

**Biting midges from Dominican amber. IV. Species of the tribes
Dasyheleini and Forcipomyiini (Diptera: Ceratopogonidae)**

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ABSTRACT. Fifteen new species of biting midges from Dominican amber are described, illustrated and interpreted. They are: *Dasyhelea antilleana*, *D. dominicana*, *D. hispaniolae*, *D. minuticola*, *Atrichopogon dominicanus*, *Forcipomyia* (*F.*) *fusiparamera*, *F.* (*F.*) *grimaldii*, *F.* (*Lasiohelea*) *americana*, *F.* (*L.*) *woodruffi*, *F.* (*Lepidohelea*) *antilleana*, *F.* (*L.*) *chrysosuccinea*, *F.* (*L.*) *domibicolor*, *F.* (*L.*) *lepidosuccinea*, *F.* (*Synthyridomyia*) *tertiaricola*, and *F.* (*Thyridomyia*) *frutetosuccinea*. One other species of *Forcipomyia* is diagnosed and illustrated but is not named. The biting midge fauna in Dominican amber is very similar to the recent fauna of Central America at the generic level and includes groups distributed in the Neotropics, pantropics and world wide. The Dominican amber biting midge fauna is less diversified than biting midge faunas in Tertiary ambers from Europe.

KEY WORDS: Diptera, Ceratopogonidae, biting midges, Dominican Republic, amber inclusions.

INTRODUCTION

This is the fourth and final article in a series of reports in which we describe the biting midge fauna in Oligocene-Miocene Dominican amber. For a discussion of our materials and methods, see our two earlier publications in this series (SZADZIEWSKI & GROGAN 1994, 1997) and a similar paper dealing with biting midges in Mexican amber (SZADZIEWSKI & GROGAN 1996). In our first paper in this series (SZADZIEWSKI & GROGAN 1994), we presented tables of numbers of species of Nematocera in Dominican amber in the U. S. National Museum of Natural History (USNM), in Washington, D. C.

In addition, we also presented a list of genera and numbers of Ceratopogonidae in the five collections that we had studied up to that time.

In the present paper, we describe and illustrate 15 new species of biting midges in the tribes Dasyheleini and Forcipomyiini as follows: Tribe Dasyheleini - *Dasyhelea*, 4 species; Tribe Forcipomyiini - *Atrichopogon*, 1 species; *Forcipomyia*, 10 species. One other species of *Forcipomyia* is diagnosed and illustrated but not named. In addition, we interpret the biting midge fauna in Dominican amber, compare it with the faunas of Tertiary European ambers, provide a list of all genera and species and present an updated table of total numbers of specimens examined by genus.

All pieces of amber in the USNM are labelled as follows: Smithsonian Institution, Entomology Department; Brodzinsky/Lopez-Penha collection, and have recently been informed by Gary Hevel (personal communication) that the entire USNM amber collection has been transferred from the Department of Entomology to the Department of Paleobiology. We are grateful to the following individuals and their institutions for allowing us to study material under their care: David Grimaldi, American Museum of Natural History (AMNH), New York; George Poinar and David Lindberg, Museum of Paleontology, University of California (UCMP), Berkeley; Robert Woodruff, Florida State Collection of Arthropods (FSCA), Gainesville; Ryszard Szadziewski, Department of Invertebrate Zoology (RYSC), Gdynia; Gary Hevel and Wayne Mathis (USNM).

For an explanation of general ceratopogonid morphological terminology, see DOWNES & WIRTH (1981); for more detailed accounts of ambers specimens, see SZADZIEWSKI (1988) for Baltic amber, and BORKENT (1995) for Cretaceous amber of North America.

SYSTEMATICS

Subfamily Forcipomyiinae Tribe Dasyheleini

Genus *Dasyhelea* KIEFFER

References: PALMER (1957); SZADZIEWSKI (1988, 1993).

All species of *Dasyhelea* described below belong to the subgenus *Sebessia* (*cincta* group sensu WIRTH 1952).

Key to fossil *Dasyhelea* of the New World (Males)

1. Terminal flagellomere with pointed apex 2
- Terminal flagellomere with blunt apex 3
2. Gonostylus straight; aedeagus H-shaped . *D. antiqua* PALMER (Miocene, California)
- Gonostylus strongly curved; aedeagus U-shaped *D. hispaniolae* sp. n.

3. Apicolateral process of tergite IX short *D. minuticola* sp. n.
 -. Apicolateral process of tergite IX long 4
 4. Apicolateral process of tergite IX slender, with long subapical seta
 *D. dominicana* sp. n.
 -. Apicolateral process of tergite IX broad, with long apical seta ... *D. antilleana* sp. n.

Subgenus *Sebessia* REMM

Dasyhelea (*S.*) *antilleana* sp. n.

Figs. 1-5

Diagnosis

Males distinguished from other species of *Dasyhelea* in Dominican amber by the following combination of characters: third palpal segment short and broad; apex of terminal flagellomere blunt; apicolateral processes of tergite IX broad with apical seta; gonostylus straight and slender; parameres symmetrical, fused distally; aedeagus with high basal arch. Females unknown.

Description

Male. Body brown. Total length 1.18 mm. Antennal flagellum (Fig. 1) typical of the subgenus *Sebessia*, with poorly developed sculpturing on bases and sometimes mid-ports of flagellomeres; proportions of flagellomeres 10-13 (in μm) 56-58-44-60. Palpus (Fig. 2) 5-segmented; segment 3 short (38 μm long), broad, inner surface with a few capitate sensilla; PR 2.08. Legs slender; hind tibial comb with 4 spines; palisade setae on proximal 3 tarsomeres; TR (I) 1.7, (II) 1.7, (III) 1.6. Wing with long macrotrichia covering entire membrane; 1st radial cell reduced to a thin suture (Fig. 3), 2nd obsolete; wing length 0.70 mm; CR 0.50. Genitalia (Fig. 4) small, rotated nearly 180°. Sternite IX barely visible on lateral portions; tergite IX with broad, triangular apicolateral processes with single long apical seta. Gonocoxite moderately long, nearly straight; gonostylus straight or curved distally, tapering distally to broadly rounded apex. Aedeagus (Fig. 5) poorly visible; basal arch heavily sclerotized, well developed, 0.56 of total length, distal portion with truncate tip and two subapical pointed sclerites. Parameres (Fig. 5) symmetrical, fused just below center of basal arch of aedeagus; distal portion not visible.

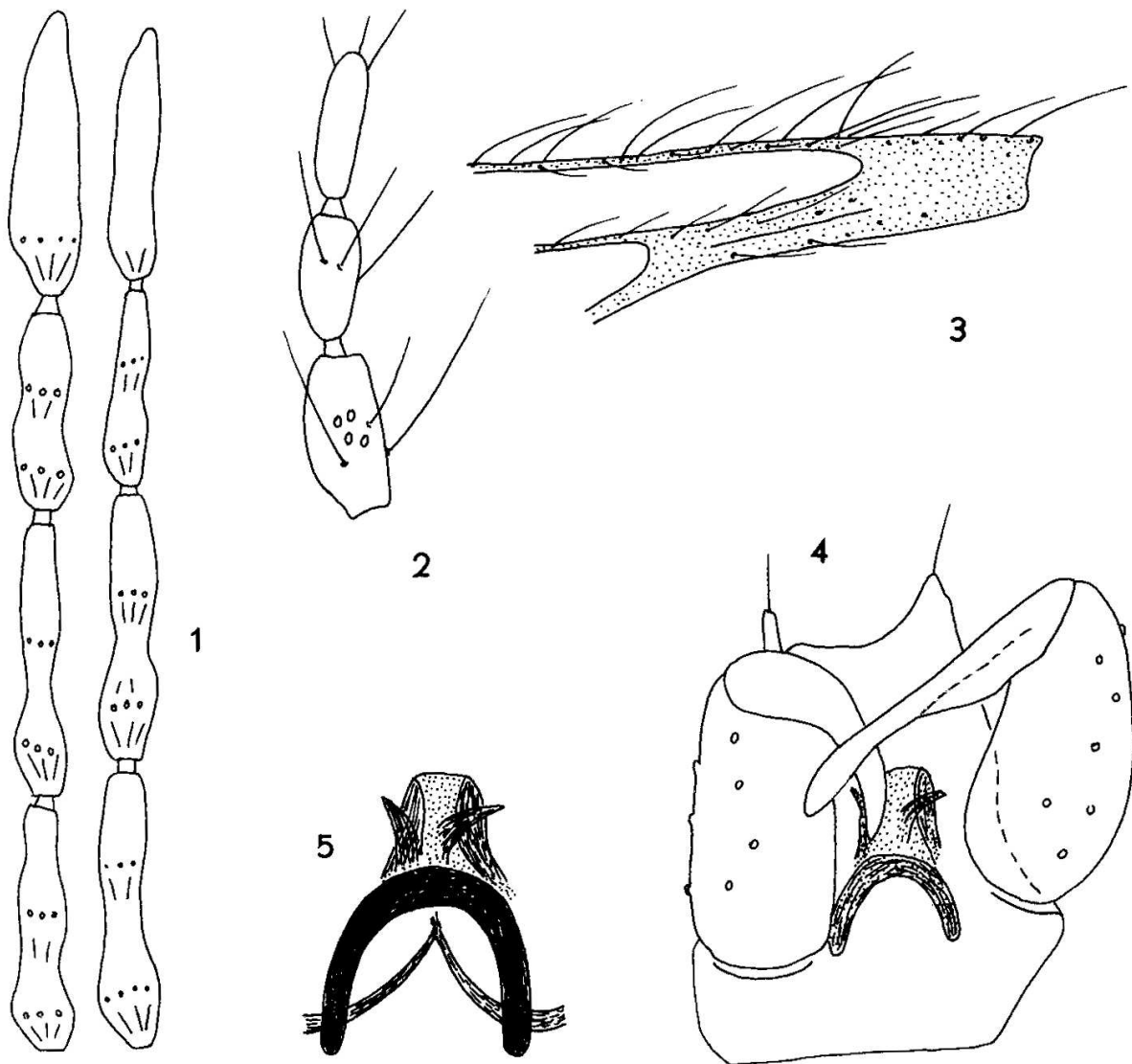
Female. Unknown.

Material examined

Holotype male, USNM 8178.

Etymology

The specific name is a reference to the Greater Antilles, which includes Hispaniola, the island of origin of the amber.



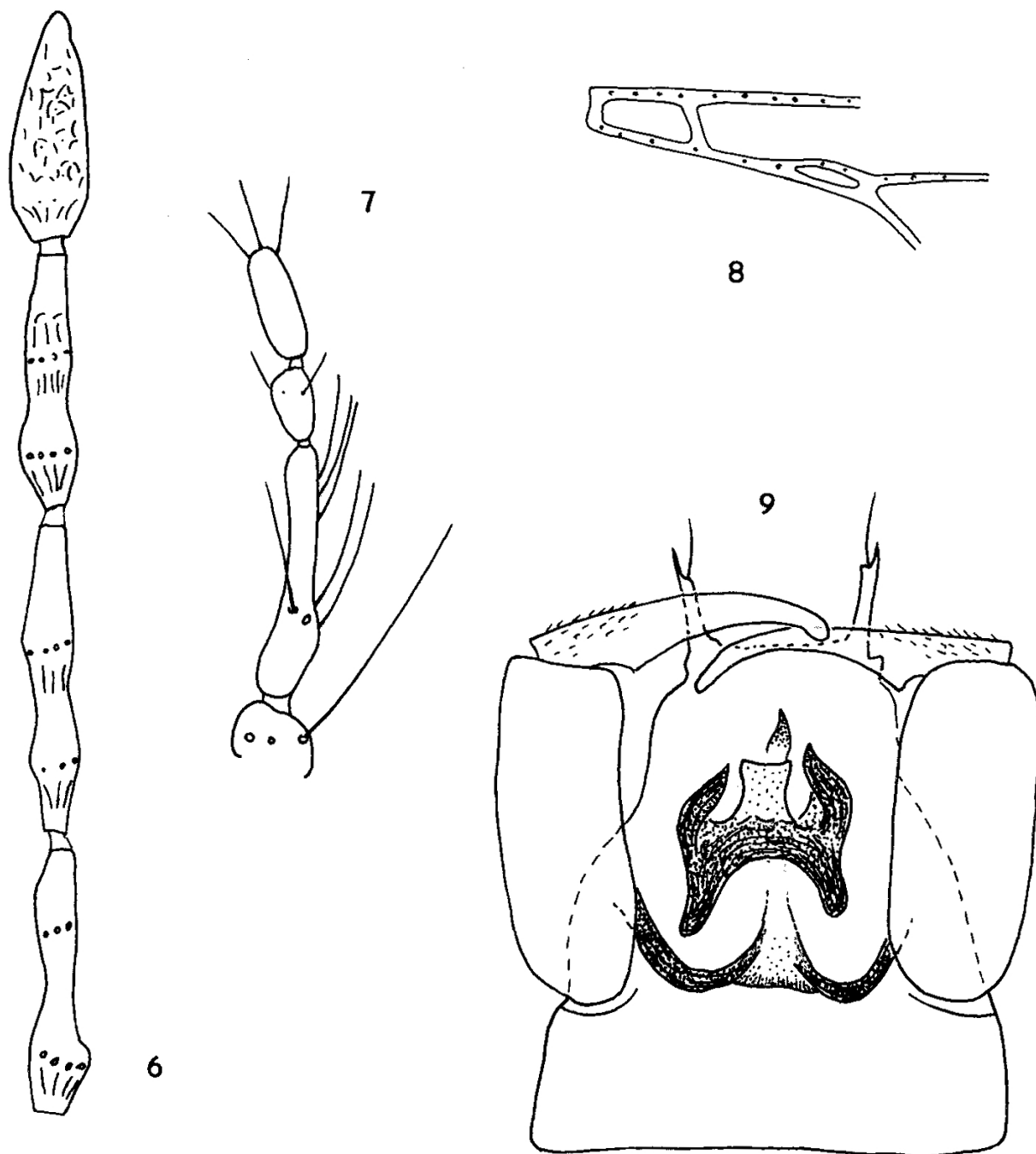
Figs. 1-5. *Dasyhelea (Sebessia) antilleana* sp. n., male. 1 - distal flagellomeres, 2 - palpus, 3 - radial cells of wing, 4 - ventral aspect of genitalia, 5 - aedeagus and parameres.

***Dasyhelea (S.) dominicana* sp. n.**

Figs. 6-9

Diagnosis

Males distinguished from other species of *Dasyhelea* in Dominican amber by the following combination of characters: palpal segment 3 long, slender, slightly swollen proximal 1/3; apex of terminal flagellomere blunt; both radial cells well developed; tergite IX with long, slender, pointed apicolateral processes bearing a single subapical seta; aedeagus H-shaped with apicomeral projection. Females unknown.



Figs. 6-9. *Dasyhelea (Sebessia) dominicana* sp. n., male. 6 - distal flagellomeres, 7 - palpus, 8 - radial cells of wing, 9 - genitalia.

Description

Male. Body dark, scutellum yellow. Total length 1.06 mm. Flagellum (Fig. 6) with poorly developed sculpturing on bases and sometimes mid-portions of flagellomeres; lengths of flagellomeres 9-13 (in μm) 68-74-60-54; flagellomere 13 with bluntly rounded apex. Palpus (Fig. 7) 5-segmented, slender; segment 3 long, slender, slightly swollen on proximal 1/3, without capitate sensilla, length 64 μm ; PR 4.78. Wing membrane with numerous rows of macrotrichia; both radial cells well developed (Fig.

8), 1st short and narrow, 2nd relatively large and quadrate; wing length 0.65-0.78 mm; CR 0.46-0.48. Genitalia (Fig. 9). Sternite IX poorly visible only extreme margins; tergite IX moderately long, constricted at mid-length, with long, cylindrical apicolateral process with outer pointed extension bearing a single subapical seta. Gonocoxite moderately long, straight, somewhat truncate apically; gonostylus curved and tapering distally with narrow rounded tip. Aedeagus H-shaped, located near center of tergite IX considerably above distal margin of sternite IX; basal arm heavily sclerotized, short, stout, straight; basal arch broad, moderately low, extending 1/3 of total length; distal portion with 2 stout, caudally directed lateral projections with pointed tips, and broad, median projection with truncate apex. Parameres symmetrical, fused; basal arms heavily sclerotized, fused at the level of bases of gonocoxites; median sclerite extending beyond apex of aedeagus, with pointed slightly curved tip.

Female. Unknown.

Material examined (5 males)

Holotype male, FSCA 650, R.E. Woodruff (+ Cecidomyiidae, Psychodidae, Scatopsidae). Paratype male, USNM 10910. Other specimens are not designated paratypes, USNM 2771.b. 3 males (+ Chironomidae). At 2771.a. *Culicoides*.

Etymology

The specific epithet is a reference to the Dominican Republic, the country of origin of the amber.

Dasyhelea (S.) hispaniolae sp. n.

Figs. 10-11

Diagnosis

Males distinguished from other species of *Dasyhelea* in Dominican amber by the following combination of characters: terminal flagellomere with slender, narrow point; apicolateral processes long, slender with slender lateral extensions and single long subapical seta; gonostyli with slender, strongly curved distal portion; aedeagus U-shaped, tripartite, with bifurcate lateral prongs, median prong short, broad, truncate apically; median sclerite of parameres very long, slender. Females unknown.

Description

Male. Body dark. Total length 1.4 mm. Flagellum with poorly developed sculpturing on bases of flagellomeres; terminal flagellomere (Fig. 10) with slender, narrow, pointed apex. Palpus barely visible, details not interpretable. Legs barely visible, most details not apparent; TR (III) 2.16. Wing barely visible; length 0.75 mm. Genitalia (Fig. 11) readily visible. Sternite IX with long, broad prolongation covering aedeagus, notched apicomediaally; tergite IX tapers gradually distally, with long, cylindrical, slender apicolateral processes with long pointed lateral extensions, each with single subapical seta. Gonocoxite moderately stout, straight, tapering slightly distally; gonostylus tapering and curved abruptly at mid-length, distal portion slender with rounded tip. Aedeagus heavily sclerotized, U-shaped, tripartite; median sclerite short, broad with

truncate apex; lateral sclerites deeply bifurcate, more median lobe with subapical tooth. Parameres symmetrical, fused at the level of base of aedeagus base; basal arms slightly or greatly recurved near apex; median sclerite long, extending just beyond aedeagus, with blunt or rounded apex.

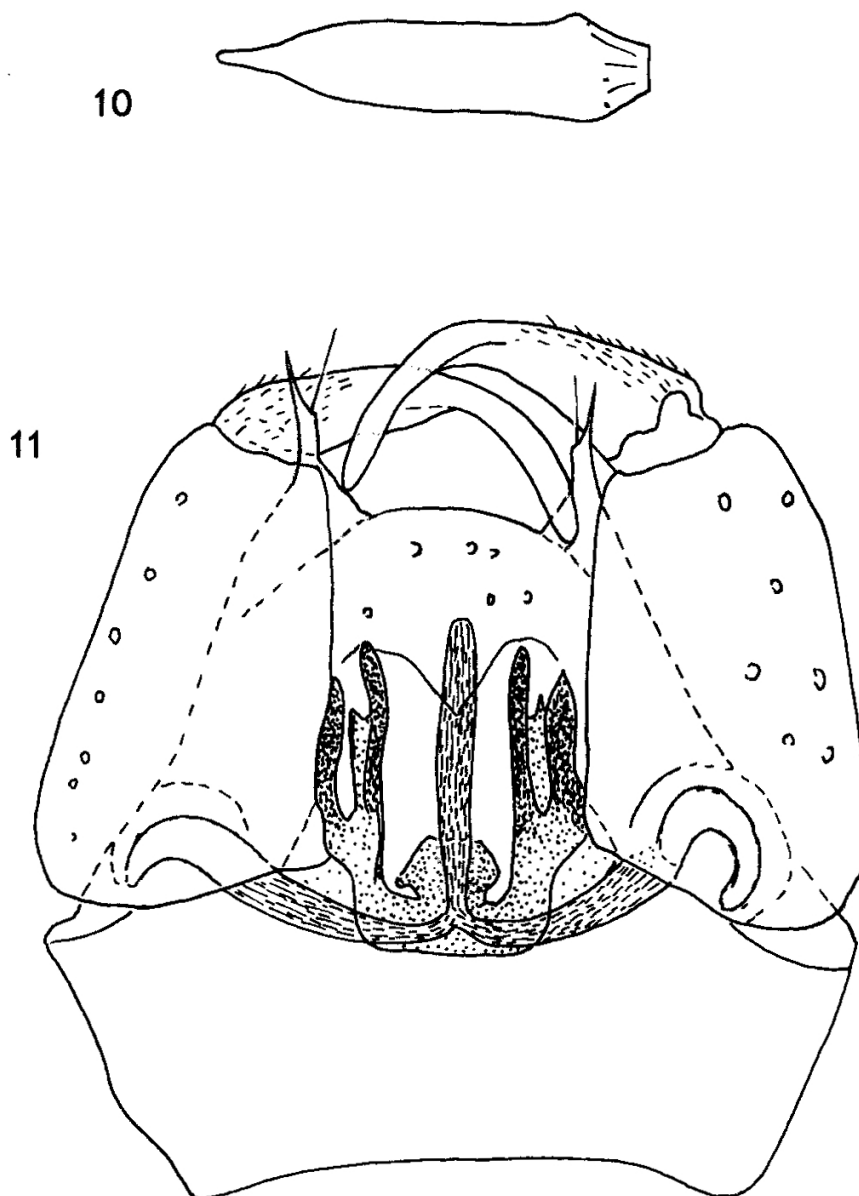
Female. Unknown.

Material examined

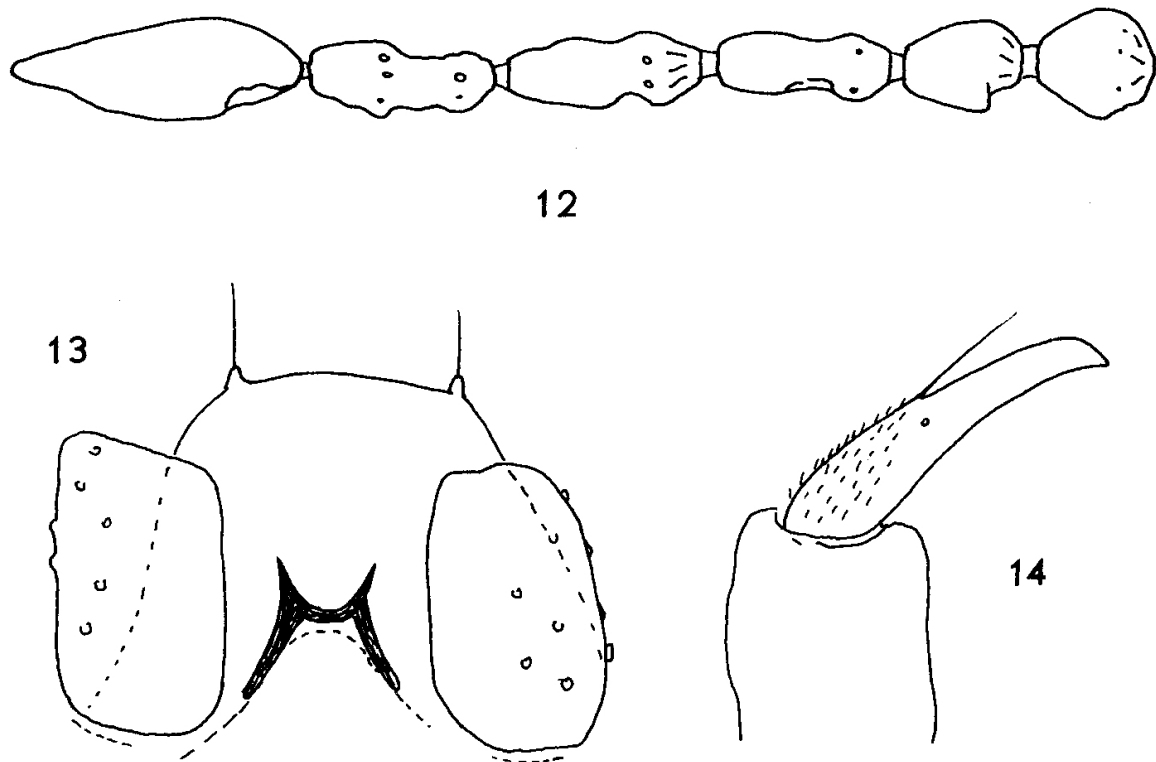
Holotype male, FSCA 13005.

Etymology

This species is named for Hispaniola, the island where the amber originated.



Figs. 10-11. *Dasyhelea (Sebessia) hispaniolae* sp. n., male. 10 - terminal flagellomere, 11 - ventral aspect of genitalia.



Figs. 12-14. *Dasyhelea (Sebessia) minuticola* sp. n., male. 12 - distal flagellomeres, 13 - ventral aspect of genitalia, 14 - gonostylus.

Dasyhelea (S.) minuticola sp. n.

Figs. 12-14

Diagnosis

Males distinguished from other species of *Dasyhelea* in Dominican amber by the following combination of characters: small size, wing length 0.5 mm; Apicolateral processes very short; aedeagus H-shaped.

Description

Male. Body dark with paler legs. Total length 0.8 mm. Flagellum (Fig. 12) with flagellomeres 9-13 very short, lengths (in μm) 20-26-28-26-42; most flagellomeres with poorly developed sculpturing on bases; terminal flagellomere tapering slightly distally to bluntly pointed apex. Palpus barely visible; segment 3 short. Legs typical of the genus. Wing membrane covered with sparse, long, erect macrotrichia in rows; 1st radial cell reduced to suture, 2nd distinct; wing length 0.50 mm; CR 0.46. Genitalia (Figs. 13-14). Sternite IX not visible; tergite IX tapering very gradually distally, with broadly rounded caudal margin, apicolateral processes short, papilla-like (Fig. 13), each with single long apical seta. Gonocoxite short, straight, quadrate; gonostylus nearly straight, proximal half covered with fine setae a long seta present at mid-length on caudal surface, distal portion with slightly curved pointed tip. Aedeagus heavily sclerotized, H-

shape; basal arms straight, diverging; distal portions much shorter, diverging, with slender pointed tips. Parameres not visible.

Female. Unknown

Material examined

Holotype male, AMNH DR-8-114, purchased in Santo Domingo by D. Grimaldi.

Etymology

The specific name is a reference to the very small size of this new fossil species of *Dasyhelea*.

Discussion

This is one of the smallest species among recent and fossil biting midges of *Dasyhelea*. In general, biting midges preserved in ambers are smaller than extant species. For example, in Baltic amber, wing lengths range from 0.7 to 1.7 mm, in Saxonian amber 1.2 mm, and in Dominican amber from 0.5 to 0.8 mm.

However, one extant species, *D. forsteri* GROGAN & WIRTH (1981) from the Solomon Islands is approximately the size of this new fossil species. It is known from both males and females, the allotype male having a wing length of 0.55 mm, and the holotype female's wing length is 0.52 mm. The male genitalia of *D. forsteri* are even more reduced than this fossil species in that it has smaller apicolateral processes, very short and greatly curved gonostyli, an aedeagus that is very small and crescent shaped, and well developed broad parameres.

COMMENTS

In the examined material, 67 *Dasyhelea* were discovered, of which, 31 are males and 36 are females. The following 59 (23 males, 36 females) specimens of *Dasyhelea* were undetermined to species: AMNH 11643, 1 female, purchased from J. Brodzinsky, Santo Domingo, 1987; 11829, 3 male 1 female [+ *Brachypogon (Isohelea) dominicanus*, Sciaridae, Cecidomyiidae, Psychodidae, Phoridae, Coleoptera, Hymenoptera, Acarina], El Valle/Bayaguaua, Monte Plata Prov.; 11845 A, 1 female, La Vega, La Vega Prov., purchased from J. Brodzinsky, Santo Domingo, 1983; DR-6-7, La Toca, 2 female; DR-6-50, 1 female, Santiago; DR-8-107, 2 male; DR-8-108, 1 female; DR-10-118 b, 2 male [at a *Brachypogon (Isohelea) dominicanus*]; DR-10-119, 1 female; W-DR 49, 1 female (+Sciaridae, Chironomidae), specific provenance unknown, purchased from Jorge Wunderlich, June 1989; Z-3, 1 male, from mines in region of Santiago, purchased from J. Brodzinsky, Santo Domingo.

FSCA 452, R.E. Woodruff, 1 male [+*Brachypogon (Isohelea) dominicanus*]; 1004/P.A., 1 female (+Chironomidae); 1157, 1 female; 1171, 1 female; 1359/MM, 1 female; 1645, 1 female (+*Forcipomyia* undet., Cecidomyiidae, Orthoptera); 1807, 1 male [+*Stilobezzia (Acanthohelea)* undet., Cecidomyiidae]; 13003, 1 female (+Diptera Brachycera); 13007, 1 male (+Psychodidae, Formicidae); 13016, 1 male.

USNM 2772, 2 female; 2870, 1 female (+Chironomidae); 3076, 1 female (+Dolichopodidae); 3098 1 male (+Cecidomyiidae, Sciaridae); 5559, 2 female

(+Chironomidae); 5611 e,c 4 male, 2 female [+*Brachypogon (Isohelea)* undet.]; 7514, 1 female (+Scatopsidae); 7736, 1 male (+*Forcipomyia* undet., Scatopsidae, Mycetophilidae, Apoidea); 7832, 1 male (+Isoptera); 8271, 1 female (+Acalyptrata, Scatopsidae, Isoptera, Hymenoptera, Aranei); 9074, 1 female (+Hymenoptera); 9262, 1 female (+Cecidomyiidae, Homoptera, Hymenoptera, Pseudoscorpionidea); 9490, 1 female (+Homoptera, Hymenoptera, Aranei); 9552, 1 female (+Limoniidae, Phoridae, Mycetophilidae, Coleoptera, Hymenoptera); 9731 b, 1 male (at a, Psychodidae, Mycetophilidae, Hymenoptera, Lepidoptera, Thysanoptera); 9758, 1 female (+Psychodidae, Sciaridae, Hymenoptera, Coleoptera); 10089, 1 male; 10206, 1 male (+Cecidomyiidae, Dolichopodidae, Coleoptera, Hymenoptera); 10378, 1 female (+Dolichopodidae, Coleoptera); 10702, 1 female (+Psychodidae); 10742, 1 female (+Chironomidae, Cecidomyiidae, Coleoptera); 10771, 1 female [+ *Brachypogon (Isohelea)* undet.]; 10855, 1 male; 10872, 1 female; 10907, 1 female.

Tribe Forcipomyiini

Genus *Atrichopogon* KIEFFER

References: SZADZIEWSKI (1988)

Atrichopogon (Atrichopogon) dominicanus sp. n.

Figs. 15-21

Diagnosis

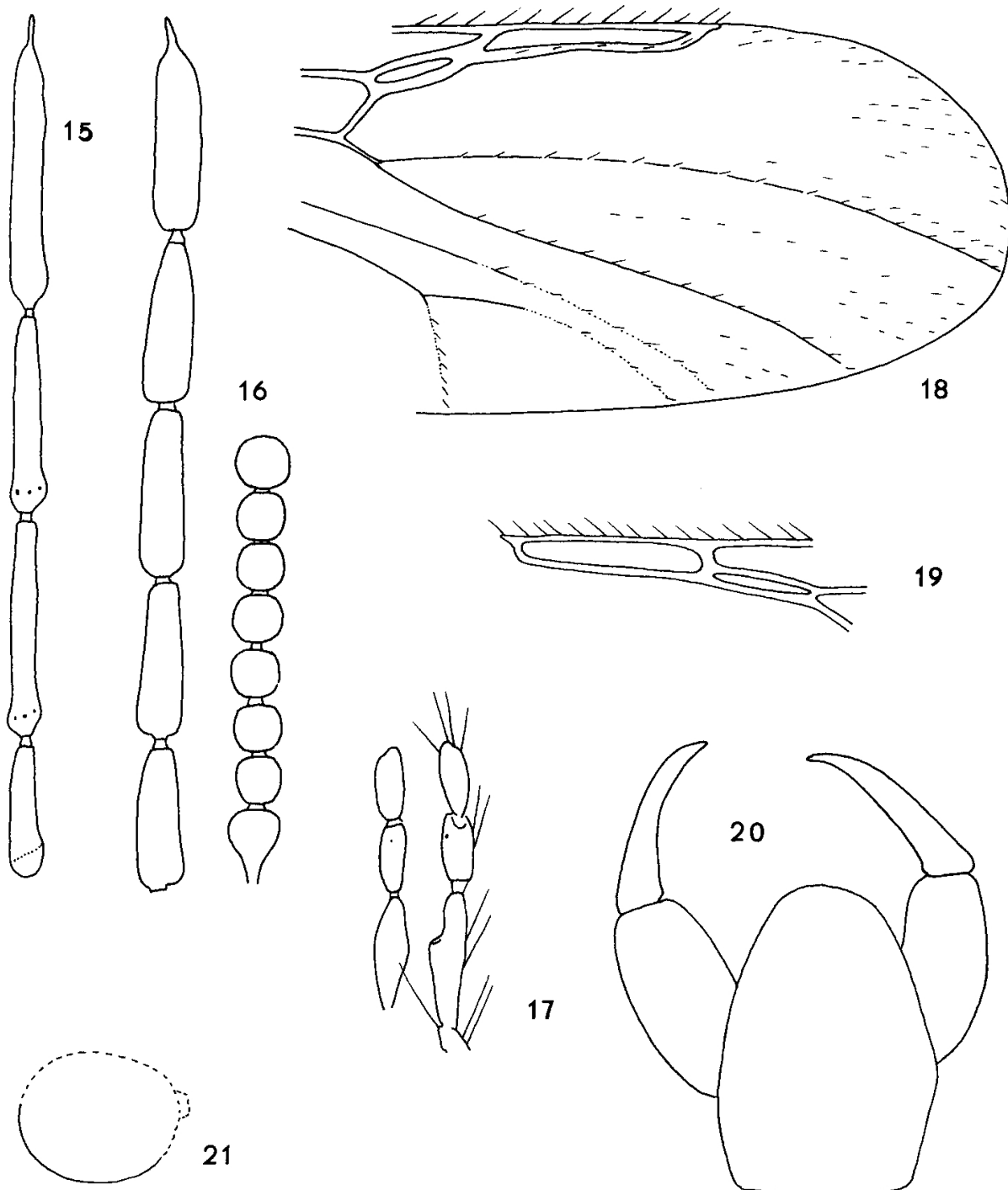
The only diagnosable species of *Atrichopogon* in the material examined. Females distinguished by their small size, wing length 0.78-0.83 mm; wing membrane with sparse macrotrichia restricted to wing tip; and proximal flagellomeres spherical. Males with larger wing than female, wing length 1.01 mm; genitalia only partly visible, tergite IX with rounded caudal margin.

Description

Male. Body dark brown. Total length 1.5 mm. Eyes bare. Antenna with well developed plume; flagellomere 11 twice as long as 10, 13 with long slender apical nipple (Fig. 15); total flagellum length, 750 μ m; AR 0.96. Palpus (Fig. 17) 5-segmented; segment 3 with small sensory pit situated beyond midlength, length of segment 42 μ m. TR(I) 3.4, TR(II) 3.5, TR(III) 3.0. Wing bare; 2nd radial cell twice as long as 1st (Fig. 19); wing length 1.01 mm; CR 0.62. Genitalia (Fig. 20), but details on ventral surface not visible. Tergite IX with evenly rounded caudal margin. Gonocoxite of normal shape and size, straight or slightly curved distally; gonostylus slender, slightly curved distally, apex pointed. Aedeagus and parameres not visible.

Female. Body dark brown. Total length 1.3 mm. Eyes pubescent. Antennal flagellum (Fig. 16) with proximal flagellomeres spherical, distal flagellomeres elongate cylindrical, flagellomere 13 with slender apical nipple; AR 1.9. Scutellum with 4

bristles. All claws with bifid apices. TR(I) 3.1, TR(II) 2.8, TR(III) 3.1. Wing (Fig. 18) unpatterned, membrane with sparse macrotrichia near wing tip; 2nd radial cell 2.7 times longer than 1st; wing length 0.78-0.83 mm; CR 0.66-0.67. One ovoid spermatheca (Fig. 21) visible, measuring 60 x 76 μ m with broad short neck.



Figs. 15-21. *Atrichopogon dominicanus* sp. n., 15 - distal male flagellomeres, 16 - female flagellum, 17 - male palpi, 18 - distal portion of female wing, 19 - radial cells of male wing, 20 - dorsal aspect of male genitalia, 21 - spermatheca.

Material examined (3 specimens: 1 male 2 females)

Holotype female, USNM 7875. Paratypes: 1 male 1 female in the same amber piece (+Homoptera), the male in copula with the female holotype.

Etymology

The specific name is a reference to the Dominican Republic, the country of origin of the amber.

Discussion

This new fossil species apparently belongs in the subgenus *Atrichopogon*, as does *Atrichopogon eocenicus* SZADZIEWSKI (1988) from Baltic amber, as well as the undetermined female mentioned below. The female of *A. eocenicus* differs from this new in being smaller (wing length 0.77 mm), has more elongated ovoid proximal flagellomeres, and more numerous macrotrichia on wing membrane. Another fossil species, *A. brunnescens* STATZ (1944), known only from Miocene deposits of Rott, Germany is of unknown subgeneric position but is distinctly larger (wing length 1.3 mm) than *A. dominicanus* (SZADZIEWSKI 1988).

COMMENTS

The material examined contained the following undetermined specimen of *Atrichopogon*: USNM 2652.a, 1 female (+Phoridae), at b. *Forcipomyia* undet., Phoridae, Hymenoptera, Aranei.

Genus *Forcipomyia* MEIGEN

References: SZADZIEWSKI (1988, 1990, 1993).

This genus predominates in the material that we have examined. We found 279 specimens (58 males, 225 females) belonging to the subgenera *Forcipomyia*, *Lasiohelea*, *Lepidohelea*, *Synthyridomyia*, *Thyridomyia*, and *Trichohelea*. The first fossils in the subgenera *Lepidohelea*, *Synthyridomyia*, and *Thyridomyia* are reported here.

Subgenus *Forcipomyia* MEIGEN

***Forcipomyia (Forcipomyia) fusiparamera* sp. n.**

Fig. 22

Diagnosis

Males distinguished from all other species of *Forcipomyia* (*F.*) in Dominican amber by the following combination of characters: very small size (wing length 1.06 mm); parameres that are fused for 0.25 of their total length; and aedeagus with relatively narrow distal portion. Females unknown.

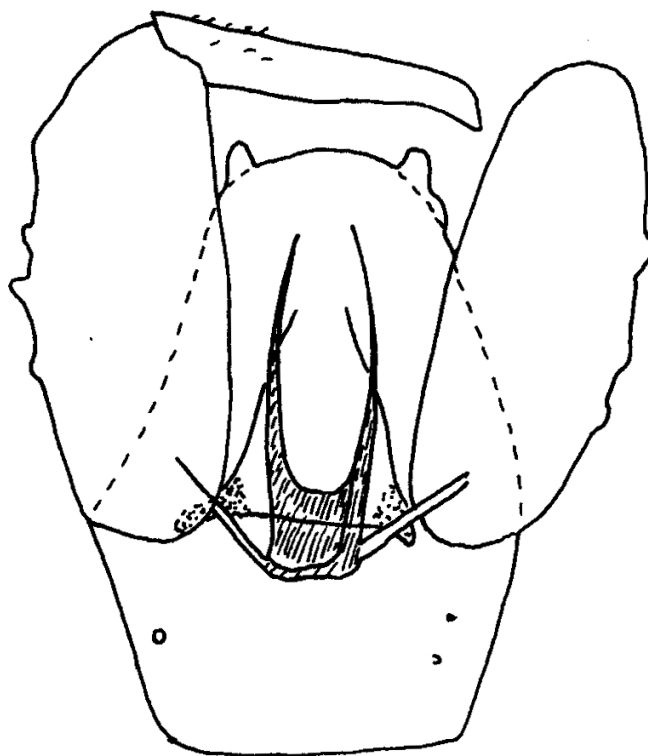


Fig. 22. *Forcipomyia (F.) fusiparamera* sp. n., male genitalia.

Description

Male. Body slender, brown. Total length 1.9 mm. Palpal segment 3 enlarged on proximal 1/2, segment length 40 μ m. TR (III) 0.8. Wing length 1.06 mm; CR 0.43. Genitalia (Fig. 22) typical of the subgenus. Sternite IX moderately long, caudal margin not visible; tergite IX with rounded caudal margin and well developed apicolateral processes. Gonocoxite straight, extending beyond tergite IX; gonostylus straight on proximal 0.8, tip slightly curved. Aedeagus triangular; basal arm heavily sclerotized, short; distal portion lightly sclerotized, tapering gradually distally, apex not visible. Parameres heavily fused, fused at bases for 0.25 of total length; basal apodemes slender, straight, greatly diverging; distal projections not reaching caudal margin of tergite IX.

Female. Unknown.

Material examined

Holotype male, FSCA 1616.

Etymology

The specific epithet is a reference to the male parameres that are fused on the proximal one-fourth of their length.

Discussion

The male genitalia of this new fossil species are similar to those of many recent species in the subgenus *Forcipomyia* from many regions of the world. However, among fossil *Forcipomyia*, the shape of the parameres is unique in being fused for 0.25 of their total length.

Forcipomyia (F.) grimaldii sp. n.

Figs. 23-29

Diagnosis

Males distinguished from other species of *Forcipomyia (F.)* in Dominican amber by the following combination of characters: very small size, wing length 1.12-1.17 mm; parameres fused only at extreme base; aedeagus with broad apex. Females are the only diagnosable species of *Forcipomyia (F.)* in Dominican amber, and are distinguished by their very small size, wing length 0.95-0.98 mm.

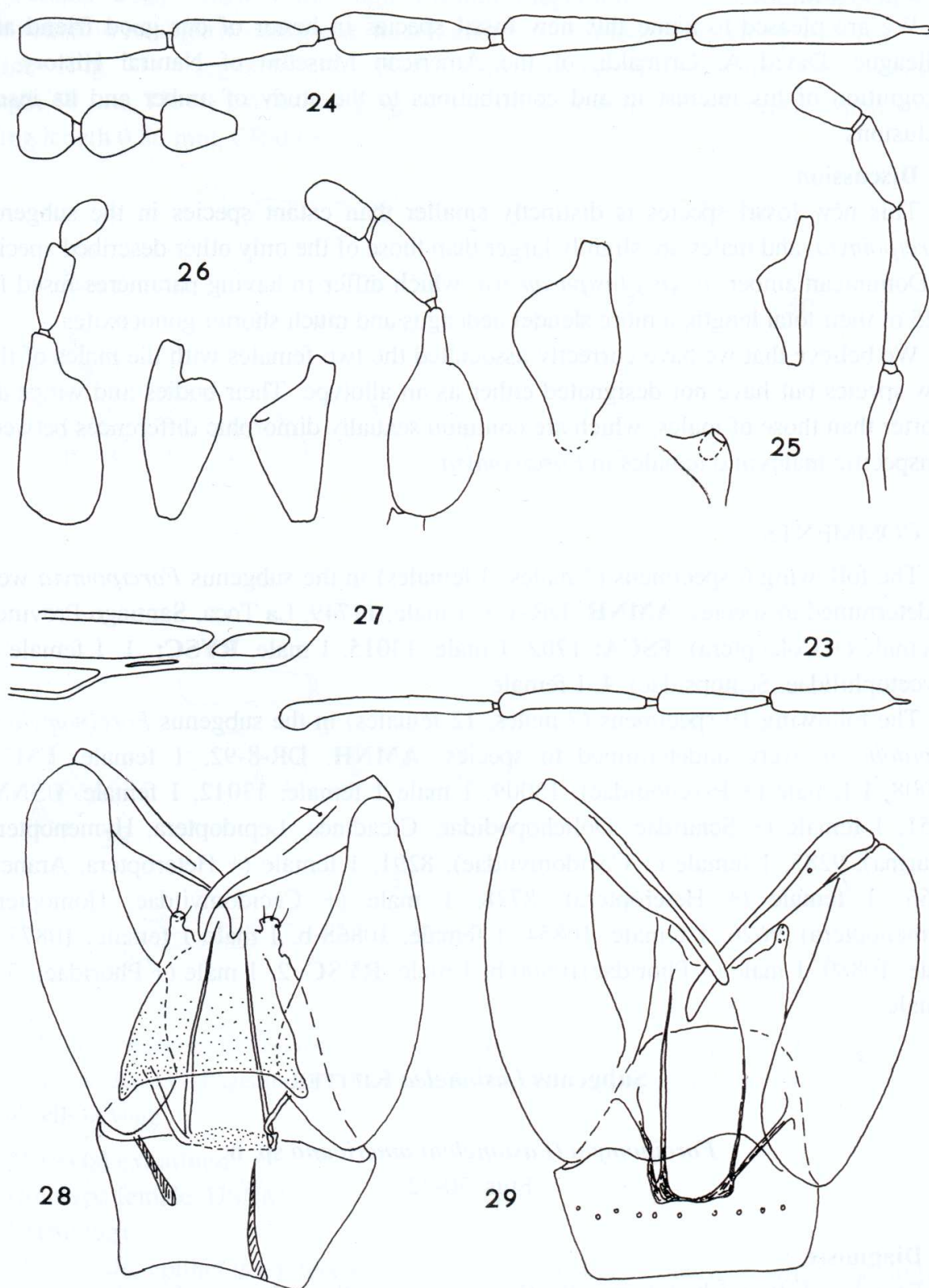
Description

Male. Body dark brown, caudal margin of scutellum pale, abdomen with broad pale transverse stripes. Total length 1.9-2.1 mm. Flagellum total length, 840 μ m; proportions of distal 4 flagellomeres (Fig. 23) 144-100-72-92. Palpus (Fig. 25) 4-segmented; segment 3 (Fig. 25) greatly swollen at midlength, length 83 μ m. Legs brownish, hind femur with dark subapical ring, tarsi yellowish; TR(I) 0.6, (II) 0.4, (III) 0.5-0.6. Wing membrane uniformly covered with macrotrichia; two radial cells present (Fig. 27), 1st slitlike, 2nd rhomboidal; wing length 1.12-1.17 mm; CR 0.40-0.46. Genitalia (Figs. 28-29). Sternite IX moderately long with straight (Fig. 28) or emarginate (Fig. 29) caudal margin; tergite IX tapers gradually distally, cerci slender, setose. Gonocoxite long, slightly curved, extending considerably beyond tergite IX; gonostylus straight to slightly curved distally, tip rounded. Aedeagus (Fig. 28) broadly triangular; basal arm very short, straight; distal portion tapers slightly distally to ?rounded apex. Parameres (Figs. 28-29) fused only on extreme base; basal arm slender, straight; distal portions very slender, apices extending beyond or near tip of tergite IX.

Female. Body dark brown, caudal margin of scutellum yellow. Total length 1.5 mm. Flagellum with proximal flagellomeres globular or ovoid, flagellomeres 9-13 elongated (Fig. 24). Palpus (Fig. 26) 4-segmented; segment 3 greatly enlarged, sensory pit with subapical opening; length 80 μ m. Hind femur with dark subapical ventral patch; TR (II) 0.4, (III) 0.6-0.7. Wing membrane uniformly covered with macrotrichia; wing length 0.95-0.98 mm; CR 0.46-0.49.

Material examined (15 specimens: 8 males, 7 females)

Holotype male, AMNH DR-6-107. Paratypes: AMNH DR-6-107, Santiago, 1 male 1 female; FSCA 2213, 1 male. The following specimens are thought to be members of this species, but are not included in the type-series: AMNH, DR-8-95, specific provenance unknown, purchased in Santo Domingo by D. Grimaldi, 1 male; AMNH, DR-8-99, specific provenance unknown, purchased in Santo Domingo by D. Grimaldi, 1 female; AMNH, DR-8-115, purchased in Santo Domingo by D. Grimaldi, 1 female; (+*F. woodruffi* sp. n. described below); AMNH, DR-10-123, 1 female; FSCA 504, 1 male (+Trichoptera, Hymenoptera, Cecidomyiidae); FSCA 528, 1 male; FSCA 13004, 1 female. USNM 2799, 1 female (+Copeognatha, Psychodidae, Formicidae, Dolichopodidae); 7347, 1 male; 10879, 1 male; 10892, 1 female.



Figs. 23-29. *Forcipomyia (F.) grimaldii* sp. n. 23 - distal flagellomeres of male, 24 - distal flagellomeres of female, 25 - male palpus, 26 - female palpus, 27 - male radial cells of wing, 28, 29 - male genitalia.

Etymology

We are pleased to name this new fossil species in honor of our good friend and colleague, David A. Grimaldi, of the American Museum of Natural History, in recognition of his interest in and contributions to the study of amber and its insect inclusions.

Discussion

This new fossil species is distinctly smaller than extant species in the subgenus *Forcipomyia*, and males are slightly larger than those of the only other described species in Dominican amber, *F. (F.) fusiparamera*, which differ in having parameres fused for 0.25 of their total length, a more slender aedeagus and much shorter gonocoxites.

We believe that we have correctly associated the two females with the males of this new species but have not designated either as an allotype. Their bodies and wings are shorter than those of males, which are common sexually dimorphic differences between conspecific males and females in *Forcipomyia*.

COMMENTS

The following 6 specimens (3 males, 3 females) in the subgenus *Forcipomyia* were undetermined to species: **AMNH**: DR-3-5, 1 male; 11749, La Toca, Santiago Province, 1 female (+ Coleoptera). **FSCA**: 1702, 1 male; 13015, 1 male. **RYSC**: 1, 1 female (+ Mycetophilidae, Scatopsidae), 4, 1 female.

The following 19 specimens (7 males, 12 females) in the subgenus *Forcipomyia* or *Lepidohelea*, were undetermined to species: **AMNH**: DR-8-92, 1 female. **FSCA**: 13008, 1 female (+ Psychodidae); 13009, 1 male 1 female; 13012, 1 female. **USNM**: 7651, 1 female (+ Sciaridae, Dolichopodidae, Cicadinea, Lepidoptera, Hymenoptera, Acarina); 9285, 1 female (+ Cecidomyiidae); 8291, 1 female (+ Heteroptera, Aranei); 8366, 1 female (+ Heteroptera); 8728, 1 male (+ Cecidomyiidae, Homoptera, Hymenoptera); 9626, 1 female; 10854, 1 female; 10868 b, 1 male 1 female; 10873, 1 male; 10880, 1 male (+ Phoridae) 10900 b, 1 male. **RYSC**: 2, 1 male (+ Phoridae); 3, 1 female.

Subgenus *Lasiohelea* KIEFFER

Forcipomyia (Lasiohelea) americana sp. n.

Figs. 30-32

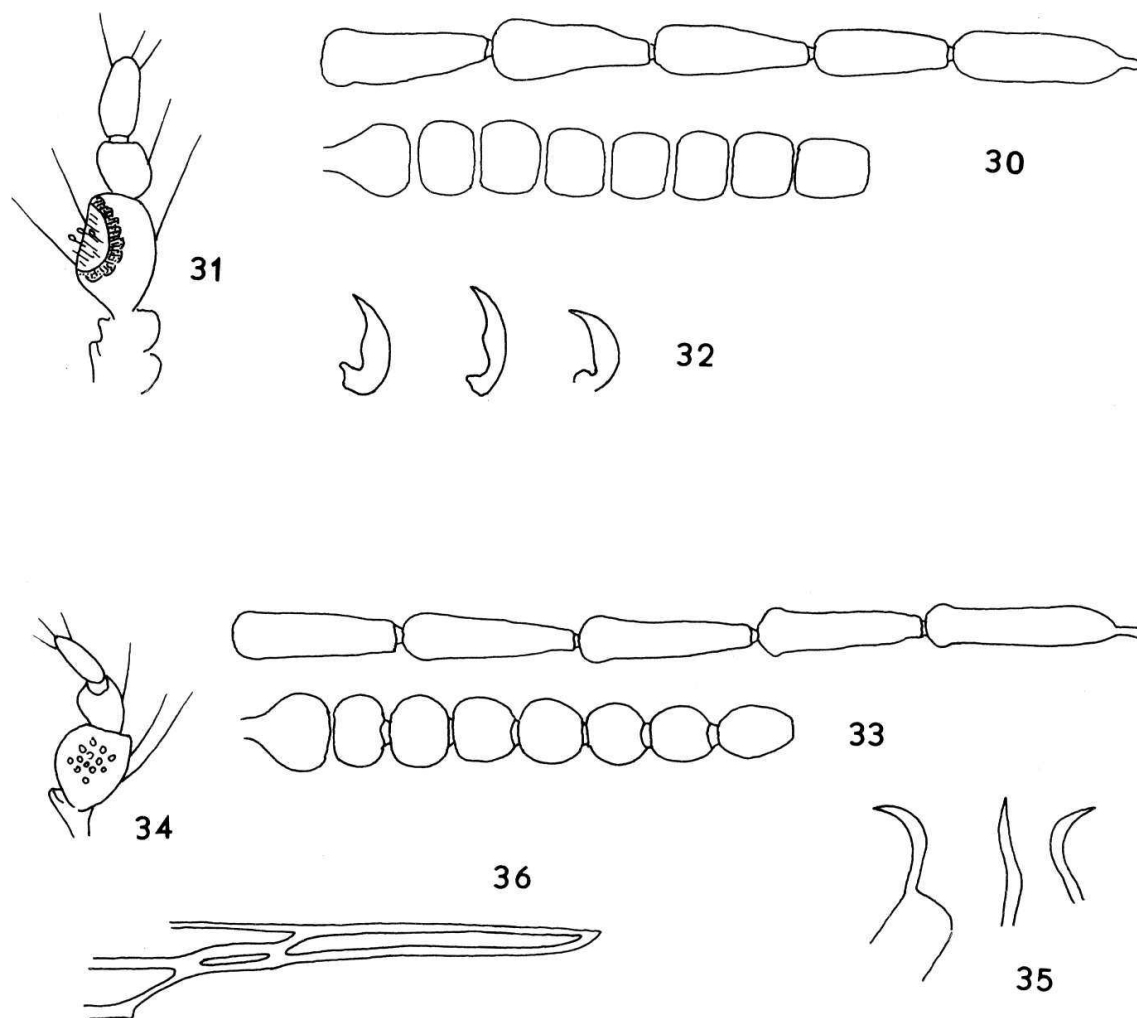
Diagnosis

Females distinguished from all other species in the subgenus *Lasiohelea* by the following combination of characters: all claws short, broad, nearly equal sized; and palpal segment 3 with very broad deep sensory pit. Males unknown.

Description

Male. Unknown.

Female. Body brown. Total length 1.0 mm. Flagellum (Fig. 30) with flagellomeres 1-8 spheroid to slightly elongated, flagellomeres 9-13 moderately elongated; AR 1.48. Palpus (Fig. 31) 5-segmented; segment 3 with very broad deep sensory pit, segment length 40 μ m; TR (I) 2.6. Claws (Fig. 32) of all legs short, broad, nearly equal sized. Wing length 0.86 mm; CR 0.63.



Figs. 30-36. *Forcipomyia (Lasiohelea) americana* sp. n. (30-32) and *F. (L.) woodruffi* sp. n. (33-36), females. 30, 33 - flagellum, 31, 34 - palpus, 32, 35 - various aspects of tarsal claws, 36 - radial cells of wing.

Material examined

Holotype female, USNM 7905 (+Cecidomyiidae, Formicidae).

Etymology

The specific epithet is a reference to the New World, the Americas, where the amber originated.

Discussion

The shapes of the female claws of this new fossil species are unique in the subgenus *Lasiohelea*. Females of all other extant or fossil species of *Lasiohelea* have long, slender, broadly curved claws (as in Fig. 35).

Forcipomyia (Lasiohelea) woodruffi sp. n.

Figs. 33-36

Diagnosis

Females distinguished from all other fossil species in the subgenus *Lasiohelea* by the following combination of characters: palpal segment 3 very short, nearly spherical in shape, without sensory pit; and elongate slender claws bent at midlength. Males unknown.

Description

Male. Unknown.

Female. Body dark brown. Flagellum (Fig. 33) with flagellomeres 1-6 spherical, 7-8 slightly cylindrical, 9-13 elongated. Palpus (Fig. 34) 5-segmented; segment 3 very short, nearly spherical, without sensory pit but sensilla scattered over mesal surface, length of segment 28 μm . TR(I) 2.7, (III) 2.5. Wing with two radial cells (Fig. 36), 1st slitlike, 2nd broader, 4.5 X longer than 1st; wing length 0.78-0.87 mm; CR 0.60-0.63. Claws (Fig. 35) of all legs elongate slender, similar in size, bent at midlength.

Material examined (9 females)

Holotype female, FSCA 2289 (+Aranei). Paratypes: AMNH DR-8-105, 1 female, purchased in Santo Domingo by D. Grimaldi; DR-8-115, 4 female, same data as above, (+ *Forcipomyia (F.) grimaldii*); DR-8-119, 1 female, same data as above; USNM 8460, 1 female (+ *Dolichopodidae*); 10881, 1 female.

Etymology

We are pleased to name this new fossil species for our good friend and colleague, Robert E. Woodruff of the Florida State Collection of Arthropods, Gainesville, in recognition of his successful efforts in accumulating an important collection of Dominican amber and their inclusions at that institution.

Key to fossil species of *Forcipomyia (Lasiohelea)* (females)

1. Palpal segment 3 moderately long, slender *F. (L.) succinea* SZADZIEWSKI (Baltic amber)
- Palpal segment 3 short, broad 2
2. Palpal segment 3 with broad, deep sensory pit; claws broad *F. (L.) americana* sp. n.
- Palpal segment 3 without sensory pit; claws slender *F. (L.) woodruffi* sp. n.

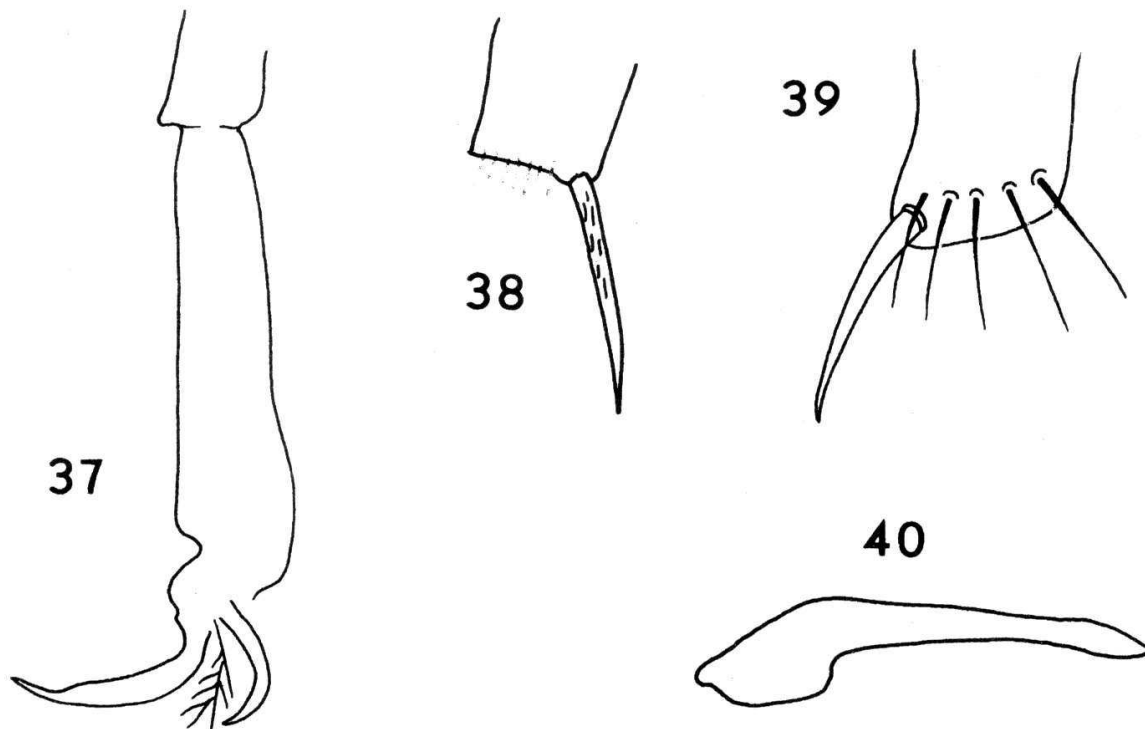
COMMENTS

The following 15 females in the subgenus *Lasiohelea* were undetermined to species: AMNH DR-3-20, 1 female; DR-8-106, 3 female; DR-8-118, 1 female; WV-2, 1 female (+ *F. (Synthyridomyia)*); USNM 3061, 1 female (+*Collembola*, Hymenoptera); 7611, 1

female (+Hymenoptera); 8229, 1 female (+Aranei); 8484, 1 female (+Hymenoptera); 9679, 1 female (+Copeognatha, Coleoptera, Blattoptera); 9712, 1 female (+*Brachypogon (Isohelea)* undet. 1 male, 4 female; Chironomidae, Psychodidae, Scatopsidae, Cecidomyiidae, Dolichopodidae, Coleoptera); 10774, 1 female (+Cecidomyiidae, Dolichopodidae, Formicidae); 10795, 1 female (+Phoridae); 10894, 1 female (*F. antilleana*).

Subgenus *Lepidohelea* Kieffer

The first fossils of *Forcipomyia* in the subgenus *Lepidohelea* are recorded herein. This group is common among Dominican amber ceratopogonids and includes at least 41 specimens. Two species of this subgenus described below are members of the *Forcipomyia bicolor* group, which are apparently found only in the New World. The group is represented in North America by 4 species and in Central and South America by 9 species (WIRTH 1991a, b). The only known species of larvae in this group live in leaf axils of epiphytic bromeliads and *Pandanus*, as well as in rotting plant materials (WIRTH & SPINELLI 1992).



Figs. 37-40. *Forcipomyia (Lepidohelea) antilleana* sp. n., male. 37 - claws of fore leg, 38 - spur of fore tibia, 39 - spur of hind tibia, 40 - gonostylus.

Forcipomyia (Lepidohelea) antilleana sp. n.

Figs. 37-40

Diagnosis

Males distinguished from other species of *Forcipomyia (Lepidohelea)* in Dominican amber by the following combination of characters: outer claw of fore leg without ventral tooth at midlength, and fore and hind tibial spurs of equal size.

Description

Male. Body brown. Total length 1.6-2.0 mm. Lengths of flagellomeres 9-13 (in μm) 44-108-104-92-96. Palpus 5-segmented; segment 3 slightly swollen on proximal 2/3, length 64-72 μm . Fore tibia with moderately long spur (Fig. 38), of same length as hind tibial spur (Fig. 39); hind tibial comb with 7 spines; TR (III) 1.0; outer claw of foreleg (Fig. 37) larger than inner claw, without ventral tooth. Wing with distinct pattern of dark and pale areas; wing length 1.01-1.31 mm; CR 0.46-0.49. Genitalia bicoloured, with sternite IX and 2/3 of gonocoxites dark, but gonostyli and apical 1/3 of gonocoxites pale. Gonostylus (Fig. 40) slender, nearly straight, tip slightly pointed. Parameres and aedeagus not visible.

Female. Wing with distinct pattern of dark and pale areas, otherwise very similar to wing of female *F. (Lasiohelea) domibicolor*.

Material examined (8 males, 6 females)

Holotype male, USNM 10915. Paratypes: AMNH 11796, 1 male (+ *Chironomidae*, *Hymenoptera*, *Copeognatha*); FSCA 13002, 1 male; USNM 9202, 1 male; USNM 10866, 1 male; USNM 10894, 1 male (+ *Forcipomyia (Lasiohelea)*); USNM 10897, 1 male. RYSC 6, from coll. Cutler "H", 1 male. Not included in the type-series: AMNH DR-8-104, 1 female; DR-6-42, El Valle, 1 female; DR-6-80, Santiago, 1 female (+ *Sciaridae*); FSCA 13001, 1 female; USNM 2826 1 female; USNM 7609, 1 female (+ *Hymenoptera*).

Etymology

The specific name is a reference to the Greater Antilles, which includes Hispaniola, the island of origin of the amber.

Forcipomyia (Lepidohelea) chrysosuccinea sp. n.

Figs. 41-43

Diagnosis

Males distinguished from other species of *Forcipomyia (Lepidohelea)* in Dominican amber by their gonostyli that are narrow on proximal 1/2 and distal 1/2 of normal width. Female unknown.

Description

Male. Body slender, length 0.95 mm. Colouration poorly preserved. Flagellum (Fig. 41) with lengths of flagellomeres 10-13 (in μm) 92-52-44-64; total flagellum length ca.

525 μm . Tibial spurs absent or weakly developed; TR (I) 1.0, (II) 1.2, (III) 1.2; claws (Fig. 42) very small, empodium moderately well developed.

Genitalia (Fig. 43). Sternite IX moderately long with straight caudal margin; tergite IX extending 0.56 the length of gonocoxite, apex truncate; gonostylus straight, proximal 1/2 narrow, distal 1/2 of normal width. Parameres and aedeagus not visible.

Female. Unknown.

Material examined (1 male)

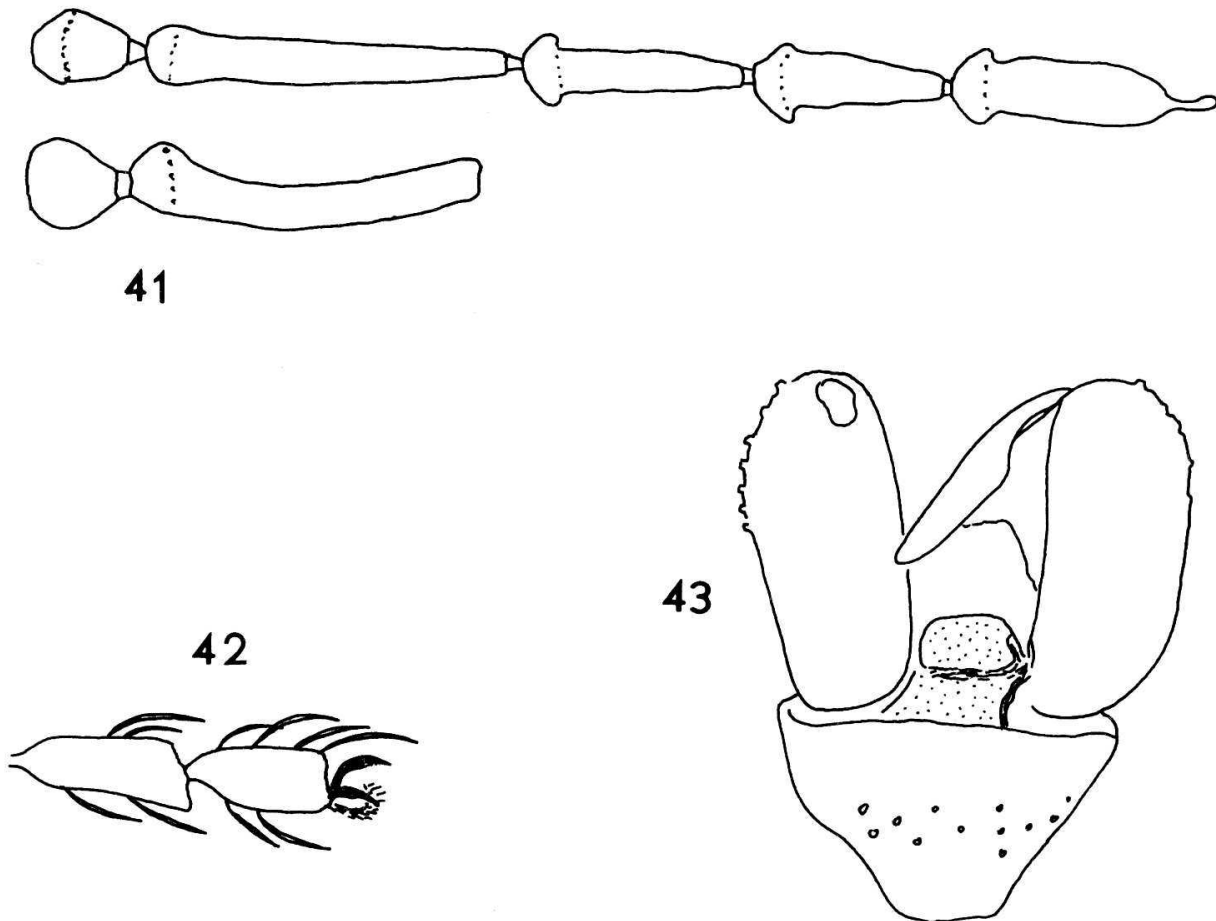
Holotype male, AMNH, DR-6-35, El Valle.

Etymology

The specific epithet is a contraction of a similar extant species, *Forcipomyia* (*Lepidohelea*) *chrysolopha* KIEFFER, and *succinum*, Latin for amber.

Discussion

Among fossil biting midges of the genus *Forcipomyia*, the shape of gonostyli are unique.



Figs. 41-43. *Forcipomyia* (*Lepidohelea*) *chryso succinea* sp. n., male. 41 - distal flagellomeres, 42 - 4th and 5th tarsomeres and claws, 43 - genitalia.

Forcipomyia (Lepidohelea) domibicolor sp. n.

Figs. 44-53

Diagnosis

Males distinguished from other species of *Forcipomyia (Lepidohelea)* in Dominican amber by the following combination of characters: outer claw of fore leg with tooth at midlength; tibial spur of hind leg greatly curved and larger than spur of fore leg; and legs with alternating pale and dark bands. Females distinguished from all other species of *Forcipomyia (Lepidohelea)* in Dominican amber by their legs with prominent alternating pale and dark banding.

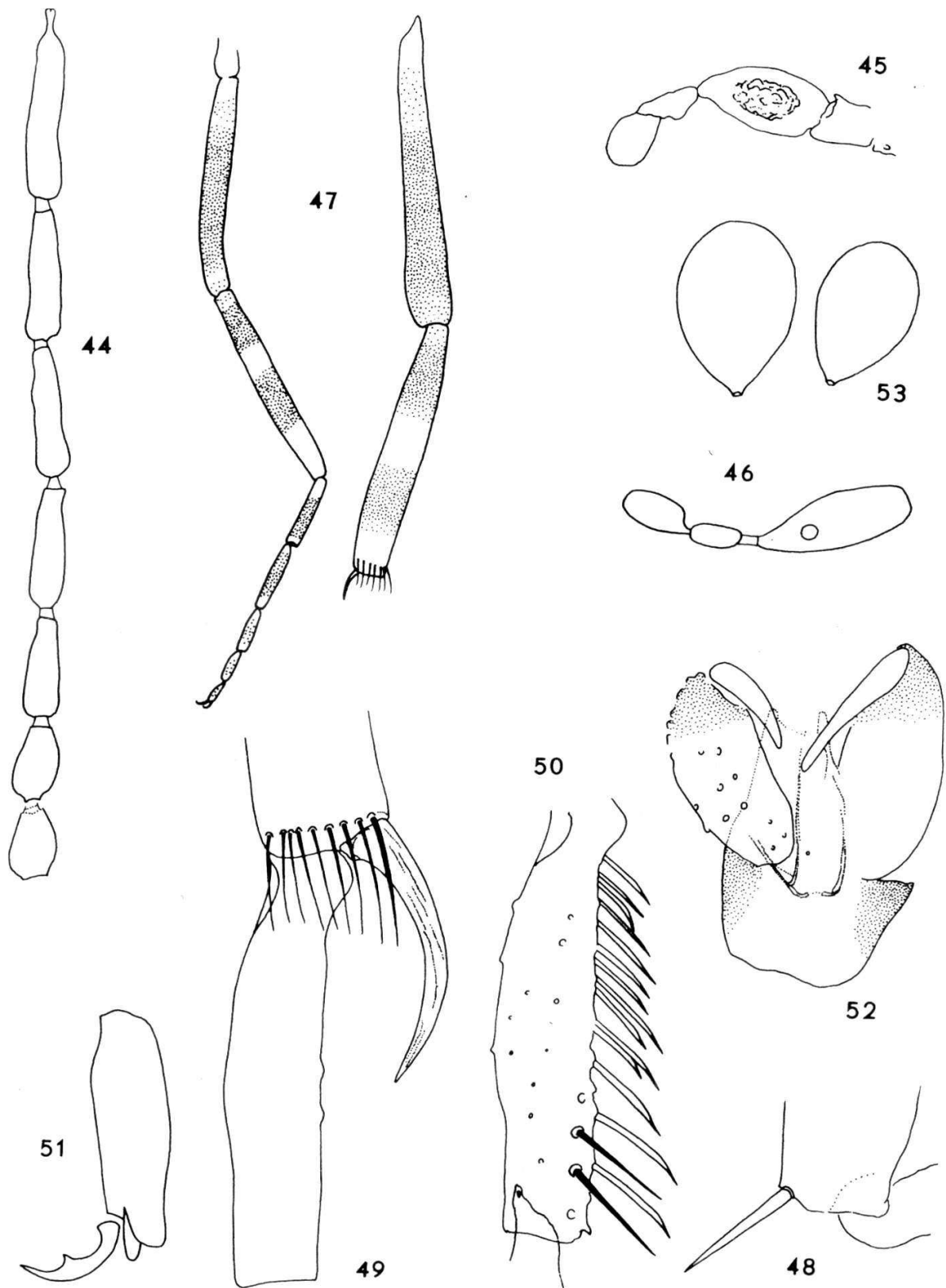
Description

Male. Total length 1.7-2.1 mm. Flagellum with lengths of flagellomeres 10-13 (in μm) 160-148-104-120; total flagellum length 990 μm ; AR 1.16. Palpus (Fig. 46) 5-segmented; segment 3 swollen on proximal 2/3, with very small sensory pit located on distal 1/3 of mesal surface, length of segment 80-83 μm long. Legs relatively stout, with alternating pale and dark bands as in female (Fig. 47); fore tibial spur (Fig. 48) short and straight, hind tibial spur (Fig. 49) long, stout and greatly curved; hind 1st tarsomere (Fig. 50) with palisade setae and scales; outer claw of fore leg (Fig. 51) with distinct tooth at mid length, all other claws simple; TR (III) 1.0-1.1. Wing with pattern of well developed pale and dark spots as in *F. antilleana*; two small radial cells covered with dark appressed blunt scale-like setae; wing length 1.09-1.17 mm; costa very short, CR 0.39-0.43. Genitalia (Fig. 52) yellow with brown lateral spots on sternite IX and dark brown apices of gonocoxites. Sternite IX moderately long, caudal margin apparently straight; tergite IX tapers slightly distally with emarginate apex. Gonocoxite straight, extending considerably past tergite IX; gonostylus straight, gradually tapering distally with slightly pointed apex. Aedeagus not visible. Parameres probably fused narrowly at base, or possibly barely separate at base; distal portions filamentous, straight, apices slender, pointed.

Female. Similar to male with the usual sexual differences. Total body length 1.4 mm. Flagellum (Fig. 44) with gradually elongating distal flagellomeres. Proboscis short. Mandibles without teeth. Palpus (Fig. 45) 5-segmented; segment 3 stout, ovoid, with broad long sensory pit, length of segment 60 μm . Legs (Fig. 47) with pattern of alternating pale and dark bands, best developed on hind legs; fore and hind tibial spurs smaller than in male, of nearly equal size. Wing membrane without distinct pattern, rather uniformly covered with dark appressed macrotrichia; wing length 0.9 mm. Cerci brown. Two large ovoid spermathecae (Fig. 53), lengths 84 and 68 μm .

Material examined (9 males, 11 females)

Holotype male, AMNH WV-1, purchased from J. Wunderlich, 1988. Paratypes: AMNH PB-299, purchased in Santo Domingo by P.F. Burke, 1 male; FSCA 1726, 1 male.



Figs. 44-53. *Forcipomyia (Lepidohelea) domibicolor* sp. n. 44 - female distal flagellomeres, 45 - female palpus, 46 - male palpus, 47 - female mid leg and femur and tibia of hind leg, 48 - male spur of fore tibia, 49 - male spur of hind tibia, 50 - first tarsomere of male hind leg, 51 - male claws of fore leg, 52 - male genitalia, 53 - spermathecae.

The following specimens are thought to be members of this species but are not included in the type series: AMNH 11762, 1 male; AMNH 11863 A, 1 female (+*Thysanoptera*); AMNH DR-6-117, 1 female; AMNH DR-6-118, 1 female; AMNH DR-6-127, 1 female, El Valle (+*Cecidomyiidae*); AMNH DR-8-102, 1 male 3 female (+*Formicidae*). FSCA 13011, 1 male. USNM 3099.b, 1 female; USNM 10651, 1 female (+*Mycetophilidae*); USNM 10868, 1 male 1 female (+*Forcipomyia*, *Cecidomyiidae*, *Arachnida*, hairs of a mammal); USNM 10876, 1 male 1 female; USNM 10908, 1 male.

Etymology

The specific name is a contraction in reference to the Dominican amber enclosing this species and to its resemblance to the extant species, *Forcipomyia (Lepidohelea) bicolor* (LUTZ).

Discussion

The species is very similar to the extant *F. (L.) bicolor*, which is common in Central and South America. However, males and females of that recent species are distinctly larger than those of *F. (L.) domibicolor*, and males have dark gonostyli.

Forcipomyia (Lepidohelea) lepidosuccinea sp. n.

Figs. 54-55

Diagnosis

Males distinguished from all other species of *Forcipomyia (Lepidohelea)* in Dominican amber by the following combination of characters: claws simple; gonostylus slender; and parameres stout. Females unknown.

Description

Male. Body brown, almost transparent in amber. Total body length 1.9 mm. Striated scales on the body not visible. Flagellum typical of the subgenus; distal 4 flagellomeres (Fig. 54) with length (in μm) 108-72-68-88. Palpus 5-segmented, barely visible. Legs probably banded; tibial spur of fore leg not visible, spur of hind leg long, clavate; TR about 1.0; Claws short, similar sized and shape on all legs, without teeth. Wing barely visible, details not discernable. Genitalia (Fig. 55) probably uniformly darkly colored. Sternite IX moderately long, with straight caudal margin; tergite IX short, tapering slightly distally, apex truncate. Gonocoxite stout, slightly curved; gonostylus slender, straight, with sharply pointed tip. Aedeagus not visible. Parameres separate, stout proximally, tapering slightly distally, apices evenly curved, tip blunt.

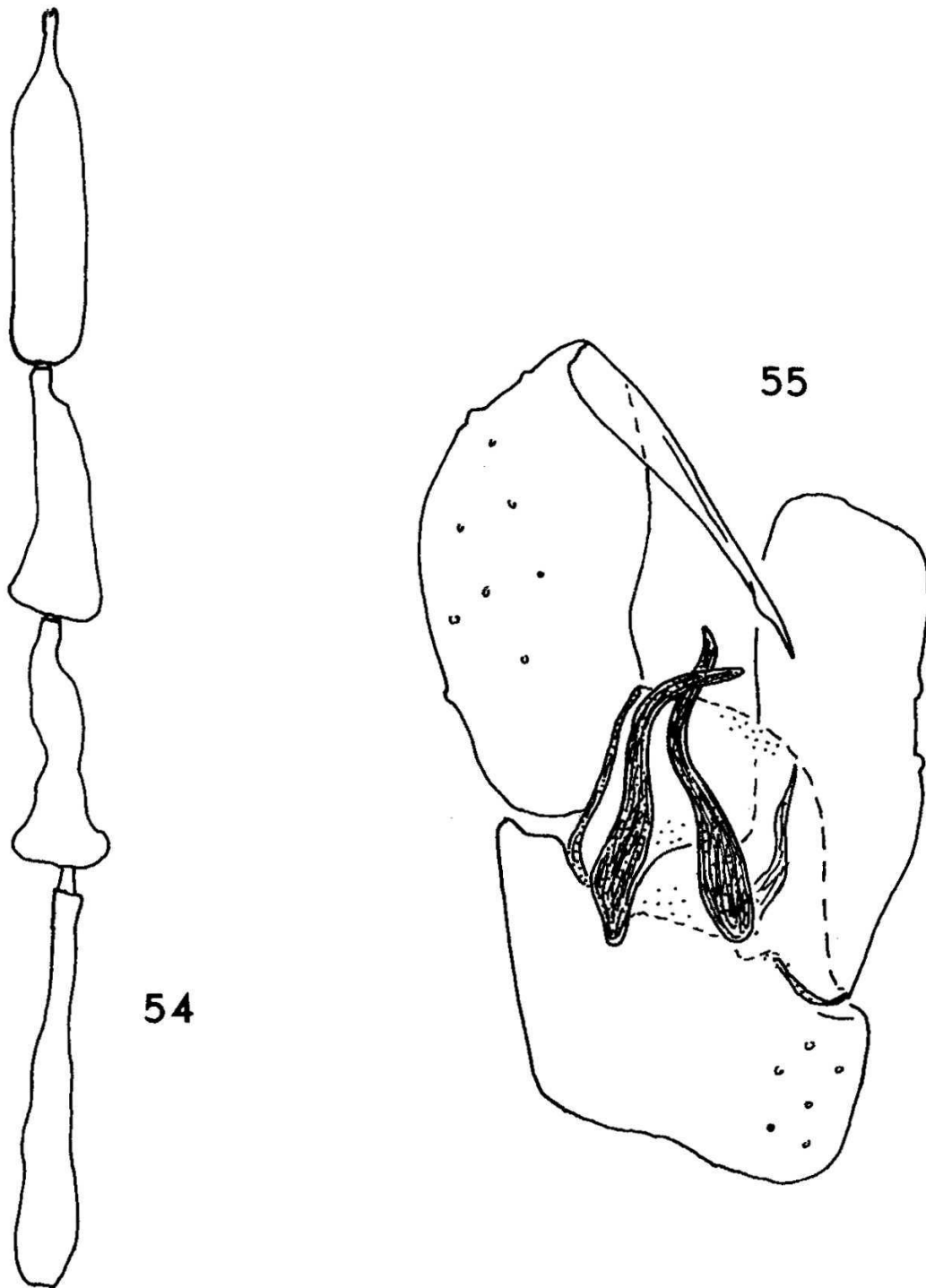
Female. Unknown.

Material examined (1 male)

Holotype male, USNM 2932 b (at a. *Stilobezzia*, Chironomidae, Sciaridae, Psychodidae).

Etymology

The specific name is a contraction of the subgenus, and *succinum*, Latin for amber.



Figs. 54-55. *Forcipomyia (Lepidohelea) lepidosuccinea* sp. n., male. 54 - distal flagellomeres, 55 - genitalia.

COMMENTS

The following *F. (Lepidohelea)* (4 males, 31 females) were undetermined to species. **AMNH:** DR-6-23, El Valle, 2 female; DR-6-42, El Valle, 1 female; DR-6-80, 1 female (+ Sciaridae); DR-6-117, 1 female; DR-6-118, 1 female; DR-6-122, 1 female; DR-8-98, 1 female; DR-8-104, 1 female; DR-8-109, 1 female; DR-8-111, 1 male; DR-8-117, 1 female; DR-10-97, 1 female; DR-10-98, 1 female (+ Hymenoptera); DR-10-116, 1 female; Z-1, 1 female (+Cecidomyiidae, Psychodidae); 11762, 1 female (+ *Forcipomyia*

undet., Psychodidae, Scatopsidae, Copeognatha); 11863 A, 1 female (+ Thysanoptera); **FSCA**: 463, 3 female (+ Phoridae); 1409, 1 female (+ Psychodidae); 1743, 1 female; 2170, 1 female; 13001, 1 female. **USNM**: 2652 b, 1 female (+ at a. *Atrichopogon*, Chironomidae, Phoridae, Hymenoptera, Aranei); 2826, 1 female (+ Cecidomyiidae, Diptera Brachycera); 3099 b, 1 female; 3709, 1 female (+ Sciaridae, Cecidomyiidae, Coleoptera, Hymenoptera); 7609, 1 female (+ Hymenoptera); 7768, 1 male (+ Hymenoptera); 7871, 1 male 1 female (+ *Forcipomyia* undet., Mycetophilidae); 9413 b. 1 male (at a. Lepidoptera); 10651, 1 female (+ Mycetophilidae).

Subgenus *Thyridomyia* SAUNDERS

Forcipomyia (Thyridomyia) frutetosuccinea sp. n.

Figs. 56-61

Diagnosis

Males are the only diagnosable species of *Forcipomyia (Thyridomyia)* species in Dominican amber, distinguished by their aedeagus with gradually curved lateral sclerites and nearly straight basal arch. Females unknown.

Description

Male. Body brownish. Flagellum (Fig. 56) with lengths of flagellomeres 10-13 (in μm) 86-52-40-52; total flagellum length 540 μm . Proboscis long. Palpus (Fig. 57) 5-segmented, slender; segment 3 (Fig. 58) slender with several capitate sensilla on midportion of mesal surface, length of segment 60 μm . Legs lacking tibial spurs; TR(I) 3.0, (II) 2.7, (III) 3.0-3.1; claws (Figs. 59-60) curved, long and slender. Wing with 2nd radial cell long; wing length 0.85 mm; CR 0.53. Genitalia (Fig. 61). Sternite IX moderately long, with barely visible caudomedian excavation; tergite IX tapers slightly distally to rounded caudal margin. Gonocoxite moderately slender, curved at base, extending to or past caudal margin of tergite IX; gonostylus straight, slender, apex expanded, paddle-shaped. Aedeagus heavily sclerotized; basal arch low, transverse, nearly straight; lateral sclerites moderately stout and gradually curved distally to moderately slender tips that cross each other on mid line; a pair of slender submedian processes barely visible. Parameres not visible.

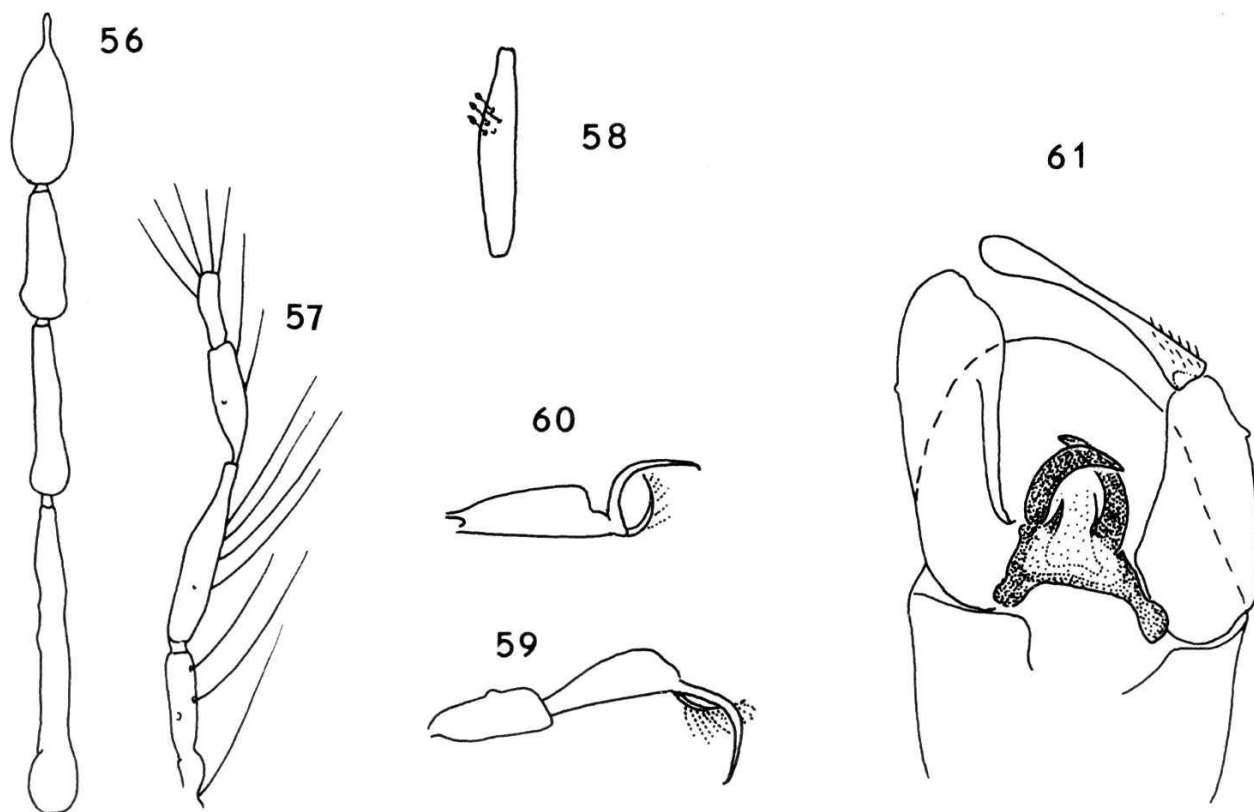
Female. Unknown.

Material examined (1 male)

Holotype male, USNM 10549 (+ Scatopsidae).

Etymology

The specific epithet is a contraction of the extant species, *F. (Thyridomyia) frutetorum* (WINNERTZ), and *succinum*, Latin for amber.



Figs. 56-61. *Forcipomyia (Thyridomyia) frutetosuccinea* sp. n., male. 56 - distal flagellomeres, 57 - palpus, 58 - third palpal segment, 59 - claws of fore leg, 60 - claws of mid leg, 61 - genitalia.

Discussion

This new species is very similar to the extant *F. (Thyridomyia) sinuosa* DOW & WIRTH, *F. (T.) tenuichela* DOW & WIRTH, *F. (T.) nodosa* SAUNDERS and *F. (T.) frutetorum* (WINNERTZ), all of which occur in Central America (DOW & WIRTH 1972). It is conceivable that future studies of more amber specimens may reveal that *F. (T.) frutetosuccinea* is still extant. The shape of the lateral sclerites of the aedeagus of *F. tenuichela* and *F. nodosa* are similar or identical to this new fossil species. However, in *F. frutetosuccinea*, the basal arch of the aedeagus is straight, whereas in extant species, it is more arched.

COMMENTS

The following 2 males in the subgenus *Thyridomyia* were undetermined to species: USNM: 2678, 1 male (+ Cecidomyiidae); 10015, 1 male (+ Mycetophilidae).

Subgenus *Synthyridomyia* SAUNDERS

Forcipomyia (Synthyridomyia) tertiaricola sp. n.

Figs. 62-64

Diagnosis

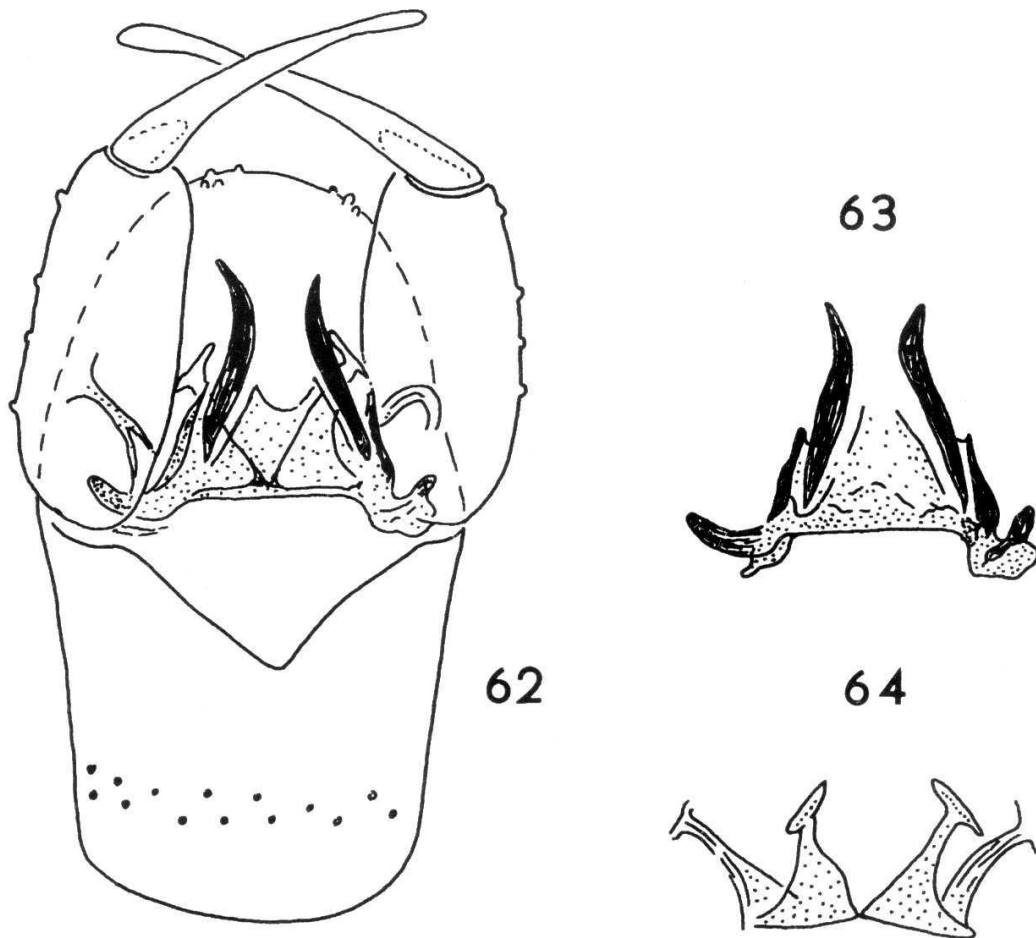
Males are the only diagnosable species of *Forcipomyia* (*Synthyridomyia*) in Dominican amber distinguishable by the T-shaped apices of its parameres.

Description

Male. Body slender, hairy, length 1.2 mm. Head barely visible. TR (III) 2.5-2.7; claws long, slender. Wing membrane uniformly covered with macrotrichia; two readily visible radial cells; wing length 0.78 mm. Genitalia (Figs. 62-64). Sternite IX long with triangular caudomedian excavation; tergite IX tapers slightly distally to broadly rounded caudal margin.

Gonocoxite straight, extending just beyond caudal margin of tergite IX; gonostylus slender, nearly straight with bluntly pointed apex. Aedeagus with very low, straight basal arch; basal arms short slightly curved; lateral sclerites heavily sclerotized, evenly pointed with slightly diverging apices. Parameres short; basal apodeme tapering distally; main portions with broad triangular bases and T-shaped apices.

Female. Body length 1.04 mm. Proximal flagellomeres slightly ovoid, distal flagellomeres relatively short. Proboscis long. Palpus 5-segmented; segment 3 enlarged on basal half. TR (III) 2.9. Wing length 0.60 mm; CR 0.53.



Figs. 62-64. *Forcipomyia* (*Synthyridomyia*) *tertiaricola* sp. n., male genitalia. 62 - ventral aspect, 63 - aedeagus, 64 - parameres.

Material examined (2 male, 1 female)

Holotype male, USNM 10039. Paratypes: 1 male and 1 female together with the holotype (+ Hymenoptera). Holotype incomplete, however with well visible genitalia.

Etymology

The specific name is a reference to the Tertiary, the age of origin of the amber.

Discussion

The new species is very similar to the extant *F. (Synthyridomyia) floridensis* DOW & WIRTH (1972) from Florida, which differs from this new fossil species in having even more expanded apices of its parameres. Both of these species are likely sister species.

COMMENTS

The following male in the subgenus *Synthyridomyia* was undetermined to species: AMNH WV-2, 1 male (+ *F. (Lasiohelea)*).

The following 87 females in the subgenera *Synthyridomyia* or *Thyridomyia* were undetermined to species: AMNH: DR-8-93, 1 female (+ Curculionidae); DR-8-94, 1 female; DR-8-96, 2 female; DR-10-93, 1 female; DR-10-105, 2 female; DR-10-139, 6 female (+ Copeognatha). FSCA: 1279, 1 female; 1708, 1 female (+ Phoridae, Hymenoptera); 1802, 1 female (+ Chironomidae, Blattoptera); 13006, 9 female (+ Brachycera); 13013, 1 female. USNM: 2562, 1 female (+ Coleoptera); 2833, 4 female; 2845, 48 female; 7412, 1 female (+ Cecidomyiidae, Mycetophilidae, Copeognatha); 7748, 2 female (+ Apoidea, Homoptera); 8720, 1 female (Formicidae, Cicadinea, Hymenoptera); 9359, 1 female (+ Formicidae, Diplopoda); 10780, 1 female (+ Cecidomyiidae, Scatopsidae, Dolichopodidae, Homoptera); 10859, 1 female; 10864, 1 female.

Subgenus *Trichohelea* GOETGHEBUER

References: SZADZIEWSKI (1988, 1993).

Key to fossil species of *Forcipomyia (Trichohelea)* (females)

1. Tarsal ratio (TR) low, 1.1 *F. (T.) eotrichoheleana* SZADZIEWSKI (Baltic amber)
- Tarsal ratio higher, 2.0-2.9 2
2. Proximal female flagellomeres transverse; female claws slender, sharply curved, apices simple; TR (III) 2.9 *F. (T.) succinicola* SZADZIEWSKI (Saxonian amber)
- Proximal female flagellomeres ovoid; female claws broad, slightly curved 3
3. Female claws deeply bifid, empodial hairs with capitate tips; TR (III) 2.5
..... *F. (T.) bifidicola* SZADZIEWSKI (Saxonian amber)
- Female claws weakly bifid, empodial hairs simple; TR (III) 2.0
..... *F. (T.)* sp. (Dominican amber)

Forcipomyia (Trichohelea) sp.

Fig. 65

Diagnosis

Females with broad claws with bifid apices. Males unknown.

Description

Male. Unknown.

Female. Body dark. Total length 1.09 mm. Proximal flagellomeres nearly spherical, distal flagellomeres, shorter, cylindrical. Palpus 5-segmented; segment 3 broad, sensory pit not visible, segment length about 38 μ m. Hind tibia with short spur; TR (III) 2.0; claws of similar size and shape on all legs (Fig. 65), greatly curved and stout, apices bifid. Wing length about 0.6 mm.

Material examined

USNM 8968.b 1 female.



Fig. 65. *Forcipomyia (Trichohelea) sp.*, female claws of fore leg.

COMMENTS

The examined material contained the following 52 specimens (7 males, 45 females) of *Forcipomyia*, that could not be identified to subgenus: AMNH: DR-6-129, 1 female (+ Cecidomyiidae, Aranei); DR-8-91, 1 female; DR-8-110, 1 female; DR-10-62, 1 female; DR-10-107, 1 female; 11758, La Toca, Santiago Province, purchased from J. Brodzinsky, Santo Domingo, 1 female; 11762, 1 female (+ *F. (Lepidohelea)* undet. 1 female, Psychodidae, Scatopsidae, Copeognatha); 11791, 1 female. FSCA: 514, 1 female (+ Copeognatha); 1239, 1 female; 1645, 1 female (+ *Dasyhelea* 1 female); 2304, 1 female. USNM: 2814, 1 female (+ Cecidomyiidae, Cyclorrhapha, Coleoptera, Hymenoptera); 3607, 2 female (+ Scatopsidae, Cecidomyiidae, Formicidae, small Hymenoptera, Homoptera, Coleoptera, Thysanoptera, Trichoptera?); 3776, 1 male (+ Chironomidae); 5450, 2 female (+ Cecidomyiidae, Hymenoptera); 7615, a 2 female (+ Hymenoptera), at b. *Stilobezzia dominicana*: 7736, 2 female (+ *Dasyhelea* 1 male,

Mycetophilidae, Scatopsidae, Apoidea); 8852, 1 female (+ Coleoptera, Orthoptera); 7790, 1 male (+ Isoptera); 7871, 2 female (+ *Forcipomyia (Lepidohelea)* undet. 1 male 1 female, Mycetophilidae); 8718, 1 male (+ Mycetophilidae, Copeognatha, Cicadinea); 8637, 1 female (+ Cecidomyiidae, Homoptera); 9047, 1 female (+ Lepidoptera); 9116, 1 female (+ Cecidomyiidae, Copeognatha); 9166, 1 male (+ Sciaridae, Copeognatha); 9255, 1 female (+ Psychodidae, Formicidae, Thysanura, Odonata, Homoptera, Hymenoptera, Pseudoscorpionida); 9425 a, 2 female (+ *Stilobezzia dominicana*); b 1 male 6 female (+ Psychodidae, Isoptera, Hymenoptera, Homoptera); 10863, 4 female; 10882, 1 male 1 female (+ Hymenoptera). RYSC: 5, 1 female (+ Chironomidae, Mycetophilidae, Hymenoptera); 7b, 1 male 2 female (at a. *Stilobezzia dominicana*).

RESULTS AND CONCLUSIONS

The material examined included 239 males, 442 females and 1 intersex of ceratopogonids enclosed in 311 pieces of Dominican amber containing 32 extinct species in 11 extant genera. The 29 named species were selected and described from specimens with diagnostic features.

The systematic arrangement of species with numbers of species in brackets for each category follows:

Subfamily Ceratopogoninae (16 spp.)

Tribe Culicoidini (5 spp.)

Genus *Culicoides*

Subgenus *Oecacta*

C. ambericus SZADZIEWSKI & GROGAN

C. antilleanus SZADZIEWSKI & GROGAN

C. brodzinskyi SZADZIEWSKI & GROGAN

C. hispanicolus SZADZIEWSKI & GROGAN

C. mammalicolus SZADZIEWSKI & GROGAN

Tribe *Ceratopogonini* (8 spp.)

Genus *Baeodasymyia* (1 sp.)

B. dominicana SZADZIEWSKI & GROGAN

Genus *Brachypogon* (3 spp.)

Subgenus *Brachypogon*

B. (B.) americanus SZADZIEWSKI & GROGAN

Subgenus *Isohelea*

B. (I.) dominicanus SZADZIEWSKI & GROGAN

B. (I.) prominuloides SZADZIEWSKI & GROGAN

Genus *Nannohelea* (1 sp.)

N. sp.

Genus *Stilobezzia* (3 spp.)

Subgenus *Acanthohelea*

S. (A.) dominicana SZADZIEWSKI & GROGAN

S. (A.) sp.

Subgenus *Stilobezzia*

S. (S.) antilleana SZADZIEWSKI & GROGAN

Tribe Heteromyiini (1 sp.)

Genus *Heteromyia*

H. dominicana SZADZIEWSKI & GROGAN

Tribe Palpomyiini (2 spp.)

Genus *Palpomyia* (1 sp.)

P. wirthorum SZADZIEWSKI & GROGAN

Genus *Phaenobezzia* (1 sp.)

P. wirthi SZADZIEWSKI & GROGAN

Subfamily Forcipomyiinae (16 sp.)

Tribe Dasyheleini (4 spp.)

Genus *Dasyhelea*

Subgenus *Sebessia*

D. antilleana sp. n.

D. dominicana sp. n.

D. hispaniolae sp. n.

D. minuticola sp. n.

Tribe Forcipomyiini (12 spp.)

Genus *Atrichopogon* (1 sp.)

A. dominicanus sp. n.

Genus *Forcipomyia* (11 sp.)

Subgenus *Forcipomyia*

F. (F.) grimaldii sp. n.

F. (F.) fusiparamera sp. n.

Subgenus *Lasiohelea*

F. (L.) americana sp. n.

F. (L.) woodruffi sp. n.

Subgenus *Lepidohelea*

F. (L.) antilleana sp. n.

F. (L.) chrysosuccinea sp. n.

F. (L.) domibicolor sp. n.

F. (L.) lepidosuccinea sp. n.

Subgenus *Thyridomyia*

F. (T.) frutetosuccinea sp. n.

Subgenus *Synthyridomyia*

F. (S.) tertiaricola sp. n.

Subgenus *Trichohelea*

F. (T.) sp.

Fossils are recorded for the first time in the genera *Baeodasymyia*, *Phaenobezzia*, and in the subgenera *Lepidohelea*, *Synthyridomyia* and *Thyridomyia* of the genus *Forcipomyia*. Fossils in other genera or subgenera were recorded previously from older Baltic amber (SZADZIEWSKI 1988), except for *Dasyhelea* (*Sebessia*), which has been reported from Miocene deposits in California (PALMER 1957).

All taxa at the generic or species group level present in Dominican amber are more or less common on islands of the Caribbean and neighbouring regions of today. The genera *Baeodasymyia*, *Heteromyia*, and the *Forcipomyia bicolor* group appear to be of Neotropical origin. In addition, species of *Nannohelea*, *Phaenobezzia*, and *Culicoides* (*Oecacta*) are mainly distributed in tropical or subtropical areas. Other genera in Dominican amber are cosmopolitan, as well as being common in Central America.

The apparent absence of species of *Serromyia* MEIGEN in Dominican amber is interesting from a biogeographic perspective. This group is now distributed in all regions except for the Neotropics (BORKENT & BISSETT 1990), and was common in the Tertiary of Europe (SZADZIEWSKI 1988, 1993). All Holarctic species of *Serromyia* form a monophyletic group restricted to that region (Borkent & Bissett 1990), but members of this Holarctic group are absent in Eocene Baltic or Miocene Saxonian ambers (SZADZIEWSKI 1988, 1993). The apparent absence of this genus in the Western Hemisphere during Tertiary times may support SZADZIEWSKI's (1993) suggestion that *Serromyia* originated in Europe, underwent radiation since the Miocene, and thereafter migrated to North America.

Similarly, the great abundance of *Forcipomyia* in the various Tertiary ambers that we have studied requires further comment. The great prevalence of members of this genus in Dominican amber, comprising over 41% of all biting midges (Table 1), suggests that not only rotting plants were common in Dominican amber forests, but also the growing importance of that genus worldwide since the Eocene. *Forcipomyia* are also fairly common in Baltic amber (ca. 40 Ma), however their percentage rate is much lower than in Dominican amber, and comprises only 16% of all biting midges from that amber (SZADZIEWSKI 1988). The increasing numbers of species of *Forcipomyia* during the late Tertiary and continuing to present times, may be evidence that it is an apomorphic group which only secondarily became terrestrial.

On average, there are 1.97 specimens of Ceratopogonidae per single piece of Dominican amber, whereas there are only 1.16 or 1.12 specimens in pieces of Baltic or Saxonian amber respectively. In two pieces of amber, we found an unusually high number of biting midges, one contained 55 specimens of *Brachypogon* (*Isohelea*) *dominicanus* (AMNH WV-4), and the other 48 specimens of an undetermined *Forcipomyia* (*Thyridomyia*) (USNM 2845). The number of specimens of each single described species in each piece of Dominican amber is 20.5, which is twice the number in Baltic amber (10.9) or Saxonian amber (9.1). This indicates that biting midges were very common in Dominican amber forests, but their fauna was not as diverse in comparison to ceratopogonid faunas in Baltic and Saxonian ambers.

Table 1. Composition of biting midges in Dominican amber. * Includes one intersex.

Genus	Males	Females	Total	%
1. <i>Forcipomyia</i>	56	228	284	41.6
2. <i>Brachypogon</i>	131	137	269*	39.4
3. <i>Dasyhelea</i>	31	36	67	9.8
4. <i>Culicoides</i>	12	24	36	5.3
5. <i>Stilobezzia</i>	5	10	15	2.2
6. <i>Atrichopogon</i>	1	3	4	0.6
7. <i>Nannohelea</i>	--	2	2	0.3
8. <i>Baeodasymyia</i>	1	1	2	0.3
9. <i>Palpomyia</i>	1	--	1	0.2
10. <i>Phaenobezzia</i>	1	--	1	0.2
11. <i>Heteromyia</i>	--	1	1	0.2
Totals	239	442	682	100.0

During the early Miocene, 15-20 million years ago (ITURRALDE-VINCENT & MACPHEE 1996), the biting midge fauna of the Greater Antilles, including Hispaniola, was very similar or identical at the generic, subgeneric or species group level to the present-day fauna in this region. This indicates that the Greater Antilles were more or less completely colonized by insects by early Miocene times. This is not too surprising since mammalian hair has been found in Dominican amber (POINAR 1988). We also found mammalian hair in two pieces of Dominican amber (USNM 3742, at *Culicoides mammalicolus*; USNM 10868, at *Forcipomyia dominicana*). This suggests that mammals were probably common during these times on Hispaniola, and along with amphibians and reptiles (POINAR 1990), had already colonized this island.

Ceratopogonids that feed upon vertebrate blood (*Culicoides*, and species of the subgenus *Lasiohelea* of *Forcipomyia*), comprise only 9.01% of all biting midges in Dominican amber, a rate over two times lower than for vertebrate blood feeding midges in Eocene Baltic amber (SZADZIEWSKI 1988). This suggests two possibilities: 1) the decreasing importance of *Culicoides*, an old group of vertebrate blood feeders, or, 2) as seems more likely, the increasing importance of *Forcipomyia* as evidenced by their large numbers in Dominican amber. It is important to note that mosquitoes (Culicidae) are rather common in Dominican amber, whereas they are extremely rare in older Baltic amber (SZADZIEWSKI & SZADZIEWSKA 1985).

The quantitative composition of nematocerous Diptera and biting midges provides some insights on possible habitats that may have produced Dominican amber. We examined nematocerous flies embedded in Dominican amber in the USNM collection in order to determine their composition (SZADZIEWSKI & GROGAN 1994). Of 13 families recorded from different collections, we found 11 families of Nematocera in the USNM material. The rate of biting midges (12%) in Dominican amber is quite high, but only slightly higher than in Baltic amber (7-11%) (KULICKA et al. 1985).

The composition and abundance of nematoceros families in Dominican amber, suggests that the amber bearing forests were wet but without streams, and included numerous living and rotting plants. Further evidence of abundant rotting plants is the predominance of Cecidomyiidae, which are represented mostly by paedogenetic mycophagous Heteropezini, as well as other families that feed on fungi or plant debris such as Scatopsidae, Sciaridae and Mycetophilidae. Within the Ceratopogonidae, the larvae of *Forcipomyia* are most commonly associated with rotting wood or plant debris. Larvae of the *Forcipomyia* (*F.*) *bicolor* group live in the leaf axils of tropical bromeliads and *Pandanus* or in rotting plant material (see *F. domibicolor*). The absence of black flies (Simuliidae) in Dominican amber is good evidence that streams were absent or merely trickles. Larvae of most genera of biting midges are able to live in small, even temporary bodies of water, including tree holes, leaf axils or in wet soils. Because non-biting midges (Chironomidae) comprise only 10% of the nematoceros families in Dominican amber, this is another good indication that large bodies of water were rare. Conversely, Chironomidae predominates (36-50%) in Baltic amber. The faunal composition of biting midges and other Nematocera suggests that the Dominican amber bearing forests were of a type similar to present day montane rain forests, such as the cloud forests of Costa Rica.

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