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SCIENTIFIC NOTE

FIRST RECORD OF *TOXORHYNCHITES RUTILUS* (DIPTERA: CULICIDAE) IN MASSACHUSETTS

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ABSTRACT. The 1st recorded capture of *Toxorhynchites rutilus* in Massachusetts, USA, is reported. This capture represents the northernmost record of *Tx. rutilus*. The implications of this capture are discussed in the context of range expansion, evolution, and climatic change.

KEY WORDS *Toxorhynchites*, range expansion, 1st record, distribution

We report the 1st recorded capture of *Toxorhynchites rutilus* (Dyar and Knab) in Massachusetts. On July 21, 1998, we found 6 *Tx. rutilus* larvae in a tree hole of a beech (*Fagus grandifolia*) tree located in the Clark University arboretum, Worcester, MA (42°15′N, 71°49′W). Subsequently, we engaged in a systematic survey and sampled 108 tree holes and tires in the surrounding area. On August 12, 1998, another beech tree hole, located on the grounds of Doherty High School, Worcester, MA, was found to contain 13 larvae of the same species. Doherty High School is located approximately 1.5 km from the Clark University arboretum. On August 13, 1998, 3 more larvae were removed from a beech tree hole located in the Clark University arboretum. At all sites numerous *Aedes triseriatus* (Say) larvae were captured.

All *Tx. rutilus* larvae were brought to the laboratory and raised to adulthood on larval *Ae. triseriatus* prey. Three adults of each sex were pinned and deposited into the Museum of Comparative Zoology at Harvard University.

Toxorhynchites spp. do not bloodfeed, and the larvae are voracious predators, especially upon the immature stages of other mosquito species. These traits have led many investigators to suggest that *Toxorhynchites* larvae be used as biological control agents of potential disease vectors (reviewed by Steffan 1975). Most early attempts to use *Toxorhynchites* as biological control agents were not considered effective (Steffan 1975). More recently, Gerberg and Visser (1978) and Focks et al. (1980) demonstrated the effectiveness of *Toxorhynchites* as biological control agents of vector mosquitoes. Despite their effectiveness, *Toxorhynchites* are not commonly used as biological control agents because of practical and financial considerations.

This discovery represents the northernmost record of *Tx. rutilus* in the United States or Canada. Previously, *Tx. rutilus* has been reported to range from Valles, Mexico (22°0′N) in the south (Eads and Campos 1963) to Point Pelee, Canada (41°56′N, 82°31′W) in the north (Parker 1977). In the northeastern USA, *Tx. rutilus* has been reported in New Jersey (Hemmerlein and Crans 1968), New York City (Klots 1961), Long Island (Guirgis and Van Orstrand 1976), Connecticut (Main et al. 1976), and Rhode Island (Lawson et al. 1994). Previous surveys conducted in Massachusetts during the 1970s failed to find *Tx. rutilus* (Bradshaw, personal communication).

These records suggest that *Tx. rutilus* may have expanded its range in New England over the past 3–4 decades. However, we note that several factors must be ruled out before confirmation of range expansion is possible. First, it must be shown that local populations are indeed self-sustaining. It is plausible that *Tx. rutilus* were inadvertently transported from southern locations to Worcester in automobile tires or similar containers, and will die out next winter. Second, this expansion pattern may be due to fortuitous sampling by mosquito investigators. It may be that *Tx. rutilus* were always locally present, but simply not observed by investigators. Finally, movement northward may be part of some climatic cycle. Because of the effects of El Niño, the winter of 1997–98 was one of the mildest on record. The mean temperature for the northeast during the period ranging from December to February 1997–98 was 29.8°F (−1.2°C) (National Climatic Data Center 1998). Only 1 winter (1932) has had higher mean temperatures since record keeping began in 1895. Cold winters seem to temporarily extinguish *Tx. rutilus* at the northern edges of its range (Bradshaw, unpublished), and drought can cause extinctions of local populations (Lounibos et al. 1997).

Of these 3 possible explanations, we believe that only the last interpretation is likely. The existence of *Tx. rutilus* larvae in separate locations in Worcester supports the contention that these larvae are members of a local population, and not accidental migrants. As for the proposition that this pattern results from chance sampling by mosquito researchers, we contend that this is highly unlikely because one of us (T.L.) has sampled the Worcester

area extensively each summer for 18 years. As for the final suggestion, only an extensive period of sampling will reveal whether the discovery of *Tx. rutilus* in Massachusetts represents a new local population or if incidental climactic conditions allowed migrants to advance far beyond their normal range.

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