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Field evaluation of different sticky traps against RSW in guava crop

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Abstract
Invasive species are one of the major and most rapidly growing threats to agriculture, of these *A. rugioperculatus* (RSW) was a feeding pest that causes stress to the host plant by removing water and nutrients, as well as production of honeydew, which covers the surface of leaves results in reduced photosynthesis of the plant. Present investigation was carried out in Guava orchard at COH, Venkataramannagudem to evaluate the attraction efficiency of RSW towards different colour sticky traps (Yellow, Blue, Green, White, Black, Red and Brown) in 2 seasons, where in each season experiment was repeated twice. The results revealed that yellow sticky traps attract more number of RSW (34.39 and 40.83 adults/15 days in winter and 43.31 and 40.85 adult/15 days seasons in summer, respectively), irrespective of the season when compared to all the other stick traps tested.

Keywords: *A. rugioperculatus*, colour sticky traps, guava

Introduction
International agricultural trade with increased global interactions lead to the movement of invasive insect species from one region of the world to another region. Invasive species are one of the major and most rapidly growing threats to agricultural biodiversity, livelihoods, human and animal health, forestry and biodiversity; and result in huge economic losses, Neha Gupta *et al.* (2018) [5]. In the recent past this type of invasions of exotic pests such as papaya mealy bug, *Paracoccus marginatus* Williams and Granara de willink on papaya during 2007 in Coimbatore, Tamil Nadu, Jhala *et al.* (2008) [4] and South American tomato leaf miner, *Tuta absoluta* Meyrick on tomato during 2014, Fall army worm, *Spodoptera fugiperda* Smith in 2018, western flower thrips, *Thrips parvispinus* Karny during 2021, Rachana *et al.* (2022) [6] in India caused awful situations among scientists and farmers. Another invasive species, A. *rugioperculatus* Martin (Hemiptera: Aleyrodidae) invaded into India. *A. rugioperculatus* feeding causes stress to the host plant by removing water and nutrients. Production of honeydew, which covers the surface of leaves results in the growth of sooty mold. Although sooty mold is not a plant disease, its presence on the upper surface of the leaf can potentially reduce photosynthesis of the plant. Although, mode of entry of *A. rugioperculatus* into India is unknown, it is expected that the pest gained entry into the country through trade of ornamental plants, Shanas *et al*. (2016) [8]. Initially, this whitefly was observed in several coconut farms in the Pollachi area of Coimbatore district, Tamil Nadu and first reported in Kottayam from Kerala during July – August 2016, Sundararaj and Selvaraj (2017) [9]. Where as in Andhra Pradesh, this pest has been first reported from Kadiyapulanka nurseries during October-November, 2016, Rao *et al*. (2018) [7], now it has spread to all parts of the state, signaling a serious threat to coconut, oil palm and various ornamental and horticulture crops like coconut, oil palm and guava cultivated in large area in coastal districts of Andhra Pradesh.
Even though many scientists have worked out pest management strategies and still attempts are going on in different directions to suppress the invasive pests. However, Indiscriminate and unwise use of chemical insecticides can result in control failure, besides polluting the environment and upsetting the ecological balance. In order to minimize the harmful effects of chemical pesticides, integrated pest management involving various eco-friendly tactics and sensible use of pesticides is needed to reduce the losses caused by pests to tolerable levels. With the broad view of above facts, the present investigation was carried out to evaluate the attraction efficacy of different colour sticky traps to control RSW.

Materials and Methods

Evaluation of sticky traps against rugose spiralling whitefly

Two field experiments were carried out in three year old guava orchard at COH, Venkataramannagudem to evaluate the attraction efficacy of different colour sticky traps (1x1mt). The first one was carried out from December 2020 to January 2021 the second from March to April 2021. The experiments were conducted in a randomized block design (RBD).

Treatment details

T_1: Yellow colour sticky trap T_2: Blue colour sticky trap T_3: Green colour sticky trap T_4: White colour sticky trap T_5: Black colour sticky trap T_6: Red colour sticky trap T7: Brown colour sticky traps.

The data was recorded 2 times by replacing the traps at 15 days intervals in each season *i.e.* December 2020 to January 2021 (first season) and March to April 2021 (second season) with the same set of treatments.

Results and Discussion

Field evaluation of different sticky traps against RSW in guava crop

Experiment was conducted in guava crop during winter and summer season of 2020 and 2021, respectively by using different colour sticky traps *viz.*, yellow, black, blue, white, red, brown, green was used to attract the adults of RSW.

Results obtain in the winter season (experiment was repeated twice with same set of treatments at 15 days days interval) revealed that in both the experiments at the end of 15 days the average of adult whitefly population attracted towards sticky trap was more in the yellow colour sticky traps (34.39 adults and 40.83 adults/15 days, respectively) followed by blue colour sticky traps (25.81 and 32.47 adults /15 days respectively), green colour sticky traps (15.61 and 19.19 adults/15 days, respectively), red colour sticky traps (12.81 and 12.02 adults/15 days, respectively), black colour sticky traps (10.06 and 9.98 adults/15 days, respectively) brown colour sticky traps (8.10 and 9.13 adults/15 days respectively) and the lowest attraction was recorded on white colour sticky traps (8.09 and 8.76 adults/15 days, respectively) (Table 1 & 2).

Similar during the summer season *i.e.* March to April 2021, experiment was conducted with same set of treatments twice at 15 days interval each. The results showed a similar trend in the data, where the yellow colour sticky traps were attracted more number of adults (43.31 and 40.85 adult/15 days, respectively) followed by blue colour sticky traps (32.31 and 21.65 adults/15 days, respectively), green colour sticky traps (25.77 and 20.69 adults/15 days, respectively), red colour sticky traps (18.63 and 16.07 adults/15 days, respectively), black colour sticky traps (17.76 and 15.79 adults/15 days, respectively), brown colour sticky traps (17.14 and 12.76 adults/15 days, respectively), while the lowest attraction number was recorded in white colour sticky traps (12.95 and 11.03 adults/15 days, respectively) (Table 3 & 4). The above results confirmed that the attractive efficiency was more for yellow traps when compared to other traps tested, one of the possible reasons might be yellow traps has high reflectance in the long-wave region from green to red (about 500-640 nm)and low reflectance in the short wave region from UV to blue (about 300-500 nm), which particularly attracts leaf feeding insects like whiteflies and another possible reason may be yellow traps create a contrast between the trap and the field background, this affects the optomotor of the insect eyes and influences the landing response of the flying insects (Idris *et al.*, 2012) [3]. The present finding which was similar to results obtained by many workers *viz.*, Susmitha *et al.* (2020) [10], Elango *et al.* (2016) [2] and Boopati *et al.* (2014) [1].

Table 1: Field evaluation of different coloured sticky traps against *A. rugioperculatus* in guava crop in winter season (2020)

S. No	Treatments	After 24 hrs	After 3 days	After 5 days	After 10days	After 15 days	Average
1	T1: Yellow	23.12 (4.76)^{a}	35.16 (5.93)^{a}	45.13 (6.73)^{a}	35.24 (5.91)^{a}	33.32 (5.75)^{a}	34.39
2	T2: Blue	18.14 (4.23)^{ab}	23.15 (4.72)^{b}	33.36 (5.72)^{a}	29.14 (5.37)^{ab}	25.25 (5.06)^{ab}	25.81
3	T3: Green	11.25 (3.30)^{bc}	13.26 (3.69)^{c}	20.15 (4.53)^{b}	19.26 (4.39)^{bc}	14.12 (3.72)^{cd}	15.61
4	T4: white	6.12 (2.27)^{c}	6.36 (2.32)^{d}	9.35 (2.97)^{cd}	7.25 (2.54)^{e}	11.36 (3.34)^{d}	8.09
5	T5: Black	6.12 (2.46)^{c}	6.36 (2.57)^{d}	11.25 (3.29)^{cd}	11.34 (3.37)^{cde}	15.25 (3.82)^{cd}	10.06
6	T6: Red	7.35 (2.64)^{c}	8.84 (2.78)^{cd}	13.25 (3.62)^{bc}	16.25 (3.93)^{cd}	18.36 (4.31)^{bc}	12.81
7	T7: Brown	7.15 (2.43)^{c}	4.65 (2.06)^{d}	5.84 (2.52)^{d}	9.69 (3.04)^{de}	13.15 (3.60)^{cd}	8.10
8	C.V %	23.73	16.71	14.43	16.11	11.39	
9	S.Em+	0.43	0.33	0.35	0.38	0.28	
10	C.D (0.05)	1.33	1.02	1.07	1.17	0.85	

Figures in parenthesis are the square root transformation values

In a column, means followed by a common letter (s) are not significantly different (P = 0.05)

Table 2: Field evaluation of different coloured sticky traps against *A. rugioperculatus* in guava crop winter season (2020)

S.no	Treatments	After 24 hrs	After 3 days	After 5 days	After 10days	After 15 days	Average
1	T1: Yellow	41.25 (6.36)^{a}	48.25 (6.36)	35.16 (5.95)^{a}	38.25 (6.17)^{a}	41.25 (6.39)^{a}	40.83
2	T2: Blue	29.25 (5.44)^{b}	35.15 (5.44)	29.36 (5.36)^{a}	32.25 (5.65)^{a}	36.25 (6.02)^{a}	32.47
3	T3: Green	14.16 (3.73)^{c}	21.15 (3.73)	18.12 (4.22)^{b}	18.35 (4.16)^{b}	24.15 (4.88)^{b}	19.19
4	T4: white	3.23 (1.71)^{e}	7.58 (1.71)	7.61 (2.71)^{c}	8.25 (2.91)^{b}	17.15 (4.10)^{c}	8.76
5	T5: Black	8.12 (2.76)^{d}	9.25 (2.76)	11.16 (3.38)^{bc}	12.14 (3.42)^{b}	9.25 (3.10)^{d}	9.98
6	T6: Red	19.25 (4.38)^{c}	11.13 (4.38)	8.12 (2.76)^{c}	8.36 (2.82)^{b}	13.25 (3.63)^{cd}	12.02
7	T7: Brown	6.36 (2.50)^{de}	9.15 (2.50)	11.65 (3.31)^{bc}	8.25 (2.76)^{b}	10.25 (3.21)^{d}	9.13
8	C.V %	12.37	12.37	15.63	20.12	9.35	
9	S.Em+	0.27	0.21	0.36	0.46	0.24	
10	C.D (0.05)	0.84	NS	1.10	1.42	0.74	

Figures in parenthesis are the square root transformation values
In a column, means followed by a common letter (s) are not significantly different (P = 0.05)

Table 3: Field evaluation of different coloured sticky traps against *A. rugioperculatus* in guava crop in summer season (2020)

S. No	Treatments	After 24 hrs	After 3 days	After 5 days	After 10days	After 15 days	Average
1	T1: Yellow	32.13 (5.65)^{a}	44.25 (6.61)^{a}	47.25 (6.85)^{a}	46.65 (6.78)^{a}	46.25 (6.77)^{ab}	43.31
2	T2: Blue	24.36 (4.93)^{a}	34.35 (5.82)^{a}	35.25 (5.89)^{ab}	37.25 (6.08)^{a}	30.36 (5.50)^{a}	32.31
3	T3: Green	21.36 (4.64)^{ab}	20.36 (4.50)^{b}	24.60 (4.93)^{bc}	35.15 (5.92)^{a}	27.36 (5.21)^{bc}	25.77
4	T4: white	7.12 (2.74)^{c}	12.36 (3.50)^{bc}	16.15 (3.94)^{d}	13.15 (3.62)^{c}	15.98 (3.91)^{c}	12.95
5	T5: Black	10.25 (3.11)^{c}	18.35 (4.23)^{bc}	18.35 (4.27)^{cd}	23.28 (4.76)^{b}	18.56 (4.26)^{bc}	17.76
6	T6: Red	12.15 (3.45)^{c}	15.35 (3.83)^{bc}	17.58 (4.09)^{cd}	22.18 (4.72)^{b}	25.89 (4.91)^{bc}	18.63
7	T7: Brown	14.36 (3.68)^{bc}	12.15 (3.45)^{c}	15.69 (3.90)^{d}	17.25 (4.19)^{bc}	26.25 (5.08)^{bc}	17.14
8	C.V %	14.84	12.61	11.42	10.17	15.98	
9	S.Em+	0.34	0.33	0.32	0.30	0.47	
10	C.D (0.05)	1.06	1.02	0.98	0.93	1.44	

Figures in parenthesis are the square root transformation values
In a column, means followed by a common letter (s) are not significantly different (P = 0.0

Table 4: Field evaluation of different coloured sticky traps against *A. rugioperculatus* in guava crop in summer season (2020)

S.No	Treatments	After 24 hrs	After 3 days	After 5 days	After 10days	After 15 days	Average
1	T1: Yellow	34.25 (5.85)^{a}	43.25 (6.59)^{a}	40.16 (6.71)^{a}	43.25 (6.56)^{a}	43.36 (6.59)^{a}	40.85
2	T2: Blue	15.25 (3.87)^{bc}	21.36 (4.60)^{b}	25.25 (5.00)^{b}	23.25 (4.83)^{b}	23.15 (4.76)^{b}	21.65
3	T3: Green	17.32 (4.15)^{b}	17.65 (4.14)^{bc}	22.18 (4.70)^{bc}	23.16 (4.76)^{b}	23.15 (4.76)^{b}	20.69
4	T4: white	7.12 (2.57)^{d}	10.25 (3.20)^{d}	12.25 (3.50)^{dd}	12.36 (3.45)^{c}	13.15 (3.62)^{c}	11.03
5	T5: Black	10.32 (3.16)^{bcd}	14 (3.81)^{cd}	15.35 (3.91)^{cd}	17.81 (4.19)^{bc}	21.46 (4.56)^{bc}	15.79
6	T6: Red	11.25 (3.40)^{bcd}	15.25 (3.94)^{bcd}	18.45 (4.23)^{bcd}	18.15 (4.23)^{bc}	17.25 (4.15)^{bc}	16.07
7	T7: Brown	8.25 (2.90)^{cd}	12.36 (3.43)^{cd}	10.36 (3.23)^{d}	15.64 (3.91)^{bc}	17.18 (4.19)^{bc}	12.76
8	C.V %	15.37	10.45	13.22	13.59	11.56	
9	S.Em+	0.33	0.26	0.34	0.36	0.31	
10	C.D (0.05)	1.01	0.79	1.05	1.10	0.96	

Figures in parenthesis are the square root transformation values
In a column, means followed by a common letter (s) are not significantly different (P = 0.05)

Field evaluation of different colour sticky traps in guava crop

Conclusion

The above field trails confirmed that the yellow sticky traps attract more number of RWS irrespective of the season which advocated the use of yellow sticky traps as an effective method for the control of RSW.

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