

## SUSCEPTIBILITY OF *SPODOPTERA LITURA* (F) TO A GRANULOSIS VIRUS

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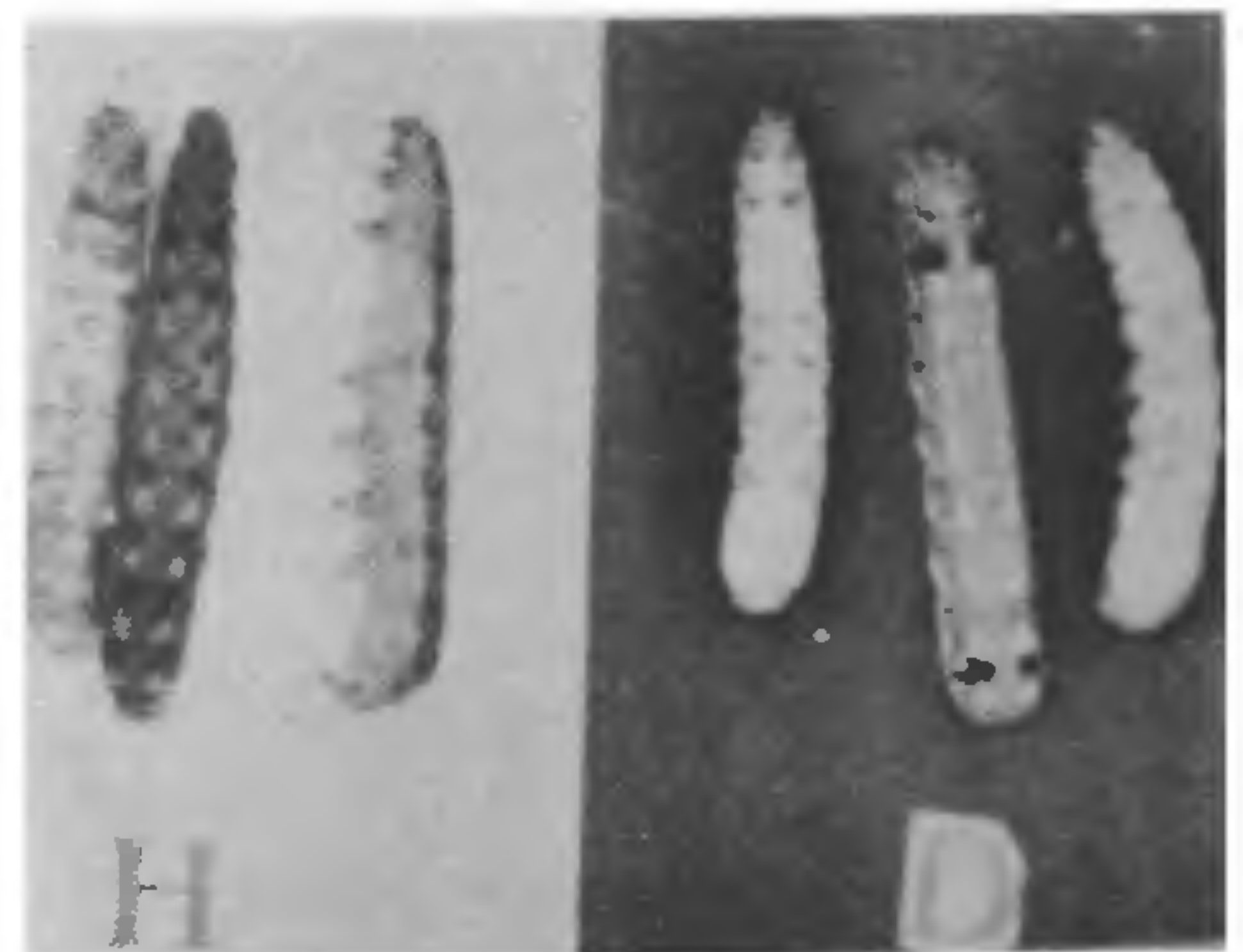
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*SPODOPTERA LITURA*, commonly known as tobacco leaf caterpillar, is an important polyphagous pest, causing heavy damage to various crops by way of defoliation. During the field survey on cabbage crop grown at this Institute, a granulosis virus (GV) was isolated from a few dead caterpillars of *S. litura*. Examination of the tissue in water mounts with either the phase contrast or dark field microscope, reveals numerous capsules emanating from the ruptured cells. Samples from some of the insects for which positive diagnosis had been made with both types of light microscopes were further checked with electron microscope. Recognition of capsules and virion which is embedded inside the capsule with the latter instrument, confirmed the identity of the particles made visible under light microscopes. Though Battu *et al*<sup>1</sup> reported the possible occurrence of GV in *S. litura*, as suspected infectious group, this report appears to be the first authentic report on the occurrence of GV in *S. litura* with a recognition of capsules and virions inside the capsules as well as by pathogenicity test. The present communication also deals with observations made on the symptomatology and gross pathology of *S. litura* larvae, when it was administered with known quantity of GV orally, by diet surface contamination technique as well as on to the eggs by chorion surface contamination technique.

Diseased larvae were homogenized with distilled water for 3 min and the homogenate was then filtered twice through several layers of muslin cloth and the filtrate was centrifuged at 2500 rpm for 15 min. The supernatant was then decanted and further centrifuged at 16,000 rpm for 1 hr. The differential centrifugation process was repeated twice and the resultant pellet was resuspended in sterile distilled water. The number of capsules/ml of the stock suspension was determined using a Petrauff-Hausser bacteria counting chamber. A test was conducted to determine its pathogenicity against all the six instars of *S. litura* maintained on artificial diet. Forty larvae of each instar were inoculated with a dose of  $1.6 \times 10^9$  capsules/0.1 ml/cup by diet surface contamination technique. The larvae were reared individually on the virus contaminated diet till their death. A similar

number of same larvae for each instar, treated similarly without virus served as control. The dead larvae were diagnosed by microscopic examination of the squashed preparations for the presence of capsules. Observations were recorded on the symptomatology and larval pupal mortality. To determine the effect of GV on the eggs of *S. litura*, one-day-old egg masses were dipped on the suspension of capsules of the virus at 4 different concentrations viz  $1.6 \times 10^{12}$ ,  $1.6 \times 10^{11}$ ,  $1.6 \times 10^{10}$  and  $1.6 \times 10^9$  capsules/ml, and with one set of egg mass, dipped in water mixed with a drop of Triton x-100 for 5 min and allowed to air dry under shade to serve as control. After hatching, 50 caterpillars in each treatment were reared separately in diet, till their death.

The symptoms of the GV infected *S. litura* were generally comparable with those of most of the granulosis viruses reported in other insects<sup>2</sup>. In contrast to the dark coloured healthy larvae of *S. litura*, the GV infected *S. litura* larva showed clear-cut whitening of the integument on the ventral side (figure 1), mostly due to the accumulation of large number of capsules. After death, a characteristic white liquid oozed out through the skin after piercing. This fluid is of the consistency of thin cream, containing large numbers of capsules. In most cases, the larvae continue to moult, grow in size and remained living for quite a long period. They increase in size to such an extent that the virus infected larvae, become larger than the healthy one, prior to pupation. Those infected larvae may continue to live after the control larvae (at the start of the experiment) have completed pupal and



**Figure 1.** Effect of granulosis virus on the larva of *S. litura*. (H-Healthy, D-Diseased. Note the characteristic white coloration on the ventral side of the body).

adult stage and they even begin to lay eggs. Upon dissection of a diseased larva, extremely enlarged and thickened fat body was noticed which appears quite white when compared to the less massive and practically colourless adipose tissue of the healthy larva. After death, the integument remains rather tough and leathery in contrast to larvae infected with nuclear polyhedrosis virus, in which case the integument ruptures quite easily.

It is evident from the result (table 1) that all the instars were highly susceptible. In general, as the instar advances, a decrease in the incubation period was noticed. It is of interest that the disease progressed to mortality at a considerably rapid rate in the older instars than in the early first and second instars. This suggests that the larva of fifth instar may be more susceptible to GV than the first and second. Similar susceptibility of later instars (compared to earlier instars) has been reported in the case of *Harrisina brillians*<sup>3</sup> and *Pseudaletia unipuncta*<sup>4</sup>. The prolonged incubation period in the first and the second instars when compared to the grown up 5th instar may be due to their gregarious feeding habit at their early stage.

When the virus was applied on to the eggs, one hundred percent mortality was observed in all the concentrations tried except at the lowest concentration of  $1.6 \times 10^9$  capsules/ml wherein 80% mortality has been recorded. The incubation period ranged from 4 to 48 days (table 2). It is well known that the lepidopterous larvae eat their way through chorionic membrane during eclosion. Thus, it is possible for the larvae to contract the disease when they eat the contaminated egg shell as they emerge, as it has been reported in the case of NPV infected *Amsacta albistriga*<sup>5</sup> and *Heliothis armigera*<sup>6</sup>.

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**Table 1** Effect of granulosis virus on different larval instars of *S. litura*.

Larval stage (instar)	Incubation period (range in days)
I	4-33
II	9-41
III	9-38
IV	10-39
V	9-23
VI	7-12

The mortality was 100% in I-V larval stage and 50% in VI

**Table 2** Effect of granulosis virus on the eggs of *S. litura*

Virus dose (capsules/ml)	Number of days until		
	Initial mortality	50% mortality	100% mortality
$1.6 \times 10^{12}$	4	12	39
$1.6 \times 10^{11}$	4	12	44
$1.6 \times 10^{10}$	5	15	44
$1.6 \times 10^9$	8	28	48*

\* Only 80% mortality was observed

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1. Battu, G. S., Dilwari, V. K. and Bindra, O. S., *Indian J. Entomol.*, 1977, **39**, 271.
2. Hugher, A., In: *Insect pathology, an advanced treatise* (ed.) E. A. Steinhaus, Vol. 1, 1963, Academic Press, New York & London, p. 531.
3. Smith, O. J., Hughes, K. M., Dunn, P. H. and Hall, I. M., *Can. Entomol.*, 1956, **88**, 507.
4. Tanada, Y., *J. Insect Pathol.*, 1959, **1**, 197.
5. Jayaraj, S., Sundaramurthy, V. T. and Mahadevan, N. R., *Madras Agric. J.*, 1976, **63**, 567.
6. Narayanan, K., *Studies on the nuclear polyhedrosis virus of gram pod borer, Heliothis armigera (Hubner) (Noctuidae: Lepidoptera)*, Ph.D. Thesis, Tamil Nadu Agril. Univ. Coimbatore, India, 1979.

## TWO NEW SPECIES OF PULVINARIA TARG.-TOZZ. (HOMOPTERA: COCCIDAE) FROM INDIA

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*PULVINARIA ALIGARHENSIS* sp n and *P. indica* sp n are described and illustrated in the present paper. Chalcidoid parasites of these species are also given. The types are deposited in the Zoological Museum, Aligarh Muslim University, Aligarh, India.

*Pulvinaria aligarhensis* sp n<sup>1</sup> (figures 1A-L)

Adult female (A): Mounted specimens broadly oval

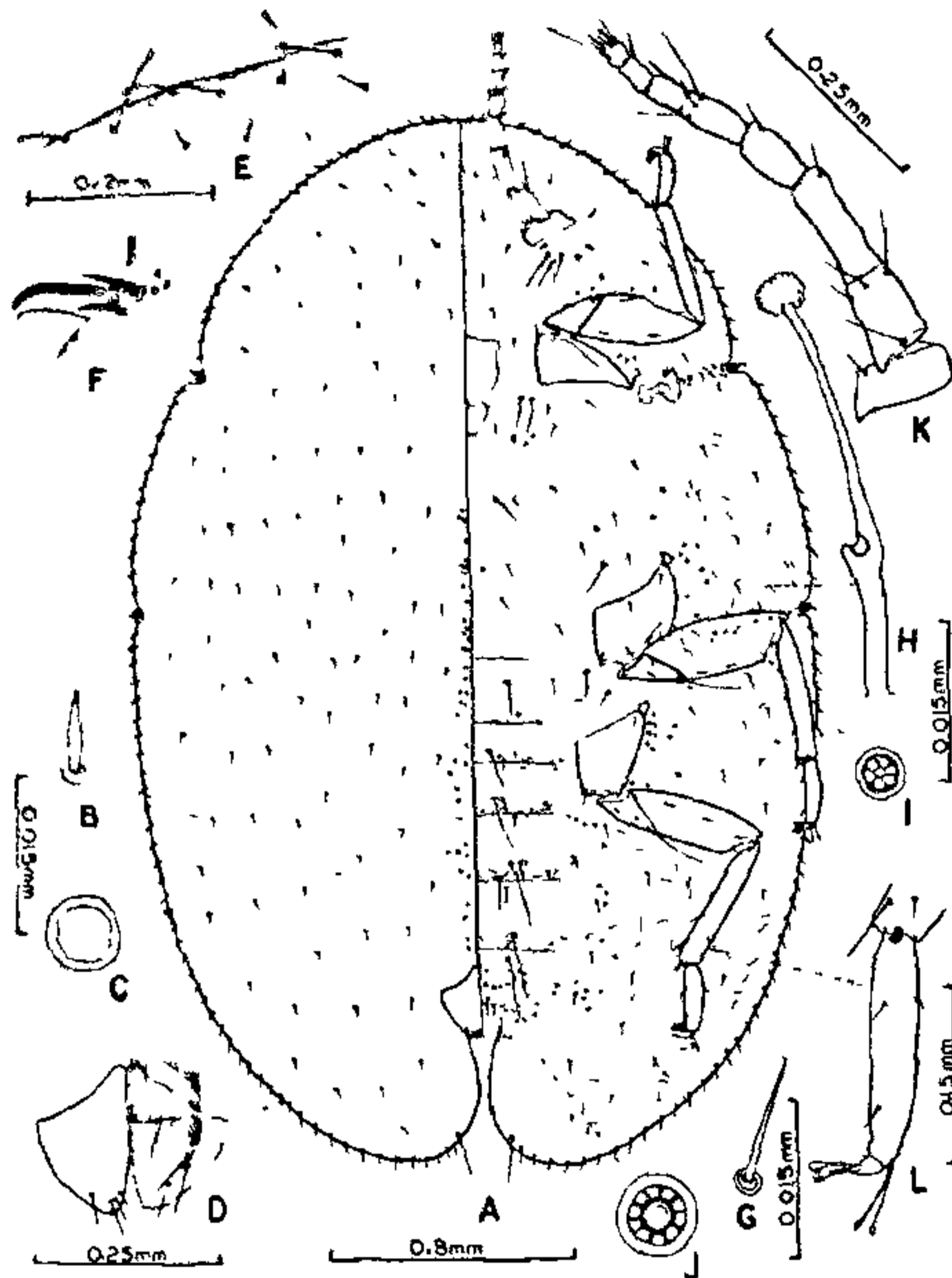


Figure 1A-L. *Pulvinaria aligarhensis* sp. n. ♀.

in shape, one and a half times longer than wide (3.41:2.00 mm). Dorsum without pale areas; dorsal setae (B) small and lanceolate, sparsely distributed; disc pores (C) numerous anterior to anal plates and extending medially near rostrum; submarginal tubercles and tubular ducts absent. Marginal setae (E) slender with clubbed apices except a pair of long simple setae on anal lobes. Stigmatic clefts well-developed, each with 3 spines, median spine long and slightly curved apically, more than twice the length of lateral spines (F). Anal plates (D) together roughly quadrate with anterolateral margins slightly shorter than posterolateral margins; each plate with 3 apical and 1 subdiscal setae dorsally, 3 long subapical setae ventrally; anal fold with 2 pairs of small fringe setae.

Venter with sparsely distributed thin spinose setae (G) of variable lengths; 4 pairs of interantennal and 7 pairs of long prevulvar setae present. Quinquelocular pores (I) in a band between spiracles and stigmatic clefts. Multilocular pores (J) numerous around genital opening and few in transverse rows on preceding 4 abdominal segments, and few near bases of coxae. Tubular ducts (H) dense on marginal and submarginal,

segmentally arranged on mid abdominal and sparse on mid cephalic and thoracic regions. Eyes absent. Antennae (K) well-developed, 8-segmented, 0.69 mm in length; segment third longest, two and a half times longer than wide. Rostrum monomerous. Spiracles normal. Legs well-developed with tibio-tarsal articulatory sclerosis; claws simple, digitules narrow and clubbed at apices; tarsal digitules slender and knobbed at apices (L). Dimensions of fore, mid and hind legs: trochanter plus femur (0.46:0.52:0.5 mm), tibia (0.37:0.41:0.4 mm) and tarsus (0.18:0.2:0.2 mm) respectively.

*Holotype* ♀, *Paratypes* 6 ♀, India: Uttar Pradesh, Aligarh, Naurangabad, on *Azadirachta indica* L., 12. iv. 1977 (R. K. Avasthi).

An aphelinid parasite *Coccophagus cowperi* Girault is known to attack *P. aligarhensis* sp n in India.

*P. aligarhensis* sp n differs from all known Indian species by its having slender marginal setae with clubbed apices and numerous disc pores anterior to anal plates which extend medially near rostrum.

*Pulvinaria indica* sp n (figures 2A-L)

*Adult female* (A): Mounted specimens oblong in shape,

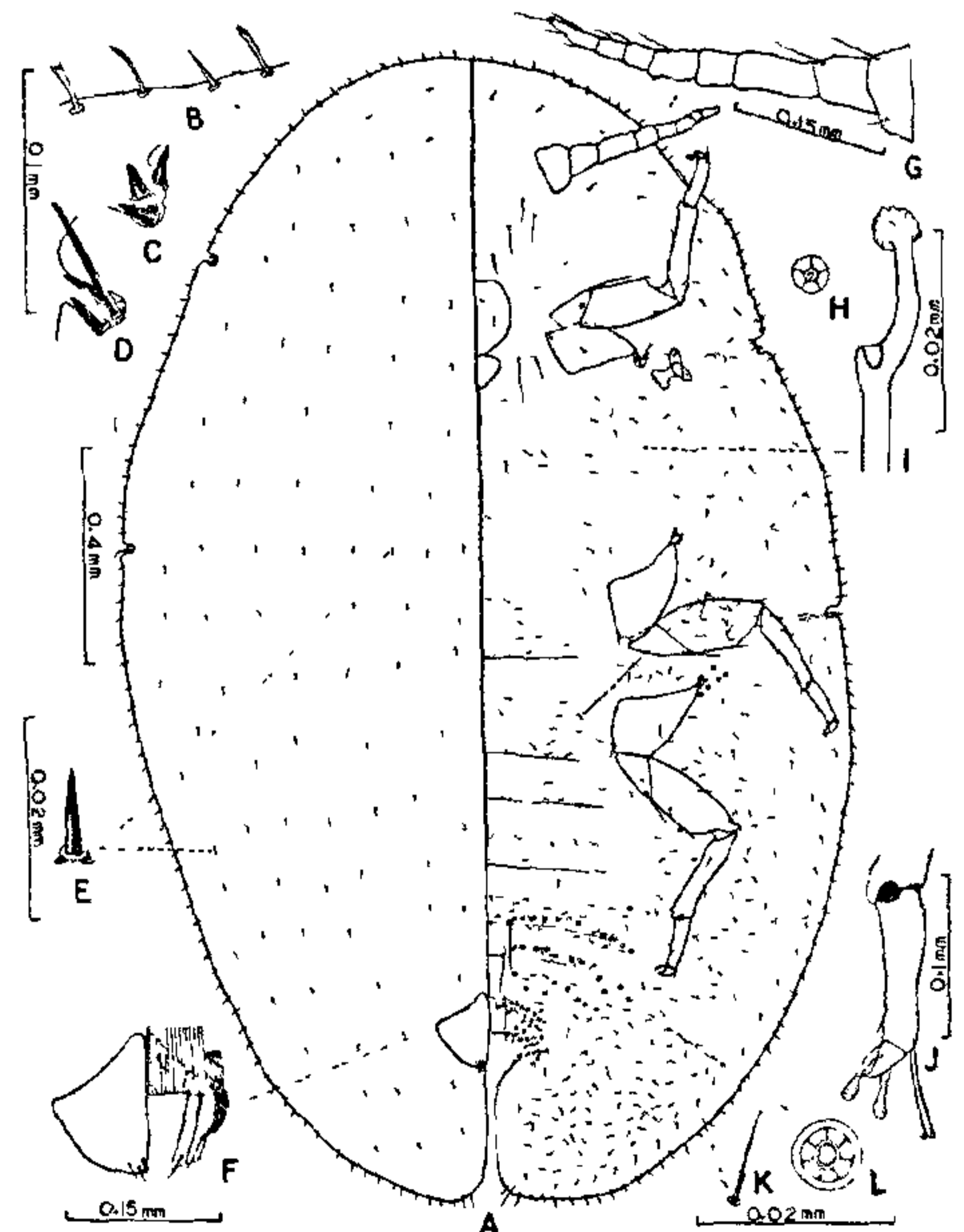


Figure 2A-L. *Pulvinaria indica* sp. n. ♀.

less than 2 times longer than wide (2.04:1.26 mm). Dorsum without pale areas; dorsal setae (E) thick and spinose, sparsely distributed; disc pores, submarginal tubercles and tubular ducts absent. Marginal setae (B) mostly bifid and fimbriate, few, simple. Stigmatic clefts well-developed, each with 3 spines; anterior cleft (C) with median spine same as lateral spine; posterior cleft (D) with median spine long and straight, more than twice the length of lateral spines. Anal plates (F) together roughly quadrate with anterolateral margins curved in and as long as posterolateral margins which are curved out, lateral angles acute; each plate with 3 small apical setae dorsally, 3 long subapical setae ventrally; anal fold with 2 pairs of long fringe setae.

Venter with thin setae (K) arranged in a row submarginally and sparse on median and submedian regions; 4 pairs of interantennal and 3 pairs of prevulvar long setae present. Quinquelocular pores (H) in a band between spiracles and stigmatic clefts. Multilocular pores (L) numerous around genital opening and in transverse rows on preceding 3 abdominal segments, few near hind coxae. Tubular ducts (I) very few on cephalic, numerous on thoracic and abdominal regions, arranged in transverse rows medially. Eyes present. Antennae (G) well developed, 8-segmented, 0.38 mm in length; third segment longest, more than 2 times longer than wide. Rostrum monomerous. Spiracles normal. Legs well developed with tibio-tarsal articulatory sclerosis; claws simple, digitules broad

with clubbed apices; tarsal digitules slender knobbed at apices (J). Dimensions of fore, mid and hind legs: trochanter plus femur (0.23:0.24:0.25 mm), tibia (0.16:0.16:0.16 mm) and tarsus (0.08:0.1:0.1 mm) respectively.

*Holotype* ♀, *Paratypes* 3 ♀, India. Andhra Pradesh, Vishakhapatnam, Simhachalam, on *Duranta repens* Linn., 18. iv. 1979 (R. K. Avasthi).

*P. indica* sp n runs close to *P. hydrangeae* Stainweden in the key to species of *Pulvinaria*<sup>2</sup> but differs by its having few tubular ducts on venter of cephalic region, median spine of anterior stigmatic cleft same as lateral spines and in the absence of disc pores and subdiscal seta on anal plate dorsally. Further, it is very close to Indian species *P. floccifera* (Westwood) but differs in the absence of submarginal tubercles, disc pores and tubular ducts on dorsum.

An aphelinid parasite *Coccophagus nigricarpus* Shafee is known to attack *P. indica* sp n in India.

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1. Avasthi, R. K. and Shafee, S. A., *Proc. 67th Indian Sci. Congr.*, 1980, 3, 124 (Abstract).
2. Williams, M. L. and Kosztarab, M., *Va. Polytech. Inst. State Univ. Res. Div. Bull.*, 1972, 74, 1.

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## NEWS

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### UTILISATION OF TSM IN HEALTH CARE DELIVERY STRESSED

“Utilisation of Traditional Systems of Medicine (TSM) on a wider scale can provide health care services to a large segments of our population with minimum cost. In India some of these systems namely, Ayurveda, Unani and Siddha, enjoy considerable respect and acceptability.” These observations were made by Union Minister for Health and Family Welfare, Mrs. Mohsina Kidwai, while addressing the 38th World Health Assembly (WHA) in Geneva on May 8, 1985.

Mrs. Kidwai said that in the country there was a large network of hospitals, dispensaries and colleges providing health care facilities and imparting instruc-

tion and training in these systems of medicine. “We are trying to further encourage and strengthen them” she said.

She expressed hope that it would be possible for the World Health Organization to extend greater support and recognition to these systems.

The minister said that our greatest concern was to preserve and realise the goal of health for all by the turn of the century through optimum utilisation of the available resources. (*News Letter*, Vol. VI, No. 1, April-June 1985, Central Council for Research in Unani Medicine, Information Centre, New Delhi 110017).