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CLAUDIO BARIGOZZI, VITTORIO VAROTTO, LAURA
BARATELLI, ROSA GIARRIZZO

**The Artemia of Urmia Lake (Iran): mode of
reproduction and chromosome numbers**

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Genetica. — *The Artemia of Urmia Lake (Iran): mode of reproduction and chromosome numbers.* Nota di CLAUDIO BARIGOZZI, VITTORIO VAROTTO, LAURA BARATELLI e ROSA GIARRIZZO, presentata dal Socio C. BARIGOZZI.

ABSTRACT. — The Authors studied the mode of reproduction of the brine-shrimp of the Urmia Lake (Iran) and demonstrate that the sample investigated is parthenogenetic. The chromosome countings gave a predominance of diploids (42), very rare tetraploids and 30% of pentaploids.

KEY WORDS: Pentaploidy; Partenogenesi; Parthenogenesis.

RIASSUNTO. — *L'Artemia del Lago di Urmia (Iran): modo di riproduzione e numeri cromosomici.* Gli Autori hanno studiato il modo di riproduzione delle artemie del Lago Urmia (Iran) e dimostrano che il campione di cisti utilizzato è composto di sole femmine partenogenetiche. Vengono studiati per la prima volta i cromosomi, e risulta che nella popolazione sono presenti in prevalenza individui diploidi (42 cromosomi), rari tetraploidi (84 cromosomi) e una aliquota di pentaploidi (105 cromosomi).

Artemia living in the Lake Urmia (Iran) was studied by Clark and Bowen (1976) in an investigation aiming to determine the sibling species of the genus. This population proved to be amphigonous and genetically isolated. For this reason Barigozzi (1980) accepted the *Artemia* from Lake Urmia as forming a sibling species naming it *A. urmiana*.

As a contribution to a revision of the *Artemia* sibling species the population of the Lake Urmia was reconsidered, starting from cysts obtained from the *Artemia* Reference Centre of the University of Ghent (Belgium) which is here kindly acknowledged. The aim of this paper is to check the mode of reproduction and to study the chromosome set, not yet investigated by the previous authors.

RESULTS

a) *Mode of reproduction.* Nearly 500 individuals were reared in Laboratory (Department of Animal Biology, University of Padua) and only females appeared. A number of these were allowed to reproduce and no male was

(*) Nella seduta del 29 novembre 1986.

found in the offspring. After three subsequent generations consisting only of females it can be concluded that the material under investigation is parthenogenetic ⁽¹⁾.

b) *The chromosome set.* The chromosomes were studied on prophases of the nauplius. Two staining techniques were used: orcein and C-banding Giemsa. For technical details see Barigozzi *et al.*, 1984.

24 nauplii were examined, and the following chromosome numbers were found:

Nauplii No.	Mitoses No.	Chromosome No.
15	40	42
1	1	84
8	11	105

The sample studied is, thus, predominantly diploid, exceptionally tetraploid, with a minority (30.3%) of pentaploid individuals. It should be noticed that the development time of the cysts is shorter in the pentaploids: thus, the first hatched nauplii are all pentaploid (fig. 1).

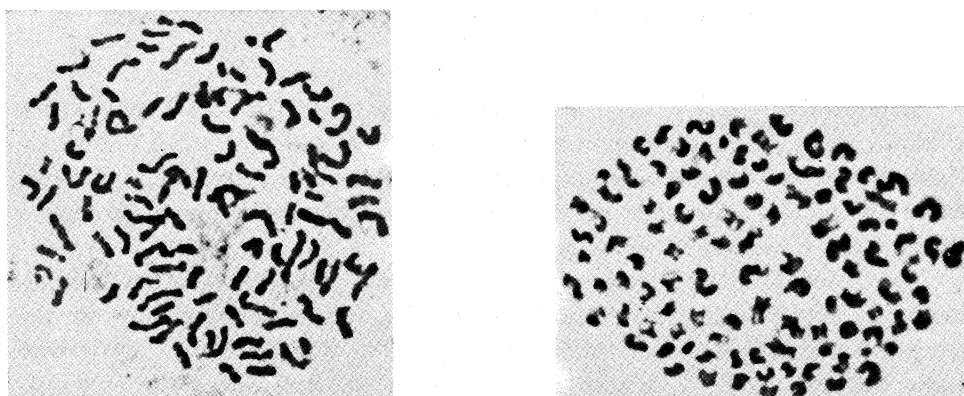


Fig. 1. - The chromosomes of the pentaploid form (105 elements). left: late prophase, right metaphase. Orcein staining.

The chromosomes stained with orcein fail to show any character distinguishing the Urmia sample from the others studied so far. In the interphase nuclei very small masses are visible, which, owing to their size, escape counting. C-banding Giemsa stain reveals that heterochromatin is practically absent: only very small positive masses can be seen near the prophasic chromosome ends as well as a few tiny interspersed bands.

(1) The shrimps were kept in natural sea water and fed on *Microchlorella*.

DISCUSSION

The data presented allow us to discuss two points.

First we wish to connect our observations with the problem of the species named *A. urmiana*. The existence of an amphigonic species genetically isolated in the Lake Urmia is based on the investigation of Clarke and Bowen (1976) and is clearly discrepant from our data. It may be added that the very low degree of heterochromatin in our shrimps is a general character of the parthenogenetic strains.

It is difficult to explain the cause of the discrepancy between the observations by Clark and Bowen and ours. An hypothesis can only be put forward: that in the Urmia Lake both bisexual and parthenogenetic individuals live together, as, according to the old data by Anikin (1899, quoted from Artom 1931), would be the case in the Siberian Salt Lake of Mormyschansk. The complete lack of bisexual individuals in our sample, as well as that of parthenogenetic ones in the sample used by Clark and Bowen might be caused by a differentiation in the ecological preferences of the two forms which lead them to prefer separate places in the lake where the cysts were collected. A situation not too distant from this is the one found near Cagliari: within few miles, in Cagliari Poetto (formerly San Bartolomeo) lives a bisexual and in S.ta Gilla a parthenogenetic population, both diploid.

In term of zoological nomenclature, the denomination of *A. urmiana* should be attributed to the bisexual species of Urmia, whereas the parthenogenetic individuals (Barigozzi, 1980) should be named *A. parthenogenetica* of the Urmia Lake (Iran). That the parthenogenetic shrimps available today in the Urmia Lake are the result of a substitution of forms in the population with extinction of the bisexual one (considering also the short time elapsed between the observations by Clark and Bowen and ours, i.e. 10 years) seems too unlikely.

The second point we wish to discuss is the chromosome number. It is especially pentaploidy which seems interesting, since this was recorded for ex. by Goldschmidt (1952) for the parthenogenetic artemia of the Dead Sea (Israel). Thus this ploidy degree seems to be very rare.

The coexistence of bisexual and parthenogenetic individuals in the same biotope poses the problem of the link between the two forms. Parthenogenetic females show different chromosome phenomena during oogenesis: some populations are ameiotic (f.ex. Margherita di Savoia, Italy) while some retain a part of the meiotic phenomena (f.ex. S.ta Gilla, Italy). The study of oogenesis is likely to allow us to understand the connection between parthenogenetic and bisexual artemia if they are both present in the Lake Urmia ⁽¹⁾.

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