

# University of Florida Book of Insect Records

## Chapter 22 *Most Saline Tolerant*

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*Brine fly larvae, Ephydrella marshalli (Diptera: Ephydridae), show remarkable powers of osmoregulation in withstanding salinities up to 5848 mOsm/l under laboratory conditions. (Sea water is 1197 mOsm/l.) Larvae of a long-legged fly, Hydrophorus plumbeus (Diptera: Dolichopodidae), are second to E. marshalli, as they withstand osmotic concentrations as great as 5650 mOsm/l.*

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I define the most saline tolerant insect as the one capable of withstanding the strongest salinity for at least 24 hours. The scope of my search was not limited to larvae, although it is larvae that hold the first and second prizes for saline tolerance.

### Methods

CD-ROM versions of Biological Abstracts and AGRICOLA (1986-1995) were searched and proved very helpful. Additional resources included personal communications with scientists, secondary literature, and the ENTOMOLOGICAL Bulletin Board.

### Results

*Ephydrella marshalli* larvae collected from commercial salt works lagoons on Port Phillip Bay, Victoria, have survived several days in hypersaline sodium chloride (NaCl) media of 5848 mOsm/l (Marshall et al. 1995). This was determined by an experiment designed to find out whether ephydrid larvae could produce hypo and hyperosmotic rectal fluids in response to changes in the external environmental salinity. *E.*

*marshalli* larvae have the ability to regulate the composition of the body fluid to compensate for fluctuating external salinities; the potassium concentration in the flies' rectal fluid rises as the salinity of the external medium increases.

The salinity tolerance of *E. marshalli* is nearly matched by larvae of yet another fly: the dolichopodid *Hydrophorus plumbeus*. Herbst and Bradley (1988) investigated the osmoregulation of *H. plumbeus* larvae they collected from Mono Lake, California, and found that they, like *E. marshalli*, are able to osmoregulate over a wide range of salinities. These larvae survived exposure to concentrations as great as 5650 mOsm/l for one week.

### Discussion

The Diptera, or true flies, are a large order of endopterygote (=holometabolous) Neoptera. In aquatic species, only the larval and pupal stages live in the water, the adults, with very few exceptions, being terrestrial (Williams & Feltmate 1992). The family Ephydridae includes shore flies and brine flies which usually inhabit littoral zones, margins of lotic and lentic habitats, saline lakes and pools, salt marshes, crude petroleum pools, and hot springs (Williams & Feltmate 1992). Dolichopodids are known to have colonized at least the periphery of the marine environment and inland saline waters, as well as margins of ponds, lakes rivers and streams (Williams & Feltmate 1992).

The salt water mosquito *Aedes detritus* has also been noted for its high salinity tolerance (Beadle 1939), although not as high as either *E.*

*marshalli* or *H. plumbeus*. Its method of osmoregulation is very similar to that of other dipterans; reabsorptive and secretory cells are arranged in parallel in an ileum-like area in *Ephydrella* larvae (Marshall & Wright 1973), and arranged in series in *Aedes* larvae (Askura 1973). Marshall et al. (1995) speculate "that since saline water ephydrid larvae have greater salinity tolerances than saline water mosquito larvae, the parallel arrangement of cell types...similar to those arranged serially in mosquito larvae, may be an inherently more efficient osmoregulatory system."

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