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A NEW NEOTROPICAL SPECIES OF *CLINODIPLOSIS* (DIPTERA: CECIDOMYIIDAE) INJURIOUS TO ALLIGATORWEED, *ALTERNANTHERA PHILOXEROIDES* (AMARANTHACEAE)

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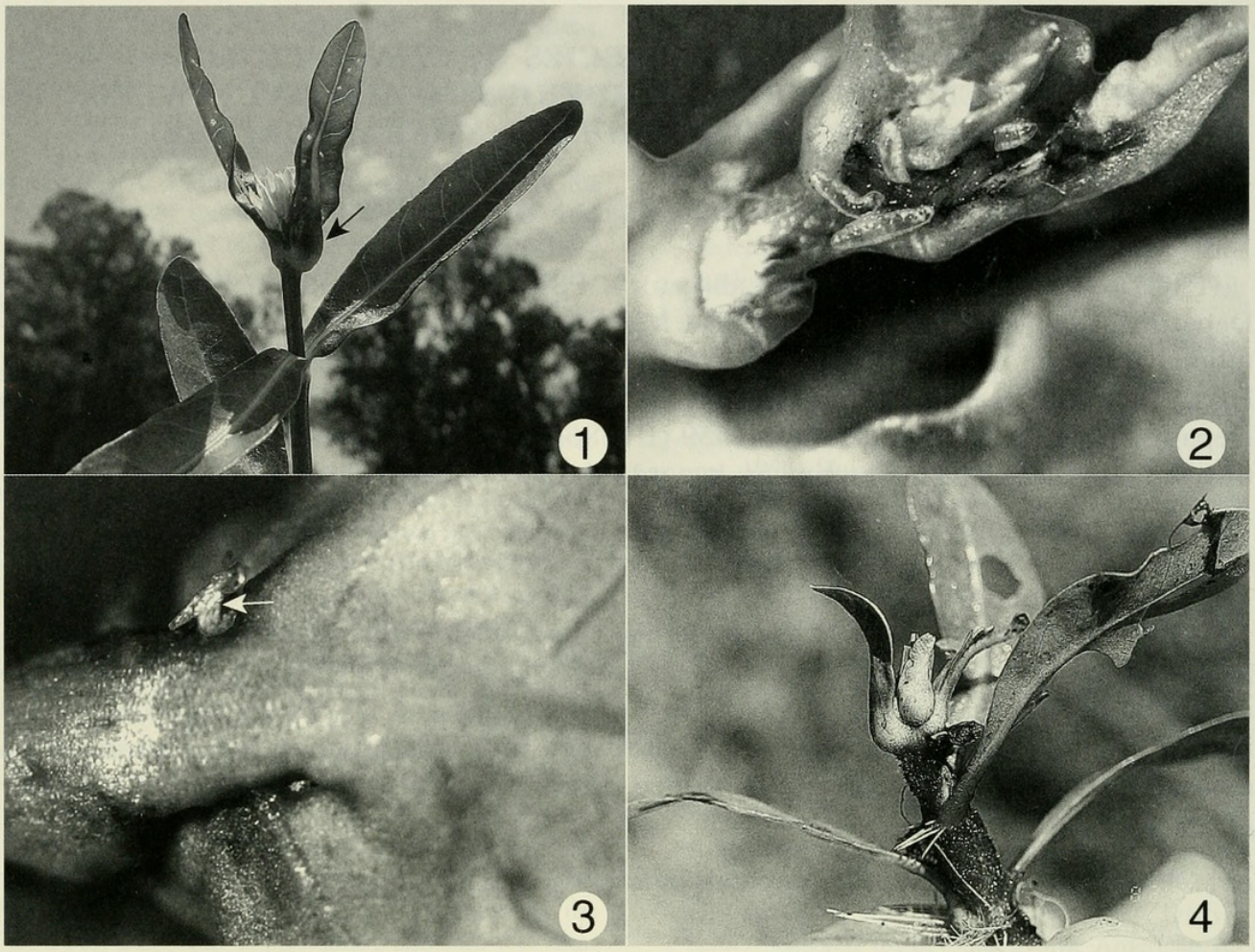
Abstract.—A **new species** of cecidomyiid, ***Clinodiplosis alternantherae* Gagné**, is reported from alligatorweed, *Alternanthera philoxeroides* (Mart.) Griseb. (Amaranthaceae) in Argentina. The gall midge forms galls on branch tips and is a likely candidate to aid in the control of the invasive, alien alligatorweed in North America and Australia. The male, female, pupa and larva are described, illustrated, and compared to other *Clinodiplosis* species.

Key Words: gall midges, Neotropical, biocontrol of alligatorweed

Alligatorweed, *Alternanthera philoxeroides* (Mart.) Griseb., an aquatic and semi-aquatic perennial plant indigenous to southern South America, has become introduced into California and southeastern United States and elsewhere, including Australia, where it outcompetes native plants and obstructs waterways. Galls of a cecidomyiid new to science are commonly found on new branch tips at sites in Argentina, Paraguay, Uruguay, and Brazil. The galls also appear on *Alternanthera aquatica* Chod.

Eggs are laid on the growing branch tips. Newly hatched larvae begin feeding on the developing leaves and cause the leaf tissue to swell and envelop the larvae (Figs. 1–4). The leaves remain green while the white, gregarious larvae inside are feeding. When mature, the larvae mine a single, cylindrical partial exit tunnel through the thickened gall tissue up to but not including the outer cell layer of the epidermis. Pupation then occurs and, when the adult stage is fully developed, the pupa breaks through the outer layer of epidermis and crawls halfway out. The adult then emerges through the thorax of the pupa. Affected branch tips then die and turn black. The gall midge is multivoltine and galls can be found throughout the year. At some sites almost every plant may be infested. Besides killing terminal buds, infestation usually causes a severe foreshortening of the inflorescence peduncle. The cecidomyiid could be an important control of alligatorweed outside its native range because of its apparent abundance and its many generations per year if host-testing shows that this species is as narrowly oligotrophic as it appears to be.

The new species of gall midge will readily run to *Clinodiplosis* in the last couplet of the key to genera in Gagné (1994). *Clinodiplosis* is a worldwide genus of 93 known species, 17 of them from the Neo-



Figs. 1–4. Galls of *Clinodiplosis alternantherae* on *Alternanthera* spp. 1, Branch tip of *A. philoxeroides* with gall at base of leaf (arrow). 2, Gall of same cut open to show gregarious larvae. 3, Base of gall showing pupal exuvia (arrow) at exit hole. 4, Branch tip of *A. aquatica* with shortened, galled leaves.

tropical Region. Outside the Neotropics, most species of this genus appear not to be host specific and are usually associated with fungus growing in or on plant tissue, such as spent flowers or old galls. The new species and most of the other Neotropical species, however, are known to be from galls in which they are primary plant feeders (Gagné 1994), as is the new species described below.

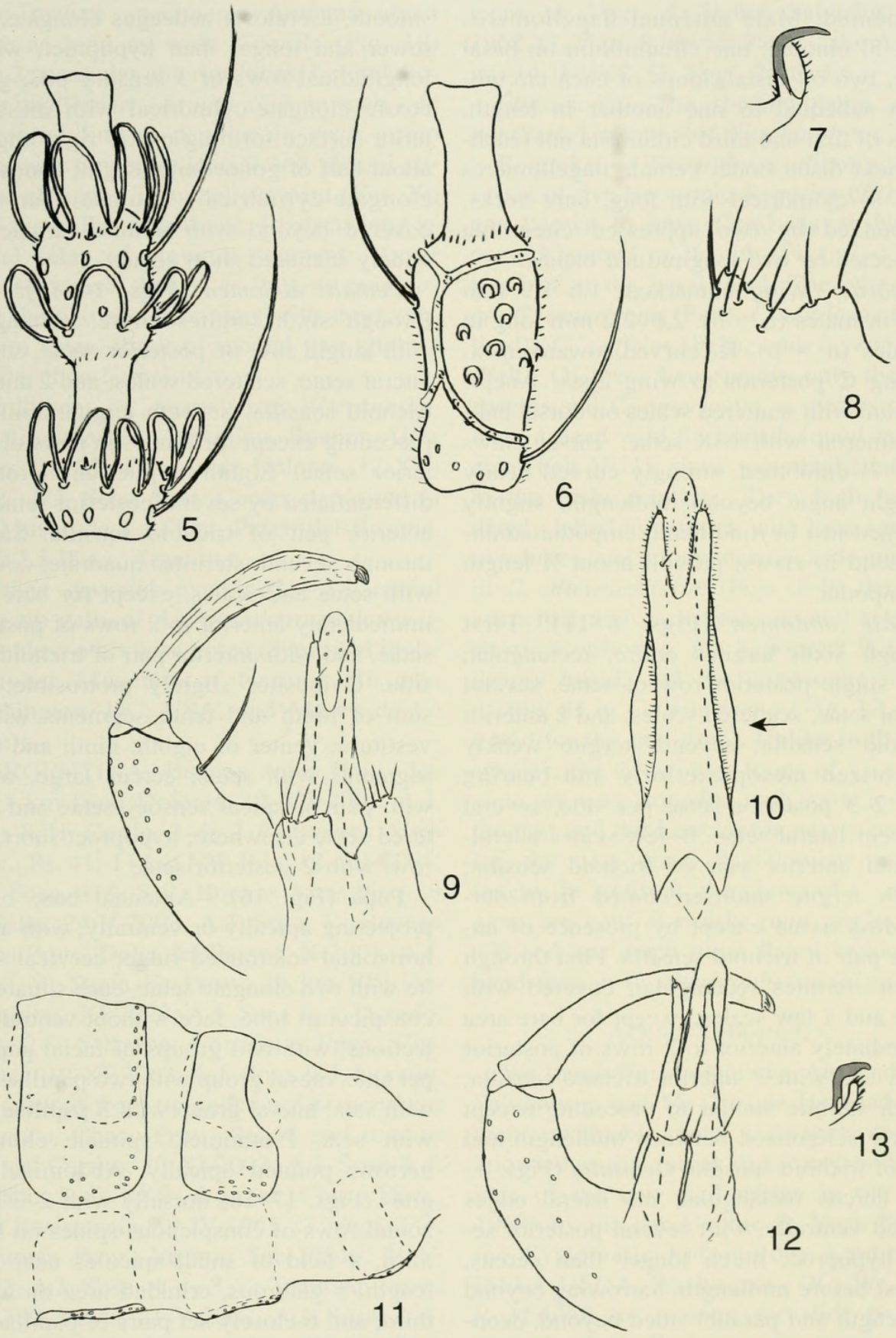
Methods

Galls with pupae or full-grown larvae collected in the field were placed in small containers until adults emerged. Specimens of immature stages and reared adults were preserved in 70% isopropyl alcohol. Samples were mounted on microscope slides using the method outlined in Gagné (1989). Terminology for adult morphology follows usage in McAlpine et al. (1981) and for larval morphology that in Gagné (1989). The field work, rearing of adults, and securing of other stages were done by H. Cordo and A. Sosa, as well as others (see acknowledgments). The taxonomic investigation was the responsibility of R.J. Gagné.

Clinodiplosis alternantherae Gagné, new species

(Figs. 5–11, 14–20)

Adult.—Head: Eyes connate, 11–12 facets long at vertex; facets hexagonoid, all closely adjacent. Occiput with dorsal protuberance with 2 large apical setae and 1–2 smaller, subapical setae. Frons with 6–8 setae. Labella ellipsoid and pointed apically, each with several lateral setae. Palpus 4-



Figs. 5–13. 5–11, *Clinodiplosis alternantherae*. 5, Male third antennal flagellomere. 6, Female third antennal flagellomere. 7, Acropod in profile. 8, Male left cercus (dorsal, flattened). 9, Male genitalia, only one gonopod shown (dorsal). 10, Male hypoproct (arrow pointing to non-setulose lateral flange) and aedeagus (dorsal). 11, Male abdomen, sixth segment through eighth segments (dorsolateral). 12–13, *Clinodiplosis americana*. 12, Male genitalia, only one gonopod shown (dorsal). 13, Acropod in profile.

segmented. Male antennal flagellomeres (Fig. 5) binodal; one circumfilum on basal node, two on distal, loops of each circumfilum subequal to one another in length, loops of first and third circumfila not reaching next distal node. Female flagellomeres (Fig. 6) cylindrical with long, bare necks, surrounded by two appressed circumfila connected by two longitudinal bands.

Thorax: Wing unmarked, 1.6–1.9 mm long in males (n = 5), 2.0–2.2 mm long in females (n = 5), R_5 curved toward apex, joining C posterior to wing apex. Anepisternum with scattered scales on dorsal half, anepimeron with 6–8 setae. Tarsal claws (Fig. 7) untoothed, strongly curved nearly at right angle beyond midlength, slightly widened just beyond bend; empodia attaining bend in claws; pulvilli about ½ length of empodia.

Male abdomen (Figs. 8–11): First through sixth tergites entire, rectangular, with single posterior row of setae, several lateral setae, scattered scales, and 2 anterior trichoid sensilla; seventh tergite weakly sclerotized mesoposteriorly and bearing only 2–3 posterior setae per side, several adjacent lateral setae, 0–few scales laterally, and anterior pair of trichoid sensilla; eighth tergite undifferentiated from surrounding tissue except by presence of anterior pair of trichoid sensilla. First through eighth sternites rectangular, covered with setae and a few scales, except for bare area immediately anterior to 2 rows of posterior setae, and with 2 anterior trichoid sensilla; eighth sternite similar to preceding except weakly sclerotized between midlength and pair of trichoid sensilla. *Genitalia* (Figs. 8–10): cercus rectangular, the lateral edges curved ventrally, with several posterior setae; hypoproct much longer than cercus, widest before midlength, narrowing beyond midlength and parallel-sided beyond, deeply divided into two narrow lobes on distal third, each lobe with a short subapical seta and a shorter distal seta, dorsal surface setulose except for smooth lateral flanges on basal third (Fig. 10), entire ventral surface smooth, asetulose; aedeagus elongate, narrower and longer than hypoproct, with 2 longitudinal rows of 3 sensory pits; gonocoxite elongate-cylindrical with mesoposterior surface forming nearly right angle at about half of gonocoxite length; gonostylus elongate-cylindrical, setulose near base, covered beyond with minute carinae and widely scattered short setae.

Female abdomen (Figs. 14–15): First through sixth tergites entire, rectangular, with single row of posterior setae, several lateral setae, scattered scales, and 2 anterior trichoid sensilla. Seventh tergite similar to preceding except for 2 uneven rows of posterior setae. Eighth tergite unsclerotized, differentiated by several posterior setae and anterior pair of trichoid sensilla. Second through seventh sternites quadrate, covered with setae and scales, except for bare area immediately anterior to 2 rows of posterior setae, and with anterior pair of trichoid sensilla. Ovipositor slightly protrusible; dorsum of ninth and tenth segments without vestiture; venter of eighth, ninth and tenth segments with setae; cercus large, ovoid, with pair of apical sensory setae and scattered setae elsewhere; hypoproct short, narrow, with 2 posterior setae.

Pupa (Fig. 16).—Antennal base barely projecting apically or ventrally, with apical horizontal sclerotized ridge; cervical sclerite with two elongate setae, each situated on conspicuous lobe; face without ventral projections, with two groups of facial papillae per side, mesal group with two papillae, one with seta, lateral group with 3 papillae, one with seta. Prothoracic spiracle elongate, narrow, pointed apically. Abdominal tergites (Figs. 17–18) dorsally with 2–3 horizontal rows of conspicuous spines on basal third, a field of small spicules near midlength, a glabrous, crinkled area on apical third, and 6 closely-set pairs of papillae between middle and posterior thirds of sclerites, only one of each pair with seta.

Third larval instar.—Length, 2.1–2.3 mm (n = 10). White. Integument mostly covered with spicules, especially prominent in

more mature specimens. Antenna about twice as long as wide. Spatula (Fig. 19) with 2 triangular anterior lobes. Lateral thoracic papillae in 2 groups of 3 on each side of central line, 2 papillae in each group each with tiny seta. Dorsal and pleural papillae elongate. Terminal segment (Fig. 20) with 8 papillae as follows: 1 pair as long as dorsal setae of previous segment; 1 pair with setae less than ⅓ as long as previous pair; the two posterior pairs with short, corniform setae, those of medial pair slightly smaller than lateral pair.

Holotype.—♂, reared from *Alternanthera philoxeroides,* Argentina, Buenos Aires Prov., Rt. 63, 4 km from Dolores, 12-XII-2001, A.J. Sosa & H. Cordo, deposited in the Museo de La Plata, Paseo del Bosque, 1900 La Plata, Argentina.

Other material examined.—All reared from tip galls of *Alternanthera philoxeroides* unless otherwise noted (deposited in the National Museum of Natural History, Washington, DC, USA, and Museo de La Plata):

ARGENTINA: Buenos Aires Prov., Rt. 63, 4 km from Dolores, 12-XII-2001, A.J. Sosa & H. Cordo, 2 ♂, 2 ♀; Buenos Aires Prov., Rt. 41, 11 km NW Pila, 12-XII-2001, A.J. Sosa, 4 ♂, 8 ♀; Buenos Aires Prov., 9 de Julio, 24-V-2002, A.J. Sosa, ♀; Buenos Aires Prov., Delta del Paraná, X-2001, A.J. Sosa, ♀; Santa Fe Prov., 22 km SW Reconquista, XI-2002, A.J. Sosa & J. Dorado, 2 ♂, 2♀, 5 larvae; Corrientes Prov., Corrientes, 19-XI-2002, A.J. Sosa & J. Dorado, 2 ♂; reared from tip galls on *Alternanthera aquatica,* Chaco Prov., Rt. 16 and road to Isla del Cerrito, 20-XI-2002, A.J. Sosa & J. Dorado, 3 ♂, 10 ♀, 8 pupae; Chaco Prov., near Resistencia, 19-IV-1961, G. Vogt, 3 ♀; Tucumán Prov., Ingenio San Pablo, 21-V-2002, A.J. Sosa, 4 ♂, 3 ♀; Tucumán Prov., Rt. 380, Lules, 21-V-2002, A.J. Sosa, 2 ♂.

URUGUAY: Montevideo, III-10-1962, G. Vogt, 2 ♀, 2 pupal exuviae, 4 larvae.

PARAGUAY: Asunción, 24-III-1960, G. Vogt, 2 pupae (♂ genitalia visible in one).

BRAZIL: Rio Grande do Sul, Porto Alegre, G. Vogt, ♂; Bahia, Salvador, 1-II-1962, G. Vogt, 8 larvae; Santa Catarina, Itajaí, 14-II-1962, G. Vogt, 2 larvae.

Etymology.—The specific name, *alternantherae,* means "of *Alternanthera.*"

Remarks.—*Clinodiplosis alternantherae* is one of five Neotropical species of the genus known to have tarsal claws that are curved beyond midlength (Figs. 7, 13) instead of at the basal third. The other four are *C. americana* (Felt), *C. cattleyae* (Molliard), *C. coffeae* (Felt), and *C. eupatorii* (Felt). Of these five species only the new species and *C. americana,* a species reared from a dead wild fig branch found in Panama (Felt 1911), show a general similarity in the male genitalia. They both have a deeply lobed hypoproct, with long and narrow lobes, and a long, narrow aedeagus, but in *C. alternantherae* (Figs. 8–9) the cerci are wider and each bears several setae instead of only two, the hypoproct is not so deeply lobed, and the gonocoxite not so narrow as in *C. americana* (Fig. 12, illustrated for the first time). Unlike in the new species, the circumfilar loops of *C. americana* are very irregular, with some loops of the first and third circumfila nearly surpassing the next distal flagellomere node in length. In addition, the claws of *C. americana* are bent at nearly right angles (Fig. 13) and are much more flared beyond the bend than in *C. alternantherae* (Fig. 7).

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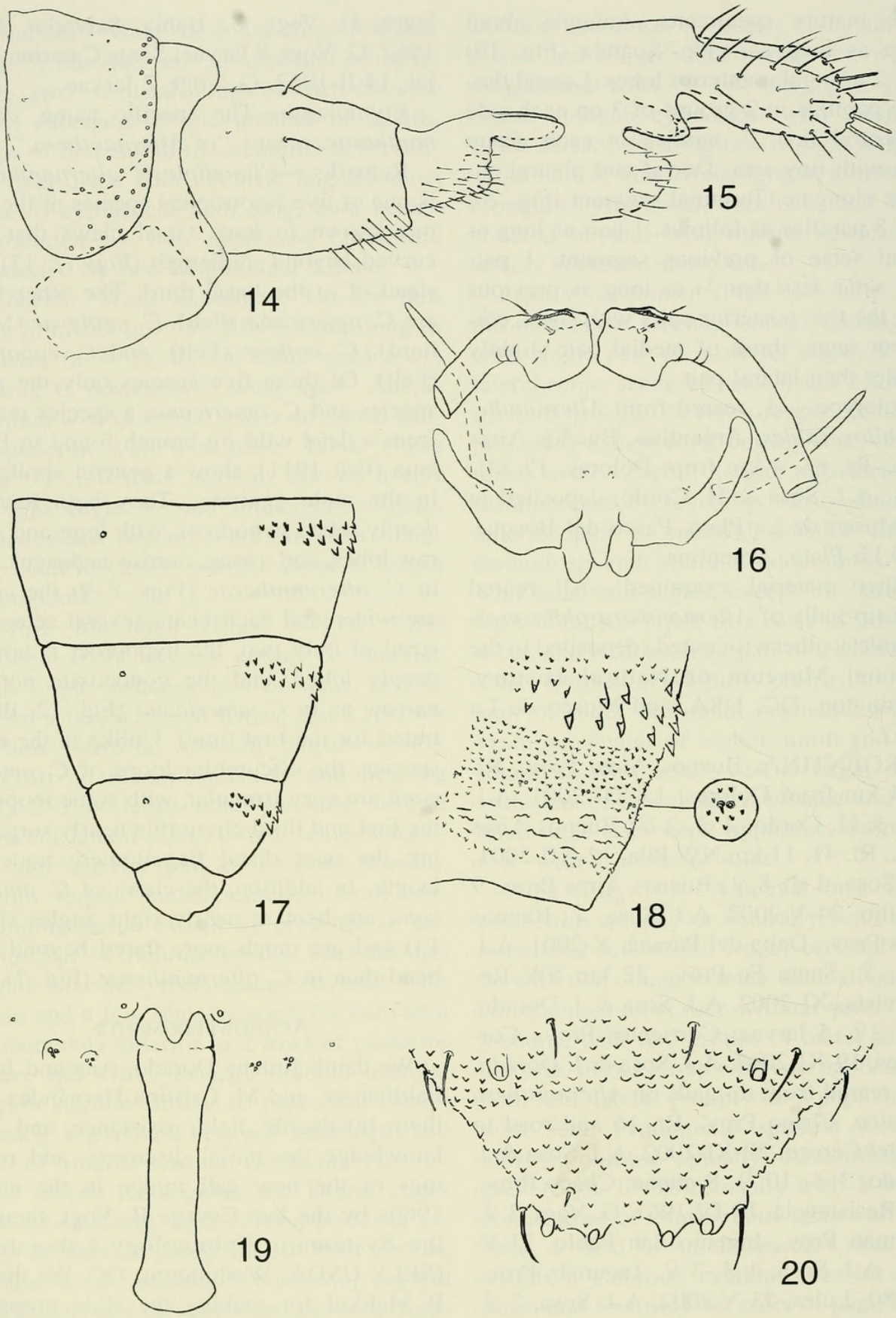

Figs. 14–20. *Clinodiplosis alternantherae*. 14, Female abdomen, seventh segment to end (dorsolateral). 15, Female tenth segment and cerci (dorsolateral). 16, Pupal head and prothoracic spiracles (ventral). 17, Pupal abdomen, sixth segment to end (dorsolateral). 18, Pupal abdomen, detail of dorsum of sixth segment (dorsolateral) with further detail showing pair of dorsal papillae. 19, Larval spatula and associated papillae. 20, Larval eighth and terminal segments (dorsal).

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