

First report of scale insects as pests of Kangra tea in Himachal Pradesh, India

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Tea, *Camellia sinensis* (L.) O. Kuntze (Theaceae) is grown in diverse agro-ecological conditions in 11 major countries with an annual worldwide production of 4,170 million kgs. In India, tea is grown mainly in Assam, West Bengal, Tamil Nadu, Kerala, Karnataka and Himachal Pradesh with an annual production of 990 million kgs. Tea is a perennial crop which provides a relatively steady microclimate and food supply for several insect and mite pests. Each tea growing country/state/region has its own distinctive insect pest complex; however, some of the species are found associated with other scale insect pests. As such, several insect and mite pest complexes have been reported in India (Gireesh Nadda *et al.* 2013).

Field survey was conducted in IHBT–Tea Experimental Station, Palampur and neighbouring tea gardens to study the infestation of scales in tea. To study the incidence of scales in the experimental plot (50 sq. m), 10 tea bushes were randomly selected for sampling. The number of scale insects (egg mass and crawlers) were counted on 10 randomly selected leaves and stem (10 cm length) per bush and represented as number of egg mass/ leaf and stem. Infestation of scales (egg mass) were first observed during April (1–2 egg mass/leaf) later the infestation gradually increased during May (3 and 5 egg mass/leaf and stem respectively), June 2012 (4 and 10 egg mass/leaf and stem) and peaked during July (8 and 13 egg mass/leaf and stem) (Fig 1 and Fig 3) which may due

to high temperature (28–30°C) and humidity (70 – 80%).

During the survey, three soft scale (Coccidae) and one armored scale (Diaspididae) species were observed during April–July 2012. These included: the green scale, *Coccus viridis* (Green) hemispherical scale, *Saissetia coffeae*, brown soft scale, *Coccus hesperidum* (Linnaeus), and the yellow scale, *Aonidiella citrina* (Coquillett). In the present studies, the incidence of all the scales were reported for the first time on tea from Palampur (altitude of 1290 m amsl; latitude 32° 6' N and longitude 76° 5' E), Himachal Pradesh.

Scales insects are not serious pests of mature tea bushes compared to younger tea plants. Adults and crawlers are responsible for causing damage to tea bushes and were observed on mature shoots (stem) and leaves. During early infestation, adult scales preferably congregated on the tender stem/shoots, where as crawlers preferred matured leaves. As the population increases in size, both crawlers and adult scales migrate to tender leaves. Both adults and crawlers suck the sap from shoots and leaves (Fig 1 and Fig 2) which affects the growth of the plants. In severe infestations, scale insects also secreted honey dew on leaves which attracts ants that protect the pest from its natural enemies. Due to secondary infestation, black sooty mould fungus was observed on leaves which affect the photosynthesis and vigour of the plants (Fig 3). Such damage can affect the marketability of produce.

Previously, scale insects have not been reported as pests on any crop in Himachal Pradesh although in some other parts of India, scale insects have been reported as major pests on fruits and plantation crops (Viswanathan, 1971; Nath, 1973; Joshi *et al.* 1981; Konar and Ghosh, 1994; Singh *et al.* 1994; Chatterjee *et al.* 2000; Konar and Saha, 2002; Mani *et al.* 2008).

Coccus viridis was first found in Florida near Davie, Broward County in May 1942 (Dekle and Fasulo, 2014). This insect is also referred to as the coffee green scale. Other major hosts of this pest include: *C. viridis* reported in sapota (Mani *et al.* 2008), coffee (Viswanathan, 1978), whereas *S. coffeae* on citrus (Konar and Ghosh, 1994); mandarin orange (Chatterjee *et al.* 2000). *C. hesperidum* on papaya (Joshi *et al.* 1981); *Citrus reticulata* (Konar and Saha, 1994); orange (Nath, 1973; Konar and Saha, 2002); coconut (Jalaluddin *et al.* 1991) and cardamomum (Singh *et al.* 1994). The adult female is shiny pale green with a conspicuous black, irregular U-shaped internal marking visible to the naked eye. The front end is more rounded and the rear has a distinct cleft extending about 1/4 of the way into the body. Two sub-marginal black eye spots are also present and can be seen with a hand lens. The outline shape may be described as elongate-oval and moderately convex. Adult scales are 2.5 to 3.25 mm, flat, oval, light green, blackish spots on dorsum. Nymphs or immature green scales are oval, flat and yellowish green in color, and have six short legs (Mau and Kessing, 2009). *C. viridis* is similar to *C. hesperidum* L., but differs by having the marginal setae strongly fimbriate (these setae are weakly fimbriate or simple in *C. hesperidum*), the multilocular pores are common anterior of the vulvar segments (the multiloculars are rare anterior of the vulva on *C. hesperidum*), and the dorsal setae are capitate (they are pointed in *C. hesperidum*).

Saissetia coffeae Walker named this species *coffeae* in 1852, presumably because it was first found on coffee bushes. Other primary hosts include: citrus (Konar and Ghosh, 1994) and mandarin orange (Chatterjee *et al.* 2000). Although it has ridges on the top shaped like an "H" when immature, it becomes smooth upon reaching adulthood. The mature female scale has a convex, light to dark yellow brown, smooth and polished, helmet-shaped carapace. When the scale occurs on flat surfaces, the carapace is almost hemispherical, but on small stems it is elongate (Zimmerman, 1948). The sessile adult stage measures about 1/12 inches (2 mm) long (Hill, 1983).

Coccus hesperidum is a cosmopolitan species with other hosts that include: papaya (Joshi *et al.* 1981), tangerine (Konar and Saha, 1994), orange (Nath, 1973, Konar and Saha, 2002), coconut (Jalaluddin *et al.* 1991) and cardamomum (Singh *et al.* 1994). Adult females are characterized by a large brood chamber containing white eggs or first stage larvae (Annecke, 1959). The overall body shape is symmetrically oval, dome-like, and 1/8 to 1/6 inch long. Adult female is hemispherical; body is covered by a brown hard shield. They are pale yellowish brown to greenish and flecked with irregular brown spots (Tenbrink and Har, 1994). Essentially, this scale is devoid of any distinguishing features (morphological features used to separate the species taxonomically include: spine-like dorsal setae, shape of marginal setae, presence of sub marginal ducts and tubercles, ventral thoracic tubular ducts, etc.). Nymphs are yellow, greenish brown or dark pink, flat and oval. 'H' shaped yellow mark (half grown scales).

Aonidiella citrina adult female is circular, translucent, 1.5–2 mm in diameter, flat, yellow-brown, composed of waxy secretions and exuviae of previous instars. The male scale is oval, elongate and

smaller. The fully grown adult female is reniform and sclerotized, while the young adult female is sub circular. This species is morphologically close to *A. aurantii* (CABI/EPPO, 1997).

CONCLUSION

Four types of scales insects viz., *C. viridis*, *S. coffeae*, *C. hesperidum* and *A. citrina* were reported for first time as a pest on Kangra tea in Himachal Pradesh. The incidence has started during April, later the infestation gradually increased during May and June and then peaked during July.

Therefore, it is necessary to study their seasonal incidence, extent of damage, natural enemies and distribution for effective management of these pests.

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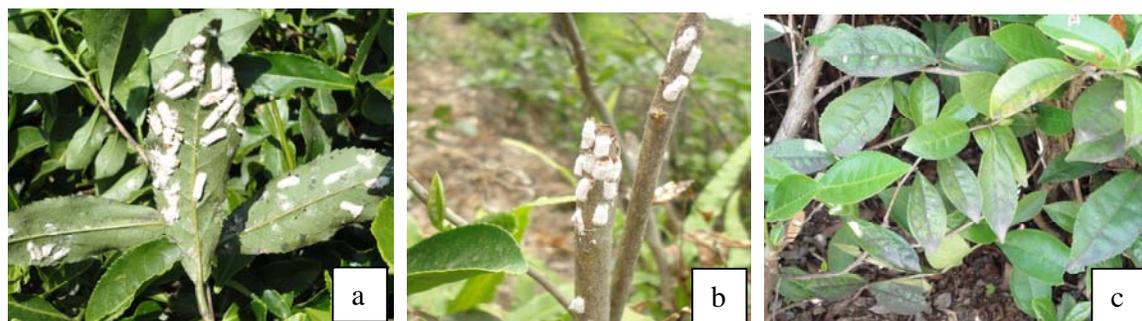


Fig. 1: Scale infestation a) egg mass on leaves; b) egg mass on stems c) sooty mould on leaves

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