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Desiccation tolerance of *Platorchestia platensis* (Krφyer, 1845) (Amphipoda, Talitridae).

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Abstract: A test of desicattion of *P. platensis* showed a reduction from 70 % of the body weight was water to 42 % water at death. Mean water loss was 30 %, and mean survival time was 43 min. Loss of tactile response ocurred at 27 %water loss. Mean osmolality was 0.62 M/Kg.

Although some physiological studies have been done on talitroidean amphipods (Divakaran and Balasubramanian 1981, Divakaran and Pillai 1981) few of these deal with littoral talitrid amphipods (Marsden 1980, 1984; Williamson 1951). Studies on desiccation tolerance and/or body fluid contet of gammaridean amphipods are scarce (Basikalova *et al.* 1946; Moore and Francis 1985; Werntz 1963). To my knowledge, no studies have been done on the physiology of *Platorchestia platensis.* The species occurs in the American Atlantic coast, from southern Newfoundland and the Gaspé Peninsula to Florida and the Gulf of Mexico (Bousfield 1973). This talitrid amphipod (Superfamily: Talitroidea; Suborder: Gammaridea) was particularly abundant in the supralittoral zone wrack and below mean high water level at Lake Wyman. Intertidally, it occurs on outer sand beach under shelter (shells, leaves, debris, etc) and damp substrate only. Furthermore, Lake Wyman is an addition to the known distribution of *P. platensis.*

The present study was undertaken to obtain survival time, water loss and osmolality values for *P. platensis.*

MATERIAL AND METHODS

Study area: Lake Wyman (latitude 26° 21' 9" N and longitude 80° 05' 5" W) partly consists of an undeveloped estuarine area surrounded by mangrove vegetation, and extending along the western shoreline of the Intracoastal Waterway in Boca Raton, Florida (Fig. 1).

Collections: One hundred and forty one individuals of *Platorchestia platensis* were collected by hand from clumps of wrack in the supralittoral zone at Lake Wyman. Sampling was done during late October and November, 1985. The average salinity in the lake, measured with a hand refractometer (Atago), was $30^{0}/_{00}$, water temperature 28°C, and air temperature 29°C. The total body length was 7.4 ± 1.6 mm for females (66 %) and 8.5 ± 1.6 mm for males (34 %). The mean size was 5.3 ± 2.5 mg dry weight and 18 ± 13 mg wet weight. Live specimens were identified by the morphological characterst outlined by Bousfield (1973) and Kunkel (1910).

Laboratory maintenance: The amphipods were maintained in plastic buckets with abundant wrack and moist sand from the collection area. During this study, the range of the room temperature in the laboratory was 24-26°C. Relative humidity, measured with a sling psycrometer, was 66.5 ± 2.5%. Amphipods were kept in the laboratory for 3-24 h prior to experimentation.

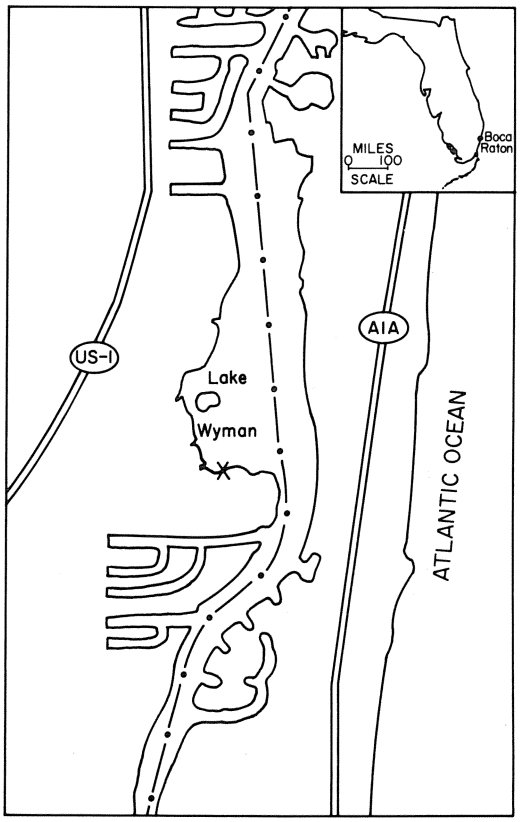

Fig. 1 Lake Wyman: general area and sampling location.

Desiccation tolerance: All desiccation experiments were carried out at room temperature 25 ± 1°C in a plastic Nalgene vacuum desiccator, containing 300 g of color-indicating anhydrous $CaSO_4$ (Drierite). Each amphipod was placed in a 20 ml beaker inside the desiccator to avoid contact with the desiccant. Because this amphipod species normally jumps or hops when uncovered, each beaker was sealed with a fine mesh screen. Individuals (N = 25) were weighed on a Torbal Torsion balance Model ET–1 to the nearest mg. After determination of wet weight (initial weight), they were placed in the desiccator, weighed initially at 5 min, and then weighed at 10 ± 5 min intervals until death. The time that the amphipods spent out of the desiccator was included in the data. After death, animals were dried at 100 °C for 24 h, using a Precision Thelco Oven Model 18, and weighed (dry weight) at 12 and 24 h. Twelve individuals of *Platorchestia platensis* were dried to constant weight to determine time for 100% water loss. The criterion for determining death was the loss of response of pereiopods, gnathopods, mouthparts, and antenna to tactile stimulation. After obtaining the dry weight (at 24 h), total body length of each amphipod was measured with a plastic rule to the nearest 0.01 cm with the aid of a dissecting microscope. The difference between the initial wet weight and the final dry weight was considered the water content of the animal.

Body fluid content: All measurements of osmotic pressure of body fluids were obtained by using a Wescor 5100C Vapor Pressure Osmometer, which was calibrated prior to each measurement. Fifteen to forty amphipods (total N =70) were blotted dry, mashed and their body fluid content immediately collected with millipore filter discs. Prior to experimentation, amphipods were anesthetized with anhydrous ether $(C_2H_5)O$, to facilitate manipulation.

RESULTS

Death by desiccation was relatively fast with a mean survival time of 43 ± 16 min at 25 ± 1°C air temperature, and 66.5 ± 2.5 % relative air humidity. The cumulative percentage of water loss showed that 9 ± 1 % of water loss was achieved in 5 ± 2 min and 27 ± 3 % in 25 ± 5 min, falling under a stress condition. The stress condition was characterized by less activity, lack of appendage movements and more pronounced curvature of the convex body. *Platorchestia platensis* began with 70 ± 8 % body weight due to water and had lost 42 ± 16 % of water at time of death. Mean water loss, percentage of body weight due to water loss at time of death were not a function of size or sex, because the entire range of total body length remained constant (8.1 ± 1.7 mm). The amount of water at death did not change after 12 h of drying to constant weight, and instead 24 h at 100 °C were necessary to achieve a 100 % water loss. The species showed moderate resistance to desiccation up to 30 ± 8 % of water loss, but after 45 ± 5 min of desiccation, water loss and death rate increased sharply (Fig. 2). When "time to death" was plotted against dry weight (mg), a uniform scatter diagram was obtained (Fig. 3). Individuals within the range of 3-13 mg were able to withstand 24 to 74 min (complete range of "time to death") of desicca-

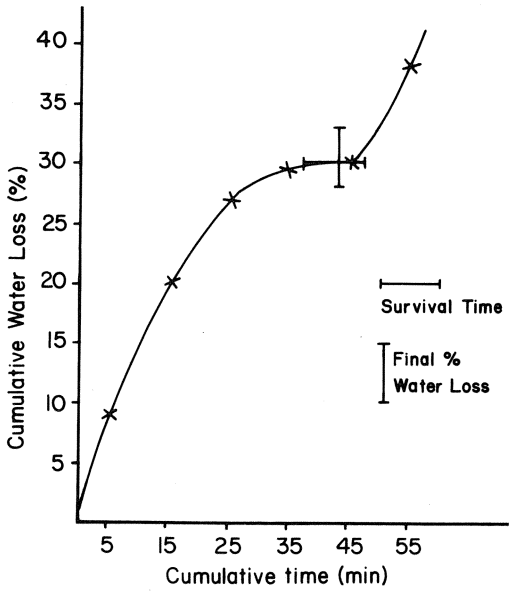

Fig. 2. Desiccation rates of the talitrid amphipod, *Platorchestia platensis.* Mean values ± standard error for survival time and final % water loss are indicated.

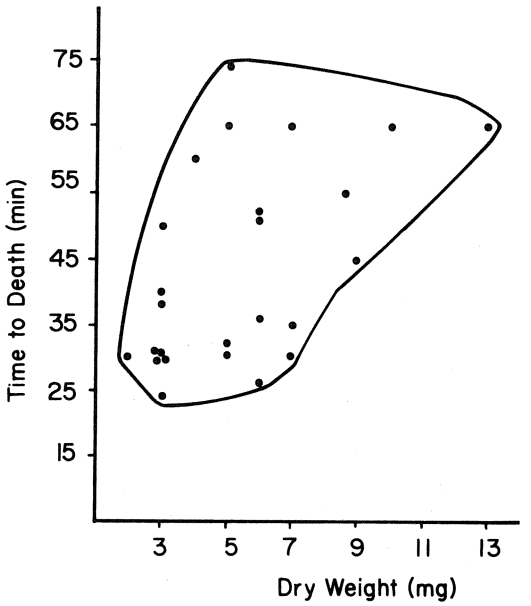

Fig. 3. Scatter diagram of dry weight (mg) against "time to death" (min) for the talitrid amphipod, *Platorchestia platensis.*

tion. Mean osmolality value for *Platorchestia platensis* was 0.62 ± 0.06 M/Kg.

DISCUSSION

A value of 70 % body weight due to water for *Platorchestia platensis* is relatively low when compared with marine crustaceans such as lobster with 79 % water content (Schmidt–Nielsen 1964). However, it is slightly high compared with two mid-intertidal xanthid crab species, *Eurypanopeus depressus* (64 %) and E. *dissimilis* (59 %) water content (Garcés 1987). Grant and McDonald (1979) reported values of 64-68 % body weight due to water and 30-32 % water lost at time of death on intertidal and subtidal populations of xanthid mud crabs, *E. depressus.* Young (1978) using similar methods, found 46-50 % water loss at death and 44-158 min survival time in three hermit crab species; both are larger than values obtained for *P. platensis.* This amphipod seems relatively sensitive to desiccation; it lost about 30-42 % of body water at time of death. Moore and Francis (1985) found that 25 % loss of total body water was intolerable in the supralittoral talitrid amphipod, *Orchestia gammarellus.* The range of osmolality values for *Platorchestia platensis* (0.56–0.71 M/Kg) falls within those given for other gammaridae species, 0.48–0.93 (Basikalova *et al.* 1946; Werntz 1963). As seen in many terrestrial crustaceans such as isopods, it appears that behavioral rather than physiological mechanisms are more important for surviving under dry conditions (Wilson 1972). Likewise, amphipods have adapted to land more by behavioral mechanisms, than by specific physiological or morphological means (Edney 1954). This is especially true in semiterrestrial species in which damp substrates and high humidity microclimates such as wrack covering are behaviorally selected to avoid dehydration. Grant and McDonald (1979) suggest that within the intertidal zone, low desiccation tolerance may be indicative of greater importance of microhabitat for a given species; *P. platensis* is such a species. It is concluded that without microhabitat protection (wrack cover and moist sand substrata) from desiccation extremes, this amphipod could not live at and below the supralittoral zone at Lake Wyman.

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RESUMEN

Setenta por ciento del peso total del anfípodo *P. platensis* corresponde al agua, que se reduce al 42 % al morir. La pérdida de agua promedio fue 30 %, y el tiempo de supervivencia promedio fue 43 min. La respuesta al estímulo táctil desapareció al perder un 27 % del peso del agua, y la osmolaridad promedio fue 0.62 M/Kg.

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