EVALUATION FOR EFFECTIVENESS OF ORGANIC INPUTS AGAINST INSECT-PESTS OF CABBAGE

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INTRODUCTION
Cabbage (Brassica oleracea L. var. capitata) is a main vegetable cash crop of Himachal Pradesh grown under organic and conventional systems of agriculture (Anonymous, 2013). Crop has been cultivated more intensively and succumbs to varied infestation by over 42 insect species (Hasan and Ansari, 2010). Diamondback moth (Plutella xylostella Linnaeus), cabbage white butterfly (Pieris brassicae Linnaeus) and aphid (Brevicoryne brassicae Linnaeus) are of major significance. B. brassicae may cause up to 80 per cent loss by leaf distortion and poor growth (Munthali, 2009). The larvae of P. brassicae, and P. xylostella eat the leaves of plants and contaminate the marketable heads of crop and have been reported to cause up to 24 and 90 per cent damage, respectively (Rejesus, 2001; Smith and Villet, 2002). Frequent applications of insecticides against these insects, though are undoubtedly effective for averting attack but has resulted in various environmental and related health problems (Sudarshan and Pijush, 2010; Bhusan et al. 2011). Tamoghna et al., 2014 developed safer organic modules to natural predators and pollinators of brinjil crop while Sharma et al., 2014 has tested the six organic modules against cabbage insect pests in mid hill zone of Himachal Pradesh. Under organic agriculture there is a need to have alternatives of synthetic pesticides for management of insects associated with the crop. Among the commonly used alternatives as plant extracts and formulations of Azadirachta indica, Lantana camera, Eupatorium spp. and Melia azadirach are promising against aphid, cabbage butterfly and diamondback moth (Sood et al., 2000; Gnanasambandhan et al., 2009; Yadav et al., 2009; Yankanchi and Patil, 2009). Many potential microbial pesticide formulations have also entered in the market (Muthukumar and Sharma, 2007; Kumari and Singh, 2009; Sharma and Gupta, 2009; Nethravati et al., 2010). The study was undertaken with an objective to evaluate some organic inputs for their effectiveness which can be replicated under field conditions while scheduling the organic spray modules.

MATERIALS AND METHODS
Organic inputs as in Table 1b were prepared (Anonymous, 2010) while biopesticides procured from local market (Table 1a). Efficacy of these treatments were tested under laboratory conditions with three replications by employing leaf dip technique against aphid and cabbage butterfly while direct spray on pupae of diamondback moth with slight modifications in FAO, 1979. The procedure involved for the exposure of respective insects; fresh organically raised cabbage leaves were cut into discs of uniform size and dipped for 30 seconds in respective organic input concentrations. These shade dried discs later fitted into the Petri plates provisioned with moistened filter paper at the base. 30 aphids/plate per treatment were released while in case of cabbage butterfly 5 neonate larvae/plate were released. In case of diamondback moth seven organic inputs tested the six organic modules against cabbage insect pests in mid hill zone of Himachal Pradesh. Under organic agriculture there is a need to have alternatives

KEY WORDS
Cabbage
Brevicoryne brassicae
Pieris brassicae, Plutella xylostella

ABSTRACT
Organic agriculture is increasing in popularity worldwide due to the rapidly growing market but insects present a major pest challenge that negatively impacts crop. To successfully manage an organic crop, effective insect management is a key. Therefore, laboratory studies for evaluation of organic inputs against key insect pests of cabbage were conducted at CSK HP Agricultural University, Palampur during 2012-2013. Aphids (Brevicoryne brassicae) were exposed to seven treatments till 72 hours and their mortality was recorded at 24, 48 and 72 hours of exposure; among which neem oil @0.3% resulted in 100% mortality (30.0 aphid) followed by 81.1% mortality (24.3 aphid) in aqueous extract of Eupatorium @10%. Using eight treatments by leaf dip technique against neonate larvae of Pieris brassicae, Bacillus thuringiensis (16000 IU/ mg) gave complete mortality (5.0 larvae) and was followed by neem oil (0.30% with66.7% mortality (3.3 larvae). Diamondback moth (Plutella xylostella) pupae were exposed to eight treatments to assess antijuvenoid effect where neem oil caused 60% reduction (2 pupae emerged out of 5 pupae) compared to 20% reduction in Melia extract. As per controlled conditions neemolican effectively manage cabbage aphid and DBM while Bt can shield cabbage butterfly. The inference of this study may help in devising the spray modules in organic insect management.

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were sprayed on 5 laboratory reared pupae per treatment per replication. Petri plates were kept in incubator at constant temperature (27 ± 1°C) and relative humidity (65 ± 5%). Data on mortality of aphids and larvae of cabbage butterfly was recorded at 24, 48 and 72 hours of their exposure to treatments. In case of diamondback moth pupae were observed daily for adult emergence and data were recorded till 5 days for emergence. The pupae which did not transform to adults were considered dead. The per cent reduction in insect numbers was worked out by using modified Abbott’s Formula (Fleming and Retnakaran, 1985). The data was subjected to statistical analysis.

RESULTS AND DISCUSSION

Cabbage aphid (B. brassicae)

The studies conducted on evaluation of seven organic inputs at field strength doses including untreated control revealed that exposure of aphids to neem oil (0.3%) and Eupatorium extract (10%) for 48 hours caused significantly higher percent mortality of 48.9 and 44.4% and 14.7 and 13.3 aphids, respectively (Table 2). Increase in mortality was observed with extended exposure for 72 hours in all the treatments but neem oil followed by Eupatorium extract resulted in highest mortality among all the treatments as 100 and 81.1%, i.e. 30.0 and 24.3 aphids, respectively. However, all the organic treatments reflected higher mortality over control but significantly higher mortality was observed by Melia and panchgavya treatments. These results are broadly in conformity with the findings of (Heidi and Eileen, 2008; Sharma and Mehta, 2009) as have documented neem oil and Eupatorium extract as effective treatments against cabbage aphid under laboratory conditions. Similarly, Patil and Patel, 2014 have found neem oil @ 0.5% in little higher concentration effective against Aphis gossypii in isabgol crop under field conditions.

Cabbage butterfly (P. brassicae)

The results obtained during laboratory evaluation on effectiveness of eight organic treatments against neonate larvae of P. brassicae (Table 3) revealed that among all the treatments, Bt (16000 IU/mg) followed by neem oil (0.30%) and Melia extract (10%) were found highly effective against cabbage butterfly and caused 100%, 66.7% and 60% larval mortality, respectively after 72 hours of exposure. The results are in conformity with Zhu (1989), who has reported that the extracts of M. azedarach caused an inhibition of metamorphosis and sensitivity to 1st and 2nd instar larvae of P. brassicae. Sharma and Gupta (2009) showed higher mortality of larvae by Melia extract while Singh et al. (2010) have advocated the superiority of Bt against its larvae and their findings are in close proximity with our results for the menace of this pest. Present findings are also in conformity with the findings of Purnik et al., 2002 and Mahesh and Men, 2007, who have documented that Bt formulations were effective against Lepidopterous larvae including cabbage butterfly and brinjal shoot and fruit borer Diamondback moth (P. xylostella)

Eight treatments i.e. Bt, Melia extract, neem oil, V. lecanii, panchgavya, NSKE, Eupatorium extract and dashparni were used to know their effect on the emergence of P. xylostella. All the treatments resulted in complete emergence while neem oil (0.3%) and Melia extract (10%) gave 40 and 80% emergence, respectively (Table 4). The results so obtained

<p>| Table 1a: Details of biopesticides |</p>
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Common name</th>
<th>Trade name</th>
<th>Manufacturer</th>
<th>Active ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Verticillum lecanii</td>
<td>Biocatch</td>
<td>T. Stanes &amp; Company Ltd.</td>
<td>10^{1} spores/ml</td>
</tr>
<tr>
<td>2.</td>
<td>Bacillus thuringensis</td>
<td>Lipel</td>
<td>Agri life</td>
<td>16000 IU/mg</td>
</tr>
<tr>
<td>3.</td>
<td>Neem oil</td>
<td>Nimbecidine</td>
<td>T. Stanes &amp; Company Ltd.</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

<p>| Table 1b: Preparation and ingredients of organic inputs |</p>
<table>
<thead>
<tr>
<th>Sr.no.</th>
<th>Name of organic input</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Panchgavya</td>
<td>2 kg fresh cow dung, cow urine 1 lit, milk 2 lit, curd 2 lit and 1 kg desi ghee in 10 liters of water.</td>
</tr>
<tr>
<td>2.</td>
<td>Melia Extract</td>
<td>Pour 5 kg chopped leaves of Melia azadirach 5 lit cow urine and add 2 kg cow dung</td>
</tr>
<tr>
<td>3.</td>
<td>Lantana Extract</td>
<td>4 kg of fresh leaves in 2 lit of cow urine in equal amount of water.</td>
</tr>
<tr>
<td>4.</td>
<td>Eupatorium Extract</td>
<td>5 kg of fresh leaves in 12 lit of cow urine in equal amount of water.</td>
</tr>
<tr>
<td>5.</td>
<td>Cow urine</td>
<td>Fermented for 15 days before its use.</td>
</tr>
</tbody>
</table>

<p>| Table 2: Effect of organic inputs on mortality of B. brassicae under laboratory conditions |</p>
<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Treatment</th>
<th>Concentration</th>
<th>Mean aphid mortality after hour^*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>1.</td>
<td>Lantana extract</td>
<td>10%</td>
<td>1.0(1.3)</td>
</tr>
<tr>
<td>2.</td>
<td>Melia extract</td>
<td>10%</td>
<td>0.7(1.2)</td>
</tr>
<tr>
<td>3.</td>
<td>Neem oil</td>
<td>0.3%</td>
<td>3.7(1.2)</td>
</tr>
<tr>
<td>4.</td>
<td>Verticillum lecanii</td>
<td>10^{1} conidia/ml</td>
<td>1.3(1.4)</td>
</tr>
<tr>
<td>5.</td>
<td>Panchgavya</td>
<td>10 %</td>
<td>2.0(1.6)</td>
</tr>
<tr>
<td>6.</td>
<td>Lantana extract</td>
<td>5%</td>
<td>2.0(1.7)</td>
</tr>
<tr>
<td>7.</td>
<td>Untreated check</td>
<td>-</td>
<td>0.0(1.0)</td>
</tr>
<tr>
<td>8.</td>
<td>C.D.(5%)</td>
<td>-</td>
<td>N5</td>
</tr>
</tbody>
</table>

* n = 30 per replication; Figure in the parenthesis are the square root transformed values
clearly indicated that these two botanicals interfere in *P. xylostella* metamorphosis. The similar results which support our findings having adverse effect on transformation by neem oil against diamondback moth have also been reported by Schmutterer, 1990 and Laxmikant, 2009. Azadiractin have also been advocated to affect the emergence of pupae due to hormonal disturbance and interference in chitin synthesis during the moulting (Mordue and Blackwell, 1993). Natthan et al., 2006 have also reported the effects of *Melia* extract in suppression and emergence of diamondback moth. Sharma et al., 2014 have documented neem oil @2.5-3.0% effective against larvae of this insect and support our findings, however, Ahmad et al., 2012 have advocated lower concentration of Neemazal i.e. 15-20 ppm for the management of DBM under laboratory conditions which may be due to the different formulation used by them in their study.

It can be advocated from the study that in cabbage crop grown organically; *B. brassicae* can be managed by using either neem oil 0.3% or *Eupatorium* extract 10%. *P. brassicae* can be checked by using Bt 16000 IU/mg or neem oil 0.3% while neem oil 0.3% or *Melia* extract 10% may be helpful for *P. xylostella* menace.

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**REFERENCES**


