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CONTARINIA SPP. (DIPTERA: CECIDOMYIIDAE) FROM SHOOTS OF SLASH PINE (*PINUS ELLIOTTII* ENGELM.) WITH THE DESCRIPTION OF A NEW SPECIES INJURIOUS TO NEEDLES

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ABSTRACT

A new species, *Contarinia acuta* Gagné (Diptera: Cecidomyiidae), which damages developing needles of slash pine, *Pinus elliottii* Engelm., in Florida, is described. It is distinguished from other North American species of *Contarinia* infesting pine, and diagnostic illustrations are provided for the larvae of the new species and those of 3 other, unnamed species of *Contarinia* associated with needles of slash pine.

RESUMEN

Una nueva especie, *Contarinia acuta* Gagné (Diptera: Cecidomyiidae), que daña las hojas en desarrollo del pino *Pinus elliottii* Engelm. en la Florida, es descrita. Es distinguida de otras especies Norteamericanas de *Contarinia* que infestan pinos, e ilustraciones diagnósticas son proveidas para larvas de la nueva especie y de otras 3 especies sin nombrar de *Contarinia* asociadas con las hojas del pino *P. elliottii.*

During research into the cause of needle damage on slash pine, *Pinus elliottii* Engelm., 4 distinct species of *Contarinia* were found associated with new shoots. A characteristic needle damage is caused by *Contarinia acuta* Gagné n. sp. described in this paper. Larvae of the other 3 species are less common than *C. acuta* and their particular role on the needles is still unknown. They were not reared to the adult stage, which is advisable before they can be named, but they are briefly described with illustrations so that they can be distinguished in future studies.

Characteristic brown lesions (ca. 4 mm long) are formed on needles as a result of the feeding of *C. acuta* larvae. Feeding occurs inside the fascicle sheath of basally elongating needles (Fig. 1). After needle elongation has been completed, the needles become dry and brittle at the lesion site and frequently break (Fig. 2). Mature larvae drop to the ground and pupate in the surface litter. In northern Florida, larvae have been collected as early as mid-February, with 6 generations having been recorded in 1 year and up to 4 between May and September (Beavers, in preparation).

Contarinia acuta Gagné, NEW SPECIES
Fig. 3-12

ADULT. *Head.* Eyes large, about 5 facets long at vertex, the facets circular, closely approximated except at midheight of eye where they lie slightly farther apart. Occiput rounded, without peak. Frontoclypeal setae 8-10. Labella hemispherical in frontal view with 4-5 setae. Palpus 4-segmented. Male antennal flagellomere 3 (Fig. 3) binodal, bicircumfilar, the circumfilar loops not attaining the next distal node. Female antennal flagellomeres 1-3 as in Fig. 4; circumfilar loops slightly bowed (Fig. 5).

Thorax. Mesoscutal row with sparse setae in mostly single row interspersed with scales. Mesanepisternum bare. Mesepimeron with 5 setae. Wing length male, 158-164 mm (162, avg. of 5), female, 173-200 mm (190 avg. of 5); RS slightly bowed apically, joining C behind wing apex. C broken, the wing margin indented at juncture with R5. Claws barely shorter than empodia.

Male abdomen (Fig. 8). Tergites 1-7 rectangular with basal pair of trichoid sensilla, a caudal, single row of sparse setae, 2-4 lateral setae, and 0 scales; tergite 8 weakly sclerotized caudally but with at least 1-2 caudal setae laterally, 0 lateral setae, 2 basal trichoid sensilla. Sternites 2-6 rectangular with pair of basal, closely approximated trichoid sensilla, a mostly single, caudal row of setae, and mixed setae and setiform scales grouped near midlength; sternite 7 as for preceding except caudal row mostly double; sternite 8 with midlength and caudal groups of setae continuous on caudal half of sclerite, and basal trichoid sensilla not as closely approximated as on sternites 2-7. Genitalia (Fig. 9(dorsal)-10(ventral): cerci short, broadly rounded with 2 caudoventral setae; hypoproct not deeply divided, the lobes broad, with 2 long setae. Aedeagus longer than hypoproct, very narrow, attenuate, and pointed at apex; gonocoxal apodeme broad; gonopod stout; gonostylus broadest near midlength, tapering to apex, setulose throughout.

Female abdomen (Fig. 6). Tergites 1-7 and sternites 2-7 as in male but setae more numerous except for fewer laterals on tergites. Tergite 7 about .14 length distal section of ovipositor. Tergite 8 longer than 7 with pair of

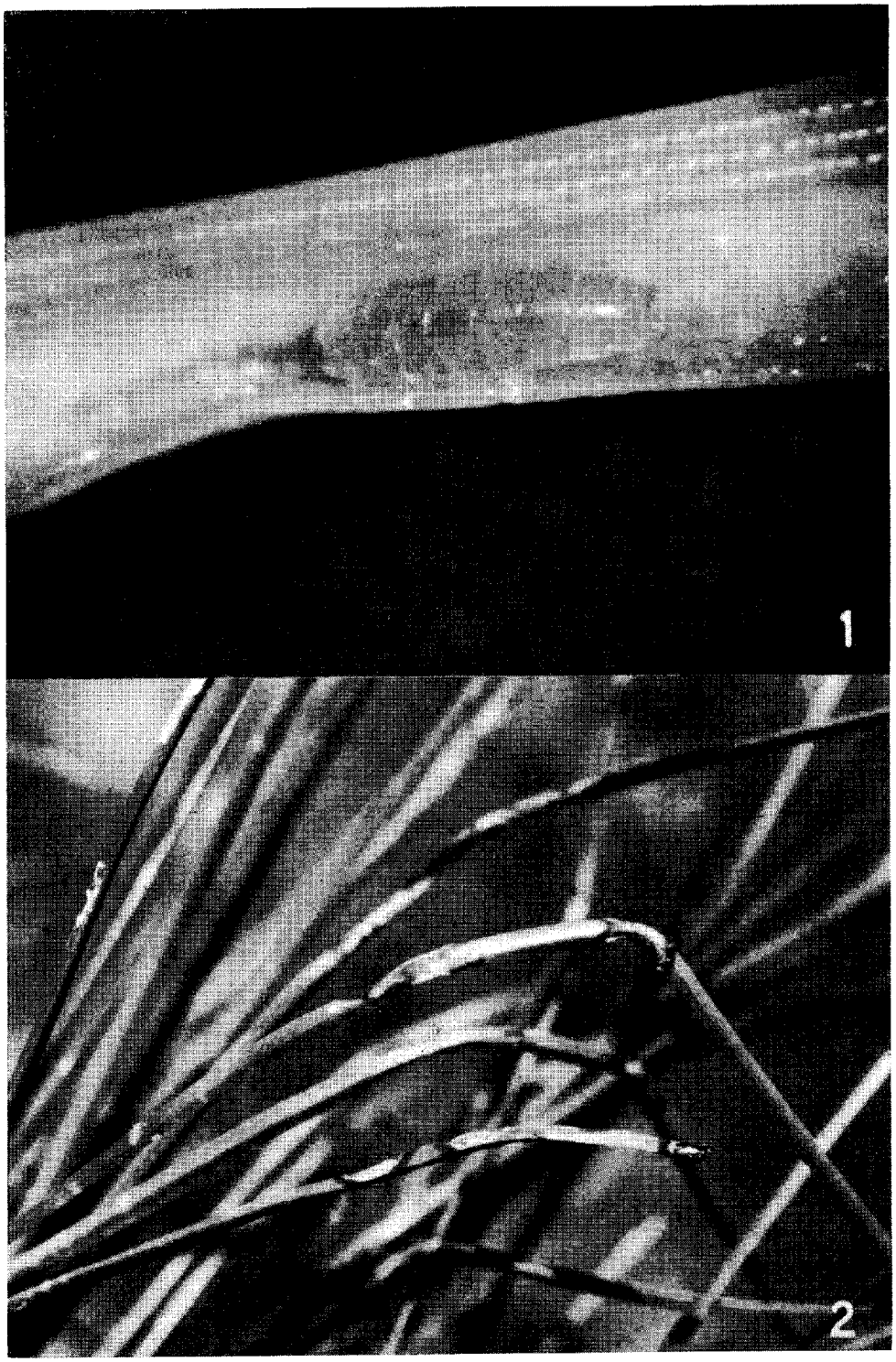


Fig. 1-2. 1) Larva of *C. acuta* feeding on adaxial surface of needle removed from fascicle. 2) Characteristic damage of *C. acuta*.

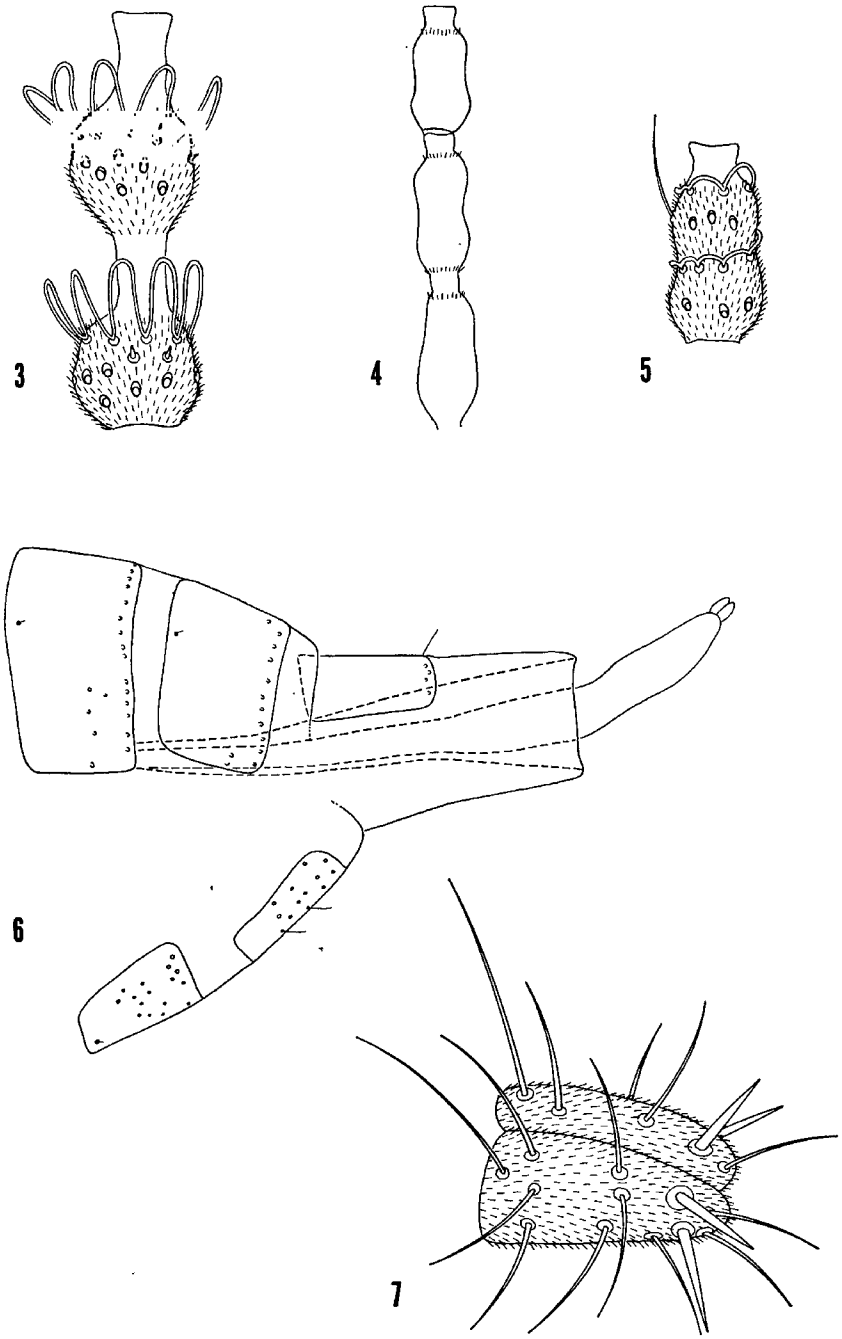
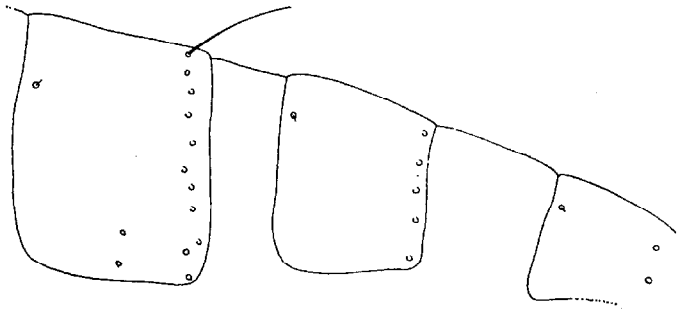


Fig. 3-7. *Contarinia acuta*: 3, 3rd ♂ antennal flagellomere; 4, 1st through 3rd ♀ flagellomeres; 5, 3rd ♀ flagellomere; 6, ♀ postabdomen; 7, ♀ cerci (dorsolateral).



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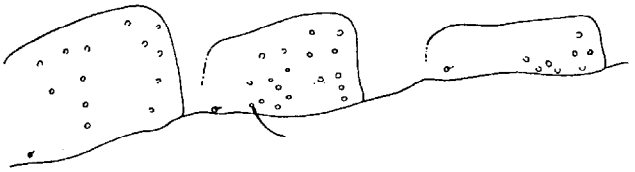

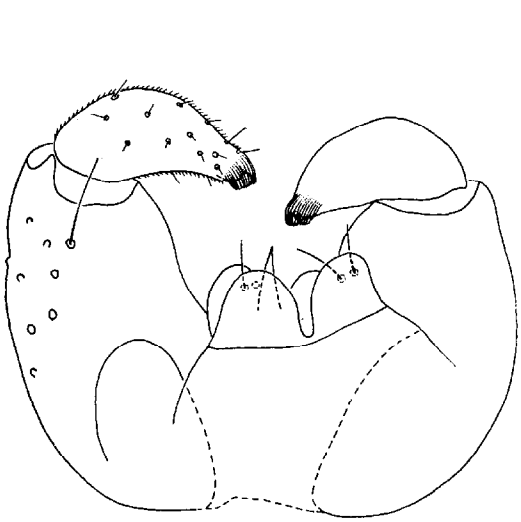

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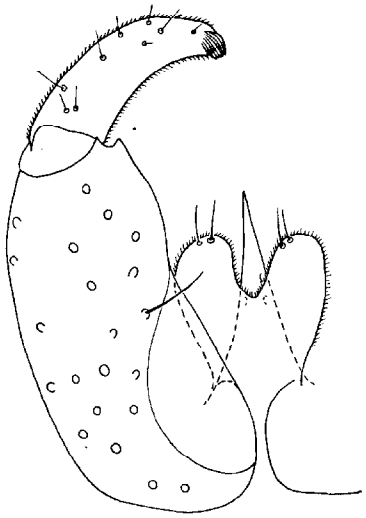

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Fig. 8-10. *Contarinia acuta*: 8, ♂ abdominal segments 6-8; 9 ♂ terminalia (dorsal); 10, same (ventral).

basal trichoid sensilla and short caudal setae. Cerci (Fig. 7) short, setulose throughout.

LARVA (*last instar*). Length 2.3-2.7 mm (2.6 mm, avg. of 20). Body smooth except for anteroventral spicule fields on abdominal segments. Spatula (Fig. 11) clove-shaped, the anterior edge deeply incised, the lobes rounded. Papillae with short setae. Spiracles of abdominal segment 8 at posterior margin. Terminal papillae as in Fig. 12.

HOLOTYPE, ♂, from slash pine shoots, Gainesville, FL, 28-VII-1981, G. M. Beavers, deposited in Florida State Collection of Arthropods, Gainesville. Paratypes (all from Florida and shoots of slash pine unless otherwise noted

and deposited in Florida State Collection and U.S. National Museum of Natural History; GMB = G. M. Beavers; JLF = J. L. Foltz; RCW = R. C. Wilkinson): 6 ♂, 1 ♀, 3 pupal exuvia, Gainesville, 13-VIII to 2-XI-81, GMB; 3 ♀ from pitch canker diseased terminals, 30-VII-1974, Flagler Co., RCW; 3 ♀, emerged from soil under slash pine, Newberry, 17-VIII-1979, RCW & JLF; 5 pupae, Alachua Co., 16-VII-1982, GMB; 9 larvae, Trenton, 30 to 31-VII-1979, RCW & JLF; 3 larvae, pitfall traps, Newberry, 5-IX-1979, RCW & JLF; 2 larvae, Newberry, 30-VII-1979, RCW & JLF; 3 larvae, Gainesville, 26-VII-1979, RCW & JLF; 6 larvae, Gainesville, 7-VII-1981, GMB; 7 larvae, pitch canker diseased terminals, Flagler Co., 27-VIII-1975, RCW; 10 larvae, Flagler Co., 30-VII-1974; and 12 larvae from slash pine needles, Alachua Co., 28-VII-1981, GMB.

Contarinia acuta is so-named for its extremely fine-pointed aedeagus. Adults will readily key to *Contarinia* in Gagné (1981), and it is the only species in that genus with such an attenuate aedeagus. It is otherwise distinguished from all other North American *Contarinia* on pine by the almost equally long claws and empodia (all other cecidomyiids associated with pine characteristically have much longer empodia than claws), the wide male hypoproct, and the completely setulose female cerci. *Contarinia baeri* (Prell) is the only other *Contarinia* known on pine in eastern North America, but that species has long empodia relative to the claws, differently-shaped male and female terminalia (unpub.), and its larva has each of the corniform terminal papillae at the end of a long caudal process (Skuhravý 1973).

The larva of *C. acuta* can be separated from those of the other 3 species of *Contarinia* associated with it on slash pine needles with the help of Fig. 11-8. In other *Contarinia* such differences are diagnostic and will presumably be so here also. *Contarinia* sp. A. (Fig. 13-4) is distinguished by a field of short spines almost surrounding the terminal corniform papillae. In addition, its spatula is least incised anteriorly of all 4 species. *Contarinia* sp. B. (Fig. 15-6) is rather similar to *C. acuta* except that the spatula is not as deeply incised, resulting in slightly differently shaped anterior lobes. *Contarinia* sp. C. (Fig. 17-8) has almost connate terminal corniform papillae and its spatula is the largest of the 4 species. Larvae of *Thecodiplosis* also have somewhat approximated corniform terminal papillae also, but without associated adults we cannot definitely say to which of the 2 genera species C belongs. For the present the larvae of species C are assigned to *Contarinia* sensu lato.

Specimens of the 3 unnamed species of *Contarinia* from slash pine are recorded as follows:

Contarinia sp. A.: 2 larvae, slash pine needle, Newberry, FL, 5-X-1981, GMB; 3 larvae, pitfall trap, Alachua Co., FL, 15-VII-1981, GMB; 1 larva, slash pine needle, Alachua Co., FL, 1-IX-1982, GMB.

Contarinia sp. B.: 2 larvae, pitfall traps, Newberry, FL, 25-I-1980, R.C.W. & J.L.F.; 2 larvae, slash pine needles, DeLand, FL, 7-X-1982, GMB.

Contarinia sp. C.: 2 larvae, pitfall traps, Newberry, FL, 25-I-1980, R.C.W. & J.L.F.; 1 larva, slash pine needle, Alachua Co., FL, 17-IX-1982, GMB; 4 larvae, Perry, FL, 2-III-1977, R.C.W.

We are grateful to Drs. John L. Foltz and Robert C. Wilkinson, Department of Entomology and Nematology, University of Florida, for initiating this study, providing research facilities, and submitting specimens for identification.

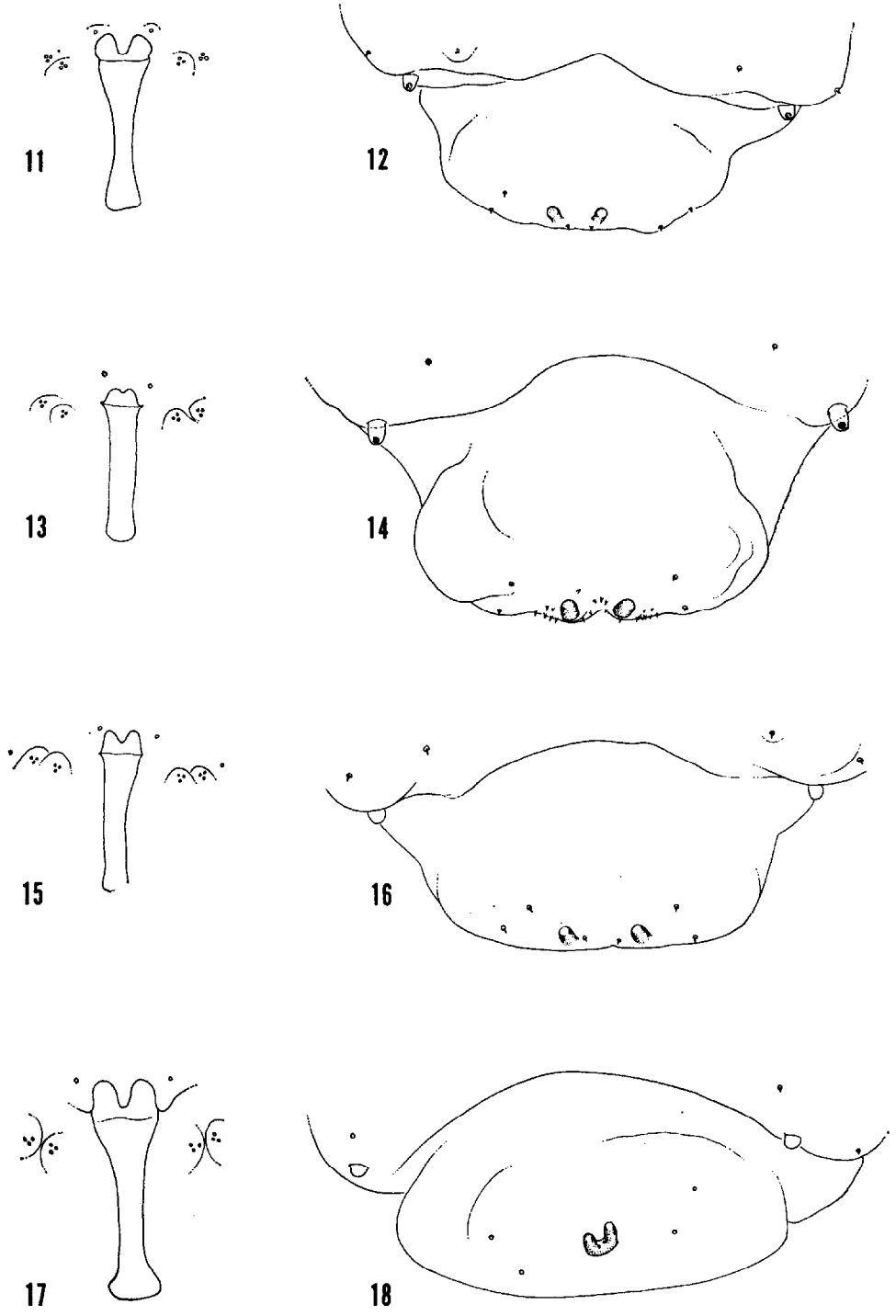

Fig. 11-18. Larval spatulae with associated papillae and terminal segments (dorsal) of *Contarinia* spp. on slash pine shoots: 11-12, *Contarinia acuta;* 13-14, *Contarinia* sp. A; 15-16, *Contarinia* sp. B; 17-18, *Contarinia* sp. C.

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EVOLUTION OF A FIREFLY FLASH CODE

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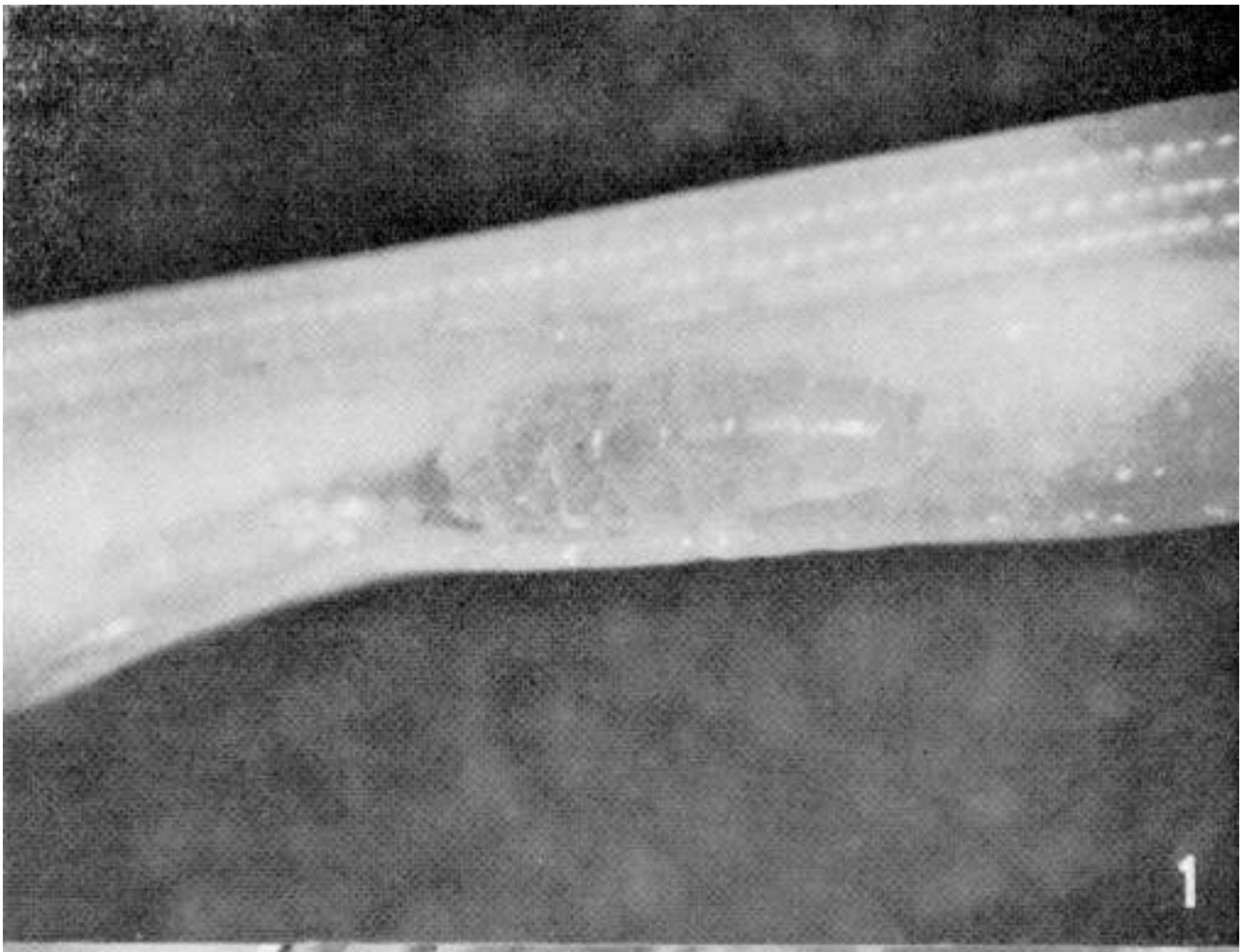
ABSTRACT

The flash code of *Photinus ignitus* (male flashes once, female delays long and then flashes) appears to have evolved from a code like that of *Photinus macdermotti* (male flashes twice, female delays briefly and flashes) by the omission of the second flash of the male pattern and the "connection" of the historic between-flash interval of the male pattern and the female short delay, thus producing the female long delay. Signaling variations and situations necessary for, and that might have led to, such a change in the hypothetical ancestor occur in today's *macdermotti.*

RESUMEN

El código de luces de *Photinus ignius* (macho: 1 luz; hembra: pausa larga, luz) aparentamente ha evolucionado de un código parecido a el de *Photinus macdermotti* (macho: 2 luces; hembra: pausa corta, luz). Ha omitido la segunda luz del patrón del macho y ha unido el intervalo histórico entre luces del patrón del macho con la pausa corta de la hembra, así produciendo la pausa larga de la hembra. Variaciónes de señales y situaciones que permitiría y podría producir tal cambio en el antecesor hipotético se observa en *macdermotti* en poblaciones actuales.

Firefly flashing behavior does not fossilize, but through a comparison of related living species we can see the sorts of changes that occur in evolution, and often get some notion of how and why these changes came about. Such a comparative approach may suggest specific observations and experiments that should be made, and focus attention on overlooked but significant details of the behavior of living species. I have made observations on and experimented with the flashing behavior of several species in the *Photinus consanguineus* group (Green 1956, Lloyd 1969) and on species with which they have pertinent interactions. I can suggest a reasonable scheme for the evolution of the code of *Photinus ignitus* from a precursor like the code of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