Biology of the brine shrimp Artemia salina (L.) and its economic importance in the Mediterranean basin

by

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Abstract

Several aspects of the biology of Artemia salina (L.) (Crustacea; Anostraca), as development, growth rate, feeding and reproduction are presented. Economic potential of A. salina in the Mediterranean region is discussed.

Résumé

L'article expose brièvement une revue sur la biologie alimentaire et reproductive du phyllopode Artemia salina (L.). Le potentiel économique de l'utilisation d'Artemia dans le bassin méditerranéen est discuté.

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The brine shrimp Artemia salina, occurs in highly saline waters in salt lakes and in the brine of the man-made salterns throughout the world.

The various strains of A. salina differ in their morphological and physiological characteristics as well as in their ways of reproduction and chromosomal numbers.

The first larval instar is a typical nauplius and the second a metanauplius. First and second instars are opaque and orange coloured. As yolk reserves are consumed, this colour disappears. The antennae are used for swimming and feeding as active feeding starts in the third instar. A drastic morphologic change occurs in the antennae in the tenth larval instar and the swimming-feeding functions start to be performed by the thoracic legs. Seventeen larval instars have been described.

Growth rate of A. salina is primarily dependent on food concentration and its composition as well as on water temperature. At optimal temperatures, feeding starts during the first day after hatching, copulation follows on the eighth and eggs are produced on the eleventh day. Growth and assimilation efficiencies are positively correlated with the amount of dietary protein and lipids. Concentration of carbohydrates is especially important during the first days of growth.

Unicellular algae and suspended detritic particles with attached bacteria, are the main food items of Artemia. The particles are filtered from the current created by the metachronal beat of the thoracic limbs, with the aid of the plumose setae situated on the filter plates on the basal endites of these legs. The distance between the filtrating setae allows for the retention of microalgae. Juveniles are able to strain smaller particles than the adults.

Various strains of Artemia are parthenogenetic, while others are zygogenetic. Both types are able to reproduce by oviparity and by ovoviviparity. Intrinsic factors, but also salinity and food supply determine the mode of reproduction. Parthenogenetic strains are reported to be di-, tri-, tetra- and pentaploid. Zygogenetic strains are reported to be di- and tetraploid. The cysts and the nauplii of the polyploids are bigger than those of the diploids. Ovoviviparous nauplii are bigger than those hatched from resting eggs.

Artemia salina is widely distributed in the Mediterranean region and recorded from most of the countries (Spain, France, Italy, Sardinia, Turkey, Morocco, Algeria, Tunisia, Libya, Egypt, Cyprus, Syria and Israel.) A wide range of ploidies and both zygogenetic and parthenogenetic strains are present in the Mediterranean area. The Mediterranean climate permits all-year round development of the Artemia populations. The possibility exists, however, that in some water bodies of this region, as for instance in the Dead Sea, Artemia cannot live. Therefore ionic composition should be taken into account.

Resting eggs of Artemia and the biomass of nauplii larvae and adults they produce are utilized as the most important food supply for the hatcheries of aquaculture fishes and crustaceans and for the tropical fish industry. In 1978, the world harvest of resting eggs of Artemia was approximately 100 metric tons (Sorgeloos, 1979). In the Mediterranean there is only one instance of small-scale commercial production of Artemia, namely in Cyprus. Artemia is a valuable by-product of the salt plants and at the same time it serves to improve the very quality of the salt, by clearing the water in the salt pans (Clark and Bowen, 1976; Davis, 1979).

Another economic field which may benefit from the utilization of the brine shrimps is that of the solar energy plants. Solar ponds perform much better after being inoculated by Artemia, which reduces the turbidity of the water. Brine shrimps are also used in the world for removing organic contamination from saline industrial wastewaters at a pilot plant scale (Milligan et al., 1979).

The natural potential of the production of Artemia in the Mediterranean region is still not exploited. So far, in most of the countries even a survey of the natural habitats of the brine shrimp and of the hypersaline waterbodies which could be artificially inoculated with Artemia, has not been done.

The future prospects for the utilization of Artemia for economic purposes in the Mediterranean region are good. Artemia can be used as a source for animal protein, as live food for cultivated aquatic organisms and as a natural clearing agent in aquatic industries.

References

Clark (L.S.) & Bowen (S.T.), 1976. - The genetics of Artemia salina. VII. Reproductive isolation. *J. Hered.* 67: 385-388.

Davis (J.S.), 1979. - Experiences with Artemia in solar saltworks. *Int. Symp. on the Brine shrimp, Artemia salina, Corpus Christi, Texas, U. S. A., Aug. 20-23,* 1979. Abstract.

Milligan (D.J.), Quick (J. A.), Hill (S.E.), Morris (J.A.) & Hover (R.J.), 1979. - Sequential use of bacteria, algae and brine shrimp to treat industrial wastewater at pilot plant scale. *Ibid.* Abstract.

Sorgeloos (P.), 1979. - Research at the Artemia reference center. Progress report on the laboratory for mariculture. *I.C.E.S. C.M. 1979 / F: 54 Mariculture Committee pp. 205-214.*