# Elephant (or Treehole) Predatory mosquito

*Toxorhynchites rutilus rutilus*
*Toxorhynchites rutilus septentrionalis*

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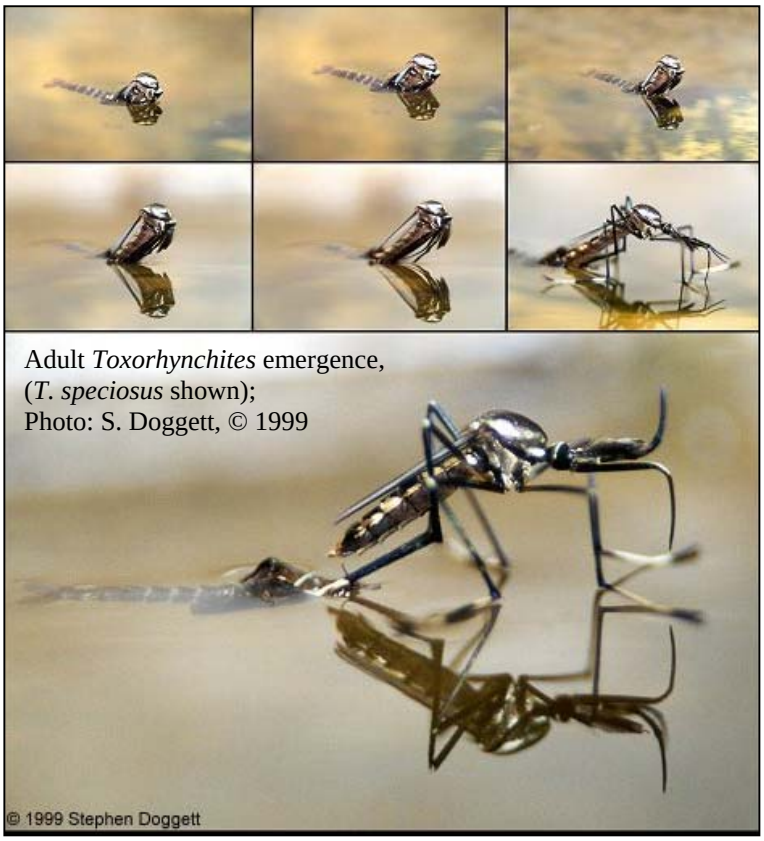
DESCRIPTION


**Taxonomy**

The largest mosquitoes (Diptera: Culicidae) in the world are members of the genus *Toxorhynchites*, found primarily in tropical, forested areas. This generic name replaced *Megarhinus*, which is pre-occupied (Stone 1948).

The taxonomy of the 88 *Toxorhynchites* species and subspecies (Jones and Schreiber 1994; Walter Reed Biosystematics Unit 2001) is quite difficult and in need of revision in the American hemisphere. *Toxorhynchites rutilus rutilis* was described in 1896 from a male and several females from Georgia and Florida and from a wrongly associated female from North Carolina (Jenkins 1949). *Toxorhynchites septentrionalis*, previously identified as *T. rutilus*, was first described in 1906 from 13 males and 11 females from Virginia, West Virginia, District of Columbia, Maryland, North Carolina, Mississippi and Louisiana (Jenkins 1949).




Adult males of the two subspecies differ significantly only in leg markings (Michener 1945; Jenkins 1949). These two brilliantly colored day-flying mosquitoes are considered subspecies (Carpenter and Jenkins 1945; Jenkins 1949) for the following reasons: the distributions of the two forms overlap in part of their ranges; a complete series of intergrades between the two forms occurs throughout the zone of overlap in ranges; the only known character separating the two forms is a color difference of the males, which is subject to variation; no significant

differences have been found to separate the two forms in the male genitalia, larvae, pupae, or females, even from reared correlated series of specimens; and the life histories, habitats, and breeding habits of the two forms are similar.

*Toxorhynchites* larva (*T. speciosus* shown); Photo: S. Doggett, © 1999

**Basic Description**

*Toxorhynchites* are unusually large mosquitoes; the wingspan may exceed 12 mm (0.4 inches) and the body length may exceed 7 mm (0.2 inches). Adults are frequently covered with iridescent scales and the proboscis has a pronounced 90-degree downward curve.

All known species produce multiple generations per year (Bates 1949; Pratt 1959). In the United States, *Toxorhynchites* generally overwinters as late larval instars. Diapause is controlled by day length rather than temperature. In the extreme southern portions of New England, *Toxorhynchites septentrionalis* undergoes a life cycle typical for a number of container-breeding mosquitoes (Bates 1949). This type of life cycle is characterized by having non-desiccation resistant eggs laid directly on water in container habitats; larvae developing in natural or artificial containers; multiple generations each year; and overwintering in the larval stage.

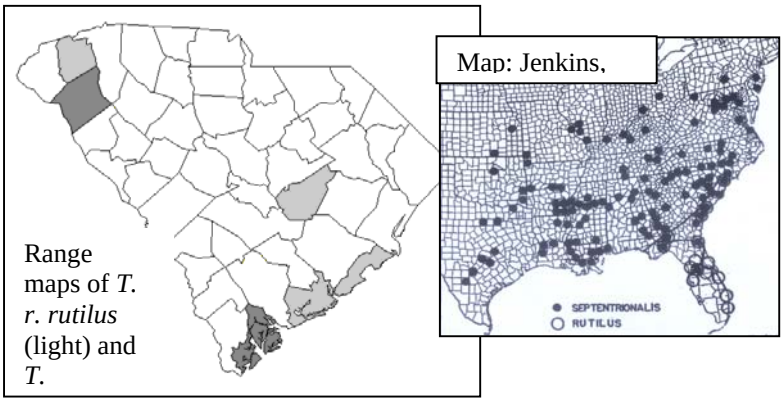
Mosquitoes in the genus *Toxorhynchites* are predaceous as larvae on the immature stages of other mosquito species and often turn cannibalistic. Larvae are generally dark brown or reddish, with conspicuous hairs on the abdomen. The head capsule has a pair of powerful mandibles. Fourth-instar larvae can be more than 2 cm (0.8 inches) in length.

**Status**

These species currently have no state or federal listing status.

POPULATION DISTRIBUTION AND SIZE

*Toxorhynchites rutilus rutilus* is found throughout peninsular Florida and southern and coastal Georgia north to South Carolina (Basham et al. 1947; CUAC 2005; Jenkins 1949; Jones and Schreiber 1994). *T. r. septentrionalis* is found from New York to Kansas south to Texas and northern Florida (CUAC 2005; Jenkins 1949; Jones and Schreiber 1994).



Range maps of *T. r. rutilus* (light) and *T.*

Population sizes for larvae of these species are typically low in number. For example, each larval predatory mosquito population, such as a population of larvae in water collecting in a discarded tire, usually consists of only a few larvae. Cannibalism is not uncommon, especially in smaller containers; however, containers such as discarded tires with ample food supplies may support half a dozen or more similarly sized larvae.

## HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Adult predatory mosquitoes feed on nectar and other naturally occurring carbohydrate sources but never take blood meals, leading many entomologists to recognize this mosquito's potential to reduce pest and disease-bearing mosquitoes.

The large larvae are found in the water in tree holes (Jenkins and Carpenter 1946), the bases of bromeliads, artificial receptacles, rodent–eaten coconut husks and bamboo stems that hold water. In addition, human-discarded items such as tires, buckets and cans are excellent larval habitats used by pest mosquitoes. These pest mosquito species include those capable of transmitting the causal agents of yellow fever, dengue, and other diseases (PHEREC). Larvae depend on movement for prey location, feeding on the living macroinvertebrates in flooded treeholes, bromeliads and human-made containers. They may eat as many as 400 larval mosquitoes during larval development; cannibalism is not uncommon, especially in small containers. Larval behavior is especially intriguing for biocontrol because killing of pest larvae without feeding has been reported (Jones and Schreiber 1994).

Predatory mosquitoes in the genus *Toxorhynchites* are the most common arthropods that have been used for control of "container-breeding" mosquitoes. The combination of carnivorous larvae and innocuous adults is very attractive in biological control, though limited studies in the United States have not shown continuous larval control with this predator. Successful biological control has been reported using *Toxorhynchites* species from Japan, Southeast Asia, the Caribbean and the United States (Jones and Schreiber 1994).

*Toxorhynchites rutilus* larvae left a few *Wyeomyia* larvae untouched in feeding experiments, no matter how many they were offered (Frank et al. 1984). Predatory mosquito larvae may conserve their prey in the manner of stock-rearers (Reiter 1985) and might, therefore, be unsuitable as biocontrol agents where survival of the prey is limited by food availability. Predatory mosquito adults will lay their eggs in most types of water-filled containers (Jones and Schreiber, 1994). However, under natural circumstances, these species do not lay enough eggs to keep pest and vector populations in check. Studies that have used predatory mosquitoes to reduce pest mosquitoes in Florida have relied on rearing and releasing additional adults of *Toxorhynchites* to boost naturally occurring populations and get ahead of pest mosquito production (PHEREC).

One of the advantages of a *Toxorhynchites* release program is that the adult mosquito can disperse and lay eggs in areas most likely to escape treatment with insecticides. This method of biological control can result in favorable press coverage and often gives a mosquito control district the opportunity to stress ecologically sound methods while controlling mosquitoes.

Biological control using predatory mosquitoes seldom results in complete control of the targeted population. *Toxorhynchites* release programs need to be timed ahead of estimated increases in mosquito nuisance/vector populations, and the use of adults has the added requirement of nectar availability to complicate timing.

## CHALLENGES

The typically low population numbers of these beneficial predators make *Toxorhynchites* highly susceptible to insecticides, and care must be exercised in timing the release of *Toxorhynchites* and application of insecticide sprays.

Although *Toxorhynchites* alone is unlikely to reduce pest or vector species below operational thresholds, it can be a valuable management tool in areas where containers and treeholes contribute substantially to the standing crop of mosquitoes. Their large size creates the opportunity for them to serve as focal points for public awareness campaigns aimed at the cleanup of human-made containers that are used as breeding sites by pest mosquitoes. However, problems using *Toxorhynchites* for biocontrol include the high labor costs of mass rearing, the short "shelf life" of the eggs (they hatch in fewer than two days) and the high labor costs of distribution.

## CONSERVATION ACCOMPLISHMENTS

There are no conservation accomplishments to date in South Carolina for *Toxorhynchites* species.

## CONSERVATION RECOMMENDATIONS

- Where feasible, promote the use of predatory mosquitoes to assist in managing pest mosquito populations.

## MEASURES OF SUCCESS

As further research and management needs are identified, projects will be initiated to address those needs. Discovery of new populations could be considered a success.

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