TABLE I

*Metrical data of somatic chromosomes of* Tinocalloides montanus, *analysed from* 16 *metaphase complements*

| Chromosome No. | Mean actual length in microns ± S.E. | Mean relative percentage length ± S.E. |
|---|---|---|
| 1 | 8·58±0·73 | 14 04±0·47 |
| 2 | 8·58±0·73 | 14·04±0·47 |
| 3 | 2·73±0·21 | 4·48±0·05 |
| 4 | 2·73±0·21 | 4·48±0·05 |
| 5 | 2·73±0·21 | 4·48±0·05 |
| 6 | 2·73±0·21 | 4·48±0·05 |
| 7 | 2·73±0·21 | 4·48±0·05 |
| 8 | 2·73±0·21 | 4·48±0·05 |
| 9 | 2·73±0·21 | 4·48±0·05 |
| 10 | 2·73±0·21 | 4·48±0·05 |
| 11 | 2·73±0·21 | 4·48±0·05 |
| 12 | 2·73±0·21 | 4·48±0·05 |
| 13 | 2·73±0·21 | 4·48±0·05 |
| 14 | 2·73±0·21 | 4·48±0·05 |
| 15 | 2·73±0·21 | 4·48±0·05 |
| 16 | 2·73±0·21 | 4·48±0·05 |
| 17 | 2·73±0·21 | 4·48±0·05 |
| 18 | 2·73±0·21 | 4·48±0·05 |

morphologically distinguishable sex elements amongst these chromosomes. No primary or secondary construction was observed in any one of the chromosomes. The chromosomes are of orthodox homopteran type, *i.e.*, holocentric. This is in concordance with the earlier reports[8,9].

In interphase nuclei no discernible structures could be observed. At prophase intermingled chromosome threads appeared which took light stain as compared to pro- and metaphase chromosomes. At prometaphase (Fig. 1) the chromosomes are randomly distributed while at metaphase the chromosomes are very compact (Fig. 2). No anaphase and telophase could be observed even from a large number of slides prepared. Meiotic cell division could not be studied as no sexual form was available in the material.

To the best of our knowledge, this is the first report on the chromosomes in *T. montanus*. Since this species is the sole representative of the genus *Tinocalloides* no correlation can be established between congeneric species. Other genera within the tribe Phyllaphidini exhibit the chromosome numbers, ranging from $2n = 6$ to $2n = 40$[2,3]. Although, there is some consistency in the chromosome numbers within the congeneric species of a few genera[2,3], the tribe Phyllaphidini shows a heterogeneous group of aphids for their chromosome numbers. Out of total cytologically known species of the tribe, nearly 23% species show $2n = 18$ chromosomes[2]. As such no cytotaxonomical conclusion can be drawn on the basis of their chromosome numbers. Extensive studies are needed to establish the cytotaxonomic significance among the different genera of the tribe.

The author is indebted to Prof. S. D. Misra, Head, Department of Zoology, for guidance and laboratory facilities. Sincere thanks are due to Prof. D. N. Raychaudhuri, Calcutta University, Calcutta, for identification of the species. Award of Teacher Research Fellowship by U.G.C, is duly acknowledged.

*June 9, 1980.*

1. Eastop, V., *Symb. Bot. Upsal.*, 1979, XII, 4, 127.
2. Kurl, S. P. and Misra, S. D., *Genetica*, 1980 (In press).
3. Blackman, R. L., *Systematic Entomology*, 1980, 5, 7.
4. Basu, A. N., *Orient. Insects*, 1969, 3, 255.
5. Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, Dr. W. Junk b.v. Publishers, The Hague, 1976, p. 429.
6. Kurl, S. P. and Narang, R. C., *Curr. Sci.*, 1978, 47, 837.
7. — and Misra, S. D., *Proc. Symp. on Recent Trends in Aphidological Studies, Bhubaneswar*, 1979 (In press).
8. Ris, H., *J. Exp. Zool.*, 1942, 90, 267.
9. White, M. J. D., *Animal Cytology and Evolution*, Cambridge University Press (3rd ed.), 1973, p. 200.

## ASSOCIATION OF BACTERIUM-LIKE ORGANISM WITH CITRUS GREENING IN INDIA

R. NAIDU* AND H. C. GOVINDU

*Department of Plant Pathology, College of Agriculture*
*University of Agricultural Sciences*
Hebbal, Bangalore 560 024, India

GREENING disease is prevalent in almost all the citrus growing states of India and is transmitted by an oriental citrus Psylla, *Diaphornia citri* Kuw[7] caused by mycoplasma-like organism (MLO)[8]. On the other hand, gram negative bacteria-like organism (BLO) has been shown to be associated with greening in other countries[1,2,5]. The present paper reports the electron microscopy of the organism associated with greening disease of citrus in India.

* Present address: CPCRI, Research Centre, Appangala, Mercara 571 201, India.

*Citrus sinensis* Osbeck (Sweet Orange CV. Sathgudi) seedlings previously inoculated with three greening strains (severe—$G_1$, corky vein—$G_2$ and mild strain —$G_3$) as reported by Naidu *et al.*[6] were used as a source of material for electron microscopic studies. Small pieces of petioles and mid-veins were collected from young infected leaves and fixed in phosphate buffers (0·05 M pH 7·2) 5% glutaraldehyde solution for 4 hr in an ice bath followed by rinsing in cold buffer for 3 hr. The material was transferred in 2% osmium tetraoxide in the same buffer overnight. Then it was rinsed for 3 hr in buffer and dehydrated in graded ethanol (10–100%) and embedded in EPON–812.

The presence of bacteria-like organism (BLO) in the phloem sieve elements were observed under electron microscope. The number of bacterial cells in the sections of invaded tissue varied from a few to a large number. The organism was spherical to ovoid (Fig. A) or filamentous (Fig. B) with rippled cell wall and measured 0·2 to 0·5 $\mu$m with an average diameter of 0·35 $\mu$m. In transverse sections (Fig. C) and in longitudinal (Fig. D) the organism was surrounded by a 25–30 nm wide envelope which consisted of three zones; inner and outer dark electron dense zones separated by an intermediate electron transparent zone. The inner zone is the cytoplasmic

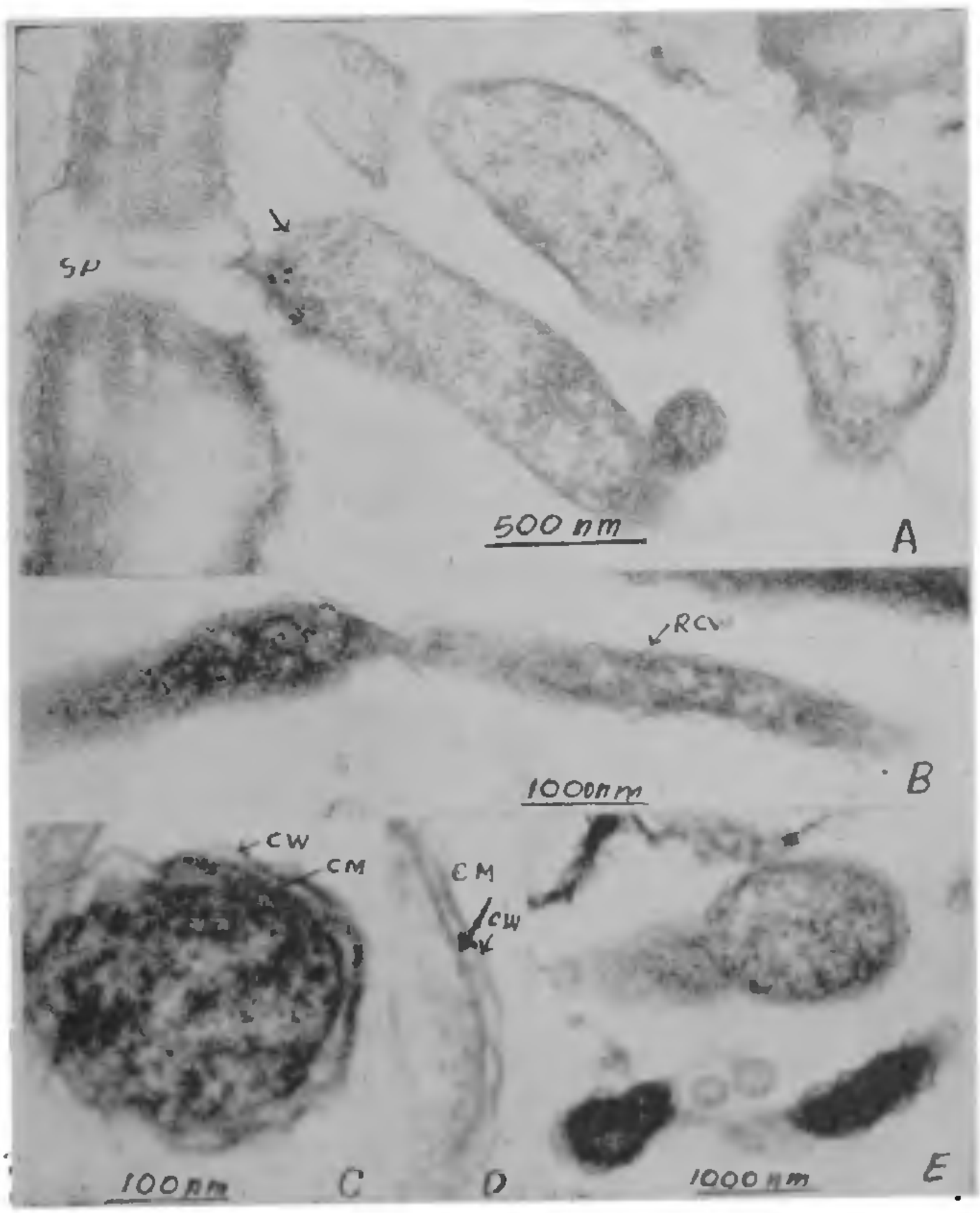



FIG. 1. Bacterium-like organism (BLO) in the phloem sieve elements of *Citrus sinensis* (Sweet orange C. V. Sathgudi) seedlings affected by greening disease. A. BLO (arrow) trying to pass through sieve pore (S.P. = sieve plate); B. Filamentous forms of BLO in the sieve elements showing thick cell wall (RCW—Arrow); C. Highly magnified electron micrograph showing transverse section of individual bacterium; D. Section of the envelope, showing (arrow) cell wall (CW) and cytoplasmic membrane (CM). E. BLO appears to multiply by budding. (Magnification A = 50,000×; B and E = 20,000×; C and D = 2,00,000×).

*membrane and the outer, the cell wall (Fig. D.)* The cytoplasm contains huge electron leucent zone with strands of DNA-like material. The organism appears to multiply by budding (Fig. E).

The constant presence of bacteria-like organism (BLO) in the phloem sieve elements of greening infected plants strongly suggest a casual relationship between the BLO and greening disease in the present study, and is similar to organism associated with various geographical forms of greening[5]. But the organism appears to be morphologically different and also entirely unrelated to bacteria-like organism observed in the xylem vessels of young tree decline affected citrus trees[3].

Bove *et al.*[1] established the positive effect of penicillin-G on the greening disease affected citrus plants, and proposed *a more appropriate term 'Gracilicute-like* bacterium' for the organism associated with greening disease.

The authors thank Dr. J. M. Bove and Miss M. Garnier, University of Bordeaux, France for their help in ultrathin sectioning and interpretation of electron micrographs.

*August* 6, 1980.

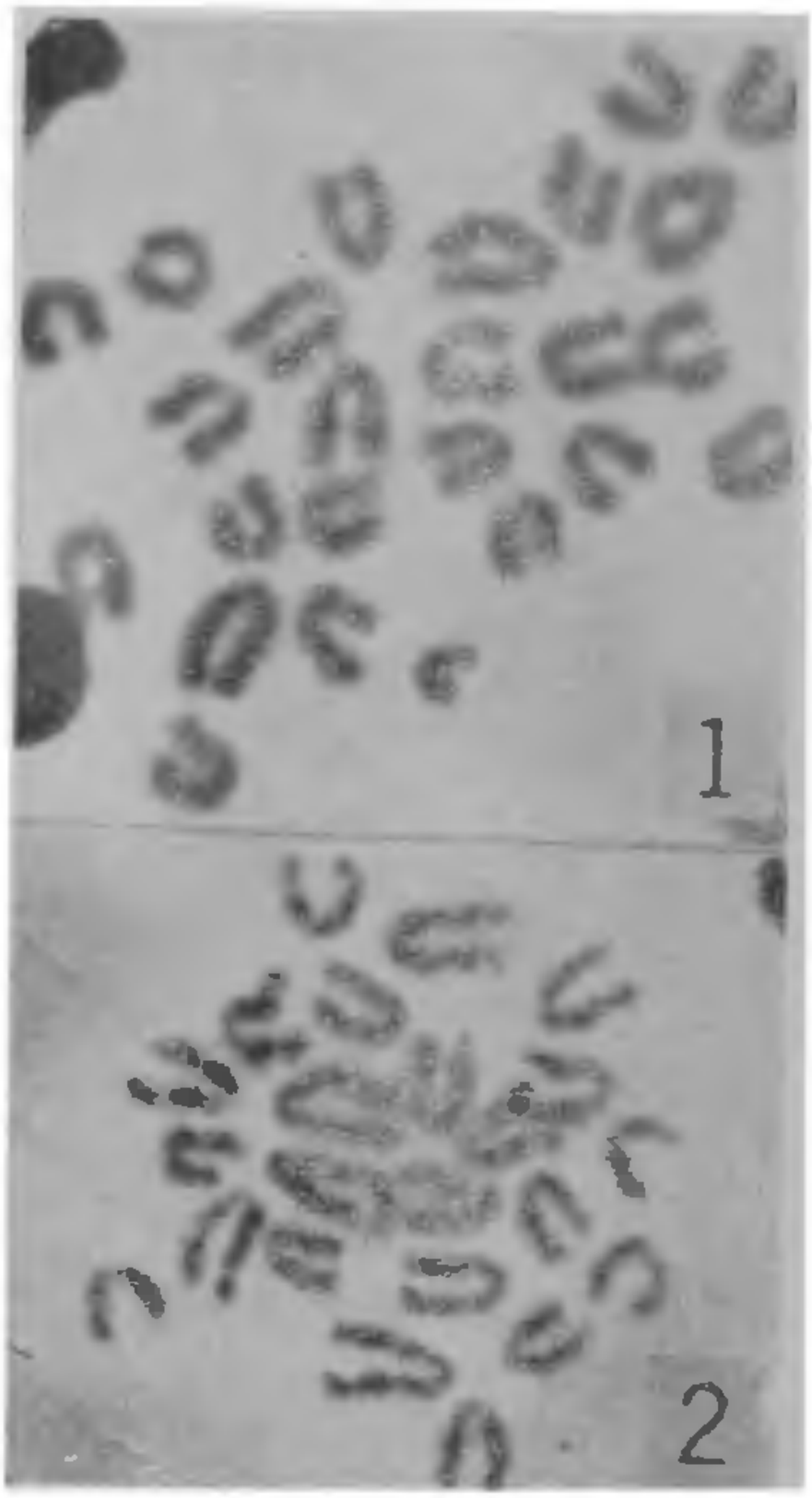
1. Bove, J. M., Bonnet, P., Garnier, M. and Aubert, B., *Proc. 8th I.O.C.V.*, 1930 (In press).
2. Catling, H. D., Garnier, M. and Bove, J. M., *FAO Plant Prot. Bull.*, 1978, 26, 16.
3. Feldman, A. W. and Hanks, R. W., *Proc. 8th I.O.C.V.*, 1930 (In press).
4. Garnier, M. and Bove, J. M., *Fruits*, 1977, 32.
5. —, Latrille, J. and Bove, J. M., *Proc. 7th I.O.C.V.*, 1976, p. 13.
6. Naidu, R., Govindu, H. C. and Ramakrishna, K., *Proc. 8th I.O.C.V.* (Abstract), 1979.
7. Raychaudhuri, S. P., Nariani, T. K., Lile, V. C. and Singh, G. R., *Proc. 5th I.O.C.V.*, 1972, p. 35.
8. Nariani, T. K., Raychaudhuri, S. P. and Viswanath, S. W., *Curr. Sci.*, 1971, 40, 552.

## A NEW KARYOTYPE IN A TELEOST FISH

K. K. Rishi, M. S. Haobam and Jaswant Singh
Department of Zoology, Kurukshetra University
Kurukshetra 132 119, India

Fishes exhibit great morphological variability and one might expect a great diversity in their karyotypes. However, this has not been found to be wholly true. Several orders and families have been found to possess similar karyotypes. For example, 48 acrocentric chromosomes are common in many species, particularly in the comparatively recent order Perciformes[1–4]. *In fact, Ohno*[5] *suggests that this karyotype may be* ancestral and perhaps was present in the primordial teleost *Leptolepis.*

It has generally been found that karyotypes with less than 48 chromosomes tend to possess some biarmed chromosomes; thus their origin can be explained on the basis of Robertsonian principle. As far as we are aware, there is no report in teleosts where the karyotype is composed of a substantially small number of chromosomes, all of which are also acrocentric. We have found in the teleost, *Monopterus alba* (Zuiew) (Family Symbranchidae, Order Symbranchiformes) a karyotype of 24 chromosomes all of which are acrocentric. Specimens of this freshwater mud-eel were obtained in living condition in Imphal (Manipur State) and were processed for chromosomal analysis. Kidney cells from *the female were chosen* and gave good results. The usual colchicine-KCl-acetic methanol-air drying technique was applied and the slides were stained with diluted Giemsa solution[6]. The karyotype was found to be composed of 24 acrocentric chromosomes (Figs. 1, 2). It will be of




Figs. 1 and 2. Somatic metaphases from the kidneys of female specimens of *Monopterus alba* (Zuiew).