

TYPES. Holotype and 19 paratypes in alcohol, 8 paratypes on slides. Holotype and 10 paratypes in alcohol deposited in United States National Museum, Washington, D.C.; 8 paratypes in alcohol and 8 paratypes on slides deposited in Entomology Museum, Michigan State University. Collection data: New Mexico, Colfax County, Springer, grass sweep at noon, 27-VIII-1909, C.N. Ainslie, collector, USNM #5568.

ETYMOLOGY. From *sagitta*, Latin for "arrow", named for the "V" mark on the dorsum of the abdomen.

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REFERENCES CITED

- CHRISTIANSEN, K. A., AND P. F. BELLINGER. 1981. The Collembola of North America North of Rio Grande. Part IV. Families Neelidae and Sminthuridae. Grinnell College, Grinnell, Iowa. p. 1043-322.
- SNIDER, R. J. 1981. *Sminthurus carolinensis*, new species from South Carolina (Collembola: Sminthuridae). Florida Ent. 64: 417-24.
- . 1982. *Sminthurus fischeri*, new species from Georgia (Collembola: Sminthuridae). Florida Ent. 65: 321-6.
- SNIDER, R. J., AND S. J. LORING. 1982. *Sminthurus incognitus*, new species from Florida (Collembola: Sminthuridae). Florida Ent. 65: 216-20.

THE CICINDELIDAE (COLEOPTERA) OF THE VIRGIN ISLANDS

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ABSTRACT

Keys, figures, biology and notes are given for the adult Cicindelidae of the Virgin Islands: *Megacephala sobrina* Dejean, *Cicindela boops* Dejean, *C. suturalis* Fabricius, and *C. trifasciata* Fabricius. A larval key is given for the 2 genera.

RESUMEN

Se presentan claves, figuras y notas biológicas para los adultos de Cicindelidae de las Islas Virgines: *Megacephala sobrina* Dejean, *Cicindela boops* Dejean, *C. suturalis* Fabricius, *C. trifasciata* Fabricius. Se presenta una clave para las larvas de los 2 generos.

The tiger beetles are taxonomically among the best known insects, yet no up to date key deals with all 4 species which occur in the Virgin Islands. A confusing number of generic, specific, and subspecific synonyms have been used, making correct identification difficult. This paper is an attempt to alleviate this problem, and provide field biologists with a taxonomic base. It is hoped that the notes on biology will spur investigation of these species' interesting ecology and behavior.

Larvae and adult tiger beetles are predators. Larvae live in vertical burrows in the soil, probably preying on whatever stumbles by. Adults are quick, active predators with well-developed eyes and sickle-like mandibles.

The 4 species in the Virgin Islands are placed in 2 genera, as is generally accepted by American workers. Some workers split *Cicindela* into several genera, and those into subgenera, so that the species here treated may appear under different generic names in some works (e.g. Balazuc and Chalumeau 1978).

Specimens cited are deposited in various collections, indicated with the following acronyms:

AMNH—American Museum of Natural History, New York, New York.

HAHC—Henry and Anne Howden, private collection, Ottawa, Ontario.

MAIC—Michael A. Ivie, private collection, Columbus, Ohio.

MCZC—Museum of Comparative Zoology, Cambridge, Massachusetts.

NMNH—United States National Museum of Natural History, Washington, District of Columbia.

RSMC—Richard S. Miller, private collection, Columbus, Ohio.

SWNC—Steven W. Nichols, private collection, Ithaca, New York.

VIER—Virgin Islands Ecological Research Station collection, St. John, Virgin Islands.

VIFW—Virgin Islands Division of Fish and Wildlife collection, St. Croix, Virgin Islands.

KEY TO THE SPECIES (ADULTS)

1. Frontal margin of labrum with 4 teeth and 4 subapical setae; pronotum bare laterally *Megacephala sobrina* Dejean
- 1'. Frontal margin of labrum with single medial tooth and 6 or more subapical setae; pronotum with white setae laterally 2
- 2(1'). Labrum with 6 submarginal setae *Cicindela boops* Dejean
- 2'. Labrum with 8 submarginal setae *Cicindela suturalis* Fabricius
- 2''. Labrum with 12 or more submarginal setae
..... *Cicindela trifasciata* Fabricius

The immatures of the Virgin Island species are undescribed. The following key is adapted from Hamilton (1925).

KEY TO GENERA (LARVAE)

1. Hooks on 5th abdominal segment curved, pointing outward
..... *Cicindela* Linnaeus
- 1'. Hooks on 5th abdominal segment straight, directed forward or slightly inward *Megacephala* Latreille

Megacephala sobrina Dejean 1831: 202. Wagenaar Humelinck 1955: 103. Balazuc and Chalumeau 1978: 18.

Tetracha sobrina, Leng and Mutchler 1914: 393, 1916: 686, 1917: 193. Beatty 1944: 131.

Megacephala rutilans, Blackwelder 1944: 13. Miskimen and Bond 1970: 78.

For a complete synonymy, description, and bibliography see Wagenaar Hummelinck (1955: 103).

The first Virgin Island records are those of Jacquelin du Val (1857: 3) for St. Thomas; Horn (1910: 142) for St. Thomas and St. Croix; Horn

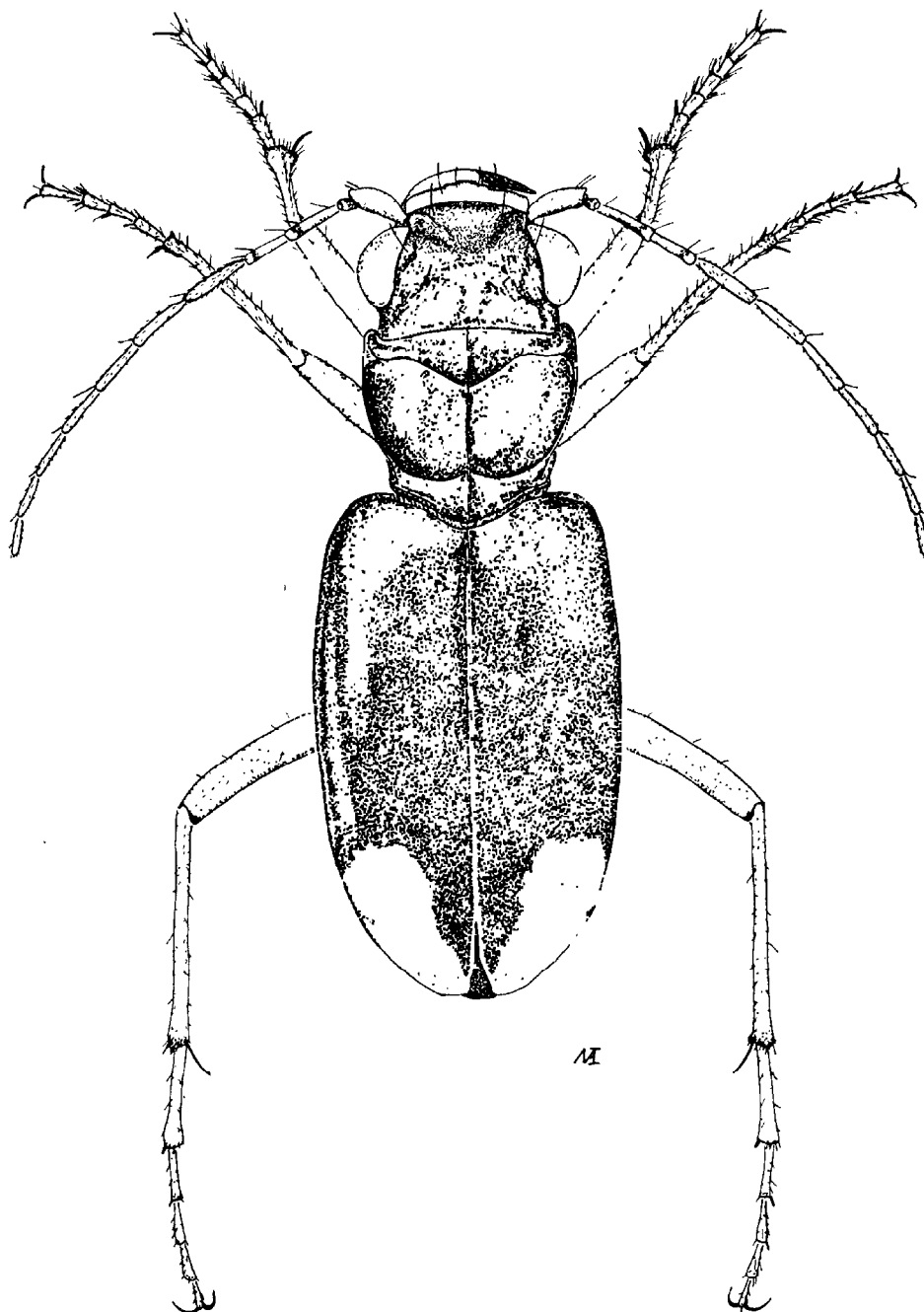


Fig. 1. *Megacephala sobrina* Dejean, habitus, St. Croix.

Megacephala sobrina Dejean
(Fig. 1)

(1926: 75) for St. John; and Blackwelder (1944: 13) for Anegada. Further material was recorded by Leng and Mutchler (1916: 686), Beatty (1944: 131), and Miskimen and Bond (1970: 78), all for St. Croix. The Jacquelin du Val record was based on a specimen in the Chevrolat collection, probably now in Paris via the Fleutiaux collection (Horn and Kahle 1935: 41).

Voucher specimens for the records of Horn are undoubtedly among the specimens cited by Wagenaar Hummelinck (1955: 114) from European museums, as follows: St. Croix—1 specimen (Moritz) in Berlin, 2 specimens in Copenhagen; St. John—1 specimen in Copenhagen; St. Thomas—1 specimen (Moritz) in Brussels. Leng and Mutchler cited the specimen from St. Croix in the Harris collection at the Museum of Comparative Zoology. The specimen in the NMNH labeled "St Croix, V.I.; H. A. Beatty; No. 745-1937" is almost certainly the voucher for the Beatty record of Concordia, October 1936, det. L. L. Buchanan. Vouchers for Blackwelder's Anegada record are possibly the specimens in the AMNH. Miskimen and Bond's St. Croix vouchers have not been located, but the records are confirmed by the material examined. The occurrence of *M. sobrina* on other of the Virgin Islands, i.e. Virgin Gorda, Tortola, etc., seems assured. This species has a long nomenclatural history, well dealt with by Wagenaar Hummelinck (1955), who placed the Virgin Island populations in the Greater Antillean subspecies *infusata* Mannerheim. His statement (1955: 91,93) that *Megacephala acutipennis* Dejean was recorded by Leng and Mutchler (1914) from St. Thomas is an error, as no such record is contained in the list by these authors.

BIOLOGY. This species appears to be completely nocturnal. Tower (1912: 20) reported that it is predaceous on mole crickets in Puerto Rico. Miskimen and Bond (1970:78) reported it as very uncommon on St. Croix. Daniel F. Keaveny, California Department of Food and Agriculture, found that the beetles congregate at night on the ground under light traps. They could be found in numbers the next day hiding under pots on the ground nearby. This agrees with an observation attributed by Wolcott (1950: 225) to Leng and Mutchler that this species was found under debris at Guanica, Puerto Rico.

DISTRIBUTION. South America and its adjacent Caribbean islands, Mexico, Cuba, Hispaniola, Puerto Rico, St. Thomas, St. John, Anegada, St. Croix, Barbuda (in AMNH), St. Martin, St. Barthélemy, Antigua, Barbados (in AMNH).

MATERIAL EXAMINED. (The number of specimens in each collection is in italics.)

St. Thomas: 1—Estate Bovoni, 29-VII-1979, M.A. Ivie (MAIC).

Anegada: 1—14-VI-1955, J. Conroy (NMNH). 1—26-III-1970, H. Miller. 3—near ponds, 12-I-1970, J. A. Y[ntema] (VIER); 1—23-VIII-1980, [found dead and damaged] M. A. Ivie (MAIC). 6—Anagarda [*sic*] 31-III-1925 [L. B. Woodruff] (AMNH).

St. Croix: 5—Golden Grove USDA-SEA station, 25-X-1979, M. A. Ivie; 1—*ibid.* 3-XI-1979; 2—CVI, 20-X-1979, D. F. Keaveny; 2—Golden Grove, X-1979, D. F. Keaveny; 2—Golden Grove, 29-X-1979, at uv light, D. F. Keaveny; 1—*ibid.*, 6-VI-1980; 1—*ibid.* 13-IV-1980; 3—*ibid.*, 31-I-1981 (MAIC, RSMC, SWNC, HAHC). 1—1937, H. A. Beatty; 12—Christianstead, 19-XI-1941, H. A. Beatty; 1—28-II-1925, A. Nicolay (NMNH). 1—Estate Good Hope, 5-X-1974, R. P[hilibosían] and J. A. Y[ntema] (VIFW). 2—O. Staudinger, Luetgens coll., Harris Collection; 1—Harris Collection, det. "*Tetracha sobrina fasciata* Mann. by Dr. W. Horn 1914" (MCZC).

Cicindela boops Dejean
(Fig. 2)

Cicindela boops Dejean 1831: 258; Leng and Mutchler 1914: 393, 1916: 194;

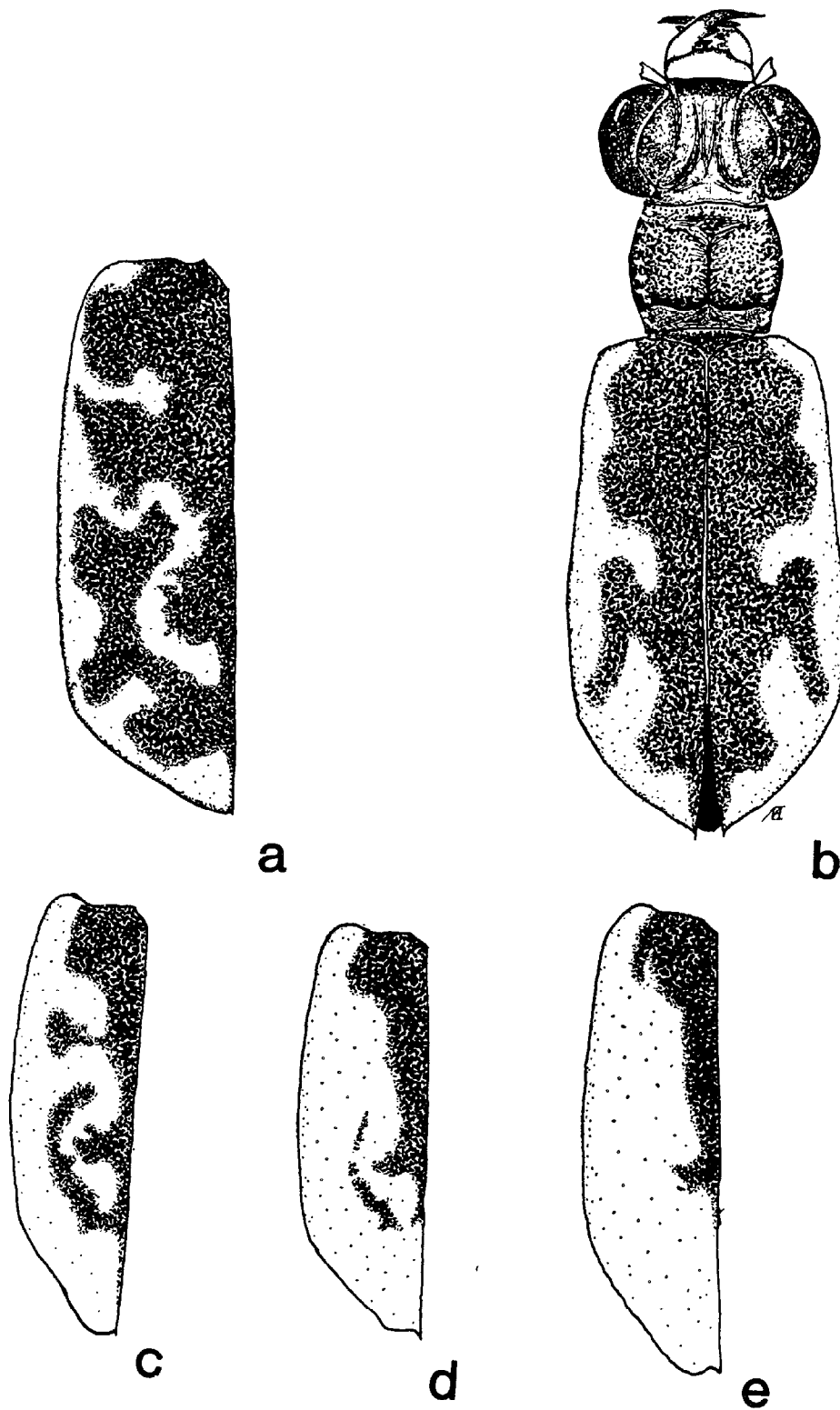


Fig. 2. a) Left elytron of *Cicindela trifasciata* Fabricius, St. Croix. b) Dorsal view of *Cicindela boops* Dejean, Anegada. c, d, e) Left elytron of *Cicindela suturalis* Fabricius. c, d) St. John. e) St. Thomas.

Beatty 1944: 132; Blackwelder 1944: 17; Miskimen and Bond 1970: 78.

Previous Virgin Island records are based on Beatty (1944: 132) for St. Croix. A possible voucher for this record is in the NMNH with Beatty's label.

BIOLOGY. This is the rarest cicindelid in the Virgin Islands and little is known about it. Wolcott (1950: 226) said that it occurred only around alkali flats and salt ponds in Puerto Rico. Beatty's record (1944: 132) from a marsh at Estate Granard on St. Croix does not indicate salinity, but Estate Granard is on the south coast and the marsh indicated may be a coastal salt pond. The Anegada specimen was taken at night on the beach, only a short distance from the salt ponds on the west end.

DISTRIBUTION. Cuba, Hispaniola, Puerto Rico, St. Croix, Anegada.

MATERIAL EXAMINED.

Anegada: 1—Windlass Bay, VIII-1980, at uv light, M. A. Ivie (MAIC).
St. Croix: 9—XI-1940, H. A. Beatty (NMNH). 1—(MCZC).

Cicindela suturalis Fabricius
(Fig. 2c,d,e)

Cicindela suturalis Fabricius 1798: 62; Leng and Mutchler 1916: 693, 1917: 194; Blackwelder 1944: 20; Jonge Poerink 1953: 133.

Cylindera suturalis, Balazuc and Chalumeau 1978: 23.

The St. Thomas record of this species dates back to the original description. The 3 type-specimens are in Copenhagen (Zimsen 1964: 65). Jonge Poerink (1953: 133) reported a pair from St. Thomas in the BMNH, a male from St. Thomas in the AMNH, and 2 males in the Leiden collection, also from St. Thomas. Blackwelder's record for St. John may be from the NMNH specimen collected by Nicolay or the AMNH specimens collected by Woodruff. According to an unpublished 1975 "Report of the Cambridge Anegada Expedition" (page 128), specimen(s) of *C. suturalis* collected by R. K. Butlin at Setting Point, Anegada are deposited in the BMNH.

The apparent absence of *C. suturalis* from St. Croix is a mystery. St. Croix has been relatively well collected by Beatty and others in the last 50 years, as well as various Danish and German collectors of the last century. The meticulous Walther Horn examined the collections of the early Europeans and did not report *suturalis* from St. Croix. In addition to Puerto Rico and the northern Virgin Islands to the west and north, it is known from virtually every island in the Leewards where collecting has been done.

BIOLOGY. This species is extremely common on beaches on St. Thomas, St. John, and Anegada at times, yet it can be absent only a few weeks later. It is very quick, agile, and difficult to collect. *Cicindela suturalis* differs behaviorally from *C. trifasciata* in its apparent preference for the white sand of the beach, and its propensity to fly when disturbed. Observations of synchronous populations of these species on Anegada in August, 1980, showed that *C. suturalis* was confined to the open sand and flew from place to place when avoiding the net. *Cicindela trifasciata* stayed on higher, darker areas covered with dried pond debris. When disturbed, *trifasciata* ran under debris, and only rarely did it fly. Where the 2 habitats abutted, the spatial division of the 2 species was quite obvious. At other times both species were observed on both substrata when only one species was present. The observations indicate that partitioning between the adults of *Cicindela*

suturalis and *C. trifasciata* may exist when the 2 are sympatric and synchronous, but that in the absence of one, the other can expand its utilization of the area available.

DISTRIBUTION. Northern South America, Hispaniola, Puerto Rico, St. Thomas, St. John, Anegada, St. Kitts (NMNH), St. Martin, St. Barthélemy, Barbuda, Antigua, Guadeloupe, Martinique, Barbados, St. Vincent, Grenada.

MATERIAL EXAMINED.

St. Thomas: 1—Nicolay; 1—VIII-1915, Nicolay; 2—VII-1915, C. R. Shomaker (det. W. Horn, 1928); 2—Wickham (NMNH). 8—01-III-1925, [L. B. Woodruff (one det. W. Horn)]; 11—Magens Bay, 1-III-1925, on beach [L. B. Woodruff] (AMNH). 1—Harris Collection (det. W. Horn, 1914); 1—Kricheldorf, Harris Collection; 1—North side, 19-V-1937, Roys (MCZC). 1—Magens Bay Beach, 28-IX-1978, M. A. Ivie; 1—Magens Bay, 13-V-1979, M. A. & L. L. Ivie; 2—Magens Bay, 11-VIII-1979, M. A. Ivie (MAIC, HAHC).

St. John: 1—05-III-1925, Nicolay (NMNH). 1—07-III-1925 (AMNH). 3—Salt Pond Bay, 05-V-1978, M. A. Ivie (MAIC, RSMC).

Anegada: 3—23-VIII-1980, M. A. Ivie (MAIC).

Cicindela trifasciata Fabricius (Fig. 2a)

Cicindela trifasciata Fabricius 1781: 286; Leng and Mutchler 1914: 393, 1916: 693, 1917: 194; Beatty 1944: 132; Blackwelder 1944: 20; Jonge Poerink 1953: 129; Miskimen and Bond 1970: 78.

Cicindelidia trifasciata, Balazuc and Chalumeau 1978: 20.

The Virgin Island records are those of Horn (1910: 403) for St. Thomas, Blackwelder (1944: 20) for St. John, and Beatty (1944: 132) for St. Croix. Miskimen and Bond (1970: 78) reported additional information for St. Croix. Vouchers for Horn's record may be the male in the DEI reported by Jonge Poerink (1953: 130), while Blackwelder's may be those in the AMNH dated March 1925. Miskimen and Bond's have not been found. Beatty's are probably among his specimens in the NMNH (the discrepancies of label data not matching Beatty's published account are probably the result of much of Beatty's material arriving at the NMNH unlabeled. The date of shipment was printed on the labels). Jonge Poerink (1953: 130) reported on a pair in the NMNH (Beatty's material). Specimen(s) of *C. trifasciata* collected by R. K. Butlin on Anegada are deposited in the BMNH according to an unpublished 1975 "Report of the Cambridge Anegada Expedition", page 128.

Three subspecies have been recorded from the Virgin Islands, 2 from St. Croix alone. Jonge Poerink (1953: 129) recognized only one subspecies (the typical one) in this area, and this biologically-sound treatment is followed here.

BIOLOGY. This species is active both day and night, and is most often captured at lights. During the day it can be found running on dark substrata in open areas above the beach, and when *C. suturalis* is absent, on the open beaches. Its behavior is described above, under *C. suturalis*.

DISTRIBUTION. Coastal America from California to Chile and North Carolina to French Guiana, Bermuda, the Bahamas, Cuba, Isla de los Niños (Isle of Pines), the Caymans, Jamaica, Hispaniola, Puerto Rico, St.

Thomas, St. John, Tortola, Anegada, St. Croix, Anguilla, St. Martin, St. Barthélemy, Barbuda, Antigua, Désirade, Guadeloupe.

MATERIAL EXAMINED.

St. Thomas: 3—22-X-1917, J. Tee Van, Harris Collection; 3—17-XII-1927, S. T. Danforth; 2—31-XII-1927, S. T. Danforth; 3—South-east, 16-V-1937, Roys; 2—Harris Collection; 2—Luetgens coll., Harris Collection (MCZC). 4—24-II-1925; 11—27-II-1925; 2—01-III-1925 [L. B. Woodruff] (AMNH). 3—Krolle, Wickham coll., 1933 (NMNH).

St. John: 6—05-III-1925 [L. B. Woodruff] (AMNH). 6—Lameshur Bay Ranger Station, 31-XII-1958, C. F. Adams (NMNH, VIER, MAIC).

Tortola: 1—24-III-1925 [L. B. Woodruff] (AMNH).

Anegada: 2—31-III-1925 [L. B. Woodruff] (AMNH). 1—26-V-1955, J. Conroy (NMNH). 2—Windlass Bay, 22-VIII-1980, at uv light, M. A. Ivie; 2—23-VIII-1980, M. A. Ivie; 2—East End, 24-VIII-1980, M. A. Ivie (MAIC, RSMC).

St. Croix: 3—Fredericksted, 26-VI-1920, W. M. Wheeler; 7—26-VII-1920, W. M. W[heeler] (MCZC). 1—07-IV-1925 [L. B. Woodruff] (AMNH). 4—Rocky Coast, Salt Pond X-1937, H. A. Beatty; 24—Christianstead, 19-XI-1941, H. A. Beatty; 4—10-XII-1941, H. A. Beatty (NMNH). 1—C.V.I., 30-XII-1979, D. F. Keaveny; 3—Golden Grove, 1980, at uv light, D. F. Keaveny; 1—ibid., 31-I-1980; 1—ibid., 06-II-1980; 1—ibid., 13-II-1980; 1—ibid., 02-V-1980; 1—ibid., 07-VIII-1980 (MAIC, HAHC).

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REFERENCES CITED

- BALAZUC, J., AND F. CHALUMEAU. 1978. Contribution a la faune des Antilles françaises cicindélides. (Coleopt. Caraboidea, Cicindelidae). *Nouv. Rev. Ent.* 8: 17-26.
- BEATTY, H. A. 1944. The insects of St. Croix. *J. Agric. Univ. Puerto Rico* 28: 114-72.
- BLACKWELDER, R. E. 1944. Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America. *United States Nat. Mus. Bull.* 185: 1-188, i-xii.
- DEJEAN, P. F. M. A. 1831. *Spécies général des coléoptères de la collection de M. le comte Dejean*, vol. 5. 883 p. Paris.
- FABRICIUS, J. C. 1781. *Species insectorum*, vol. 1, 552 p. Kilonii.
- . 1798. *Supplementum entomologiae systematicae*. 572 p. Hafniae.
- HAMILTON, C. C. 1925. Studies on the morphology, taxonomy and ecology of the larvae of holarctic tiger beetles. *Proc. United States Nat. Mus.* 65: 1-87.
- HORN, W. 1910. *Genera insectorum de P. Wytsman*, Coleoptera, fam.

- Carabidae: subfam. Cicindelinae, fasc. 82b, p. 105-208, pl. 6-15. Verteneuil and Desmet, Bruxelles.
- . 1926. Colcopteroorum catalogus, pars 86, Carabidae: Cicindelinae, p. 1-345. Junk, Berlin.
- , AND I. KAHLE. 1935. Über entomologische Sammlungen, Entomologen und Entomo-Museologie. Entomologische Beihefte aus Berlin-Dahlem. 2: 1-160 + 2, pl. 1-16.
- JACQUELIN DU VAL, P. N. C. 1857. Insectes. Orde de coleopteres, Linn. in Sagra, Histoire physique, politique et naturelle de l'Ile de Cuba. Animaux articles, 7: 137-328. Paris.
- JONGE POERINK, W. H. 1953. Caribbean tiger beetles of the genus *Cicindela*. Stud. Fauna Curaçao other Caribb. Isl. 4: 120-143, pl. 13-17.
- LENG, C. W., AND A. J. MUTCHLER. 1914. A preliminary list of the Coleoptera of the West Indies as recorded to January 1, 1914. Bull. American Mus. Nat. Hist. 33: 391-493.
- , AND ———. 1916. Descriptive catalogue of West Indian Cicindelinae. Bull. American Mus. Nat. Hist. 35: 681-99, pl. 12.
- , AND ———. 1917. Supplement to preliminary list of the Coleoptera of the West Indies. Bull. American Mus. Nat. Hist. 37: 191-220.
- MISKIMEN, G. W., AND R. M. BOND. 1970. The insect fauna of St. Croix, U. S. V. I. Scientific Survey Porto Rico Virgin Islands 13: 1-114. New York Academy of Science, New York.
- TOWER, W. V. 1912. First Rpt. Bd. Comm. Agr. P. R. 20 p. San Juan. [from Wolcott 1950].
- WAGENAAR HUMMELINCK, P. 1955. Caribbean tiger beetles of the genus *Megacephala*. Stud. Fauna Curaçao other Caribb. Isl. 6: 89-125, pl. 6-9.
- WOLCOTT, G. W. 1950 [1948]. The insects of Puerto Rico. Coleoptera. J. Agric. Univ. Puerto Rico 32: 225-416.
- ZIMSEN, E. 1964. The type material of I. C. Fabricius. 656 p. Munksgaard, Copenhagen.

NESTING BEHAVIOR OF *PHILANTHUS SANBORNII*
IN FLORIDA
(HYMENOPTERA: SPHECIDAE)

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ABSTRACT

The activities of an aggregation of *Philanthus sanbornii* were studied at the Archbold Biological Station, Lake Placid, FL. Females sat head outward in the entrances, investigated conspecific nests, grappled near entrances, removed sand from their burrows, captured honey bees in front of hives, and flew with prey to their nests. *Apis mellifera* (Apidae) workers and *Colletes brimleyi* (Colletidae) males comprised 20 and 24 of 49 prey, respectively, with the remainder being a *C. brimleyi* female, Halictidae, Megachilidae and Anthophoridae. Three long, deep unfinished nests contained terminal storage chambers and from 3 to 8 rearing cells. From 4 to 9 bees, usually of 2 or 3 families, were stored in a cell. The bees were totally or nearly devoid of pollen and some had presumably been cleaned

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