THE CHROMOSOMES OF CALANUS FINMARCHICUS AND C. HELGOLANDICUS

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Calanus finmarchicus (Gunnerus, 1765) and C. helgolandicus (Claus, 1863) are two closely related copepods. The differences between them in morphology and in geographical and seasonal distribution have been reviewed by Marshall & Orr (1955). In the absence of breeding experiments, which are as yet not technically feasible, it must remain a matter of opinion whether the differences are sufficient to warrant placing the two forms in different species or not. Whether interbreeding to give fertile offspring could take place or not would be largely determined by the compatibility or otherwise of the chromosomes of the two forms and the work described in this paper was undertaken to see whether any morphological differences in the chromosomes themselves could be detected.

Chromosomes of Calanus in various stages of meiosis or mitosis were examined during short visits to Plymouth and Millport. The method employed was the simple one of making aceto-carmine squashes of testis, ovary, egg or early embryo after fixing in one part of glacial acetic acid and three parts of absolute alcohol. The glacial acetic acid was saturated with carmine and had a little iron acetate as well. The squashes were made into permanent preparations for later study by holding the cover-slip in place with a piece of polythene while the slide, in a vertical position, was transferred through the alcohols to benzene in a series of staining jars, remaining in each jar for at least an hour. After taking the slide out of the benzene the polythene was carefully removed without disturbing the cover-slip and the slide ringed in a horizontal position with a thin solution of canada balsam in benzene. Slides prepared in this way, after drying in the oven, seem to be permanent. No change has been observed in any of them during the ten and more years since they were first made.

The preparations from which the drawings and photographs illustrating this paper have been made are all preserved at the British Museum (Natural History), London.

Most of the Calanoida have a haploid number of 16 or 17 chromosomes and the number in both C. finmarchicus and C. helgolandicus is 17. The chromosomes tend to be rather crowded together in spermatogenesis so that they are not easy to study individually in the testis. Chiasmata are conspicuous in the diplotene and diakinesis stages (pl. V figs. 1, 2) but their frequencies have not been determined. The number of chiasmata becomes reduced in the usual way and most of the
bivalents of metaphase I are united by a single terminal chiasma. A lateral view
of the plate before the chromosomes have contracted to their minimum lengths
(pl. V fig. 3) shows the position of the chiasma of each bivalent as a distinct
constriction, and often each partner also shows a less conspicuous constriction
which may indicate the position of the centromere region. From the appearance
of these bivalents it might be thought that the chromosomes have their centromeres
near one end as so many of them are joined end to end; but this is not so, as can
be seen from the chromosomes of the oocytes and of cleavage mitoses. A few, usually

![Fig. 1. Prophase chromosomes of the first cleavage division of an egg of *C. helgolandicus* (Claus)
giving the positions in a squash preparation (B.M. 1954. 10. 25. 21) reconstructed from individual
photographs similar to pl. VI fig. 2. × 220.]

one or two in the male, of the bivalents may have two chiasmata and be ring-
or tetrad-shaped. It is not often possible to count these chromosomes as they are
usually closely packed together, and those shown in pl. V fig. 3 may not all belong
to the same cell. Occasionally, however, a polar view of a plate is found in which
fully contracted chromosomes are sufficiently well separated from one another
to be counted without difficulty (pl. V fig. 4).

The chromosomes of the female are easier to count than those of the male,
and the following account of the chromosomes of the female will be supplemen-
tary to that of Hilton (1931) who described the formation and disappearance
of the large nucleolus in the oocytes but was not particularly concerned with the
chromosomes themselves.