

**DESCRIPTION OF THE PUPA OF *Aedes (Ochlerotatus)*
Grossbecki Dyar and Knab (Diptera: Culicidae)¹**

WILLIAM E. BICKLEY² AND BRUCE A. HARRISON³

ABSTRACT. The pupa of *Aedes grossbecki* is described for the first time. Characters are provided for separating *Ae. grossbecki* from *Ae. canadensis* and *Ae. vexans*, two species that are commonly associated with *Ae. grossbecki* in ground pools in the spring.

INTRODUCTION

The pupal stage has been described for 54 (83%) of the 65 *Aedes (Ochlerotatus)* species recognized in the United States and Canada (Knight and Stone 1977, Knight 1978, Wood et al. 1979, Darsie and Ward 1981, Ward 1984). Among those lacking a described pupal stage is *Ae. grossbecki* Dyar and Knab. Although infrequently collected, this species is fairly common in eastern North America. Helson et al. (1978), Darsie and Ward (1981) and Ward and Darsie (1982) report it from 20 states and one Canadian province, from Ontario south to South Carolina and from Wisconsin south to Texas. Dyar and Knab (1906) based their description of *Ae. grossbecki* on the larval stage. They stated that this species was the *Culex squamiger* of Smith (1904) (*non* Coquillett 1902). Grossbeck (1906) described the adults of *Ae. grossbecki* as *Ae. sylvicola*. Additional descriptions of adults, male genitalia, and larvae were published by Ross (1947) and Carpenter and LaCasse (1955). The egg was described by Horsfall et al. (1970).

In this paper we provide the first description of the pupa. Terminology used is that recommended by Harbach and Knight (1980). The specimens examined for this study (1♂, 1♀, 2Le, 1P) bear the following label data: Maryland, Prince George's County, Fort Washington, coll. no. BH 901, 28 Feb. 1990, Bruce A. Harrison, ACC 1509, and are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC.

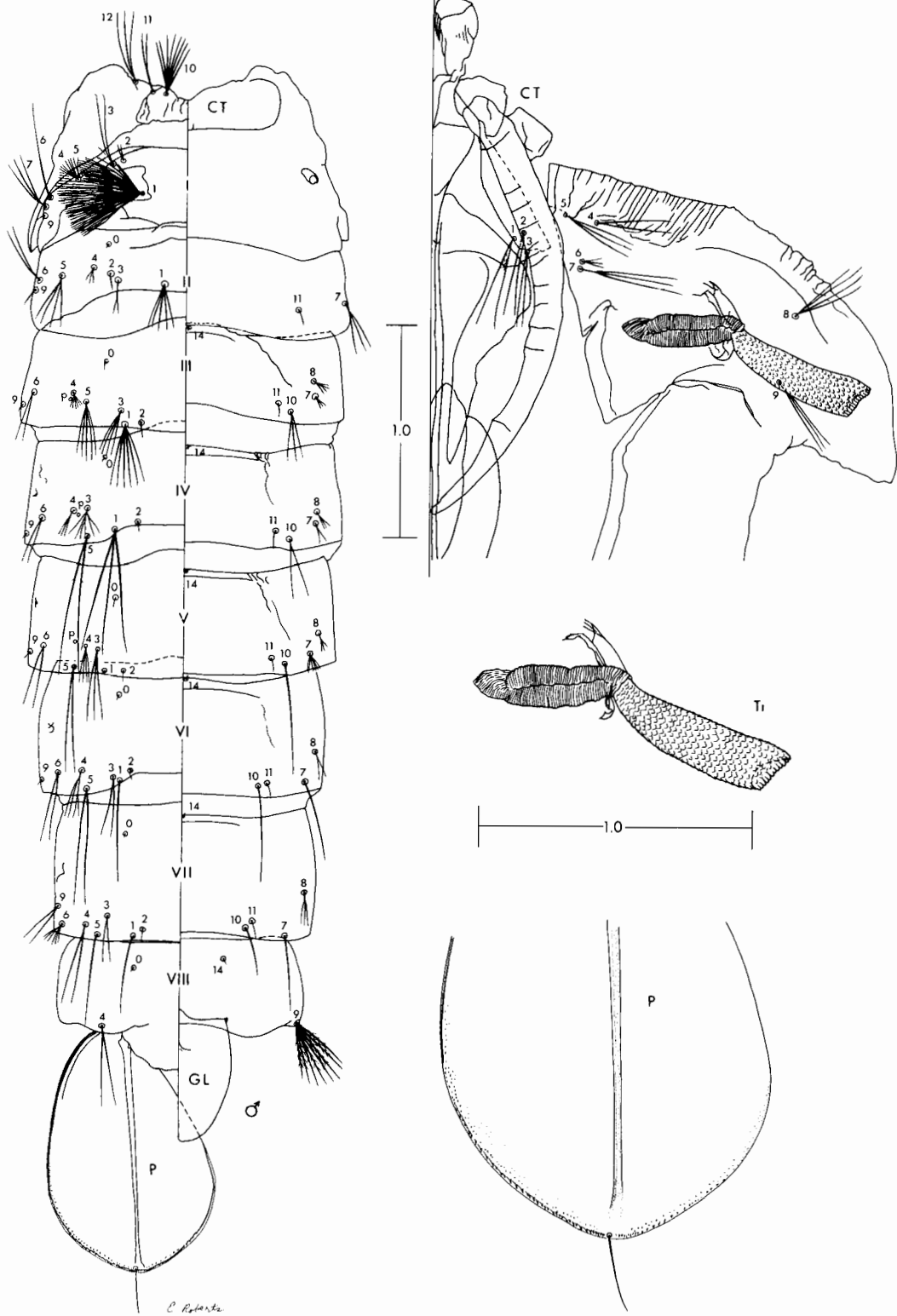
DESCRIPTION

Figure 1 provides the general shape and position of the setae on the two available pupal exuviae (BH 901-1, BH 901). Unless otherwise indicated, the branching of setae is from the base and the branches are approximately the same length. *Cephalothorax*: Seta 1-3-CT long, 4,11-CT double; 5,9-CT triple; 6-CT short, triple; 7-CT triple, with branches arising on basal 0.33; 8-CT with 4 branches; 10-CT with 8 branches; 12-CT triple, longer than 10,11-CT. *Trumpet*: Pinna extremely short, less than 0.05 length of meatus; ratio 10:3. *Abdomen*: Seta 0-II-VIII minute, single; 1-I well developed, dendritic with approximately 50 terminal branches; 1-II moderately long with 5,6 branches; 1-III moderately long with 6 branches; 1-IV long, triple; 1-V missing on both exuviae; 1-VI,VII long, single; 2-I very short, double; 2-II-VII very short, single; 3-I long, double; 3-II short, bifid beyond 0.50; 3-III moderately long with 4 branches; 3-IV short with 6 branches; 3-V short with 4 branches; 3-VI,VII longer than 3-V, double; 4-I and 4-III very short with 6 branches; 4-II

¹ The views of the authors do not purport to reflect the position of the Department of the Army or the Department of Defense (para4-3), AR 360-5.

² Research Associate, Department of Entomology, Museum Support Center, Smithsonian Institution, Washington, DC 20560.

³ Walter Reed Biosystematics Unit, Museum Support Center, Smithsonian Institution, Washington, DC 20560 (address for reprints). Current address: National Research Council, BOSTID, FO-2060, 2101 Constitution Ave., N.W., Washington, DC 20418.



very short, triple; 4-IV short, triple; 4-V short with 4 branches; 4-VI moderately long with 4 branches; 4-VII,VIII long, double; 5-I very short, double; 5-II moderately long with 4 branches; 5-III moderately long with 5 branches; 5-IV-VI very long, double; 5-VII very long, single; 6-I long, single, longer than 7-I; 6-II-VI moderately long, double; 6-VII very short with 6 branches; 7-I,II moderately long, trifid with branching on basal 0.33; 7-III very short, triple; 7-IV very short, double; 7-V very short with 6 branches; 7-VI,VII long, single; 8-III very short with 4 branches; 8-IV,V very short, triple; 8-VI short, double; 8-VII short, triple; 9-I-VI very short, single, on dorsolateral margin; 9-VII moderately long, double, on dorsolateral margin; 9-VIII moderately long with 8 aciculate branches, on ventral surface of segment; 10-III moderately long, triple; 10-IV moderately long, double; 10-V,VI long, single; 10-VII moderately long, single; 11-II-VI very short, single; 14-III-VII minute, single, on midline at anterior margin; 14-VIII minute, single, lateral to midline. *Paddle*: Refractile outer margin extending from base to approximately 0.60; edge hyaline distal to refractile margin, with minute sublateral spicules; hyaline margin and minute sublateral spicules also present on apical 0.40 of inner margin; mid-rib straight; apex faintly acute with minute spicules present; index 3:2; seta 1-P moderately long, single.

DISCUSSION

Specimens studied were collected as larvae in a temporary woodland pool about 7.5 cm deep and stained by submerged leaves of red maple (*Acer rubrum* L.) and sweetgum (*Liquidambar styraciflua* L.). Larvae of *Ae. canadensis* (Theobald) and a species of *Mochlonyx* (Chaoboridae) were collected at the same time. *Aedes grossbecki* larvae have been reported previously in association with *Ae. can-*

adensis (Wirth 1947, Siverly 1972). *Aedes vexans* (Meigen) larvae have also been collected with *Ae. grossbecki* (Wirth 1947).

Aedes grossbecki is a univoltine mosquito whose larvae hatch in the first warm periods of late winter and early spring. At these times this mosquito can be quite common; however, it is infrequently collected because most mosquito surveillance programs do not begin until later in the spring. Larvae of this mosquito usually appear simultaneously with larvae of *Ae. canadensis*, and can be overlooked because they are usually outnumbered. *Aedes vexans* usually appears later, and the association of *Ae. vexans* with *Ae. grossbecki* reported by Wirth (1947) must have occurred near the end of the *Ae. grossbecki* presence. Since these three species may be found together, we are providing a key to separate the pupae.

1. Seta 3-I not more than twice as long as 2-I; 3-III single; trumpet clearly wider at opening than at midpoint *vexans*
 – Seta 3-I more than twice as long as 2-I; 3-III with at least 2 branches; trumpet opening approximately equal in width or only slightly greater in width than at midpoint 2
2. Seta 1-VI single; 3-IV with 6 branches; 3-VII double *grossbecki*
 – Seta 1-VI with at least 2 branches; 3-IV usually with fewer than 6 branches; 3-VII with more than 2 branches *canadensis*

ACKNOWLEDGMENTS

We are grateful to James Pecor and Peter Mundel for preparing microscope slides, to Lisa Roberts and Taina Litwak for preparing the illustrations, and Ralph Harbach, Richard Wilkerson and Ronald Ward for their review of the manuscript and their helpful comments.

Fig. 1. Pupa of *Aedes (Ochlerotatus) grossbecki*, with enlargements of the trumpet to show the relationship between the width of the opening and the trumpet at midlength, and the paddle to show the hyaline outer edge on the distal half.

REFERENCES CITED

- Carpenter, S.J. and W.J. LaCasse. 1955. Mosquitoes of North America (north of Mexico). Univ. Calif. Press, Berkeley.
- Coquillett, D.W. 1902. New Diptera from North America. Proc. U.S. Nat. Mus. 25:83-126.
- Darsie, R.F., Jr. and R.A. Ward. 1981. Identification and geographical distribution of the mosquitoes of North America, north of Mexico. Mosq. Syst. Suppl. 1:1-313.
- Dyar, H.G. and F. Knab. 1906. The larvae of Culicidae classified as independent organisms. J. N.Y. Entomol. Soc. 14:169-230.
- Grossbeck, J.A. 1906. Notes on *Culex squamiger*, Coq. with a description of closely allied species. Can. Entomol. 38:129-131.
- Harbach, R.E. and K.L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publ. Inc., Marlton, New Jersey.
- Helson, B.V., G.A. Surgeoner, R.E. Wright and S.A. Allan. 1978. *Culex tarsalis*, *Aedes sollicitans*, *Aedes grossbecki*: new distribution records from southwestern Ontario. Mosq. News 38:137-138.
- Horsfall, W.R., F.R. Voorhees and E.W. Cupp. 1970. Eggs of floodwater mosquitoes. XIII. Chorionic sculpturing. Ann. Entomol. Soc. Am. 63:1709-1716.
- Knight, K.L. 1978. Supplement to a catalog of the mosquitoes of the world (Diptera: Culicidae). Thomas Say Found. 6(Suppl.):1-107.
- Knight, K.L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). Second Edition. Thomas Say Found. 6: 1-611.
- Ross, H.H. 1947. The mosquitoes of Illinois. (Diptera: Culicidae). Bull. Illinois Nat. Hist. Surv. 24:1-96.
- Siverly, R.E. 1972. Mosquitoes of Indiana. Indiana State Board of Health, Indianapolis.
- Smith, J.B. 1904. Report of the New Jersey State Agricultural Experiment Station upon the mosquitoes occurring within the state, their habits, life history . . . New Brunswick, New Jersey.
- Ward, R.A. 1984. Second supplement to "A catalog of the mosquitoes of the world" (Diptera: Culicidae). Mosq. Syst. 16:227-270.
- Ward, R.A. and R.F. Darsie, Jr. 1982. Corrections and additions to the publication, identification and geographical distribution of the mosquitoes of North America, north of Mexico. Mosq. Syst. 14:209-219.
- Wirth, W.W. 1947. Notes on the mosquitoes of Louisiana. J. Econ. Entomol. 40:742-744.
- Wood, D.M., P.T. Dang and R.A. Ellis. 1979. The mosquitoes of Canada (Diptera: Culicidae). Series: The insects and arachnids of Canada. Part 6. Biosystematics Res. Inst., Can. Dept. Agric. Publ. 1686:1-390.