

Monitoring of *Drosicha mangiferae* in Different Varieties of Mango through Various Colored Sticky Traps in Tando Jam

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Abstract: The experiment was carried out on Monitoring of the *Drosicha mangiferae* in different varieties of mango through various colored sticky trap in Tando Jam at Horticulture Garden, Sindh Agriculture University, Tando Jam from November 2018 to March 2019. The orchard comprises four mango varieties such as Chausa, Langra, Sindhri and Sonaro, total five mango trees were selected randomly, one from center and four from different sides (North, South, West, and East) and Three different colors of the sticky traps i.e. Blue, green and yellow were installed. The experiment on the monitoring and influence of color traps on the attractiveness of the population of *Drosicha mangiferae* in different varieties of mango revealed that black ants, the damselfly, the *Brumus* beetle, the zigzag beetle, the spiders, the mite, the mango mealy bug and the mango hoppers were attracted the colored traps. Maximum 150 males of *Drosicha mangiferae* were caught on yellow sticky traps compared with green 50 and blue 15. The appearance of adults on traps was recorded during April and May 2019. However, maximum catches were recorded in April month. The total catches of all three traps indicated that the traps installed on Sindhri variety had maximum catches 110 adult male *Drosicha mangiferae* in 41, 33 and 28 on Sonaro, Chausa and Langra mango varieties, respectively. The adult females of mango mealy bug collected from the branches of mango plant having sticky traps installed showed significant difference in oviposition that only 70% of the females laid eggs, which were collected from the branches that had sticky blue traps. Among them, 10% of females laid > 100 eggs, while the remaining 60% laid <100 eggs. Similarly, 70% of the females laid their eggs that were collected from the sticky green trap branches. Only 30% of the females laid > 100 eggs. 40% of the females laid their eggs, which were collected from the branches that had sticky yellow traps. 30% of them laid <100 eggs. It was concluded that females that laid less than 100 or no eggs were considered unmated females; however, less than 100 eggs could be due to the reproduction of parthenogenesis. Since the sticky traps, especially the yellow color, effectively captured the male *Drosicha mangiferae* that reduced the possibility of mating with the females, consequently, most of the females descended from the tree without mating. Therefore, it reduced egg production in *Drosicha mangiferae*. While, overall the total 414 insect pests (arthropods) including *Drosicha mangiferae* on yellow sticky trap followed by 119 and 115 green and blue sticky traps were trapped on Sindhri, Sonaro, Chausa and Langra mango variety trees, respectively.

Keywords: *Drosicha mangiferae*; colored sticky trap; Chausa; Langra; Sindhri; Sonaro.

1. INTRODUCTION

Mango *Mangifera indica* L. is known the king of fruits, the second major fruit crop in Pakistan and also, one of the most important fruit in the world, as well as in Pakistan. Pakistan is 3rd largest producer and the 5th largest exporter of mango in the world [16]. Mango is delicious fruit that an excellent source of vitamins A, B and C, and contains water, protein, sugar, fat, fiber and iron, etc, which are also processed into preserves, juices, jams, jellies, nectars and crisp mango chips, which are consumed as snacks, young and unripe fruits are used as pickles, chatnies, murabas etc [14] and [17]. Mango is grown in just under ninety tropical, and subtropical countries of the world. India, China, Mexico, Thailand, the Philippines, Pakistan, Nigeria, Indonesia, Brazil and Egypt are, in that order, the ten most important mango producing countries in the world. Asia, the original home of the fruit, provides approximately 3/4 of the world's mangoes [14]. Pakistan is standing at 5th place by contributing 916.4 MT mangos, which is 3.9 % in the total world production [3] and [10]. The mango is grown in Balochistan and KPK, the fruit is grown mainly in Sindh and southern Punjab. Mirpur Khas and Multan are known for their huge mango

orchard. Hyderabad, Nawabshah, Naushahroferoz, Khairpur Mirs, Rahim Yar Khan, Bhawalpur, Muzaffargarh, Sheikhpura are important areas of mango cultivation in Pakistan. Production of mango in Khanewal, Sahiwal, Vehari, Okara, Faisalabad, Jhang, Toba Tek Singh and Sargodha etc is also considerable [14]. There are many varieties of mango which are being grown and famous in Pakistan, but some are very common i.e. Sindhri, Langra, Chausa, Fajri, Samar Bahisht, Anwar Ratole, Doshehri, Saroli, Tuta Pari, Neelam, Maldah, Collector, and Began Palli etc. [8]. Pakistani mangoes are mostly yellow when fully ripe, have a strong aroma and a sweet taste, no mango of any origin can compete in taste with the Pakistani mango [1] but production has been threatened by insect and disease problems. *Drosicha stebbingi* Green and more than 4000 species of fruit flies distributed all over the world. Mango mealybug *Drosicha mangiferae* Green and *Dacus zonatus* and *Dacus dorsalis* are the serious pests of mango in Pakistan. Their feeding process steadily weakens the branches, which leads to the falling of flowers, and the immature fruits. Mango mealy bug and fruit fly are serious pests of mango and are difficult to control by insecticides.

Testing several treatments developed an IPM strategy. Pheromone sticky traps can effectively attract males from a distance of approximately 91.44 m [13], [21] and [20] traps are cheap to prepare and easy to install on tree stem. The yellow sticky traps are effective in capturing the adult insects that other color sticky trap [19] and can be used for the controlling and monitoring the population of many pests [9]. The sticky bands along with burning and burying treatments significantly reduced the incidence about 0.00-15.79% infestation by *Drosicha mangiferae*. It is a harmful pest that seriously infests mango trees and could not be controlled by the exclusive use of insecticides, which led to the development of IPM strategies when developing different treatments including the use of sticky bands along with sticky traps that significantly reduced the mealy infestation to 16% [6]. The present study is planned to evaluate the effect on the mating of the female in the mealy bug of the mango by using the several colored sticky traps in different mango varieties. The *Drosicha stebbingi* is the most familiar dimorphic insect pest of mango trees [2]. The results of the experiments will be utilized in planning IPM strategies against mango mealy bug.

2. MATERIALS AND METHODS

The experiment was carried out in mango orchard infested with mango mealy bug at Horticulture Garden, Sindh Agriculture University, Tando Jam from November 2018- March, 2019. The orchard comprises of four mango varieties such as Chausa, Langra, Sindhri and Sonaro, total five mango trees from each variety were randomly selected, one from center and four from different sides (North, South, West and East) of the particular area of the varieties planted in mango orchards. The sticky traps of different colors, i.e., blue, green and yellow, were installed on different sides of each tree. East, west and south of the mango trees at 1.5 – 2.15 meters above ground level. The traps were made of clean plastic sheets with a 5 mm grade. The size of each trap was 12” x12”. Grease as adhesive material was applied to the trap for attracting flying male of mango mealy bugs and the associated predators and parasitoids. The adhesive material was replaced with the fresh one at weekly intervals. The adult female of mango mealy bugs was collected separately while down ward movement from those mango branches having color traps installed. The collected females were then released into separate buckets (1.5’ high and 1.2’ dia) having soil clods to facilitate them to lay eggs. There were ten replications (10 buckets for each color trap) and one female was released in each bucket. After release of the females, the clods were gently taken out from each bucket twice a week to examine any fecundity by the female. The impact of male catches was determined through egg lying of the females. The females who laid more than 100 eggs were considered as mated females. The eggs laid less than 100 by the female might be the result of parthenogenesis reproduction, and those did not lay their eggs were considered virgin. Finally, the data were statistically analyzed through analysis of variance using Statitix 0.8.

3. RESULTS

The data in Table-1 show that the five different predators i.e black ants, spiders, *Brumus* beetle, Zigzag beetle, damsel fly and three mango pests namely mite, mango mealy bug and mango hoppers were attracted to the color traps. The maximum catches 514 predators and pests were recorded on yellow sticky traps followed by green 238 and blue sticky traps 143. Maximum 200 male mango mealy bug were attracted on yellow sticky traps compared with green 81 and blue 21. Further it was observed that traps installed before 10-04-2019 did not show any catches of male mealy bugs. The 1st appearance of adults was recorded on 10-04-2019 and continued till 01-05-2019. However, maximum catches were recorded on 24-04-2019. Analysis of variance showed that yellow sticky traps attracted significantly more insects ($F = 11.83, df = 2, P < 0.01$). LSD showed non- significant difference ($P < 0.05$) between insect catches on blue and green sticky traps.

TABLE-1: Population of *Drosicha mangiferae* and other arthropods on different varieties of mango

Arthropods	Color sticky traps		
	Blue	Green	Yellow
Mealy Bug	15	50	150
Black Ants	34	46	87
Spiders	6	9	9
L. B. Beetle	2	6	3
Zigzag beetle	2	1	3
M. Hopper	52	77	158
Mite	3	0	3
Damsel fly	1	1	1

The data in Table- 2 reveal that maximum catches of males *Drosicha mangiferae* were recorded on Sindhri variety. 5, 25 and 80 on blue, green and yellow sticky traps, respectively were installed on the branches of Sindhri variety tree. While traps installed on Sonaro variety had 2, 8 and 25 on blue, green and yellow sticky traps, respectively. The traps installed on Chaunsa had 4, 9 and 20 on blue, green and yellow sticky traps, respectively. Similar on Langra variety 4, 9 and 25 on blue, green and yellow sticky traps were installed, respectively. The total catches of all three traps indicated that the traps installed on Sindhri variety had maximum catches 121 male mealy bugs followed by Sonaro 58, Chaunsa 52 and Langra 45.

Table -2: Population of *Drosicha mangiferae* and other arthropods on different mango varieties in 10th April – 1st May 2019

Arthropods	Variety											
	Sindhri			Sonaro			Chaunsa			Langra		
	Sticky trap			Sticky trap			Sticky trap			Sticky trap		
	Blu	Gr	Yllw	Blu	Gr	Yllw	Blu	Gr	Yllw	Blu	Gr	Yllw
Mealy Bug	5	24	80	2	8	25	4	9	20	4	9	25
Black Ants	3	14	30	4	6	20	5	19	21	22	7	16
Spiders	2	2	1	1	2	4	1	4	2	2	1	2
L. B. Beetle	0	4	0	0	1	1	1	1	0	1	0	2

Zigzag beetle	1	0	1	1	1	1	0	0	1	0	0	0
M. Hopper	10	33	41	14	25	45	19	3	31	9	16	41
Mite	1	0	0	1	0	1	0	0	1	1	0	1
Damsel fly	0	1	0	1	0	0	0	0	0	0	0	1

The data in Table- 3 reveal that only 70% of the females laid eggs, which were collected from the branches that had sticky blue traps. Among them, 10% of females laid > 100 eggs, while the remaining 60% laid <100 eggs. Similarly, 70% of the females laid their eggs that were collected from the sticky green trap branches. Only 30% of the females laid > 100ggs. 40% of the females laid their eggs, which were collected from the branches that had sticky yellow traps. 30% of them laid <100 eggs. It was concluded that females that laid less than 100 or no eggs were considered unmated females; however, less than 100 eggs could be due to the reproduction of parthenogenesis. Since the sticky traps, especially the yellow color, effectively captured the male *Drosicha mangiferae* that reduced the possibility of mating with the females, consequently, most of the females descended from the tree without mating. Therefore, it reduced egg production in *Drosicha mangiferae*. To determine the impact of male trapping on the development of the *Drosicha mangiferae* population, the selected adult females of *Drosicha mangiferae* were taken from the branches of mango plants having color sticky traps installed to the laboratory for oviposition.

Table -3: Fecundity of females of *Drosicha mangiferae* collected from the braches having different color traps installed for male adult caches

Sticky trap	No. of females released	No. of females laid egg	No of females laid >100 eggs	No of females laid < 100 eggs
Blue	10	7	1	6
Green	10	7	3	4
Yellow	10	4	1	3

The data in Fig.1 show that overall the total 414 insect pests were trapped on yellow sticky trap followed by 119 and 115 green and blue sticky traps on Sindhri, Sonaro, Chaunsa and Langra mango variety trees, respectively.

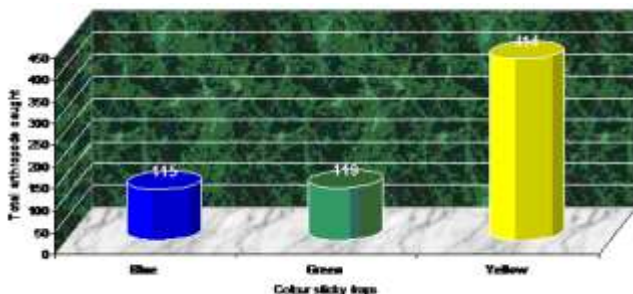


Fig. 01: Total arthropods trapped through different coloured sticky traps

4. DISCUSSION

The experiment was carried out on Monitoring of the *Drosicha mangiferae* in different varieties of mango

through various colored sticky traps in Tando Jam at Horticulture Garden, Sindh Agriculture University, Tando Jam from November 2018 to March 2019.

In the present study the arthropods and non arthropods i.e black ants, spiders, Lady Bird beetle, Zigzag beetle, damsel fly and three mango pests namely mite, mango mealy bug and mango hoppers were attracted to the color traps. The yellow sticky traps attracted maximum predators and male *Drosicha mangiferae* as compared to green and followed by blue sticky traps. The present study agrees with those [19] reported the responses by adults of *Plutella xylostella* to various colored sticky traps. The vinyl chloride plates showed that more adults were caught on yellow than the other colors tested, including clear, blue and red. Our study also agrees with those [15] suggested that the sticky traps catch pests. Sticky traps a very useful tool for early detection and management of pest populations such as winged aphids, whiteflies, thrips, leafminers, fungus gnats, shore flies and beneficial insects such as the whitefly parasitoid, *Encarsia formos*. Sticky trap colors that reflect certain wavelengths of yellow or blue are often used. White or red traps are also effective for some insects. The most studies show that blue traps are better at capturing western flower thrips and shore flies. The finding of [18], [5] & [4] also favor the use of this technique, they reported that sticky traps are most common types of traps in use, and it employs a sticky surface to retain or immobilize the attracted insects. Sticky traps are generally more efficient at catching the attracted insects. [9] reported that yellow sticky traps can be used for monitoring and controlling many pests. [20] also suggested yellow sticky cards to be used to trap the flying male mealy bugs. Result further showed that the appearance of adults was recorded from April 10, 2019 to May 1st, 2019. However, maximum catches were recorded on April 24th 2019. These finding are in agreement with those of [12] who reported migration of mealy bugs from the tree downwards to the ground and oviposition in the soil are generally confined to the months from April to June. However, the findings of [7] are little deviated; who reported that Chausa retained maximum population. This could be due to maximum plantation of Sindhri variety in Sindh conditions. The impact of male trapping on population of mealy bugs was determined through the fecundity of females, only 30% females laid their eggs, which were collected from the branches having yellow color sticky traps followed by the female collected from green and blue sticky traps. The trapping of males reducing the chance of mating with females, consequently majority of females went down the tree without mating. [20] mentioned that trapping of flying adult male mealy bugs is nothing but to preventing them from mating. Similarly, [21] mentioned that catching of male through pheromone sticky traps diminishing the chance of mating and reproduction of *Planococcus kraunhiae* and successfully reduce damages on fruits by this *Drosicha mangiferae* in Japanese persimmon orchards.

5. CONCLUSIONS

On the basis of the study results is concluded that:

1. Maximum male of *Drosicha mangiferae* and predators attracted by yellow sticky traps.
2. In the branches of the mango variety Sindhri, the maximum of male *Drosicha mangiferae* was captured followed by the variety Sonaro, Chaunsa and Langra.
3. The capture of adult males reduces the possibility of mating with females, so that only 40% of the females of yellow sticky traps were fertilized compared to 70% of females of green and blue, respectively.

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