

A journal of world insect systematics

INSECTA MUNDI

1063

Aposematic-habitat correlation in Nearctic species
of *Episyron* Schiødte (Hymenoptera: Pompilidae:
Pompilinae: Pompilini)

Frank E. Kurczewski

1188 Converse Drive NE
Atlanta, GA 30324

Date of issue: July 26, 2024

Center for Systematic Entomology, Inc., Gainesville, FL

Kurczewski FE. 2024. Aposematic-habitat correlation in Nearctic species of *Episyron* Schiødte (Hymenoptera: Pompilidae: Pompilinae: Pompilini). *Insecta Mundi* 1063: 1–5.

Published on , 2024 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
<http://centerforsystematicentomology.org/>

INSECTA MUNDI is a journal primarily devoted to insect systematics, but articles can be published on any non-marine arthropod. Topics considered for publication include systematics, taxonomy, nomenclature, checklists, faunal works, and natural history. *Insecta Mundi* will not consider works in the applied sciences (i.e. medical entomology, pest control research, etc.), and no longer publishes book reviews or editorials. *Insecta Mundi* publishes original research or discoveries in an inexpensive and timely manner, distributing them free via open access on the internet on the date of publication.

Insecta Mundi is referenced or abstracted by several sources, including the Zoological Record and CAB Abstracts. *Insecta Mundi* is published irregularly throughout the year, with completed manuscripts assigned an individual number. Manuscripts must be peer reviewed prior to submission, after which they are reviewed by the editorial board to ensure quality. One author of each submitted manuscript must be a current member of the Center for Systematic Entomology.

Guidelines and requirements for the preparation of manuscripts are available on the *Insecta Mundi* website at <http://centerforsystematicentomology.org/insectamundi/>

Chief Editor: David Plotkin, insectamundi@gmail.com
Assistant Editor: Paul E. Skelley, insectamundi@gmail.com
Layout Editor: Robert G. Forsyth
Editorial Board: Davide Dal Pos, M. J. Paulsen, Felipe Soto-Adames
Founding Editors: Ross H. Arnett, Jr., J. H. Frank, Virendra Gupta, John B. Heppner, Lionel A. Stange, Michael C. Thomas, Robert E. Woodruff
Review Editors: Listed on the *Insecta Mundi* webpage

Printed copies (ISSN 0749-6737) annually deposited in libraries

Florida Department of Agriculture and Consumer Services, Gainesville, FL, USA
The Natural History Museum, London, UK
National Museum of Natural History, Smithsonian Institution, Washington, DC, USA
Zoological Institute of Russian Academy of Sciences, Saint-Petersburg, Russia

Electronic copies (online ISSN 1942-1354) in PDF format

Archived digitally by Portico.
Florida Virtual Campus: <http://purl.fcla.edu/fcla/insectamundi>
University of Nebraska-Lincoln, Digital Commons: <http://digitalcommons.unl.edu/insectamundi/>
Goethe-Universität, Frankfurt am Main: <http://nbn-resolving.de/urn/resolver.pl?urn:nbn:de:hebis:30:3-135240>

This is an open access article distributed under the terms of the Creative Commons, Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.
<https://creativecommons.org/licenses/by-nc/3.0/>

Aposematic-habitat correlation in Nearctic species of *Episyron* Schiødte (Hymenoptera: Pompilidae: Pompilinae: Pompilini)

Frank E. Kurczewski

1188 Converse Drive NE
Atlanta, GA 30324
kurczewskifrank@gmail.com

Abstract. Three Nearctic species of *Episyron* Schiødte (Hymenoptera: Pompilidae: Pompilinae: Pompilini) were examined morphologically, geographically, and ecologically with intent to infer an aposematic correlation with habitat type, protarsal digging rake morphology, and host spider association. *Episyron quinquenotatus quinquenotatus* (Say) and *E. conterminus cressoni* (Dewitz), two subspecies with extensive aposematic markings and more and longer protarsal comb spines, were associated with bare or sparsely vegetated sandy soils near water courses. *Episyron biguttatus biguttatus* (Fabricius), with few aposematic markings and less and shorter protarsal comb spines, was associated with more densely vegetated terrain and gravelly and loamy soils. Three subspecies of *Anoplius apiculatus* (Smith) (Hymenoptera: Pompilidae: Pompilinae: Pompilini) are discussed as an aposematic-habitat comparison.

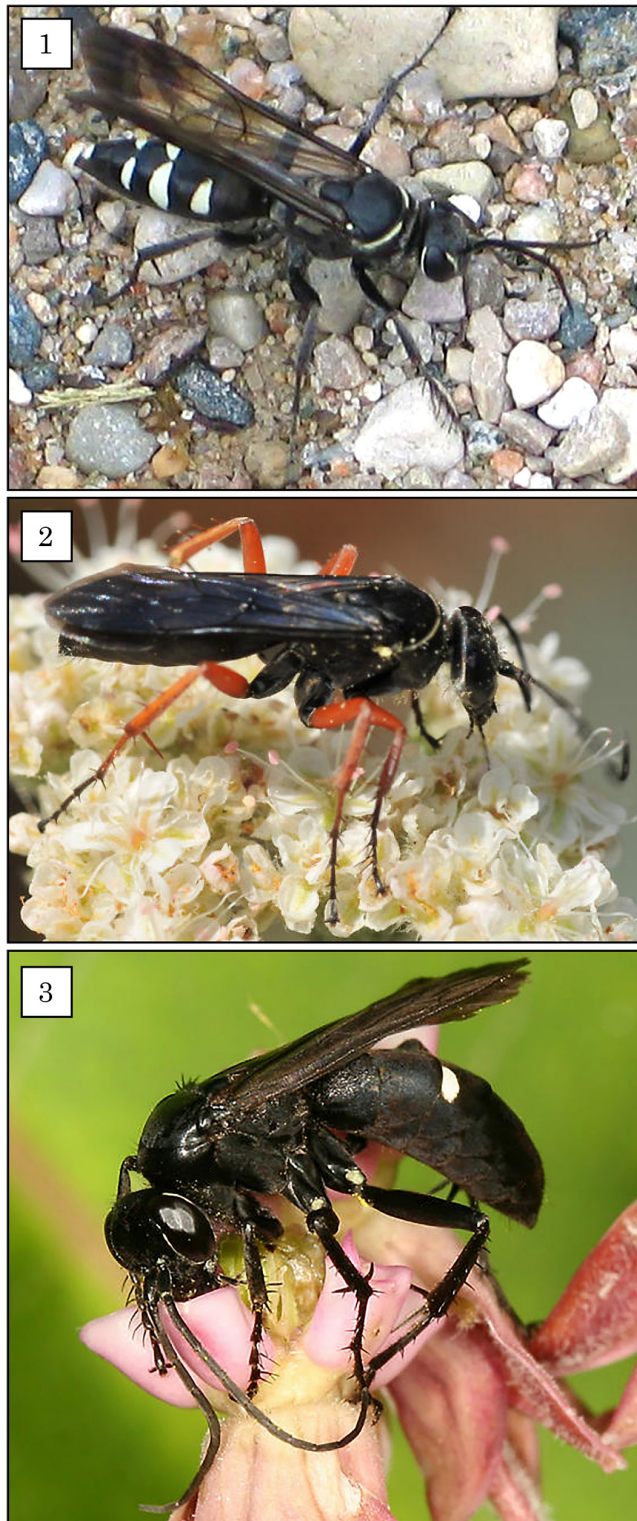
Key words. *Episyron quinquenotatus quinquenotatus*, *Episyron conterminus cressoni*, *Episyron biguttatus biguttatus*, aposematic body coloration, habitat type, protarsal digging rake morphology, host spider association, *Anoplius apiculatus*.

ZooBank registration. [urn:lsid:zoobank.org:pub:6A128918-F0FC-4B58-BDDF-992DEDCD2755](https://zoobank.org/pub:6A128918-F0FC-4B58-BDDF-992DEDCD2755)

Introduction

Bright and contrasting aposematic coloration (red, orange, yellow, or white on a black body) in spider wasps (Hymenoptera: Pompilidae) is often associated with open terrain and sparse or no vegetation. Three Nearctic subspecies of *Episyron* Schiødte, *E. quinquenotatus quinquenotatus* (Say) (Fig. 1), *E. conterminus cressoni* (Dewitz) (Fig. 2), and *E. biguttatus biguttatus* (Fabricius) (Fig. 3) were examined to test this hypothesis. The three subspecies are comparable in size, the females averaging 10–12.5 mm in body length (Evans 1950). East of the Rocky Mountains, *Episyron b. biguttatus* and *E. q. quinquenotatus* females are black with whitish markings on the inner and outer eye orbits, posterior pronotal margin, behind the tegulae, and metasomal tergites (Evans 1950). *Episyron b. biguttatus* usually has only a pair of whitish spots on metasomal tergite 3 and may lack whitish marking on the posterior pronotal margin. *Episyron q. quinquenotatus* has a whitish spot on the apical metasomal tergite and paired whitish spots or single united whitish bands on tergites 2, 3, and 4. On the West Coast, females of different subspecies are basically black [*E. quinquenotatus hurdi* Evans] or bluish black [*E. biguttatus californicus* (Banks)] (Evans 1950; Wasbauer and Kimsey 1985). *Episyron conterminus cressoni* (Dewitz) females have pale yellowish markings on the inner and outer orbits, neck, posterior pronotal margin, behind the tegulae, and, sometimes, paired spots on metasomal tergite 3 (Evans 1950, 1966). Tibiae and femora of *E. conterminus cressoni* are rufous.

Episyron q. quinquenotatus occurs from Canada to the Gulf of Mexico and is especially abundant on the Great Lakes sand beaches, sand dunes, and dry sand plain (Evans 1950; Evans and Yoshimoto 1962; Kurczewski 1999, 2001; Kurczewski and Kiernan 2015). *Episyron conterminus cressoni* frequents sandy soils of the Atlantic Coastal Plain south of Long Island, Gulf Coastal Plain, Mississippi River Valley, and from California to Costa Rica (Krombein 1952; Kurczewski 1963; Evans 1966; Wasbauer and Kimsey 1985; Krombein and Norden 1996). *Episyron b. biguttatus* occurs from Canada to the Gulf of Mexico and nests in open woodland, woodland edges, overgrown fields, and vegetable gardens in loamy sand, gravel, and loam; abandoned gravel pits; and gravelly



Figures 1–3. Habitus photographs of *Episyron* Schiödte females. **1)** *Episyron q. quinquenotatus* (Say) female habitus, Inverhuron Provincial Park, Bruce County, Ontario, Canada. Photograph © Robin McLeod. **2)** *Episyron conterminus cressoni* (Dewitz) female habitus, Natural History Museum of Los Angeles County gardens, Los Angeles County, California. Photograph © Hartmut Wisch. **3)** *Episyron b. biguttatus* (Fabricius) female habitus, Orange Town Forest, Orange County, Vermont. Photograph © Tom Murray.

parking lots (Kurczewski 1962, 1999; Kurczewski and Kiernan 2015). Difference in habitat between the three subspecies correlates with the extent of the female protarsal digging rake: *E. q. quinquenotatus* basitarsus has 4 or 5 flattened, very long comb spines; *E. conterminus cressoni* has 3 long comb spines; and *E. b. biguttatus* has 3 shorter comb spines. The comb spines of *E. b. biguttatus* are shorter than other Nearctic species of *Episyron*, including *E. oregon* Evans and *E. snowi* (Viereck) (Evans 1950).

Nearctic species and subspecies of *Episyron* capture and provision nests in soil with various genera and species of Araneidae (orb-weaving spiders) (Evans and Yoshimoto 1962). The females search for, approach, and attack the orb-weavers in their webs, usually causing the spider to drop to the ground where it is stung and immobilized (Kurczewski 2001). Although occupying different habitats, *E. q. quinquenotatus* and *E. b. biguttatus* have a remarkably similar list of host orb-weaving spiders, including seven common genera and nine common species in Erie County, PA (Kurczewski and Kiernan 2015). There is much less similarity in host genera and species of Araneidae between *E. q. quinquenotatus* and *E. conterminus cressoni*, despite likeness in habitat, because of their different geographic ranges and ecological regions (Krombein 1952; Kurczewski 1963, 1981; Kurczewski and Kurczewski 1968a, b, 1973; Krombein and Norden 1996). *Episyron q. quinquenotatus* predominantly inhabits the northeastern U. S. and *E. conterminus cressoni*, the southeastern U. S. (Evans 1950).

Materials and Methods

Field observations were made on the three *Episyron* subspecies from 1960 through 2014 in Ontario, New York, Pennsylvania, Michigan, New Jersey, Maryland, Florida, and California. The following number of females were observed, habitat noted, nests excavated, and host spiders identified: *E. q. quinquenotatus*, 446; *E. b. biguttatus*, 42; and *E. conterminus cressoni*, 33. Habitat and nesting behavior information was correlated with subspecies external morphology using dichotomous keys and subspecies descriptions in Evans (1950, 1951, 1966) and Wasbauer and Kimsey (1985). Ecological information on these subspecies was compared with reports by Krombein (1952), Evans and Yoshimoto (1962), Kurczewski (1962, 1963, 1981, 1999, 2001), Kurczewski and Kurczewski (1968a, b, 1973), Krombein and Norden (1996), Kurczewski and Pitts (2011), Kurczewski et al. (2013, 2017), and Kurczewski and Kiernan (2015).

Results and Discussion

The evolutionary development of a ground-nesting spider wasp species is related to many environmental factors: ambient temperature; amount of precipitation; daily hours of sunshine and cloud cover; density of vegetation; and soil friability, texture, temperature, and humidity. The conspicuousness of aposematic coloration within species and between congeners varies in Nearctic species of Pompilidae. The amount of warning coloration of spider wasp species or subspecies often infers the type of habitat and density of vegetation of the area. *Episyron q. quinquenotatus* and *E. conterminus cressoni* have an extensive amount of aposematic coloration and both species inhabit bare or sparsely vegetated sandy soils, often near water courses. *Episyron b. biguttatus* has much less warning coloration and inhabits areas with denser vegetation and often gravelly or loamy soil. [For example, compare Fig. 2 (*E. biguttatus*, abandoned and overgrown gravel pit) and Fig. 24 (*E. quinquenotatus*, sand beach and sand dunes) in Kurczewski and Kiernan (2015) for typical habitat and soil differences.] The larger number or length of comb spines on the protarsal digging rakes of *E. q. quinquenotatus* and *E. conterminus cressoni* reinforce their distinctive psammophilous habitats in contrast to the shorter comb spines and more densely vegetated, less friable soils of *E. b. biguttatus*.

Another example of the extent of aposematic coloration correlated with climate, habitat, and density of vegetation is found among the three subspecies of *Anoplius apiculatus* (Smith), also in the tribe Pompilini. The three subspecies designated by Evans (1951) are highly psammophilous, occurring mainly on sand beaches and sand dunes along water courses. In these taxa the 3 comb spines of the protarsal digging rake are exceedingly long, as in *E. q. quinquenotatus*. Noticeable differences between the three subspecies include the amount of rufous aposematic coloration on the metasomal segments and silvery pubescence on the body, which acts as reflective

vestiture. *Anoplius apiculatus apiculatus* (Smith) occurs from the Lower Sonoran Region to Central America. It has a bright rufous metasoma, except for the small black base of the first segment (Evans 1951). The wings are hyaline in density and the reflective pubescence of the body is conspicuously silvery. This color combination is typical of certain solitary wasps (Hymenoptera: Aculeata) from open, sparsely vegetated, arid, or semi-arid terrain in southwestern U. S. and Mexico with low levels of annual precipitation and high summer temperatures. *Anoplius apiculatus autumnnalis* (Banks) inhabits the Great Plains and Eastern Temperate Forest Level I Ecological Region of North America (Commission for Environmental Cooperation Working Group 2006). The most common aposematic coloration of the metasoma of this subspecies is basal 3 segments rufous and apical 3 segments black (Evans 1951). The body of *A. apiculatus autumnnalis* is patterned with reflective silvery pubescence and the apical half to third of the forewing is lightly infuscate. This color combination is typical of Pompilini from the eastern U. S. in areas with denser vegetation, higher amount of annual precipitation, and more moderate summer temperatures. *Anoplius apiculatus pretiosus* (Banks) ranges from Maine to Florida in the Atlantic Coastal Plain. This subspecies has noticeably darker body coloration than *A. apiculatus autumnnalis*, silvery pubescence substantially reduced, and forewing more fuscous (Evans 1951). Darker body coloration is typical of wasp populations that live along the Atlantic Coast, especially in the southeastern U. S. Areas along the ocean generally stay cooler and have a more moderate temperature range than inland areas, lessening the need for reflective silvery body pubescence that prevent overheating.

Acknowledgments

Steven Alm, University of Rhode Island, Kingston, RI; and Elijah Talamas, FDACS-DPI, Florida State Collection of Arthropods, Gainesville, FL, reviewed the manuscript. Tom Murray sent information about *Episyron b. biguttatus* habitat and soil in Orange Town Forest, VT. The following persons provided their copyrighted photographs of *Episyron* species: Robin McLeod (Fig. 1); Hartmut Wisch (Fig. 2); and Tom Murray (Fig. 3).

Literature Cited

- Commission for Environmental Cooperation Working Group. 2006.** Level I Ecological Regions of North America (map). Available at https://gaftp.epa.gov/EPADDataCommons/ORD/Ecoregions/cec_na/NA_LEVEL_I.pdf (Last accessed April 24, 2024.)
- Evans HE. 1950.** A taxonomic study of the Nearctic spider wasps belonging to the tribe Pompilini (Hymenoptera: Pompilidae). Part I. Transactions of the American Entomological Society 75: 133–270.
- Evans HE. 1951.** A taxonomic study of the Nearctic spider wasps belonging to the tribe Pompilini (Hymenoptera: Pompilidae). Part II. Genus *Anoplius* Dufour. Transactions of the American Entomological Society 76: 207–361.
- Evans HE. 1966.** A revision of the Mexican and Central American spider wasps of the subfamily Pompilinae (Hymenoptera: Pompilidae). Memoirs of the American Entomological Society 20: 1–422.
- Evans HE, Yoshimoto CM. 1962.** The ecology and nesting behavior of the Pompilidae (Hymenoptera) of the northeastern United States. Miscellaneous Publications of the Entomological Society of America 3: 65–119.
- Krombein KV. 1952.** Biological and taxonomic observations on the wasps in a coastal area of North Carolina (Hymenoptera: Aculeata). Wasmann Journal of Biology 10: 257–341.
- Krombein KV, Norden BB. 1996.** Behavior of nesting *Episyron conterminus posterus* (Fox) and its cleptoparasite *Ephuta s. slossonae* (Fox) (Hymenoptera: Pompilidae, Mutillidae). Proceedings of the Entomological Society of Washington 98: 188–194.
- Kurczewski FE. 1962.** Observations, including new prey records, of some Nearctic Pompilidae (Hymenoptera). Bulletin of the Brooklyn Entomological Society 57: 85–90.
- Kurczewski FE. 1963.** Some new pompilid prey records from southern Florida (Hymenoptera: Pompilidae). The Florida Entomologist 46: 209–213.
- Kurczewski FE. 1981.** Observations on the nesting behaviors of spider-wasps in southern Florida (Hymenoptera: Pompilidae). The Florida Entomologist 64: 424–437.
- Kurczewski FE. 1999.** Comparison of spider wasp faunas from two ecologically distinct sites in Erie County, Pennsylvania (Hymenoptera: Pompilidae). Journal of the Kansas Entomological Society 72: 339–360.

- Kurczewski FE. 2001.** Comparative nesting behavior of *Episyron quinquenotatus* (Hymenoptera: Pompilidae) in the north-eastern United States. *Northeastern Naturalist* 8: 403–426.
- Kurczewski FE, Edwards GB, Pitts JP. 2017.** Hosts, nesting behavior, and ecology of some North American spider wasps (Hymenoptera: Pompilidae), II. *Southeastern Naturalist* 16 (Monograph 9): 1–82.
- Kurczewski FE, Kiernan DH. 2015.** Analysis of spider wasp host selection in the eastern Great Lakes Region (Hymenoptera: Pompilidae). *Northeastern Naturalist* 22 (Monograph 11): 1–88.
- Kurczewski FE, Kurczewski EJ. 1968a.** Host records for some North American Pompilidae (Hymenoptera) with a discussion of factors in prey selection. *Journal of the Kansas Entomological Society* 41: 1–33.
- Kurczewski FE, Kurczewski EJ. 1968b.** Host records for some North American Pompilidae (Hymenoptera). First Supplement. *Journal of the Kansas Entomological Society* 41: 367–382.
- Kurczewski FE, Kurczewski EJ. 1973.** Host records for some North American Pompilidae (Hymenoptera). Third Supplement. Tribe Pompilini. *Journal of the Kansas Entomological Society* 46: 65–81.
- Kurczewski FE, Pitts JP. 2011.** Additions to the spider wasp fauna of Erie County, Pennsylvania (Hymenoptera: Pompilidae). *Journal of the Kansas Entomological Society* 84: 320–322.
- Kurczewski FE, Pitts JP, Elliott NB. 2013.** Annotated list of spider wasps from The Bahamas, with description of a new species of *Tachypompilus* (Hymenoptera: Pompilidae). *Caribbean Naturalist* 5: 1–28.
- Wasbauer MS, Kimsey LS. 1985.** California spider wasps of the subfamily Pompilinae (Hymenoptera: Pompilidae). *Bulletin of the California Insect Survey* 26: 1–130.

Received April 24, 2024; accepted June 1, 2024.

Review editor Davide Dal Pos.

