

A Concise Guide to the Bionomics and Key Morphological Characteristics for Identifying *Culex coronator* (Dyar & Knab, 1906)—an Invasive Mosquito Species from the Neotropics¹

Ana L. Romero-Weaver, Lawrence E. Reeves, Michael T. Riles, Yoosook Lee, and Bryan V. Giordano²

Abstract

Culex coronator Dyar and Knab is a highly invasive Neotropical species, first described at the beginning of the 20th century in Trinidad and Tobago (Dyar and Knab 1906). This is an important invasive species in Florida, that needs to be carefully surveilled by mosquito control experts. This publication is structured like those from Walter Reed Biosystematics Unit (WRBU; <https://www.wrbu.si.edu/>) so that readers can obtain a similar level of detail to that offered through WRBU species pages, which are widely used by anyone interested in mosquito biology, research, and education.

Intended Audience and Purpose

This is the general species information page of *Culex coronator* for mosquito control professionals, students, scientists, and the general public. This publication is structured like those from Walter Reed Biosystematics Unit (WRBU) so that readers can obtain a similar level of detail offered through WRBU species pages, which are widely used by anyone interested in mosquito biology, research, and education.

Neotropical Region (Nearctic Region) and Part of the United States

[Global Invasive]

Family: Culicidae

Subfamily: Culicinae

Tribe: Culicini

Genus: *Culex*

Subgenus: *Culex*

Group: *coronator*

Brief Species Description

Culex coronator Dyar and Knab is a neotropical species that has been introduced to Florida and the southeastern United States. The species was first described at the beginning of the 20th century in Trinidad and Tobago (Dyar and Knab

1. This document is ENY-2093, one of a series of the Entomology and Nematology Department, UF/IFAS Extension. Original publication date March 2023. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication.
2. Ana L. Romero-Weaver, technician; Lawrence E. Reeves, assistant professor, Entomology and Nematology Department; UF/IFAS Florida Medical Entomology Laboratory; Michael T. Riles, mosquito control profession, Central Life Sciences; Yoosook Lee, assistant professor, Entomology and Nematology Department, UF/IFAS Florida Medical Entomology Laboratory; and Bryan V. Giordano, mosquito control professional, Broward County Mosquito Control Division; UF/IFAS Extension, Gainesville, Florida 32611.

1906). *Culex coronator* is the nominate member of the *Culex coronator* complex, a group of five cryptic sibling species. The *Culex coronator* complex includes *Culex coronator s.s.*, *Culex camposi* Dyar, *Culex ousqua* Dyar, *Culex usquatissimus* Dyar, and *Culex usquatus* Dyar (Bram 1967). All species of the *Culex coronator* complex have a prominent crown of spines close to the apex. These species are distributed across much of the Neotropics (Bram 1967; Wilke et al. 2020). They have expanded their distribution to most of the Americas where they can occur in sympatry. The sibling species can only be differentiated by characteristics of the male genitalia, while females and immature stages are morphologically indistinguishable (Laurito et al. 2018; Demari-Silva et al. 2017). Recent morphological and molecular evidence suggests that these five species are synonyms of *Culex coronator*, rather than five distinct species, and they represent a single polymorphic species (Laurito et al. 2018). *Culex coronator*, in its native range, has been infected with St. Louis encephalitis virus (Anderson et al. 1957) and Venezuelan equine encephalitis virus (Burguete et al. 1973). Recently Zika virus has been detected in the saliva of wild-caught females of this species (Elizondo-Quiroga et al. 2018). However, its role in the transmission of these viruses to humans is unknown.

Type Locality

Trinidad and Tobago

Etymology

Culex from Latin (gnat, mosquito)

coronator, Dyar and Knab 1906: *coroner* = “crown” in Latin; informal name: “crowned Trinbagonian typical mosquito” (Wilkerson et al. 2021)

coronator subspecies: *mooseri* Vargas & Martínez Palacios 1954 (Bram 1967); synonymous with *coronator* (Wilkerson et al. 2021)

camposi Dyar, 1925: *campo* – “field” in Portuguese; informal name: “campos Ecuadorian typical mosquito” (Wilkerson et al. 2021)

ousqua Dyar, 1918: squalid/foul/filthy in Portuguese; *ousia* = “lively” in Latin; Informal Name: “Lively Panamanian Typical Mosquito” (Wilkerson et al. 2021)

ousqua subspecies *albertoi* Anduze 1943; synonymous with *ousqua* (Wilkerson et al. 2021)

usquatissimus, Dyar 1922: most ancient or old in Portuguese; Informal name: “Large Panamanian Typical Mosquito” (Wilkerson et al. 2021)

usquatus, Dyar 1922: whiskey/aged; Informal Name: “Whiskey Surinamese Typical Mosquito” (Wilkerson et al. 2021)

Type Depository

Global Biodiversity Information Facility (Copenhagen, Denmark). Available at: <https://www.gbif.org/species/1653144> (Bánki et al. 2021)

National Ecology Observatory Network (NEON) Biorepository Data Portal (Arizona State University, USA). Available at: <https://biorepo.neonscience.org/portal/>

National University of Cordoba, Cordoba Argentina

Diagnostic Characters

Adult

Culex coronator is a medium-sized mosquito. The adults are a drab, brownish color (Figure 1). The mesonotum is brown and lacks ornamentation. Much of the body is covered with brown, black, or pale white scales. The presence of obvious pale bands on the hind tarsi of the adult male and female is a notable morphological character, and in Florida, *Culex coronator* adults can be distinguished from other *Culex* subgenus *Culex* species by the presence of these bands and absence of a complete ring of pale scales on the proboscis, although they may have a pale patch on the underside. *Culex coronator* is somewhat variable in its morphological appearance and coloration. In Florida, the only other *Culex* subgenus *Culex* species with apparent bands of pale scales on the hind tarsi are *Culex bahamensis* and *Culex tarsalis*. *Culex bahamensis* occurs only in the far southern Florida Peninsula and the Florida Keys, while *Culex tarsalis* has been recorded at scattered locations across Florida but is very rare in the state. Both *Culex bahamensis* and *Culex tarsalis* have a complete ring of pale scales on the proboscis, and this character distinguishes them from *Culex coronator*.

Head

Head with dark erect forked scales dorsally. Occiput with narrow golden scales and bordered with a patch of broad white scales laterally (Figure 2). As in most mosquitoes, the antennae of the male are substantially larger and bushier than those of the female.



Figure 1. *Culex coronator*.
Credits: L. E. Reeves, UF/IFAS



Figure 2. Head and thorax of a *Culex coronator* female.
Credits: L. E. Reeves, UF/IFAS

Palpus

Palpus without pale scales. The palps of the female are short and entirely dark-scaled (Figure 2).

Proboscis

The proboscis is mostly covered in dark scales with a ventral median area of pale scales that does not form a complete ring; costal and subcostal (Figure 2).

Thorax

The integument of the thorax is brown. The scutum is covered with narrow, golden-brown scales. The mesepimeron and meskatepisternum have small patches of white scales, and, in most specimens, patches of brown integument darker than the background color of the integument above or below the patches of white scales.

Legs

The hind tarsomeres are ringed with distinct white bands (Figure 3). The white bands are both basal and apical bands, connecting where the tarsomeres meet.

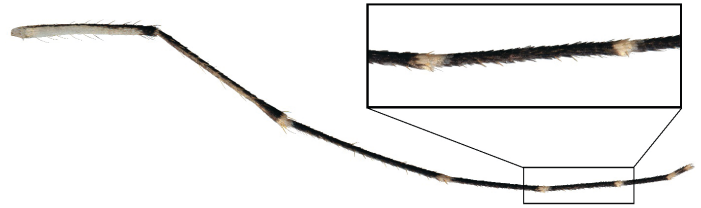


Figure 3. A leg of *Culex coronator*; inset showing a closeup of the tarsal bands.

Credits: L. E. Reeves, UF/IFAS

Abdomen

Dorsally, the abdomen is covered in black and white scales (Figure 1). White scales form conspicuous basal bands across each tergite that broaden laterally to form lateral patches of pale scales. The sterna are mostly white, though there is some variability in the extent of patterning with darker scales. The abdomen is black with basal white or pale bands of scales; abdominal sterna without dark triangles.

Wings

The veins of the wings of *Culex coronator* are covered in narrow, dark scales, typical of species of *Culex* subgenus *Culex*; costal and subcostal veins, dark scaled. Wing characteristics are not needed to key out this species (Figure 4).



Figure 4. *Culex coronator* wing.
Credits: A. L. Romero-Weaver, UF/IFAS

Larva

Antennal tuft located in a constriction near the outer third; antennal shaft spiculate basally (Figure 5A).

Head hair, the upper in four or five, the lower in three or four (Figure 5B).

Postclypeal head hair 4 short, single; upper and lower frontal head hairs 5 and 6 long, three or four branched, and barbed; preantennal head hair 7 long, multiple, and barbed.

Mentum with about 15 teeth; the apical tooth is broader and longer than the lateral teeth.

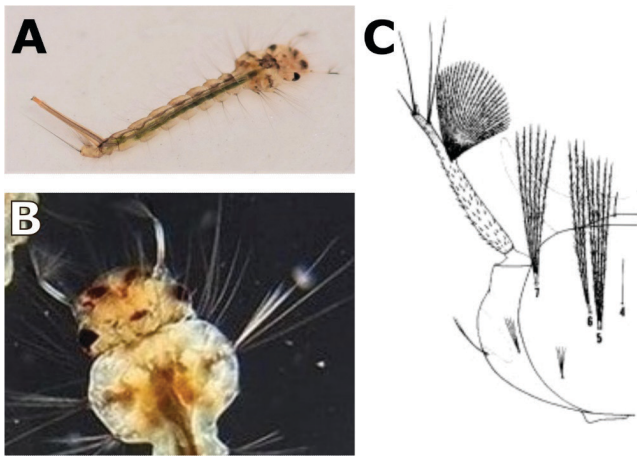


Figure 5. A) *Culex coronator* larvae, whole body; B) *Culex coronator* head and thorax of larvae; C) Illustration of *Culex coronator* head. Credits: A) Emmanuel Rodriguez Rojas, National Technological University, Alajuela Costa Rica; B) Walter Ishikawa; C) Carpenter and LaCrosse (1955)

Thorax spiculate. Comb with many scales in a patch; each scale rounded apically and fringed with subequal spinules.

Anal segment spiculate, completely ringed by the saddle, moderate gills.

Siphon long and thin, siphonal index 8.0 to 9.0; four double siphonal tufts inserted on the siphon beyond the pecten; a crown of prominent spines is present before the apex of the siphon of most specimens, with some variability.

Pecten with 8 to 14 teeth on the basal fourth of the siphon; each tooth with two to five coarse barbs on one side. The saddle on segment X with distinct spicules on the posterolateral margins (Figure 6).

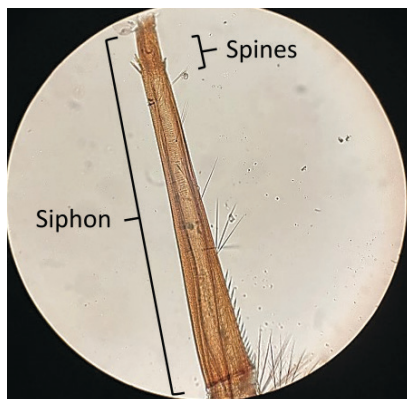


Figure 6. Shown here a crown of prominent spines before the siphon apex of *Culex coronator*.

Credits: Michael T. Riles, used with permission

Taxonomic Keys

Dyar and Knab 1906

Bram 1967

Clark-Gil and Darsie 1983

Darsie and Ward 2005

Harrison et al 2016

Laurito et al. 2018

Exemplar DNA Sequences

TAXONOMY ID 526217

Genbank ID: MF040162.1 (*Culex coronator* isolate RS10_109 mitochondrion, complete genome; source = Rio Grande do Sul, Brazil)

Bionomics

Immatures

Culex coronator females lay rafts of eggs in diverse natural and artificial microhabitats including swales, roadside ditches, animal water troughs, forest ponds, and rock pools (Dyar and Knab 1906; Goddard et al. 2006; Varando et al. 2012). Artificial water-holding containers including trash cans and car tires have also been reported as larval habitats (Yee et al. 2012)

Adults

Culex coronator can be found in sylvatic, rural, urban, domestic, and suburban habitats. Females of this species are predominantly nocturnal, and blood feed primarily upon large mammals such as white-tailed deer and horses (Almiron and Brewer 1995; Reyes-Villanueva et al. 2006) although they can also blood feed from birds (Mackay et al. 2008). They are low anthropophilic (Carpenter and Lacasse 1955; Consoli and Lourenco-de-Oliveira 1994).

Associated Pathogens

Culex Flavivirus (Miranda et al. 2019)

Ilheus virus (unpublished data reported in Turell et al. 2005)

St Louis encephalitis virus (Aitken et al. 1964; Turell et al. 2005)

Venezuelan equine encephalitis virus (Burguete et al. 1973)

West Nile virus (Mackay 2007; Kelly et al. 2008; Unlu et al. 2010)

Zika virus (Elizondo-Quiroga et al. 2018)

DISTRIBUTION NOTES (Bram 1967; Sames et al. 2021)

Culex coronator is native to Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Chile, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, United States, Uruguay, and Venezuela (Figure 7). Between the 1920s and 1970s, *Culex coronator* was reported from several states in the western and central United States (Arizona, New Mexico, Louisiana, Mississippi, Oklahoma, and Texas). In the early 2000s, the species expanded its United States distribution eastward, and in 2000s and 2010s, it was reported for the first time as far east as Florida and Virginia (Sames et al. 2021).



Figure 7. *Culex coronator* distribution.
Credits: UF/IFAS

Available GIS Models

None as of December 2021.

Current Synonyms

Culex camposi, *Culex ousqua*, *Culex usquatissimus*, *Culex usquatatus*

Funding

We acknowledge funding support of the Southern IPM Center (Project S21-002) as part of USDA National Institute of Food and Agriculture Crop Protection and Pest Management Regional Coordination Program (Agreement No. 2018-70006-28884).

Conflict of Interest

The authors declare no conflict of interest. The funders had no role in the writing of the manuscript, or in the decision to publish.

Cited References

- Aitken THG, Downs WG, Spence L, Jonkers AH. 1964. St. Louis Encephalitis Virus Isolations in Trinidad, West Indies, 1953–1962. *American Journal of Tropical Medicine and Hygiene* 13: 450–451. <https://doi.org/10.4269/ajtmh.1964.13.450>
- Almiron WR, Brewer MM. 1995. “Host preferences of Culicidae (Diptera) collected in central Argentina.” *Revista de Saúde Pública* 29:108–114. <https://doi.org/10.1590/S0034-89101995000200004>
- Anderson CR, Aitken TH, Downs WG, Spence L. 1957. “The isolation of St. Louis virus from Trinidad mosquitoes.” *American Journal of Tropical Medicine and Hygiene* 6:688–692. <https://doi.org/10.4269/ajtmh.1957.6.688>
- Anduze PJ. 1943. “Estudios de Entomología Medica en el Estado Merida-Venezuela”. *Boletín de Entomología venezolana*, 2(4).
- Bánki O, Roskov Y, Vandepitte L, DeWalt RE, Remsen D, Schalk P, Orrell T, Keping M, Miller J, Aalbu R, Adlard R, Adriaenssens E, Aedo C, Aesch E, Akkari N, Alonso-Zarazaga MA, Alvarez B, Alvarez F, Anderson G, et al. 2021. “*Culex coronator* Dyar & Knab, 1906.” in Catalogue of Life Checklist (Version 2021-08-25). *Catalogue of Life*. <https://doi.org/10.48580/d4sg> (accessed on 26 October 2021).
- Bram R. 1967. “Classification of *Culex* subgenus *Culex* (Diptera: Culicidae)”. *Proceedings of the United States National Museum* 120:1–123. Available at: https://repository.si.edu/bitstream/handle/10088/16935/1/US-NMP-120_3557_1967.pdf (accessed on 25 October 2021) <https://doi.org/10.5479/si.00963801.120-3557.1>
- Burguete J, Romero-Acevedo S, Salido RF, Pierce EP. 1973. “Epizootic and epidemic of Venezuelan equine encephalitis in the state of Morelos.” *Salud Pública de México* 15:231–235.
- Carpenter SJ, LaCasse WJ. 1955. “Mosquitoes of North America (North of Mexico).” Berkeley, CA: University of California Press. <https://doi.org/10.1525/9780520325098>
- Clark-Gil S, Jr. Darsie RF. 1983. “The mosquitoes of Guatemala, their identification, distribution and bionomics, with keys to adult females and larvae, in English and Spanish.” *Mosquito Systematics* 15:151–284. https://www.biodiversity-library.org/content/part/JAMCA/MS_V15_N3_P151-284.pdf

- Consoli RAGB, Lourenço-de-Oliveira R. 1994. "Principais mosquitos de importância sanitária no Brasil." Editora Fiocruz, Rio de Janeiro. *Brasil Press* 97–114. <https://doi.org/10.7476/9788575412909>
- Demari-Silva B, Multini LC, Suesdek L, Oliveira TMP, Salum MAM, Marrelli MT. "Wing Morphometry and genetic variability between *Culex coronator* and *Culex usquatus* (Diptera: Culicidae), two sibling species of the *coronator* group." *Journal of Medical Entomology* 54:901–908. <https://doi.org/10.1093/jme/tjx033>
- Dyar HG, Knab F. 1906. "The larvae of mosquitoes classified as independent organisms." *Journal of the New York Entomological Society* 14:169–230.
- Dyar HG, Knab F. 1918. "New American mosquitoes." *Insector Inscitiae Menstruus*, 6(7–9), pp.120–129. <https://doi.org/10.5962/bhl.part.14938>
- Dyar HG. 1922. "Mosquito notes (Diptera, Culicidae)." *Insector Inscitiae Menstruus*. 10(4–6), 92–99.
- Dyar HG. 1925. "Some mosquitoes from Ecuador (Diptera, Culicidae)." *Insector Inscitiae Menstruus*. 13:27–31.
- Elizondo-Quiroga D, Medina-Sánchez A, Sánchez-González JM, Eckert KA, Villalobos-Sánchez E, Navarro-Zúñiga AR, Sánchez-Tejeda G, Correa-Morales F, González-Acosta C, Arias CF, López S, Del Ángel RM, Pando-Robles V, Elizondo-Quiroga AE. 2018. "Zika Virus in Salivary Glands of Five Different Species of Wild-Caught Mosquitoes from Mexico." *Scientific Reports*. 8:809–815. <https://doi.org/10.1038/s41598-017-18682-3>
- Goddard J, Varnado WC, Harrison BA. 2006. "Notes on the ecology of *Culex coronator* Dyar and Knab in Mississippi." *Journal of the American Mosquito Control Association*. 22:622–625. [https://doi.org/10.2987/8756-971X\(2006\)22\[622:NOTEOC\]2.0.CO;2](https://doi.org/10.2987/8756-971X(2006)22[622:NOTEOC]2.0.CO;2)
- Harrison BA, Byrd BD, Sither CB, Whitt PB. 2016. "Mosquitoes of the Mid-Atlantic Region: An Identification Guide." Western Carolina University, Cullowhee, North Carolina. *Mosquito and Vector-Borne Infectious Diseases Laboratory Publication*. 2016–01. 207 pp.
- Kelly R, Mead D, Harrison BA. 2008. "The discovery of *Culex coronator* Dyar and Knab (Diptera: Culicidae) in Georgia." *Proceedings of the Entomological Society of Washington* 110:258–260. <https://doi.org/10.4289/0013-8797-110.1.258>
- Laurito M, Briscoe AG, Almirón WR, Harbach RE. 2018. "Systematics of the *Culex coronator* complex (Diptera: Culicidae): Morphological and molecular assessment." *Zoological Journal of the Linnean Society* 182:735–757. <https://doi.org/10.1093/zoolinnean/zlx053>
- Mackay AJ. 2007. "Detection of West Nile virus activity in male and female mosquitoes, and evaluation of host utilization patterns of mosquitoes, in East Baton Rouge, Louisiana." [Ph.D. dissertation]. Louisiana State University, Baton Rouge, Louisiana.
- Miranda J, Mattar S, Gonzalez M, Hoyos-López R, Aleman A, Aponte J. 2019. "First report of *Culex flavivirus* infection from *Culex coronator* (Diptera: Culicidae), Colombia." *Virology Journal* 16:1. <https://doi.org/10.1186/s12985-018-1108-2>
- Reyes-Villanueva F, Barrientos-Lozano L, Rodríguez-Pérez MA. 2006. "Feeding pattern of mosquitoes (Diptera: Culicidae) transmitters of the West Nile virus collected from horses and humans in northern Mexico." *Veterinaria México* 37:407–415. <http://veterinariamexico.unam.mx/index.php/vet/article/view/171>
- Sames WJ, Mann JG, Kelly R, Evans CL, Varnado WC, Bosworth AB, Noden BH, Ramberg FB, Riles MT, Killingsworth D, Doyle MS, Pitts RJ. 2021. "Distribution of *Culex coronator* in the USA." *Journal of the American Mosquito Control Association* 37:1–9. <https://doi.org/10.2987/21-6995.1>
- Turell MJ, O'Guinn ML, Jones JW, Sardelis MR, Dohm DJ, Watts DM, Fernandez R, Travassos da Rosa A, Guzman H, Tesh R, Rossi CA, Ludwig GV, Mangiafico JA, Kondig J, Wasieloski LP, Jr, Pecor J, Zyzak M, Schoeler G, Mores CN, Calampa C, Lee JS, Klein TA. 2005. "Isolation of viruses from mosquitoes (Diptera: Culicidae) collected in the Amazon Basin region of Peru." *Journal of Medical Entomology* 42: 891–898. <https://doi.org/10.1093/jmedent/42.5.891>
- Unlu I, Kramer WL, Roy AF, Foil LD. 2010. "Detection of West Nile virus RNA in mosquitoes and identification of mosquito blood meals collected at alligator farms in Louisiana." *Journal of Medical Entomology* 47: 625–633. doi: 10.1603/ME09087. <https://doi.org/10.1603/ME09087>
- Varnado WC, Goddard J, Harrison BA. 2005. "New state record of *Culex coronator* Dyar and Knab (Diptera: Culicidae) from Mississippi." *Proceedings of the Entomological Society of Washington* 107:476–477.

Veggiani Aybar CA, Rossi GC. 2017. "Mosquitoes (Diptera: Culicidae) of the meridian zone of the subtropical mountainous rainforest of Argentina: Update on the fauna and geographical distribution." *Check List* 13:2102. <https://doi.org/10.15560/13.2.2102>

Wilke ABB, Benelli G, Beier JC. 2020. "Beyond frontiers: On invasive alien mosquito species in America and Europe." *PLoS Neglected Tropical Diseases* 14:1e0007864. <https://doi.org/10.1371/journal.pntd.0007864>

Wilkerson RC, Linton YM, Strickman D. 2021. "*Mosquitoes of the World* (Vol. 1)". Johns Hopkins University Press. Baltimore, MD. ISBN-13: 978-1421438146

Yee DA, Allgood D, Kneitel JM, Kuehn KA. 2012. "Constitutive differences between natural and artificial container mosquito habitats: vector communities, resources, microorganisms, and habitat parameters." *Journal of Medical Entomology* 49:482–491. <https://doi.org/10.1603/ME11227>