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COLOUR PREFERENCE AS A POPULATION INDEXING TECHNIQUE IN THE WHITEFLY, *BEMISIA TABACI* GENN. (ALEYRODIDAE; HOMOPTERA)

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The present studies investigated colour preferences of *Bemisia tabaci* so as to devise a population indexing technique. Sticky stakes with yellow coloured papers were found to be a very good technique for indexing whitefly populations. This colour preference has also suggested the behaviour of *B. tabaci* underlying its effective transmission of YMV to host plants. It further indicates a basis for exploitation of host colour characteristics in *B. tabaci*-vectored plant viruses by avoiding yellow in varietal improvement programmes.

INTRODUCTION

Bemisia tabaci is a major pest of several crops throughout the tropics and sub-tropics. This insect is polyphagous and has recently been recorded on 75 different host plant species belonging to many families in India (Nene *et al.*, 1972). Within the aleyrodid vectors of plant viruses, *Bemisia tabaci* is by far the most important and is responsible for the transmission of over 25 different diseases of economic importance on various crops distributed throughout the world (Costa, 1969). In Pakistan, the whitefly *B. tabaci* transmits a Yellow Mosaic Virus (YMV), occurring on four important pulse crops viz., urd (*Phaseolus mungo*), mung (*P. aureus*), moth (*P. aconitifolius*) and soybean (*Glycine max*) (Ahmad and Harwood, 1973). The present studies were initiated to find out the importance of colour in host selection in order to develop an efficient method for whitefly population indexing.

REVIEW OF LITERATURE

Many previous workers (Moericke, 1949, 1950, 1951, 1955, 1957; Muller, 1956, 1964; Broadbent, 1948; and Quayyoom, 1965) have shown that

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aphids, notably *Myzus persicae*, are strongly attracted to yellow. On the basis of his experiments, Moericke (1951) devised a yellow water pan trap for capturing flying aphids. Since then most investigators in Europe, Australia, and America have adopted the Moericke trap to study flight dispersal of aphids.

Several workers have demonstrated colour preferences in whiteflies. Lloyd (1922) and Moericke *et al.* (1966) noted that *Trialeurodes vaporariorum* (Westw.) is attracted to yellow. Butler (1938) similarly found that *Aleurodes brassicae* was more strongly attracted to yellow green light transmitted through a filter at 5000-6000 A° than to daylight diffusing through a filter at 4000-7000 A°. Hussain and Trehan (1940) stated that *Bemisia gossypiperda* was attracted to colours in the order of yellow green, yellow, red, orange red, dark green and purple. Moericke (1954) demonstrated a reaction by *A. brassicae* to ultraviolet radiation and found that attraction was greater to a whitish yellow surface to which lead had been added than one to which zinc had been added. This he correlated with the differential emission of ultraviolet light from the two surfaces, since zinc absorbs this radiation more than lead. According to Mound (1962), *B. tabaci* is attracted by wave lengths transmitted in the blue ultraviolet and the yellow parts of the spectrum.

MATERIALS AND METHODS

Sticky stakes, some 24" high (about $\frac{2}{3}$ of the plant height), of different colours were positioned in rows of 2-month old mung (*P. aureus*) plants. Each stake consisted of a flat wooden plank wrapped with paper painted by poster water colours with white, black, violet, indigo, blue, green, yellow, orange and red. Each coloured surface was then coated with an adhesive material called "Tekko (Ostico)" available locally for mango mealy bug control. By always utilizing an identical surface area i.e., 35 sq. inch, standard capture conditions were possible on both flat surfaces of the stakes, and by using lined paper the trapped insects could be readily counted or scanned under a dissecting microscope. The stakes were left in the field plot rows for 24 hours. They showed good uniformity of capture within a location at any particular time.

RESULTS

The data are presented in table I.

TABLE I. *Data showing the preferential behaviour of (B. tabaci) to different colours.*

Date of catch.	Colour of sticky stakes								
	White	Black	Violet	Indigo	Blue	Green	Yellow	Orange	Red
May 8, 1972	1	0	0	1	2	6	45	18	3
May 15	4	1	3	0	2	10	90	33	2
June 1	2	0	1	2	1	4	266	61	3
June 30	3	3	1	3	0	22	197	66	5
July 18	2	4	0	2	4	8	120	45	1
August 3	1	3	4	0	5	14	150	62	4
August 17	5	8	3	6	6	30	225	100	7
October 18	3	0	2	3	2	12	53	36	1
Total :	21	19	14	17	22	106	1146	421	26
Per cent attraction :	1.2	1.1	0.8	1.0	1.2	6.0	64.0	23.5	1.5

It is evident from the preceding table that *Bemisia tabaci* strongly prefers surfaces coloured yellow (64%) and orange (23.5%) and weakly responds to green (6%). It is also clear that yellow coloured sticky stakes are suitable for whitefly population indexing in the field because uniformly a large number were collected.

The efficacy of yellow stakes coated by "Ostico" adhesive was found equally practicable for recording whitefly populations for pest control experiments or for seasonal variations in count, not only on pulse crops like urd, mung, moth and soybean but also on other crops viz., potato, tomato, cucurbits and cotton. The only precaution is that one must vary the height of the coated surface according to the height of the plants.

DISCUSSION

Moericke's experiments on the response of aphids and other insects contributed materially to our knowledge of this sort and his results have stimulated others to investigate ways in which this response may be utilized as an effective method of population indexing, and to protect plants from aphid attack or virus infection. With insects as active and small as whiteflies methods of leaf counts or sweep net collecting

are laborious and inadequate, and overly sensitive to slight disturbances. The present technique is convenient for population indexing purposes, and undoubtedly more uniform because a prolonged period, such as 24 hours of sampling, can be employed. The one drawback to this coloured sticky surface trapping method is that rains or blowing dust will affect the catch.

Few plant breeders have considered the importance of selecting plants for colour variation in their search for plant resistance to insect attack. Muller's studies (1964) showed that many more *Myzus persicae* and other flying aphids alighted on green or yellow-green varieties of lettuce than on bronze varieties and that virus infection was correspondingly reduced in bronze varieties. Similarly in Pakistan resistance to YMV on 4 important pulses can be selected by avoiding yellow or orange colour in the varietal improvement programme.

Furthermore the colour preference of whiteflies for yellow to orange seems to explain transmission of yellow mosaic virus by *B. tabaci* on urd, mung, moth and soybean. Yellow colour preference attracts whiteflies to YM-affected leaves, that are bright yellow in colour and later often become orange; the flowers are yellow, and the tender new terminal growth of most varieties is yellowish green. Our investigations indicate, through leaf isolation cage tests, that whitefly transmission of YM agent is nearly impossible on older leaves. But this finding of attraction to yellow suggests that a high degree of transmission can occur at high temperature conditions, even if the viral agent is not very systemic, because the large numbers of whiteflies preferentially acquire virus from yellowed leaves on account of physical attraction, and pass it on to new growth and to yellow flowering structures. It also explains why one can occasionally observe YM-affected seed pods, which develop after the yellow flowers, while the same plant may show no evidence of YM on the leaves.

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