

The genus *Eucatops* of Costa Rica (Coleoptera: Leiodidae, Cholevinae, Eucatopini)

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Abstract—The genus *Eucatops* Portevin, 1903 was previously known by 20 described species, all from South America. In this paper we describe 13 new species from Costa Rica, all in the subgenus *Eucatops*: *Eucatops (Eucatops) andersoni* sp. nov.; *E. (E.) antennatus* sp. nov.; *E. (E.) apterus* sp. nov.; *E. (E.) dentatus* sp. nov.; *E. (E.) femoratus* sp. nov.; *E. (E.) globosus* sp. nov.; *E. (E.) magnus* sp. nov.; *E. (E.) minutus* sp. nov.; *E. (E.) montanus* sp. nov.; *E. (E.) osa* sp. nov.; *E. (E.) paramontanus* sp. nov.; *E. (E.) solisi* sp. nov.; and *E. (E.) tenuisaccus* sp. nov. Some of the species are also reported from neighboring Nicaragua or Panama.

Résumé—Le genre *Eucatops* Portevin, 1903 contenait jusqu'à maintenant 20 espèces décrites, toutes d'Amérique du Sud. Nous décrivons ici 13 espèces nouvelles du Costa Rica, appartenant toutes au sous-genre *Eucatops* : *Eucatops (Eucatops) andersoni* sp. nov., *E. (E.) antennatus* sp. nov., *E. (E.) apterus* sp. nov., *E. (E.) dentatus* sp. nov., *E. (E.) femoratus* sp. nov., *E. (E.) globosus* sp. nov., *E. (E.) magnus* sp. nov., *E. (E.) minutus* sp. nov., *E. (E.) montanus* sp. nov., *E. (E.) osa* sp. nov., *E. (E.) paramontanus* sp. nov., *E. (E.) solisi* sp. nov. et *E. (E.) tenuisaccus* sp. nov. Quelques-unes des espèces sont aussi signalées des pays limitrophes, le Nicaragua ou le Panama.

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Introduction

The genus *Eucatops* (Coleoptera: Leiodidae) was described by Portevin in 1903, with *Eucatops curvipes* Portevin, 1903, from Bolivia, as the type species. It became the type genus for the tribe Eucatopini Jeannel, 1921 and is still the only genus in the tribe. The adults are small (body length 2–7.5 mm), ovate, weakly pubescent, and with elytra striate (or rarely granulopunctate) (Fig. 1). Larvae are unknown. The beetles apparently feed as scavengers on bacteria or fungi on dung or carrion, and there are records of adults from the nests of ants (*Pheidole* Westwood and *Camponotus* Mayr in Argentina (Gnaspini 1994)) and from palm tree flowers. *Eucatops* occurs only in the Neotropical region, and several authors have described nine species in the subgenus *Eucatops* Portevin, 1903 and three species in the subgenus *Sphaerocatops* Portevin, 1907 (Peck *et al.* 1998). Salgado (2003, 2005a, 2005b) added eight species and the subgenus *Napocatops* Salgado, 2005 from Ecuador. All these species were described from localities in South America. No species have been described

from Mexico or Central America, but undescribed material has been collected in all countries in this region except Guatemala and El Salvador (Peck 2000).

The purpose of this paper is to describe the species of *Eucatops* now known from Costa Rica, as a part of the beetle species inventory project of INBio (Instituto Nacional de Biodiversidad) of Costa Rica. This is the fifth in a series of contributions on the species diversity of Leiodidae in Costa Rica (Gnaspini and Peck 1996; Peck 2003a, 2003b; Peck and Cook 2003). A summary of the known diversity of Leiodidae of Costa Rica is given by Peck and Newton (2001). The current study does not exhaust the supply of undescribed species of *Eucatops* in Costa Rica. There are additional species for which we have too few specimens to justify description.

Materials and methods

Specimens of *Eucatops* have previously been taken only rarely and mostly in baited pitfall traps and in litter sifting. The fairly recent and continued use of flight intercept traps (FITs) (Peck and Davies 1980) in moist Neotropical forests has greatly increased the number of specimens now available. This paper is based on the study of 859 specimens. The specimens

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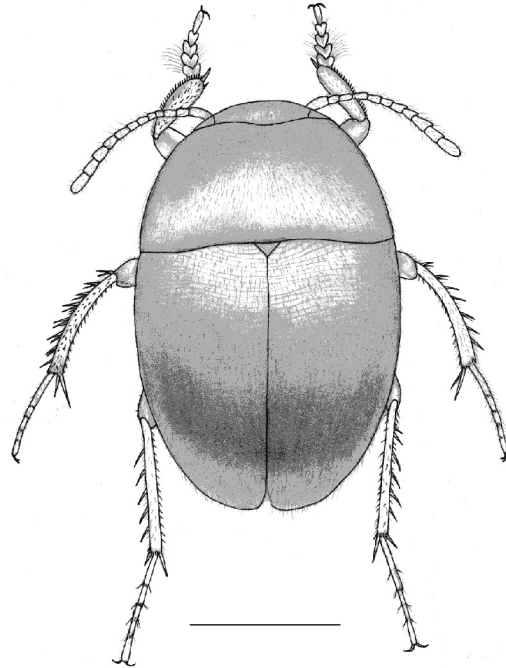
reported here were collected mostly by, and are in the collections of, the first author (SBPC; to be deposited in the Canadian Museum of Nature, Ottawa, Ontario, Canada). Additional material is from the parataxonomy collectors of the INBio program (INBio); from E.G. Riley, Department of Entomology, Texas A&M University, College Station, Texas, United States of America (TAMU); and from J.S. Ashe and collaborators of the Snow Entomology Museum, University of Kansas, Lawrence, Kansas, United States of America (SEMC).

For holotype and paratype specimens of new species, we report data as they appear on the specimen labels. We have not edited or altered these data for uniformity, but have quoted them to aid in recognition of type specimens seen by us. Other label data are summarized to obtain generalizations about distributions, field notes and habitats, and seasonality. INBio labels contain exact locality data as a set of 12 numbers in North and South Lambert coordinates.

To confirm identifications it is necessary to examine the aedeagus of male specimens and (or) the spermatheca of female specimens. For species where spermathecal shape is the best defining character, a female has been designated as holotype. The sexes are separable by the fact that males have broadly expanded basal protarsal segments. Females have all the protarsal segments unexpanded (with the same diameter). Minor males (males in which secondary sexual characters are not well developed) may be difficult or impossible to place to species. Specimens were dissected after being relaxed and removed from points or a card. Relaxing was by immersion for an hour or more in a commercial household ammonia-based window-cleaning solution. The specimen was then dissected in alcohol. The aedeagus or spermatheca was dehydrated in alcohol and placed in euparal mounting medium on a small acetate-plastic microslide. External characters were examined with a stereomicroscope at 6×–160× magnification. Outline illustrations were made from structures mounted on a microslide in euparal and photographed with a digital camera mounted on a stereomicroscope. Details were observed with a compound microscope and then added to the outline illustrations.

We have found species assignable only to the subgenus *Eucatops* in Costa Rica. The species are arranged in alphabetical order. We think it is premature at this time to propose species groups or to attempt a phylogenetic analysis of

Fig. 1. Habitus of *Eucatops* sp. from Costa Rica. Drawing by Alejandro Herrera, INBio. Scale bar = 1.0 mm.



all known species in the genus, especially in light of the expected diversity to be found in the some 3000 unstudied specimens from throughout the Neotropics now in collections, especially SBPC.

Morphology

The genus *Eucatops* possesses typical characters of the leioidid subfamily Cholevinae Kirby, 1837 (= Catopidae or Catopinae, and Leptodiridae or Leptodirinae) (Newton 1998). In addition, the following characters define the tribe Eucatopini: mesocoxal cavities narrowly separated by a prolonged mesosternal process; epistomal suture absent; all tarsi 5-segmented; head with a strongly elevated lateral occipital crest or occipital carina, which is medially weak or absent; metacoxae contiguous; maxillary palp with segment 4 much longer than segment 3, fusiform; abdominal tergum 7 not carinate; prosternum flared ventrad to form a procoxal cowl; postcoxal process of pronotum acutely triangular; outer edge of protibia with external comb of short spines; mesepisternal-epimeral suture absent; underside of elytra with microstriated area near apex;

small sclerite present behind each posterior corner of abdominal tergum 7; reflexed portion of abdominal sternum 7 produced into erect flap; abdominal spiracle 8 minute but probably non-functional; and aedeagus highly specialized (Newton 1998).

Males are characterized by having the first three segments of the protarsus broadly expanded and bordered with long setae, and the mesotarsi are not expanded. The metafemur and (or) mesofemur of what we call major males may bear teeth on the posterior margin, and the metatrochanter may bear an elongate tooth. What we call minor males are characterized as lacking these teeth, but their genitalia are identical to those of major males. The male genital segment (abdominal segment 9) is broad dorsally, usually with a median dorsal lobe at the apex, and with lateral extensions bearing setae. The morphological interpretation and terms for the unusual aedeagus were established by Jeannel (1936). The median lobe (penis) is reduced and represented by two free triangular valves (dorsal and ventral). The ventral valve is prolonged by a large, free basal piece ("basal blade" of Gnaspi 1994) in the shape of a trough, which contains the internal sac. The internal sac contains large chitinized structures of complex shape. Among these pieces is a chitinized flagellum (stylet). Parameres are free, are at the sides of or dorsal to the median lobe, and bear different patterns and numbers of setae.

Females have no expanded tarsal segments. The spermatheca, a most useful species-specific structure, is of various shapes, gradually or abruptly narrowing to the thin spermathecal duct. In contrast to Salgado (2005a, 2005b), we do not illustrate the elongate and highly coiled spermathecal duct because we find that its shape is not a constant character but is variable according to how it is stretched or manipulated.

Discussion

Phylogenetic relationships

The above characters contain numerous unique conditions that isolate the tribe Eucatopini from all other Cholevinae. Jeannel associated the tribe with Ptomaphagini, based mostly on the shared presence of the distinct protibial comb, but Perreau (1989) and Gnaspi (1994) questioned this relationship and concluded that this character was

convergent and not evidence of a relationship. Presently the genus seems to have more in common with Oritocatopini (with three Afrotropical genera) than any other cholevine (Newton 1998). Giachino *et al.* (1998) place Eucatopini as a sister group to Oritocatopini and these as a sister to a more basal Ptomaphagini. They interpret the geographic separation of Eucatopini and Oritocatopini as a vicariant event resulting from the Gondwana separation of Africa and South America between 150 and 120 million years ago.

Wing and eye reduction in *Eucatops*

Hind wing reduction in beetles is well known (Darlington 1943; Roff 1990; Thayer 1992) and is fairly common among Leiodidae (Peck 1973; Leschen 2000). Flightlessness has been reported previously in *Eucatops* for *E. (Sphaerocatops) brevistylus* Szymczakowski, from São Paulo, Brazil (Szymczakowski 1963). Among *Eucatops* in Costa Rica, flight wing reduction is known in only one species, *E. (Eucatops) apterus* **sp. nov.** *Eucatops (E.) apterus* is the only Costa Rican species known to occur above 2000 m altitude. Its occurrence in cool, wet cloud forest is consistent with the hypothesis that wing reduction is favored in stable, upper-altitude montane environments (Darlington 1943; Roff 1990).

Eye reduction is often associated with wing reduction (Thayer 1992). Among leiodids, eye reduction is commonly associated with adaptation to caves, mammal burrows, or deep litter (Peck 1973). In the high-altitude species *E. (E.) apterus*, the eyes are reduced to 6–7 facets in length. Eye reduction has not been noted previously in *Eucatops* species.

Distributional and seasonal patterns

The Costa Rican species of *Eucatops* occur in moist forests from sea level up to montane cloud forest at about 2600 m. Most of the species known to occur in Costa Rica are limited to restricted parts of the country. Lowland species are the most widespread. Upper-altitude species may be limited to a single mountain, especially if they are small-eyed or wingless species inhabiting deep litter at upper altitudes. Some species are known to have distributions that extend into either neighbouring Nicaragua or Panama. Seasonality is determined by available moisture. The species are seemingly active year-round in the permanently moist lowland

forests of the Atlantic slope. In contrast, there are no records from the dry season in the seasonal deciduous forests of the Pacific slope of the northwestern part of the country.

Systematics

Key to the Costa Rican species of *Eucatops*

Eucatops species cannot be identified reliably without dissection of male or female genitalia. Minor males cannot be identified with this key; they are most readily identified by their association with females and (or) major males and by aedeagal characters.

- 1a. Elytra covered in granules and dense punctures not forming transverse striolae; presently known from Brazil, Bolivia, and Argentina; not known from Costa Rica . . . subgenus *Sphaerocatops* Portevin, 1907
- 1b. Elytra lacking granules, with fine dense punctures arranged in lines, either forming transverse striolae or not 2
- 2a. Body length less than 5 mm; more or less covered with fine transverse striolae over entire elytron and always visible; spermathecal complex with or without basal plate and never bifurcate when present; subgenus *Eucatops* s. str. 3
- 2b. Body length over 6 mm; transverse striolae either absent or very scattered and visible only on parts of the elytron; spermathecal complex with well-developed, bifurcate basal piece. Elytra with vaguely aligned transverse punctures, but these are not contiguous and do not form striae; apex of each elytron regularly rounded; internal spur of metatibia shorter than first article of the metatarsus; presently known only from Ecuador; not known from Costa Rica subgenus *Napocatops* Salgado, 2005
- 3a. Parameres widely separated, with apical setae only (Fig. 5) 4
- 3b. Parameres narrowly separated or approximate basally, with setae apically and on inner margins (Fig. 15) 7
- 4a. Lateral lobes of male genital segment broad (Figs. 6, 64), enclosing median dorsal lobe; spermatheca narrowing gradually to duct (Fig. 7) or U-shaped (Fig. 65) 5
- 4b. Male genital segment not as above; spermatheca an elongate sac, coiled apically (Figs. 12, 40) 6
- 5a. Major males with small tooth on posterior margin of mesofemur (Fig. 3); apex of median lobe of aedeagus acute (Fig. 5); spermatheca gradually narrowing to duct (Fig. 7). . . *E. (E.) andersoni* **sp. nov.**
- 5b. Major males lacking tooth on mesofemur; apex of median lobe of aedeagus rounded, with a small lobe (Fig. 63); spermatheca U-shaped (Fig. 65) *E. (E.) solisi* **sp. nov.**
- 6a. Apical antennal segment shorter than segments 9 + 10 (Fig. 35); large species, total length greater than 3 mm *E. (E.) magnus* **sp. nov.**
- 6b. Apical antennal segment longer than segments 9 + 10 (Fig. 8); small species, total length less than 3 mm. *E. (E.) antennatus* **sp. nov.**
- 7a. Major males with elongate, angulate metatrochanteral tooth (Figs. 20, 31) 8
- 7b. Major males with metatrochanteral tooth shorter, not angulate (Fig. 25), or absent 11
- 8a. Dorsal median lobe of male genital segment truncate (Fig. 54) *E. (E.) osa* **sp. nov.**
- 8b. Dorsal median lobe of male genital segment rounded (Figs. 22, 33). 9
- 9a. Spermatheca globose (Fig. 34); parameres basally separated (Fig. 32) *E. (E.) globosus* **sp. nov.**
- 9b. Spermatheca not globose; parameres basally approximate (Figs. 21, 68) 10
- 10a. Spermatheca strongly curved (Fig. 23) *E. (E.) dentatus* **sp. nov.**
- 10b. Spermatheca elongate, constricted medially (Fig. 70). *E. (E.) tenuisaccus* **sp. nov.**
- 11a. Total length less than 2 mm; male genital segment lacking a median dorsal lobe (Fig. 43); spermatheca globose (Fig. 44) *E. (E.) minutus* **sp. nov.**
- 11b. Total length greater than 2 mm; male genital segment with a median dorsal lobe; spermatheca not globose 12
- 12a. Metatrochanter of major males with a posteriorly directed tooth (Fig. 25); spermatheca weakly constricted medially, narrowing abruptly to duct (Fig. 28) *E. (E.) femoratus* **sp. nov.**
- 12b. Metatrochanter of major males with apical tooth minute or lacking; spermatheca reniform, gradually tapering to duct (Figs. 17, 49, 60) 13
- 13a. Flight wings atrophied, nonfunctional; eyes reduced, 6–7 facets in length *E. (E.) apterus* **sp. nov.**
- 13b. Flight wings fully developed, functional; eyes not reduced 14
- 14a. Spermatheca gradually narrowing to duct; duct at base following curvature of body of spermatheca (Fig. 49) *E. (E.) montanus* **sp. nov.**

- 14b. Spermatheca abruptly narrowing to duct; duct at base not following curvature of body of spermatheca (Fig. 60) *E. (E.) paramontanus* **sp. nov.**

***Eucatops (Eucatops) andersoni*
Peck et Cook, sp. nov.**

(Figs. 2–7, 71)

Type material

Holotype male in INBio. **COSTA RICA. Guanacaste Province.** Cacao Biol. Sta., 1050 m, 10°55'38"N, 85°27'7"W, 10–11JUL 2000, J. Ashe, R. Brooks, Z. Falin, CR1ABFOO 097, ex flight intercept trap. **Paratypes** (10). Same data, 1, SEMC. **Alajuela Province.** Sector San Ramon de Dos Rios, 620 m, 12–13 Mar 1994 and 16 ENE–3 /FEB, F.A. Quesada and D. Garcia, L_N 318100, 381900, #2768 and #4400; 1, INBio and 1, SBPC. E.B. San Ramon, R.B. San Ramon 27 km N & 8 km W San Ramon, 810 m, 10°13'4"N, 84°35'46"W, 8 Jul 2000, S. Ashe, R. Brooks, Z. Falin, CR1ABFOO 084, ex. Flight intercept trap; 1, SBPC. **Guanacaste Province.** Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Jul a Ago 1992, Tp Malaise, L_N 330200, 380200; 1, INBio and 2, SBPC; same locality, May 1995, P. Rios, C. Moraga, interseccion, L_N 329950, 380450; 1, INBio and 1, SBPC; same locality, 10°59'22"N, 85°25'33"W, 13–15 Jul 2000, J. Ashe, R. Brooks, Z. Falin, CR1ABFOO 135, ex flight intercept trap; 1, SEMC.

Etymology

The species is named in recognition of the extraordinary collections of Leiodidae made by Robert Anderson in Costa Rica.

Diagnostic description

Total length 2.7–3.8 mm; greatest width 1.7–2.3 mm. Antenna (Fig. 2) with segment 3 longer than segment 2; club shorter than six basal segments; segment 8 wider than long; apical segment about as long as segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur (Fig. 3) with a small tooth at middle of posterior margin. Male metafemur (Fig. 4) with a small tooth at middle of posterior margin. Male metatrochanter (Fig. 4) with a small tooth at apex. Aedeagus (Fig. 5) with median lobe acutely angled at apex; large sclerite of internal sac median in position, not curved. Parameres (Fig. 5) short,

widely spaced, with setose apices. Male genital segment (Fig. 6) with median dorsal lobe short, rounded apically, completely enclosed by broad lateral lobes. Spermatheca (Fig. 7) an elongate sac with a small thickening at base, gradually tapering to duct.

***Eucatops (Eucatops) antennatus*
Peck et Cook, sp. nov.**

(Figs. 8–12, 72)

Type material

Holotype female in INBio. **COSTA RICA. Alajuela Province.** 38 km NW San Ramon, Reserva San Ramon, 850 m, premontane forest, 14–15.VI.97, FIT, S. & J. Peck, 97–22. **Paratypes** (2). Same data, 1 female, SBPC. Est. Biol. San Ramon, Res. Biol. San Ramon 27 km N & 8 km W San Ramon, 810 m, 10°13'4"N, 84°35'46"W, 8 Jul 2000, S. Ashe, R. Brooks, Z. Falin, CR1ABFOO 084, ex. Flight intercept trap; 1 male, SEMC.

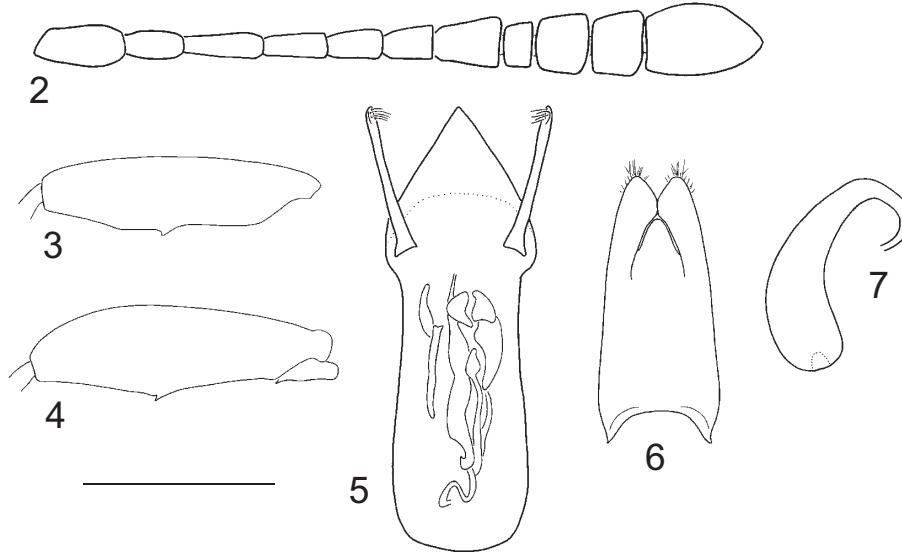
Etymology

The name *antennatus* (Latin) refers to the distinctive, elongate terminal antennal segment of this species.

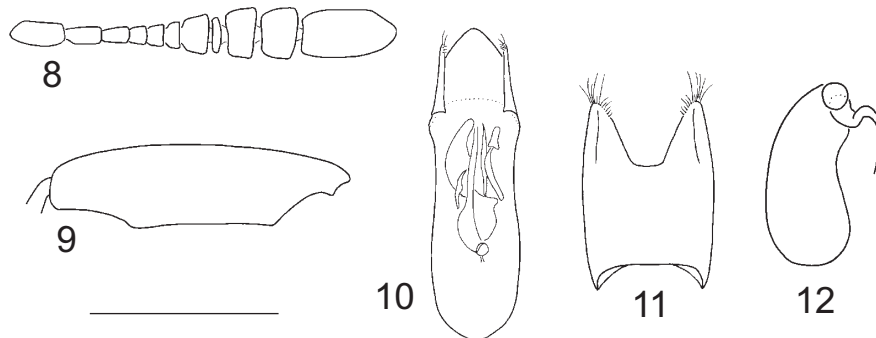
Diagnostic description

Total length 2.1–2.6 mm; greatest width 1.4–1.6 mm. Antenna (Fig. 8) with segment 3 shorter than segment 2; club longer than six basal segments; segment 8 short, more than 2 times wider than long; apical segment longer than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur (Fig. 9) obtusely angulate on apical half of posterior margin. Male metafemur and metatrochanter unmodified. Aedeagus (Fig. 10) with median lobe broad, apex rounded; large sclerite of internal sac curved to right; parameres (Fig. 10) short, widely separated basally, setose apically. Male genital segment (Fig. 11) with median dorsal lobe absent. Spermatheca (Fig. 12) an elongate reniform sac, narrow and strongly curved apically.

Figs. 2–7. *Eucatops (Eucatops) andersoni*: 2, antenna; 3, male mesofemur, ventral; 4, male metafemur and metatrochanter, ventral; 5, aedeagus, dorsal; 6, male genital segment, dorsal; 7, spermatheca. Scale bar = 0.5 mm (Figs. 2, 5), 1.0 mm (Figs. 3, 4, 6), and 0.2 mm (Fig. 7).



Figs. 8–12. *Eucatops (Eucatops) antennatus*: 8, antenna; 9, male mesofemur, ventral; 10, aedeagus, dorsal; 11, male genital segment, dorsal; 12, spermatheca. Scale bar = 0.5 mm (Figs. 8, 9), 0.4 mm (Figs. 10, 11), and 0.2 mm (Fig. 12).



***Eucatops (Eucatops) apterus* Peck
et Cook, sp. nov.**

(Figs. 13–17, 71)

Type material

Holotype male in INBio. **COSTA RICA. Heredia province.** P.N. Braulio Carrillo, Volcan Barva, 2600 m, 10°07'30"N, 84°07'30"W, 11.VI.1997, R. Anderson, oak forest litter 97–011. **Paratypes** (10). Eight with same data, SBPC. **San Jose Province.** 4.6 km E de Villa Mills, Est. Querici, alrededor de la Estacion, 2600 m, 23 Oct–1 Nov, 1995, B. Gamboa Foso, L_S 389400, 499600 #6334; 1,

SBPC. **San Jose Province.** Pan American Highway, km 80.5, 9.5 km SSW, on San Gerardo Rd, Caterata Trail, 2020 m, 23 Jul 2000, J. Ashe, R. Brooks, Z. Falin, CR1ABFOO 229, ex. fogging fungus covered log; 1, SEMC.

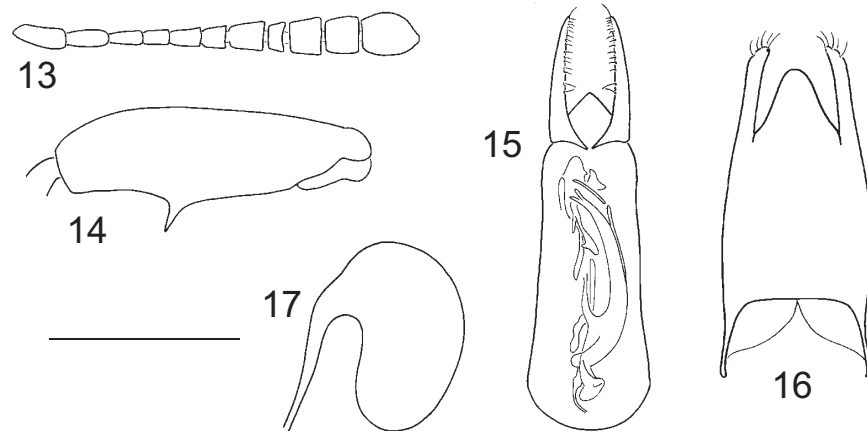
Etymology

The name *apterus*, from the Greek prefix *a* (not) and *pteron* (winged), refers to the flightlessness of this species.

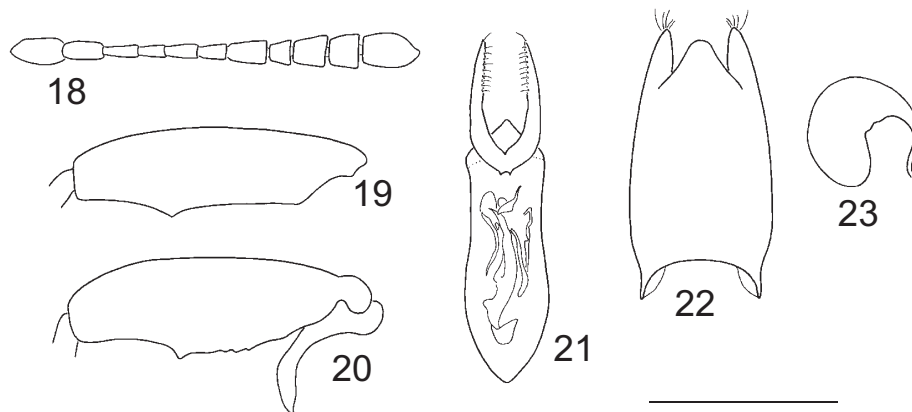
Diagnostic description

Total length 2.3–2.4 mm; greatest width 1.4–1.5 mm. Antenna (Fig. 13) with segment 3

Figs. 13–17. *Eucatops (Eucatops) apterus*: 13, antenna; 14, male metafemur and metatrochanter, ventral; 15, aedeagus, dorsal; 16, male genital segment, dorsal; 17, spermatheca. Scale bar = 0.5 mm (Figs. 13, 14), 0.4 mm (Figs. 15, 16), and 0.2 mm (Fig. 17).



Figs. 18–23. *Eucatops (Eucatops) dentatus*: 18, antenna; 19, male mesofemur, ventral; 20, male metafemur and metatrochanter, ventral; 21, aedeagus, dorsal; 22, male genital segment, dorsal; 23, spermatheca. Scale bar = 0.5 mm (Figs. 18–20), 0.4 mm (Figs. 21, 22), and 0.2 mm (Fig. 23).



slightly shorter than segment 2; club shorter than six basal segments; segment 8 wider than long; apical segment shorter than segments 9 + 10. Eyes somewhat reduced, about 6–7 facets long and 11–12 facets high. Metathoracic wings reduced, nonfunctional; length of wing about one-half length of elytron. Male mesofemur unmodified. Metafemur of major male (Fig. 14) with a narrow tooth, angled slightly apically, on apical half of posterior margin. Male metatrochanter unmodified. Aedeagus (Fig. 15) with median lobe short, broad, apex approximately right-angled; large sclerite of internal sac curved to left; parameres (Fig. 15) elongate, narrowly separated basally, setose on inner margins and apically. Male genital segment (Fig. 16) with median dorsal lobe narrow,

rounded apically. Spermatheca (Fig. 17) reniform, gradually narrowing to duct.

***Eucatops (Eucatops) dentatus*
Peck et Cook, sp. nov.**

(Figs. 18–23, 72)

Type material

Holotype male in INBio. **COSTA RICA.** **San Jose Province.** Escazu, 1350 m, Eberhard forest, FIT, VI.97, S. & J. Peck, 97–28. **Paratypes** (103). Same locality, from VII to XII.97, S. & J. Peck 97–28; 72, SBPC. Cerros de Escazu, c. 2 km S San Antonio, 09°53'30"N, 84°09'W, R. Anderson, mixed forest liter, 97–013F; 3, SBPC. **Alajuela Province.** Sect. San

Ramon de Dos Rios, 620 m, 16 ENE–3 FEB1995 and 12–13 Mar1994, D. Garcia and, F.A. Quesada, L_N 318100.381900; 2, SBPC and 1, INBio. **Guanacaste Province.** Estacion Maritza, 600 m, W side Volcan Orosi, Malaise trap, 1988, GNP Biod. Sur, 326900 373000; 1, SBPC. Estacion Pitilla, 9 km S Sta. Cecilia, 700 m, 22 Ago 1993 and Jul 1994 and Mar 1995, P Rios and C. Moraga, L_N 330200_380200; 2, SBPC and 1, INBio. Tierras Morenas, Rio San Lorenzo, Nov 1992 and Set 1995, G. Rodriguez, L_N 287800, 427600; 1, SBPC and 1, INBio. **Heredia Province.** Santo Domingo de Heredia, INBio Cafetal FIT, 25–28.VI.97, 1100 m, S. & J. Peck 97–27, 7, SBPC. Finca Naranjo Valenciana, 2 km sur Pueblo Nuevo, Sarapiquí, 90 m, 9 a 30 set 1992 M. Ortiz, L_N 271800.523750; 1, SBPC and 1, INBio. **Limon Province.** Estacion Quatro Esquinas, P.N. Tortuguero, 0 m, Jun 1990 and 20 set–7 oct 1990, J. Solano and E. Rojas, L_N 280000.590500, 1, SBPC and 1, INBio. Rio Sardinias, R.N.F.S. Barra del Colorado, Feb 1994, F. V. Araya, L_N 291500_564700 #2607; 1, SBPC. Sector Cedrales de la Riya, 3 km N del Puente, Ruta Puerto Lindo, 10 m, MAR and AGO 1996, E. Rojas, interseccion, L_N 278600.566500, # 7231; 2, SBPC and 1, INBio. Sector Coroci, 30 km al N de Cariari, A. C. Tortuguero, 100 m, Feb 1994 and Dic 1993, E. Rojas, L_N 286000.567500; 1, SBPC and 1, INBio. **Puntarenas Province.** Est. Biol. Las Alturas, Coto Brus, 1500 m, Ago and 23 mar a 2 may 1992, M. Ramirez, E. Sancho, F. Araya, L_N 322500.591300; 2, INBio.

Etymology

The name *dentatus* is from the Latin word *dentat* (toothed) and refers to the elongate tooth on the metatrochanter of major males of this species.

Diagnostic description

Total length 2.1–2.6 mm; greatest width 1.3–1.8 mm. Antenna (Fig. 18) with segments 2 and 3 subequal in length; club shorter than six basal segments; segment 8 slightly wider than long; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Mesofemur of major male (Fig. 19) with tooth on apical half of posterior margin. Metafemur of major male (Fig. 20) with several small teeth at middle of posterior margin. Metatrochanter of major male (Fig. 20) with

elongate, curved tooth at apex. Aedeagus (Fig. 21) with median lobe short and broad, approximately right-angled apically; large sclerite of internal sac curved to left. Parameres (Fig. 21) elongate, approximate basally; with setae apically and on inner margins. Male genital segment (Fig. 22) with median dorsal lobe narrow and rounded apically. Spermatheca (Fig. 23) strongly curved, gradually tapering to duct.

Eucatops (Eucatops) femoratus Peck et Cook, sp. nov.

(Figs. 24–28, 73)

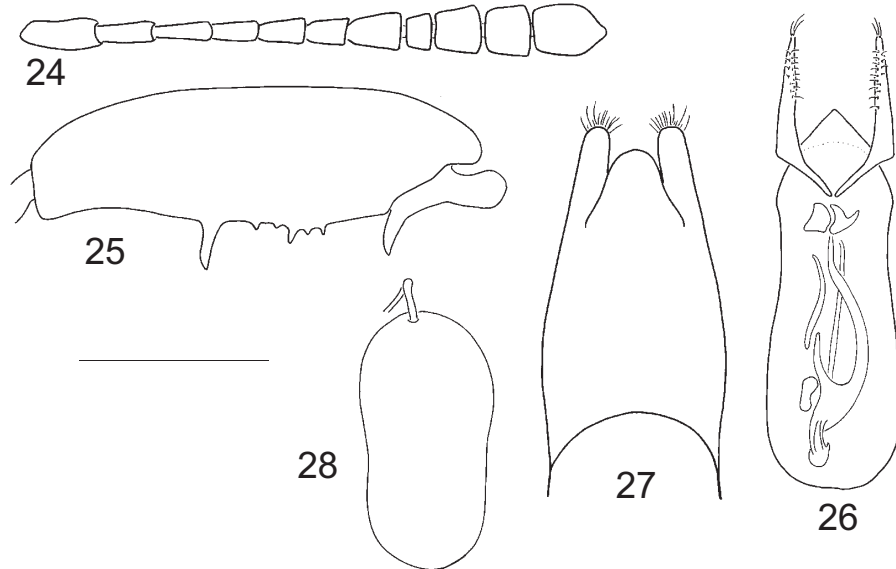
Type material

Holotype male in INBio. **COSTA RICA. Alajuela Province.** 38 km NW San Ramon, Reserva San Ramon, 850 m, premontane forest, 14–15.VI.1997, S. & J. Peck, 97–22. **Paratypes** (78). **Alajuela Province.** E. B. San Ramon, R. b. San Ramon, 27 km N & 8 km W San Ramon, 810 m, 10°13'4", 84°35'46"W, 8 Jul. 2000, J. Ashe, R. Brooks, Z. Falin, CR 1ABFOO 084, ex. flight intercept trap; 1, SEMC. **Heredia Province.** 16 km SSE La Virgen, 1050–1150 m, 10°16'N, 84°05'W, 9–14.III.2001, E.G. Riley, primary forest FIT; 38, SBPC and TAMU. **PANAMA. Chiriqui Province.** La Fortuna Dam, 1200m, 15–21.VI.1982, B. Gill; 8, SBPC. Same data, VI.1982, mini cup; 4, SBPC. Same data, 14.VI–16.VII.1982, wet forest; 16, SBPC. La Fortuna, "Cont. Divide Trail" 08°46'N, 82°12'W, 1100m, 21–23 May 1995, J. & A. Ashe #044, ex flight intercept trap; 1, SEMC. Same locality, 1150m, 23.V–9.VI.1995, J. Ashe, R. Brooks #155, ex flight intercept trap; 5, SEMC. Same data, 9–12.VI.1995, #186; 1, SEMC. La Fortuna, "Hydro Trail" 08°46'N, 82°14'W, 1100m, 24–27 Jan 1994, D. Windsor, Flt. Intpt. Trap; 2, SBPC. 20 km N Gualaca, Finca La Suiza, 08°39'N, 82°12'W, 1350m, 24.V–9.VI.1995, #154, J. Ashe & R. Brooks, ex flight intercept trap; 1, SEMC. Rio Hornito Trl., 12–16.V.1999, Morris/Wappes, feces baited pitfall trap; 1, SBPC.

Etymology

The name *femoratus*, from the Latin word *femoris* (upper part of leg), refers to the multidentate metafemur of major males of this species.

Figs. 24–28. *Eucatops (Eucatops) femoratus*: 24, antenna; 25, male metafemur and metatrochanter, ventral; 26, aedeagus, dorsal; 27, male genital segment, dorsal; 28, spermatheca. Scale bar = 0.5 mm (Figs. 24, 25), 0.4 mm (Figs. 26, 27), and 0.2 mm (Fig. 28).



Diagnostic description

Total length 2.9–3.8 mm; greatest width 1.9–2.4 mm. Antenna (Fig. 24) with segments 2 and 3 subequal in length; club shorter than six basal segments; segment 8 wider than long; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur unmodified. Metafemur of major male (Fig. 25) with several teeth in middle of posterior margin. Metatrochanter of major male (Fig. 25) with tooth at apex. Aedeagus (Fig. 26) with median lobe broad, approximately right-angled at apex; large sclerite of internal sac curved to left. Parameres elongate, narrowly separated basally; with setae on inner margins, dorsally and apically. Male genital segment (Fig. 27) with dorsal median lobe short, broad, rounded apically. Spermatheca (Fig. 28) large, elongate, weakly constricted medially, abruptly narrowing to duct.

Eucatops (Eucatops) globosus Peck et Cook, sp. nov.

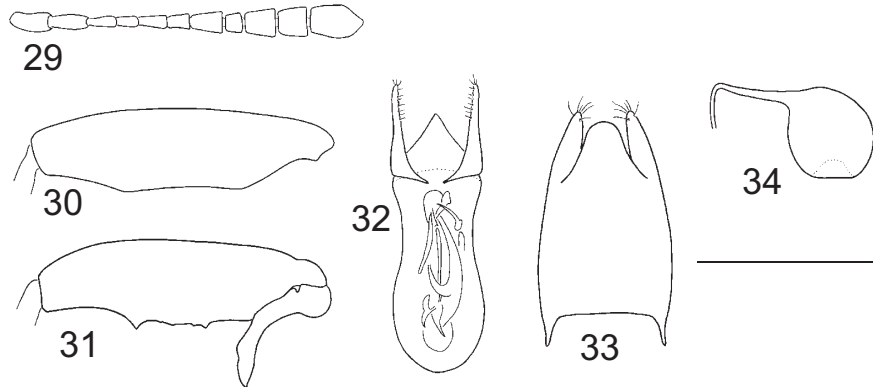
(Figs. 29–34, 74)

Type material

Holotype male in INBio. **COSTA RICA.** **Alajuela Province.** Reserva San Ramon, 38 km NW San Ramon, 850 m, 14–15.VI.97, premontane forest, S. & J. Peck, 97–22.

Paratypes (145). Three with same data; SBPC. Same locality, 950 m, wet premontane forest litter, R. Anderson, 97–014; 2, SBPC. E. B. San Ramon, R. B. San Ramon, 27 km N & 8 km W San Ramon, 810 m, 10°13'4", 84°35'46"W, 8 Jul. 2000, J. Ashe, R. Brooks, Z. Falin, CR IABFOO 084, ex. flight intercept trap; 6, SBPE and SEMC. **Guanacaste Province.** Patilla Biological Station, 610 m, 10°59'22"N, 85°25'33"W, 13–15 JUL 2000, J. Ashe, R. Brooks, Z. Falin, CR IABFOO 135, flight intercept trap; 12, SBPC and SEMC; same locality, 700 m, Feb 1990 to May 1995 L_N330200 380200; 3, SBPC and 3, INBio. Cacao Biol. Sta., 1050 m, 10°55'38"N, 85°27'7"W, 10–11 JUL 2000, J. Ashe, R. Brooks, Z. Falin, CR IABFOO 097, ex flight intercept trap; 1, SEMC. Rio San Lorenzo, Tierras Morenas, Z. P. Tenorio, 1050 m, Nov 1992, G. Rodriguez, L_N 287800 427600: 1, SBPC and 1, INBio. **Heredia Province.** 10 km W Puerto Viejo, 170 m, 2–5.III.1991, FIT and dung traps, H. & A. Howden; 12, SBPC. Est. Biol. La Selva, 50–150 m, 10°26'N, 84°01'W, 5–8.III.2001, E.G. Riley, FIT; 32, SBPC and TAMU. La Selva, 50 m, VII–VIII.1998, N. Franz, FIT; 1, SBPC. **Limon Province.** Sector Cerro Coroci, Finca Elias Rojas, A. C. Tortuguero, 150 m, L_N 286000,567500, Ago 1991 to Jun 1993, E. Rojas; 32, INBio and SBPC. **NICARAGUA.** **Rio San Juan Department.** 8 km SE El Castillo, Refuge Bartola,

Figs. 29–34. *Eucatops (Eucatops) globosus*: 29, antenna; 30, male mesofemur, ventral; 31, male metafemur and metatrochanter, ventral; 32, aedeagus, dorsal; 33, male genital segment, dorsal; 34, spermatheca. Scale bar = 0.5 mm (Figs. 29–31), 0.4 mm (Figs. 32, 33), and 0.2 mm (Fig. 34).



N18°58.6', W84°20.4', 30m, 25–31.V.2002, rainforest, 6 Fits, S. Peck, 02–09; 36, SBPC.

Etymology

The name *globosus* is from the Latin word *globo* (globe) and refers to the globose shape of the spermatheca of this species.

Diagnostic description

Total length 2.1–2.8 mm; greatest width 1.3–1.8 mm. Antenna (Fig. 29) with segment 2 slightly longer than segment 3; club shorter than six basal segments; segment 8 slightly wider than long; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Mesofemur of major male (Fig. 30) obtusely angulate on apical half of posterior margin. Metafemur of major male (Fig. 31) with several small teeth at middle of posterior margin. Metatrochanter of major male (Fig. 31) with an elongate tooth at apex. Aedeagus (Fig. 32) with median lobe narrowing to acute apex; large sclerite of internal sac curved to left. Parameres (Fig. 32) elongate, narrowly separated basally; with setae on inner margins and apically. Male genital segment (Fig. 33) with dorsal median lobe short, broad, rounded apically. Spermatheca (Fig. 34) globose, with a basal thickening.

Eucatops (Eucatops) magnus Peck et Cook, sp. nov.

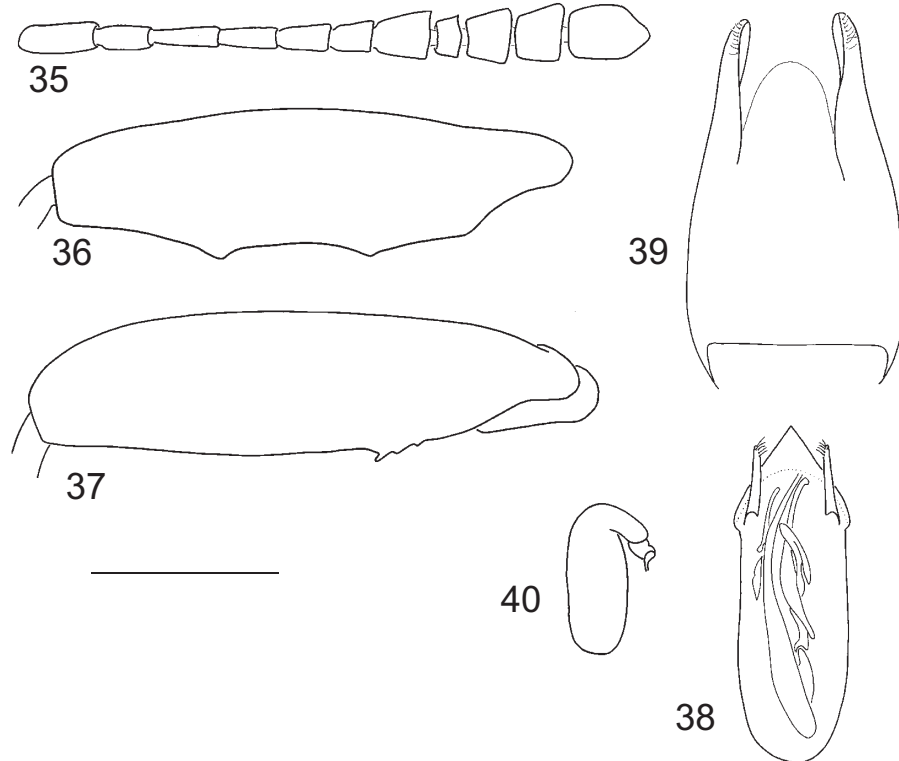
(Figs. 35–40, 75)

Type material

Holotype male in INBio. **COSTA RICA.**

Puntarenas Province. Monte Verde Biology Station, N 10°19.672, W 84°49.141, 10–17.VI.01, 1515 m, cloud forest FITs, S. & J. Peck, 01–10. **Paratypes** (115). Forty-six with same data; SBPC. Same locality, but 1540 m and 1470 m; 34, SBPC and H. & A. Howden; 1, SBPC. **Alajuela Province.** 38 km NW San Ramon, Reserva San Ramon, 850 m, premontane forest, 14–15.VI.97, FIT, S. & J. Peck 97–22 and 8 JUL 2000, J. Ashe, R. Brooks, Z. Falin; 2, SBPC and SEMC. **Guanacaste Province.** Est. Cacao, lado SO Volcan Cacao, P.N. Guanacaste, 1000–1400 m, 21–28 may 1992, G. Rodriguez, L_N 323300, 375700; 1, SBPC. **Puntarenas Province.** Est. Agujas, Sendero Zamia, Rio Agujas, 300 m, 2–15 ENE 1996, interseccion, A. Azofeifa, L_S 276750, 526550; 2, SBPC and 2, INBio. Peninsula de Osa, Rancho Quemado, 200 m, 1–20 Dec. 1993, A. Marin, L_S 292500 511000; 2, SBPC and 1, INBio. Rincon de Osa, N 8°41.141, W 83°31.117, 23–26.VI.01 and 21–25.VI.97, 40 m, rainforest streamside FIT, S. & J. Peck, 01–15 and 97–25; 4, SBPC. Corcovado National Park, Sirena Stn., upper Ollas Trail, 140 m. 8°29'7"N, 83°34'39"W, J. Ashe, R. Brooks, Z. Falin; 1, SEMC. R. B. Monteverde, Est. La Casona, 1520, 9–31 Mar 1993, N. Obando, Ig. Barbosa, A. Pound, LA. Pereira, L_N 253250 449700; 1, SBPC. **San Jose Province.** Est. Santa Elena, Viejo, Santa Elena, Las Nubes, 1210 m, 4–15 ENE 1996, A. Alfaro, interseccion, L_N 371750, 507800; 1, SBPC. **PANAMA. Chiriqui Province.** 20 km N Gualaca, Finca La Suiza, 08°39'N, 82°12'W, 1350m, 24.V–9.VI.1995, #154, J. Ashe & R.

Figs. 35–40. *Eucatops (Eucatops) magnus*: 35, antenna; 36, male mesofemur, ventral; 37, male metafemur and metatrochanter, ventral; 38, aedeagus, dorsal; 39, male genital segment, dorsal; 40, spermatheca. Scale bar = 0.5 mm (Figs. 35–37, 39), 0.4 mm (Fig. 38), and 0.2 mm (Fig. 40).



Brooks, ex flight intercept trap; 4, SEMC. Same data, 10–13 June 1995, # 196; 1, SBPC. Same data, 22–24.V.1995, J. & A. Ashe, #054; 4, SEMC. Hornito, Finca La Suiza, 1220m, 29.V.2000, H. & A. Howden, FIT; 5, SBPC. Same data, 1–6.VI.2000; 2, SBPC. **Panama Province.** El Llano–Carti Rd., 400m, VII.1982, B. Gill, FIT; 1, SBPC.

Etymology

The name *magnus* is from the Latin and refers to the large size of this species.

Diagnostic description

Total length 3.2–4.2 mm; greatest width 2.0–2.7 mm. Antenna (Fig. 35) with segment 3 longer than segment 2; club shorter than six basal segments; segment 8 wider than long; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Mesofemur of major male (Fig. 36) with two widely spaced teeth at middle of posterior margin. Metafemur of major male (Fig. 37) with a minute, apically angled tooth on basal half.

Metatrochanter (Fig. 37) unmodified. Aedeagus (Fig. 38) with apex of median lobe acutely angled; large sclerite of internal sac curved to right side. Parameres (Fig. 38) short, widely separated basally, setose apically. Male genital segment (Fig. 39) with median dorsal lobe poorly sclerotized, rounded apically. Spermatheca (Fig. 40) an elongate sac, narrow and strongly coiled apically.

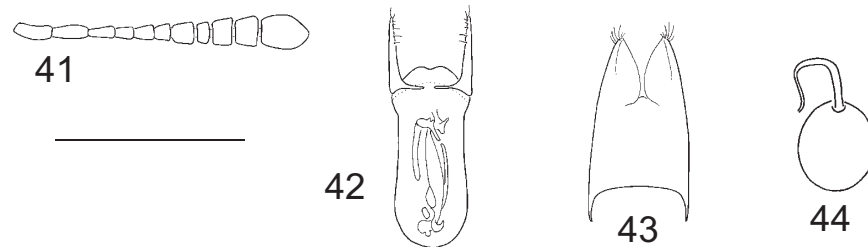
Eucatops (Eucatops) minutus Peck et Cook, sp. nov.

(Figs. 41, 44, 72)

Type material

Holotype male in INBio. **COSTA RICA, Puntarenas Province.** Rincon de Osa, N 8°41.141, W 83°31.117, 23–26.VI.01, 40 m, rainforest streamside FIT, S. & J. Peck, 01–15. **Paratypes** (2). Two with same data; SBPC.

Figs. 41–44. *Eucatops (Eucatops) minutus*: 41, antenna; 42, aedeagus, dorsal; 43, male genital segment, dorsal; 44, spermatheca. Scale bar = 0.5 mm (Fig. 41), 0.4 mm (Figs. 42, 43), and 0.2 mm (Fig. 44).



Etymology

The name *minutus* is from the Latin word *minut* (small) and refers to the small size of this species.

Diagnostic description

Total length 1.7–1.8 mm; greatest width 1.1–1.2 mm. Antenna (Fig. 41) with segment 2 longer than segment 3; club shorter than six basal segments; segment 8 wider than long; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur, metafemur, and metatrochanter unmodified. Aedeagus (Fig. 42) with apex of median lobe curved ventrally, appearing bilobed in dorsal view; large sclerite of internal sac curved to left side. Parameres (Fig. 42) elongate, moderately separated basally; with setae on inner margins and apically. Male genital segment (Fig. 43) with median dorsal lobe absent. Spermatheca (Fig. 44) globose, abruptly narrowing to duct.

Eucatops (Eucatops) montanus Peck et Cook, sp. nov.

(Figs. 45–49, 76)

Type material

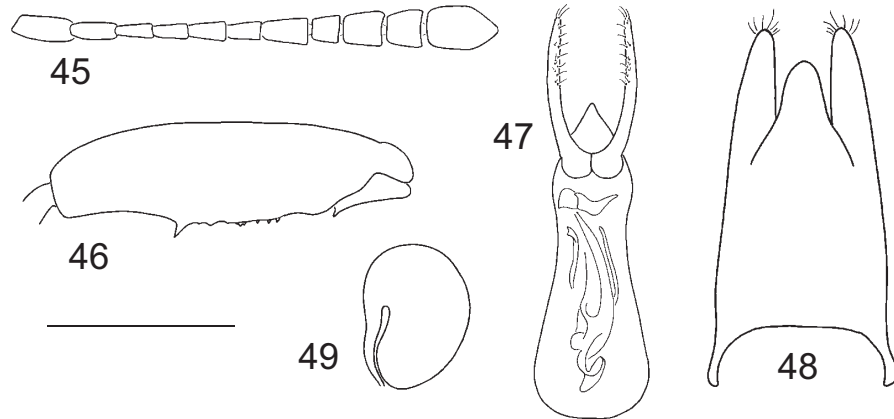
Holotype male in INBio. **COSTA RICA. San Jose Province.** Km 117 Pan American Highway, 19 km N San Isidro, 09°28'N, 83°42'20"W, 1800 m, 20.IV.1997, R.S. Anderson, cloud forest litter, 97–035. **Paratypes** (62). Twelve with same data; SBPC. **Alajuela Province.** E.B. San Ramon, R.B. San Ramon 27 km N & 8 km W San Ramon, 10°50'N, 84°35'30"W, 15.VI.1997, R.S. Anderson, wet premontane forest litter, 97–015; 1, SBPC. **Cartago Province.** Pan Am Hwy, km 45, 6 km NW El Empalme, 8–26.VI.97, 1975 m, forest FIT, S. & J. Peck, 97–19; 1, SBPC. **Guanacaste Province.** 6 km NE Santa

Elena, Santa Elena Forest Reserve, 1640 m, N 10°20.701 W 84°47.899, 11–17.VI.01, Cloud forest FIT, S. & J. Peck, 01–12; 4, SBPC. **San Jose Province.** Cerros de Escazu, ca. 2 km S. San Antonio, 09°53'30"N, 84°09'W, 1650 m, 13.VI.1997, R.S. Anderson, mixed forest litter, 97–013; 6, SBPC. Km 117 Pan American Highway, 19 km N San Isidro, 09°28'N, 83°42'20"W, 1750 m, 20–25.IV.1997, S. & J. Peck, montane forest FIT 97–23; 12, SBPC. Same data except 1800m, 15.II.1998, R. Anderson, cloud for. lit.; 8, SBPC. **PANAMA. Chiriqui Province.** 5.6 km N Boquete, La Culebra Trail, 08°49'23"N, 82°25'18"W, 1650m, 15–19 Jun 1996, J. Ashe, R. Brooks, PAN1AB96 177B, ex flight intercept trap; 2, SBPC. Same data, 1450m, 19.VI.1996, R. Anderson, PAN2A96 96–141D; 2, SBPC. 6.0 km NE Boquete, 08°48'00"N, 82°26'00"W, 1550m, 14–19 Jun 1996, J. Ashe, R. Brooks, PAN1AB96 179B, ex flight intercept trap; 5, SBPC. Same data, 1650m, 180B; 4, SBPC. 5.4 km NE Boquete, 08°48'N, 82°26'W, 1520m, 19.VI.1995, J. Ashe & R. Brooks, #247, ex fogging fungusy log; 2, SBPC. 11 km NW Boquete, Volcan Baru, 08°48'00"N, 82°29'00"W, 2150m, 18 Jun 1995, R. Anderson, PAN2A95 33E, ex oak forest litter; 1, SBPC. 12 km NE Santa Clara, Cerro Pando, 08°54'44"N, 82°43'30"W, 1850m, 18.VI.1995, R. Anderson, PAN2A96 139B, ex oak forest litter; 1, SBPC. Cerro Pando, 08°54'42"N, 82°43'18"W, 1875m, 17–18 Jun 1996, J. Ashe, R. Brooks, PAN1AB96 185A, ex flight intercept trap; 1, SBPC.

Etymology

The name *montanus* is from the Latin word *montan* (mountain) and refers to the relatively high-altitude habitat of this species.

Figs. 45–49. *Eucatops (Eucatops) montanus*: 45, antenna; 46, male metafemur and metatrochanter, ventral; 47, aedeagus, dorsal; 48, male genital segment, dorsal; 49, spermatheca. Scale bar = 0.5 mm (Figs. 45, 46), 0.4 mm (Figs. 47, 48), and 0.2 mm (Fig. 49).



Diagnostic description

Total length 2.7–3.0 mm; greatest width 1.8–1.9 mm. Antenna (Fig. 45) with segment 2 longer than segment 3; club shorter than six basal segments; segment 8 as long as wide (females) or longer than wide (males); apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur unmodified. Metafemur of major male (Fig. 46) with several small teeth at middle of posterior margin. Metatrochanter of major male (Fig. 46) with small tooth at apex. Aedeagus (Fig. 47) with median lobe narrow, acutely angled at apex; large sclerite of internal sac curved to left side. Parameres (Fig. 47) elongate, approximate at base; with setae on inner margins, dorsally and apically. Male genital segment (Fig. 48) with median dorsal lobe elongate, narrow, rounded apically. Spermatheca (Fig. 49) reniform, gradually narrowing to duct.

Eucatops (Eucatops) osa Peck et Cook, sp. nov.

(Figs. 50–55, 77)

Type material

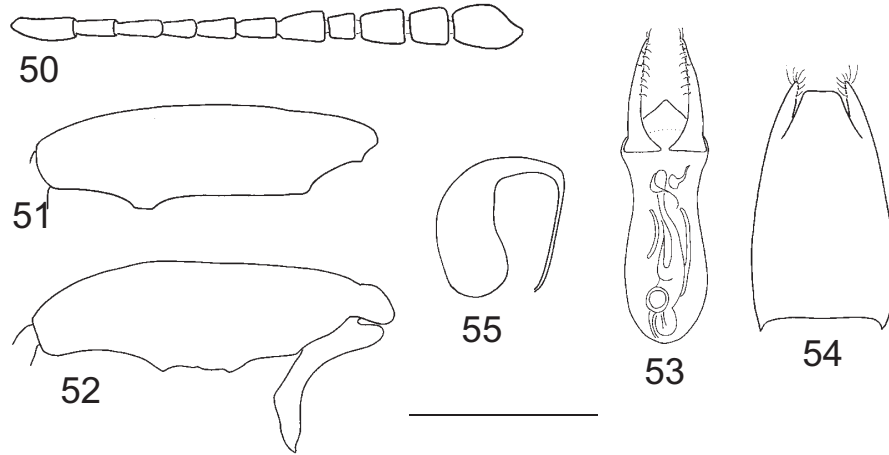
Holotype male in INBio. **COSTA RICA. Puntarenas Province.** Rincon de Osa, N 8°41.141, W 83°31.117, 23–26.VI.01, 50 m, rainforest streamside FIT, S. & J. Peck, 01–13. **Paratypes** (141). Same data; 18, SBPC. Same data but 40 m, 01–15; 3, SBPC. Same data but 150 m, 01–1; 24, SBPC. **Puntarenas Province.** Agujas, Sendero Zamia, Rio Agujas, 300 m, 20–24 Jun 1996 and 2–15 ENE 1996,

interseccion, A. Azofeifa, L_S 276750, 526550; 7, SBPC and 6, INBio. Peninsula de Osa, Est. Esquinas, A. c. Osa, 200 m, Jul 1993 and Mar 1994, M. Segura, L_S 301400 542200, # 2272 and 2776; 6, SBPC and 5, INBio. Peninsula de Osa, Rancho Quemado, 200 m, Set, Oct and Nov 1992, F. Quesada, L_S 292500 511000; 13, SBPC and 12, INBio. Peninsula de Osa, Estacion Fundacion Neotropica, Aguas Buenas, 7 km N Rincon de Osa, 21–25.VI.97, 50 and 80 m, rainforest FIT, S. & J. Peck, 97–24 and 97–25; 10, SBPC. Peninsula de Osa, Cerro Helado, 17 km NE Rincon de Osa, 21–25.VI.97, S. & J. Peck, 97–26; 1, SBPC. Osa Peninsula, 8–15, VIII.1966, S. Peck, carrion and phaloid fungus baited traps; 8, SBPC. Corcovado National Park, Sirena Stn, lower Ollas trail at 5 m and upper Ollas trail at 140 m, 24–28.JUN 2000, 8°29'7"N 83°34'39"W, Z. Falin, ex. Flight intercept traps; 16, SBPC and SEMC. Sirena Stn, Corcovado Trail, 150 m, 8°29'7"N, 83°34'39"W, 28 JUN–1 JUL, Z.H. Falin, flight intercept traps; 5, SBPC. Sirena Stn, upper Rio Claro Trail, 100 m, 8°28'29"N, 83°35'8"W, 28 JUN–1 JUL, Z.H. Falin, flight intercept traps; 6, SBPC. Sirena Stn, upper Rio Pavo Trail, 5 m, 8°29'5"N, 83°35'33"W, 25–28 JUN, Z.H. Falin, flight intercept traps; 1, SBPC.

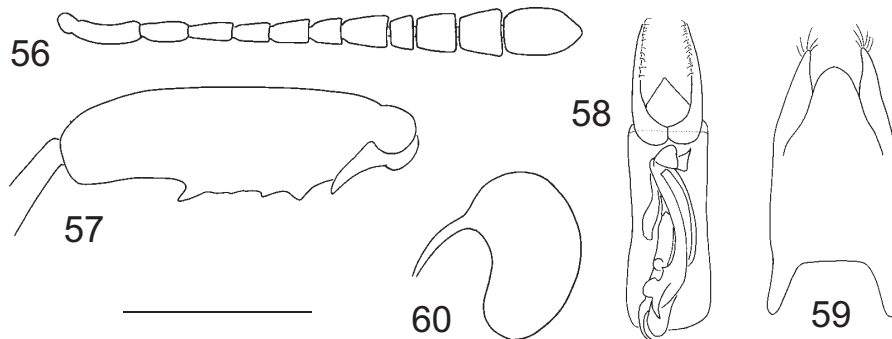
Etymology

The name *osa*, used as a noun in apposition, refers to the geographic distribution of this species on the Osa Peninsula.

Figs. 50–55. *Eucatops (Eucatops) osa*: 50, antenna; 51, male mesofemur, ventral; 52, male metafemur and metatrochanter, ventral; 53, aedeagus, dorsal; 54, male genital segment, dorsal; 55, spermatheca. Scale bar = 0.5 mm (Figs. 50–52), 0.4 mm (Figs. 53, 54), and 0.2 mm (Fig. 55).



Figs. 56–60. *Eucatops (Eucatops) paramontanus*: 56, antenna; 57, male metafemur and metatrochanter, ventral; 58, aedeagus, dorsal; 59, male genital segment, dorsal; 60, spermatheca. Scale bar = 0.5 mm (Figs. 56, 57), 0.4 mm (Figs. 58, 59), and 0.2 mm (Fig. 60).



Diagnostic description

Total length 2.1–2.6 mm; greatest width 1.3–1.7 mm. Antenna (Fig. 50) with segments 2 and 3 subequal in length; club slightly shorter than six basal segments; segment 8 as long as or slightly longer than wide; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Mesofemur of major male (Fig. 51) with a broad tooth on apical half of posterior margin. Metafemur of major male (Fig. 52) with several irregular teeth on middle of posterior margin. Metatrochanter of major male (Fig. 52) with elongate, curved tooth at apex. Aedeagus (Fig. 53) with apex of median lobe broad, right-angled at apex; large sclerite of internal sac curved to left. Parameres (Fig. 53) elongate, narrowly separated basally; with setae on inner

margins and apically. Male genital segment (Fig. 54) with median dorsal lobe truncate. Spermatheca (Fig. 55) an elongate sac, gradually narrowing at apex.

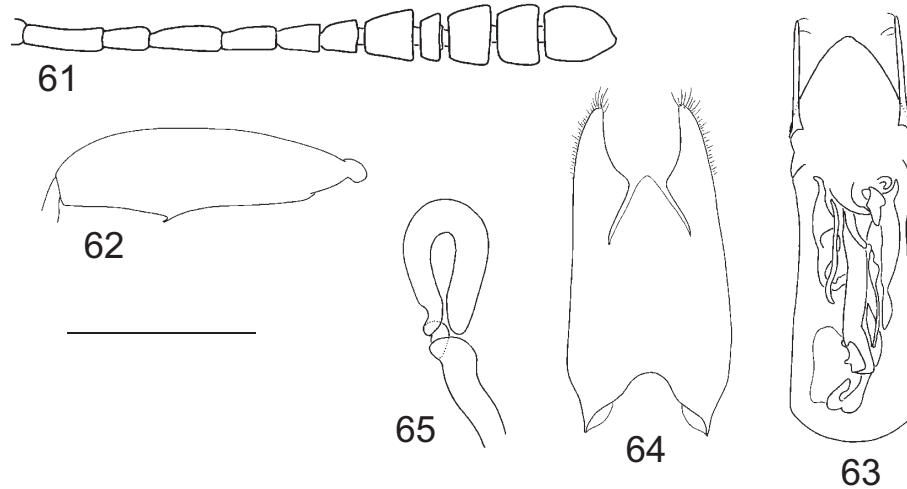
Eucatops (Eucatops) *paramontanus* Peck et Cook, sp. nov.

(Figs. 56–60, 74)

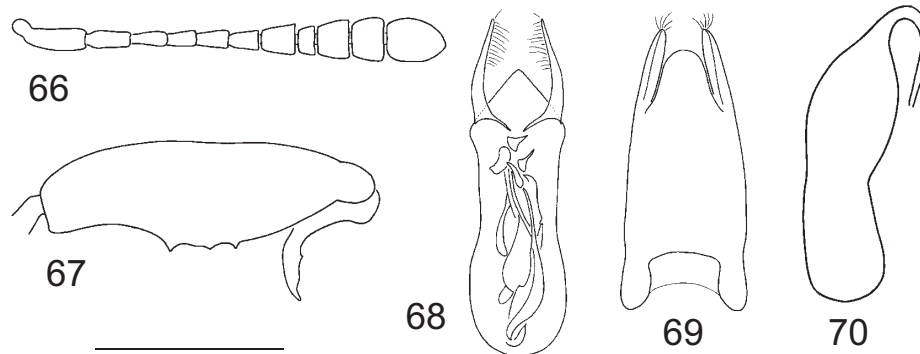
Type material

Holotype female in INBio. **COSTA RICA.** **Puntarenas Province.** Est. Biol. Las Alturas, 2 km NE Alturas, 1520 m, 08°56'56"N, 82°50'01"W, 20.VI.1998, R.S. Anderson, upper montane/cloud forest litter, 98–104. **Paratypes** (106). Eight with same data; SBPC. Same data

Figs. 61–65. *Eucatops (Eucatops) solisi*: 61, antenna; 62, male metafemur, ventral; 63, aedeagus, dorsal; 64, male genital segment, dorsal; 65, spermatheca. Scale bar = 0.5 mm (Figs. 61, 63, 65) and 1.0 mm (Figs. 62, 64).

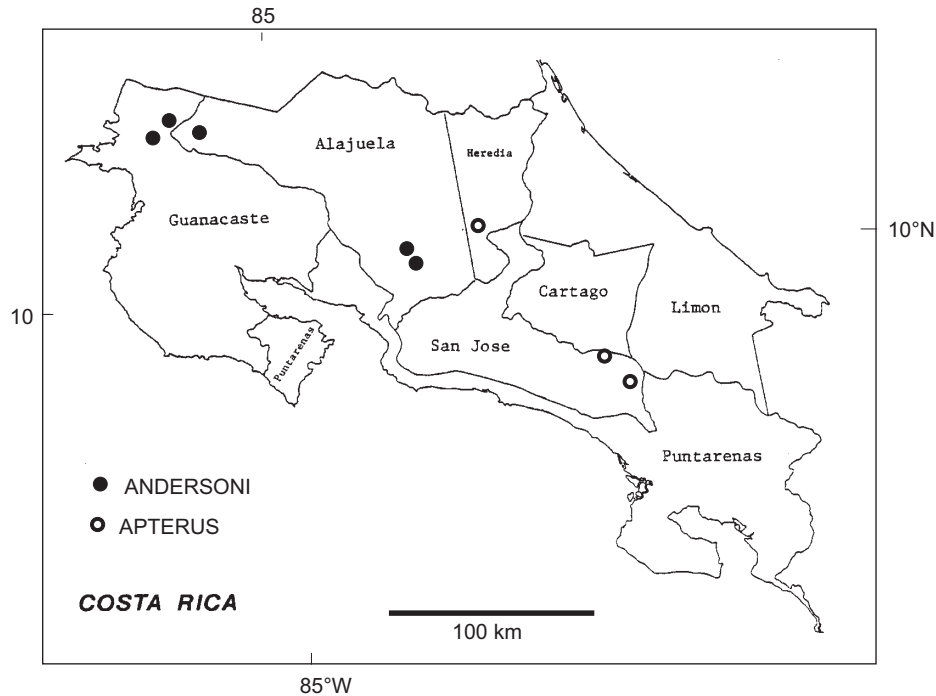


Figs. 66–70. *Eucatops (Eucatops) tenuisaccus*: 66, antenna; 67, male metafemur and metatrochanter, ventral; 68, aedeagus, dorsal; 69, male genital segment, dorsal; 70, spermatheca. Scale bar = 0.5 mm (Figs. 66, 67), 0.4 mm (Figs. 68, 69), and 0.2 mm (Fig. 70).



but 1720 m, 08°58'26"N, 82°50'04"W, upper montane/oak forest trans. litter, 98–106; 2, SBPC. Las Alturas, Coto Brus, 1500 m, 23.III–2.V.1992, F. Araya, L-S 322500, 591300; 1, SBPC and 1, INBio. Same data but XI.1991, M.A. Zumbado; 1, SBPC and 1, INBio. Las Alturas (Stanford Biol. Sta.), 29 km NE San Vito, 1500m, 27 May 1993, J.S. & A.K. Ashe, #063, ex flight intercept trap; 2, SBPC. **San Jose Province.** Est. Santa Elena, Viejo, Santa Elena, Las Nubes, 1210 m, 4–15.I.1996. E. Alfaro, Intesecccion L-S 371750, 507800 #6857; 1, SBPC. **PANAMA. Chiriqui Province.** 27.7 km W Volcan, Hartman's Finca, 08°45'0"N, 82°48'0"W, 1800m, 16 Jun 1995, R. Anderson, PAN2A95 28E, ex oak forest litter; 1, SBPC. Same data, 1450m, J. Ashe & R.

Brooks, #226, ex fogging fungusy log; 1, SBPC. Same data, 1450m, 14–17.VI.1995, J. Ashe & R. Brooks, #231, ex flight intercept trap; 2, SBPC. Same data, 08°51'42"N, 82°44'48"W, 1650–1700m, 17 Jun 1996, J. Ashe, R. Brooks, PAN 1AB96 164, ex fungusy log; 1, SBPC. 20 km N Gulaca, Finca La Suiza, 08°39'N, 82°12'W, 1350m, 24.V–9.VI.1995, J. Ashe & R. Brooks, ex flight intercept trap; 1, SBPC. Same data, 22–24.V.1995, #054; 1, SBPC. Same data, 22.V.1995, #036, ex fungusy log; 1, SBPC. Cerro Hornito, 15 km NE Gulaca, 1200m, VIII. 1982, B. Gill, FIT; 30, SBPC. La Fortuna Dam, 14.VI–16.VII.1982, 1200m, B. Gill, wet forest, FIT; 6, SBPC. Cerro Pelota, Hartman's Finca, Ojo de Aqua, 1500m, 30.VI–14.VII.82, B. Gill, FIT; 40, SBPC.

Fig. 71. Collection localities of *Eucatops (Eucatops) andersoni* and *E. (E.) apterus*.

Hornito, Finca La Suiza, 1220m, 29.V.2000, H. & A. Howden, FIT; 3, SBPC. Cerro Pelota, 4 km N Santa Clara, 1500m, 5–15.VII.1982, B. Gill; 2, SBPC.

Etymology

From *para*, close to, and *montanus*, indicating the similarity of this species to *E. (E.) montanus*.

Diagnostic description

Total length 2.1–2.9 mm; greatest width 1.3–1.8 mm. Antenna (Fig. 56) with segments 2 and 3 subequal in length; club shorter than six basal segments; length of segment 8 less than width; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur unmodified. Metafemur of major male (Fig. 57) with two small teeth near base of posterior margin and an acute, posterolaterally angled tooth distal to middle of posterior margin. Metatrochanter of major male (Fig. 57) with small apical tooth. Aedeagus (Fig. 58) with median lobe acutely angled at apex; large sclerite of internal sac curved to left side. Parameres (Fig. 58) elongate, narrow, approximate at base; with setae on apical half of inner margins. Male genital segment (Fig. 59) with median dorsal lobe variable

in width, rounded apically. Spermatheca (Fig. 60) reniform, abruptly narrowing to duct.

Eucatops (Eucatops) solisi Peck et Cook, sp. nov.

(Figs. 61–65, 73)

Type material

Holotype female in INBio. **COSTA RICA. Puntarenas Province.** Est. Biol. Las Alturas, Coto Brus, 1500m, Oct 1991, M.A. Zumbado, L-S 322500, 591300. **Paratypes** (23). **Puntarenas Province.** Fca. Cafrosa, Estacion Las Melizas, P. N. Amistad, 1300m, Apr 1990, M. Ramirez, G. Mora; 1, SBPC. Las Alturas (Stanford Biol. Sta.), ca 29 km NE San Vito, 1500m, 27 May 1993, J.S. & A.K. Ashe, #063, ex flight intercept trap; 1, SBPC. **PANAMA. Chiriqui Province.** Cerro Pelota, Hartman's Finca, Ojo de Agua, 1500m, 30.VI–14.VII.82, B. Gill, FIT; 5, SBPC. Cerro Pelota, 4 km N Sta. Clara, 1500m, VIII.1982, B. Gill; 1, SBPC. Same data, 5–15.VII.1982; 5, SBPC. Hornito, Finca La Suiza, 1220m, 1–6.VI.2000, H. & A. Howden, FIT; 6, SBPC. Hartman's Finca, 27.7 km W Volcan, 08°45'N, 82°48'W, 1450m, 14–17.VI.1995, J. Ashe & R. Brooks, #231, ex flight intercept trap; 4, SBPC.

Fig. 72. Collection localities of *Eucatops (Eucatops) antennatus*, *E. (E.) dentatus*, and *E. (E.) minutus*.

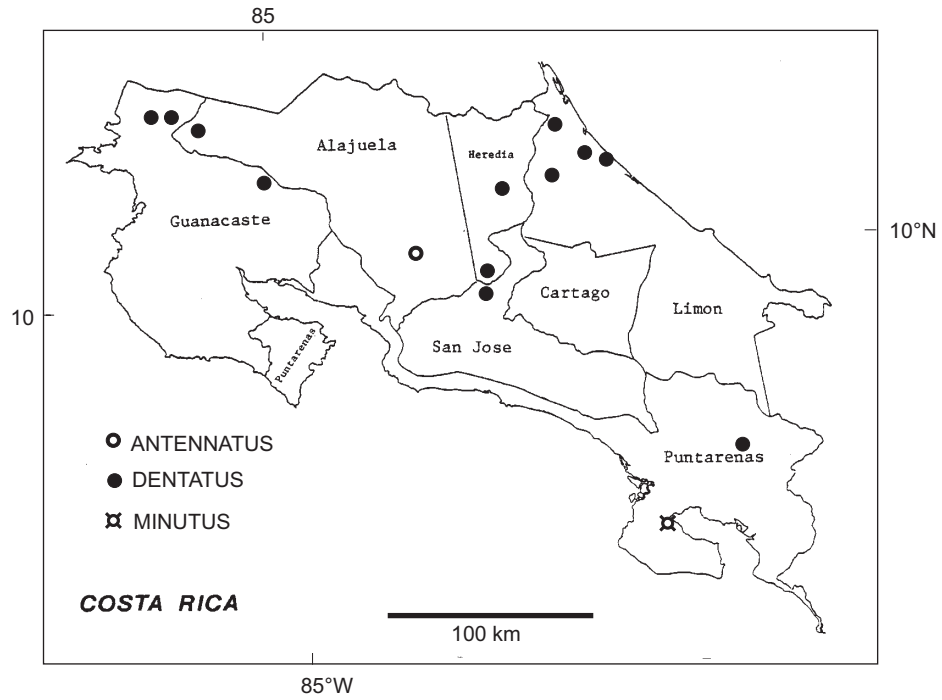


Fig. 73. Collection localities of *Eucatops (Eucatops) femoratus* and *E. (E.) solisi*.

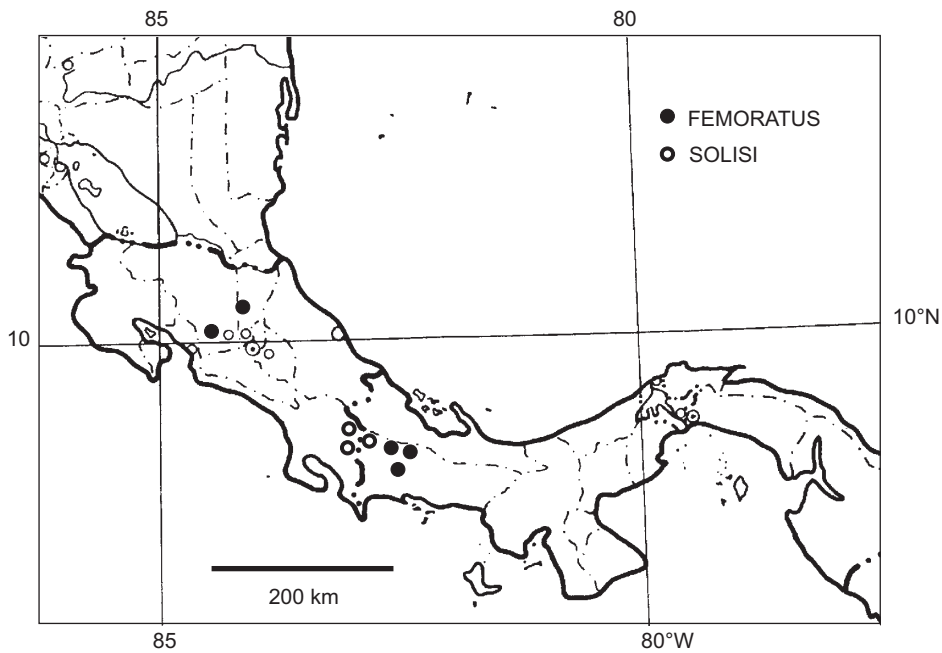
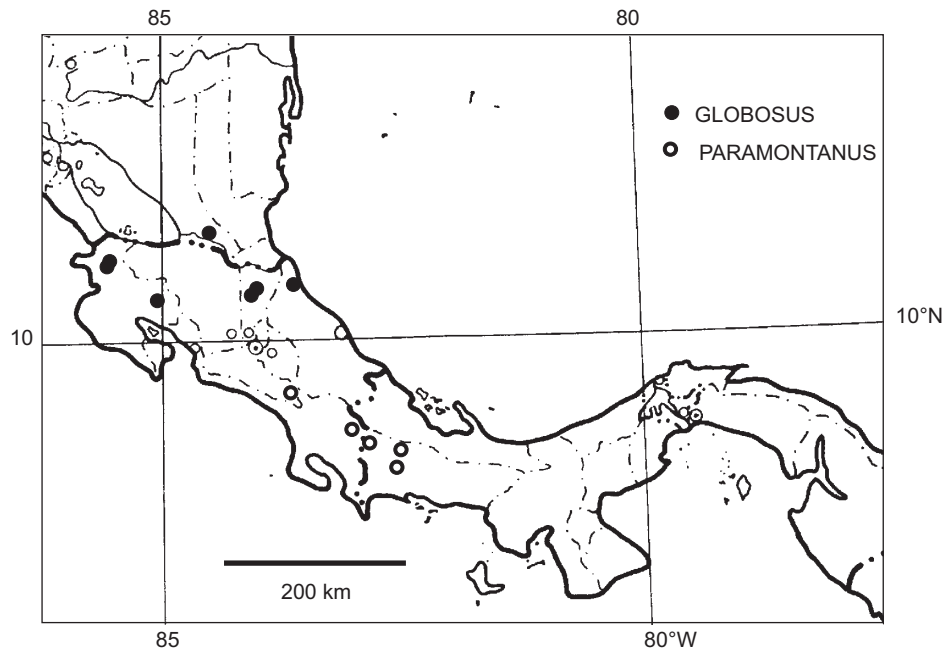
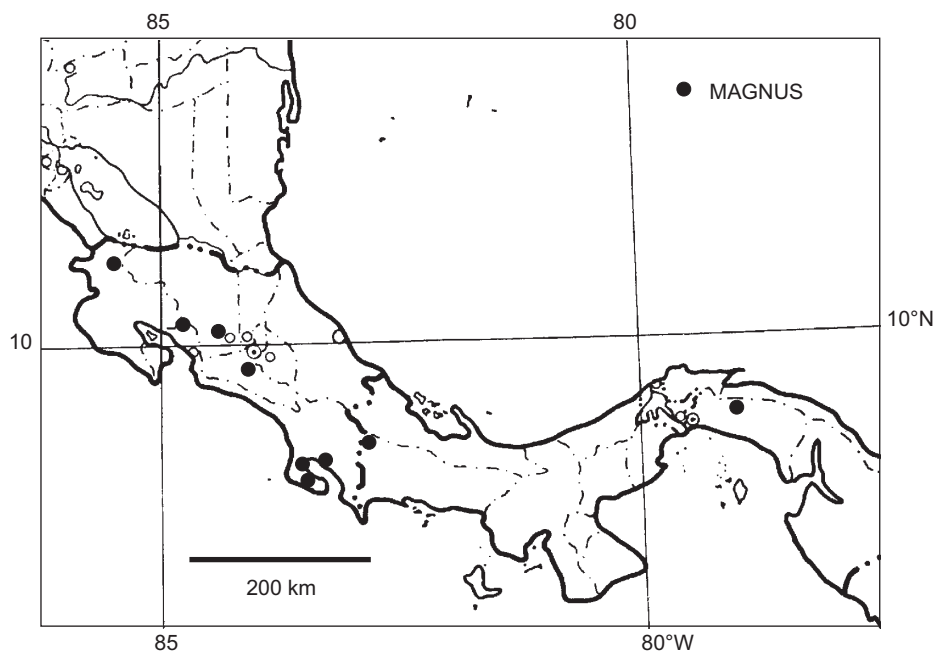


Fig. 74. Collection localities of *Eucatops (Eucatops) globosus* and *E. (E.) paramontanus*.**Fig. 75.** Collection localities of *Eucatops (Eucatops) magnus*.**Etymology**

This species is named in recognition of the extensive collecting and biodiversity research in Costa Rica of Angel Solis, INBio.

Diagnostic description

Total length 3.6–4.3 mm; greatest width 2.2–2.6 mm. Antenna (Fig. 61) with segment 3 longer than segment 2; club shorter than six basal

Fig. 76. Collection localities of *Eucatops (Eucatops) montanus*.

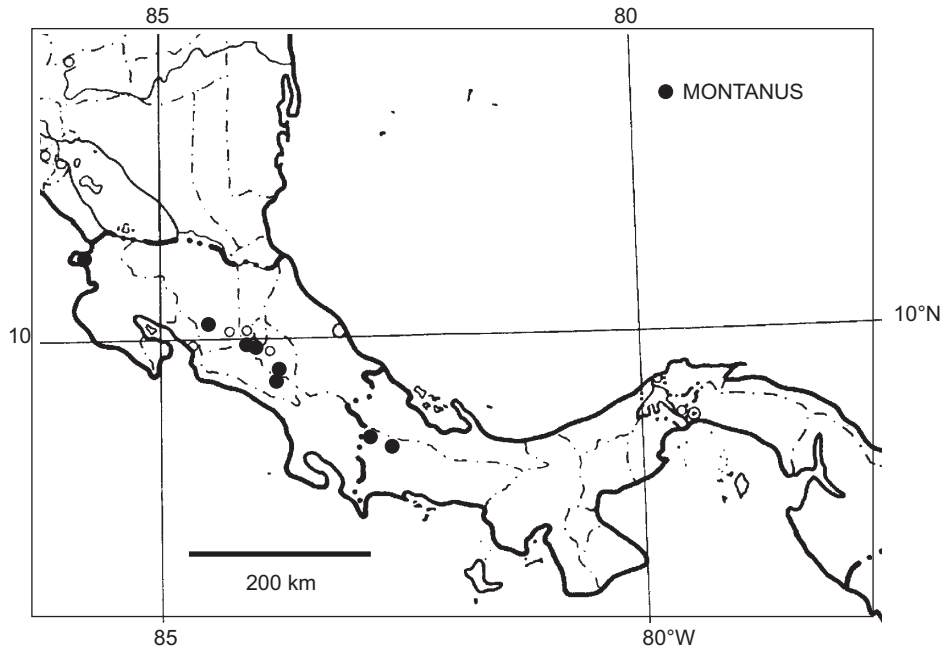
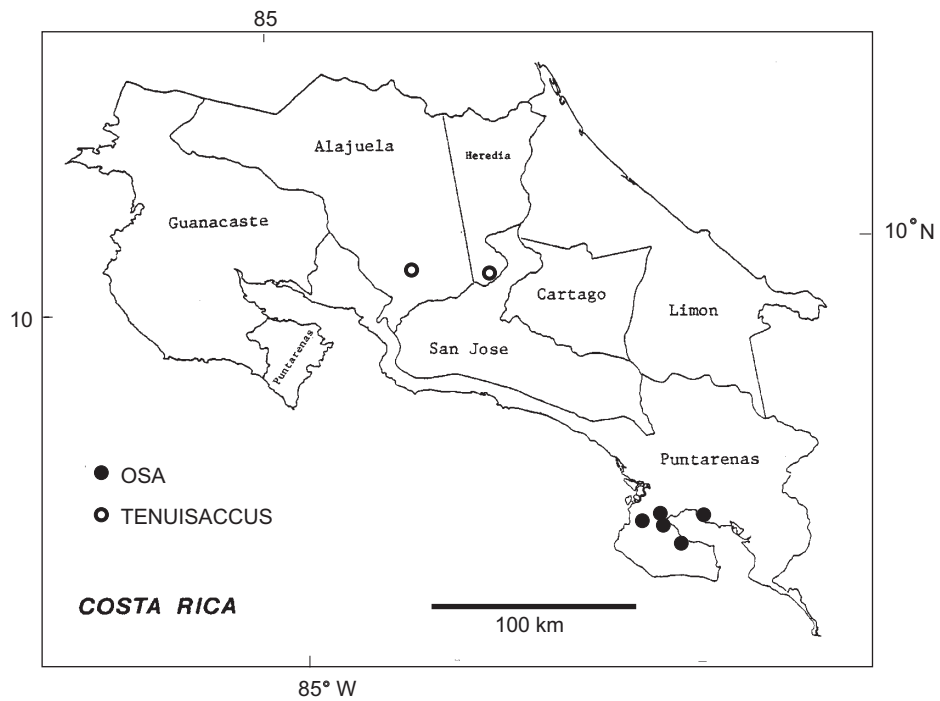


Fig. 77. Collection localities of *Eucatops (Eucatops) osa* and *E. (E.) tenuisaccus*.



segments; segment 8 short, width more than twice length; apical segment shorter than segments 9 + 10. Eyes not reduced. Metathoracic wings fully developed. Male mesofemur unmodified. Metafemur of major male (Fig. 62)

with a small, apically angled tooth on apical half of posterior margin. Metatrochanter unmodified. Aedeagus (Fig. 63) with median lobe rounded and weakly lobed apically; large sclerite of internal sac median in position.

Parameres (Fig. 63) short, widely separated, with apical setae. Male genital segment (Fig. 64) with median dorsal lobe short, triangular, enclosed by basal half of lateral lobes. Spermatheca (Fig. 65) narrowly U-shaped, with a short, coiled duct.

***Eucatops (Eucatops) tenuisaccus*
Peck et Cook, sp. nov.**

(Figs. 66–70, 77)

Type material

Holotype female in INBio. **COSTA RICA. Heredia Province.** Zurqui, 1600 m, 1–9.IX.1998, C.W. O'Brien, FIT. **Paratypes** (45). Same data; 44, SBPC. **Alajuela Province.** E.B. San Ramon, R.B. San Ramon, 27 km N & 8 km W San Ramon, 08°13'30"N, 84°35'30"W, 1050 m, 15.VI.1997, R. Anderson, wet pre-montane forest litter, 97–015E; 1, SBPC.

Etymology

The name *tenuisaccus* is from the Latin words *tenui* (thin) and *saccus* (sac) and refers to the slender spermatheca that characterizes this species.

Diagnostic description

Total length 2.2–2.9 mm; greatest width 1.5–1.8 mm. Antenna (Fig. 66) with segment 2 longer than segment 3; club shorter than six basal segments; apical segment shorter than segments 9 + 10; segment 8 wider than long. Eyes not reduced. Metathoracic wings fully developed. Mesofemur of major male unmodified. Metafemur of major male (Fig. 67) with three small teeth at middle of posterior margin. Metatrochanter of major male (Fig. 67) with elongate, curved tooth at apex. Aedeagus (Fig. 68) with median lobe curved ventrally, apex acute; large sclerite of internal sac curved to left. Parameres (Fig. 68) elongate, narrowly separated basally; with setae on inner margins and apically. Male genital segment (Fig. 69) with median dorsal lobe broadly rounded; lateral lobes broad dorsally. Spermatheca (Fig. 70) elongate, constricted medially.

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