Agropyron occidentale*)
Pascopyrum smithii	NE		6.4 ± 0.9	3.5 ± 0.5	Ellipsoidal	NEB 1508705 (labeled *Agropyron occidentale*)
Pascopyrum smithii	NE		6.2 ± 0.8	3.7 ± 0.4	Ellipsoidal	NEB 158693 (labeled *Agropyron smithii*)
Pascopyrum smithii	IA		6.0 ± 1.2	2.9 ± 0.5	Ellipsoidal	NY: W. Okaboju, 1932, G.W. Martin (labeled *Agropyron smithii*)
Pascopyrum smithii	KS		5.2 ± 0.7	2.9 ± 0.5	Ellipsoidal	NY: Ellis and Everhart's Fungi Columbiani 1816, E. Bartholomew (labeled *Agropyron occidentale*)
Secale cereale	ND		5.8 ± 1.1	3.2 ± 0.4	Ellipsoidal	NY: Fungi Dakotenses 328, J.F. Brenckle
Secale cereale	NY		6.5 ± 0.9	3.1 ± 0.0	Ellipsoidal	CUP 2891
Triticum aestivum	NY		5.4 ± 0.5	3.3 ± 0.3	Ellipsoidal	CUP 19373
Cyperaceae						
Claviceps nigricans						
Eleocharis macrostachya	CA		9.5 ± 2.0	3.8 ± 0.5	Ellipsoidal-oblong	RM 38811
Eleocharis macrostachya	CA		10.4 ± 0.9	3.6 ± 0.4	Ellipsoidal-oblong	CUP 47305
Eleocharis palustris	CA		11.2 ± 2.1	3.6± 0.6	Ellipsoidal-oblong	NY: CA Fungi 764, 1949, M.A. Nobs & S.G. Smith
Eleocharis rostellata	CA		11.1 ± 1.5	3.6 ± 0.4	Ellipsoidal-oblong	CUP 36613
Claviceps grohii						
Carex sp.	OR		16.4 ± 1.9	5.2 ± 0.6	Ellipsoidal-oblong	OSC 1852
Carex brunnesens	Canada		11.2 ± 1.3	3.8 ± 0.3	Ellipsoidal-oblong	DOAM 13621
Carex canescens spp. *arctaeformis*	Canada		13.2 ± 2.1	4.5 ± 0.5	Ellipsoidal-oblong	DOAM 105889
Juncaceae						
Claviceps sp.						
Juncus nevadensis	CA		12.1 ± 1.5	4.4 ± 0.6	Ellipsoidal-oblong	WIS: Modoc Co., 1958, col. L.C. Anderson, det. H.C. Green
Juncus ensifolius	Canada		13.8 ± 2.1	4.4 ± 0.4	Ellipsoidal-oblong	NY: DOAM 214361
Juncus articulatus	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 *Brachiaria* 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 × 5 µm, ellipsoidal mesoconidia, 11 × 4 µm, and spherical-ellipsoidal microconidia, 4 × 3 µm.

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, 11-12 × 4-5 µm, 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 ascomata 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	
Phragmites australis (Cav.) Trin. ex Steud.	DC (BPI); IA (ISC, 9, 53, 116, 136); NJ (9, 136); ND (136, 162); OK (9, 41, 126, 136)
= *Phragmites phragmites* (L.) H. Karst	
= *Phragmites communis* Trin.	
Danthonieae	
Danthonia paryii Scribn.	CO (136)
Danthonia spicata (L.) Beauv. ex Roemer & Schult.	MI (MICH, 9, 123, 136); WI (BPI)
Molinia caerulea (L.) Meonch	DC (BPI)
Stipeae	
Achnatherum lemmonii (Vasey) Barkworth	ID (WSP, 136); IN (9); UT (BPI, WSP, 9, 136); WA (9)
= *Stipa columbiana* Macoun	
Achnatherum lettermanii (Vasey) Barkworth	WA (WSP, 9, 136, 147); WY (RM)
= *Stipa lettermanii* Vasey	
Achnatherum nelsonii (Scribn.) Barkworth	UT (BPI); WA (136, 148)
= *Stipa columbiana* var *nelsonii* (Scribn.)Hitchc.	
Achnatherum nelsonii (Scribn.) Barkworth ssp. *dorei* (Barkworth & J.R. Maze) Barkworth	IN (105)
= *Stipa minor* (Vasey) Scribn.	
Achnatherum robustum (Vasey) Barkworth	MT (99, 136)
= *Stipa robusta* (Vasey) Scribn.	
Achnatherum scribneri (Vasey) Barkworth	CO (NY)
= *Stipa scribneri* Vasey	
Heterostipa comata (Trin. & Rupr.) Barkworth	MT (MONTU); ND (136, 162)
= *Stipa comata* Trin. & Rupr.	
Heterostipa spartae (Trin.) Barkworth	ND (136, 162); WI (WIS, 63)
= *Stipa spartea* Trin.	
Nassella viridula (Trin.) Barkworth	IA (ICS, 52, 157); MN (9, 45, 127, 136); ND (BPI, 9, 44, 136, 162); SD (106)
= *Stipa viridula* Trin.	
Oryzopsis asperfolia Michx.	NY (CUP)
Oryzopsis racemosa (Sm.) Ricker ex A.S. Hitchc.	WI (61)
Piptatherum miliaceum (L.) Cosson	DC (BPI)
= *Oryzopsis milacea* (L.) Asch. & Schweinf.	
Chloridoideae	
Bouteloua curtipendula (Michx.) A. Gray	NE (9, 136); OK (136)
Bouteloua gracilis (Kunth) Lag. ex. Steud.	OK (125, 136)
Buchloe dactyloides (Nutt.) Engelm.	OK (BPI)
Cynodon dactylon (L.) Pers.	OK (25, 26)
Distichlis spicata (L.) Greene	DC (BPI); MD (136); MS (9, 118); WA (FH, UC, 9, 136)
Pooideae	
Aveneae	
Agrostis canina L.	IA (ICS, 52, 157)
Agrostis capillaris L.	DC (BPI); IA (116); OR (BPI, 2, 9, 135, 136); WA (BPI, 17, 136); WI (WIS)
= *Agrostis tenuis* Sibth.	
= *Agrostis vulgaris* With.	
Agrostis exarata Trin.	AK (22, 136); OR (BPI, NY, OSC, 9, 135, 136); UT (NY)
Agrostis hyemalis (Walter) B.S.P.	ND (9, 162); OK (9, 41); WI (9, 61)
Agrostis scabra Willd.	ND (136); OK (125, 136); WI (BPI, 136)
Agrostis stolonifera L.	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)
= *Agrostis alba* L.	
= *Agrostis alba* var. *ovularies*	
= *Agrostis palustris* Huds.	
Alopecurus borealis Trin.	MT (BPI); WY (BPI)
= *Alopecurus alpinus* Sm.	
= *Alopecurus occidentalis* Scribn. & Tweedy	
Alopecurus geniculatus L.	ND (RM, 9, 136, 162)
Alopecurus pratensis 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)
Ammophila arenaria (L.) Link	MI (BPI, MICH); OH (NY); WI (BPI, WIS, 136)
Ammophila breviligulata Fern.	IN (9); MI (BPI, 9; 105); NY (BPI, NY); NC (54); OH (9); WI (WIS, 61)
Anthoxanthum odoratum L.	NY (NY)
Arctagrostis latifolia (R. Br.) Griseb.	AK (BPI, 22)
Arrenatherum elatius (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)
Arrenatherum elatius var. *bulbosum* (Willd.) Spenner	IA (52, 157)
= *Arrhenatherum tuberosum* (Gilib.) F.W. Schultz	
Avena sativa 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
Calamagrostis canadensis (Michx.) Beauv. = *Calamagrostis canadensis* var. *scabra* (Presl) Hitchc. = *Calamagrostis canadensis* var. *acuminata* 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)
Calamagrostis canadensis (Michx) Beauv. var. *langsdorfii* (Link) Inman = *Calamagrostis langsdorfii* (Link) Trin.	AK (BPI, 22)
Calamagrostis coarctata (Torr.) Eat. = *Calamagrostis cinnoides* W. Bart.	MA (BPI)
Calamagrostis epigeios Roth	IA (ICS, 52, 157, 165)
Calamagrostis hyperborea Lange	ND (162)
Calamagrostis koeleroides Vasey	CA (UC)
Calamagrostis nutkaensis (J. Presl) J. Presl ex Steud. = *Calamagrostis aleutica* Trin.	AK (BPI, 22, 136); OR (135, 136)
Calamagrostis purpurascens R. Br.	CO (BPI)
Calamagrostis rubescens Buckley	MT (WSP, 138)
Calamagrostis stricta (Timm.) Koel. = *C. neglecta* (Her) Gaertn., B. Mey. & Schreb.	MN (75, 127); NE (NEB); ND (BPI, OSC, NY, 19, 136); WI (56, 61,136)
Calamagrostis stricta (Timm.) Koel. ssp. *inexpansa* (A. Gray) C.W. Greene = *C. inexpansa* A. Gray = *C. inexpansa* var. *brevior* (Vasey) Stebbins	MN (WSP, 9, 127, 142); MT (9, 136, 147); ND (OSC, 9, 44, 136); SD (FH, 106); WI (WIS, 66).
Cinna arundinacea L.	WI (WIS, WSP, 61, 136)
Cinna latifolia (Trev. ex Goepp.) Griseb.	AK (144)
Deschampsia caespitosa (L.) Beauv.	IA (ICS, 52, 157); OR (9, 44, 136)
Deschampsia caespitosa ssp. *holiciformis* (C. Presl) W.E. Lawrence = *Deschampsia holiciformis* C. Presl	DC (BPI); WA (WIS)
Hierochloe odorata (L.) Beauv.	CT (ICS); ND (136, 162)
Holcus lanatus L.	OR (BPI, OSC, NY, 9, 135, 136); WA (BPI, CUP, WIS, WSP, 9).
Keoleria macrantha (Ledeb.) J.A. Schultes = *Koeleria cristata* (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)
Phalaris aquatica L. = *Phalaris tuberosa* L.	IA (ICS)
Phalaris arundinacea L. = *Phalaris arundinacea* var *picta* 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);
Phalaris californica Hook. & Arn.	IA (ICS, 52, 157)
Phalaris canariensis L.	IA (52, 157); MI (9, 123, 136); MN (9, 127, 136)
Phalaris caroliniana Walt.	IA (ICS, 52, 58)
Phleum pratense 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)
Trisetum canescens Buckley	ID (WSP, 9, 148, 136)
Bromeae	
Bromus anomalus Rupr. ex Fourn.	WY (RM)
Bromus carinatus Hook. & Arn. = *Bromus marginatus* Nees ex Steud. = *Bromus polyanthus* 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)
Bromus ciliatus L.	MT (9, 44, 136); WI (WIS, 61, 136)
Bromus commutatus Schrad.	IL (ILLS); IA (52, 157)
Bromus erectus Huds.	DC (BPI); MN (9, 99, 127, 136); MT (9, 44, 136); NY (BPI, 9)
Bromus erectus subsp. *condensatus* (Hack.) Ascher. & Graebn. = *Bromus condensatus* Hack.	ID (45)
Bromus inermis 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); widespread (9); general eastward (136)
Bromus inermis Leyss. var. *pumpellianus* (Scribn.) C.L. Hitchc. = *Bromus pumpellianus* Scribn.	AK (WIS); MN (127, 136); MT (136)
Bromus japonicus Thunb. ex Murray	IA (52, 107, 157)

(*Continued on next page*)

Table 3. (*Continued from previous page*)

Host	Source
Bromus kalmii Gray = *Bromus purgans* L.	IA (ICS, 52,107, 157)
Bromus secalinus L.	IL (ILLS); IA (ICS, 52, 157); IN (9, 105, 136); KY (9, 73); MO (F); WA (WSP, 136, 148); WV (BPI, 38)
Bromus tectorum L.	KS (BPI)
Meliceae	
Glyceria borealis (Nash) Batch.	ID (BPI, 136); ME (BPI, 136); MI (MICH, 136); NY (CUP); WI (BPI, F, 32, 60, 61, 136)
Glyceria canadensis (Michx.) Trin.	ME (BPI, 136)
Glyceria fluitans (L.) R. Br. = *Panicularia fluitans* (L.) Kuntze	IA (53, 115, 116); WI (WIS, 9, 45)
Glyceria grandis S. Watson ex A. Gray = *Panicularia grandis* (S. Wats.) Nash	IA (136); ND (136, 162); WI (63)
Glyceria septentrionalis A. S. Hitchc.	IA (ISC, 9); IN (9, 136); WI (9, 61, 136)
Glyceria striata (Lam) A.S. Hitchc. = *Glyceria nervata* (Willd.) Trin.	OK (9, 41, 126, 136); WA (9, 136); WI (BPI, 9, 61, 136)
Poeae	
Arctophila fulva (Trin.) Rupr. ex Andress.	AK (22, 136)
Briza media L.	DC (BPI)
Dactylis glomerata 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)
Festuca arvernensis Auquier, Kerguelen & Markgr.-Dannenb. = *Festuca ovina* var. *glauca* (Lam.) W.D.J. Koch	MO (99)
Festuca heterophylla Lam. = *Festuca rubra* var. *heterophylla* (Lam.) Mutel	MN (45, 85, 127)
Festuca idahoensis Elmer	ID (9, 44, 148, 136); MT (WSP, 136); ND (136); OR (WSP, 9, 148, 136); WY (BPI)
Festuca kingii (S. Wats.) Cassidy = *Festuca confinis* Vasey	CO (136, 147); UT (BPI); WY (WSP, 136, 147)
Festuca ovina L.	AK (WIS); ID (140); IA (ICS, 52, 157); MD (BPI, 9); MO (9, 136); WI (BPI, WSP, 61, 136)
Festuca rubra L.	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)
Festuca rubra ssp. *falax* Thuill. = *Festuca rubra* var. *commutata* Gaud.	KY (73, 136); ND (136); OR (2); WA (44, 136).
Festuca subverticillata (Pers.) Alexeev. = *Festuca obtusa* Biehler	WI (WIS; 65)
Lolium arundinaceum (Schreber) Darbysh = *Festuca arundinacea* Schreb. = *Festuca elatior* L. = *Festuca elatior* var. *arundinacea* (Schreb.) Wimm.	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)
Lolium giganteum (L.) Darbysh. = *Festuca gigantea* (L.) Vill.	DC (BPI)
Lolium multiflorum Lam. = *Lolium italicum* A. Braun	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)
Lolium perenne L.	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)
Lolium pratense (Hudson) Darbysh. = *Festuca pratensis* Huds.	DC (BPI); MA (NY); MN (45); VT (BPI)
Lolium rigidum ssp. *lepturoides* (Boiss.) Sennen & Maurico = *Lolium subulatum* Vis.	CA (WSP, 140)
Poa annua L.	IA (116); MO (136); OK (9, 41, 126, 136)
Poa arida Vasey	ND (9, 136, 148)
Poa compressa L.	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)
Poa fendleriana (Steud.) Vasey = *Poa longiligula* Scribn. & Williams	CO (9); ND (9); UT (BPI, NY, 136); WA (9); ND to CO (9)
Poa nemoralis L.	WA (44, 136)
Poa nervosa (Hook.) Vasey	WY (136)
Poa palustris L.	IN (105); MN (127, 136); ND (BPI, 9, 44, 134, 136); SD (106, 136)

(*Continued on next page*)

Table 3. (*Continued from previous page*)

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

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Table 3. (*Continued from previous page*)

Host	Source
Elymus multisetus M.E. Jones	OR (WSP)
Elymus semicostatum (Nees ex Steud.) A. Love = *Agropyron striatum* (Nees ex Steud.) Hook. = *Agropyron semicostatum* (Nees ex Steud.) Boiss.	MI (71, 136); ND (136); WA (136)
Elymus trachycaulus (Link) Shinners = *Agropyron trachycaulum* (Lk.) Malte = *Agropyron pauciflorum* (Schwein.) Hitchc. = *Agropyron gamelinii*	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)
Elymus trachycaulus (Link) Gould ex Shinners ssp. *subsecundus* (Link) A.&D. Love = *Agropyron subsecundum* (Lk.) Hitchc. = *Agropyron trachycaulum* var. *unilaterale* (Cassidy) Malte	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)
Elymus trachycaulus (Link) Gould ex Shinners ssp. *trachycaulus* = *Agropyron tenerum* Vasey	IA (53); MI (MICH); MN (45, 85); NM (BPI); ND (162); SD (BPI; 164); WI (45)
Elymus villosus Muhl. ex Willd.	IA (ICS); WI (61)
Elymus virginicus L. = *Elymus striatus* Willd.	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)
Elymus virginicus var. *submuticus* Hook	KS (116)
Elytrigia intermedia (Host) Nevski = *Agropyron intermedium* (Host) Beauv. = *Agropyron glaucum* (Desf.) Roemer & Schultes = *Agropyron trichophorum* (Link) Richt.	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)
Elytrigia pugens (Pers.) Tutin = *Agropyron pungens* (Pers.) Roem. & Schult.	MT (99); WA (BPI)
Elytrigia repens (L.) Nevski = *Agropyron repens* (L.) Beauv.	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).
Eremopyrum triticeum (Gaertn.) Nevski = *Agropyron triticum* Gaertn.	WY (BPI)
Hordeum brachantherum Nevski = *Hordeum nodosum* L. = *Hordeum nodosum* var. *boreale* (Scribn. & Sm.) Hitchc. = *Hordeum boreale* Scribn & J.G. Sm.	AK (BPI, 9, 22, 136); CO (136); MN (9, 45, 127, 136, 148); WA (136)
Hordeum jubatum L. = *Hordeum jubatum var. caespitosum* (Scribn. ex Pammel) A.S. Hitchc.	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)
Hordeum murinum L.	WA (9)
Hordeum vulgare 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)
Leymus ambiguus (Vasey & Scribn.) Dewey = *Elymus ambiguus* Vasey & Scribn.	MT (44, 136)
Leymus angustus (Trin.) = *Leymus angustus* (Trin.) Pilger	ND (BPI)
Leymus chinensis (Trin.) Tzvel. = *Elymus pseudoagropyron* (Trin. ex Griseb.) Turcz.	MT (99, 136, 163)
Leymus cinereus (Scribn. & Merr.) A. Love = *Elymus cinereus* Scribn. & Merr.[b]	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)
Leymus condensatus (J. Presl) A. Love = *Elymus condensatus* Presl.	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)
Leymus flavescens (Scribn. & J.G. Sm.) Pilger = *Elymus arenicola* Scribn. & Smith	OR (BPI, OSC, 135, 136)
Leymus innovatus (Beal) Pilger = as *Elymus innovatus* Beal	WA (WSP, 141)
Leymus mollis (Trin) Hara ssp. *mollis* = *Elymus mollis* Trin.	AK (BPI, WIS, WSP, 22, 136, 137); OR (BPI, 135, 136); WA (CUP, 1); general (9).
Leymus paboanus (Claus) Pilg. = *Elymus salsuginosus* (Griseb.) Turcz. ex Steud.	ND (44, 136)
Leymus racemosus (Lam.) Tsvelev = *Elymus giganteus* Vahl.	DC (BPI); IA (ICS, 52, 157); MO (109), ND (136); WA (44, 136)

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Table 3. (*Continued from previous page*)

Host	Source
Leymus triticoides (Buckl.) Pilger = *Elymus triticoides* Buckl.	CA (BPI, 44, 136); CO (NEB); IN (105); NV (BPI, 136, 154); OR (BPI, OSC, WSP, 135, 136); WA (44, 136); general (9).
Pascopyrum smithii (Rydb.) A. Love = *Agropyron smithii* Rydb. = *Agropyron occidentale* (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)
Psathyrostachys juncea (Fisch.) Nevski = *Elymus junceus* Fisch.	MT (44, 136); ND (WSP, 44, 136); WA (WSP, 136, 147); general (9)
Pseudoroegneria spicata (Pursh) A. Löve = *Agropyron spicatum* (Pursh) Schribn. & Sm. = *Agropyron divergens* (Nees ex Steud.) Vasey = *Agropyron inerme* (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)
Secale cereale 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)
Triticum aestivum L. and *T. durum* 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)

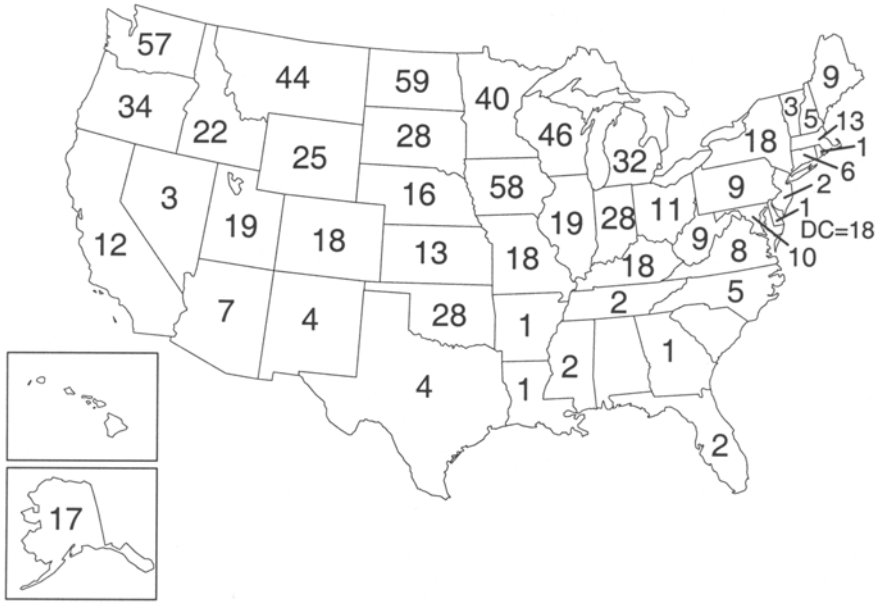

Fig. 2. Number of grass species reported within each state as a host of *Claviceps purpurea* var. *purpurea*.

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 monogeneric 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 Paniceae. 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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