dehydrogenase was shown to be activated by zinc[6], and experiments carried out on the uptake of zinc by avian eggs suggested that zinc might be a specific activator of several enzymes[7]. The enzyme uricase was also reported to contain 0.13% of zinc[8].

In termites which basically live on cellulose material, the enzyme cellulase is of major importance in digestion. This enzyme is synthesized by higher termites, like *M. tragardhi*, but is produced by microorganismic symbionts living in the alimentary system in primitive termites.

The role of zinc in the digestion of cellulose was thus investigated, testing the effect of zinc on the activity of cellulase in vitro.

Material and methods. The cellulase solution was prepared by dissolving 100 mg (2 E.U.) of the enzyme in 100 ml of phosphate buffer (pH 6). Cellulose (Whatman pure grade powder) was used as the substrate. 100 mg of the substrate were placed in each of 9 digestion tubes and 9 ml of the enzyme preparation were added to each of the tubes. The digestion mixture in one tube was made up to 10 ml by adding distilled water, while 1 ml of zinc sulphate solution, of different concentration was added, respectively, to each of the other 8 tubes.

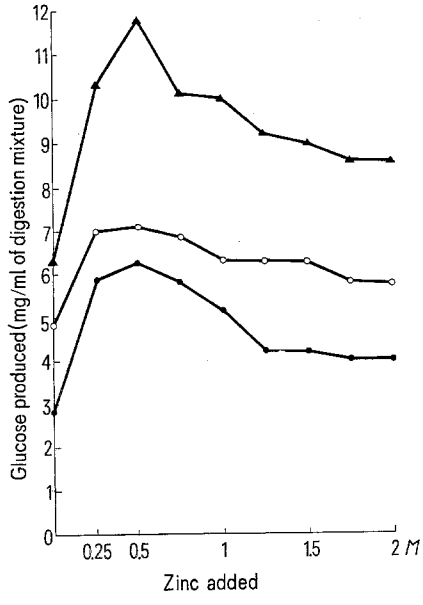
The digestion mixtures were incubated at 37 °C (C.T.) for 48 h and then centrifuged for 15 min to sediment undigested cellulose. The supernatants were pipetted into separate test tubes. Aliquotes (1 ml) of these solutions were used for the quantitative determination of the glucose resulting from the enzymatic hydrolysis of the cellulose. The method adopted was based on that of CLARK[9]. The amount of glucose produced has been taken as a measure of the rate of the activity of the enzyme.

The above experiment was repeated using higher concentrations of cellulase: 0.2 and 0.3% (w/v) in phosphate buffer.

Results and discussion. The mean results of 8 replicates are summarized in the Figure. These demonstrate that the amount of glucose produced at different concentrations of the enzyme was nearly doubled when 0.25 *M* zinc sulphate (= 1.6345 mg of zinc per ml of the digestion mixture) was added.

The peak of the activation of the enzyme was reached after the addition of 0.5 *M* zinc sulphate. Higher concentrations of zinc sulphate, however, resulted in a gradual drop in the amount of glucose produced. This reached a level where the activity of the enzyme was no longer affected by the addition of more zinc ions.

In conclusion, it seems most probable that zinc, which occurs at an appreciable amount in the termite body, functions as activator of the enzyme cellulase.



Activation of cellulase at 3 different concentrations, by zinc ions, in vitro. ●, 0.1% cellulase; ○, 0.2% cellulase; ▲, 0.3% cellulase.

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Cytogenetic Observations in *Ceratitis capitata*[1]

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Summary. The $2n = 10 + XX/XY$ complement of *C. capitata* includes 3 pairs of metacentric and 2 pairs of submetacentric autosomes; the *X* and *Y* chromosomes are acrocentrics. The sex chromosomes do not pair somatically during mitotic prophase, and, using the C-banding technique, band more extensively than the autosomes. Male meiosis may be achiasmate; there is no leptotene, zygotene or diplotene.

The Mediterranean fruit fly, *Ceratitis capitata* (Family Tephritidae), is a pest of particular economic importance to commercial growers of soft fruits, in many parts of the world. Females habitually deposit their eggs in healthy fruit, and, when the larvae emerge about 8 days later, they begin to feed and burrow into the pulp of the host causing considerable damage. Different eradication measures are constantly being explored to alleviate the problem but as yet relatively little research has been conducted on genetical control methods which involve various forms of chromosome translocation, inversion hybridity and systems of meiotic drive. An essential prerequisite in this type of work is a thorough understanding of the normal chromosome complement and how the various components behave during mitosis and meiosis. This paper presents a brief outline of these aspects.

[1] Material kindly supplied by Dr. D. A. LINDQUIST, I.A.E.A./FAO Vienna, Austria.

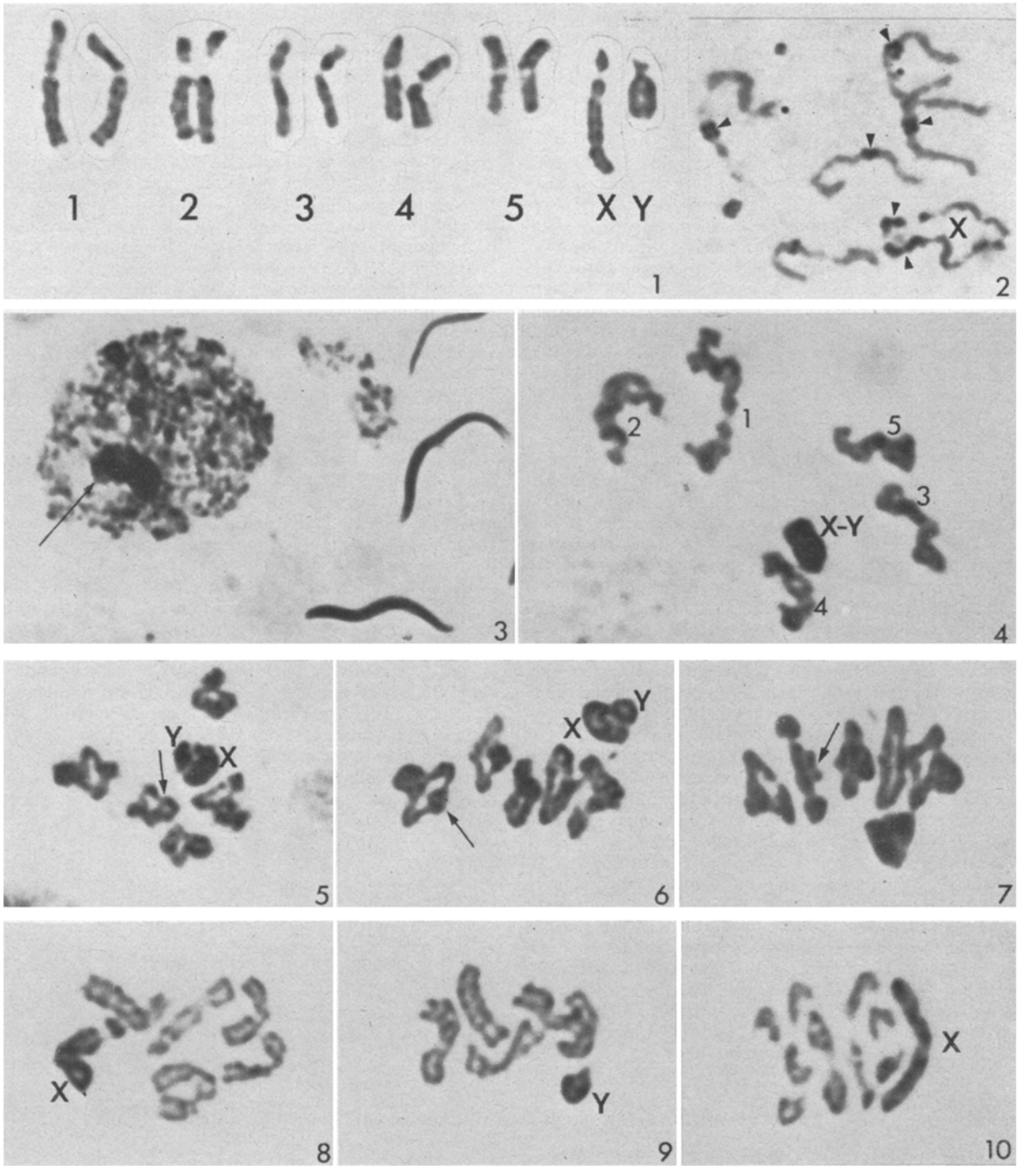

Fig. 1. Male karyotype of *Ceratitis capitata*. × 3,500.

Fig. 2. Giemsa stained female mitotic prophase cell. Note somatic association of autosomes and unpaired *X* chromosomes. Arrows indicate positions of centromeres. × 3,100.

Fig. 3. Nucleus emerging from pre-meiotic interphase. Arrow indicates the precociously condensed *X*-*Y* bivalent.

Fig. 4. Late pachytene showing 5 autosomal bivalents and highly condensed *X*-*Y* bivalent.

Fig. 5–7. Diakinesis/prometaphase – metaphase I. Note the apparent end-to-end association of the *X* and *Y* (Figure 5 and 6), and some of the points of contact between the autosomes which may represent regions of crossing over (arrows).

Fig. 8–9. Prophase II illustrating differential condensation of the *X* chromosome (Figure 8), *Y* chromosome (Figure 9) and the autosomes.

Fig. 10. Anaphase II. Figures 3–10. × 3,100.

Materials and methods. Mitosis was examined mainly in orcein stained cells from the cerebral ganglia of 3rd instar larvae, and meiosis in the developing testes of puparia. The Giemsa staining technique was identical to that used on the chromosomes of Orthopterans[2] and *Aedes aegypti*[3].

Mitosis. The somatic pairing commonly found in most Dipterans is a feature of this species, and homologous autosomes invariably emerge from interphase already associated as somatic bivalents. However, the sex chromosomes are an exception, for neither the two X chromosomes in females nor the X and Y in males ever appear intimately associated (Figure 2). As the autosomes contract during prophase the close association tends to lapse and the only point of contact is restricted to a region surrounding homologous centromeres. By metaphase even this link is lost. The remainder of mitosis is unexceptional, sister chromatids move to opposite poles at anaphase, and following cleavage of the cytoplasm to form two new cells, they despiralize to an amorphous nuclear mass.

In both sexes the diploid chromosome complement in $2n = 10 + XX/XY$, and the male karyotype is illustrated in the idiogram (Figure 1). The largest and 2 shortest autosomal pairs are almost metacentric whereas pairs 2 and 3 are noticeably submetacentric. Both the X and Y chromosomes are acrocentrics although the short arm of the Y is appreciably smaller than that of the X. In overall length the X resembles that of chromsosome 1 whereas the Y is slightly shorter than chromosome 5.

The C-banding technique was used to discover whether there are any additional cytological markers[3] which might prove useful in research involving chromosome mutations. In this respect the method proved disappointing, for similar sized segments on each side of the centromere in all the autosomes stained with equal intensity, and there were no intercalary bands (Figure 2). However, the entire short arms of the X and Y chromosomes stain, together with a substantial segment proximal to the centromere in their long arms.

Meiosis. Cells in meiosis have been identified in 3rd instar larvae, pupae and adults together with a substantial number of mitotically dividing cells. The onset of meiosis is heralded by the appearance in the nucleus of a dark staining heterochromatic mass (Figure 3) which corresponds to the precociously condensed and already associated X and Y chromosomes. Like other Dipteran species where pronounced somatic pairing is a characteristic feature there is no classical leptotene or zygotene[4–6]. The first recognizable stage is pachytene; the autosomes are closely synapsed and only in occasional cells can the duplicate nature of a chromosome be identified. Autosomal bivalents continue to contract (Figure 4) until a point is reached when the intimate pairing tends to lapse. This is particularly noticeable in procentric regions but can also be detected at other points along the bivalents (Figure 5). It may be significant that there is no diplotene stage of the type found, for example, in the *Culicini*, for these bivalents more closely resemble diakinesis or prometaphase[7]. This may well reflect an achiasmate mode of meiosis although structures have been observed which could be interpreted as cross-overs (Figures 5, 6 and 7). It seems almost certain that if there is chiasma formation on the male side then only genetical methods will provide the answer, for the bivalents are so small that normal cytological techniques are inadequate.

Throughout first prophase the heteromorphic sex bivalent remains highly condensed and in the majority of cells it is difficult to establish the pairing relationship of the X and Y. However, it is tentatively suggested that there is an end-to-end association of the long and short arms of the 2 chromosomes (Figures 5 and 6). Their behaviour at anaphase I is unpredictable for they may move to opposite poles in concert with the autosomes, they may separate precociously, or they may exhibit delay.

Following cytokinesis at the end of the first sequence meiosis, the chromosomes retire briefly into an interphase stage, and when they reappear at second prophase contract rapidly to metaphase II. Precocious condensation is again displayed by both the X and Y members during these stages (Figures 8 and 9) and is still evident at anaphase II (Figure 10). After the chromatids have arrived at the poles in telophase II the autosomes gradually despiralize to form a reticulate mass in the spermatid nuclei but both the X and Y chromosomes remain as heterochromatic bodies.

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Ethanol as a 'Food' for *Drosophila melanogaster*: Influence of the *Ebony* Gene

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Summary. The survival time of adult *Drosophila melanogaster* flies without food is greater in the presence of ethanol, especially for flies of strains or lines with a higher alcohol dehydrogenase activity. It seems that the *ebony* gene can act in some populations as a selective factor favoring the ADH^F allele, as well as the minor genes enhancing the alcohol dehydrogenase activity level.

In adapting itself to temperate climates, *Drosophila melanogaster* seems to have modified its ecological niche in order to exploit food sources characterized by a higher alcohol concentration: European strains are much more ethanol-tolerant than African or American tropical strains[2]. Such an adaptation must be in some way related to the genes controlling the alcohol dehydrogenase isozymic pattern, as the ratio of the ADH^F to the ADH^S allelic frequencies varies in the Eastern United States according to a clinal pattern from 1 to 9 in the South to about 1 to 1 in the North[3]. Under laboratory conditions, addition of alcohol to the culture medium shifts the ADH^F allelic frequency to higher values[4]. Enzymatic activity is usually higher in ADH^F/ADH^F than in ADH^S/ADH^S