

# CULICOIDES (DIPTERA:CERATOPOGONIDAE) REARED FROM BREEDING SITE COLLECTIONS IN NORTH CAROLINA WITH A SUMMARY OF THE SPECIES OCCURRING IN THAT STATE<sup>1</sup>

F. V. BATTLE AND E. C. TURNER, JR.<sup>2</sup>

**INTRODUCTION.** *Culicoides* are tiny nematoceros flies commonly referred to as "biting gnats" or "biting midges." Many species are bothersome to man and animals because of their painful bites (Jamnback, 1965), and some species have been associated with various pathogenic agents such as viruses, protozoa, and filarial nematodes (Fallis and Bennett, 1961).

Many species breed in wet mud or organic debris at the edge of streams, ponds, marshes, etc. (Battle and Turner, 1969). The present study was undertaken to survey this type of breeding habitat in northern North Carolina. Unpublished records from the U. S. National Museum are designated by (NMNH).

The authors wish to acknowledge the following: Dr. Willis W. Wirth of the U. S. National Museum, for verifying the identification of *C. loisiae* Jamnback, and for permitting us to examine the collection at the National Museum for unpublished records; Dr. David A. Young, for checking the collection at N. C. State University for unpublished records of *Culicoides*; Mrs. Martha Farley, for technical assistance.

**PROCEDURE.** The collecting and rearing procedures were described in a previous paper (Battle and Turner, 1969). Collections 802-811 in the present study consisted of 300 ml each of breeding substrate and were taken on April 17, 1969. Collections 52-54 and 84-91 contained 500 ml each and were taken on May 3 and June 6, 1969, respectively.

<sup>1</sup> Supported by grant no. 12-14-100-9127(33) from the Entomology Research Division, ARS, USDA.

<sup>2</sup> Graduate Assistant and Professor, respectively; Department of Entomology, Virginia Polytechnic Institute, Blacksburg, Virginia 24061.

**RESULTS AND DISCUSSION.** The following is a description of the breeding sites (by collection no.) which yielded *Culicoides* in the present study:

*Coll. 52*—Mud packed with decaying leaves at edge of roadside stream; N.C. 343, South Mills, Camden Co. *Coll. 53*—Mud from small bog at edge of shaded lagoon leading into stream; N.C. 343, 2 mi. N.W. of Camden, Camden Co. *Coll. 54*—Peat-like mud in root system of small shrubs and weeds at edge of ditch overflowing with black, stagnant water; U.S. 158, 2½ mi. E. of Camden, Camden Co. *Coll. 84*—Decaying leaves and black mud in lowlying, shaded area adjacent to stream; U.S. 158, 9 mi. E. of Reidville, Rockingham Co. *Coll. 85*—Red mud in marshy growth at edge of small pond; U.S. 158, 5 mi. E. of Yanceyville, Caswell Co. *Coll. 86*—Black mud at edge of lagoon opening into small stream; U.S. 158, 7 mi. E. of Yanceyville, Caswell Co. *Coll. 87*—Dark, sandy mud alongside Hyco Creek in broad, heavily shaded gully; U.S. 158, 9 mi. E. of Yanceyville, Caswell Co. *Coll. 88*—Dark, thick mud at edge of So. Hyco Creek; U.S. 158, 7 mi. W. of Roxboro, Person Co. *Coll. 89*—Thick mud beneath tree roots overhanging small stream; U.S. 158, 12 mi. W. of Oxford, Granville Co. *Coll. 90*—Heavily polluted mud at edge of hog pond; U.S. 158, Berea, Granville Co. *Coll. 91*—Sandy mud at edge of Smith Creek; U.S. 1 at Virginia state line, Warren Co.

*Coll. 802*—Stagnant mud from overflow of small pond; N.C. 62, 10 mi. W. of Roxboro, Person Co. *Coll. 803*—Red mud at edge of tiny creek emptying into pond at site 802. *Coll. 805*—Sandy mud at edge of Tar River; U.S. 158, Granville Co. *Coll. 806*—Sandy mud at edge of roadside

stream; U.S. 158, E. of Henderson, Vance Co. Coll. 807—Red, stagnant mud in marsh adjacent to stream at site 806. Coll. 808—Mud at edge of small lake; U.S. 158, 2 mi. E. of Norlina, Warren Co. Coll. 809—Mud from pothole subjected to periodic flooding from nearby stream; same location as site 808. Coll. 811—Sandy mud at edge of standing pool connected to small stream; U.S. 158, 8 mi. W. of Roanoke Rapids, Halifax Co.

*Culicoides baueri* HOFFMAN

New records from this study: Coll. 89 (5 males, 5 females).

Previous records: not known from North Carolina prior to the present study.

*C. crepuscularis* MALLOCH

New records from this study: Coll. 54 (1 male); Coll. 88 (1 female); Coll. 90 (2 males); Coll. 805 (1 male); Coll. 808 (3 males, 3 females).

Previous records: Murphy (Snow *et al.*, 1957).

*C. haematopotus* MALLOCH

New records from this study: Coll. 53 (1 male, 1 female); Coll. 84 (5 females); Coll. 86 (12 males, 8 females); Coll. 87 (15 males, 11 females); Coll. 88 (1 male, 1 female); Coll. 89 (1 female); Coll. 91 (5 males, 5 females); Coll. 802 (2 females); Coll. 805 (4 males, 2 females); Coll. 808 (3 males, 4 females); Coll. 809 (3 females); Coll. 811 (9 males, 13 females).

Previous records: not known from North Carolina prior to the present study.

*C. loisae* JAMNBACK

New records from this study: Coll. 811 (1 female). The identity of this specimen was verified by Dr. W. W. Wirth of the U. S. National Museum.

Previous records: This species had not been reported south of Virginia prior to the present study (Jamnback, 1965; Gazeau and Messersmith, 1970). There

is an unpublished record of *loisae* from Highlands, N.C. in the collection at the National Museum.

*C. spinosus* ROOT AND HOFFMAN

New records from this study: Coll. 89 (1 male); Coll. 91 (1 female); Coll. 802 (1 male).

Previous records: Andrews (Snow *et al.*, 1957).

*C. stellifer* (COQUILLET)

New records from this study: Coll. 52 (1 male, 1 female); Coll. 802 (4 males, 2 females); Coll. 803 (1 male, 2 females); Coll. 806 (1 male, 1 female); Coll. 807 (1 male); Coll. 808 (3 males, 1 female); Coll. 809 (1 male, 1 female); Coll. 811 (1 male).

Previous records: Murphy (Snow *et al.*, 1957).

SUMMARY. In addition to the six species covered in this paper, the following *Culicoides* had been previously collected in North Carolina: *C. biguttatus* (Coquillett): Rowan Co. (NMNH). *C. furens* (Poey): no location given (Hall, 1932); Brunswick Co. (NMNH). *C. hinmani* Khalaf: there are slides in the National Museum collection from Cherokee Village and Valley River—Hiwassee Reservoir, both labelled as being in Alabama. These localities could not be located in that state, but have been placed in western North Carolina in the present review. We assume the slides at the National Museum to be incorrectly labelled. *C. hollensis* (Melander and Brues): reported from Wrightville, S.C. by Foote and Pratt (1954), but their material at the National Museum is labelled Wrightville, N.C. Since we were unable to locate a Wrightville in coastal South Carolina (*hollensis* is a coastal species) but found it in New Hanover Co., N.C., we believe the South Carolina record to be incorrect. This species has also been collected in Onslow Co. (NMNH). *C. melleus* (Coquillett): Long Beach (NMNH). *C. obsoletus* (Meigen): Cherokee, Fontana Village,

Murphy (Snow *et al.*, 1957); Lake Junaluska (Jamnback and Wirth, 1963). Since our concepts of this species were altered in 1963 (Jamnback and Wirth), the first three records above may actually refer to *C. sanguisuga* (Coquillett). *C. paraensis* (Goeldi): South Mills (NMNH). *C. sanguisuga* (Coquillett): Jackson, Macon, and Rowan Cos. (Jamnback and Wirth, 1963). *C. venustus* Hoffman: Camp Davis (Foote and Pratt, 1954); Murphy (Snow *et al.*, 1957). There are now 15 *Culicoides* spp. known from North Carolina.

#### References Cited

- BATTLE, F. V., and TURNER, E. C., JR. 1969. New records of Virginia *Culicoides* (Diptera: Ceratopogonidae). Va. J. Sci. 20:44-46.
- FALLIS, A. M., and BENNETT, G. F. 1961. Ceratopogonidae as intermediate hosts for *Haemoproteus* and other parasites. Mosq. News 21:21-28.
- FOOTE, R. H., and PRATT, H. D. 1954. The *Culicoides* of the eastern United States (Diptera: Heleidae). Public Health Monograph No. 18: 1-53.
- GAZEAU, L. J., and MESSERSMITH, D. H. 1970. A synopsis of Maryland *Culicoides* (Diptera: Ceratopogonidae). Mosq. News 30:34-38.
- HALL, D. G. 1932. A new biting *Culicoides* from saltmarshes in the southeastern states. Proc. Ent. Soc. Wash. 34:88-89.
- JAMNBACK, H. A. 1965. The *Culicoides* of New York State (Diptera: Ceratopogonidae). N.Y. St. Mus. and Sci. Serv. Bull. 399:1-154.
- JAMNBACK, H. A., and WIRTH, W. W. 1963. The species of *Culicoides* related to *obsoletus* in eastern North America. Ann. Ent. Soc. Amer. 56:185-198.
- SNOW, W. E., PICKARD, E., and MOORE, J. B. 1957. The Heleidae of the Tennessee River Basin. J. Tenn. Acad. Sci. 32:18-36.

## AXENIC REARING OF *CULEX SALINARIUS*<sup>1</sup>

ROBERT C. WALLIS AND SCOTT W. LITE<sup>2</sup>

Section of Medical Entomology, Department of Epidemiology and Public Health  
Yale University School of Medicine, New Haven, Connecticut 06510

**INTRODUCTION.** The experimental rearing of mosquito larvae in sterile media was initiated by Barber (1927, 1928) in his examination of the role of microorganisms in larval nutrition. He reported no growth of *Culex quinquefasciatus* and *Aedes aegypti* larvae in sterile media, or in water containing only dead organic water.

Later, Hinman (1930, 1932) was able to rear a few *A. aegypti* to the adult stage, but obtained no growth of *Culex* or *Anopheles* larvae. Rozeboom (1935), in his

study of the relationship of bacteria and bacterial filtrates to the development of larvae, found that sterilization of the medium rendered it unsuitable for larval development since bacteria were utilized as food. However, Trager (1935a, 1935b, 1936 and 1937) in study of growth requirements of larval *A. aegypti* found that growth occurred in media free of microorganisms when essential nutritional components were incorporated in it. Since then, investigators have axenically reared this species for various purposes (Trager and Sabbarow, 1938; Sabbarow and Trager, 1940; Trager, 1935a, 1935b, 1936, 1937, 1948; Buddington, 1941; Goldberg and DeMeillon, 1948a, 1948b; Lea *et al.* 1956; Lea, 1957; Singh and Brown, 1957; Grace, 1966; Akov, 1962; and Peleg and Trager, 1963). However, only a few species other than *A. aegypti* have been

<sup>1</sup>This study initially supported by USPHS Research Grant from the National Institutes of Health, No. 5 RO1-GM 12362-05.

<sup>2</sup>A portion of this work is included in the junior author's study that was conducted in partial fulfillment of the essay requirement for the degree of Master of Public Health, Yale University School of Medicine.