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Host Preference Vegetables of Tobacco Whitefly *Bemisia tabaci* (Gennadius, 1889) in Nepal

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ABSTRACT

The host preference of whitefly *Bemisia tabaci* was experimented in four economically important vegetable plants viz. tomato, brinjal, capsicum and cucumber in 2012-2013. It was found that preference of whitefly for feeding under both conditions free-choice and no-choice was significantly different after 24 hours, 48 hours, 72 hours and 96 hours. Cucumber was the most preferred host plant for oviposition while capsicum was the least.

Keywords: whitefly, feeding preference, vegetables, oviposition, free-choice**,** no-choice,

INTRODUCTION

Tobacco Whitefly *Bemisia tabaci* (Gennadius 1889)*,* native to Pakistan and India (Brown *et al.* 2005) is distributed throughout the tropics. It is one of the serious pests of vegetable crops in the tropical world and greenhouse production in temperate regions (Oliveira *et al.* 2001). Whitefly includes species complex of 41 distinct populations distributed throughout the world (De Barro *et al.* 2003, Boykin *et al.* 2007, Brown 2007 and Esterhuizen *et al.* 2013) with 24 populations of a specific biotypes (Perring 2001). It is sap sucking insect and vector of viruses (Brown *et al.* 1995). The pest damages host plant by feeding, making plant physiological disorder, contamination of the crops with excreted honeydew (Henneberry *et al.* 2001) and irregular ripening of fruit (McKenzie & Albano 2009). It transmits nearly one-hundred and fourteen virus species and some are devastating to plants (Byrne & Bellows 1991, Jones 2003).

In Nepal, it was reported as pest of cotton in 1998 and now becoming the burning pest of vegetables both in hills and Tarai (NARC 2011). Although, chemical control is the key denominator in the management of *B. tabaci* (Byrne 2003), it becomes difficult to control with contact insecticides because whitefly lives on the underside of the leaves (Zhang *et al.* 2004) and possessed resistance to a wide range of insecticides (Dennehy *et al.* 2006). Such reliance is expected to lead to increase tolerance in addition to the adverse effects on non-target organisms (Palumbo *et al.* 2001). Alternative management strategies include natural enemies, including parasitoids and predators, which are regarded as potential agents for use in classical biological control of this pest (Gerling *et al.* 2001).

A large number of natural enemies are found to be associated with *B. tabaci.* The use of natural enemies for bio-control of this pest is safest but very slow (van Lenteren *et al.* 2006). To improve the target insecticide spray and to apply the ecological based management of the pest, we need to understand the host plant preference, and oviposition (Simmon 1994). The host plant selection by herbivore arthropod is a major theme in ecology (Nomikou *et al.* 2003).

This study provides the results of host preference by *B. tabaci* experimented on the selected vegetables viz. cucumber, tomato, brinjal and capsicum.

MATERIALS AND METHODS

Whitefly *B. tabaci* were mass reared in cherry tomato in the glass house in Entomology Division, Nepal Agricultural Research Council (NARC), Khumaltar in 2012-13. The leaf containing nymphs were taken to the laboratory and kept inside the cylindrical plastic vessels with covering of the muslin clothes on the top. The newly released adults were then aspirated and transferred to the experimental box. Laboratory experiment for the host preference choice was conducted in NARC. The cherry tomato leaves containing nymphs were brought to the laboratory and kept inside the cylindrical plastic vessels covered with muslin clothes. The newly released adults were then aspirated and transferred to the experimental box.

The experiment was conducted in a controlled condition in NARC laboratory (25±2°C). Four host plants of *B. tabaci* viz. tomato (Srijhana), brinjal (Mayalu 555), capsicum (Sagar) and cucumber (Bhaktapur local) were tested for preference choice for feeding and oviposition.

Experimental plant varieties grown at four leaved stages were planted in plastic bottles of 10 cm height and diameter of 5 cm. Plants were kept together at a distance of 20 cm in transparent boxes of 30×30×21 cm^3 size in free-choice test (Fig.1). Unsexed 80 individuals of one day old adults were released inside the box.

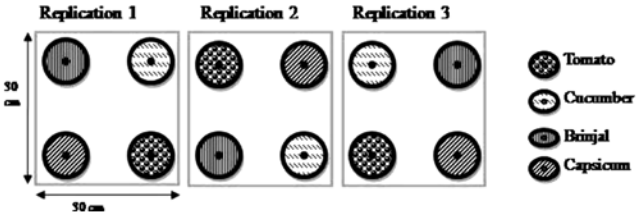

Fig. 1. Layout of the experimental designs for free-choice test

In case of no-choice test all four plants were kept individually and covered with cylindrical plastic vessels of 21 cm height with diameter of 11 cm covered with muslin cloth (Fig. 2). Unsexed 20 individuals of one day old adults were released in each cylindrical vessel. All the experiment contains three replications. The whitefly feeding were observed in both experiments after 24 hrs, 48 hrs, 72 hrs and 96 hrs while in case of oviposition preference the numbers of eggs present were counted after 96 hrs in all plants with the help of hand lens (20X) .

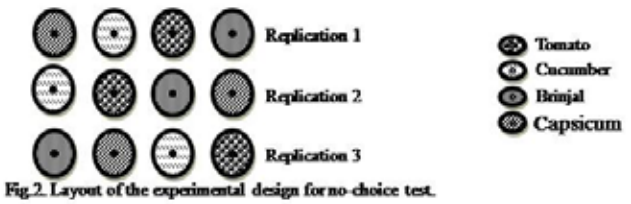

Fig. 2. Layout of the experimental design for no-choice test

The observed data for the host preference for feeding and oviposition were analysed using one way ANOVA and mean were compared using Duncan's Multiple Range Test (DMRT).

RESULTS

The results showed that preference of whitefly for feeding under free-choice condition was significantly different after 24 hours (p = 0.025, P<0.05), 48 hours (p = 0.007, P<0.01), 72 hours (p = 0.003, P<0.01) and 96 hours (p = 0.048, P<0.05). When no-choice was given for feeding, there was also significant difference in number of whitefly after 24(0.021, P<0.05), 48(0.023, P<0.05), 72(0.006, P<0.01), and 96(0.023, P<0.05) hours after the experiment (Table 1).

Table 1. One-way ANOVA between feeding preference in free-choice condition

Time period	Groups		Free-choice		No-choice	
		df	F	Sig.	F	Sig.
24 hrs.	Between Groups	3	5.392	0.025	3.435	0.021
	Within Groups	8				
	Total	11				
48 hrs.	Between Groups	3	8.561	0.007	6.137	0.023
	Within Groups	8				
	Total	11				
72 hrs.	Between Groups	3	11.780	0.003	11.207	0.006
	Within Groups	8				
	Total	11				
96 hrs.	Between Groups	3	4.141	0.048	5.286	0.023
	Within Groups	8				
	Total	11				

Table 2. Feeding preferences of B. tabaci on different host plants under free-choice condition.

Host plant	24 hrs (mean±S.E)	48hrs (mean±S.E)	72hrs (mean±S.E)	96hrs (mean±S.E)
Free-choice condition				
Tomato	23.66±5.81*	19.66±4.33	12.33±2.96	11.66±3.28
Capsicum	5.33±0.66	0.66±0.66	1.33±0.66	1±0.58
Brinjal	14±4.61	14.66±6.36	15.33±6.83	22.33±11.31*
Cucumber	37±9.01*	45±10.01*	51±10.06*	45±14.22*
No-choice condition				
Tomato	5±1.15	5.66±2.03*	5.0±1.15	5.33±2.33*
Capsicum	3.33±0.88	1.0±0.57*	1±0.577	0.33±0.33
Brinjal	8±42.51*	7.33±2.18	6.66±2.33	8±3.05
Cucumber	11.66±0.88*	11±1.73	11.66±1.20*	12±1.52

(*significantly different at P > 0.05)

Further DMRT for free-choice showed that cucumber was the most preferred host plant in 24, 48, 72 and 96 hrs, while there is no significant difference among capsicum vs brinjal, capsicum vs Tomato. The preference increased in brinjal while it was decreased in case of tomato during the experimental period and capsicum remained the least preferred plant for whitefly. Likewise DMRT for no-choice also cucumber was the most preferred host plan after 24, 48, 72, and 96 hrs followed by brinjal; but there was no significant difference in preference between tomato and capsicum. After 48 hrs and 96 hrs there was no significant difference between brinjal and cucumber while capsicum was the least preferred (Table 2).

There was significant difference in the preference for oviposition for whitefly in both free-choice test (p=0.019, P<0.05) and no-choice test (p=0.043, P<0.05) (Table 3).

Table 3. One-way ANOVA table for oviposition preference

		df	F	Sig.
Free-choice test	Between Groups	3	6.050	0.019
	Within Groups	8		
	Total	11		
No-choice test	Between Groups	3	4.343	0.043
	Within Groups	8		
	Total	11		

In free-choice test capsicum was least preferred, while tomato and brinjal were not significantly different for oviposition. Cucumber was found to be most preferred host for oviposition. When no-choice was given there was no difference in oviposition among capsicum and tomato while cucumber was found to be most preferred host (Table 4).

Table 4. Oviposition preferences of B. tabaci on different host plants

Host plant	Free-choice test (mean±S.E)	No-choice test (mean±S.E)
Tomato	255±71.37*	68.33±26.82
Capsicum	35±12.89	40.33±5.36
Brinjal	262±48.19*	88.33±42.84*
Cucumber	355.33±67.98*	175±22.91*

(*significantly different at P > 0.05)

DISCUSSION

The results showed that when all the potential host of whitefly were placed either together or separately, cucumber was the highly preferred host plant for feeding and oviposition following brinjal, tomato, and capsicum. Khan *et al.* (2011) reported that host plant selection and oviposition behaviour was significantly higher in brinjal in comparison to chilli and tomato. The mean number of adults and eggs were also higher in brinjal in comparison to tomato and chilli (Mansour *et al.* 2012). Tomato was preferred for feeding and oviposition in comparison to chilli (Schuster 2003). Tomato was found most preferred host than cucumber and eggplant for feeding and oviposition. Morales and Cermeli (2001) also reported tomato as the most preferred host plant in comparison to cucumber.

The reason for the preference of the pest for the different host plant is determined by the component of the host plant quality (Awmack & Leather 2002), role of plant volatiles in the choice behaviour (Blekeer *et al.* 2009) as plants respond to feeding or egg deposition by changing volatile blends that they emits (Mumm & Dicke 2010) and risk of the predation (Nomikou *et al.* 2003).

Plant varieties often affect the activity, preference and leaf structure, constitutive and induced chemical profiles are critically important determining the whitefly fitness (Inbar & Gerlinger 2008). Islam *et al.* (2010) found that among the varieties of eggplants 'Baiyu' was less preferred than other. Oviposition and other activity also differ among the varieties of tomato (Setiawati *et al.* 2009, Fekri *et al.* 2013). The preference among the host plants also differs due to the present of the resistance component of the genetic materials to the insect (Júnior *et al.* 2007). The preference for oviposition and landing of whitefly among different host may be due to the presence of different biotype of the whitefly (Omondi *et al.* 2005) where he observed that cassava biotype of *B. tabaci* prefer cassava for landing and oviposition, but did not oviposit on okra. The okra biotype preferred okra, oviposited on eggplant, tomato, garden egg and cowpea but did not oviposit on cassava. The leaf subtracts among the different host plants also affect the choice of oviposition (Sun *et al.* 2011).

CONCLUSION

Cucumber was found to be the most preferred host plant for feeding and oviposition. The Brinjal was the next, followed by tomato and capsicum in both free-choice and no-choice experiments. Highest mean numbers of adults and eggs were observed in cucumber than other plants.

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