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Systematic Study of Inter-Relation Between Nectary Glands and Insects and Making an Effective Fruit Fly Trap for Farmers

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***Abstract*: A brief idea about the project: The project revolves around the study of Nectary Gland and it's inter-relation between the insects like ants and bees. We also studied the reason behind the decline of these insects. We studied the root cause of it and found out a solution. We prepared an effective fruit fly trap to catch the fruit flies.**

***Keywords*: Fruit fly, fruit flies, nectary glands, nectaries, farmers.**

1. Explanation

First we studied the nectaries under expert guidance at Maharashtra Nature Park and observed which insects get attracted to which type of Nectaries. We understood that chemical used by the farmers were responsible for the reduction in the population of the insects like bees and ants which do not harm but are helpful to the plants. For this, we had to undergo a deep research work. We then created a fruit fly trap that was made from the waste materials. For the trap model, we collected waste plastic bottles from different places surrounding our school premises. We restructured the model such that it can be used as a trap. We collected waste fruit peels like citrus and sugarcane molasses and prepared the bait for catching fruit flies. The fruit peels were crushed down into a broth. Different broths were made of different pH values according to the soil pH values. The trap was then used for trapping fruit flies under the community work for farmers. The broth can be disposed directly into the soil and refilled again. We also prepared a disc in place of broth but it was not that successful. We compared broth trap, disc trap and synthetic trap. We came to a conclusion that our broth trap was proved to be more efficient than the commercial one.

2. Need Statement

First we conducted a deep study of nectary gland and insects that helps in pollination and protection of plants. We then prepared a sustainable fruit fly trap containing organic broth as a bait. We compared it with the commercial product. We wanted to maintain the population of important insects like bees and ants which is getting reduced in the farm area due to the use of chemicals in the farms.

3. Introduction

Nectar, a sugar containing solution, is secreted by nectary which most frequently accord on insect and bird pollinated plants. Nectary may consist of specialized tissue which differs in structure from the neighbouring tissues; i.e., structural nectary.

Many insect pollinated plants produce nectar which attracts insects. This substance is recreated by special cellular structures, the nectaries.

We came across an issue which farmers faces because of the nuisance created by the fruit flies, farmers have to make use of chemicals to keep the pests away. This also affects the insects like ants and bees which come to the plants for sugary fluid from nectaries but do not harm them.

4. Aims

1) To study the inter-relation between the nectary gland and insects like ants and bees.
2) To study the organic fruit fly trap along with it's efficiency.

5. Objectives

1) To collect different plant samples with nectary glands.
2) To study the types of nectaries.
3) To classify the nectary glands according to the types.
4) To study the insects visiting the plants.
5) To tackle the problem of fruit flies sustainably.
6) To check the pH values of soil samples and broth samples.
7) To come up with a sustainable fruit fly trap.

6. Hypothesis

1) There may be symbiotic association between nectary gland and insects as per the position of the Nectary gland.
2) If pesticides are used then biodiversity may get harmed.
3) Chemicals may make the soil infertile.

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7. Methodology

A. Observation

We studied around 22 plants having nectary glands. They were examined for nectaries as well as their symbiotic association with insects like ants and bees. The plant samples were observed at Maharashtra Nature Park, Mumbai.

We sorted out the nectaries into two major types: Floral nectaries and Extrafloral nectaries. The morphology of these nectaries were studied.

Under floral nectaries,10 plants were kept. On the other hand,12 plants were observed for extrafloral nectaries which were present near the petiole, base of the flower, stem, etc.

The morphology of these nectaries differed then that of floral nectaries.

8. Experimentation

Making of sustainable fruit fly trap:

- Take a waste plastic bottle of 250ml/500ml.
- Cut the bottle into half.
- Invert the upper part of the bottle upside down.
- Fill in 30ml of broth into the lower half of the bottle.
- Make an appropriate size of holes into the lid of the bottle.
- Place the Inverted upper half and fix it into the lower half.
- Use it for catching fruit flies.

pH value of soil checked: 7 samples of soil were collected from different farms and nurseries. Their pH values were checked. Broth according to these pH values were prepared.

Making of organic broth for sustainable fruit fly trap:

- Collect fruit peels from fruit juice vendours.
- Check the pH values: Citrus fruit peels are acidic and sugarcane crumbles are basic.
- Prepare the acidic, basic and neutral Broths. [Add Epsom salt (1gm) for every sample.]
- Acidic Broth: Citrus content must be comparatively more than that of sugarcane content and water.
- Basic Broth: Sugarcane content + Epsom salt must be comparatively more than that of citrus content and water. [Note: Fixed contents given in the observation table.]
- Neutral Broth: 50ml of water + 20gm Citrus content + 20gm Sugarcane crumble content.
- Crush it well into a broth.

Disc making process: [To see whether the shelf life of the bait can be increased, we made a disc of the broth.]

Protocol:

- For making a solid disc of the broth, we require the pulp containing the broth content. The pulp with less moisture is needed.
- For this, (to make neutral disc) 20gms of citrus pulp, 20gms of sugarcane molasses,10ml of water and 10gm of corn flour are taken.
- This pulp is inoculated in a disc mould, which is then covered by a layer of muslin cloth and blotting paper.
- This pulp is compressed with the wooden log. The excess moisture is absorbed by the blotting paper and muslin cloth.
- The pulp becomes disc shaped.
- To remove the excess of moisture, the disc was roasted for 5 minutes.
- Initially, the weight of the pulp taken was 290gms to 300gms and after the removal of moisture, the weight becomes 178 -180gms.

Table 1
pH values of soil samples

Sr. No.	Soil Samples (Place of Collection)	pH value
1.	School's Nursery	8.00
2.	Farm at Dahanu	8.5
3.	Farm at Bhilad	7.9
4.	Sanjay Gandhi National Park	7.0
5.	Outside School's premises	4.0
6.	Nearby Garden	3.0
7.	Kora Kendra Nursery	6.0

A. Data Collection

Table 2

Collection of Fruit peels and crumbles.

Broth making Quantification chart:

Sr. No.	Water in ml.	Citrus (gm)	Sugarcane (gm)	Shelf life (days)
1.	Broth- 50ml	20	20	10 days
2.	Broth- 100ml	20	20	5 days
3.	Broth- 80ml	20	20	7 days
4.	Disc (minimum)	20	20	10 days

Sr. No.	Sam-ples	Citrus crush (gm)	Sugar-cane crumble (gm)	Water (ml)	Epsom salt (gm)	PH value	Results
1.	A1	12	8	25	1gm	3.92	Strongly acidic
2.	A2	14	6	25	1gm	4.00	Acidic
3.	A3	16	4	25	1gm	5.42	Slightly acidic
4.	N	10	10	25	1gm	7.00	Neutral
5.	B1	8	12	25	1gm	8.97	Slightly basic
6.	B2	6	14	25	1gm	9.77	Strongly basic
7.	B3	4	16	25	1gm	7.63	Basic

Sr. No.	Characteristics	Organic Broth Trap	Organic Disc Trap	Synthetic Trap
1.	Nitrogen content	10.283%	10.199%	0.00%
2.	Microbial Action	8.04×10^4 cfu/gm	6.77×10^5 cfu/gm	Nil
3.	Carcinogenic Effect	No	No	Yes (Methyl eugenol)
4.	Biodegradability	Yes	Yes	No
5.	Harmful effects on environment	No	No	Yes
6.	Used as fertilizer	Yes	Yes	No
7.	No. of flies trapped (5traps/acre)	18	06	12
8.	Cost per piece	Zero rupees	Rs. 2	Rs. 67

B. Data Analysis

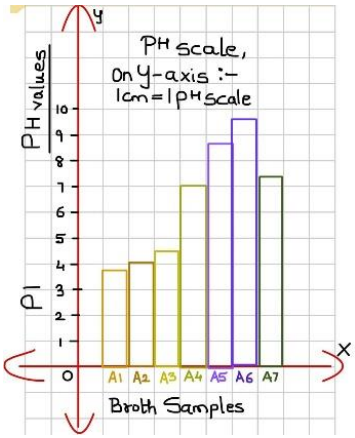

Fig. 1. Broth samples vs. pH values

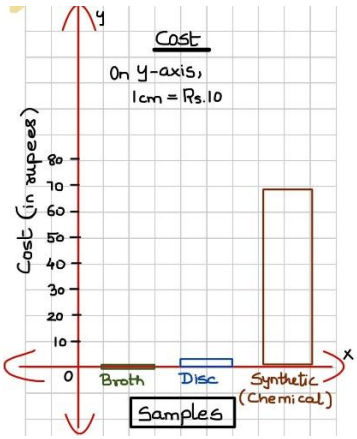

Fig. 2. Samples vs. Cost

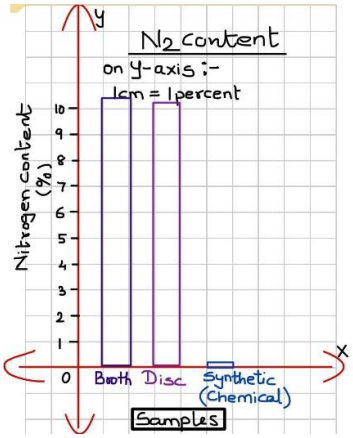

Fig. 3. Samples vs. Nitrogen content

9. Conclusions

The benefits of our sustainable fruit fly trap:

1) *Symbiotic association:* It was observed that there is a strong symbiotic association between insects like ants and bees and the plant nectaries. Bees help in pollination process and ants help protect the plants in turn of the nectary juice.
2) *Harmful effects of synthetic chemicals:* The commercial trap contains synthetic Methyl Eugenol because of which the environment can be damaged on disposal.
3) *Soil fertility:* Our organic broth for trap contains some amount of Nitrogen and can act as a fertilizer but on the other hand the synthetic chemical present in the commercial trap is not suitable for disposing in the environment.
4) *Biodegradablity:* Our organic broth is absolutely sustainable and Biodegradable. Once we use it the flies get trapped, after 10 days we can directly dispose it in the soil and the trap container can be refilled.
5) *pH value:* We created broth according to the pH value of the soil. This makes it more sustainable and suitable for the soil.
6) *Plastic waste:* We used waste plastic bottles as our trap model, but the commercial traps are made up of new plastic which leads to more plastic accumulation in the environment.
7) *Health hazards:* Our organic broth does not harm any living things in the ecosystem except the fruit flies that destroy the economically important fruits and vegetables. On the other hand, synthetic chemicals like Methyl Eugenol has adverse effect on human health.
8) *Cost/expense:* Our fruit fly trap is not only sustainable but also cost effective. It takes zero rupees to prepare the trap. Unlike the commercial trap which cost rupees 67 to 70 per piece.
9) *Community Work:* Our project was very fruitful to the farmers. We did our community work for the benefit of the farmers. A group of farmers from Dahanu and Bhilad were selected. We used our organic broth trap and showed them a live demonstration of its sustainability, in comparison with the synthetic trap. We used 5 traps each per acre and they were stunned by our organic broth trap. We did soil testing there and provided them a suitable sample of organic broth.
10) *Failure of one experiment, i.e., using disc for trap:* We made the disc of broth but it didn't turn out to be that successful in comparison with the actual broth. So we provided the farmers original broth.

Doesn't matter if disc making experiment was a failure, it still can be a conclusion. Ultimately, the organic broth trap was proved to be the best!

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