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White grubs (Coleoptera: Scarabaeidae) on fruit crops: Emerging as pests of economic importance

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ABSTRACT: White grubs (Coleoptera: Scarabaeidae) are polyphagous pests with a wide host range including several commercially important crops. Surveys conducted in different parts of the country covering six states (Assam, Himachal Pradesh, Punjab, Kerala, Karnataka, Uttar Pradesh) during 2015-18 revealed the occurrence of white grubs on major fruit crops like mango, grapes, pomegranate, guava, apple, peach and plum in considerable proportions. Though white grub adults and larvae are known to be pests of fruit crops, they were considered as minor pests. However, the survey results indicate that in the recent past, white grubs are causing considerable damage ranging from 15-40% in different fruit crops and diversity of species occurring also has widened. While young plantations of guava and pomegranate suffered root damage resulting in death of 10–25% plants, other crops were defoliated by adult beetles. White grubs encountered during these surveys mainly belonged to 11 species under six genera *viz*., *Holotrichia*, *Anomola*, *Maladera*, *Schizonycha, Adoretus* and *Popillia*. Emergence of white grubs, once considered to be minor or sporadic pests of fruit crops, necessitates regular surveillance and documentation to implement timely management practices.

Keywords: Scarabaeidae, white grubs, diversity, mango, guava, grapes, pomegranate

INTRODUCTION

White grubs, also known as June beetles or chafer beetles or root grubs, belong to two subfamilies *viz.,* Melolonthinae and Rutelinae under family Scarabaeidae of Coleoptera. They are serious pests of several crops such as sugarcane, groundnut, millets, potato, maize, wheat, sunflower, cotton, tobacco, soybean, vegetables, and also turf, meadows, lawns etc. They also attack plantation crops such as arecanut, cashew nut, coconut, tea, coffee, etc. and fruit crops with varying damage levels (Khan and Ghai, 1974; Veeresh, 1974). Yadava and Sharma (1995) reported 70 per cent damage in several commercial crops due to white grubs infestation. In India, white grub is one of the five pests of national importance (Yadava and Vijayavergia, 1994). Most of the species are annuals, while some species are biannuals and biennials (Ritcher, 1958). The adults are predominantly leaf feeders whereas the grubs are subterranean feeders on roots, rootlets and underground stems of living plants. The larval feeding on roots of the plants slowly leads to drying, wilting and subsequent death of the plants. The duration of larval stage of white grubs, in general lasts for 5-8 months in annuals, while active adult life is brief lasting only a few weeks or months. Eggs are laid in the soil and larvae feed on humus and roots at varying depths depending upon temperature. Pupation occurs in the soil. Adults emerge out of soil with the onset of monsoon in large numbers. They are active during dusk and settle on the nearby trees for feeding and mating. Later in the morning, adults dwell into the soil and the eggs are laid in the moist soil. The hatched neonate initially feeds on soil organic matter and humus and as the larvae grow, they shift to feed on roots and rootlets of the plants.

Though white grubs are polyphagous, their pestiferous intensity in fruit crops in general is not alarming. Butani (1979) listed various chafer beetles as minor pests causing defoliation of fruit crops like mango, guava, fig etc. However, during our surveys and explorations conducted in different parts of the country,

it was observed that there were increased instances of white grubs causing considerable damage to fruit crops. Hence, the present study was carried out to document the species composition associated with and ascertain the extent of damage inflicted by white grubs to different fruit crops.

MATERIALS AND METHODS

Roving surveys were conducted during 2015-2018 in different states (Assam, Himachal Pradesh, Punjab, Kerala, Karnataka, Uttar Pradesh) to document the species diversity of white grubs in different agri and horticultural cropping systems. Focused surveys were aimed to collect adult beetles through light traps as well as those directly feeding on fruit trees in the night besides collecting grubs from the soil based on symptoms of damage during day time. Adult beetles were collected between 6:30 and 10:00 pm by using light traps with black and mercury bulbs as light sources. Since the beetles settle on the foliage of fruit crops and avenue trees for feeding and mating after emergence, adults were also collected from the nearby host trees by scouting using the powerful light torches. The beetles trapped in the collection bucket were sorted out and transferred to insect vials/bottles containing 95% alcohol for further processing. The different stages of white grubs were brought to laboratory. They were cleaned, relaxed, pinned and labeled for identification. After processing, all the specimens were identified up to species level with the available keys (Brenske, 1896, 1899; Arrow, 1917; Khan, 1975).

The fruit orchards were also surveyed for white grub infestation and the wilting plants were pulled out to observe the presence of grubs or adult beetles. The extent of damage in terms of defoliation as well as number of plants wilting and drying due to grub damage was also recorded and per cent damage was calculated.

RESULTS AND DISCUSSION

During the course of surveys and explorations, 11 species of white grubs were observed to be associated with eight fruit crops (Table 1). Of them, white grubs of the genus *Holotrichia* with four species *viz*., *H. consanguinea* (Blanchard), *H. serrata* (Fabricius), *H. staudingeri* Brenske and *H. longipennis* (Blanchard) were the most dominant one attacking seven crops. The other species included *Anomola bengalensis* (Blanchard), *A. ruficapilla* (Burmeister), *Adoretus* sp., *Lepidiota* sp., *Maladera* sp., *Popillia* sp. and *Schizonycha ruficollis* (Fabricius). Majority of the fruit crops suffered defoliation by adult beetle feeding. The adult beetles were found feeding on leaves making holes in the laminar portion in small sized species like *Maladera* and *Popillia* sp. whereas the entire laminar portion was devoured leaving the midrib alone by the certain species of *Holotrichia* and *Lepidiota.* In fruit trees like apple, peach, plum, the adults of *Anomala, Adoretus* and *Popillia* species were found feeding on blossoms and fruits thus affecting the yield. The damage to root system resulting in wilting and death of plants was noticed to the tune of 20-25% and 15-20% in young (1-3 year old) plantations of guava and pomegranate (cv. Bhagwa), respectively (Table 2 and Plates 3&4). White grub damage to guava roots was also reported by Veeresh (1974a).

The species composition of white grubs varied with the crop and the geographic location. There was 10-40% defoliation of new flush in mango trees at different places. While two species of *Anomola* viz., *A. bengalensis* and A. *ruficapilla* were recorded feeding on mango in Bengaluru, Karnataka (Plate 1), it was *H. serrata* in Uttar Pradesh and *Lepidiota* sp. in Sorbhog, Assam. Similar way, the species recorded on guava as foliage feeders differed in differed states. They were *H. serrata* in Thrissur (Kerala), *H. staudingeri* in Jorhat (Assam), *S. ruficollis* in Ludhiana (Punjab) and *Maladera* in Kodagu (Karnataka). *Holotrichia staudingeri* was found to be abundant in guava orchards in Jorhat (Assam) congregating in large numbers and feeding on leaves. The occurrence of *Anomola* spp. and *Holotrichia* spp. on mango was reported earlier by Butani (1979) while Pal (1977) recorded the infestation of guava trees with *H. serrata* and *H. consanguinea* in Bihar and Rajasthan, respectively. On grapes, three species *viz.*, *H. serrata* (Devanahalli, Karnataka), *H. consanguinea* and *Adoretus* sp. (both in Punjab) were recorded. Batra *et al*. (1973) reported the incidence of adult beetles of *S. ruficollis*, *Adoretus brachypygus, A. duvavceli* and *Pachyrrhinadoretus frontatus* on grapevines in central India. The fig trees were severely damaged by adults of *H. serrata* in Bengaluru (Plate 2). Interestingly though fig was attacked by *H. serrata*, at the same time, the nearby mango orchard was defoliated by *Anomola* spp. indicating a resource partition pattern among species.

The species wise profiling on different fruit crops indicated that *H. serrata* was found to be damaging four fruit crops i.e. fig, guava, grapes and mango followed by *Adoretus* sp. and *Popillia* sp. on three crops each. The rest of the species were confined to 1-2 fruit crops

Table 1. White grub species recorded as defoliators and the extent of damage in different fruit crops

Crop	White grub species associated	Extent of damage (% defoliation)	Location with geographic coordinates
Mango	*Holotrichia serrata* (Fabricius)	10-15%	Shamli, Uttar Pradesh 29.45° N, 77.31° E
	Anomala ruficapilla (Burmeister)	25-30%	Bengaluru, Karnataka 12.97° N, 77.59° E
	Lepidiota sp.	20-30%	Sorbhog, Assam 26.49° N, 90.88° E
	Anomala bengalensis (Blanchard)	10-15%	Bengaluru, Karnataka 12.97° N, 77.59° E
Guava	*Holotrichia serrata* (Fabricius)	15-20%	Thrissur, Kerala 10.52° N, 76.21° E
	Holotrichia staudingeri Brenske	10-15%	Jorhat, Assam 26.75° N, 94.20° E
	Schizonycha ruficollis (Fabricius)	10-15%	Ludhiana, Punjab 30.9010° N, 75.8573° E
	Maladera sp.	12-25%	Kodagu, Karnataka 12.33° N, 75.80° E
Fig	*Holotrichia serrata* (Fabricius)	20-25%	Bengaluru, Karnataka 12.97° N, 77.59° E
Grapes	*Holotrichia serrata* (Fabricius)	35-40%	Devanahalli, Karnataka 13.24° N, 77.71° E
	*Holotrichia consanguinea (*Blanchard)	20-25%	Ludhiana, Punjab 30.90° N, 75.85° E
	Adoretus sp.	10-15%	Ludhiana, Punjab 30.90° N, 75.85° E
Apple	*Holotrichia longipennis* (Blanchard)	22-25%	Mashobra, Shimla, H.P. 31.12° N, 77.22° E
Peach	*Popillia* sp.	15-20%	Mashobra, Shimla, H.P. 31.12° N, 77.22° E
Plum	*Adoretus* sp.	10-15%	Sirmour, H.P. 30.56° N, 77.47° E

Table 2. White grub species associated with root damage and wilting of fruit crops

Crop	Species associated	Extent of damage (Per cent plants showing wilting symptoms)	Location with geographic coordinates
Guava	*Anomala bengalensis* (Blanchard)	20-25%	Bengaluru, Karnataka 12.97° N, 77.59° E
Pomegranate	*Schizonycha ruficollis* (Fabricius)	15-20%	Lepakshi, Andhra Pradesh 13.80° N, 77.60° E

Plate 1. *Anomola* spp. feeding on mango leaves

Plate 2. *Holotrichia serrata* feeding on fig leaves

Plate 3. Guava plants damaged by grubs of *Anomola bengalensis* (inset : grub recovered from root region)

Plate 4. Pomegranate plant affected by white grub

Table 3. Species-wise distribution of white grubs occurring on different fruit crops in different states

Species	No. of crops associated with	States from which recorded
Adoretus sp.	3 (grapes, peach, plum)	Punjab, Himachal Pradesh
Anomala bengalensis	2 (guava, mango)	Karnataka
Anomala ruficapilla	1 (mango)	Karnataka
Holotrichia consanguinea	1 (grapes)	Punjab
Holotrichia longipennis	1 (apple)	Himachal Pradesh
Holotrichia serrata	4 (fig, guava, grapes, mango)	Karnataka, Kerala, Uttar Pradesh
Holotrichia staudingeri	1 (guava)	Assam
Lepidiota sp.	1 (mango)	Assam
Maladera sp.	1 (guava)	Karnataka
Popillia sp.	3 (peach, pear, plum)	Himachal Pradesh
Schizonycha ruficollis	2 (guava, pomegranate)	Andhra Pradesh, Karnataka

Though there are earlier reports on the occurrence of different species of white grubs on certain fruit crops (Batra et al., 1973; Veeresh, 1974a), yet the information on the recent status on the species composition and the extent of damage inflicted to different fruit crops is inadequate. There have been significant changes in cropping pattern and habitat composition as well as orchard management in the last couple of decades thus leaving a scope for shifts in pest composition. Expansion of area under fruit crops to non conventional and hitherto uncultivated lands coupled with modern practices like high density planting are potential factors that might alter pest complex, especially the white grub adults, which are known to attack mainly avenue and forest tree species.

This study has revealed the emergence of white grubs as pests of economic importance in fruit crops and serves to strengthen the preparedness for their management. A strict monitoring and vigil in fruit crop orchards, especially young plantations, during monsoon time for the occurrence of white grub adults in the night helps in minimizing losses. Similar way, in case of plant wilting due to root damage by larvae of white grubs in crops like guava and pomegranate, it is possible that farmers may mistake it for fungal wilt. An awareness on the damage caused by root grubs facilitates suitable management practices. Since white grub larvae are subterranean and have a long duration, early interventions especially targeting adult stages are essential to prevent economic losses.

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