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OBSERVATIONS ON GERMINATION OF GEMMULES IN FRESHWATER SPONGE *TROCHOSPONGILLA* (PORIFERA: SPONGILLIDAE) FROM WESTERN MAHARASHTRA.

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Abstract:
The present study deals with the observations on germination of gemmules of a freshwater sponge *Trochospongilla. The* gemmules were collected from freshwater pools at the Sagareshwar sanctuary Dist. Sangli, Maharashtra. The production of gemmules is a trait shared by freshwater sponges but the gemmules display different levels of complexity. The functional role of gemmules is double as propagules and as resting bodies. They are efficient means of dispersal. The low metabolism of gemmules allows sponges to survive extreme environmental conditions. The temperature and p^H are key factors in germination of gemmules in *Trochospongilla*.

Keywords: Freshwater sponge, gemmules, propagules, *Trochospongilla*

Introduction:

Many freshwater sponges and few marine sponges form dormant structures called gemmules. These are asexually reproduced reproductive bodies that consist of a mass of undifferentiated cells enclosed within a protective capsule.(Pennak,1953; Simpson andFell,1974).Gemmules are sometimes formed as a response of the adult sponge to environmental stress (Harrison,1982). They remain attached to the substratum or become freed and rise to the surface or sink to the bottom. They can be viable after three years of drying (Smith 2001).

Freshwater sponges reproduce both sexually and asexually.As a part of their life cycle, many sponges produce gemmules as a means of surviving environmental challenge. In most sponges, the gemmules contain cells that are initially in a state of metabolic arrest that is controlled by endogenous factors. This state is known as Diapause. When favorable conditions return, the gemmules germinate and produce a new sponge. Production of gemmules is triggered by environmental factors such as decreased temperature and involves cell aggregation of thesocytes and lying down of gemmule coat. Thesocytes contain yolk platelets as an energy store and high osmotic concentrations of polyols that maintain high osmotic concentration in the cells of the gemmules. The high osmotic concentration maintains metabolic depression and turns off cell division. Early in the germination process, the polyols are converted to glycogen, reducing osmotic pressure and releasing the inhibition of cell division and metabolic rate. (Loomis SH, 2010) The sponge species go dormant during seasonal fluctuation of temperatures, particularly low winter temperatures and extremely high temperatures and environmental stress. (Thorp and Covich, 2010).

We still know very little about sponge diversity, biology and ecology as compared with other animal groups. (J.N.A Hooper 2000). Literature survey reveals that there is no record or description of gemmules and their germination as well as no data is available regarding ideal ecological conditions of freshwater habitat for germination of gemmules of *Trochospongilla* from western Maharashtra hence an attempt has been made to describe the same

The physico-chemical parameters of the habitat were analyzed.

Material and Method:

Geographical location of the site: The study site Sagareshwar wildlife sanctuary (PLATE-I, FIG.a) is located on the borders of three tahsils Khanapur, Walva, and Palus in Dist.-Sangli and about 49 Kms. from Sangli. It is well known and protected sanctuary having total area 10.87 sq.Km protected for Deer.

Sagareshwar Wildlife Sanctuary: 17°8'46.42"N 74°22'59.44"E

Collection: The samples were photographed in habitat. Sample was collected and placed in 90% alcohol.

The **identification** of collected specimen was confirmed by Zoological Survey of India, WRO, Pune (ZSI letter No.F.6-1/Techl/2012-13/419 dated 16/04/2013).

Light Microscopy: The gemmules were observed under trinocular microscope (Olympus model: CH2O i Tr.)

Photography: The preparation was photographed by using camera (IXUS canon of 12.1 megapixels

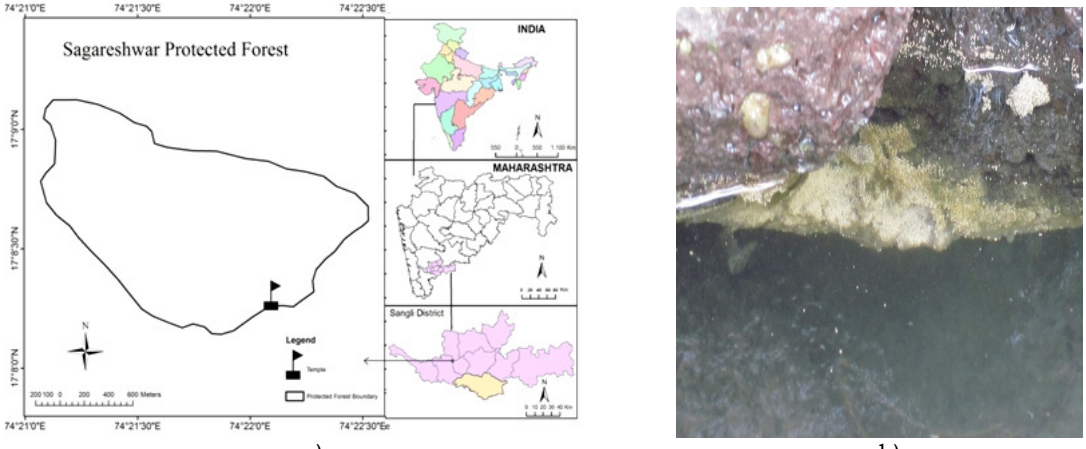
The water samples were analyzed by using standard methods suggested by APHA (1971)

Results and Discussion:

Freshwater sponges are found in water bodies with high quality water and low levels of pollutants, disturbance and silt. (Holley 2009). According to Old (1932) sponges are very sensitive to alteration in environment. The water quality parameters affect the ability to survive in streams, because sponge is sessile organism and is unable to migrate to areas with more favorable conditions.

Asexual reproduction in sponge begins with small particles known as gemmules, forming within parent sponge. The cells that ultimately constitute fully formed and mature gemmules are referred to as thesocytes that are resting archeocytes. The thesocyte is binucleated with a cytoplasm packed with vitelline platelets. The germination process, starting with hatching from gemmule, is thought to be a system to ensure survival from the dry or high temperature conditions that can severely damage the parent sponge. Usually germination is inhibited by an inhibitory factor from the parent sponge tissue. But when the parent sponge is destroyed and subsequently eliminated from around the gemmule, germination occurs. (Simpson, 1984).In this study complete disappearance of parent sponge was recorded (PLATE-I, Fig-b).The germination doesn't take place till parent sponge is surviving as it secretes inhibitory factors. When germination begins, thesocytes undergo mitosis within the gemmule coat and become either archeocytes (stem cells, mononucleated) or histoblasts (nuclei lacking nucleolus) (Simpson, 1984). Histoblasts and archeocytes then migrate out from the gemmule coat. Archeocytes proliferate and differentiate into all types of cells to form a fully functional miniature sponge (Hohr, 1977).

The germination and sub-segment hatching of gemmules occurs based on condition such as temperature. (Simpson and Fell.1974) The collected sample shows various stages in gemmule germination (PLATE-II, Fig.-b-g). It was collected in the month of November i.e. during winter when the temperature falls and becomes favorable for germination. According to Zeuthen (1939), the gemmules will hatch any time after their formation at a temperature of 21 to13^{0}C, The germination of gemmules occurs between 13^{0}C to 23^{0}C requiring two weeks of sustained temperatures in autumn and a few days in spring (Smith 2001).Freshwater sponges are believed to germinate between 13^0 and15^{0}C (Pennak,1953). Old (1932) describes 16^{0}C to 24^{0}C as ideal habitat for *E. mulleri*. In present study the temperature range recorded in habitat for *Trochospongilla* was 20^0-22^{0}C.The physico-chemical parameters of water samples from habitat of *Trochospongilla* were compared with normal values of drinking water. Calcium and magnesium are important controlling factors for normal cell activity because they affect cell permeability (Ruttner, 1969).The calcium and magnesium contents were 3.25-3.5 and1.17-5.01 meq./lit. Which are slight low and appropriate respectively as compared to drinking water as compared to drinking water.The sodium was very high, Potassium and nitrates were appropriate, Macan (1961) has included calcium as a limiting factor for freshwater organisms. Although the calcium shows a tendency to support greater growth and differentiation than magnesium, both elements appear necessary for normal growth. The p^H was appropriate (7.12-7.5). Upon gemmule hatching new sponges are formed.



a) b)

Figure 1 a) Location of Sagareshwar Sanctuary, b) Gemmules attached to substratum in natural habitat

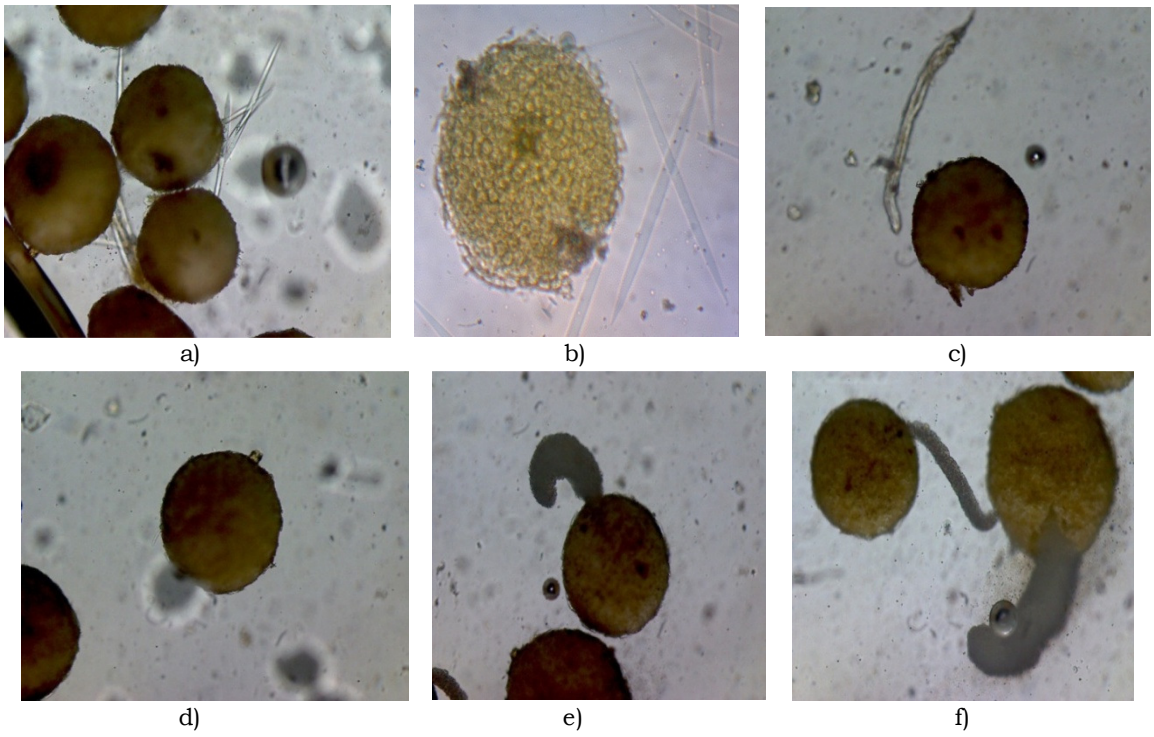


Figure 2 Various stages in germination of gemmules
a) Gemmules under low magnification:-10X b) Gemmules under high magnification:-40/45X

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