

**COMPARATIVE ANATOMY OF THE FEMALE GENITALIA OF
GENERIC-LEVEL TAXA IN TRIBE AEDINI (DIPTERA: CULICIDAE).
PART XXVII. GENUS *HOPKINSIUS* REINERT, HARBACH AND KITCHING**

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Abstract. A comparative, morphological analysis of the female genitalia of the genus *Hopkinsius* Reinert, Harbach and Kitching was conducted and a composite description is provided. The genitalia of the type species of the genus, *Hk. ingrami* (Edwards), are illustrated for the first time. *Hopkinsius* is divided into two subgenera, *Hopkinsius* and *Yamada* Reinert, Harbach and Kitching. Treatment of the genital morphology of each subgenus includes a description, detailed description of the type species, list of the species examined, list of published descriptions of included species with their literature citations, and a discussion. The discussion section contains a list of the most distinctive female genital features and a comparison of these with other aedine genera, and other pertinent information.

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INTRODUCTION

This is the twenty-seventh in a series of papers by the author that describe the female genitalia of the generic-level taxa included in tribe Aedini of family Culicidae. Part I of the series (Reinert 2000a) included an introduction to the series, a brief historical background of published papers dealing with the subject, preparation techniques and anatomical terminology, part II (Reinert 2000b) dealt with genus *Psorophora* Robineau-Desvoidy, part III (Reinert 2000c) with genus *Udaya* Thurman, part IV (Reinert 2000d) with genus *Zeugomyia* Leicester, part V (Reinert 2000e) with genus *Aedes* Meigen, part VI (Reinert 2001a) with genus *Ayurakitia* Thurman, part VII (Reinert 2001b) with genus *Opifex* Hutton, part VIII (Reinert 2001c) with genus *Verrallina* Theobald, part IX (Reinert 2001d) with genus *Eretmapodites* Theobald, part X (Reinert 2002a) with genus *Heizmannia* Ludlow, part XI (Reinert 2002b) with genus *Haemagogus* Williston, part XII (Reinert 2002c) with genus *Armigeres* Theobald, part XIII (Reinert 2002d) with genus *Ochlerotatus* Lynch Arribalzaga, part XIV (Reinert 2002e) provided a key to genera recognized at that time, part XV (Reinert 2008a) with genus *Georgecraigius* Reinert, Harbach and Kitching, part XVI (Reinert 2008b) with genus *Phagomyia* Theobald, part XVII (Reinert 2008c) with genus *Dahlia* Reinert, Harbach and Kitching, part XVIII (Reinert 2008d) with genus *Hulecoeteomyia* Theobald, part XIX (Reinert 2008e) with genus *Danielsia* Theobald, part XX (Reinert 2008f) with genus *Rampamyia* Reinert, Harbach and Kitching, part XXI (Reinert 2008g) with genus *Patmarksia* Reinert, Harbach and Kitching, part XXII (Reinert 2008h) with genus *Downsiomyia* Vargas, part XXIII (Reinert 2008i) with genus *Tanakaius* Reinert, Harbach and Kitching, part XXIV (Reinert 2008j) with genus *Vansomerenis* Reinert, Harbach and Kitching, part XXV (Reinert 2008k) with genus *Dobroworskyius* Reinert, Harbach and Kitching, and part XXVI (Reinert 2008l) with genus *Collessius* Reinert, Harbach and Kitching. Reinert et al. (2004, 2006, 2008) conducted phylogenetic analyses of tribe Aedini and revised the classification of generic-level taxa. This paper covers the female genitalia of genus *Hopkinsius* Reinert, Harbach and Kitching, which was originally described by Reinert et al. (2008).

A comparative, morphological analysis of the female genitalia of *Hopkinsius* species was conducted and a characterization is given for the genus and the two included subgenera, *Hopkinsius* and *Yamada* Reinert, Harbach and Kitching. The genitalia of the type species of the genus, *Hk. ingrami*, are illustrated for the first time. The format used for each subgenus includes a composite description, a detailed description of the type species, a list of the species examined, a list of published descriptions of species with their literature citations, and a discussion including the most distinctive features and other pertinent information.

MATERIALS AND METHODS

Female genitalia of genus *Hopkinsius* are considered here to include all structures caudad of abdominal segment VII. Segment VIII is included since its tergum and sternum are often modified in development and shape, and possess specialized setae.

Terminology used in the descriptions and illustration follows Reinert (2000a, 2008a) and the abbreviations used are found in the “List of Abbreviations Used in the Text and/or Figure” that precedes the figure. The morphological description is based on slide-mounted genitalia that were dissected from nonliving, dried females. Measurements and descriptions of female genital structures are based on specimens that were cleared, dissected, arranged in a dorsoventrally flattened position, and mounted in Canada balsam under glass cover slips on microscope slides. Ranges are based on the species (listed under “species examined” section) and the specimens that I have examined, therefore some variation may occur in species not seen. A phase contrast microscope was used because this was usually necessary to determine some structures, e.g., spermathecal eminence on the roof of the vagina. Measurements of structures (e.g., length and width of terga VIII and IX, sternum VIII, cercus, etc.) include only the pigmented and sclerotized areas and were made at 400X magnification using an ocular micrometer having a linear scale of 100 divisions that had been calibrated using a stage micrometer. The scale used in the illustration is in millimeters.

The method of preparation of specimens followed Reinert (2000a). During dissection of the genitalia extra care should be taken when separating the insula and lower vaginal lip from sternum VIII as the insula often breaks off and remains attached to the apical intersegmental membrane of the sternum. To avoid this condition the intersegmental membrane of sternum VIII can be separated from the apical margin of the sternum and mounted with the insula and lower vaginal lip.

FEMALE GENITALIA OF GENUS *HOPKINSIUS* REINERT, HARBACH AND KITCHING

Genus description. Segments VII and VIII. Laterally compressed; intersegmental membrane between VII-Te and VIII-Te relatively short. **Tergum VIII.** Width greater than length; covered with minute spicules; moderately to heavily pigmented; base nearly straight; apex broadly rounded; apical margin with several short and moderately long, slender setae; setae on distal 0.49-0.79; basal lateral seta present; numerous broad, dark and pale scales covering distal 0.68-0.94; VIII-Te index 0.68-0.91; VIII-Te/IX-Te index 2.50-3.55; length 0.20-0.37 mm; width 0.28-0.47 mm. **Sternum VIII.** Width greater than length; covered with minute spicules; moderately to heavily pigmented; base gently concave mesally; apex with small, median emargination separating pair of broadly rounded lobes; apical margin with several short setae and several slightly longer, nearly straight setae more or less evenly interspersed; numerous setae on distal 0.77-0.96; basal lateral seta absent; numerous broad dark and pale scales covering distal 0.81-0.93; VIII-S index 0.70-0.85; length 0.27-0.40 mm; width 0.32-0.51 mm. **Tergum IX.** Relatively moderately long; moderately wide; moderately pigmented; comprised of single sclerite with small to moderately deep, median emargination separating rounded lobes on apical margin; 2-8 short, slender setae apically on each lobe; 4-15 total setae; dorsal spheres present; IX-Te width/length ratio 1.30-2.15; length 0.08-0.12 mm; width 0.13-0.23 mm. **Insula.** Liplike; covered with short spicules; lightly pigmented; with 2 or 3 (usually 2) moderately long, slender setae laterally on each side; 4-6 total setae. **Lower vaginal lip.** Lightly pigmented; narrow, without lower vaginal sclerite. **Upper vaginal lip.** Moderately to heavily pigmented; narrow, median caudal area somewhat flattened, upper vaginal sclerite small to moderate in size. **Spermathecal eminence.** Membranous; ill-defined. **Postgenital lobe.** Covered with short spicules; moderately long; relatively broad; apex with minute to small, median emargination; few to several setae on distal 0.32-0.61 of ventral surface, one apicolateral seta long and equal to or longer than PGL ventral length; PGL ventral index 1.00-1.52; PGL ventral width/Ce dorsal width ratio 0.88-1.27; ventral length 0.08-0.12 mm.

Proctiger. With few to several scattered minute spicules; membranous. **Cercus.** Covered with minute to short spicules; moderately pigmented; relatively short; moderately wide; apical margin moderately rounded (somewhat broader in *Hk. ingrami*) with few short and 2 or 3 moderately long setae; setae on distal 0.46-0.75 of dorsal surface; normally with 1 or 2 (occasionally with 3) scales per cercus (some species occasionally without scales on one cercus); cercus index 2.16-2.43; Ce/dorsal PGL index 2.23-3.32; length 0.15-0.20 mm; width 0.06-0.09 mm. **Spermathecal capsules.** One large and 2 slightly smaller, spherical capsules; several small spermathecal capsule pores near orifice. **Accessory gland duct.** Basal area moderately to darkly pigmented, relatively short to moderately long.

Type species description (*Hk. ingrami*, Figure 1). **Tergum VIII.** Setae on distal 0.68-0.74; numerous broad scales on distal 0.69-0.80; VIII-Te index 0.87-0.91; length 0.24-0.33 mm; width 0.28-0.36 mm. **Sternum VIII.** Setae on distal 0.88-0.91; seta 1-S inserted distally some distance from base; numerous broad scales on distal 0.93; VIII-S index 0.70; length 0.29-0.37 mm; width 0.42 mm. **Tergum IX.** With 2-4 setae apically on each lateral lobe; 4-7 total setae; IX-Te width/length ratio 1.30-1.53; length 0.08-0.11 mm; width 0.13-0.15 mm. **Insula.** With 2 setae laterally on each side; 4 total setae. **Postgenital lobe.** Apex with very small, median emargination; setae on distal 0.32-0.49 of ventral surface; PGL ventral index 1.41-1.52; PGL ventral width/Ce dorsal width ratio 1.04-1.08; ventral length 0.10-0.11 mm. **Cercus.** Distal part wider than proximal part; dorsal surface with setae on distal 0.46-0.54; scales absent or with 2 or 3 scales per cercus; cercus index 2.35-2.38; length 0.15-0.16 mm; width 0.06-0.07 mm.

Discussion. The following combination of features is most distinctive for the female genitalia of species belonging to genus *Hopkinsius*. The postgenital lobe is moderately long, relatively broad, the apex has a minute to small, median emargination, and one apicolateral seta is long and equal to or longer than the ventral length of the postgenital lobe. Sternum VIII has the width greater than the length, the apical margin has a small, median emargination separating a pair of broadly rounded lobes which bear several short and several slightly longer, nearly straight setae that are more or less interspersed, and numerous broad scales cover the distal 0.81-0.93. The cercus is relatively short, moderately wide and normally bears one or two broad scales. Tergum VIII has the width greater than the length, the apex is broadly rounded and bears several short and moderately long setae, and numerous dark and pale, broad scales cover the distal 0.68-0.94.

When compared to other generic-level taxa of Aedini with a liplike insula with setae in lateral patches, the female genitalia of genus *Hopkinsius* are somewhat similar to those of *Bruceharrisonius* Reinert and *Jarnellius* Reinert, Harbach and Kitching in the relatively short and moderately wide cercus (especially those of subgenus *Yamada*). The moderately long, relatively broad postgenital lobe with a minute to small, median, apical emargination and with one of the apicolateral setae long and equal to or longer than the ventral length of the postgenital lobe is somewhat similar to those of *Bruceharrisonius*, *Georgecraigius*, *Jarnellius* and some species of *Ochlerotatus*. Tergum VIII and sternum VIII densely covered with broad scales are also present in *Bruceharrisonius*, *Georgecraigius* and some species of *Ochlerotatus*. The female genitalia of *Hopkinsius* can be distinguished from the above genera by the shape of the apical margin of sternum VIII and a combination of other features.

Female genitalia of the two subgenera, *Hopkinsius* and *Yamada*, of genus *Hopkinsius* are described below.

Reinert et al. (2008) provided a brief description of the female genitalia and a description of all stages of this genus and both subgenera.

FEMALE GENITALIA OF *HOPKINSIUS* SUBGENERASUBGENUS *HOPKINSIUS* REINERT, HARBACH AND KITCHING

Subgenus description. *Tergum VIII.* Setae on distal 0.49-0.74; scales on distal 0.69-0.88; VIII-Te index 0.68-0.91; VIII-Te/IX-Te index 2.84-3.55; length 0.24-0.37 mm; width 0.28-0.47 mm. *Sternum VIII.* Setae on distal 0.83-0.96; numerous broad scales on distal 0.84-0.93; length 0.29-0.40; width 0.42-0.51 mm; VIII-S index 0.70-0.80. *Tergum IX.* With 2-7 setae on each apical lobe; 4-13 total setae; IX-Te width/length ratio 1.30-2.15; length 0.08-0.10 mm; width 0.13-0.23 mm. *Insula.* With 2 setae laterally on each side, 4 total setae. *Postgenital lobe.* Width of proximal 0.50 slightly narrower than width of distal 0.50; PGL ventral index 1.00-1.52; PGL ventral width/Ce dorsal width ratio 0.97-1.27; ventral length 0.10-0.12 mm. *Cercus.* Distal 0.30 wider than proximal 0.30; normally with 1-3 broad scales per cercus (rarely without scales on one cercus); length 0.15-0.20 mm; width 0.06-0.09 mm.

Type species description (*Hk. ingrami* (Edwards)). See above under genus.

Discussion. The form of the cercus, i.e., the distal 0.30 is wider than the proximal 0.30 and middle 0.30, is the most distinctive feature of the female genitalia of subgenus *Hopkinsius*.

Species examined. *Hopkinsius barnardi* (Edwards), *Hk. embuensis* (Edwards), *Hk. ingrami* and *Hk. nyasae* (Edwards).

Published descriptions of female genitalia. *Hopkinsius embuensis*: Reinert et al. (2006), (2008); *Hk. ingrami*: Reinert et al. (2006), (2008).

SUBGENUS *YAMADA* REINERT, HARBACH AND KITCHING

Subgenus description. *Tergum VIII.* Setae on distal 0.55-0.79; scales on distal 0.68-0.94; VIII-Te index 0.70-0.84; VIII-Te/IX-Te index 2.50-3.05; length 0.20-0.29 mm; width 0.29-0.37 mm. *Sternum VIII.* Setae on distal 0.77-0.87; numerous broad scales on distal 0.81-0.88; VIII-S index 0.79-0.85; length 0.27-0.32 mm; width 0.32-0.40 mm. *Tergum IX.* With 2-8 setae on each apical lobe, 5-15 total setae; IX-Te width/length ratio 1.73-1.86; length 0.08-0.10 mm; width 0.14-0.18 mm. *Insula.* With 2 or 3 setae laterally on each side; 4-6 total setae. *Postgenital lobe.* PGL ventral index 1.32-1.40; PGL ventral width/Ce dorsal width ratio 0.88-1.09; ventral length 0.08-0.10 mm. *Cercus.* Proximal 0.30 approximately same width as distal 0.30, both narrower than middle 0.30; length 0.15-0.19 mm; width 0.07-0.08 mm.

Type species description (*Hk. seoulensis* (Yamada)). *Tergum VIII.* Setae on distal 0.70; numerous broad scales on distal 0.68; VIII-Te index 0.71; length 0.26 mm; width 0.37 mm. *Sternum VIII.* Setae on distal 0.85; numerous broad scales on distal 0.81; VIII-S index 0.80; length 0.32 mm; width 0.40 mm. *Tergum IX.* With 7 or 8 setae apically on each lateral lobe; 15 total setae; IX-Te width/length ratio 1.73; length 0.10 mm; width 0.18 mm. *Insula.* With 2 setae laterally on each side; 4 total setae. *Postgenital lobe.* Setae on distal 0.38 of ventral surface; PGL ventral index 1.40; PGL ventral width/Ce dorsal width ratio 1.00; ventral length 0.11 mm. *Cercus.* Dorsal surface with setae on distal 0.75; 1 or 2 broad scales per cercus; cercus index 2.43; length 0.19 mm; width 0.08 mm.

Discussion. The form of the cercus, i.e., the proximal 0.30 is approximately the same width as the distal 0.30 and the middle 0.30 is wider than both the distal and proximal areas, is the most distinctive feature of the female genitalia of subgenus *Yamada*.

Species examined. *Hopkinsius albocinctus* (Barraud) and *Hk. seoulensis*.

Published descriptions of female genitalia. *Hopkinsius albocinctus*: Reinert et al. (2006), (2008); and *Hk. seoulensis*: Reinert et al. (2006), (2008).

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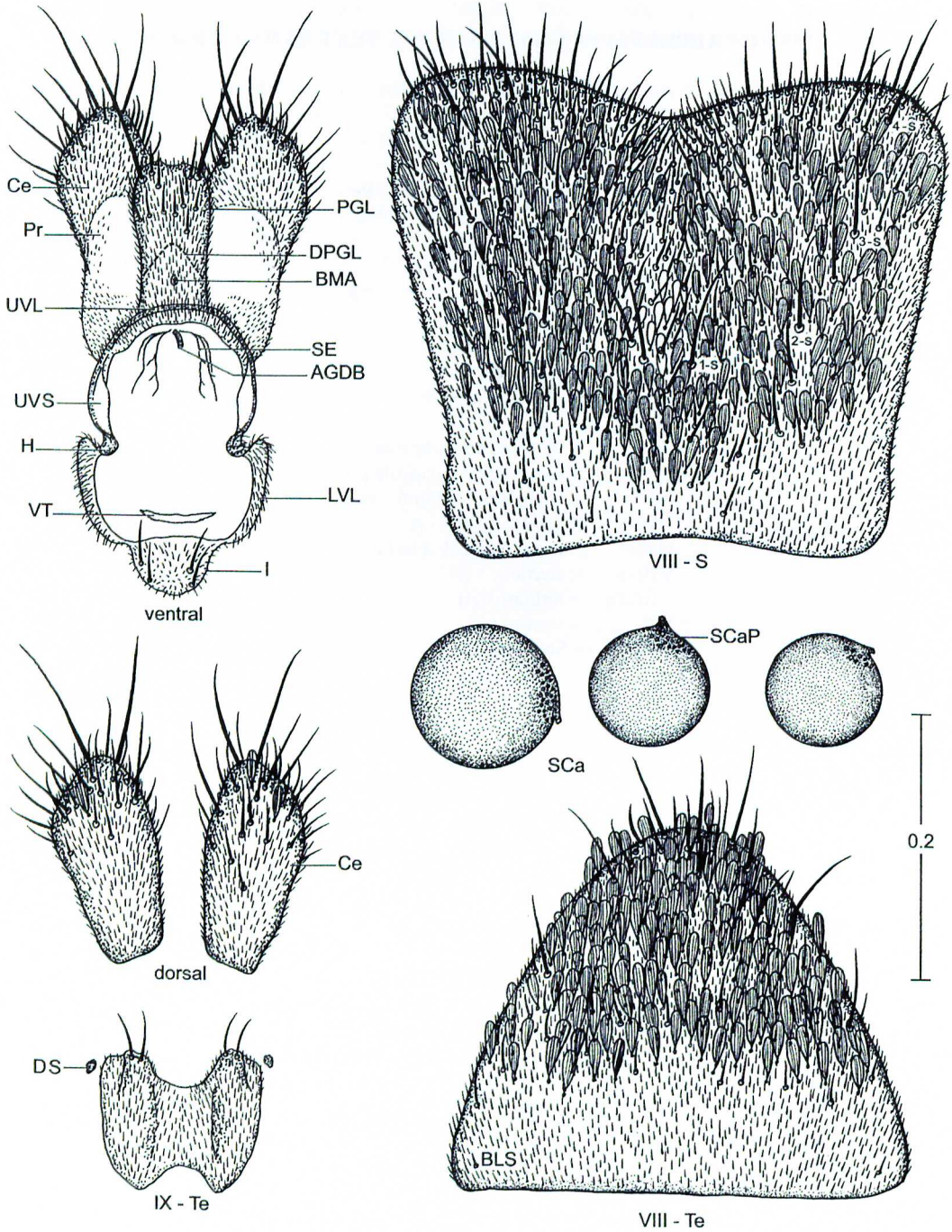
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FIGURE 1. FEMALE GENITALIA OF *HOPKINSIUS INGRAMI*

LIST OF ABBREVIATIONS USED IN THE TEXT AND/OR FIGURE

AGDB	= accessory gland duct base
BLS	= basal lateral seta
BMA	= basal mesal apodeme
Ce	= cercus
DPGL	= line of attachment of Pr to dorsal surface of PGL
DS	= dorsal sphere
H	= hinge
I	= insula
IX-Te	= tergum IX
LVL	= lower vaginal lip
mm	= millimeter
PGL	= postgenital lobe
Pr	= proctiger
SCa	= spermathecal capsule
SCaP	= spermathecal capsule pore
SE	= spermathecal eminence
UVL	= upper vaginal lip
UVS	= upper vaginal sclerite
VIII-S	= sternum VIII
VIII-Te	= tergum VIII
VT	= ventral tuft
1-4-S	= Seta 1-4-S

Fig. 1



Hopkinsius ingrami

SYSTEMATIC INDEX

Valid generic and specific taxa are italicized, other taxa are in Roman type. Boldface page numbers are those which began the primary treatment of the taxon.

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<i>Ayurakitia</i>	2
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<i>Danielsia</i>	2
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<i>Dobrotworskyius</i>	2
<i>Downsiomyia</i>	2
<i>embuensis</i>	5
<i>Eretmapodites</i>	2
<i>Georgecraigius</i>	2, 4
<i>Haemagogus</i>	2
<i>Heizmannia</i>	2
<i>Hopkinsius</i>	1, 2, 3, 4, 5, 6, 9, 10
<i>Hulecoeteomyia</i>	2
<i>ingrami</i>	1, 2, 4, 5
<i>Jarnellius</i>	4
<i>Ochlerotatus</i>	2, 4
<i>Opifex</i>	2
<i>nyasae</i>	5
<i>Patmarksia</i>	2
<i>Phagomyia</i>	2
<i>Psorophora</i>	2
<i>Rampamyia</i>	2
<i>seoulensis</i>	5, 6
<i>Tanakaius</i>	2
<i>Udaya</i>	2
<i>Vansomerenis</i>	2
<i>Verrallina</i>	2
<i>Yamada</i>	1, 2, 4, 5
<i>Zeugnomyia</i>	2