Minimum lethal doses of phosphamidon on test animals

| Name of test animal | Average size (in mm) | $LD_{100}$ (in ppm) | Average time for lethal action (in h) |
|---|---|---|---|
| (a) Fishes: | | | |
| *Labeo rohita* (Ham.) | | | |
| fry | 24.4 | 150 | 34.6 –101.7 |
| early fingerling | 42.5 | 200 | 29.1 – 61.2 |
| late fingerling | 87.1 | 250 | 13.8 –109.6 |
| *Amphipnous cuchia* (Ham.) | 139.0 | 20 | 62.0 |
| *Channa punctatus* (Bl.) | | | |
| fry | 21.8 | 30 | 2.1 –135.6 |
| fingerling | 43.2 | 40 | 4.9 – 52.9 |
| adult | 108.0 | 50 | 70.5 |
| *Nandus nandus* (Ham.) | 46.25 | 50 | 19.6 – 31.1 |
| *Trichogaster fasciatus* (Bl. Schn.) | | | |
| adult | 66.1 | 50 | 51.7 – 72.2 |
| *Anabas testudineus* (Bl.) adult | 86.0 | 100 | 64.9 –138.25 |
| *Heteropneustes fossilis* (Bl.) | | | |
| fry | 35.16 | 100 | 44.36–130.4 |
| fingerling | 57.7 | 110 | 36.9 – 60.9 |
| *Mystus vittatus* (Bl.) adult | 59.9 | 125 | 42.25– 50.75 |
| (b) Insects: | | | |
| *Dysticus* sp. adult | 10.25 | 2 | 93.3 –115.3 |
| Dragon-fly nymph | 12.7 | 2 | 61.9 |
| *Notonecta* sp. adult | 8.12 | 4 | 4.9 – 68.4 |
| *Sphaerodema* sp. adult | 24.0 | 4 | 21.5 – 67.5 |
| *Ranatra* sp. adult | 30.0 | 5 | 36.4 – 93.4 |
| *Nepa* sp. adult | 18.2 | 5 | 14.75–134.75 |
| *Belostoma* sp. adult | 77.0 | 10 | 19.0 |
| *Hydrophilus* sp. adult | 30.0 | 10 | 13.0 |

The results contradict the assertion of GANGULY and MITRA[3], who think that eradication of insects from nursery tanks by the use of chemicals is not possible, and that they can be eliminated only with the help of small mesh drag nets.

The results given in the Table also show that, while even the young stages (fry and fingerlings) of the carp *Labeo* die in 150–250 ppm of phosphamidon, the predatory fishes *Nandus, Amphipnous, Channa* (fry, fingerling and adult), and *Trichogaster*[4] (adult) are eradicated in 50 ppm or less. *Heteropneustes* (fry and fingerling) and *Anabas* and *Mystus* (adults) die in a concentration of 100–125 ppm. All insect predators experimented upon are unable to survive even as low a concentration of the poison as 10 ppm or lower.

In other words, by using a concentration of 10 ppm of phosphamidon, it appears that most insect predators can be eradicated from fresh-water reservoirs without affecting the fish population at all, and by employing 100–125 ppm of the chemical most of the predatory fish can also be removed.

*Zusammenfassung.* Laboratoriumsexperimente mit Phosphamidon ergeben eine günstige kritische Dosisempfindlichkeit für Labeo-Karpfen (150–250 ppm). Es gelingt so leicht, Wasserinsekten (2–10 ppm) und Raubfischstadien (20–125 ppm) aus den Frischwasserreservoiren zu eliminieren.

U.S. SRIVASTAVA and S. K. KONAR

*Department of Zoology, Bihar University, Muzaffarpur (India), January 25, 1965.*

[3] D. N. GANGULY and B. MITRA, Ind. Agric. *5*, 184 (1961).

[4] The predatory activities of *Trichogaster fasciatus* have been observed in this laboratory.

## Structure of the Centromere in Telocentric Chromosomes

KOSLOV[1] and SCHRADER[2] maintained that centromeres possessed one spherule for every chromatid. Some time after this (1947) it was proved by OSTERGREN[3] that the two spherules were longitudinally double. Then, LIMA-DE-FARIA[4-11], in a series of excellent studies published between 1949 and 1958, dealing with the centromere in chromosomes in meiosis and mitosis, came to the conclusion that the centromeres in pachytene (in the case of rye) were composed of three zones: an inner zone, formed by two small chromomeres, on the threshold of microscopic visibility; a second zone, outside this, consisting of the two larger chromomeres; and a third zone consisting of fibres connecting the larger chromomeres in the second zone with the arms. This basic type was described by TJIO and LEVAN[12] in the prophase and metaphase of the mitosis, but the innermost zone of small chromomeres could not be observed. On the other hand, in their study of ascitic tumour cells in mice, TJIO and LEVAN[13] described the terminal centromeres of the chromosomes in their case as consisting of a single chromomere which was, however, prolonged in such a way as sometimes to give the impression of a series of small chromomeres one next to another.

*Material and methods.* The material for observation was from chromosomes belonging to the cells of a hypertriploid Ehrlich's ascitis tumour. Processing consisted of 20 min exposure to hypotonicity achieved by adding three times the volume of distilled water to the ascitis liquid. The fixation and spreading was made according to TJIO and WHANG's[14] technique, using Giemsa for staining.

*Observations and discussion.* In the opinion of TJIO and LEVAN[13], the observation of the centromere in the telo-

[1] V. E. KOSLOV, Biol. Zhurnal *6*, 759 (1937).
[2] F. SCHRADER, Chromosoma *1*, 230 (1939).
[3] G. OSTERGREN, Botaniska Notiser *176* (1947).
[4] A. LIMA-DE-FARIA, Hereditas *35*, 77 (1949).
[5] A. LIMA-DE-FARIA, Chromosoma *5*, 1, 68 (1952).
[6] A. LIMA-DE-FARIA, Chromosoma *6*, 33, 44 (1953).
[7] A. LIMA-DE-FARIA, Hereditas *41*, 238, 240 (1955).
[8] A. LIMA-DE-FARIA, Hereditas *42*, 85, 160 (1956).
[9] A. LIMA-DE-FARIA, Chromosoma *6*, 330 (1954).
[10] A. LIMA-DE-FARIA, Hereditas *43*, 462 (1957).
[11] A. LIMA-DE-FARIA, Int. Rev. Cytol. *7*, 123 (1958).
[12] J. H. TJIO and A. LEVAN, Nature *165*, 368 (1950).
[13] J. H. TJIO and A. LEVAN, Lunds Universitets Arsskrift, N. F. Avd. 2, Vol. 50. Nr. 15 (1954).
[14] J. H. TJIO and J. WHANG, Stain Technol. *37*, 17 (1962).

centric chromosomes of mice is due to pre-treatment with 8-oxyquinoleine. Our own observations of monochromomeric structures have been a frequent occurrence without pre-treatment.

The structure of the centromere is to all appearances like a half of that normally observed in the chromosomes of plants in metaphase. It looks as if it were composed of a double spherule, the two halves of which take divergent directions at the end of the metaphase. The chromomere is the first point in the chromosome from which the movement towards the poles begins, which suggests that the fibres composing the spindle fix themselves onto the chromomere, and the rest of the chromosome is attracted through it.

The type of centromere we have described represents a half of the centromere which is described by LIMA-DE-FARIA, TJIO, and LEVAN. The question of the existence, or non-existence, of terminal centromeres has been the subject of much discussion, some people even going so far as to advance the opinion that all chromosomes, though apparently telocentric, really possessed two arms. WHITE[15] is of the opinion that there are two kinds of terminal centromeres: those which are the result of misdivision and true terminal centromeres from natural telocentric chromosomes. And it is these latter which are, in fact, stable.

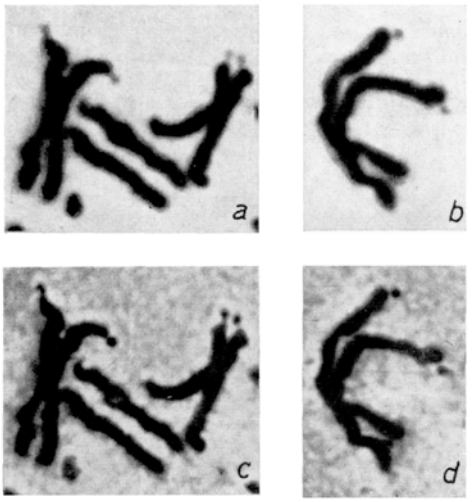


Fig. 1. a and b, Monochromomeric terminal centromeres. c and d, The same chromosomes observed with phase contrast.

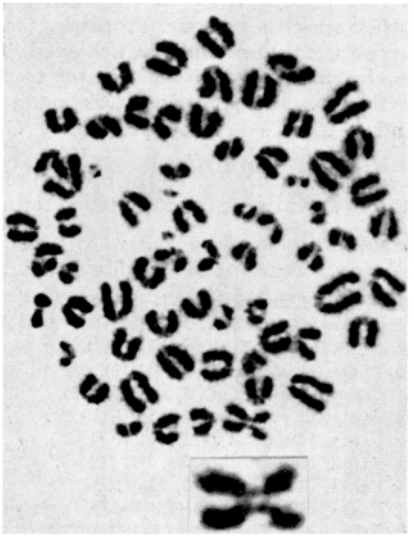

Fig. 2. Metaphase plate in cell of ascitis tumour. The quadruple centromeric structure in the metacentric marker chromosome can be observed.

MELANDER[16] found, in the telocentric chromosomes of *Ulophisema*, that in this case 'each chromatid ends in two minutes and clearly stainable globules, which are separated by less stained material. Thus the functioning kinetochore consists of four stained components lying close together in pairs', which shows that this type of centromere might well resemble that of a metacentric chromosome, even in the case of a telocentric chromosome. In the monochromomeric type we have mentioned the size of the single spherules corresponds to that of the spherules found in the centromeres of chromosomes of *Allium cepa*, their structure being apparently half that of the latter.

In principle we may accept the opinion according to which there are two different kinds of terminal centromeres: (a) those which are structurally identical with the centromeres of metacentric chromosomes, and (b) those which consist morphologically of half the structure of the first kind. This would also be in accordance with the postulate which denies that there is one single structural pattern to be found in the centromeres of metacentric chromosomes, which may vary in structure so as to embrace various forms, from the types described by LIMA-DE-FARIA to the polychromomeric type[17], and the diffused centromeres[18] observed in the genus *Luzula*. This suggests that centromeres, although they may differ morphologically, are identical in their dynamic properties. MATSUURA and KURABAIASHI[19] observed the possibility of fusion between centromeres from different chromosomes, and concluded that all centromeres are homologous.

The existence of the monochromomeric type may point to its being the simplest form of localized centromere, and hence, possibly, the most primitive. The centromeres of metacentric chromosomes would then be the result of a centric union between telocentric chromosomes, in which Robertson's law would acquire its full significance. In the case of ascitic tumour cells, the metacentric marker chromosome is characterized by the possession of a centromere of the same type as that described by TJIO and LEVAN in plants. This chromosome, formed within a karyotype in which all chromosomes are telocentric, with monochromomeric centromeres, was in all probability formed by the fusion of two telocentric chromosomes.

*Résumé.* Les centromères terminaux se présentent comme formés par un chromomère. Leur structure apparaît comme la moitié de la structure centromérique des chromosomes métacentriques.

G. GIMÉNEZ-MARTIN, J. F. LÓPEZ-SÁEZ, and A. MARCOS-MORENO

*Sección de Citología, Instituto de Biología Celular, CSIC, Madrid (Spain), February 9, 1965.*

[15] M. J. D. WHITE, *Cambridge* (1948).
[16] Y. MELANDER, Hereditas *36*, 233 (1950).
[17] G. GIMÉNEZ-MARTÍN, Fiton *11*, 139 (1958).
[18] C. D. MALHEIROS and A. CAMARA, Agronomía Lusitana *9*, 51 (1947).
[19] H. MATSUURA and M. KURABAYASHI, Chromosoma *4*, 273 (1951).