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TWO NEW SPECIES OF *COLEOPHORA* FROM THE NEW WORLD, WITH RECORD OF A NEW HOSTPLANT FAMILY FOR COLEOPHORINES (LEPIDOPTERA: COLEOPHORIDAE: COLEOPHORINAE)

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ABSTRACT.– *Coleophora xyridella* **n. sp.** is described from specimens from Louisiana, Mississippi, Florida and South Carolina. Four Mississippi specimens were reared from larval cases found on seed heads of *Xyris* sp. (Xyridaceae), which represent a new hostplant family for Coleophorine larvae. This new species is superficially similar to the widespread *C. cratipennella* both as adult and as larval case but differs markedly in male and female genitalia. The papillae anales are extraordinarily elongate and sclerotized, protruding characteristically from the abdomen of undissected females. *Coleophora xyridella* belongs to the *caespititiella* species group based on the presence of a strengthening carina on the female tergum VIII, and the monocot seed-feeding habits of the larva. *Coleophora cisoriella* **n. sp.** is described from Brazil (Minas Gerais). It is closely related to *C. xyridella* in the structures of the male and female genitalia and thus presumed to belong to the same species group. Its host- plant is unknown but it is presumed to be seeds of a monocot.

KEY WORDS: Amazonas, biology, Brazil, ***Coleophora xyridella*** n. sp., ***Coleophora cisoriella*** n. sp., Florida, Goías, hostplants, Louisiana, Minas Gerais, Mississippi, Nearctic, South Carolina, taxonomy, USA, Xyridaceae.

While collecting at the Grand Bay savannah in Jackson Co., Mississippi, in April 1993, I found clusters of cigar-shaped, straw-colored coleophorid cases attached to the seed heads of rush-like monocots growing at the edge of a drainage ditch. At the time I mistook the plant for *Juncus* and immediately thought that the cases were those of the widespread and common *Coleophora cratipennella* Clemens. Because the cases looked unusually pale and the plants were senescent, I assumed that they were old, empty cases bleached by the sun. Nevertheless for the record I collected the seed heads with the attached cases in a plastic bag and, after returning from the trip, left the bag on a shelf. Later in early July, upon opening the bag to prepare and label the cases for the collection, I noticed to my surprise that the cases had moved away from the seeds and were fixed to the inside of the bag, thus revealing that the cases were not old, empty ones but still contained live and active larvae. I transferred the lot to a rearing container where the larvae soon attached their cases to stems and no more activity occurred. After a few days, I checked, without detaching them, the cases through the anal valves and found that four of them contained a pupa. Four moths, two males and two females, emerged in the following weeks.

At a glance, the freshly emerged adults looked like specimens of *C. cratipennella*. But while spreading them, I immediately noticed that the females had strikingly long and heavily sclerotized papillae anales protruding from their abdomen. Females of *C. cratipennella* have a short ovipositor with rounded, membranous papillae anales, so I knew immediately that the moths represented another species. Dissections revealed that they belonged to an undescribed species. When I had the seed heads checked by a botanist, it turned out that they were not *Juncus* but *Xyris* (Xyridaceae), a plant family hitherto unreported as larval host of *Coleophora*. A careful search in the *C. cratipennella* material and other miscellaneous specimens that I have on loan for my systematic study of *Coleophora* produced additional specimens, all collected at light. Furthermore, this search resulted in the discovery of another, closely related, undescribed species from Brazil, with similarly enlarged and sclerotized female papillae anales.

METHODS

Genitalia dissections were carried out as outlined in Landry and Wright (1993) except that following cleaning in 30% ethanol, dissected parts were neutralized in pure lactic acid. Orange G stock solution was prepared by dissolving the stain powder in distilled water and by adding a few drops of the saturated solution to pure lactic acid. Using lactic acid has two advantages: it neutralizes quickly any trace of KOH and it fixes the Orange G stain to the cuticle (otherwise Orange G is removed quickly by anything less than absolute alcohol); even so, the stain is not so fast that any excess can be washed in water, although this takes longer than without lactic acid treatment. Chlorazol black stain was done in 70% ethanol.

Drawings of genitalia parts were prepared with a drawing tube attached to a Nikon Optiphot compound microscope. Drawing of the juxta rods in dorsal aspect was made prior to permanent mounting on slide, with the structures immersed in lactic acid on a ringed slide and held in position by glass chips. Outline pencil sketches were inked on mylar drafting film, digitized on a flatbed scanner and edited in Adobe Photoshop®.

Microphotographs of genitalia were taken with a Nikon Optiphot compound microscope using Kodak Ektachrome 64T slide film. Specimen photographs were taken with a Nikon SMZ-U stereoscope with fiber-optic illumination diffused through Mylar drafting film, using Kodak Ektachrome 64T slide film. Photographic slides were digitized at 2700dpi with a Polaroid SprintScan 35 film scanner then edited in Adobe Photoshop for plate preparation. Distribution maps were generated with ESRI ArcView GIS ® and edited in Adobe Illustrator®.

Terms for structures follow Landry and Wright (1993). Holotype data are cited *verbatim* from the specimen labels, with vertical bars indicating label line breaks.

The following acronyms are used in the text to indicate deposition of specimens.

VBEC Collection V. O. Becker, Brazil. Type material provisionally deposited there will be eventually transferred to a Brazilian institution with the V. O. Becker collection (Becker, pers. comm.).

CNC Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Neatby Bldg., C.E.F., Ottawa, Ontario K1A 0C6, Canada.

FSCA Florida State Collection of Arthropods, P. O. Box 147100, Gainesville, Florida 32614-7100 (J. B. Heppner).

MEM Mississippi Entomological Museum, P. O. Drawer EM, Mississippi State, Mississippi 39762, USA. (R. L. Brown).

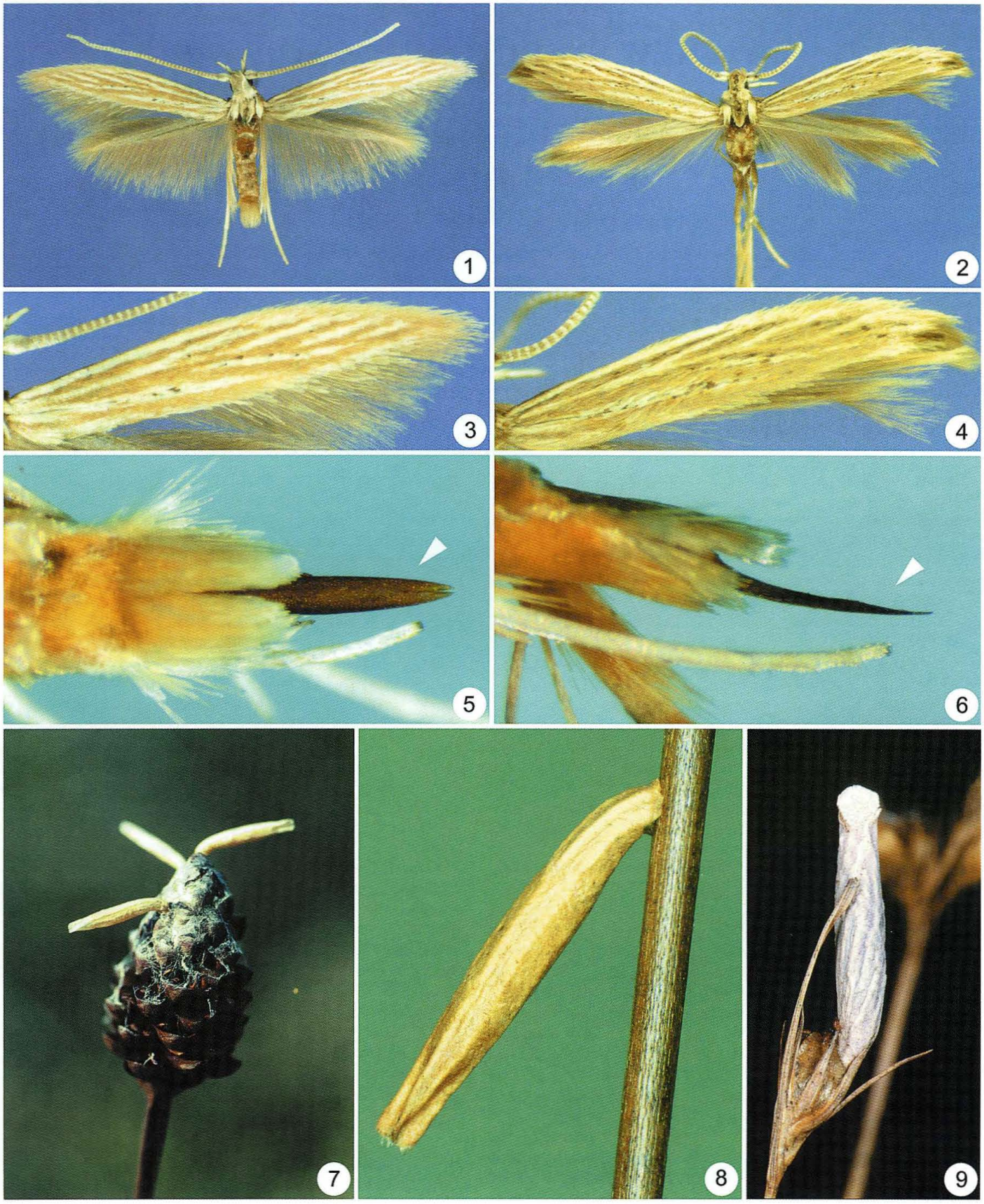

Fig. 1-9. **1)** *Coleophora xyridella*, ♂ paratype, USA, Mississippi, Grand Bay Savannah, em. 13 Aug. 1993 ex. *Xyris* seeds, leg. J.-F. Landry (CNCI). **2)** *Coleophora cisoriella*, ♂ holotype, Brazil, Minas Gerais, Serra do Cipo, 17-19 Apr 1991, leg. V. O. Becker (USNM). **3)** *C. xyridella*, detail of FW pattern. **4)** *C. cisoriella*, detail of FW pattern. **5)** Apex of abdomen of ♀ *C. xyridella*, dorsal aspect. **6)** *Idem*, lateral aspect; white arrows pointing at heavily sclerotized papillae anales. **7)** Cases of *C. xyridella* attached to seed head of *Xyris* sp., Mississippi, Grand Bay Savannah, 20 Apr 1993. **8)** Closeup of case of *C. xyridella*. **9)** Case of *Coleophora cratipennella* on *Juncus tenuis* seed.

USNM Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, USA (J. W. Brown; loan initially arranged by R. W. Hodges, now retired).

Coleophora xyridella J.-F. Landry, sp. nov.

(Fig. 1, 3, 5-8, 10-13, 18, 20)

Diagnosis.– Superficially the adults of this species are very similar to those of *C. cratipennella* Clemens in nearly every respect. The only consistent external difference is the very sparse peppering of dark brown scales on the white discal areas of the forewing of *C. xyridella* specimens (Fig. 1, 3). Specimens of *C. cratipennella* show no trace of such dark peppering. The buff-ochreous streaks of the forewings tend to be relatively thicker in *C. xyridella* than in *C. cratipennella* but this slight difference is difficult to appreciate unless specimens of the two species are compared side by side. Females of *C. xyridella* can be recognized at once by the protruding, heavily sclerotized, blade-like ovipositor, which is exposed in undissected specimens (Fig. 5-6), a feature not found in any other Nearctic *Coleophora*. Females of *C. cratipennella* have a short, membranous, lobe-like ovipositor, only the apex of which is usually barely discernible in undissected specimens.

The genitalia of the two species are very different in both sexes. Males of *C. xyridella* have a long, arched, medially very narrow tegumen; a broad, subrectangular sacculus; a proportionally large cucullus; smooth juxta rods with a single apical tooth; and a comb-like cluster of falcate cornuti. Females have a markedly sclerotized, suborbicular sterigma with a pair of large finger-like projections on the posterior margin bracing the ovipositor; a proportionally narrow colliculum and ostium; and a nearly straight ductus bursae with a short lamina not extended beyond the spiculate section. Males of *cratipennella* have a short, broad tegumen; a narrow, curved sacculus; a proportionally shorter cucullus; dorsally coarsely dentate juxta rods; and numerous small, fine cornuti. Females have a weakly sclerotized sterigma; a proportionally large, funnel-shaped colliculum with a wide ostium; and a long, coiled ductus bursae with a long lamina extended far cephalad of the spiculate section. For illustrations of *C. cratipennella*, see Baldizzone and Landry (1993).

The geographical distributions of these two species overlap completely in the southeastern United States, although *C. cratipennella* is a very widespread, nearly transamerican species. Their flight periods also overlap in May when *C. cratipennella* is on the wing, although the latter, thought abundantly collected, has not been found later in summer as have those of *C. xyridella*.

The larval case of *C. xyridella* is similarly shaped to that of *C. cratipennella* but larger, more buff- or tan-colored, and distinctly costate (Fig. 7-8). Cases of *C. cratipennella* are usually dirty white with an irregular surface, distinct but ill-defined darker, wavy reticulations, and a more pronounced mouth angle of ca 60° (Fig. 9). Larvae of *C. cratipennella* feed on seeds of *Juncus* spp. (Juncaceae).

Another species with a similar forewing pattern is *C. laurentella* McDunnough. Like *C. cratipennella*, it lacks the dark peppering found in *C. xyridella*. Its labial palpi differ from both *C. xyridella* and *C. cratipennella* in proportions, the 3rd article being shorter, ca. half the length of the 2nd and apically less tapered, the 2nd article has a conspicuous, pointed ventral apical tuft, and the eyes are proportionally smaller. *C. laurentella* is also completely different in genitalia and in larval case from both *C. xyridella* and *C. cratipennella*, the latter being of the annulate type (see Braun, 1925; McDunnough, 1933; Landry, 1997), with larvae being leaf miners on *Aster novae-angliae* L. It is distributed in the Northeast and its adults fly in summer (July).

Description.– Wingspan 12.5-17.5mm, mean = 14.4mm; male 12.5-13.0 mm; female 13.0-17.5mm. *Head*: white, frons and vertex pale buff. Eyes proportionally large. Labial palpi white except for pale brown streak on inner and outer sides of 2nd article and on ventral side of 3rd article; 2nd article with very short or without ventral apical tuft; 3rd article acuminately tapered, ca 2|3 length of 2nd. Scape white above, flagellum entirely white in female; in male with pale buff or very pale brown annulations on proximal one-third to half of antenna. *Thorax*: Dorsum of thorax pale buff in male, white in female. *Forewing*: upper surface (Fig. 1, 3) ground color white, with several ochreous-brown narrow streaks highlighting intervenal areas; white areas in cell and behind cell with very scattered dark brown scales, peppering of varying extent on specimens; extreme costal margin edge dark brown in proximal half. *Hindwing*: upper surface pale grey-brown. Fringes buff grey. FW underside grey-brown, basal half darker in male. *Abdomen*: Underside of body creamy white. Legs creamy white, femurs and tibiae with pale brown longitudinal streak on outer side, darker in female. Abdomen creamy white or yellowish white. Abdominal tergum 1 without posterior struts; transverse strut straight, lightly sclerotized in middle. Spine patches elongate, 2-3x longer than wide, with 25-35 spines. *Male genitalia* (Fig. 10-12, 18) (3 preparations examined). Tegumen very elongate, stem very narrowly constricted, arched. Gnathos knob subglobular. Transtilla straight, narrow. Costa slightly concave. Valvula triangular, distinctly delineated, sclerotized, surface covered with fine somewhat sparse bristles. Cucullus proportionally large, elongate and more or less spoon--shaped or tongue-shaped in outline, extended far beyond apex of sacculus. Sacculus trapezoid, apical margin bluntly squarish, straight, ventral angle with dense, fine setae, dorsal angle slightly dentate. Phallotheca rods of equal length, straight, unarched in lateral aspect, apically tapered, dorsal edge keeled in distal third, keel ended in small triangular tooth which projects laterally in dorsal aspect (Fig. 18). Annulus indistinct. Appendix of outer sheath with single, broad coil (Fig. 12). Cornuti 15, progressively longer and thinner distally, in moderately compact bundle, apical cornuti markedly curved, falcate, whole set of cornuti appearing comb-like, base with very small spinose sclerification (Fig. 12). *Female genitalia* (Fig. 13) (5 preparations examined). Segment VIII and extended ovipositor and papillae anales nearly as long as entire abdominal segments 1-7 combined, heavily sclerotized. Sterigma well sclerotized, posterior margin extented into pair of long, digitiform, thickly sclerotized projections bracing ovipositor, projections with short, stiff setae on outer margins. Sterigma with sides rounded, medially with X-shaped strengthening sclerotization extended from ostium to posterior projections, anterior apophyses heavy, about half length of SVIII. Ostium medially situated near anterior margin of SVIII, relatively narrow 0.25x width of SVIII. Colliculum amphora-shaped. Ductus bursae membranous, nearly straight, ca 2.5-3x length of sterigma, spinulate section straight, shorter than sterigma with fine, small, granular-looking spinules; ductus at inception of ductus seminalis with lightly sclerotized, spinose area which is bent in a tight loop. Corpus bursae ovoid, small, signum absent. Posterior apophyses heavily sclerotized, ca 2.5x length of sterigma (SVIII). Papillae anales heavily sclerotized, extraordinarily elongate, ca half length of abdomen or = abdominal segment 1-4 combined, blade-like, subacuminate, covered with very short, peg-like setae; membranous, telescoped portion of ovipositor about length of sterigma. TVIII elongate-subconical with medial longitudinal strengthening keel or bar.

Larval case (Fig. 7-8).– Length of mature case 9.5-11.5mm. Of the tubular silk type, buff or tan-colored, cigar-shaped, slightly bulged in middle, longitudinally weakly costate; anal end trivalved, mouth angle ca. 30-40°

Hostplant and phenology.– Mature larval cases were found attached to seed heads of senescent *Xyris* sp. (Xyridaceae) plants (tentatively identified as *X. iridifolia* Chapman; the seed head sample has been subsequently misplaced or lost, so identification of the species cannot be confirmed). Although no feeding was actually observed, *Xyris* seeds are the presumed larval food.

Collecting dates of adults range from 1 Apr to 16 Sep, with earliest records in April and May from central Florida. Reared specimens emerged between 22 Jul and 21 Aug. These dates suggest either a protracted generation or perhaps two overlapping generations. The feeding period of larvae is uncertain, feeding was apparently completed when cases were collected in April in Mississippi.

Distribution (Fig. 20).– Known from Louisiana, Mississippi, Florida and South Carolina.

Type material.– *Holotype* ♂: [label 1]: USA, MISSISSIPPI | Jackson Co., Grand Bay | Savannah, jct. Hwy10&90 | em. 22.VII.1993 | leg. J.-F. Landry; [label 2]: JFL no. 93-02 | host: *Xyris* | *?iridifolia* seeds | larva: 20.IV.1993; [label 3]: genitalia slide ♂ | MIC 4236; [label 4]: HOLOTYPE | Coleophora | xyridella | J.-F. Landry | CNC no. 22426; (CNC).

Paratypes: 2 ♂♂, 12 ♀♀. *Allotype* ♀: same data as holotype except for emergence date 31 Jul 1993 (genitalia slide MIC 4237) (CNC).

Other *paratypes*:

Mississippi

1 ♂, 1 ♀, same data as holotype except for emergence date 13 Aug 1993 (♂, genitalia slide MIC 4238) and 21 Aug 1993 (♀) (CNC).

1 ♂, Jackson Co., 1 mi W hwy. 90 & 57, T7S R8W, Sec 25, 4 Sep 1991, leg. R. L. Brown (genitalia slide BL 663).

Louisiana

2 ♀♀, Calcasieu Parish, 6 mi ESE Buhler, 30°18'44"N 93°15' 39"W, 14 Jun 1993 and 15-16 Sep 1993, leg. R. L. Brown and D. M. Pollock (genitalia slides JFL 1559 and1560) (MEM).

Florida

4 ♀♀, Lake Placid, Archbold Bio. Sta., 1 Apr 1959 (2) and 1-7 May 1964 (2), leg. R. W. Hodges (genitalia slide JFL 1562) (USNM).

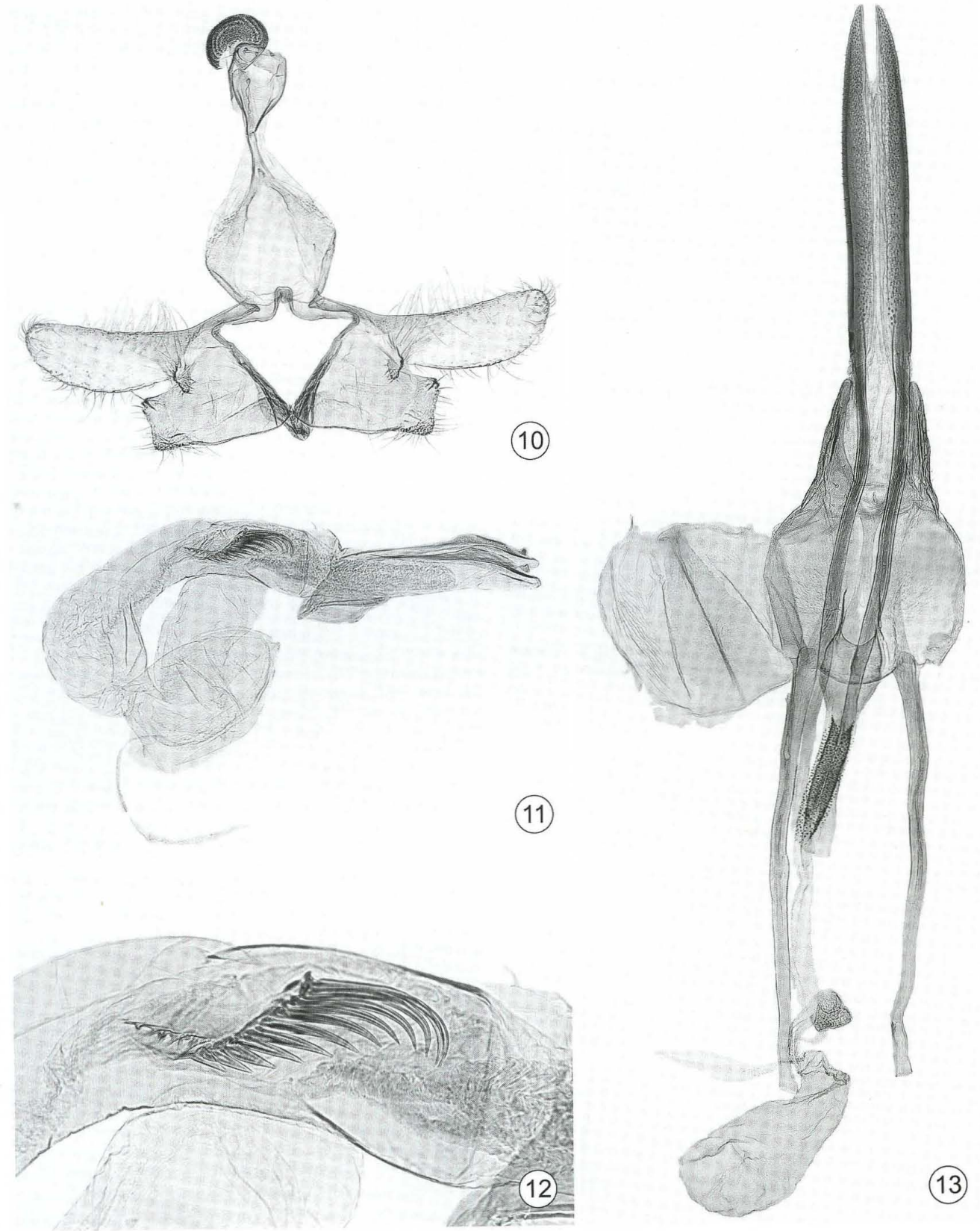

Fig. 10-13. Genitalia of *C. xyridella*. **10)** ♂ genitalia spread in posteroventral aspect, phallus complex removed (slide MIC 4236), tegumen stretched up. **11)** phallus complex, lateral aspect, ventral appendix of juxta broken (slide MIC 4236). **12)** ♂ cornuti, closeup (slide MIC 4236). **13)** ♀ genitalia, ventral aspect, with tergum VIII partly cut out and flipped to the left (slide MIC 4237).

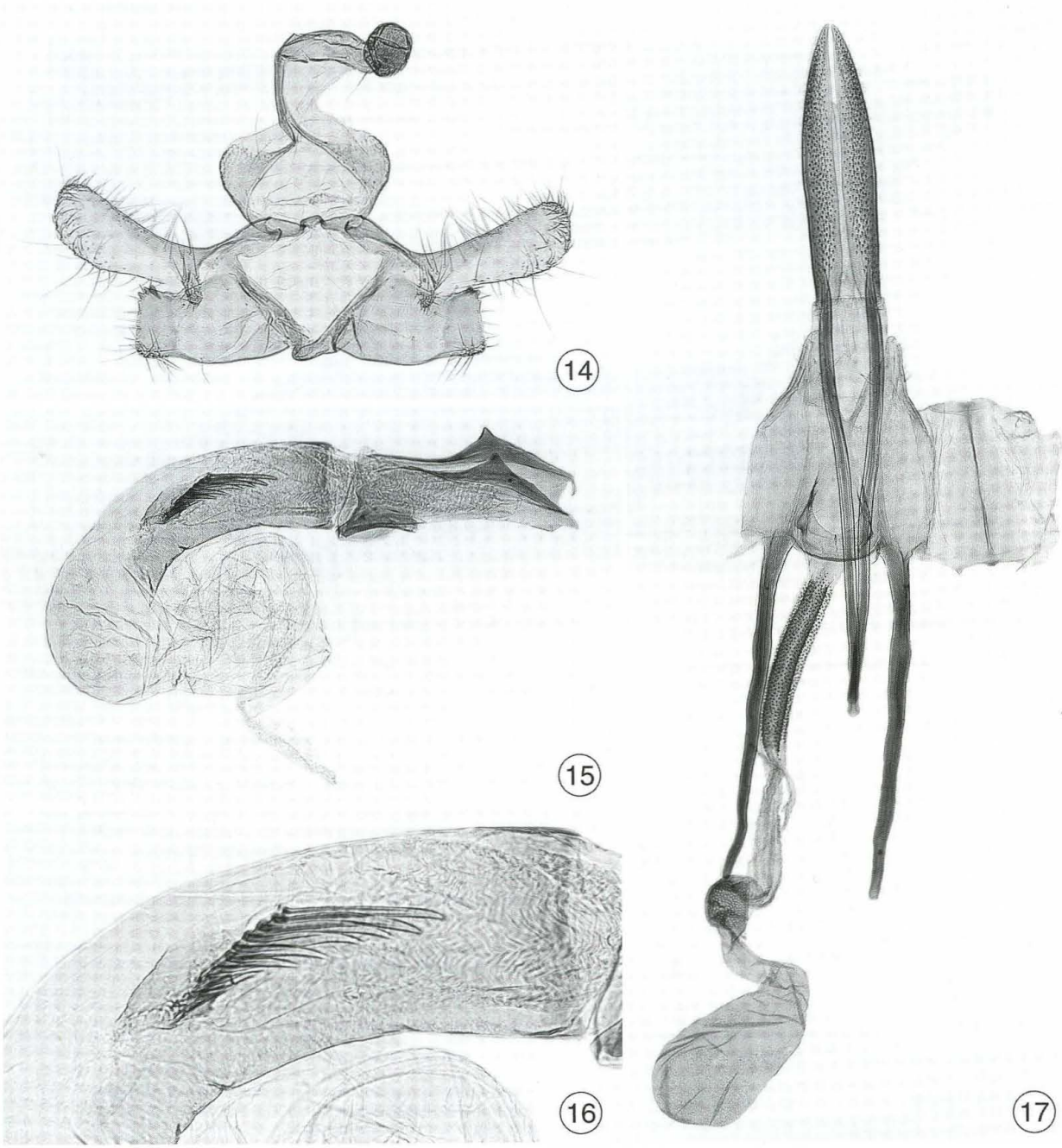

Fig. 14-17. Genitalia of *C. cisoriella*. **14)** ♂ genitalia spread in posteroventral aspect, phallus complex removed (slide JFL 1568), tegumen bent to the right. **15)** phallus complex, lateral aspect, ventral appendix of juxta broken (slide JFL 1568). **16)** ♂ cornuti, closeup (slide JFL 1568). **17)** ♀ genitalia, ventral aspect, with tergum VIII partly cut out and flipped to the right (slide JFL 1565).

1 ♀, Highlands Co., Parker Is. [near Lake Placid], 4-5 Jun 1964, leg. R. W. Hodges (USNM).

1 ♀, Bradenton, Gulf Coast Exp. Sta., 8 Jul 1955, leg. E. G. Kelsheimer (FSCA).

1 ♀, Lake Alfred, 30 Jun 1928, at light, leg. L. J. Bottimer (USNM).

South Carolina

1 ♀, McClellanville, Wedge Plantation, 22 Aug 1968, leg. D. C. Ferguson (genitalia slide JFL 1561) (USNM).

Etymology.– The specific epithet is derived from the generic name of the food plant, *Xyris*.

Remarks. The Xyridaceae represent a newly recorded family of larval host for *Coleophora*. They are monocots in the same subclass as the Juncaceae (subclass Commelinidae), albeit in a different order (Commelinales vs Juncales for Juncaceae) (Cronquist, 1988). Seeds of Juncaceae (*Juncus* spp. and *Luzula* spp.) are used as larval food by a number of *Coleophora* species (Landry and Wright, 1993; Emmet *et al.*, 1996; Falkovitsh, 1996; Landry, 1997). Several species of *Xyris* occur in the Atlantic region of the southeastern United States and the host genus is abundantly represented in the Neotropical region. Thus *C. xyridella* could be much more widely distributed than known records indicate.

Relationships.– This species belongs to the *caespititiella* species group as defined by the following autapomorphies (Landry and Wright, 1993): possession of a strengthening longitudinal carina or strengthening bar in the middle of TVIII, and larvae feeding on seeds of monocots. The general shape of the tegumen with a narrow median constriction and prominent laterobasal angles occurs in several *Juncus*-feeding species. The lack of signum is a character state shared with *cratipennella* which, conversely, lacks the male

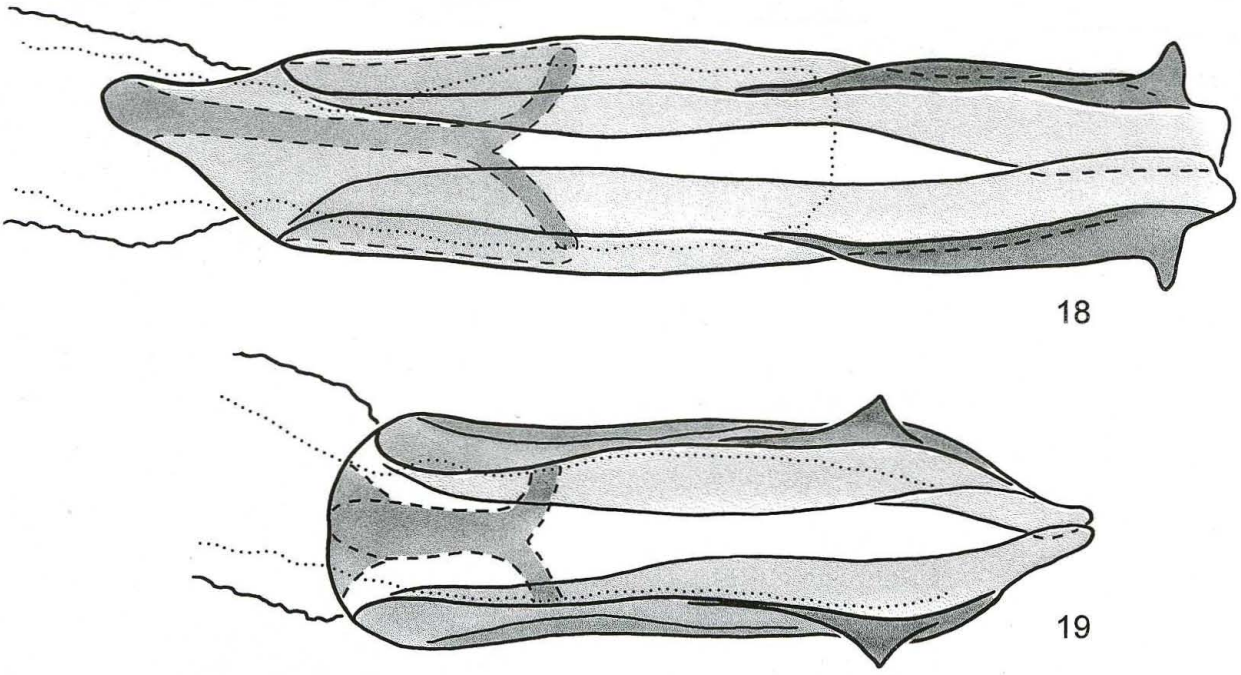

Fig. 18-19. Juxta rods of ♂ genitalia, dorsal aspect. **18)** *C. xyridella*. **19)** *C. cisoriella*. Drawn to same magnification.

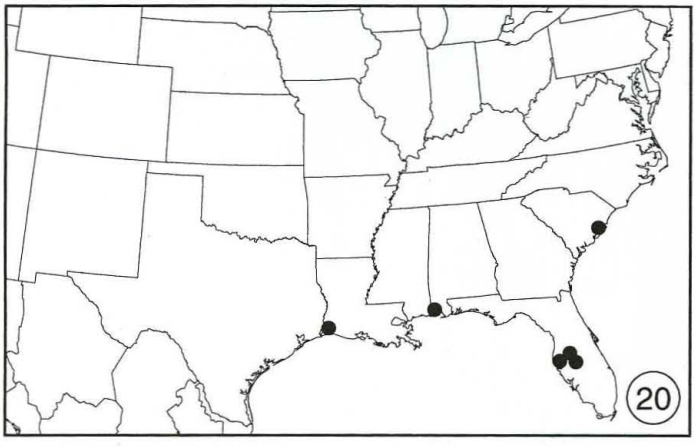

Fig. 20. Known geographical distribution of *C. xyridella*.

genital features of the group.

The papillae anales are reminiscent of those of the Palearctic *C. phlomidella* group, which mine grasses (Baldizzone, 1993).

Coleophora cisoriella J.-F. Landry, sp. nov.

(Fig. 2, 4, 14-17, 19, 21)

Diagnosis.– Superficially the adults of *C. cisoriella* are similar to those of *C. xyridella* in nearly every respect. Smaller on average, dark brown peppering of FW slightly more extensive (Fig. 2, 4). Male genitalia appearing more compact, with proportionnally shorter cuculli, concave costal margin, juxta rods with prominent, triangular dorsal tooth in middle (tooth much smaller and subapical in *C. xyridella*), cornuti straight (longer ones curved in *C. xyridella*) (Fig. 14-16, 19). Female genitalia proportionally shorter, sterigma with sides straight and shorter apical projections, colliculum shorter (Fig. 17).

Description.– Wingspan 9.5-13.9mm, mean = 11.2mm; male 10.0-12.0 mm; female 9.5-13.0mm.

Similar to *C. xyridella*, except as follows : Labial palpi with brown streak on outer side only. Antennal flagellum with distinct pale buff annulations in both sexes. Dark brown peppering of FW scattered about radial sector and cell area (Fig. 2, 4). *Male genitalia* (Fig. 14-16, 19) (3 preparations examined). Proportionnally shorter than *C. xyridella*. Costa markedly concave. Valvula digitiform. Cucullus slightly broader distally. Sacculus with apical margin square, dorsal angle finely dentate. Juxta rods apically acuminate, dorsally with strong keel near middle ended in acute triangular tooth which projects laterally in dorsal aspect. Cornuti 8-10, straight, in compact comb-like bundle. *Female genitalia* (Fig. 17) (4 preparations examined). Proportionnally shorter than *C. xyridella*. Sterigma with sides straight, digitiform projections of postero-apical angles shorter and more straight. Colliculum shorter and broader. Spiculate section of ductus bursae about as long as sterigma. Posterior apophyses ca. 2x length of sterigma. Papillae anales ca. two-thirds length of combined abdominal segments 1-4.

Larval case.– Unknown.

Hostplant and phenology.– Larval host unknown but given the similarities in female ovipositor with *C. xyridella*, it may also be feeding on the seeds of *Xyris* or of a related monocot. Collecting dates of adults range from 1 Apr to 16 Sep.

Distribution (Fig. 21).– Known only from the Brazilian states of Minas Gerais, Goias, and Amazonas.

Type material.– *Holotype* ♂: [label 1]: Col. Becker | 78091; [label 2]: Brasil: MG [Minas Gerais] 1400m | Serra do Cipo [43°55'W 19°50'S, nr Lagoa Santa] | 17-19.iv.1991 | V.O. Becker Col.; [label 3]: genitalia slide ♂ | JFL 1563 [green]; [label 4]: HOLOTYPE ♂ | Coleophora | cisoriella | J.-F. Landry; (VBEC).

Paratypes: 2 ♂♂, 6 ♀♀. *Allotype* ♀: same data as holotype (genitalia slide JFL 1564) (VBEC).

Other *paratypes*:

2 ♂♂, 2 ♀♀, same data as holotype; ♂ genitalia slides JFL 1567, 1568; CNC no. 22678 (VBEC, CNC).

1 ♀, BRAZIL, Goias, Alto Paraiso, 1300m, 30 May 1994, V. O. Becker & K. S. Sattler leg.; Col. Becker 92798 (genitalia slide JFL 1565) (CNC).

1 ♀, BRAZIL, Goias, Teresina, [ca. 47°30'W, 13°45'S], 500 m, 29 May 1994, V. O. Becker & K. S. Sattler leg.; Col. Becker 92580; (genitalia slide JFL 1566) (VBEC).

1 ♀, BRAZIL, Amazonas, Canadian Fathers' Pool, 2 km N of Itacoatiara-Manaus Hwy, 11 km W of Itacoatiara, 8 May 1972, E. G., I. & E. A. Munroe; (genitalia slide MIC 4235) (CNC).

Etymology.– The specific epithet is derived from the Latin *cisorium*, which means a cutting instrument; in reference to the scissorblade-like aspect of the papillae anales of the female.

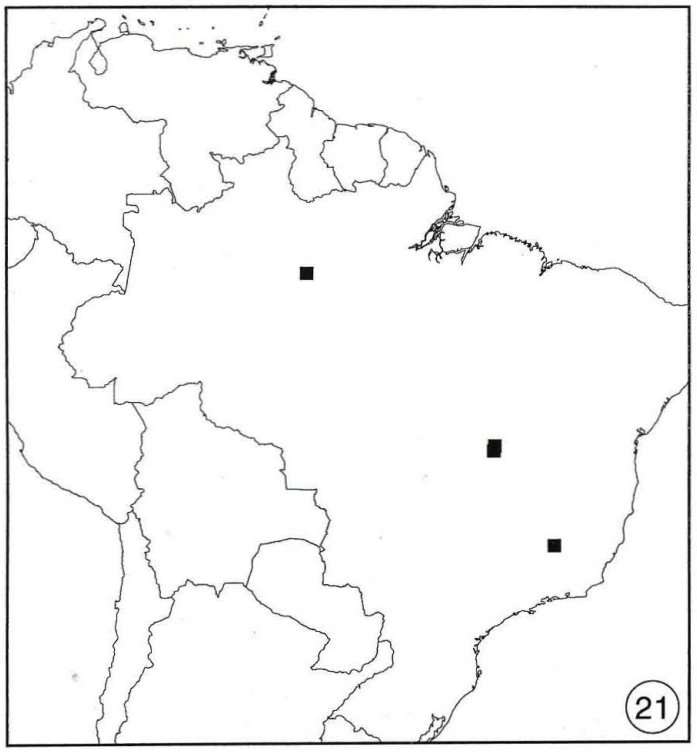

Fig. 21. Known geographical distribution of *C. cisoriella*.

Relationships.– This species is evidently closely related to *C. xyridella* based on close similarities in the genitalia. Thus, I assign it also to the *caespititiella* species group.

ACKNOWLEDGMENTS

I am indebted to Richard Brown, Mississippi Entomological Museum, for inviting me to participate in the NSF-funded insect survey of coastal savannah habitats and to carry out sampling with him in Mississippi, Alabama and Louisiana, which led to the discovery of *C. xyridella*. I thank the curators and individuals listed in the Methods section for loaning specimens used in this study. Eric Rickey provided technical assistance and Bernard Landry field companionship. I thank Jacques Cayouette for identifying the seed heads on which larval cases were found. D. E. Bright and J. D. Lafontaine reviewed the manuscript.

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