

the testes in spermatogenesis, or they are catalyzed by transaminases, decarboxylases or deaminases.

In the anal glands and brain the least number of amino acids were detected. The anal glands produce a peculiar type of sticky secretion, it is very likely that some of the amino acids of the haemolymph are used up in the synthesis of proteins of this secretion. In the brain various kinds of activities go on continuously for which a lot of energy is required, and it is very probable that to provide this energy there may be catalysis of some of the amino acids.

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#### KARYOLOGICAL STUDIES ON THE GENUS ACARTIA (COPEPODA)

The genus *Acartia* is one of the most abundant amongst the copepods in zooplankton collected from the Mandovi-Zuari estuarine complex. The present communication forms a part of the studies on this estuarine complex undertaken by the National Institute of Oceanography for its ecology and biological resources.

A comparative account of the karyotypes in the males and females of four species of the genus *Acartia*, namely, *A. spinicauda* Giesbrecht, *A. negligens* Dana, *A. centrura* Giesbrecht and *A. plumosa* T Scott has been given. While discussing the evolution of the karyotype, considerations are given to alteration in the basic chromosome number and form and size of the chromosomes.

The material was collected from the Mandovi-Zuari estuarine complex, Goa, using a square mouth version of the WP-2, UNESCO<sup>8</sup>, i.e., H.T. net having a mouth area of 0.25 m<sup>2</sup>. The specimens soon after collection were fixed in a mixture of acetic and absolute alcohol (1:3). The various species were sorted under the stereoscopic microscope and the squashes were prepared after staining them with Gomori's haematoxylin.

In the males and females of all the four species, the diploid number of chromosomes is 11 and 12 in the respective sexes whereas the haploid number in all is 6 (Figs. 1 to 4, 7 to 9 and 12 to 14). At meiosis II of males, the two types of metaphase plates revealed 5 and 6 chromosomes (Figs. 5, 6, 10 and 11).



FIGS. 1-14. Figs. 1-2. *Acartia plumosa*. Fig. 1. Spermatogonial metaphase. Fig. 2. Oogonial metaphase. Figs. 3-7. *Acartia centrura*. Fig. 3. Spermatogonial metaphase. Fig. 4. Metaphase-I (male). Figs. 5 and 6. Metaphase-II (male). Fig. 7. Oogonial metaphase. Figs. 8-10. *Acartia spinicauda*. Fig. 8. Spermatogonial metaphase. Fig. 9. Oogonial metaphase. Figs. 10 and 11. Metaphase-II (male). Figs. 12-14. *Acartia negligens*. Fig. 12. Oogonial metaphase. Fig. 13. Metaphase-I (female). Fig. 14. Spermatogonial prometaphase.

Braun<sup>1</sup> and White<sup>2</sup> have pointed out that the copepods show a great variation of chromosome number even amongst the closely related species. Goswami and Goswami<sup>3</sup>, by their studies on some copepods in an earlier communication, also came to the same conclusion. The present investigation on the genus *Acartia*, however, shows constancy in the haploid and diploid number of chromosomes. Six ( $1n$ ) in this genus seems to be the basic number of chromosomes.

In *A. plumosa*, *A. centrura*, *A. spinicauda* and *A. negligens*, the sex-mechanism is of the XO-XX type where male is the heterogametic sex. Rüschi<sup>5</sup> has also described XO-XX type of sex-mechanism in *Eucyclops serrulatus*. However, in this case female is the heterogametic sex.

In all the species under investigation except *A. centrura*, the sex-chromosomes cannot be distinguished during mitosis and meiosis. Even in *A. centrura* the acrocentric sex-chromosomes can only be distinguished during meiosis (Figs. 5 and 6). According to Lewis and John<sup>3</sup> such cases where the sex-chromosomes cannot be distinguished during mitosis and meiosis, the sex is controlled by genes.

The size of the chromosomes in *A. plumosa*, *A. centrura* and *A. spinicauda* is larger than that in *A. negligens* (Figs. 12 and 14). In the former species all the chromosomes have the same form and size. They are metacentric whereas in the latter two species though the size of chromosomes in a particular complement is the same, the form changes due to the position of the centromere. Some chromosomes are metacentric while the others are acrocentric. In *A. centrura* the acrocentric chromosomes are the sex-chromosomes whereas in *A. spinicauda* they are the autosomes in four pairs. In the 4th species *A. negligens*, all the chromosomes are rod-shaped without any distinction of centromeric constriction during mitosis. In meiosis the behaviour of these chromosomes is metacentric.

This change in the form of chromosomes in the various karyotypes considered above is due to a change in the position of the centromere though the basic number is the same. This has probably occurred by some sort of chromosomal rearrangements on the submicroscopic level. Swanson<sup>6</sup> is of the opinion that chromosomal rearrangements can occur without altering visibly the external appearance of the chromosome. In species like *A. plumosa* and *A. negligens* where the karyotypes are the same except for the size of chromosomes in the latter case, it seems gene mutations have played the leading role. Difference in size of the chromosomes has been attributed probably to the nutritional and genetic conditions as suggested by Pierce<sup>4</sup> and Thomas<sup>7</sup>.

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#### HERBICIDES AS REGULANTS FOR STOMATAL CLOSURE IN DRYLAND FARMING

A DECADE ago, Zelitch<sup>1</sup> predicted on theoretical grounds that closing stomata in a specific manner would depress transpiration more than photosynthesis. This deduction provided a strategic and rational means for achieving changes of great scope in dryland agriculture, hydrological cycle and ecology. Many spray materials including some herbicides have been demonstrated since 1961, to effect stomatal closure, but none of the compounds, so far tested, appear to have found practical use under dryland farming conditions<sup>2</sup> without toxic side effects.

In the winter of 1970-71, the herbicides—monuron, diuron, simazine, atrazine, chlorobromuron and ametryne at  $M \times 10^{-3}$ ,  $^{-5}$ ,  $^{-7}$  and urea 3% were evaluated for their effects on stomatal closure on wheat (*Triticum aestivum* Moench.) cv. K 65. K 68 grown usually for dryland farming. Among these, monuron, diuron and simazine were found promising along with slight promise for urea as well. In the winter of 1971-72, these herbicides were retested at  $M \times 10^{-6}$ ,  $^{-9}$ ,  $^{-12}$  and urea at 1.5, 3 and 4.5%. Wheat cv. K 65 was grown on a medium black loam soil under standard agronomic practices, without irrigation. The density was 32 plants/m<sup>2</sup>. The herbicide treatments were given at 75 days from the sowing. The stomatal closure (Table I) was scored in 3 × 3 plant/treatment in random replicates under field conditions, by stripping a peel from the leaf next lower to the boot leaf, within 20 seconds under the low power of a microscope. On the average, 43 stomata were seen under the microscopic field. The observations were made between 9.20 and 10.15 A.M. on sunny