

A NEW SPECIES OF *CECIDOMYIA* (DIPTERA: CECIDOMYIIDAE) FEEDING ON RESIN OF BALDCYPRESS

RAYMOND J. GAGNÉ¹ AND KENNETH L. HIBBARD²

¹Systematic Entomology Laboratory, PSI, Agricultural Research Service, USDA,
c/o U. S. National Museum NHB 168, P.O. Box 37012, Washington, DC 20013-7012, USA
e-mail: raymond.gagne@ars.usda.gov

²Bureau of Methods Development and Biological Control, Division of Plant Industry,
Florida Department of Agriculture and Consumer Services, 3513 S, US 1, Ft. Pierce, FL 34945-3045
e-mail: hibbard@doacs.state.fl.us

ABSTRACT

Cecidomyia lamellata Gagné, **new species**, is described from adults of both sexes, pupae, and larvae taken from resin in branchlet swellings of baldcypress, *Taxodium distichum* (L.) Rich. (Taxodiaceae), in Fort Pierce, Florida. Some anatomical characters of the new species depart from the previously known limits of the genus. Baldcypress is the first known non-Pinaceae host of *Cecidomyia*.

Key Words: gall midges, *Taxodium distichum*, Taxodiaceae, Florida, stem galls

RESUMEN

Se describe una nueva especie, *Cecidomyia lamellata* Gagné, de adultos de ambos sexos, pupas y larvas recolectados de la resina en ramas engrosadas de ciprés, *Taxodium distichum* (L.) Rich. (Taxodiaceae) en Fort Pierce, Florida. Algunos caracteres anatómicos de la especie nueva son distintos de los límites conocidos para este género. El ciprés es el primero hospedero conocido de *Cecidomyia* que no pertenece a la familia Pinaceae.

Baldcypress, *Taxodium distichum* (Taxodiaceae), is a widespread deciduous conifer of lowland southeastern United States and northeastern Mexico. Branchlet swellings 2 to 3 cm long and 1 to 2 cm in diameter were discovered on baldcypress in Fort Pierce, Florida by one of us (KLH). The exterior of the swellings was similar in texture to the rest of the branchlets, grayish-brown and scaly, except that a part of the surface was concave and led into a pool of resin in which gregarious cecidomyiid larvae were suspended.

The larvae belong to an undescribed species of *Cecidomyia*, one that forces a redefinition of the genus. *Cecidomyia* is a mostly Holarctic genus of 18 previously known species that feed on resin of conifers (Gagné 2004). The last pair of abdominal larval spiracles are greatly enlarged and posteriorly displaced, allowing the larvae to live immersed in the resin. The genus was previously known only from Pinaceae, mainly *Pinus* but also *Abies*, *Picea*, and *Pseudotsuga*, so this new record from *Taxodium* extends the host boundary of *Cecidomyia*. Among the more conspicuous and unique differences between the new species and previously described congeners are the foreshortened adult antennae, the bowed instead of bent tarsal claws, the short empodia, the broad and completely setulose gonostylus, and the lamellate terminal segment of the larva. The new species is

described and illustrated here and placed in context with its congeners and most similar genera.

MATERIALS AND METHODS

Some full-grown larvae were removed from the resin in swellings and placed directly into 70% ethanol. Other swellings were saved intact over the winter atop damp peat moss in a plastic container to obtain pupae and adults in spring. These also were saved in 70% ethanol. Samples were mounted on microscope slides according to the method outlined in Gagné (1989). Terminology for adult morphology follows usage in McAlpine et al. (1981) and follows Gagné (1989) for larval morphology. Specimens and seasonal information of the new species were obtained by KLH. The taxonomic investigation in this paper was the responsibility of RJG.

Cecidomyia lamellata Gagné, **New Species**

Adult. Head: Eyes large, about 10 facets long at vertex, barely separated to partly connate; facets circular, adjacent throughout except up to 1/2 diameter apart near midheight and at vertex. Frons with 6-9 setae per side. Labella hemispherical in frontal view, each with 5-6 blunt-tipped setae. Palpus 4-segmented. Antenna: male flagellomeres

(Fig. 1) foreshortened, internode not developed on proximal flagellomeres and barely so beyond fifth flagellomere; necks shorter than wide; circumfila with short loops not attaining next distal circumfilum; setulae sparse. Female flagellomeres (Fig. 2) cylindrical with short necks, some circumfilar segments with loops on distal part of node.

Thorax: Anepisternum with a few scales dorsally; anepimeron with 26-34 setae; pleura otherwise bare. Wing length, male 1.9-2.2 mm ($n = 5$), female 2.1-2.5 mm ($n = 4$). Acropods (Figs. 3-4): claws falciform, untoothed; empodia less than 1/2 length of claws; pulvilli about 1/4 length of claws.

Male abdomen: First through seventh tergites entire, rectangular, each with mostly single, uninterrupted, posterior row of setae, a few lateral setae, a pair of trichoid sensilla on anterior margin, and otherwise evenly covered with scales. Eighth tergite rectangular, smaller than seventh, with anterior pair of trichoid sensilla and bare or with a few setae posteriorly. Second through seventh sternites with single row of posterior setae, additional setae along lateral margins and medially at midlength, a pair of closely set anterior trichoid papillae, and elsewhere covered with long, thin scales. Eighth sternite with posterolateral setae, a pair of widely set anterior trichoid sensilla, and scales covering distal third. Genitalia (Figs. 5-6): cerci elliptical; hypoproct wider than aedeagus, deeply bilobed, each lobe with 1 apical and 2-3 subapical setae, entire surface setulose; aedeagus cylindrical, slightly recurved dorsally, rounded apically, subequal in length to hypoproct and cerci, with several sensilla; gonocoxite cylindrical, unlobed; gonostylus terete, wide throughout length to apical tooth, with setae evenly dispersed, longest laterally, entire surface setulose.

Female abdomen: First through seventh tergites as for male. Eighth tergite rectangular, smaller than seventh, with anterior pair of trichoid sensilla and covered with setiform scales. Second through seventh sternites as for male. Eighth sternite weakly sclerotized with posterolateral setae, a pair of widely set anterior trichoid sensilla, and scales covering posterior third. Ovipositor (Figs. 7-8) elongate-protrusible; extended eighth segment (beyond tergite and sternite) with evenly scattered, short setae; ninth segment about twice length of seventh tergite, with numerous short setae throughout; tenth tergite asetose; cerci (Fig. 8) discrete with setae dispersed over entire surface, each with pair of apical peglike setae.

Pupa (Fig. 9). Cephalic sclerite with 2 papillae atop a protuberance on each side, one papilla with short, one with long seta. Base of antenna with short, wide, pigmented ridge ventrally. Frons smooth with ventrolateral triplet of papillae, 2 with setae, and 8 frontal papillae, 4 with setae. Prothoracic spiracle fairly short. Abdomen uniformly covered with short verrucae, pointed on dorsum and venter, rounded on pleura.

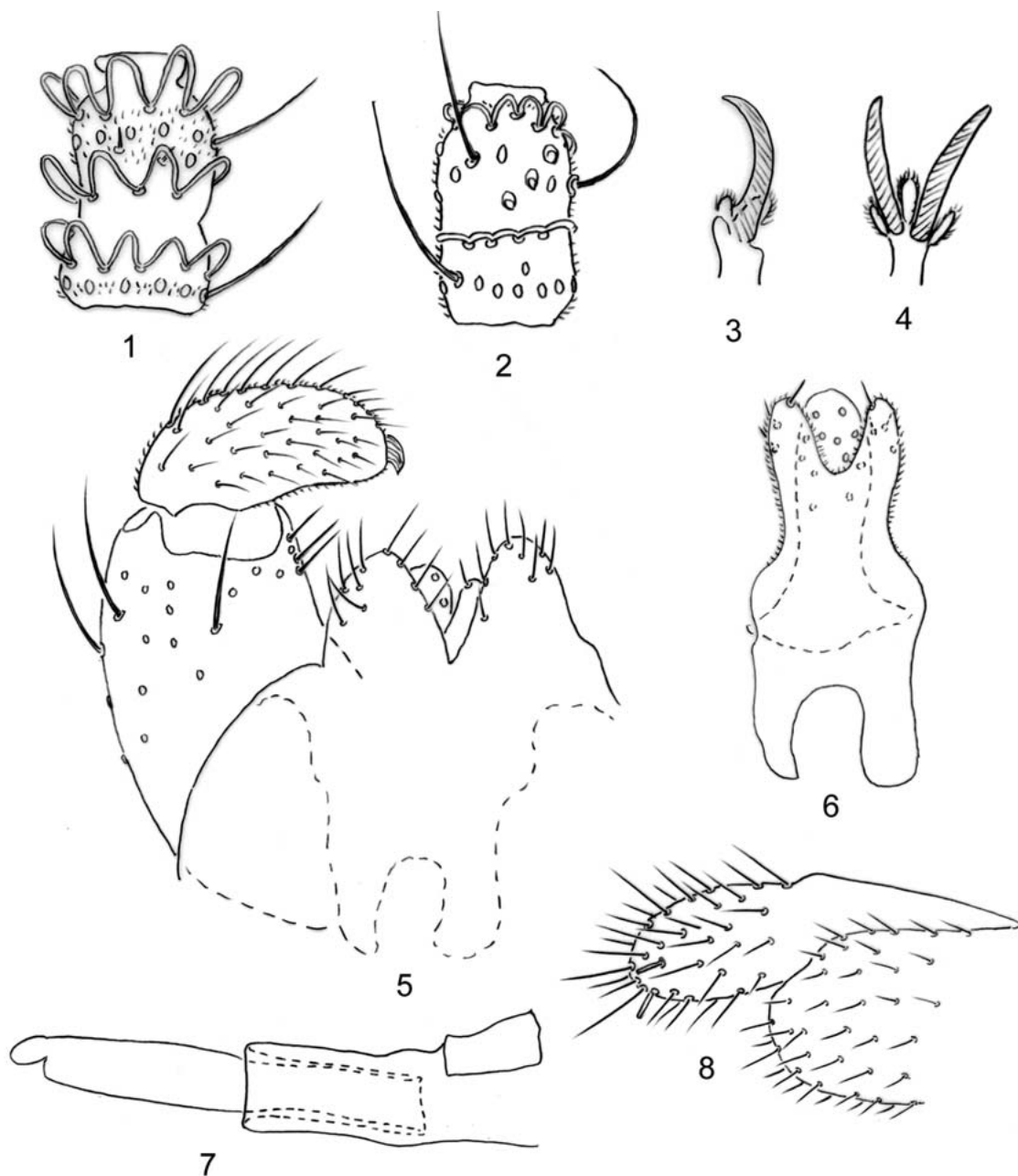
Larva. Third instar (Figs. 10-12): Body elongate, spindleform, without conspicuous lobes except posteriorly. Integument smooth except for anterior horizontal rows of spinose verrucae on second thoracic segment through seventh abdominal segment of both dorsal and ventral surfaces and additionally on eighth dorsal abdominal segment and surrounding anus. Spatula (Fig. 10) with short, convex anterior tooth and long shaft thinning gradually from both ends toward midlength. Papillae typical of supertribe Cecidomyiidi (Gagné 1989), all present and setose or not setose as in other *Cecidomyia* spp. (Gagné 1978), the setae where present fairly short except for the long dorsal and pleural setae on the eighth segment (Fig. 12). Eighth segment exceeding terminal (ninth) segment in length, hind spiracles of eighth abdominal segment greatly enlarged, set at end of posteriorly directed lobes, tapering to closed apex, opening laterally. Terminal segment (Fig. 11) modified posteriorly as a dorsoventrally flattened lamella ending in 2 elongate appendages each subtending a corniform terminal papilla; 2 of remaining terminal papillae without setae, situated dorsally at base of lamella, 2 with moderately long setae situated laterally at midlength, the remaining 2 with short setae, as wide as long, situated ventrally on lamella.

Holotype: Male, from stem swelling of *Taxodium distichum*, Ft. Pierce, Florida, collected X-6-2006, K.L. Hibbard, emerged III-19-2007, deposited in the National Museum of Natural History in Washington, DC (USNM). Other material examined: 7 males, 6 females, 6 pupae, 12 larvae, same pertinent data as holotype except adults emerged III-5 to 23-2007. All deposited in USNM.

Etymology. The specific name is an adjective that refers to the lamellate terminal larval abdominal segment, a structure unique to this species.

Biological Note. Larvae of this species spend their lives immersed in resin. The full-grown third instars spin a cylindrical cocoon within the resin mass, effectively separating them from the liquid. They then turn end to end inside the cocoon with their heads facing the exterior and eventually pupate in that position. When adults are fully developed inside the pupae, they force the still closed pupal skin through the end of the cocoon and any dried resin and become lodged part way out of the cocoon. Adults then emerge through sutures in the pupal thorax.

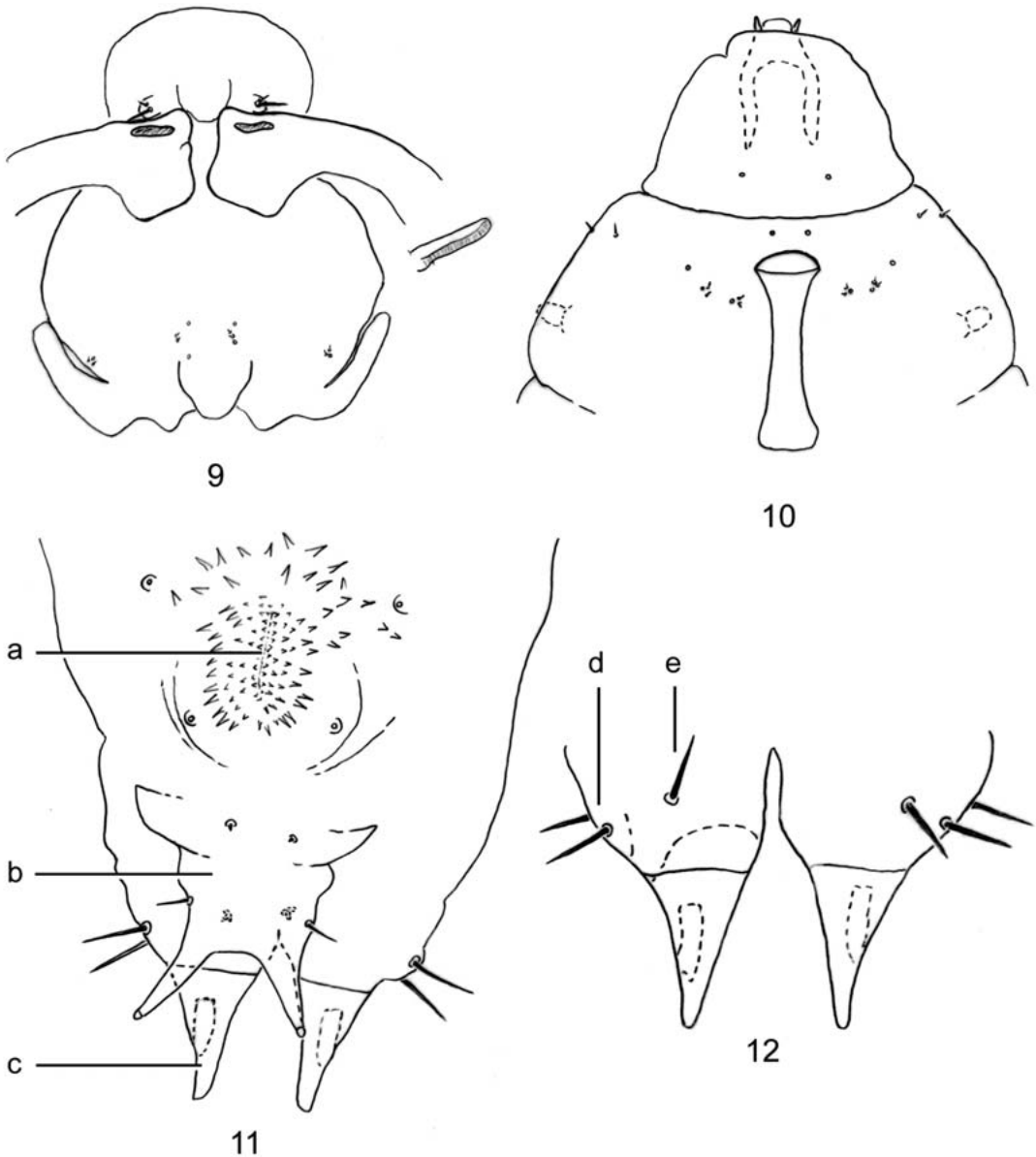
Remarks. The chief distinguishing characters of *Cecidomyia* are as follows: Eyes are more or less confluent at vertex, their facets either hexagonal and closely juxtaposed, or circular and not touching. The occipital process is absent. The antenna has 12 flagellomeres, the first and second not connate; male flagellomeres are binodal and tricircumfilar, except foreshortened and cylindrical in *C. lamellata*; female flagellomeres are cylindrical with short necks. The palpus is usually



Figs. 1-8. *Cecidomyia lamellata* n. sp. 1, Male third flagellomere (ventral). 2, Female third flagellomere (ventral). 3, Acropod (lateral). 4, Same (dorsal). 5, Male genitalia (dorsal). 6, Hypoproct and aedeagus (dorsal). 7, Female abdomen, eighth segment to cerci (lateral). 8, Detail of female cerci (lateral).

four-segmented, three-segmented in one species. The R_5 wingvein is curved distally to join C behind the wing apex, the costa is broken at its juncture with R_5 , the M 3+4 fold is present, and the cubitus is forked. The tarsal claws are simple, curved beyond midlength or (in *C. lamellata* only) bowed, empodia are slightly longer than claws or (in

C. lamellata only) but half as long, and pulvilli are diminutive, about 1/4 length of the claws. Male and female first through seventh tergites have 1 to 2 rows of posterior setae, several lateral setae, and a pair of anterior trichoid sensilla. The gonostylus is setulose basally, asetulose and ridged apically, or, in *C. lamellata*, completely set-



Figs. 9-12. *Cecidomyia lamellata* n. sp. 9, Pupal head (dorsal, but cervical sclerite anterior). 10, Larval head and cervical and first thoracic segments (ventral). 11, Larval eighth and terminal segments (ventral): a = anus; b = lamellate terminal segment; c = hind spiracle. 12, Larval eighth segment (dorsal): d = pair of pleural papillae; e = dorsal papilla.

ulose. The ovipositor is usually short-protrusible, but long-protrusible in *C. lamellata*. Female cerci are discrete, evenly covered with setae, 1 apicolateral pair thick and blunt-tipped. The pupal abdomen is covered both ventrally and dorsally with uniformly short, acute verrucae, and laterally with rounded verrucae. Larvae have elongate cephalic apodemes and greatly enlarged and posteriorly displaced hind spiracles.

Cecidomyia lamellata is a remarkable addition to *Cecidomyia* because of several anomalies. These are the foreshortened adult antennae, the bowed instead of bent tarsal claws, the short empodia, the broad and completely setulose gonostylus, the longer than usual ovipositor, and on the larva, the lamellate terminal segment and the merged 4 apical points of the hind spiracle. Baldcyress further extends the known host range of

Cecidomyia beyond Pinaceae from which the genus was previously known.

In the key to Nearctic genera in Gagné (1981), the bowed instead of bent claws of *C. lamellata* will prevent this species from running to the same place as other species of *Cecidomyia*. It will instead run to couplet 126 with *Sequoiomyia* and *Taxodiomyia*. Interestingly, both these genera are restricted to baldcypress. Unlike either *Sequoiomyia* and *Taxodiomyia*, the first and second flagellomeres are not connate in *Cecidomyia*. *Sequoiomyia* is further distinguished from *Cecidomyia lamellata* by its fully connate eyes with all facets hexagonal and the presence of at least 2 complete rows of posterior setae on the abdominal terga. In *C. lamellata* the eyes are not fully connate and the facets are circular and not all adjacent, and the posterior setae of the abdominal terga form only a single row. *Taxodiomyia* female cerci are fused instead of discrete and the gonostylus is widest basally and is asetulose and lined with ridges apically. In *C. lamellata* the female has discrete cerci and the male gonostylus is broad throughout its length, completely setulose and without ridges. In addition, *Sequoiomyia* and *Taxodiomyia* larvae live, respectively, in seeds and complex leaf galls and their larvae are ovoid, while *Cecidomyia* larvae live in resin and are spindleform. The short empodia of these 3 genera is a departure from the general rule that conifer feeding gall midges have empodia that are appreciably longer than the tarsal claws. It is a striking coincidence that the short empodia and bowed

tarsal claws occur on all 3 genera of gall midges on baldcypress.

ACKNOWLEDGMENTS

We are grateful to Nit Malikul, Systematic Entomology Laboratory (SEL), for preparing the microscopic slides; Diana Marques for arranging the drawings and photos onto plates; and, for their helpful comments on drafts of the manuscript: David A. Nickle and Allen L. Norrbom, Systematic Entomology Laboratory; Keith M. Harris, Ripley, Surrey, UK; and two anonymous reviewers.

REFERENCES CITED

- GAGNÉ, R. J. 1978. A systematic analysis of the pine pitch midges, *Cecidomyia* spp. (Diptera: Cecidomyiidae). U.S. Department of Agriculture Tech. Bull. 1575: 1-18.
- GAGNÉ, R. J. 1981. Cecidomyiidae, pp. 257-292 In J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood [eds.], Manual of Nearctic Diptera. Vol. 1. Research Branch, Agriculture. Canada Monograph No. 27.
- GAGNÉ, R. J. 1989. The Plant-Feeding Gall Midges of North America. Cornell University Press, Ithaca, New York. xi and 356 pp. and 4 pls.
- GAGNÉ, R. J. 2004. A catalog of the Cecidomyiidae (Diptera) of the world. Mem. Entomol. Soc. Washington 23: 1-408.
- MCALPINE, J. F., B. V. PETERSON, G. E. SHEWELL, H. J. TESKEY, J. R. VOCKEROTH, AND D. M. WOOD [eds.]. 1981. Manual of Nearctic Diptera. Vol. 1. Research Branch, Agriculture. Canada Monograph No 27. vi + 674 pp.