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Colour Preference of Sugarcane Jassid Cofana Spectra Distant (Homoptera: Cicadellidae).

KEYWORDS: Colour attractively, C. spectra, sugarcane pest, ecofriendly control.

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ABSTRACT *The colourof plant parts, light and texture play an important role in attracting insect pests and further their utility in pest management. Colour attractively in a sugarcane jassid Cofana spectraDistant (Homoptera: Cicadellidae) have been studied for hopping ecofriendly strategy of pest control. C. spectrawas tested under laboratory conditions (27±1°C, 75-80% R. H., 12 hrs photoperiod) against 7 colours for their attractively. Above species showed maximum preference to yellowcolour followed by orange, green, red, indigo and violet*

INTRODUCTION

Sugarcane is an important economic crop grown in India. Cofana spectra Distant (Hemiptera: Cicadellidae) is quite destructive pest of sugarcane which is responsible for transmitting the diseases SCWL (sugarcane white leaf). It is also causing the damage to agricultural crops like Paddy, Jowar and Maize in Kolhapur region, India and difficult to control with conventional pesticides due to development of resistance. It also cause damage to crops by sucking the cell sap resulting in curly and yellowing of leaves, causing sooty mould on leaves, affecting photosynthesis and growth and finally the yield of the crops. Therefore, use of coloured traps would be crucial alternative for the use of pesticides against the Jassids.

For the purpose of food, shelter and mate insect attracts towards the different colours (Berlinger,1980; Prokopy& Owens, 1983; Sathe et al. 1987; Chu et al, 2000; Ramamurthy et al. 2010).Insects fly directly towards the moon at night in a straight line. This behaviour is very useful for them in the dark. Colour attractive behaviourof insect can be used for controlling some harmful insects. Many insects have receptors that can process light beyond our own visual spectrum; therefore, they can see the colours that don't look to humans. (Stark and Tan,1982). Generally, nocturnal insect pollinators attract to the white colours which have high contras of white day. Flying pollinators mostly attract to blue violet and red colours. However, the light plays an important rolein phototropism and pest management (Sathe & Owlkar, 2010). Maximum insects attract to light. Short wavelength lights, such as blue and violet are usually more attractive to insects than other colours (Stark and Tan, 1982). Insect control capacity depends partly on the mobility of the insects. Hence,sticky traps, light traps and pheromone traps are widely used for monitoring and controlling the insect populations.

Perusal of literature indicates that Vaishampayan et al. (1975), Berlinger, (1980), Stark and Tan (1982), Prokopy and Owens (1983), Sathe et al. (1987), Byrne et al. (1990),Das &Pande (1991),Oosman (1996), Kersting et al. (1997), de Gooyer et al. (1998), Wolfe et al. (1998), Chu et al. (2000), Bi et al. (2001), Hamilton and Brown (2001), Oliveida et al. (2001), Sathe & Margaj (2001), Raja & Arivudainambi (2004), Alegbejo and Banwo (2005), Hanbonsoong et al. (2006), Chu et al.(2007), Demirel & Yildirim (2008), Sathe & Oulkar (2010), etc. worked on colour attraction by insects including Jassids.

In the present work sugarcane jassid Cofana spectra Distant was studied with respect to colour attractively. The use of coloured traps would be crucial alternative for pesticidal use against jassids.

MATERIALS AND METHODS

Initial culture of C. spectra wasmaintained in the laboratory by collectingadults and nymphs from various sugarcane fields of Kolhapur during the year 2014-2015. Laboratory reared insects have been used to study the colour response under laboratory conditions (27±1°C, 75-80% R. H., 12 hr photoperiod). Eight different colour papers i.e. Red, Yellow, Green, Blue, , White, Orange Indigo and Violet were used (Fig-2). In the experiment the colour papers intriangle were pasted at the bottom of plastic container of size 1.5 lit. volume (Fig.5). 50 individuals of pest were kept in the container and observations were taken on the settlement of Jassids on various colours at 1 hr interval .On the basis of highest number settled on specific colour the colour attractiveness was finalized.

RESULTS

Colour attractiveness of jassid C. spectra is recorded in table 1. The result recorded in table 1 and figs 1 to 5 indicated that C. spectra was attracted to yellow colour with highest number (11.9). Out of eight colours tested, maximum Jassids were attracted towards the yellow colour followed by orange and green (Table-1). The order of preference to different colours given by C. spectra refer to yellow>orange >green>red>indigo>violet> blue (Table-1).

Table 1: Colour attractivity of C. spectra

Sr. No.	Colour	Replicates										Mean
		1	2	3	4	5	6	7	8	9	10	
1	Red	02	02	-	03	02	02	-	-	-	-	1.1
2	Orange	02	05	05	04	03	04	03	03	01	-	3
3	Green	-	02	04	02	02	01	02	01	01	-	1.5
4	Yellow	21	15	13	15	17	18	07	04	06	03	11.9
5	Blue	-	-	-	-	-	01	-	-	-	-	0.1
6	Indigo	01	01	01	-	01	-	-	-	-	01	0.5
7	Violet	-	-	01	01	-	01	-	01	-	-	0.4

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DISCUSSION

Insect response to colour is dependant on the ground composition, physiological state of the insect and quality of incident wave length (Prokopy & owens, 1983). Thein et al. (2011) studied the attractiveness of leafhoppers Mastsumuratetti hiroglyphicus (Matsumara) and Yamatotettix flavovittatus Matsumarato various colour of sticky traps and light traps at sugarcane field in Phandon village, Kampawap district, Vron Thani Province, North east region of Thailand. They reported a high number of M. hiroglyphicus and Y. Flavovittatus trapped on blue and yellow colour as compared to white, orange, green and colourless traps. They concluded that a trap with black light and blue colour was the best attractive for monitoring the sugarcane leafhoppers.

According to Giurfa et al. (1995) and Horvath et al. (2002) the insects phototropism and colour vision considered to be the most important factors that help in identifying food source of insects. Insects use the different colours to distinguish between the host and the surrounding environment (Begum et al., 2004). Chu et al. (2000) examined nine different colours for whitefly Bemisia argentifolii (Bellows and Perring) with a wavelength range between 490-600nm wherein the most attractive colours were yellow, green, blue and the spring green. Mohamed (2007) studied the attractive colours and adaptive directions inB. tabaci and proved that the yellow colour was more significant from bluish green and than the orange, indigo and the green.

According to Saleh et al. (2010) yellow colour was significantly the most attractive colour while, blue and violet colours were the least preferred by B. tabaci. They further stated that the orange colour comes after the yellow colour which was the most attractive colour for B. tabaci and orange followed by green, then blue and finally violet for both males and females of B. tabaci. The females were always significantly greater than males in being attracted to these colours. While, Sathe et al. (1987) reported a common strong response to blue, white and green colour under laboratory conditions (24±1°C, 55-60 % R. H.) showed by Achea janata L., Athalia proxima Klog. and Zonabria postulata T.

The yellow and orange colour sticky traps were significantly attractive for leafhopper, Emposca decipiens in cotton (Demirel and Yildirim, 2008). The red colour sticky traps caught more Scaphoideu stitamus (a grapewine FDP-vector) than white, yellow or blue (Lessio and Alma, 2004). According to Thein et al. (2011) a trap with black light-blue colour was the best attractive for monitoring the insects of the vectors of sugarcane white leaf phytoplasma in sugarcane fields. Similarly, the yellow colour traps were significantly more attractive to Orosius orintalis (Kerstinget al, 1997) and the potato leafhopper Empoasca fabae(de Gooyeret al., 1998). Yellow colour was also found most attractive with a capture of highest number of adults of Idioscopus clypealis (Leith)(Homoptera: Cicadellidae) (11.53 adults / trap) while, pink and purple colours were found less attractive (Saeed et al. 2013). In the present form also yellow colour was most attractive. However orange colour was also potentially attractive to Jassids. In a multiple colour choice test, out of seven colours, maximum catches of whitefly adult Dialeurodes pallida Singh, a pest of Piper betle L. obtained by using yellow sticky traps followed by red (Das &Pande, 1991).

Hamilton and Brown (2001) reported bright colour of autumn foliage as a signal for aphids to indicate the tree species or individuals invested heavily in chemical defence and consequently not suitable for aphids. According to handicap-signalling hypothesis individuals within a signalling species show the variation in the expression by autumn colouration. Hamilton and Brown (2001) predicted that tree species which suffer greater insect damage could invest more in autumn colour signalling than less troubled species. Hamilton and Brown (2001) indicated that the number of aphid species were higher in tree species with higher autumn colouration index and the correlation was stronger with yellow leaved trees than with red leaved species. Holopainen and Peltonen (2002) concluded that higher number of aphids were related to the trees with bright autumn leaf colours. In the present study the insects were more commonly associated with the yellow colour.

Foliar reflectance was occurred around 350-650nm which accompanied by a lower saturation via an increase in UV and blue reflectance results in a “whitish” appearance (Prokopy and Owens, 1983). According to Thorsteinson (1958) some insects surprisingly attract towards the black colour. It wasspeculated that the heat absorbing properties of black colour acted as “theras lure” for some insects. Black colour attracted more insects in the colder months as in September and October.

Insects are sensitive to broad spectrum of light ranging from ultraviolet (UV) to red colour (Stark and Tan, 1982). Sensitivity in the UV spectrum played important role in foraging navigation in insects. This attraction to UV light has made insects a useful model for understanding visual sensitivity to UV light (Stark and Tan, 1982) and for the use in pest management since pesticidal control leads several demerits like pest resistance, secondary pest outbreak, pest resurgence and pollution.

Nitrogen concentrations or level of free amino acids in free foliage explains better aphid performance than concentration of total Phenolics including anthocyanins (Kaihulainen et al. 2000). The flavonoids pigments in senescing leaves accumulate only in the upper palisade of leaves (Hoch et al. 2001), suggest that pigments can not be directly feeding deterrent for Phloem feeders. Probably aphids can even detoxify Phenolics in their host plants (Urbanska et al. 1998). Therefore, the role of anthocyanins and flavonoids in autumn leaves or aphids is of greater interest in crop-pest interactions (Sathe and Margaj, 2001; Hoch et al. 2001). Mutikainen et al. (2000) reported that trees with bright colour may even attract aphids in autumn. According to Holopainen and Peltonen (2002) the frequent occurrence of migrant viviparous aphids with nymphs on yellow leaves and lower number of aphids on green leaves might be an indication that bright yellow colour of leaves acts as signal for the last winged aphid generation indicating high quality food value for its oviparous offsprings.

In the present study, under laboratory condition, out of 7 basic colours C. spectra showed highest preference to yellow colour.

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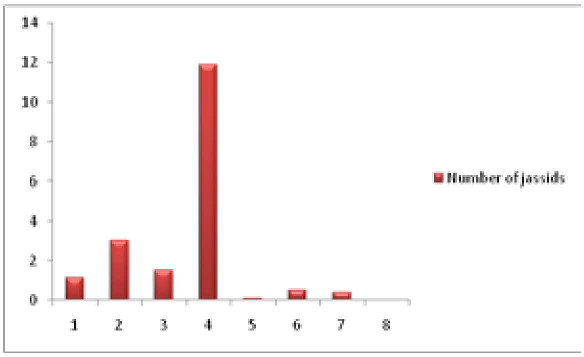

Fig- 1. Colour preference by C. spectra.

Fig- 2. Colour attractive panels for *C. specra*Fig-3. *C. spectra* on sugarcane

Fig-4.C. spectra adults on yellow colour panel Fig-5. Container with colour panel and C. Spectraadults.

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