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Population densities of blossom thrips at different phenological stages of apple in Kashmir

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Abstract
Thrips continue to be one of the most important pests affecting agricultural production systems. Thrips of Kashmir region on apple crop have been poorly studied in despite their significance to the important crop of valley, so in this regard a research trail were carried out for the year 2016 and 2017 to determine the change in the population densities from bud burst to peanut stage of apple by sampling each of the five stages: bud burst, pink bud, full bloom, petal fall and peanut stage. Two methods viz; sticky traps and direct count were employed to determine the change in the densities of the pest. Thrips density was significantly affected by apple bloom stages in both years. Densities were higher during bloom period both in 2016 and 2017. However total thrips count was more on sticky traps than direct count. Of total (264) count by sticky traps, 35.98% represents the bloom period followed by petal fall which represents 29.92% and 19.31% for pink bud and 13.25% for bud burst for the year 2016. In case of direct count of total number (220) was counted out of which full bloom represents 36.81% followed by petal fall which represents 31.36% and pink bud which represents 20% and 11.81% bud burst for the year 2016. A similar trend was followed for the year 2017 but varying total Thrip count in both cases.

Keywords: Thrips, apple, bud burst, pink bud, petal fall, full bloom, peanut stage, sticky trap

Introduction
The genus *Thrips* Linnaeus is the largest in the subfamily Thripinae, with 293 described species in the world (Thrips Wiki, 2018) [17]. About 7400 species of thrips has been reported worldwide (Mound, 2012) [12], out of which five hundred species of thrips are known to infest different vegetables (Mound and Kou, 1996) [13]. Thrips (Thysanoptera: Thripidae) are economic pests of deciduous fruit tree crops, causing direct damage during fruit development or as fruits mature. Worldwide, at least12 thrips species have been reported to cause economic damage to deciduous fruits (Broughton *et al.*, 2011) [2]. They cause economic damage in different crops by feeding and virus transmission (Lewis, 1973) [10]. Yield losses in certain vegetable crops like cucumber, cardamom, onion, garlic and tomato due to thrips were estimated up to 50-100 per cent in various regions (Cooper, 1990; Kumar *et al.*, 2001; Dharmadasa *et al.*, 2008, Diaz *et al.*, 2011 and Kunkalikar, 2011) [4, 7, 5, 6, 8]. Damage during fruit development isca used when females oviposit eggs in flower buds and flowers (Pearsall and Myers 2000) [14]. In apples, cherries, pears, and plums, oviposition damage may cause 'pansy spots'. This damage results from scar tissue (<1 mm) forming over the oviposition site, and is often surrounded by a pansy-shaped white discolouration (Cockfield *et al*., 2007; Terry, 1991) [3, 15]. In plums, apples and cherries, dimplesalso form as a result of the differential growth between injured and uninjured tissue around the oviposition site (Allsopp, 2010) [1]. Damage to maturing fruits (late season) occurs as fruits ripen, usually after the fruit has coloured. Nectarines are particularly susceptible to silvering. Thrips may be attracted to nectarines due to changes in the odour of the ripening fruit (La Rue *et al*., 1972) [9] or a combination of olfactory, gustatory and tactile cues (Teulon *et al*., 1993) [16]. All types of thrips damage can cause fruit to be culled or downgraded. They increase their population gradually in early season (Meena *et al*., 2013) [11] and multiply rapidly, because of which they are not feasible to control easily.

Correct idea of change in the population density of the pest is very important for effective management. The change in the population density clearly gives an idea about the thrip management so that the pest could be timely managed and prevents the crop from the pest damage. For this reason a research trail were conducted in Kashmir valley to determine the change in the population density of thrip species present on apple so that the pest may be easily and timely controlled.

Material method

Studies were conducted in an orchard with proper infestation of pest. The changes in the abundance of thrips were monitored from bud burst to petal fall of apple by sampling each of the five stages: bud burst, pink, full bloom, petal fall and peanut stage. Five trees are going to select: 4 in corner and one in the middle of the orchard. These selected trees will not go to receive any insecticide application during studies and these are again used for the next year. From each selected tree two methods viz: sticky traps and direct count were employed for determining the densities of pest at above various described stages. Blue wet sticky traps were used to monitor thrips in apple orchards. Traps of 10.2 cm wide and 12.5 cm high and pre–coated on both sides with sticky adhesive. Every 7 days, traps were removed and replaced. Blossom of plant were shaken or flicked vigorously into a white cup (either Styrofoam or plastic), even without removing the blossom from the plant. Five flower clusters from four directions and one at center per tree were sampled.

Results and discussion

Thrips density was significantly affected by apple bloom stages in both years. Densities were higher during bloom period both in 2016 and 2017. However total thrips count was more on sticky traps than direct count. Of total (264) count by sticky traps, 35.98% represents the bloom period followed by petal fall which represents 29.92% and 19.31% for pink bud and 13.25% for bud burst for the year 2016 (Table 1, fig. 1). In case of direct count of total number (220) was counted out of which full bloom represents 36.81% followed by petal fall which represents 31.36% and pink bud which represents 20% and 11.81% bud burst for the year 2016. A similar trend was followed for the year 2017(Table 2, fig. 2) but varying total thrip count in both cases. Of total (280) count by sticky traps, 36.42% represents the bloom period followed by petal fall which represents 29.64% and 20% for pink bud and 13.92% for bud burst for the year 2017. In case of direct count of total number (242) was counted out of which full bloom represents 35.95% followed by petal fall which represents 31% and pink bud which represents 20.24% and 12.80% bud burst for the year 2017. Thrip population was found least in peanut stage while it reached maximum in full bloom for both years 2016 and 2017.

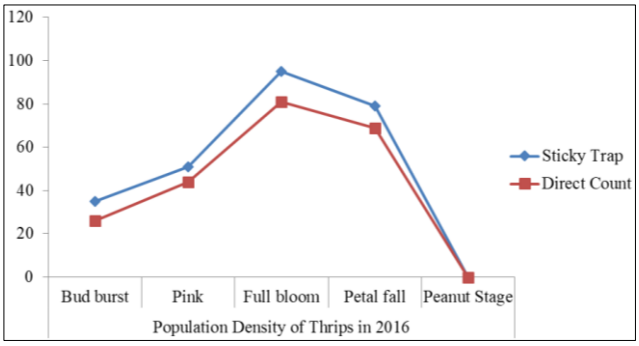
Table 1: Population density of *Thrips carthami* on apple in Kashmir during 2016 at different phenological stages

Method	Population Density of Thrips in 2016				
	Bud burst	Pink	Full bloom	Petal fall	Peanut stage
Sticky Trap	35	51	95	79	0
Direct Count	26	44	81	69	0

*Total of two weeks

Table 2: Population density of *Thrips carthami* on apple in Kashmir during 2017 at different phenological stages.

Method	Population Density of Thrips in 2017				
	Bud burst	Pink	Full bloom	Petal fall	Peanut stage
Sticky Trap	39	56	102	83	0
Direct Count	31	49	81	75	0



*Total of two weeks

Fig 1: Population density of *Thrips carthami* on apple in Kashmir during 2016 at different phenological stages.

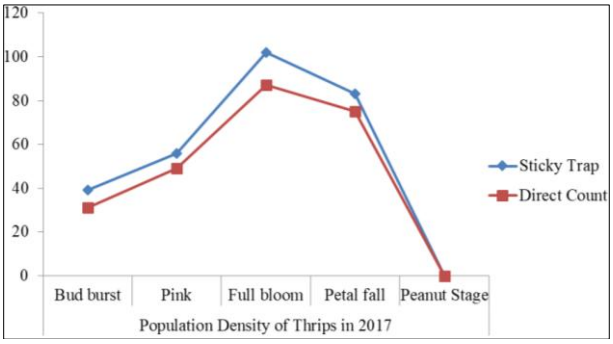


Fig 2: Population density of *Thrips carthami* on apple in Kashmir during 2017 at different phenological stages.

Conclusions

Thrip population densities are significantly affected by apple bloom stage. The thrip population increasers from green tip stage up to bloom stage and then it decreases with faster rate. Counts on sticky traps are more than on direct counts.

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