

Table 1. Nodulation, nitrogen content and yield of chickpea as influenced by rhizobia.

Treatment	Pusa 261 nodule		Nodule		Pusa 256 yield (g/pot)		N content (mg/pot)	
	Number	Fresh wt (mg/plant)	Number	Fresh wt.	Grain	Dry matter	Grain	Dry matter
No-inoculation	12	293	22	338	4.8	9.0	182.7	69.3
<i>Cicer-Rhizobium</i>	10	222	43	503	8.9	12.7	299.5	120.3
<i>B. japonicum</i>	5	57	31	552	8.3	12.3	335.8	102.5
<i>R. leguminosarum</i>	16	296	22	406	8.2	12.8	289.8	127.3
Green gram- <i>Rhizobium</i>	13	164	19	307	6.8	10.3	250.8	113.7
C.D. 0.05					1.85	2.21	67.29	20.07
CV%					23.20	18.00	23.00	17.50

Average of three replicates. *Average number of nodules per plant.

Table 2. Biomass production in soybean isolines.

Treatment	Grain (g/pot)	Shoot	Root
80 kg N ha ⁻¹			
Non-nod, uninoculated	2.1	15.6	5.6
Non-nod, inoculated	4.1	13.8	5.5
20 kg N ha ⁻¹			
Nod-uninoculated	3.1	27.0	6.8
Nod-inoculated	4.8	19.7	4.8

Average of three replicates.

strain of *Bradyrhizobium japonicum* unable to invade and produce nodules on the non-nod type of soybean was found to influence plant growth. Reduction in shoot and root weight in nodulating isolate may be ascribed to competition between host and *Rhizobium* for photosynthates.

Symbiotic association between legumes and *Rhizobium* implies invasion, nodule formation and fixation of atmospheric N, however the role played by the latter in absence of nodules, in providing N and enhancing yield of plants, is not fully understood. Competition and synergistic effects amongst strains in mixed cultures of rhizobia, *Rhizobium* and *Azotobacter/Azospirillum* have been observed^{5,6}.

Instances of successes and failures of inoculation with strains of *Rhizobium* occupying between 30 and 75% of nodules have been reported^{7,8}. Decrease in ¹⁵N content of plants — an indicator of possible N₂ fixation in Clark-63, a non-nodulating isolate of soybean inoculated with strain SB 113 of *B. japonicum* was observed (Raverkar, personal communication).

In general, most of the native soil rhizobia are ineffective and are known to compete with inoculated strain causing delay and/or reduction in nodulation⁷. Beneficial effects of seed inoculation with different rhizobia to wheat, where no nodules are formed, have also been observed even under field conditions^{9,10}.

Favourable effects of heterologous rhizobia on yield of chickpea and, that of homologous *B. japonicum* on non-nodulating soybean observed in these experiments, thus

point out possibility of beneficial effects of rhizobia on leguminous plants in absence of nodulation.

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Cytoplasmic polyhedrosis virus infecting redpalm weevil of coconut

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A highly potent cytoplasmic polyhedrosis virus (CPV) has been detected for the first time in Kerala in stages of the redpalm weevil, *Rhynocophorus ferrugineus* F., which infests coconut. It infects all the life stages of the pest, including the adult. Infection in the late grub stage resulted in malformed adults and suppressed the insect population drastically. The midgut of infected insects was enlarged and filled with thousands of polyhedral inclusion bodies (PIBs) visible under a light microscope. Electron microscopic studies revealed characteristic surface projections of viral bodies characteristic of CPV.

INVESTIGATION on a disease prevalent among the life stages

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of the redpalm weevil, *Rhynocophorus ferrugineus* F. in Trivandrum district (Kerala), led to the detection of a cytoplasmic polyhedrosis virus (CPV).

The diseased grubs collected from the field were much smaller and yellowish in appearance compared to the white translucent healthy ones. In early stages of the disease the grubs showed retarded development, less movement and feeding. In due course the head of the infected grubs became enlarged and a marked constriction appeared at the anterior abdominal region. The hindgut was getting completely extroverted and the grubs became moribund. The cadaver was shrunken, leathery and yellow in appearance. The integument was remarkably tough and shiny (Figure 1, *a-h*).

The last instar grubs inoculated in laboratory resulted

in the emergence of deformed adults which died in 10 to 15 days while the normal adults had a life span of 60 to 118 days. Microscopic examination of the body fluid of such adults revealed thousands of polyhedral inclusion bodies (PIBs). The infected adults laid very limited number of viable eggs, and the young grubs emerging from those eggs succumbed to disease and died within a day or two. Nelsom¹ made similar observations in CPV-infected lepidopterans.

On dissection of the diseased specimen the midgut region was seen opaque enlarged and milky white in colour and the tissues at the two ends were weakened. The midgut breaks off at the weakened portion even by very slight touch. Wilson and Ramsoka² also found such a phenomenon in variegated cutworms infected by CPV. Smears of the



Figure 1. CPV-infected *R. ferrugineus*. *a-c* ($\times 2$), Leathery extruded grubs; *d, e* ($\times 1$), healthy grubs; *f, g* ($\times 1.5$), diseased pupae, crinkled, malformed wings; *h* ($\times 2$), healthy pupa.

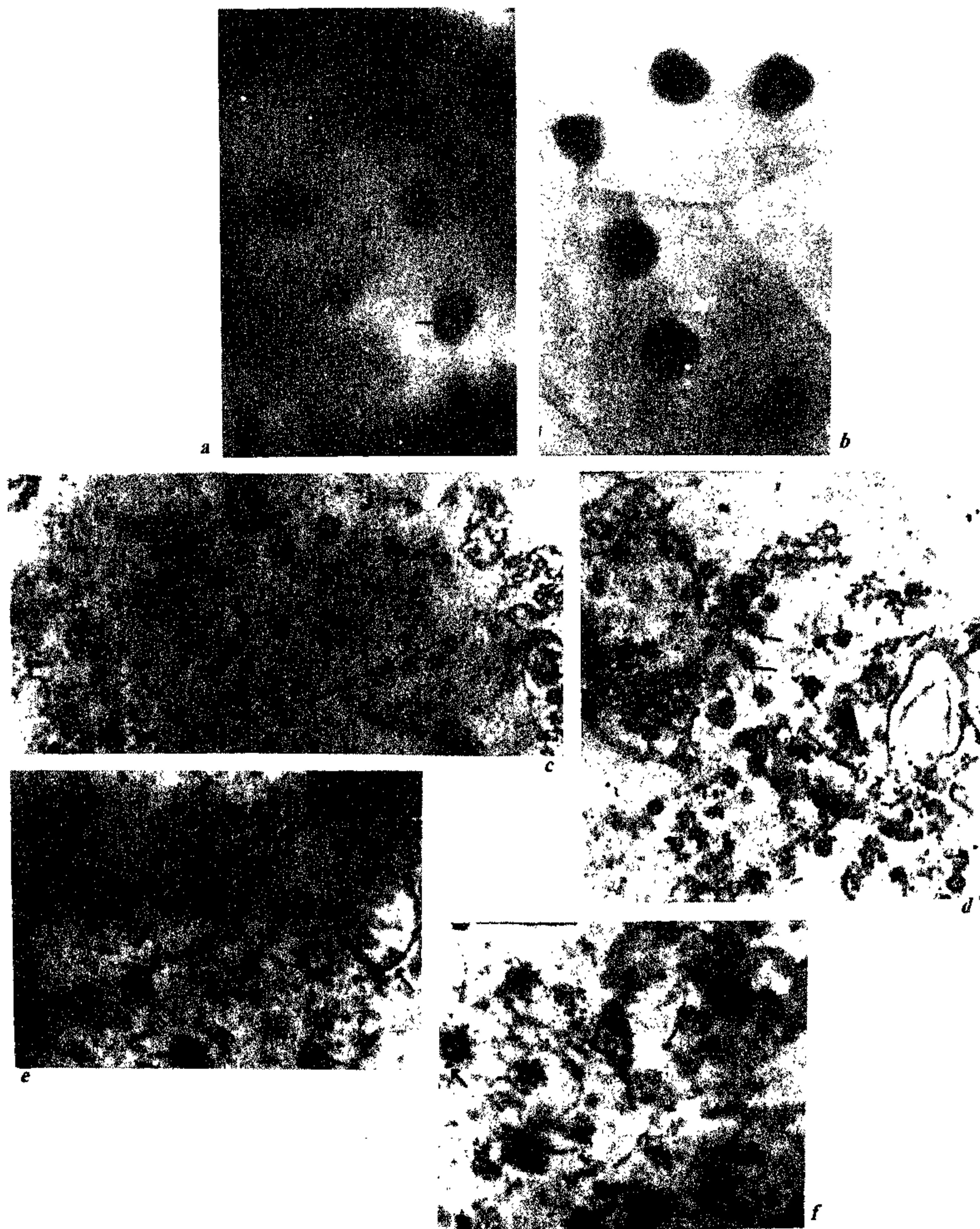


Figure 2. Electron micrographs of polyhedral inclusion bodies (PIBs); cross-section of inclusion bodies and virions from CPV-diseased *R. ferrugineus*. *a*, EM of PIBs ($\times 24000$) pitted appearance of virions (arrows) on the inclusion bodies. *b*, PIBs hexagonal in shape ($\times 28000$); EM of virions ($\times 78000$) (arrows). *c*, Virions ($\times 78000$); scattered (arrows). *d*, Virions ($\times 78000$); spherical size and surface projections (arrows). *e*, Cross-section of PIBs (arrows) ($\times 78000$) emptied. *f*, Virions ($\times 78000$) inside the PIBs, detached viral particles (arrows) from the surface of the spherical-shaped virions ($\times 78000$).

midgut content showed thousands of PIBs under light microscope. The PIBs were varied in size and took Giemsa stain. Under the electron microscope, the PIBs had a hexagonal and pitted appearance and the virions were seen located near the surface. The virus particles were spherical and possessed surface projections³ typical of other

cytoplasmic polyhedrosis virus (Figure 2, *a-f*). Similar characters of PIBs and virions were recorded from CPV-infected *Spodoptera frugiperda*⁴ and *Anoplonyx destructor*⁵.

Pathogenicity tests of the CPV isolated from the diseased grubs on second stage grubs of the host was carried out by

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feeding fresh slices of coconut petiole dipped in semipurified PIBs suspension. The treated grubs were reared individually in widemouthed glass bottles provided with untreated petioles. The behaviour of the infected grubs and the development of disease symptoms in the laboratory were similar to those observed in field. The mortality commenced from the fourth day, (with 100% mortality in 10 days) while the grubs in control emerged as adults. This is the first investigation report on a viral disease (CPV) of redpalm weevil recorded.

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BOOK REVIEWS

Observations on Medico-Botany of Andaman-Nicobar Islands. Central Council for Research in Ayurveda and Siddha, Ministry of Health and Family Welfare, New Delhi. 1988. 94 pp. Rs. 58.

Vegetable drugs play a dominant role in Ayurveda and there exist numerous folk traditions of local health care in tribal as well as other rural areas. Many of these local traditional herbal remedies need to be revitalized and evaluated in the light of indigenous health sciences like Ayurveda, Siddha and Unani in order to achieve the national goal of 'Health for all by 2000 AD'.

The present publication is the outcome of two surveys conducted during 1975-80 and aims at fulfilling such an objective. The book provides an account of the herbal potential of the chain of islands, along with relevant information on the local tribes, their socio-hygenic aspects, general vegetation, and as many as 42 herbal remedies following ethnobotanical studies. Of the 306 plant species collected from the islands 223 species are reported to have medicinal properties and 141 species are found to be useful in the Ayurvedic system of medicine. The book also provides useful information on 80 Ayurvedic drugs selected out of the actual collections made by the authors and another 29 on the basis of earlier reports. The information includes

the accepted botanical source, Andaman and Nicobar source, therapeutic properties, important Ayurvedic preparations, and the major diseases in which the preparations can be used. Twenty black-and-white colour photographs of medicinal plants and tribals are provided, the production of which could have been better. Botanical names in the enumeration of Ayurvedic drugs should have been in italics or bold face. Illustrations of important medicinal plants would have added to the utility of the book. Considering the enormous biodiversity and medico-botanical potential of the islands, the study could have been much more exhaustive. Although the production and get-up of the book is satisfactory, the size and price of the book may not be liked by all users.

On the whole, the book is a successful venture, useful to workers in the field of Ayurveda and various allied disciplines on the one hand and ethnobiologists on the other.

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*Botanical Survey of India
Dehra Dun.*

Environmental Analysis: Water, Soil and Air. Second edition. M. M. Saxena. Agro Botanical Publishers (India). 1990. 186 pp. Rs. 200, US \$ 400

This is a comprehensive book dealing

with sampling and analytical techniques for a wide array of water, soil and air environments. It is a useful manual for individuals and laboratories engaged in the field of environmental investigations, including those concerned with ecology, pollution, agriculture, fisheries, water supply, sanitation, and health and hygiene. The book also contains at the end appendices containing equivalents, conversion factors, national standards, etc.

The book will prove to be still more useful if a list of suppliers, with addresses, of instruments mentioned in the book is also included in the appendix. Also it is necessary to include simple methods, where available, instead of those involving expensive instruments. For instance, on page 108, bacterial colonies are recommended to be counted by a Quebec colony counter. For those who cannot afford this counter, manual counting is an acceptable procedure.

The only criticism I have of the book is its high cost which would discourage individuals from purchasing it.

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