

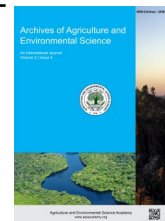


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ORIGINAL RESEARCH ARTICLE



Evaluation of lures for monitoring the population of thrips and whitefly in the major horticultural crops in Nepal

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ABSTRACT

Field experiment was conducted to evaluate the effectiveness of whitefly and thrips lure in yellow sticky traps in major horticultural crops in IRD station, Dahachowk & Nala, Nepal. This experiment was carried out from June to September, 2019. Six major horticultural crops have been selected. In each cropping area yellow sticky traps with whitefly lure, yellow sticky traps with thrips lure and yellow sticky traps only has been setup. Weekly data of insects has been recorded with the help of hand lens. In yellow sticky traps wide range of insects whitefly, thrips, leaf miner, winged aphids, housefly, fungus gnats, fruit fly, *Tuta absoluta* whereas, some beneficial insects as bee, wasp, beetle has been monitored. Analysis of variance was carried out as per the procedures given in R-STATC statistical computer package for the paired two T- tests. Thrips lure has shown significant result against thrips whereas whitefly lure doesn't show any notable effects against whitefly over yellow sticky traps. Further research on such lure will be valuable for the farmers in different agro-climatic locations of the country for validation.

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INTRODUCTION

Insect pests play a major role for declining the yield of horticultural crops. In Nepal, commercial farming has increasing trend (Shrestha *et al.*, 2014, 2018) and it shared a larger fragment of urban agriculture in Kathmandu Valley as the profitability attracted farmer day by day. The crop loss due to pest is estimated to be 35-40% of the total production (PPD and FAO, 2004). Whitefly is one of the serious pests of vegetable crops in the tropical world and greenhouse production in temperate regions (Oliveria *et al.*, 2001). Whitefly was reported as pest of cotton in 1998 in Nepal and now becoming the burning pest, especially in vegetables both in hills and Terai of Nepal (NARC 2011). Whiteflies are minute insects generally characterized by having wings covered with wax (Hodges and Evans, 2005; Liburd and Nyoike, 2012). It is a phloem feeding insect that lives predominantly on herbaceous plant (De Barro *et al.*, 2011). Whitefly is a vector agent to transfer the tomato leaf curl virus

(TLCV) is becoming a serious problem in the tomato crop of terai and foothills (Shrestha, 1997). As like, thrips are also the minute insects with fringed wings, puncturing and sucking mouthparts mostly affect the diverse range of the crops. Tomato spotted wilt virus is transmitted and spread in nature by insects of the family *Thripidae* (Thysanoptera) in Nepal (CABI, 1998; CABI/EPPO, 2010). In Nepal, *Thrips tabaci*, *Scirtothrips dorsalis* are found in horticultural crops as Solanaceae and Cucurbitaceae family whereas *Megalurothrips* spp. in Leguminosae plant. The management of this pest is being challenging day by day as it is developing resistance against various insecticides (Rao *et al.*, 2007). Consequently, there has been considerable interest in developing a range of new methods for thrips pest management, including the use of semi chemicals as lures (Koschier, 2008).

Yellow sticky traps are used as a one of effective IPM strategy for different insect pests in most parts of the world. Bright yellow (about 550 to 600 nm wavelength) is highly attractive to

many insects. They provide an easy method for estimation of pest population density. In monitoring program before the observation of damage to plant, yellow sticky traps provide an early warning of pest presence which is helpful for developing an environment friendly and safer control strategy (Webb and Smith, 1980; Patti and Rapisarda, 1981; Sharaf, 1982). As a result there is generally a reduction in pesticide use which further lead to less input cost, less workers exposure to pesticides and ultimately less pesticides induced phyto-toxicity and less expenses directly affect quantity and quality of the yield. Yellow sticky traps have been widely used in the polyhouse and open condition in Dahachowk and Nala. Wide ranges of insects are attracted in the yellow sticky traps. But, those insects has not been identified and studied. So the research aims on the identification of major insects attracted in the yellow sticky traps. Further, this research was also performed to examine the effectiveness of whitefly lure and thrips lure over the yellow sticky traps against whitefly and thrips in the major horticultural crops grown in Dahachowk, Kathmandu and Nala, Kavre district of Nepal.

MATERIALS AND METHODS

Description of experiment site

A field trial was conducted at Innovative Research and Development Center, Dahachowk, Kathmandu and Nala, Kavrepalanchowk district during the period from July to September, 2019. Six major horticultural crops were grown at a same time in two different places.. IRD, station Dahachowk is located in Kathmandu district, 27° 42' N 85° 13' E, 1350m above sea level and IRD, station Nala is located in Kavrepalanchowk district 27° 38' N 85° 31' E, 1500m above sea level.

Cropping pattern

In polyhouse tomato and sweet pepper were cultivated whereas; cucumber, bitter-gourd, melon and hot pepper were cultivated in open field condition. All cultural practices have been performed as per recommended.

Monitoring of insects

In each cropping area, three yellow sticky traps have been setup. Yellow sticky traps of size 7.5*45 cm were placed above 1m height from ground level. Two different lures were placed in each yellow sticky trap in each selected crop. Weekly insects' population in each trap has been counted with the help of the hand lens of 10x power.

Table 1. Treatments details used in the study.

	Location	Selected crops	Treatment
1.	Dahachowk, Kathmandu	Tomato Sweet pepper	T ₁ : Yellow sticky traps only T ₂ : Yellow sticky traps with whitefly lure
2.	Nala, Kavre	Bittergourd Cucumber Hot pepper Melon	T ₃ : Yellow sticky traps with thrips lure

Statistical analysis

The collected data were compiled using the MS-Excel program. Analysis of variance for all parameters was carried out as per the procedures given in R-STATC statistical computer package for the paired two T- tests.

RESULTS AND DISCUSSION

The result revealed that in the both location inside the tomato cultivated polyhouse, maximum number of whitefly has been monitored in yellow sticky traps. In open field condition the population of whitefly observed to higher in cucumber followed by hot pepper (Tables 2, 3). Similar supported finding, as tomato is the most preferred host plant of whitefly in comparison to cucumber followed by hot pepper (Morales and Cermeli, 2001, Sharma and Budha, 2015). Yellow sticky traps serve as a tool for early detection, identification of hotspots as well as for estimating relative abundance and monitoring dispersal activity of adult whiteflies, including those occurring in greenhouses, namely *Trialeurodes vaporariorum* (Westwood) and *Bemisia tabaci* (Gennadius) (Gillespie and Quiring, 1992; Heinz *et al.*, 1992). Most studies have shown that aphids (Döring, 2014) and whiteflies (Isaacs *et al.*, 1999) orient preferentially toward green and yellow surfaces. Insect color perception is dependent upon the sensitivity of their photoreceptors. Since most insects possess the same chromophore (vitamin A1 based, 11-cis retinal), their sensitivity to light wavelength remains relatively conserved exhibiting maximal sensitivities in the UV, blue and green regions of the light spectrum (Briscoe and Chittka, 2001). Yellow sticky traps (YSTs) in particular have been a subject of research for many decades, and incorporated in management programmes of various pests such as whiteflies, thrips, leaf mining flies and fungus gnats in a number of crops. In greenhouses, they have become a key component of IPM programmes of several greenhouse pests (Steiner *et al.*, 1999; Kaas, 2005; Park *et al.*, 2011a).

In yellow sticky traps, in the both locations especially in the cucurbitace family crops as cucumber, bitter gourd and melon both male and female fruit fly has been trapped. In this scenario while monitoring in yellow sticky traps large number of female fruit fly has been attracted as compared to the male fruit fly. Reason behind it may be female fruit fly activity in finding a host plant based on aroma and color to lay eggs. This is supported by the opinion of Marmaini and Wahyu Saputra, (2016) female fruit fly is more attracted to the yellow color because it has a wavelength of 424–491 nm. Some beneficial insect as honey bee, wasp, and beetle also has been trapped but their population was in minute number. About 87.08% percent of insects were whitefly monitored in Dahachowk, Kathmandu and 66.98% in Nala, Kavre followed by housefly and fungus gnats. Efficiency of lure has been tested in both locations. In Dahachowk, the thrips lure (23) was found highly significant over the yellow sticky traps (1) against thrips as p value is less than 0.05. Similarly, in Nala also similar result was found.

Table 2. Average number of insect pest monitored in yellow sticky traps in major horticultural crops in IRD station, Dahachowk, Nepal.

Horticultural crops	Polyhouse cultivation			Open cultivation			Mean insect population
	Tomato	Sweet Pepper	Bitter gourd	Cucumber	Hot Pepper	Melon	
No. of insects							
Whitefly	944	176	102	695	348	340	434.2
Thrips	1	0	2	0	0	3	1.0
Leaf miners	6	0	0	4	0	0	1.7
Winged	2	0	0	0	0	0	0.3
Aphids							
Housefly	16	26	16	22	20	12	18.7
Fungus gnats	13	38	72	38	12	5	29.7
Fruit fly (♂)	3	2	7	3	0	5	3.3
Fruit fly (♀)	2	1	15	7	1	19	7.5
<i>Tuta absoluta</i>	2	1	0	0	0	0	0.5
Honey Bee	0	0	0	0	0	0	0.0
Wasp	1	0	0	3	0	0	0.7
Beetle	1	0	0	0	2	3	1.0

Table 3. Average number of insect pest monitored in yellow sticky traps in major horticultural crops in IRD station, Nala, Nepal

Horticultural crops	Polyhouse cultivation			Open cultivation			Mean insect population
	Tomato	Sweet peeper	Bitter gourd	Cucumber	Hot Pepper	Melon	
No. of insects							
Whitefly	144	110	86	120	94	39	98.8
Thrips	0	0	0	1	0	0	0.2
Leaf miners	16	0	0	8	0	1	4.2
Winged aphids	0	0	0	0	0	2	0.3
Housefly	12	26	12	14	20	15	16.5
Fungus gnats	21	15	12	16	20	25	18.2
Fruit fly (♂)	3	0	2	1	0	8	2.3
Fruit fly (♀)	2	0	5	3	0	14	4.0
<i>Tuta absoluta</i>	9	1	0	0	0	0	1.7
Honey Bee	1	0	0	0	0	1	0.3
Wasp	0	0	0	0	0	0	0.0
Beetle	1	0	3	0	2	0	1.0

Table 4. Number of thrips monitored in different treatments at Dahachowk and Nala, Nepal.

Treatment	Number of thrips	
	Dahachowk	Nala
Thrips lure in yellow sticky traps	23±7.06	20.63±6.46
Yellow sticky traps only	1±0.38	0.81±0.26
Degree of freedom	10	10
t value	-3.192	-3.027
p value	0.009	0.012

Table 5. Number of whitefly monitored in different treatments at Dahachowk and Nala, Nepal.

Treatment	Number of whitefly	
	Dahachowk	Nala
Whitefly lure in yellow sticky traps	604.18 ± 99.81	118 ± 21.53
Yellow sticky traps only	568.54 ± 144.75	104.9 ± 20.64
Degree of freedom	10	10
t value	-0.394	-0.785
p value	0.701	0.45

The thrips lure in yellow sticky traps (20.63) was found highly significant over the yellow sticky traps (0.81) against thrips as p value is less than 0.05 (Table 4). Teulon *et al.* (2007) for *T. tabaci* the mixtures of para-anisaldehyde and methyl isonicotinate proved to be only as strong as the most powerful lure for the thrips. The whitefly lure was not found to be significant against the yellow sticky traps. In Dahachowk, in whitefly lure (604.18) was monitored over the yellow sticky traps (568.54) against whitefly where calculated p value is more than 0.05. Similarly, in Nala, the whitefly lure in yellow sticky traps (118) was monitored over the yellow sticky traps (104) against whitefly where calculated p value is more than 0.05 (Table 5).

Conclusion

In Dahachowk and Nala area, the yellow sticky trap is the effective means for the monitoring and management of whitefly. It has been found that wide range of other harmful pest such as fungus gnats, leaf miner, housefly, fruit fly, winged aphids, thrips are attracted in yellow sticky traps. The population of insect in the yellow sticky trap has found to be varies with the structure house and crops. In context of lure, in both location large numbers of thrips are attracted in thrips lure over the yellow sticky traps whereas, whitefly lure doesn't show a significant result against whitefly over the yellow sticky traps. Further, it is recommended to test the impact of the lure in wide range of the area, in various climatic conditions.

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