Feeding preference of *Achatina fulica* attacking vanilla and its management through barrier substances

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ABSTRACT: The present study was conducted to understand the most preferred feeding site on vanilla and the most preferred host for the Giant African snail, *Achatina fulica* B. On vanilla, terminal leaves were most preferred followed by bottom leaves. Among six different hosts tested, cauliflower and cabbage leaves were highly preferred by the snails which can be used to attract snails from vanilla field in future. Besides, the present investigation also indicated that barrier substances can also be used to arrest the movement of snails from one place to another. Among the four substances tested, copper sulphate even at 3cm thickness and common salt at 6cm thickness were found to be very effective barriers against these snails.

Keywords: Giant African snail, bait traps, vanilla

INTRODUCTION

Vanilla (*Vanilla planifolia*) is the second most important spice crop next only to saffron in terms of economic value and it is one of the expensive spices traded in global market. It is commonly known as ‘Orchid of Commerce’. A wide array of insects damages vanilla (Vanitha, 2005). One among the pests causing severe injury to vanilla is the Giant African snail *Achatina fulica* Bowdich. The Giant African Snail consumes almost all parts of vanilla viz., shoot tip, tender leaves, shoot, basal stem region, inflorescence, beans of vanilla. The attack results in weakening of the plants and makes them more susceptible to pathogens and sun scorch. The present study was taken up to find out the feeding preference of this snail to vanilla and other hosts. Since vanilla is grown mostly under organic condition, an experiment was conducted to test the effectiveness of some barrier substances against snails.

MATERIALS AND METHODS

Experiments were conducted in net house at Tamil Nadu Agricultural University, Coimbatore to evaluate the feeding preference of *A. fulica* and to evaluate different barrier substances for its management

Feeding preference of *A. fulica* on vanilla leaves

To understand the most preferred feeding site on vanilla for the snails, young, medium and old leaves representing the top, middle and bottom portions of vanilla plants were collected from one and half year old plants in a vaniillery at Vandalayamaram (Coimbatore District, TamilNadu). The snails were allowed at varying numbers at 1, 2 and 3/box to feed on the leaves under no choice as well as free choice condition. Four replications were maintained for each set. The leaf area consumed was measured graphically after 24 h and expressed in terms of cm².

Assessment of feeding preference of *A. fulica* on different host plants

The discs of 7.5cm diameter were made from five different preferred hosts viz., cabbage leaf, cauliflower leaf, tomato leaf, potato tuber and carrot tuber along with vanilla leaf. The discs were then placed randomly over a 2cm thick wet sand layer in a tray and was kept inside a glass-topped wire mesh cage. Care was taken to maintain high humidity inside cages by keeping wet cotton swabs at the corners of cages. Since discs were being kept inside humidity rich chamber, they were weighed after one hour to record the initial weight of samples. Snails of medium size, pre-starved for two days were placed over the discs and confined with perforated plastic cups of 8cm dia x 11cm height. The area consumed as well as the weight of the discs were recorded after 12 hours. The discs were replaced with fresh ones whenever necessary. The same experiment was conducted in free choice condition also. The above set of experiment was replicated thrice.

Barrier substances

A laboratory experiment was conducted to evaluate four barrier substances viz., Copper sulphate (CuSO₄), Common salt (NaCl), Bleaching powder (CaOCl₂) and Powdered quartz (‘Kola podi’) against the movement of *A. fulica*. The experiment was conducted using circular plastic trays of 45cm diameter and 15cm height. Wet sand was applied as a layer of 3cm thickness in the trays. The barrier substances were applied as a hollow
Feeding preference of *Achatina fulica*

circle of 3 and 6 cm thickness of 0.5 cm height. The inner diameter of the hollow circle was kept at 10 cm where the snails were supposed to be released. Trays without any barrier substances served as control. A grown up snail (6–7 cm shell length) was released at the center of the barrier circle and the preferred host, viz., cauliflower leaves was placed outside the circle to attract snails, so as to induce them to cross the barrier. Nine such trays were kept for each treatment, where each snail represents one replication. The trays were kept inside the glass topped wire mesh cages and moistened cotton swab were placed inside cages to maintain sufficient humidity to keep snails active. The number of snails that had crossed the barriers was recorded up to 48 h.

RESULTS AND DISCUSSION

Influence of leaf age on the feeding preference of *A. fulica*

Under no choice condition, more consumption was recorded in terminal leaves followed by bottom leaves, whereas the middle leaves were least preferred. For the box with one snail, the leaf area consumption recorded was 6.55, 2.21 and 5.14 cm$^2$ respectively over terminal, middle and bottom leaves. The leaf area consumption on the terminal leaves was 6.55, 13.54 and 29.52 cm$^2$ for one, two and three snails/tray respectively (Table 1). Though the leaf area consumption increased with increase in number of snails in all three cases, increase was more for terminal leaves. In free choice condition also, the consumption was more on terminal leaves (8.46 cm$^2$) followed by bottom leaves (2.65 cm$^2$) at 1 snail/box. It was observed that, with the presence of terminals, the snail preferred to consume mainly on terminals (8.46 cm$^2$) followed by bottom leaves (2.65 cm$^2$) and only negligible amounts on middle leaves (0.31 cm$^2$). It was clear that the leaf consumption was more at higher population (Table 2). In the present study, it is manifested that the terminal and basal leaves were preferred compared to middle leaves. Nair and Sandanandan (1974) also observed the differential preference of *A. fulica* in the same plant, where they recorded more feeding damage on the stem epidermis and terminals followed by basal leaves in arecanut and coconut.

Assessment of the feeding preference of *A. fulica* on different hosts under free choice and no choice condition

Under no choice condition, the order of preference of snail to different hosts was cauliflower > cabbage > potato > vanilla > carrot > tomato. After 12 h of release, highest consumption was recorded in cauliflower (24.63 cm$^2$) followed by cabbage (29.98 cm$^2$) and the least was in tomato leaf (0.40 cm$^2$) (Table 3). Under free choice condition also the higher preference of snails was to cauliflower leaves followed by cabbage leaves which recorded consumption of 160.87 cm$^2$ and 89.0 cm$^2$ weighing 65.73 g and 45.59 g respectively followed by potato (2.69 g). Since in free choice condition, damage to vanilla was less compared to crucifers, it is very well suggested that, a layer of cabbage and cauliflower leaves can be spread in and around vanilla field so as to attract these snails which can be collected and destroyed later. This was in agreement with the findings of Mead (1961), who stated that the crucifers were the most preferred hosts of the snails. Similarly, Mehendale and Bhagwat

### Table 1. Effect of the stage of vanilla leaves on the feeding preference of snails (No choice condition)

<table>
<thead>
<tr>
<th>Category</th>
<th>Area consumed (cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 snail/box</td>
</tr>
<tr>
<td>Terminal leaf</td>
<td>6.55 (3.75)$^a$</td>
</tr>
<tr>
<td></td>
<td>29.52 (1.65)$^c$</td>
</tr>
<tr>
<td>Middle leaf</td>
<td>2.21 (2.44)$^c$</td>
</tr>
<tr>
<td>Bottom leaf</td>
<td>5.14 (3.30)$^b$</td>
</tr>
<tr>
<td></td>
<td>20.05 (3.30)$^b$</td>
</tr>
</tbody>
</table>

Means followed by a common letter are not significantly different at 5 % level by DMRT

Figures in parentheses are square root transformed values.

* Mean of three replications

### Table 2. Effect of the stage of vanilla leaves on the feeding preference of snails (Free choice condition)

<table>
<thead>
<tr>
<th>Category</th>
<th>Area consumed (cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 snail/box</td>
</tr>
<tr>
<td>Terminal leaf</td>
<td>8.46 (2.99)$^a$</td>
</tr>
<tr>
<td></td>
<td>13.54 (3.14)$^c$</td>
</tr>
<tr>
<td>Middle leaf</td>
<td>0.31 (0.90)$^c$</td>
</tr>
<tr>
<td>Bottom leaf</td>
<td>2.65 (1.77)$^b$</td>
</tr>
</tbody>
</table>

Means followed by a common letter are not significantly different at 5 % level by DMRT

Figures in parentheses are square root transformed values.

also reported cabbage and cauliflower were most attractive to the snails and they could even be used as food lure traps for snails.

Barriers

Among the four substances tested, CuSO$_4$ was found to be more effective at both thicknesses tested (Table 4). Not even a single snail had crossed the CuSO$_4$ barrier and excess mucus secretion was noticed at the points where snails tried to touch the barrier. This is in accordance with the findings of Henderson (1968) and Sullivan and Cheng (1976) who also noticed excessive secretion of mucus from the sole of snails upon contact with CuSO$_4$. The second best barrier was common salt where none of the snails crossed the barrier of 6 cm thickness and only two out of nine snails could successfully cross the barrier of 3 cm thickness even after 48 h of release. Prasad et al. (2004) reported earlier that effective prevention for the movement of A. fulica was achieved by application of a five cm band of common salt. Among the other two barriers,
bleaching powder was noted as comparatively more effective than powdered quartz, because it allowed 44 and 55 per cent of snails to cross over the barrier at 3 and 6 cm thickness respectively (Table 4). Though powdered quartz was found to be effective at 12 HAT, as time advanced all the snails crossed the barrier at its both thicknesses.

In all the four cases, while the snails crossed the barrier, mucus secretion was observed and it was highest in CuSO₄. The present study suggests that, to arrest or divert the movement of snails away from vanilla plants, copper sulphate and common salt can be placed as a band around the vanillaries or between the vanillary and the breeding sites of snails. This is in agreement with the findings of Godan (1983) who reported that gastropod damage was kept within tolerable limits in cabbage fields by spreading copper sulphate one to two weeks before planting. Besides, along with sodium chloride, several dehydrating substances such as cattle salt, caustic soda, kainite or completely dried quick lime sodium carbonate, potassium chloride, sodium nitrate, plaster of Paris, barley chaff, chopped straw, pine needles and fine sand were also found as effective barriers against snails (Tomaszewski, 1949 and Godan, 1983).

REFERENCES


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