

EFFECT OF CARDINAL GEOGRAPHICAL DIRECTIONS ON THE EFFICIENCY OF YELLOW STICKY BOARD TRAPS IN ATTRACTING CERTAIN INSECT PESTS INFESTING SOME MEDICINAL PLANTS

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ABSTRACT

Field studies were conducted at Plant Protection Research Station at Kaha region, Qalyoubia Governorate on the effect of the main geographical directions (north, south, east and west) on efficiency of yellow sticky board traps in attracting aphids (*Aphis gossypii* Glover), whiteflies *Bemisia tabaci* (Genn.) and jassids, *Empoasca lybica* deBerg infesting guar (*Cyamopsis tetragoloba* Linne), roselle (*Hibiscus sabdariffa* Linne) and peppermint (*Mentha piperita* Linne) during 2006 and 2007 growing seasons. Results showed that the highest numbers of trapped aphids, jassids and whitefly were recorded on traps faced to eastern direction on the guar and roselle crops, where the corresponding seasonal mean counts in the two seasons altogether were 11.88, 16.97 and 151.89 individuals/trap in guar crop and 15.40, 22.40 and 205.37 individuals/trap for the roselle crop, respectively.

In peppermint, the yellow sticky board traps were more suitable to capture the maximum number of aphids and whiteflies when directed to eastern direction throughout the tested seasons under investigation (12.63 and 219.62 individuals/trap, respectively), on the other hand, the highest trapped jassids of 12.70 individuals/trap was captured with southward traps. Contrary, the lowest numbers of the three studied insect species were recorded on the traps faced to west direction, except for *A. gossypii* in the case of peppermint, as the traps located in the north direction caught the lowest numbers (8.18 individuals/trap during the two seasons together). However, the observations clearly indicated that the remaining tested traps in the other directions trapped moderate numbers of the three studied insects.

INTRODUCTION

Guar (*Cyamopsis tetragoloba*), roselle (*Hibiscus sabdariffa*) and peppermint (*Mentha piperita* Linne) are the most important medicinal and aromatic plants for human health as well as for domestic animals. Recently the cultivated area with these plants increased to cope the increasing needs for exportation and local consumption. Guar seeds, peppermint leaves and Roselle are used in medical industries, as well as peppermint leaves are used as a spicy in carry powdered. Some insect species infest these plants and cause severe damage in the yield (Young and Edwards, 1990).

The effects of sticky traps on the population abundance of different pests

infesting different plants were studied by many investigators. Nucifora *et al.*, 1983; Gillespie and Quiring, 1987; Edigaryan and Eritsyayn, 1988; Jimenez and Delgado, 1991; Roychoudhury and Jain, 1993; Emam, 1999; Mannaa, 2000; Costa *et al.*, 2002; Mutwiwa and Tantau, 2005 and Ramegowda *et al.*, 2007.

The present study was carried out to study the attraction of certain insect pests infesting some aromatic and medicinal plants (guar, Roselle and peppermint) to yellow sticky broad traps facing the four cardinal geographical directions (north, south, east and west).

MATERIAL AND METHODS

This experiment was conducted at Plant Protection Research Station at Kaha region Qalyoubia Governorate during 2006 and 2007 seasons to evaluate the influence of the four cardinal geographical directions (north, south, east and west) on the attraction efficacy of yellow sticky board traps to certain flying insects, *i.e.*, the cotton aphids, (*Aphis gossypii*), the cotton leafhopper (*Empoasca lybica*) and the cotton and tomato whitefly (*Bemisia tabaci*) infested the three investigated medicinal and aromatic crops, guar, roselle and peppermint.

Seeds of guar and roselle crops were planted at the first day of April and seedling of peppermint transplanted at the same date during the two studied seasons. Normal agricultural practices were followed except for keeping the whole area free from any pesti- cidal treatment.

The experimental area of each crop was about 0.25 feddan divided into five equal plots (about 210 m² each). Five traps were randomly located in the area of each crop. The traps consisted of square wooden frame of 25 × 25 cm put on a vertical piece of wood at the higher level of plant length (10cm above). Each trap was covered with a thin layer sticker. The sticky board traps were hanged horizontally and directed to the four main directions. All yellow sticky traps were changed every five days. Samples of sticky traps were sorted, identified and counted. The numbers of the investigated flying insects, aphids, jassids and whiteflies in the four tested directions were recorded.

All data concerning counts of the three studied insects were statistically analyzed by using a computer software package "SAS". Comparisons between means of treatments were depended on the F and L.S.D. tests.

RESULTS AND DISCUSSION

Data presented in Tables 1, 2 & 3 show the seasonal mean numbers of aphids (*Aphis gossypii* (Glove.)), jassid, *Empoasca lybica* deBerg and whitely (*Bemisia tabaci* (Genn.)) caught on the yellow sticky board traps which facing to main cardinal directions of the guar, Roselle and peppermint plants during two seasons (2006 and 2007). The obtained results can be summarized as follow:

1: Insects infesting guar.

1.1: The cotton aphids, *Aphis gossypii*

Glover.

Data presented in Table (1) show the differences between the seasonal mean numbers of winged forms of *A. gossypii* attracted to the yellow sticky board traps directed to the four tested directions. In the first season, the significantly highest number of *A. gossypii* was recorded on the yellow sticky traps facing south and east directions, as they attracted throughout the whole season 13.25 and 11.40 individuals/trap, respectively. While the yellow sticky traps facing north and west

caught the significantly lowest counts of 5.60 and 4.20 individuals/ traps, respectively.

In the second season, the highest captured number was recorded on the yellow traps directed to the east direction (12.35 individuals/traps) followed significantly by the traps directed to north and south which caught 6.05 and 6.20 individuals/trap, respectively. The traps facing west direction caught the significantly lowest count of *A. gossypii* (3.70 individuals/trap).

According to statistical analysis of the obtained data in the two seasons altogether, the four tested cardinal directions could be arranged descendingly, according to the caught numbers of *A. gossypii* to east (11.88) > south (9.73) > north (5.83) > west direction 4.20 individuals/trap, respectively.

1.2: The cotton leafhopper, *Empoasca lybica* de Berg.

Results in Table (1) clearly indicated that this pest more attracted to the traps side

facing to the eastern direction showing the highest averages numbers of 16.70 and 17.24 winged individuals/trap, while there was low flying activity westwards with averages numbers of 8.82 and 9.75 jassids/trap during 2006 and 2007 seasons, respectively. Statistical ana-

lysis of variance using F. test proved that the differences in the degree of attraction between the four directions measured as average numbers of captured flying jassids per trap were significant in the two studied seasons.

Table (1): Effect of four cardinal geographical directions on the efficiency of yellow colour board traps in attracting the population abundance of aphids, jassids and whitefly infesting guar plants.

Pest Seasons Direction	Aphids			Jassids			Whiteflies		
	2006	2007	Mean	2006	2007	Mean	2006	2007	Mean
North	5.60 ^a	6.05 ^b	5.83 ^c	13.56 ^b	13.84 ^b	13.70 ^b	89.39 ^b	102.38 ^c	95.89 ^c
South	13.25 ^a	6.20 ^b	9.73 ^b	15.11 ^{ab}	16.93 ^{ab}	15.52 ^{ab}	146.63 ^a	107.23 ^b	126.93 ^b
East	11.40 ^a	12.35 ^a	11.88 ^a	16.70 ^a	17.24 ^{ac}	16.97 ^a	134.56 ^a	169.21 ^a	151.89 ^a
West	4.20 ^b	3.70 ^c	3.95 ^c	8.82 ^c	9.75 ^c	9.29 ^c	55.45 ^c	66.88 ^d	61.17 ^d
F	31.75	49.66	35.55	19.42 ^b	10.65	18.81	78.61	1121.21	186.52
L.S.D	2.54	1.72	1.79	2.52	3.27	2.51	15.48	4.16	9.40

Regarding the overall mean counts of *Empoasca lybica* captured at the two seasons altogether, it is clear that the east side showed the highest average numbers (16.97 individuals/trap), while, the lowest average number (9.29 individuals/trap) was recorded in the south direction.

1.3: The cotton and tomato whitefly, Bemisia tabaci (Genn.).

The obtained results in Table (1) revealed that the average numbers of whitefly adult individuals found on sticky traps faced to the four tested cardinal directions could be arranged as follows: 134.56, 169.21; 89.39, 102.38; 55.45, 66.88 and 146.63, 107.23 individuals/trap for eastern, northern, western and southern directions during the two seasons of 2006 and 2007, respectively.

From the obtained results in both seasons together, we can say that the differences between the seasonal mean numbers of *B. tabaci* adults captured on the yellow sticky traps in the tested cardinal directions were statistically significant in the two investigated seasons. It is worthy to mention that the traps faced to east direction occupied the first attractive group, as they caught 151.89 adults/trap, followed significantly by the second

attractive group which represented by traps faced to south direction (126.93 adults/ trap). However those faced to north direction caught the moderate numbers of trapped *B. tabaci* adults (95.89 individuals/ trap). The lowest attractive one was represented by the traps located in the west direction (61.17 adults/ trap).

2: Insects infesting roselle:

2.1: The cotton aphid, Aphis gossypii Glover.

The captured winged individuals of cotton aphid attracted to yellow sticky board traps were significantly affected by the tested cardinal directions (Table, 2). The obtained results evidently demonstrated that, sticky traps directed towards both east and north attracted the highest average numbers of 15.65 & 6.95 and 15.15 & 11.20 winged aphids/trap in the two studied seasons, respectively. On the other hand, traps oriented towards the west direction caught the lowest average numbers of 3.45 and 6.05 insects/trap in the first and second seasons, respectively. Traps faced to south direction gave moderate averages numbers of captured insects of 5.25 and 8.60 individuals/traps in the two seasons, respectively.

Data of the overall means of the two seasons and their statistical analysis showed clearly that the yellow colour traps oriented to east direction trapped the heaviest numbers of winged forms aphid (15.40 individuals/trap). While, the lowest number was recorded on the traps faced to west direction (4.75 individuals/trap).

2.2: The cotton leafhopper, *Empoasca lybica* de Berg.

Reading the data recorded in Table (2), it is obviously clear that the sticky traps faced to east direction captured the highest average numbers of 21.56 and 23.23 jassids/trap during 2006 and 2007 season, respectively. Whereas, the lowest ones of 9.42 individuals/trap in the first season and 12.48 in the second one were recorded with west direction.

Statistical analysis proved that the differences between average numbers of jassids caught on the sides of sticky traps oriented to the four cardinal geographical directions were significant in the two studied seasons, as F value were 48.89 and 51.20, respectively.

It is clear from the results at the two seasons altogether, that the traps could be divided into four groups as; a-/highly attractive traps which faced to east direction (22.40 individuals/trap) b. and c. moderately attracted traps which directed to north and south, as they captured 17.44 and 15.34 jassids/trap, respectively) and c. the lowest captured traps which represented by the traps directed towards to west direction (10.95 individuals/trap).

Table (2): Effect of four cardinal geographical directions on the efficiency of yellow colour board traps in attracting the population abundance of aphids, jassids and whitefly infesting rosella plants.

Pest Seasons Direction	Aphids			Jassids			Whiteflies		
	2006	2007	Mean	2006	2007	Mean	2006	2007	Mean
North	6.95 ^b	11.20 ^b	9.08 ^b	16.03 ^b	18.84 ^b	17.44 ^b	95.98 ^c	118.54 ^c	107.26 ^c
South	5.25 ^{bc}	8.60 ^c	6.93 ^c	14.31 ^b	16.37 ^c	15.34 ^c	165.96 ^b	134.98 ^b	150.47 ^b
East	15.65 ^a	15.15 ^a	15.40 ^a	21.56 ^a	23.23 ^a	22.40 ^a	213.51 ^a	197.32 ^a	205.37 ^a
West	3.45 ^c	6.05 ^d	4.74 ^d	9.42 ^c	12.48 ^d	10.95 ^d	71.00 ^c	69.51 ^d	70.26 ^d
F	8600	95.82	111.61	48.89	51.20	110.69	39.79	918.23	111.39
L.S.D	1.9	1.29	1.42	2.34	2.05	1.47	37.69	5.67	19.22

2.3: The cotton and tomato whitefly, *Bemisia tabaci* (Genn.).

Regarding the effect of the different four cardinal directions on the numbers of captured whitefly adults to yellow sticky board traps, results tabulated in Table (2) demonstrated that the trapped adults were significantly impacted by the four directions in both first and second seasons. The highest average numbers of 213.51 and 197.32 adults/trap were captured with eastwards in 2006 and 2007, respectively. While in the case of the other directions, the insect population declined from 71.00 to 165.96 in 2006 season and from 69.51 to 134.98 individuals in 2007 with traps located in west and south directions,

respectively. L.S.D values clearly indicated that the differences between average numbers of whitefly adults attracted to traps facing to northwards and westwards did not reach significant degree at 0.05 level of probability in the first season on one hand and reach to significant in the second season on the others hand.

The overall mean numbers of trapped adults of whiteflies of both years together confirmed that the highest number of whiteflies trapped to traps located in east direction (205.37 adults/ trap). Contrary, the lowest mean numbers was recorded on the trap placed in west direction (70.26 adults/trap).

3: Insects infesting peppermint:

3.1: The cotton aphid, *Aphis gossypii* Glover.

In both seasons, 2006 and 2007 as shown in Table (3), data indicated that geographical directions had a highly significant effect on the flight activity of the winged forms of cotton aphids during the two seasons of the present study. Traps facing eastwards heavily caught alates than those facing the

other directions recording the highest average numbers of 9.65 and 15.60 individuals/trap in the two seasons, respectively. On the other hand, the lowest population abundance of 5.80 and 10.55 individuals/trap were observed and detected with the north direction in the first and second season, respectively. Either west or south directions trapped moderate numbers of alates.

Table (3): Effect of four cardinal geographical directions on the efficiency of yellow colour board traps in attracting the population abundance of aphids, jassids and whitefly infesting peppermint plants.

Seasons Direction	Aphids			Jassids			Whiteflies		
	2006	2007	Mean	2006	2007	Mean	2006	2007	Mean
North	5.80 ^c	10.55 ^b	8.18 ^c	7.35 ^c	11.19 ^{ab}	9.27 ^{bc}	167.61 ^c	158.23 ^c	162.92 ^c
South	8.40 ^b	14.30 ^a	11.35 ^a	11.15 ^a	14.25 ^a	12.70 ^a	202.40 ^b	182.71 ^b	192.56 ^b
East	9.65 ^a	15.60 ^a	12.63 ^a	9.27 ^b	12.03 ^{ab}	10.65 ^b	231.79 ^a	207.44 ^a	219.62 ^a
West	8.20 ^b	11.15 ^b	9.68 ^b	6.69 ^c	9.81 ^b	8.25 ^c	120.77 ^c	96.69 ^d	108.73 ^d
F	28.95	11.72	23.27	13.92	3.35	14.49	325.41	910.02	521.32
L.S.D	0.98	2.32	1.31	1.76	3.31	1.65	8.63	5.14	6.79

As shown in Table (3), statistical analysis revealed significant differences between seasonal mean numbers of *A. gossypii* on the tested color traps in different directions in 2006 and 2007 and the two season's altogether. The four directed traps used in this investigation could be divided, statistically, according to the trapped *A. gossypii* into three separate groups of which the east and south directions are the best (12.63 and 11.35 individuals/traps, respectively) followed significantly by the traps located in the west direction (9.68 individuals/traps) and finally the traps in the northwards which caught the lowest numbers of *A. gossypii* (8.18 individuals/traps).

The obtained results partially agree with those of Mohamed (1984) who found that there were significant differences in the occurrence of aphids on wheat plants for the cardinal directions of east, west, north and south. Also, Roychoudhury and Jain (1993) stated that aphid trapped in yellow sticky traps were *A. craccivora*, *A. gossypii*, *Brevicoryne brassica*, *Myzus persicae* and *Rhopalosiphum*

maidis. Patel and Raman (2000) stated that the eastern direction was more suitable for attracting the maximum numbers of aphids, *A. gossypii* from cotton plants followed by the northern, southern and western directions. Ramegowda *et al.* (2007) recorded that the maximum numbers of aphids was trapped in traps placed on the eastern side. The traps placed on north and south sides did not differentiate among themselves and recorded low aphid counts.

3.2: The cotton leafhopper, *Empoasca lybica* de Berg.

Statistical analysis of data tabulated in the same Table (3) indicated that the averages number of *E. lybica* caught by the yellow sticky board traps facing the four cardinal directions were significantly affected by changing direction in both 2006 and 2007 peppermint summer growing seasons.

The highest degrees of attraction (11.15 and 14.55 jassids/trap) were recorded on traps of southward direction in the two studied seasons, respectively. While, the

corresponding lowest ones (6.96 and 9.81 jassids/trap) occurred with yellow sticky traps directed westwards in the two seasons, respectively. The other tested directions, *i.e.*, east and north indicated moderate averages numbers of flying jassids in both investigated seasons.

The overall mean counts of jassids estimated on the test traps for the two seasons together showed these differences, as the heaviest seasonal mean number of captured jassids was associated with the traps facing to south direction (12.70 individuals/traps), followed significantly by the seasonal mean number of jassids attracted to traps directed to east direction (10.65 individuals/traps). While, the lowest seasonal mean numbers of trapped jassids were associated with yellow sticky board traps of north and west directions, *i.e.* 9.27 and 8.25 individuals/traps, respectively.

The abovementioned results are nearly the same with those obtained by Jimenez and Delgado (1991) who recorded that yellow sticky traps were more effective for trapping leafhoppers, and Seyedoleslami *et al.* (2002) stated that there were significant differences between adults of *Agonosciana pistaciae* Burckhardt (Homoptera) captured by yellow sticky board trap and eggs density among geographical directions.

3.3 The cotton and tomato whitefly, *Bemisia tabaci* (Genn.).

The effects of different cardinal geographical directions on the abundance level of *B. tabaci* adults attracted towards yellow sticky board traps were recorded. Cardinal directions could be arranged descendingly as follows: eastwards (231.79 & 207.44 adults/trap), southwards (202.40 & 182.71), northwards (167.61 & 158.23) and westward (120.77 & 96.69 adults/trap) during 2006 and 2007 seasons, respectively (Table, 3). Statistical analysis of the obtained results demonstrated that the differences between average

numbers of whiteflies captured by sticky traps facing the four cardinal directions were highly significant during the two successive investigating seasons.

Data of the overall means of the two seasons and their statistical analysis showed clearly that the traps located towards south direction lead to attract the highest population density of whiteflies, while, those located in the west direction trapped the lowest counts of whitefly adults.

Studies conducted by Nucifora *et al.* (1983) showed that the yellow sticky board traps alone could protect tomato crop from whitefly if they were exposed at the first sign of adults. Gillespie and Quring (1987) & Edigaryan and Eritsyanyan (1988) and El-Dessouki *et al.* (2008) recorded that yellow sticky traps were highly effective in capturing whitefly adults and the use of traps reduced pesticide costs and increased tomato yield. These results are in partial agreement with those obtained by Patel and Raman (2000) who found that the eastern direction was the more suitable for attracting the maximum numbers of *B. tabaci* adults from cotton plants followed by northern, southern and western directions. On the other hand, they disagree with Emam (1999) who recorded that the highest number of *B. tabaci* adults trapped on yellow sticky trap was on those facing northerly and least numbers were trapped on those facing southward.

Generally, all studied insect species recorded the highest seasonal mean numbers on the yellow sticky board traps faced to east direction during the two tested seasons, except for *E. lybica* in case of peppermint which was attracted to traps faced to north direction during first season. On the other hand, these insects showed the lowest numbers at the west direction traps except for *A. gossypii* in case of peppermint which recorded the lowest average numbers at north direction.

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تأثير الاتجاهات الرئيسية على كفاءة المصائد الصفراء اللاصقة في جذب أهم الآفات الحشرية
التي تصيب بعض النباتات الطبية

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أجريت هذه الدراسة في محطة معهد بحوث وقاية النباتات بمدينة قها- محافظة القليوبية خلال الموسمين ٢٠٠٦ و ٢٠٠٧ حيث تم وضع المصائد الصفراء اللاصقة في اتجاهات الشمال، الجنوب، الشرق والغرب وذلك بهدف دراسة تأثير تلك الاتجاهات على كفاءة هذه المصائد في جذب حشرات مَن القطن، جاسيد القطن والذبابة البيضاء التي تصيب نباتات الجوار، الكركدية والنعناع البلدي. وقد بينت نتائج هذه الدراسة للموسمين معاً أن للاتجاهات تأثير معنوي واضح على كفاءة تلك المصائد حيث أظهرت النتائج أن الحشرات الثلاثة المختبرة في كل من محصولي الجوار و الكركدية قد انجذبت بشدة إلى المصائد الصفراء اللاصقة المتجهة إلى الشرق حيث سُجل أعلى تعداد لها على تلك المصائد وهو ١١,٨٨، ١٦,٩٧ و ١٥١,٨٩ فرد/مصيدة خلال الموسم الاول و ١٥,٤٠، ٢٢,٤٠ و ٢٠٥,٣٧ فرد/مصيدة للموسم الثاني على الترتيب. أما في نباتات النعناع البلدي فقد تشابهت النتائج مع نتائج المحصولين السابقين في حالة حشرتي مَن والذبابة البيضاء حيث تم الحصول على أعلى تعداد لهما خلال موسمي الدراسة معاً على المصائد المتجهة ناحية الشرق وهو ١٢,٦٣ و ٢١٩,٦٢ فرد/مصيدة للحشرتين على الترتيب. أما في حالة حشرة الجاسيد فقد اختلفت النتائج عن سابقتها حيث تم تسجيل أكبر تعداد لهذه الحشرة على المصائد المتجهة ناحية الشمال و كان متوسط الأعداد في الموسمين معاً ١٢,٧٠ فرد/مصيدة. على العكس من ذلك فقد تم تسجيل أقل تعداد للحشرات المدروسة على المصائد المتجهة ناحية الغرب عدا حشرة مَن الذي يصيب النعناع البلدي حيث سُجل أقل تعداد لهذه الحشرة على المصائد المتجهة ناحية الشمال حيث كان متوسط الأعداد خلال الموسمين معاً ٨,١٨ فرد/مصيدة.