NOTES ON THE BIOLOGY OF A COMMON GASTROTRICH OF THE CHICAGO AREA *LEPIDODERMA SQUAMATUM* (DU JARDIN)

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Introduction

Although the Gastrotricha have been elevated to the category of a phylum since 1936 by the Committee on Nomenclature of the Zoological section of the American Association for the Advancement of Science, no other group of fresh water animals has seemingly been as greatly neglected by research workers in this country. European observers since Du Jardin (1841) have contributed most of our information concerning this group, including several comprehensive monographic treatments by such workers as Zelinka (1889), Grunspan (1910), and Remane (1936). However, with the exception of the studies of Stokes on the Gastrotrichs of New Jersey in 1887 and 1888, and those of Brunson (1947), very limited observations have been made in the United States. The author has been making collections of this group for several years for taxonomic and speciation studies to be published at a later date. This paper is a brief report on various factors of the biology and life history observations made on a single species.

The species of most general distributions in the Chicago area keys out as *Lepidoderma squamatum* in Ward's taxonomic key included in "Fresh Water Biology" by Ward and Whipple (1918), and it shows little or no variation from written descriptions of this species derived from Du Jardin's original type species. Since holotype European specimens are not available, the assumption is that this study is concerned with a geographical variant of the original European species.

Ecology and Distribution

Collections of this species were made over the summer months of the years 1946 and 1947 in the vicinity of the Chicago area from both running stream and temporary pond habitats. This species has been found repeatedly in collections from the Des Plaines River. Although no precise quantitative measurements were made, it became apparent from the habitat sources that this species requires a moderate amount of oxygen concentration in a fresh water habitat that contains very minimal amounts of organic contamination. When this organism was transferred to the laboratory and raised in an artificial medium, it required the control of pH by addition of a buffer for successful culturing.

Pure Culture Technique

Successful pure line culture technique was made possible by the isolation of single individuals through the employment of a micropipette and their introduction into glass

finger bowls containing spring water which had been conditioned by being allowed to stand for ten days and containing several rice grains which were then allowed to ferment within the water. Several of these pure line cultures were maintained for more than a year and required only the addition of a few grains of rice every three to four weeks and the replacement of water lost through evaporation. Various different types of culture media were tested, including infusions of oats, corn, peas, and hay as well as the method of cultivation by using malted milk powder described by Packard (1937). None of these were as successful as rice in maintaining cultures, and complete negative results were obtained with Packard's malted milk medium. Life history observations were made on isolated individuals grown in hanging drop preparations and in shallow depression slides.

Life History Stages

The adult animal has the body externally divided into superficial regions of head, neck, and trunk which appears to be generally characteristic of all species of fresh water Gastrotricha. Measurements made on mature living specimens show a slight variation in length between 120 to 148 mu. The width of the head varies between 20 to 25 mu, that of the neck is approximately 20 mu, and the width of the abdominal region varies between 25 to 30 mu. The body is distinctly scaled and the ventral surface bears several longitudinal rows of cilia. The head of this species is rounded anteriorly and bilobed on each lateral surface. Groups of cilia in tuft formations are found on the lateral surfaces of the head. At the posterior end the trunk forks into a pair of caudal appendages which vary in length between 23 to 26 mu. Internally, a rather heavily walled pharynx can be seen which terminates anteriorly in a mouth-like opening and posteriorly leads to the stomach-intestine. The mature form can be readily distinguished from the immature larval forms by the larger size and by the usual presence of a single large developing ovum located in the posterior third of the body.

Several hundred specimens were studied for evidence of a possible differentiation as to sex or the possibility of the existence of hermaphroditism. Histological sections were made in the search for male gonads. In all instances these observations were negative so that this organism must still be considered as reproducing only by parthenogenesis. All experimental attempts to produce a male type of organism by simulating environmental temperature variations or by the employment of sublethal temperature shocks on both egg and adult failed also in this respect.

Population clones developed from single isolated individuals which varied in size from minimal to maximal measurements showed the same variations in these characteristics as is found in any mixed population. It is thus concluded that such variations are environmentally produced and are related to some factor such as nutritional differences among individuals. Remane (1927) considers the marine Gastrotrichs as being the primitive members of this group, and the degenerate nature of *L.*

squamatum became somewhat evident with the difficulty encountered by this observer to experimentally produce genetic variations in isolated populations.

The egg of *L. squamatum* is oval in shape and has a mean length of 45 mu and a mean width of 25 mu. It appears to be covered with a chitinous-like material and bears numerous spine-like processes over the surface which appear after oviposition has occurred. The eggs are deposited on the bottom of the culture dish, usually in the vicinity of the fermenting rice media. Within the adult, the egg develops into a large cell occupying the entire posterior third of the animal. It appears as a prominent nucleus surrounded by a considerable amount of cytoplasmic material. In experimentally subjecting pure line cultures to variable constant low tempertures and to temperature shock treatment, the egg retained its viability even when maintained at approximately 4°C. Since the adults were killed off by prolonged low temperatures, it seems likely that the overwintering stage for this species in this area is in the egg.

The egg also appears to have a great deal of resistance to desiccation over extended periods of time, although this does not appear to be a necessary element in the life cycle. Three glass finger bowl cultures were allowed to dry out by evaporation at room temperatures and after a period of three weeks, the liquid was replaced by the addition of conditioned spring water. In two of the three cultures living specimens of this species were found once again after two weeks time.

Metchnikoff in 1865 described two kinds of eggs, "summer" and "winter," for the species *Chaetonotus larus,* and Remane (1926) describes a similar condition of two kinds of eggs for the species *C. persetosus.* He notes, however, that these are not to be considered as summer and winter eggs since the so-called "winter eggs" are produced throughout the year. This observer has failed to find other than a single type of egg for the species *Lepidoderma squamatum,* despite experimental attempts to produce variant types by subjecting the organism to temperatures ranging from 4°C. to 28°C. It is thus felt that experimental observations seem to preclude the question of summer and winter eggs for this species.

Summary

Collections from fresh-water ponds and streams over several seasons have indicated that the species *L. squamatum* is the most generally distributed species of Gastrotricha in the Chicago area. This organism has been successfully maintained as pure cultures in artificial infusion media, and observations were made on its life history stages. Only a single type of egg could be observed to be produced under controlled and varying experimental temperature fluctuations and this egg proved to be viable under rather prolonged extreme low temperature conditions and periods of desiccation. Thus it is suggested that the egg serves as the carrying-over stage when the organism encounters adverse environmental conditions and this may be the explanation for rather wide distribution of this species in both Eur-

ope and the United States. The egg of this species appears to be of a single type, even when tested under varying experimental conditions, and this would seem to dispel the possibility of seasonal types of eggs which have been described in the literature for other species. Adults appear under all circumstances to be unisexual and undergo true parthenogenetic reproduction. Size variation could not be shown to be a genetic constant in population clones derived from single individuals varying from minimal to maximal measurements.

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