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First report of *Hyalococcus striatus* (Russell) (Hemiptera: Coccomorpha: Asterolecaniidae), an alien pest on sweet orange in India

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The economic globalization of trade and tourism has led to an increase in the introduction of invasive scale insect species (Hemiptera: Coccomorpha) to new areas; in the absence of their natural enemies, these alien insects are likely to multiply and spread rapidly (Worner & Gevrey 2006). In the last 15 years, several mealybugs (Coccomorpha: Pseudococcidae and Rhizoecidae), soft scales (Coccomorpha: Coccidae) and armoured scale insects (Diaspididae) have been accidentally introduced to India, of which some have become serious pests (Joshi *et al*. 2022; Joshi *et al*. 2024). Once an invasive alien pest becomes established in a new geographical area, it is likely to spread to different host plants and new regions, so the accidental introduction of a single species should be considered a serious cause of concern (Huber *et al.* 2002).

Asterolecaniidae (Coccomorpha) is a small family containing 247 species in 25 genera (García Morales *et al*. 2016) that occurs in almost all zoogeographic areas. Some members of the family are economically important pests in various parts of the world, such as *Bambusaspis bambusae* (Boisduval) and *B. miliaris* (Boisduval) on bamboo in the West Indies, Central and South America, Africa and Asia (Bartlett 1978); *Asterodiaspis quercicola* (Bouché) and *A. minor* (Russell) on oaks in California (Gill 1993); *Asterolecanium coffeae* Newstead on coffee in Kenya (James 1933); and *Russellaspis pustulans* (Cockerell) on tea in China (Cen 1986). In India, eight species of Asterolecaniidae belonging to four genera have been recorded in the literature (García Morales *et al*. 2016).

The genus *Hyalococcus* Borchsenius, 1950 is one of the smallest genera in the Asterolecaniidae and has not been recorded from India so far (García Morales *et al*. 2016). It contains only two species, *H. mali* Borchsenius (known from Russia infesting *Malus* and *Pyrus* [Rosaceae] (Borchsenius 1950)) and *H. striatus* (Russell) (known to attack *Citrus* [Rutaceae] in Indonesia and Singapore (Kalshoven 1981; Russell, 1941)).

Field photographs of scale insect collected on sweet orange in Andhra Pradesh were captured using a digital camera. Collected adult females were slide-mounted using the technique described in Williams & Watson (1988). Slide-mounted specimens were observed through a Nikon Eclipse 80i microscope and photomicrographs were taken with a Nikon DS-Vi1 digital camera mounted on the microscope. All the plates were generated using Adobe Photoshop CS2. Observations on the morphology of the slide-mounted female were based on 18 specimens mounted on 2 slides which are deposited at the National Insect Museum of ICAR—National Bureau of Agricultural Insect Resources, Bengaluru, Karnataka, India under the accession numbers ICAR/NBAIR/ASTERO/Hyalo/070724-01-04 and 070724-05-18.

Material examined: INDIA, Andhra Pradesh, Sri Satya Sai District, Dharmavaram mandal, Gotluru village, 14.4533° N, 77.7373° E, 18 ♀♀ on *Citrus sinensis* (L.) Osbeck (Rutaceae), 07.vii.2024, Srinivas Reddy coll.

All the developmental stages of the pest scale insect were found covering the branches and trunks of the infested trees (Fig. 1A). Crawlers and nymphal stages yellowish, almost transparent and thin, shiny; later instars become more

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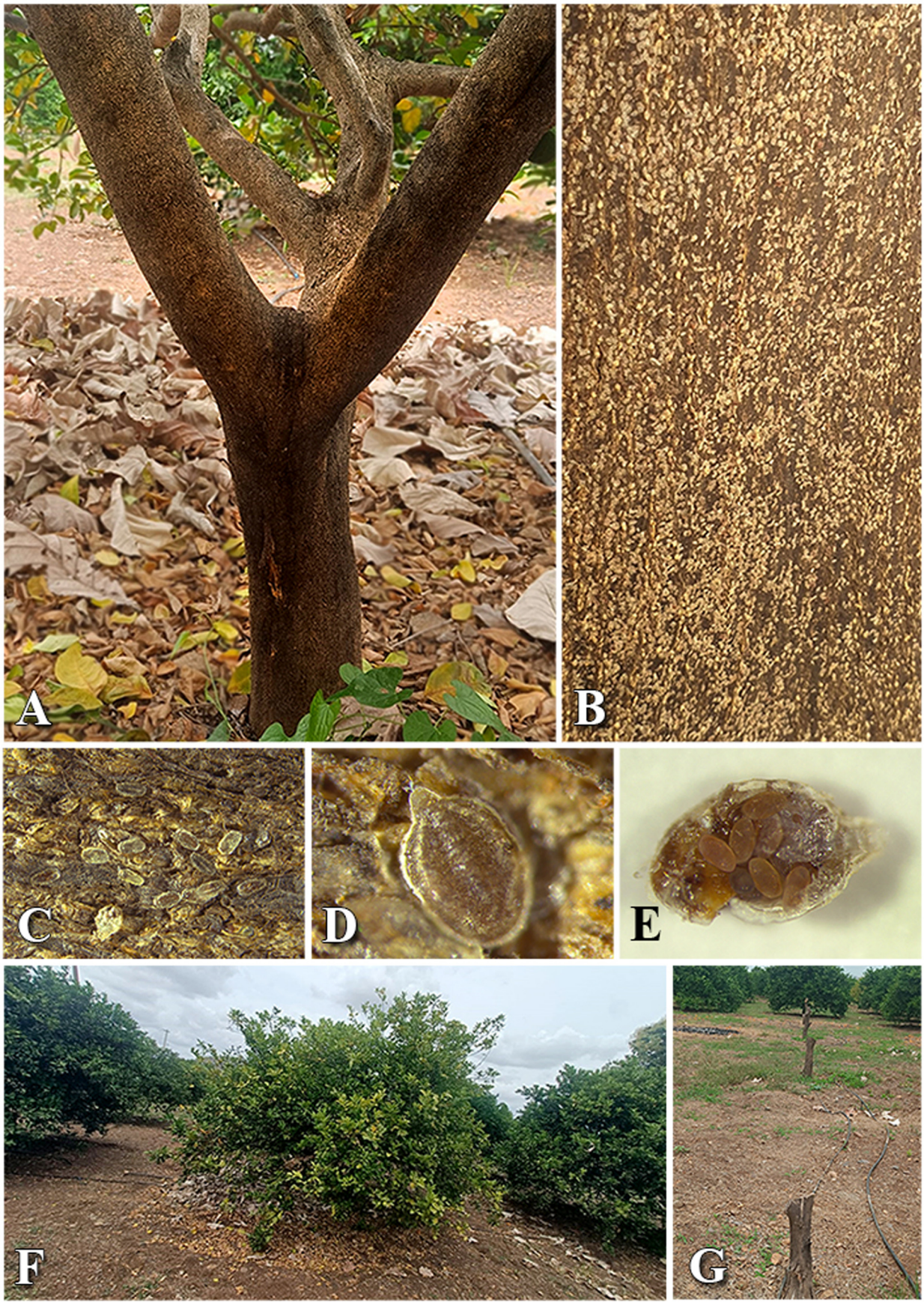

FIGURE 1. Field appearance of *Hyalococcus striatus* (Russell). **A.** Infestation covering the entire trunk of the host; **B.** Close-up of infested stem, showing crowded nymphs; **C.** Nymphs; **D.** Adult female; **E.** Overturned female with eggs; **F.** Infested tree showing yellow and dried fallen leaves; **G.** Trees cut to avoid further pest incidence and gummosis.

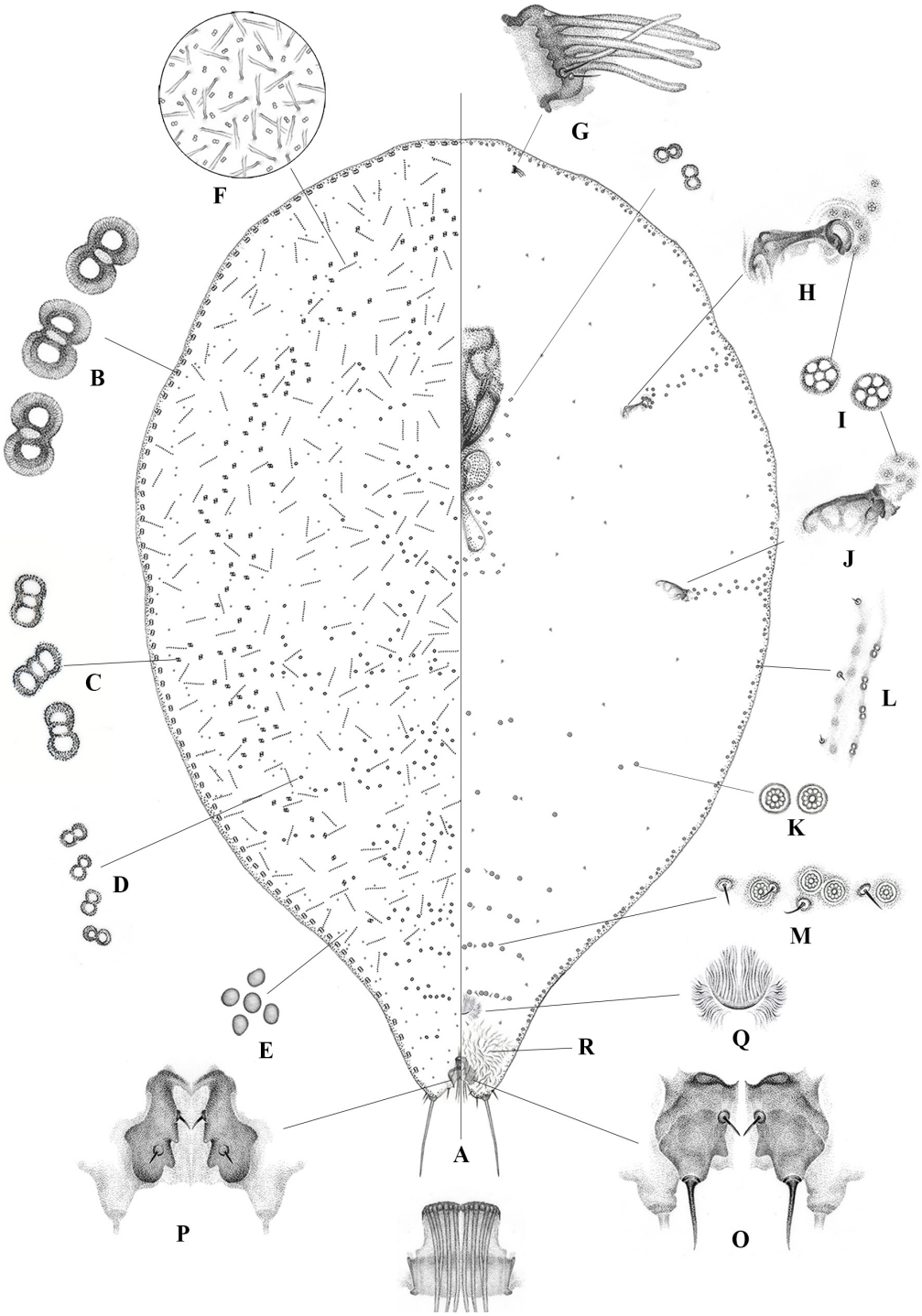

FIGURE 2. *Hyalococcus striatus* (Russell), slide-mounted adult female. **A.** Body of the female longer than wide, posterior end narrowed and produced, with a distinct notch at the apex of the abdomen; **B.** Margin with continuous row of 8-shaped pores; **C.** Larger size of 8-shaped pores on dorsum, which are smaller than marginal pores, arranged in submarginal bands; **D.** Smallest 8-shaped pores on dorsum in irregularly arranged transverse rows; **E.** Simple irregularly circular discoidal pores scattered on dorsum; **F.** Long tubular ducts, parallel sided at basal area near cuticle and tapering and bending towards inner indentation, scattered on dorsum; **G.** Antenna, short, sunken with three long setae each longer than basal diameter of antenna; **H.** Anterior spiracle with 3–7 spiracular pores around atrium; **I.** 8–12 similar quinquelocular pores extending from spiracle to body margin; **J.** Posterior spiracle; **K.** 60–80 multilocular pores forming 5 or 6 complete and 1–2 interrupted rows; **L.** Marginal setae and quinquelocular pores in a complete row on ventral margin; **M.** 3–5 ventral setae in a posterior row of multilocular pores; **N.** Anal ring with 6 long setae; **O.** Anal plate dorsal surface with apical setae; **P.** Anal plate ventral surface with two triangular protrusions on inner margin; **Q.** Vulva with lunar shaped opening; **R.** Reticulate area around anal plate.

convex, and dull (Fig. 1B & C). Test of adult female brownish yellow, pyriform, somewhat convex in median area, with longitudinal and submarginal carina (Fig. 1D); dorsal filaments on carina whitish; anal extremity with short white wax filament (Fig. 1D); ventral surface flat. When turned over, venter of adult female (Fig. 1E) accompanied by greenish yellow eggs, each covered with a thin transparent membrane.

Morphological studies of slide-mounted adult females led to the identification of the pest as *Hyalococcus striatus* (Russell), based on the characters shown in Fig. 2. The only plant host species recorded for this scale species is *Citrus* (García Morales *et al*. 2016). In the present study, the pest was not found on any other hosts and no ants or natural enemies were seen attending the scale insects.

In 2022, a severe infestation of a sap-feeding scale insect species was found in Andhra Pradesh, India, covering several sweet orange plants, mainly infesting the trunks and branches. The insects did not produce any mealy wax coating or honeydew, and no sooty mould was observed. After the initial collection, purposive surveys were conducted in *Citrus*-growing areas of Andhra Pradesh in June and July 2024. During surveys of sweet orange gardens in Satya Sai and YSR Kadapa Districts of Andhra Pradesh, scale infestations on the main trunks and branches were noticed. A similar infestation was also found at Sweet Orange Garden farm, on Sathgudi Cultivar budded on rough lemon, Jambheri rootstock, 24 years old; out of 600 plants observed, 200 were infested. Likewise, in a neighboring *Citrus*-growing region, damage due to these scales was recorded in Kadapa District, Veerapanayunipalli Mandal, Moillacheruvu village, on 8-year-old sweet orange trees of the same cultivar; out of 750 trees, a total of 56 were infested by the pest. At the initial stage of infestation, leaf drying, leaf drop (Fig. 1F) occurred, followed by drying of the branches and trunk as the infestation intensified; subsequently, infested trees may develop phytophthora infections, causing gummosis and dry root rot, further weakening the plants, and the trees may die. Some farmers have resorted to cutting down these severely infested trees (Fig. 1G) to arrest further spread to healthy trees. It is predicted that the pest may spread at a faster rate because growers use pyrethroid-based insecticides to control other pests that damage the crop at different stages. The new pest is being monitored regularly in the fields surveyed in Kadapa district.

The presence of this alien species in large numbers on an economically important fruit crop in India is alarming and may represent a major threat to citrus plantations. The pathways of introduction by which the pest entered India are not known; however, scale insects are one of the most commonly transported insect groups in the trade in live plant material and some other commodities, and are some of the most successful invasive insects (Malumphy *et al*. 2012). Further investigations should focus on determining the likely routes of its introduction, present distribution in India, natural enemies, and other suitable host plants. From these data, it should be possible to develop control measures and manage its further spread to additional areas and possibly to other economically important host plants.

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