

**ON THE DIAGNOSTICS OF MEALYBUG OCCURRING  
ON COTTON, SPHERICAL MEALYBUG *NIPAEOCOCCUS  
VIRIDIS* (NEWSTEAD) (HEMIPTERA: PSEUDOCOCCIDAE)**

**Asha Thomas\* and V. V. Ramamurthy\***

\* Division of Entomology, Indian Agricultural Research Institute, New Delhi 110 012, INDIA. E-mails: ashabio@gmail.com; vvr3@vsnl.com

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ABSTRACT: Detailed studies on the mealybugs collected from different parts of India on cotton and other hosts revealed the abundance of *Nipaeococcus viridis* (Newstead) (Hemiptera: Pseudococcidae), and established that it is emerging as next most widely distributed mealybug after *Phenacoccus solenopsis* Tinsley. This mealybug can be distinguished by its even segmented antennae, distribution of setae similar to cerariiian setae on dorsal surface of the body and number of cerarii discernible with difficulty. The need to differentiate this from other important mealybugs occurring in cotton agroecosystems has been taken care of through making its diagnostics as simple as possible. The examination of populations from different regions, simplifying its diagnostics through illustration of taxonomic characters significant at all taxonomic levels and explaining their terminology has also been achieved.

KEY WORDS: Coccoidea, taxonomic characters, illustrated diagnostics.

Cotton is an economically important crop and pests and pathogens are the major threats to its productivity. Among these mealybugs of the family Pseudococcidae are currently being reported as serious pests. Of the twenty three species of mealybugs reported worldwide, incidence of seven species had been recorded so far from India. These are *Phenacoccus solenopsis* Tinsley, *Nipaeococcus viridis* (Newstead), *Maconellicoccus hirsutus* (Green), *Rastrococcus iceryoides* Green, *Ferrisia virgata* Newstead and *Paracoccus marginatus* Williams and Granara de Willink. Among these *P. solenopsis* is most widely distributed and its diagnostics and complexities in taxonomic characters had been already illustrated (Thomas & Ramamurthy, 2008). Studies undertaken under the auspices of a project of Technology Mission on Cotton at the Indian Agricultural Research Institute revealed that *N. viridis* (Hemiptera: Pseudococcidae) is emerging as the next most injurious mealybug, in particular, in parts of Andhra Pradesh, Delhi, Maharashtra and Orissa. The perusal of taxonomic information available on this species reveals that there had been confusions on its species identity due to misidentifications (Ayyar, 1921; Ghose, 1961; Green, 1908; Kirkalady, 1902) and synonymy (Ali, 1970; De Lotto, 1958; Green, 1922; Zimmerman, 1948). Also, detailed illustrated diagnostics as available for *P. solenopsis* needs to be developed and made available to facilitate its diagnostics. Hence, the present study analyses *N. viridis* (Hemiptera: Pseudococcidae) at all taxonomic levels and provides a simplified diagnostics to enable its authentic identification.

#### MATERIALS AND METHODS

Adult female mealybugs collected from cotton during 200-2010 from Andhra Pradesh, Delhi, Maharashtra and Orissa. 273 specimens were processed using

standard procedure (Hodges & Hodges, 2004). The terminologies followed are those of Ferris (1950), Downie & Gullan (2004) and Willams (2004).

## RESULTS

*Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) is distinguished at the **family** Pseudococcidae level by the characters namely, broadly oval shaped body, (Fig. 1 & 2)  $3.080 \pm 0.507 \times 2.292 \pm 0.216$  mm; antennae seven segmented (Fig. 1a & Fig. 2a),  $0.210 \pm 0.130$  mm long, its apical segment with 9-11 hair like setae, 4 fleshy and 2 stiff setae near apex, preapical segment with 2-4 hair like setae and also with a fleshy seta; clypeolabral shield (Fig. 2b) about  $0.150 \pm 0.003$  mm long; labium (Fig. 2c) about  $0.120 \pm 0.003$  mm long with 11 pairs of setae; spiracles (Fig. 2d,e): width of anterior peritremes  $0.040 \pm 0.007$  mm, posterior peritreme  $0.055 \pm 0.005$  mm; legs well developed (Fig. 1f & Fig. 2f), metathoracic leg: coxa  $0.124 \pm 0.002$  mm, trochanter  $0.073 \pm 0.014$  mm, femur  $0.136 \pm 0.006$  mm, tibia  $0.100 \pm 0.008$  mm, tarsus  $0.067 \pm 0.005$  mm, claw  $0.028 \pm 0.008$  mm; translucent pores present on anterior and posterior surface of hind coxa and posterior surface of hind tibia (Fig. 1h & Fig. 2g,h); tarsal digitules both knobbed (Fig. 1i & Fig. 2i); claw digitule  $0.044 \pm 0.001$  mm long, claw without denticle; tubular ducts of varied size present (Fig. 1k & 2k),  $0.009 \pm 0.001 \times 0.002 \pm 0.0005$  mm; ostioles moderately developed, one pair each present anteriorly and posteriorly (Fig. 1m & Fig. 2l,m); trilocular pores present on dorsal and ventral surface (Fig. 1n & Fig. 2n), about  $0.004$  mm wide, frequent throughout and fairly evenly distributed; dorsal surface with lanceolate setae, similar to those of cerariian but shorter and variable (Figs. 1o & 2o),  $0.021 \pm 0.001$  mm long, with their collar  $0.005 \pm 0.001$  mm; ventral surface with flagellate setae, those on head  $0.040 \pm 0.007$  mm long and those on abdomen  $0.020 \pm 0.013$  mm long, other setae minute,  $0.011$  mm long, with their collar  $0.003$  mm wide; discoidal pores about  $0.002$  mm, simple, distributed sparsely; anal ring  $0.105 \pm 0.006 \times 0.098 \pm 0.009$  mm at the apex, with 2 rows of cells and 6 slender setae, each setae about  $0.030 \pm 0.060$  mm long (Figs. 1s & 2s); anal lobes moderately developed and less sclerotized; number of cerarii (Fig. 1p & 2p) difficult to verify precisely, anterior cerarii on abdomen, mesothorax and metathorax discernible with paired lanceolate setae,  $0.019 \pm 0.002$  mm long with their collar  $0.008 \pm 0.0005$  mm wide and 2-6 trilocular pores, distance between the lanceolate setae increasing towards thoracic region; anal lobe cerarii with two broadly lanceolate setae which are  $0.018 \pm 0.007$  mm long, with 6-10 trilocular pores situated on their margins; circulus, between III and IV segments (Fig. 1q & 2q), round to quadrate  $0.081 \pm 0.016 \times 0.100 \pm 0.010$  mm; and multilocular disc pores present ventrally (Fig. 1r & 2r),  $0.007 \pm 0.0009$  mm wide on abdomen and  $0.007 \pm 0.001$  mm wide on thorax. At the **subfamily** Pseudococcinae level it is defined by the seven segmented,  $0.210 \pm 0.130$  mm long antennae; tarsal digitules knobbed, claw without denticle; and quinquelocular pores absent. At the **tribe** Trabutinini level it is defined by its bluish black appearance, and presence of elongated dorsal setae which are  $0.021 \pm 0.001$  mm long. At the **generic** level *Nipaecoccus* is defined by the broadly ovoid body,  $3.080 \pm 0.507 \times 2.292 \pm 0.216$  mm; antennae seven segmented and  $0.210 \pm 0.130$  mm long; legs well developed, claws stout,  $0.028 \pm 0.008$  mm long, without denticle, tarsal digitules knobbed; hind coxa and hind tibia with translucent pores; venter with oral collar tubular ducts,  $0.009 \times 0.001$  mm long; cerarii 1-17 pairs; dorsal setae,  $0.021 \pm 0.001$  mm long, similar to cerariian setae; and venter with its multilocular disc pores  $0.007 \pm 0.009$  mm wide. At **species level** *viridis* is distinguished by seven segmented,  $0.210 \pm 0.130$

mm long antennae; multilocular disc pores ventrally,  $0.007 \pm 0.009$  mm wide; and oral collar tubular ducts  $0.009 \times 0.001$  mm long, numerous, reaching thorax and present medially and in marginal zone.

## DISCUSSION

Authentic diagnostics of *N. viridis* is possible with the combination of seven segmented antennae, claw without denticle, tarsal digitule knobbed, dorsal setae which is often similar in size and shape to the cerarii setae all over the body, multilocular disc pores and oral collar tubular ducts present medially and to the marginal zone throughout. The peculiarity of difficulty in distinguishing the number of cerarii is also one of the important characters of this species. Normally bluish black when preserved in spirit and sometimes difficult to prepare and stain on the microslides are its other distinct differentiating characters. On the contrary, *P. solenopsis* has nine segmented antennae, claws with denticle, tarsal digitule setose, 18 pairs of cerarii and multilocular disc pores concentrated medially on the abdominal segments VI, VII and VIII, and marginally on 1 to IV.

There had been misidentifications of *N. viridis* as *N. nipae* due to similarity in characters and the difficulties in processing due to its soft body. According to Williams (2004), *nipae* differs from *viridis* in its characteristics of multilocular disc pores on abdomen only and presence of oral collar tubular ducts medially and submedially; also *N. viridis* is longer (upto 4 mm) than *nipae* (2.3 mm).

Analysis of mealybug samples obtained through consistent sampling during 2007-2010 reveal that 86% comprises *P. solenopsis*, 13% of *N. viridis* and 0.7% of *M. hirsutus* and 0.3% of *P. marginatus*; these also, reveals the presence of *P. solenopsis* throughout the country while *N. viridis* is only in the states namely Andhra Pradesh, Delhi, Maharashtra, and Orissa; *M. hirsutus* has been observed at Delhi, Maharashtra, and Tamil Nadu. These findings reveal that *N. viridis* is emerging as another important injurious mealybug after *P. solenopsis* in the cotton agroecosystems of India. Also enough attention is required to consider all the taxonomic characters together for flawless species identification.

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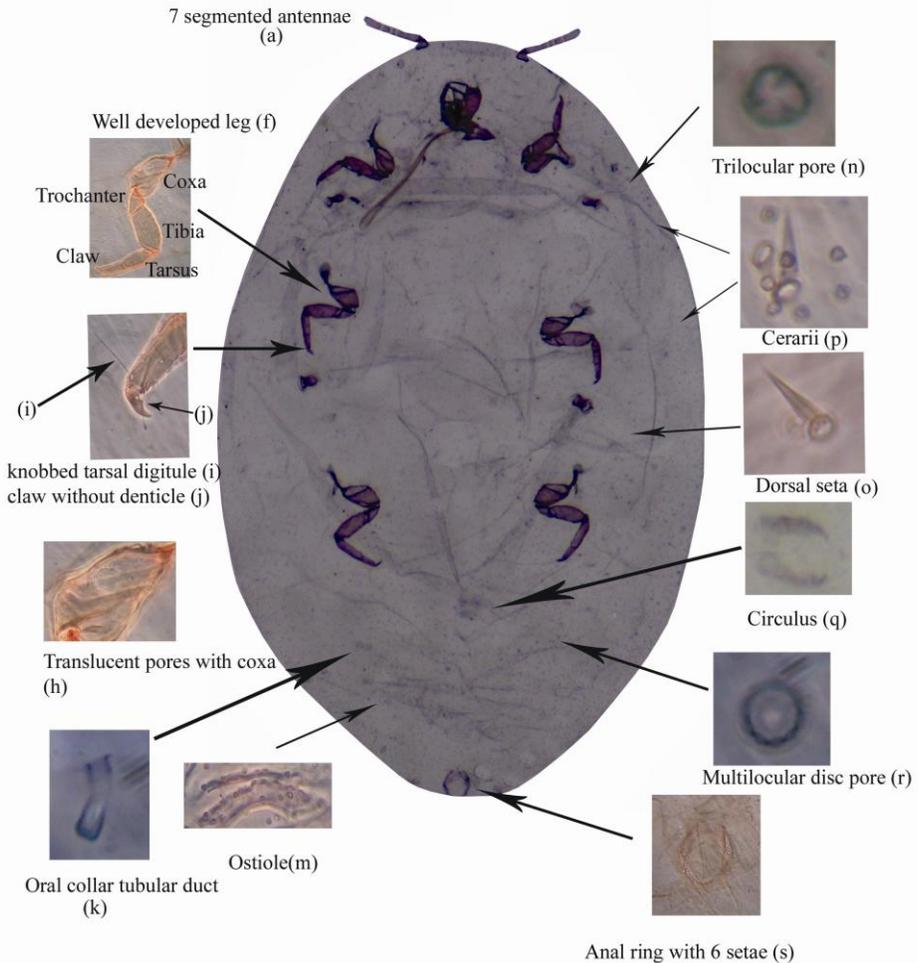


Figure 1. *Nipaecoccus viridis*- Key characters: a. 7 segmented antennae, f. well developed leg, i. knobbed tarsal digitule, j. claw without denticle, h. coxa with translucent pores, k. oral collar tubular duct, m. ostiole, s. anal ring with 6 setae, n. trilocular pore, p. cerarii, q. circulus, r. multilocular disc pore, o. dorsal seta.

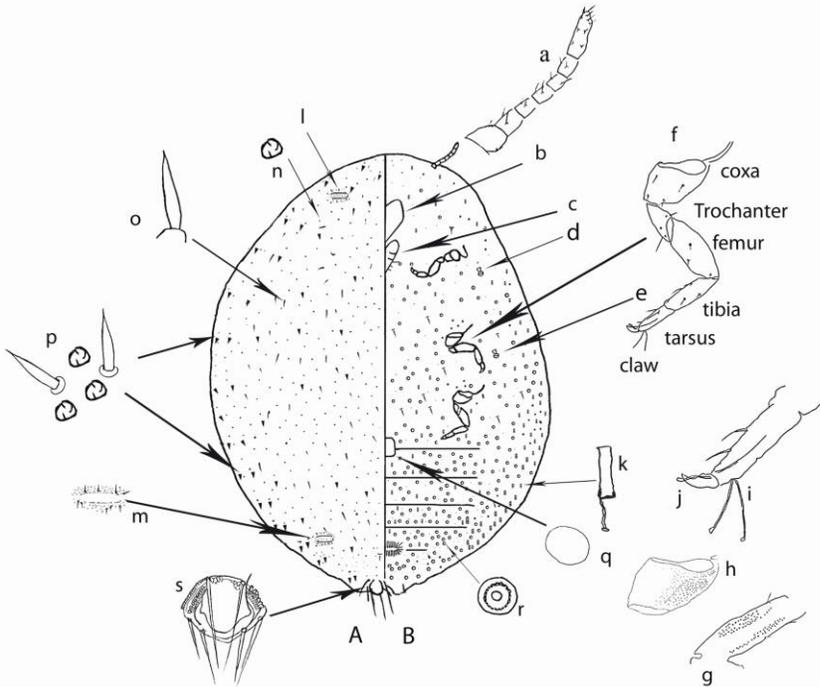


Figure 2. *Nipaecoccus viridis*- key characters: Diagrammatic view. A-dorsal, B-ventral. a. 7 segmented antennae, b. clypeolabral shield, c. labium, d. anterior spiracle, e. posterior spiracle, f. well developed leg, g. tibia with translucent pores, h. coxa with translucent pores, i. knobbed tarsal digitule, j. claw without denticle, k. oral collar tubular duct, l. anterior ostiole, m. posterior ostiole, n. trilocular pore, o. dorsal seta, p. cerarii, q. circulus, r. multilocular disc pore, s. anal ring with 6 setae.