Hence observations were made on the disease occurrence, their extent and the possible causes for the outbreak. In a square metre plot, on an average 20 larvae were observed hanging on to the plants exhibiting typical NPV symptoms; the larvae with such polyhedrosis symptoms constituted 86.6% of the field population. Though daincha has been reported as a host[1] for this polyphagus pest, it does not seem to be a natural host since no egg laying was observed on this crop. The larvae were, however, found to migrate to this crop from groundnut, cowpea and jute grown around daincha crop and pick up virus infection by feeding on the leaves. This epizootic observation has lent support the view that if proper distribution methods are provided, the virus can establish well in field and induce epizootics resulting in natural control of *S. litura*.

It is reported that causes for such outbreaks may be attributed to soil borne virus particles which play a major role in the initiation of epizootics. The accumulated virus particles near the surface of the soil spread to outer leaves of the growing crop, and ingested by the early instars, lead to the initiation of infection, and rapid dissemination occurs when the infected larvae crawl to the central parts of the plants[5]. Further infection occurs on fresh larvae either by ingestion of the contaminated food or by feeding on the liquified cadavars of virus killed larvae. Thus, once the infection is initiated, rain is the chief spreading agent and high mortality rate could occur in the second or subsequent generations[6]. In this case also initiation would perhaps have started from soil borne virus particles accumulated at the instance of first generation larvae, which were first noticed on weed hosts during the last week of July 1981. The subsequent almost continuous monsoon rains in August and September splashing on the accumulated soil virus, onto the plants, together with the unfavourable climatic conditions had been conducive for the increased infection resulting in the severe epizootic disease reported in this note.

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A NEW MULTICRYSTALLIFEROUS *BACILLUS THURINGIENSIS* ISOLATE FROM DISEASED MOSQUITO LARVAE

K. K. R. MENON, A. S. RAO AND S. V. AMONKAR
Biology and Agriculture Division, Bhabha Atomic Research Centre, Trombay, Bombay 400 085, India.

THE entomocidal bacterium *Bacillus thuringiensis* produces a proteinaceous, bipyramidal crystal concomitant with sporulation that is toxic upon ingestion and solubilization to the larvae of Lepidopteran and Dipteran insects[1]. The organism usually produces one crystal per maturing cell except in *B.t.*var *thuringiensis* (BA-068)[2], *B.t. var darmstadiensis*[3] and *B.t.* var *tohokuensis*[4], which are bicrystalliferous. In this note, we report yet another, hitherto unknown multicrystalliferous *B.t.* isolate (ISPC-4).

From the jet black larval cadavers that appeared in our *Culex fatigans* colony, the pathogen was isolated on nutrient agar medium. The opaque creamish colonies with curly hair margins were those of typical *Bacillus thuringiensis*.

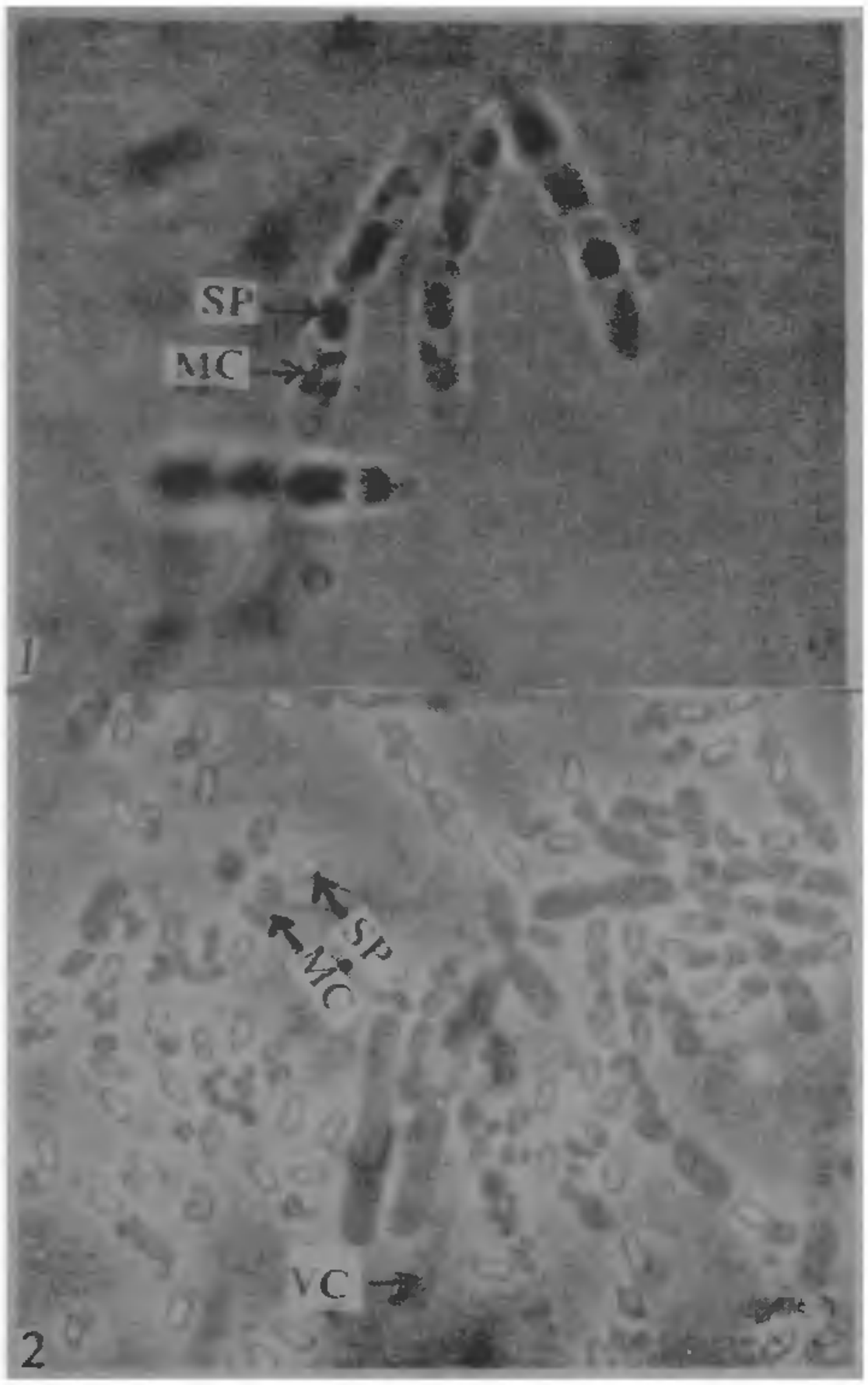
Morphological observations with the purified growth material showed that the vegetative cells were motile, gram positive rods, measuring 1.2–1.6 μm × 4.2–5.6 μm. The spores were elliptical, measuring 0.86–1.01 μm × 1.6–3 μm. The organism showed 2–5 bipyramidal crystals per sporangium (figures 1 and 2), was aerobic or facultative anaerobe and tolerated upto 5% NaCl.

Biochemical reactions were as follows: indole and β-exotoxin production, MR, VP, citrate utilization and acid from mannitol, xylose, arabinose were negative. NO_3-NO_2, catalase, acid from glucose, and growth in 1% lysozyme were positive. Also, this organism belonged to serotype 3a, 3b and biotype III_2.

Thus morphological, biochemical and serological studies identified our new multicrystalliferous isolate (ISPC-4) as *B. thuringiensis* var *kurstaki* (serotype 3a, 3b and biotype III_2).

This organism was shown to be pathogenic to *Culex fatigans* larvae. The LC_{50} values[5] were found to be 1.91×10^5 and 1.93×10^5 spores/ml to 2nd and 3rd instar larvae respectively. These values were based on the cumulative mortality data recorded for 5 days. The bacillus also gave 100% mortality to 2nd, 3rd and 4th-instar larvae of *Achaea janata* (Lepidoptera: Noctuidae) at a concentration of 10^9 spores/ml within 48 hr.

Presently the microbial insecticide formulations which are widely used in agriculture and forestry are based on single crystal producing *Bacillus thuringiensis* varieties like (HD-1) strain[6] and these have been proved safe to man and other non-target organisms. Since our new isolate *B.t.* var *kurstaki*



Figures 1 and 2. 1. Development of the spore (SP) and multiple crystals (MC) in crystalliferous bacillus. **2.** Vegetative cells (VC), liberated spores (S) and multiple crystals belonging to same vegetative cell are shown.

(ISPC-4) produces 2–5 crystals per cell, it would be worth exploring its performance in biocontrol programmes.

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SEED SURFACE STUDY OF POSSIBLE HYBRID BETWEEN C_3 AND C_4 SPECIES OF *CLEOME* (CAPPARIDACEAE)

G. RAJENDRUDU AND V. S. RAMA DAS
Department of Botany, Sri Venkateswara University, Tirupati 517 502, India.

ATTEMPTS have been made to produce hybrids between C_3 and C_4 plants through breeding programme in the genera *Panicum*, *Zygophyllum*, *Euphorbia*, and *Atriplex*. However, such hybridisations have met with success only with *Atriplex* species[1]. This report presents the results of interspecific hybridisation between C_3 and C_4 species in the genus *Cleome* using conventional breeding techniques.

Two species of *Cleome*, *Cleome viscosa* L. and *Cleome gynandra* L. (*Gynandropsis gynandra* L.) representing C_3 and C_4 plants respectively were selected for the present study. The plants were raised in beds (4 × 3 m) under field conditions during November 1980-February 1981. The beds were initially over-seeded and the 2–3 week old seedlings were thinned to 10-15 plants/m². Plants in the border rows were not used for aritificial cross-pollinations. The usual cultural operations were provided and the plots irrigated whenever necessary.

Both the species commenced flowering after 40–45 days after sowing. Flower buds appeared initially in leaf axils singly in *C. viscosa* and in terminal corymbs in *C. gynandra*. The flowers in both species develop and open in an acropetal succession and opened early in the morning. Flower buds borne at the lower leaf axils of the stem were chosed for emasculation. Flowers were emasculated in the evening preceding anthesis and covered with a paper bag to prevent natural cross-pollination. All untreated flower buds very close to artificially pollinating flowers were removed in each branch. Emasculated flowers were artificially cross-pollinated approximately at the time of anthesis. Sufficient care was taken to avoid physical injury during the process of hybridisation. The fruits of cross pollinated flowers were harvested at maturity and drying.

Mature seeds of freshly dehusked and dry fruits were prepared for scanning electron microscopy. Seeds were mounted on specimen stubs with silver conducting paste and gold coated in a sputter coater. Gold-coated specimens were stored in a desiccator until examination. Observations were made at 15 kV with a JEOL JSM-35 SEM and recording images with INDU 120 mm, ASA 125 film at the University of Hyderabad.