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REDESCRIPTION OF TWO NEOTROPICAL SPECIES OF *TOXOPHORA* MEIGEN (DIPTERA, BOMBYLIIDAE, TOXOPHORINAE)

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ABSTRACT

Two Neotropical species of Toxophora Meigen, 1848 are redescribed (T. aurea Macquart, 1848 and T. leucon Séguéy, 1930) and the male terminalia, female spermathecae, and the eggs are described and illustrated. Both species can be easily segregated from the other congeners by the following features: T. leucon: body covered with dark brown scales, longitudinal stripe formed by yellow scales on center of mesonotum, scutellum and abdomen, and abdomen slender; T. aurea: antenna with short dark brown scales, body covered with yellow scales and spots of dark brown scales with greenish reflex, wings without inter-radial vein, femora with yellow scales and without setae on males, and abdomen stout.

KEYWORDS: *Eniconevra*, taxonomy, *Toxophora aurea*, *Toxophora leucon*, Toxophorini.

INTRODUCTION

Bombyliidae constitutes one of the largest families of Diptera, with more than 4,600 species known worldwide (Evenhuis & Greathead, 2003), divided into 15 subfamilies (Evenhuis & Greathead, 1999). One of these, the Toxophorinae, in which *Toxophora* Meigen is placed, includes three tribes: Toxophorini, Systropodini, and Gerontidini. The Toxophorini are characterized by a stout body with humped thorax, enlarged pronotum, ocellar tubercle with two large, anteriorly directed setae, elongated antenna, with the flagellum thin, flattened and with a long stylus, wings with three posterior cells, anal cell always closed and two or three submarginal cells, abdomen strongly

convex, wider than thorax on base and covered by dark brown scales, yellow or white scales forming different spots on the abdomen dorsum (d'Andretta & Carrera, 1950).

The tribe includes only *Toxophora*, with its 47 species distributed in all zoogeographical regions, 10 of them restricted to the Neotropical region, seven to the Nearctic, 18 to the Afrotropical, 14 to the Palearctic, one to the Oriental, and one to the Australasian/Oceanian (Evenhuis & Greathead, 1999).

The species redescribed in this paper, *T. aurea* Macquart, 1848 and *T. leucon* Séguéy, 1930, can be easily identified using the key of d'Andretta & Carrera (1950), mainly based on different patterns of abdominal scales disposition and coloration. However,

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the descriptions available in the literature for both of them are incomplete and lack many details of important morphological characters. *T. leucon* is known only by the original description, which is simple and does not include the male terminalia morphology. The present study aims to contribute to the knowledge of Toxophorini providing detailed morphological descriptions with characters that will be used in a future cladistic analysis of the tribe. This analysis aims to clarify the relationships between the species and also to verify the taxonomic status of *Eniconevra* Macquart, 1840, synonymized with *Toxophora* by Kertész (1909) without a justification.

RESULTS

Redescriptions

Toxophora aurea Macquart, 1848 (Figs. 1-8)

Toxophora aurea Macquart, 1848:197(37); Kertész, 1909:91; d'Andretta & Carrera, 1950:362; Hull, 1973:236; Painter & Painter, 1974:84; Painter *et al.*, 1978:20; Evenhuis & Greathead, 1999:70.

Toxophora aurifera Rondani, 1848:98; Kertész, 1909:91; d'Andretta & Carrera, 1950:357; Hull, 1973:236; Painter & Painter, 1974:84; Painter *et al.*, 1978:20; Evenhuis & Greathead, 1999:70.

Toxophora dryitis Séguy, 1930:532; Hull, 1973:236; Painter & Painter, 1974:84; Painter *et al.*, 1978:20; Evenhuis & Greathead, 1999:70.

Toxophora verona Curran, 1934:363; Hull, 1973:236; Painter & Painter, 1974:84; Painter *et al.*, 1978:20; Evenhuis & Greathead, 1999:70.

Male: Head: As wide as thorax; holoptic; frons gray pollinose; base of antennae with yellow scales; scape twice the length of the other two articles, covered by short dark brown scales and short white scales on ventral surface; pedicel with short dark brown scales, except on external surface, with nearly half the length of flagellum (Fig. 1); flagellum with short dark brown setae and long stylum; face white pollinose; proboscis dark-brown, long, with nearly twice the length of the head; palpus unisegmented, brown with short brown setae and length nearly half of proboscis; occiput gray pollinose with yellow hairs; ocellar tubercle with two strong dark brown setae directed forward.

Thorax: pronotum gray pollinose with seven pairs of strong dark brown setae, one median pair directed

backwards, one paramedian pair directed to the center, and five lateral pairs (Fig. 1); mesonotum dark brown with yellow hairs and strong dark brown setae on lateral margin, dark brown scales mainly on posterior region with greenish reflex; one pair of prescutellar setae; pleurae gray pollinose with yellow hairs on the anterior region of katepisternum and anepisternum, the last one with dark-brown setae on the postero-superior margin and row of dark brown setae on the superior margin, metepisternum with fine yellow hairs; rest of pleurae bare; halter with stem brownish-yellow and knob light yellow; scutellum with dark brown scales and greenish reflex, yellow pile and dark brown bristles on posterior margin.

Wings: costa with dark brown scales; hyaline surface with yellow to light brown infuscation on anterior half; r-m crossvein on apical third of discal cell; two submarginal cells; calypter with long yellow hairs.

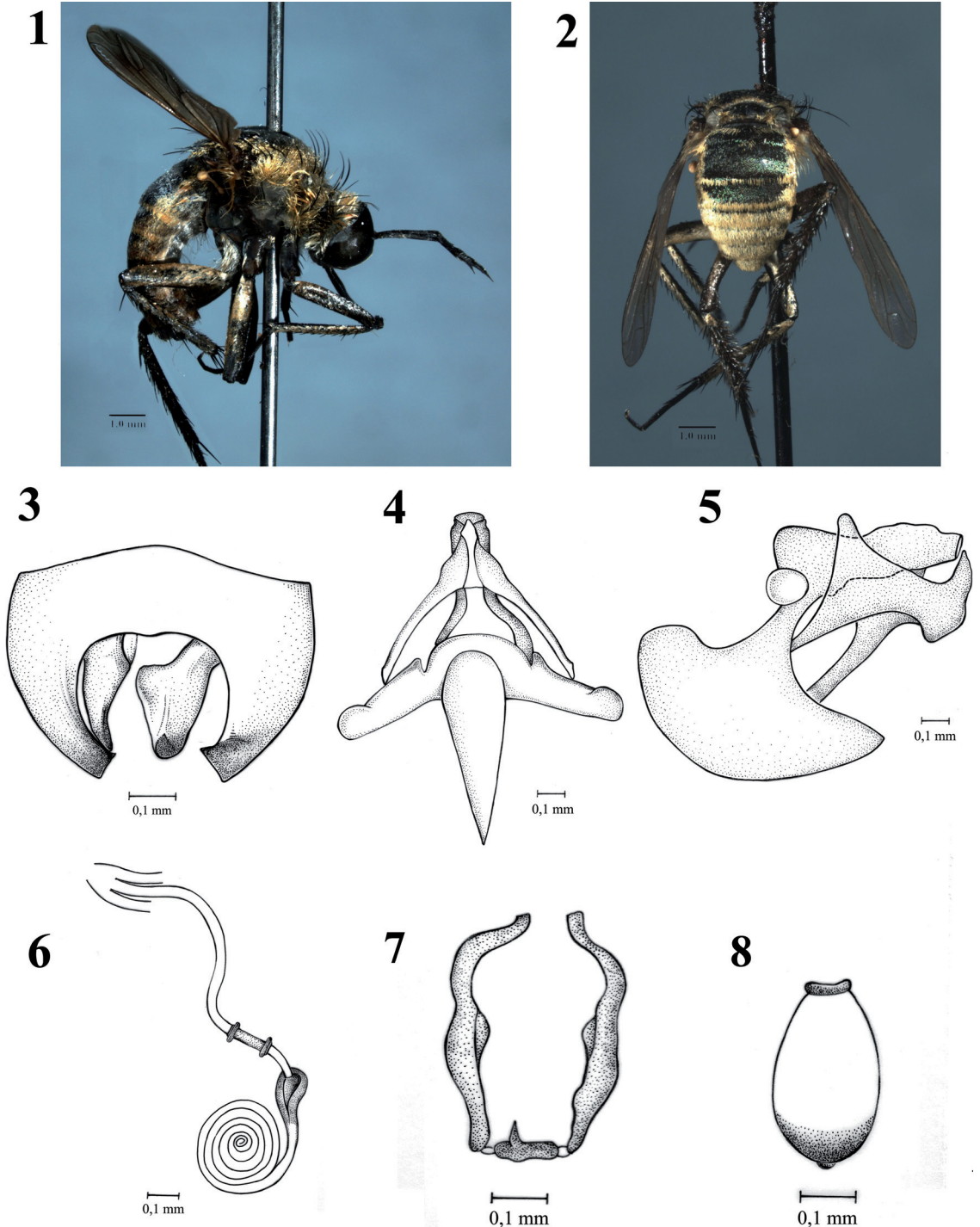
Legs: coxa I and II with white scales, coxa III with white scales, white pile and three long brown setae; trochanter II with three dark brown setae; femur I with dark brown scales and yellow scales on apex of posterior surface, femur II with dark brown scales on anterior surface and yellow on posterior, femur III with yellow scales on anterior surface and dark brown on posterior; tibia I and II with yellow scales on posterodorsal surface, tibia I with two parallel rows of setae on the dorsal surface and one setae on the base of the posterior surface, tibia II with a row of setae on dorsal surface alternating with long and short setae, tibia III with dark brown setae on all surfaces, yellow scales on the anterodorsal surface and dark brown on the posterodorsal; tarsi dark brown, with brown pile and dark brown bristles on ventral surface; pulvilli light brown with nearly the same length as claws.

Abdomen: stout; dark brown scales with greenish reflex; tergite I covered with dark brown scales and yellow scales laterally; tergite II with dark brown scales, yellow scales laterally and one spot on the basal center; tergite III-VI with dark brown scales on basal half; tergite VII with yellow scales and with a small stripe of dark brown scales on basal margin (Fig. 2); sternites I-VII with white scales and sparse yellow pile.

Genitalia: epandrium with posterior margin strongly concave (Fig. 3); hypandrium absent; gonocoxites fused, without median internal ridge; distiphallus with beak-like form, not surpassing apex of posterior process of gonocoxa; epiphallus wide with broad apex

(Figs. 4 and 5); gonostylus short with thin and pointed apex; lateral aedeagal apodema and ejaculatory apodema long, both surpassing gonocoxal limits.

Female: Similar to males, except for the following: dichoptic; trochanter without setae; tibia I and II with row of setae on posterior surface.



FIGURES 1-8: *Toxophora aurea* Macquart, 1848: (1) General habitus, lateral view; (2) Abdomen, dorsal view; (3) Epandrium, dorsal view; (4) Male terminalia, ventral view; (5) Male terminalia, lateral view; (6) Spermathecae; (7) Furca; (8) Egg.

Spermathecae: furca U-shaped with an anterior spine (Fig. 7). Spermathecal duct five times longer than sperm pump, sperm pump with well developed sclerotized collars, with indented margin. Spermathecal bulbs sclerotized, tubular and strongly coiled (Fig. 6).

Egg: oval form, 1.5 to 2.0 times longer than wide, with an operculum (Fig. 8).

Variation: In some specimens there are brownish-yellow scales on the base of antennae.

Examined material: BRAZIL: 17-VII-1928, 1 female (781), AM Parko col., n° de proc. 11/836 (MNRJ); *Amapá*: Porto Platon, 20-IX-1957, 2 females e 1 male (782), Campos collection, K. Lenko col (MNRJ), 21-IX-1957, 1 female, 18-IX-1957, 1 male, J Lane col. (MZUSP); *Amazonas*: Audes, VI-1948, 1 female (786), JCM Carvalho col. (MNRJ); Manaus, 27-IX-1955, 1 female (785), 30-XII-1955, 1 male (785), Ellias e Roppa col. (MNRJ); *Distrito Federal*: Brasília, I-1961, 1 female e 1 male (783), HS Lopes col. (MNRJ); *Mato Grosso*: Fazenda Murтинho, XII-1929, 1 female (778), R Spitz col., HS Lopes det. (MNRJ); Utiariti, Rio Papagaio, 7-VIII-1961, 1 male, K Lenko col. (MZUSP); *Pará*: Belém Utin-ga, VII-1936, 1 female (779), Almeida col., HS Lopes det. (MNRJ); Piratuba, Abaere, 1938, 1 female (784), Ceelva col. (MNRJ); Rio Acará, 23-VIII-1954, 2 females, N Cerqueira col. (1 MNRJ e 1 MZUSP); Urucurituba, 4-IV-?, 1 female (20.071), CHT Town-cend col. (MZUSP); *Rio de Janeiro*: Duque de Caxias, São Bento, I-1954 e 5-I-1955, 2 females, PA Teles col. (MZUSP); Petrópolis, Retiro Pedro Rio, 25-I-1957, 1 female, CA Campos Seabra col. (MZUSP); *São Paulo*: Araçatuba, Fazenda Jacareatinga, XI-1962, 1 male, Lane e Rabello col. (MZUSP); Castilho, left margin of Paraná river, X-1964, 1 female e 1 macho, Exp. Depto. Zool. (MZUSP); Onda Verde, Fazenda São João, I-1946, 1 male (20.080), F Lane col. (MZUSP); Porto cabral, Paraná river, 20-31-III-1944, 1 female e 1 male (20.069), Trav., Carrera e E Dente col. (MZUSP); Rio Claro, I-1941, 1 male (20.084), Pde. Pereira col. (MNRJ); Severínia, XII-1940, 1 female (20.076), AG Silva col. (MZUSP); PARAGUAY: Assuncion, XI-1943, 1 female (780), Mis. Cient. Brasil col. (MNRJ); SURINAME: Marowijine river, VII-1965, 1 male (7236), Cambridge Expedition, EAM Gale col. (MNRJ).

Distribution: Brazil: Acre, Amapá, Amazonas, Distrito Federal, Mato Grosso, Pará, Paraná, Rio de Janeiro,

Roraima, São Paulo; Guyana; French Guiana; Paraguay; Suriname.

Toxophora leucon Séguy, 1930
(Figs. 9-16)

Toxophora leucon Séguy, 1930:533; Painter & Painter, 1974:88; Painter *et al.* 1978:21; Evenhuis & Greathead, 1999:72.

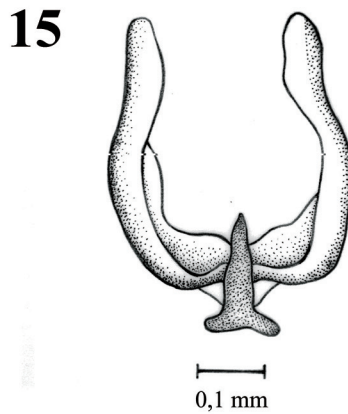
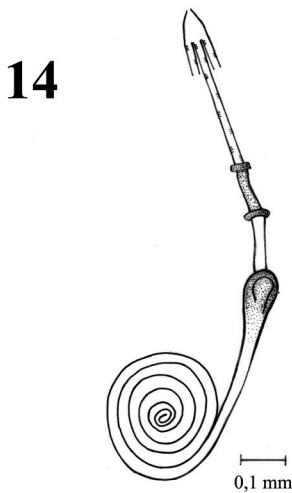
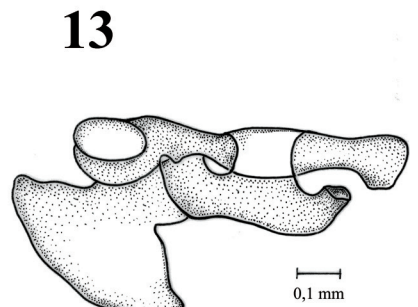
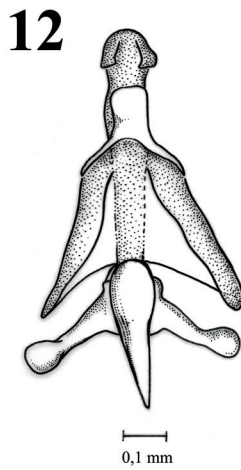
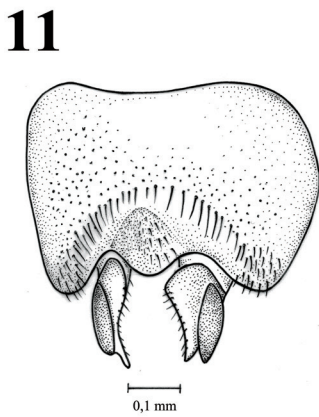
Eniconeura leucon: d'Andretta & Carrera, 1950:370, missp.

Toxophora (Eniconeura) leucon: Hull, 1973:236.

Male: Head: As wide as thorax; holoptic; frons gray pollinose; base of antennae with brown scales and brownish-yellow scales on laterals; scape twice the length of the two other segments, densely covered by dark brown and brown scales; pedicel with short dark brown scales on lateral and ventral surfaces, with nearly the same length of flagellum (Fig. 9); flagellum with short dark brown setae; face gray pollinose; proboscis dark-brown, long, with nearly twice the length of head; palpus unisegmented, brown with short brown setae and half of proboscis length; occiput gray pollinose, with brownish-yellow hairs and brown scales; ocellar tubercle with two strong dark brown setae directed forward.

Thorax: pronotum well developed with five pairs of strong dark brown setae, one median pair directed backwards, one paramedian pair directed to the center, and three lateral pairs (Fig. 9); mesonotum dark brown with brownish-yellow hairs and strong dark brown setae on lateral margin, brownish-yellow scales forming a longitudinal stripe on center; pleurae gray pollinose and with white scales on katapisternum and metepisternum; anepisternum with yellow scales, yellow pile, dark brown setae on the postero-superior margin and a row of yellow setae on superior margin; rest of pleurae bare; halter brownish-yellow; scutellum with brownish-yellow scales forming a longitudinal stripe on center, white scales and dark brown bristles on posterior margin.

Wings: costa with dark brown scales; hyaline surface with brown infuscation on anterior half and circular spots on R4 vein, base and apex of discal cell, r-m crossvein and apex of R2+3; inter-radial crossvein, merging R4 with R2+3; r-m crossvein on middle third of discal cell; three submarginal cells; calypter with long whitish-yellow hairs.



FIGURES 9-16: *Toxophora leucon* Séguy, 1930: (9) General habitus, lateral view; (10) Abdomen, dorsal view; (11) Epandrium, dorsal view; (12) Male terminalia, ventral view; (13) Male terminalia, lateral view; (14) Spermathecae; (15) Furca; (16) Egg.

Legs: coxa I and II with white scales, coxa III with white scales and three long brownish-yellow setae on dorsal surface; trochanter II with four dark brown setae; femur I and II with dark brown scales and brownish-yellow scales on anterior surface and white on posterior, femur II with a row of setae on the basal 2/3 of the ventral surface, femur III with white scales on anterior surface and dark brown on posterior, with three dark brown setae, two on the anteroventral surface and one on the posteroventral; tibia I and II with brownish-yellow scale on posterior and dorsal surfaces; tibia I with two parallel rows of setae on dorsal surface and one setae on the base of the posterior surface, tibia II with a row of setae on dorsal surface alternating with long and short setae, tibia III with long dark brown and brown scales and dark brown setae on all surfaces; tarsi dark brown, with brown pile and dark brown setae on ventral surface; pulvilli light brown with nearly the same length as claws.

Abdomen: covered with dark brown scales, except for brownish-yellow scales forming a longitudinal stripe on center of all tergites and white scales laterally (Fig. 10); sternites I-IV with white scales; sternites V-VII with dark brown scales, brownish-yellow on apex and white laterally.

Genitalia: epandrium with posterior margin concave (Fig. 11), with a small projection on center, fused to posterodorsal region of the gonocoxite; cercus with a group of short dark brown setae forming a spot on the lateral; hypandrium absent; gonocoxites fused, without median internal ridge; distiphallus shorter than epiphallus, wide and with broad apex pointing upwards; epiphallus with long base and apex wide with two long projections on lateroventral faces (Figs. 12 and 13); gonostylus short with thin and pointed apex; lateral aedeagal apodema and ejaculatory apodema long, both surpassing gonocoxal limits.

Female: similar to male, except for the following: dichoptic; trochanter without setae; lack of setae on femur III; tibia I and II with a row of setae on posterior surface.

Spermathecae: furca U-shaped with an anterior spine (Fig. 15). Spermathecal duct two and a half times longer than sperm pump; sperm pump with well developed sclerotized collars with indented margins. Spermathecal bulbs sclerotized, tubular and strongly coiled (Fig. 14).

Egg: oval form, 1.5 to 2.0 times longer than wide, with an operculum (Fig. 16).

Examined material: BRAZIL, *Mato Grosso:* Corumbá, 16-XI-1994, 1 male (7289), 1 female (7290), LF Gomes col., CJE Lamas det., (MNRJ); Corumbá, Serra do Urucum, 3-XII-1960, 2 females, 4-XII-1960, 1 female, K. Lenko col (MZUSP); *Pará:* Santarém, 9-IV-1956, 1 male (788), Elias e Roppa col. (MNRJ); *São Paulo:* Araçatuba, Córrego Azul, II-1946, 3 males e 4 females, Barreto col. (MZUSP).

Distribution: Argentina; Brazil: Mato Grosso, Pará, São Paulo; Bolivia; Paraguay.

DISCUSSION

d'Andretta & Carrera (1950), studying the Brazilian *Toxophoriinae*, redescribed the *Toxophora* species and described four species of *Eniconevra* (unjustified emendation of *Eniconevra* Macquart). They considered *Toxophora* and *Eniconevra* as valid genera and showed that differences between them were mainly related to the presence of an inter-radial vein on *Eniconevra* species. This particular character primarily seemed to be really important and strong enough to justify their segregation, but the study of species from other regions of the world revealed that only the three species placed by d'Andretta & Carrera (1950) among *Toxophora* (*T. aurea*, *T. cuprea* (Fabricius, 1787), and *T. pallida* d'Andretta & Carrera, 1950) do not have the inter-radial vein.

The species herein redescribed can be easily segregated by the following characters: *T. leucon* with antenna covered by long scales; body covered with dark brown scales and longitudinal stripe formed by yellow scales on center of mesonotum, scutellum and abdomen; anepisternum with a row of yellow setae; wings with an inter-radial vein; femora with white scales and dark brown setae on males; abdomen slender. *T. aurea* has antenna with short dark brown scales; body covered with yellow scales and spots of dark brown scales with greenish reflex; anepisternum with a row of dark brown scales; wings without inter-radial vein; femora with yellow scales and without setae on males; abdomen stout.

Besides these characters, the study of male terminalia revealed other important characters to segregate these species as the shape of epandrium, epiphallus and distiphallus. Yeates (1994) presented the character "epandrium fused to posterodorsal region of the gonocoxite" as a synapomorphy of *Toxophora*, based on the examination of *T. virgata* Osten Sacken, 1877 and *T. compta* Roberts, 1929, but this fusion was not observed in *T. aurea*. This character should be exam-

ined in other *Toxophora* species and tested, with cladistic analysis, if it is really a synapomorphy of the genus with a secondary loss in *T. aurea*.

RESUMO

Redescrição de duas espécies neotropicais de *Toxophora* Meigen (Diptera, Bombyliidae, Toxophorinae). Duas espécies de *Toxophora* Meigen, 1848 são redescritas (*T. aurea* Macquart, 1848 e *T. leucon* Séguy, 1930) e as terminálias masculinas, femininas e os ovos são aqui descritos e ilustrados. Ambas as espécies podem ser facilmente distintas pelas seguintes características: *T. leucon*: corpo coberto por escamas castanho-escuras, faixa longitudinal formada por escamas amarelas no centro do mesonoto, escutelo e abdômen e abdômen fino; *T. aurea*: antenas com escamas curtas castanho-escuras, corpo coberto por escamas amarelas e manchas de escamas castanho-escuras com reflexo esverdeado, asas sem a nervura inter-radial, fêmures com escamas amarelas e ausência de cerdas nos machos e abdômen largo.

PALAVRAS-CHAVE: *Eniconevra*, taxonomia, *Toxophora aurea*, *Toxophora leucon*, Toxophorini.

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