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Evaluation of certain botanicals against *Aphis gossypii* (Glover) and *Brevipalpus californicus* (Banks) in Gerbera

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Abstract

An investigation was carried out in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014-2015 and 2015-2016 on organic approaches for management of pests of Gerbera. Although conventional pesticides having novel target site of action have been used for many years to counter the problem of insect pests, but the pests have developed resistance against these conventional pesticides in recent years. Plant derived products proved to be eco-friendly, residue free, biodegradable and cost effective and about 2400 plant species are reported to possess pest suppression properties. Therefore, certain plant extracts were used in the present investigation to assess their efficacy against *Aphis gossypii* (Glover) and *Brevipalpus californicus* (Banks) infesting gerbera. The treatments were leaf extracts of Datura (*Datura stramonium*) 5%, Basil (*Ocimum basilicum*) 5%, Curry (*Murraya koenigii*) 5%, Wood apple (*Aegle marmelos*) 5%, Patharua bihlangani, (*Polygonum hydropiper*) 5% and pestoneem @ 3ml/l as check. Out of these six botanicals, *P. hydropiper* gave the best result showing up to 94.06% and 94.26% reduction in *A.gossypii* population five days after application in the year 2015 and 2016, respectively. Similarly, in case of *B. californicus*, *P. hydropiper* gave the best result showing up to 95.59% and 96.17% reduction after five days of application in the year 2015 and 2016, respectively.

Keywords: Efficacy, *Aphis gossypii*, *Brevipalpus californicus*

1. Introduction

Gerbera jamesonii Bolus is an important commercial floricultural crop grown throughout the world. This perennial herb belonging to the family Asteraceae is native to South Africa and Asia. According to global trends in floriculture, gerbera occupies the 4th place among cut flowers [1]. Gerbera is often attacked by leaf miners, spider mite, thrips etc that are destructive and cause damage to the leaves as well as flowers [2]. Though synthetic pesticides for effective pest control in the agro ecosystem have been recommended, but its ill effects possess the potential threat to the environment and human health. Botanicals help in preventing the dumping of thousands of tons of pesticide on the earth and they are safer to the user and the environment because of their biodegradable nature. Botanicals are effective in very small quantities which affect only target pest and closely related organisms. The neem (*Azadirachta indica*) is a promising tree from the practical utility point of pest management and out of 25 active compounds identified; azadirachtin is the most important one [3, 4]. Neem products have been reported to control more than 200 species of insect pest belonging to different orders like Coleoptera, Diptera, Lepidoptera, Heteroptera, Orthoptera, Thysanoptera and several species of mites and nematodes [5]. Members of the genus Datura have extended its reputation as a potential biopesticide because of the presence of Tropane alkaloids [6], a chemical family of secondary metabolites, which are synthesized in the roots and stored in the vacuoles and secreted as a chemical defensive biochemical against pest organisms [7]. In the present era of sustainable organic agriculture and considering the burgeoning demand of gerbera as a cut flower as well as for other purposes investigation on the problems is in need to be undertaken to save the crop from pests ravages.

2. Materials and methods

Field experiment was conducted in the experimental farm, Department of Horticulture for two crop seasons in the year 2014-15 and 2015-16 to assess the efficacy of different botanicals against major pests of gerbera on the variety Red gem.

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The experiment was laid out in the randomized block design with 7 treatments and three replications each. A total of 21 plots of 1.5m×1.0m and a plant to plant spacing of 30cm×30cm were maintained.

The treatment details

- T₁: Datura leaf extract, *Datura stramonium* L. @ 5%
 T₂: Basil leaf extract, *Ocimum basilicum* L. @ 5%
 T₃: Curry leaf extract, *Murraya koenigii* L. @ 5%
 T₄: Wood apple leaf extract, *Aegle marmelos* L. @ 5%
 T₅: Pathurua Bihlangani leaf extract, *Polygonum hydropiper* L. @ 5%
 T₆: Neem *Azadirachta indica* (pestoneem) @3ml/l
 T₇: Control (Untreated)

For extraction of botanicals, the collected fresh leaves of the respective plants were washed thoroughly with distilled water and grinded using a mechanical grinder to form a paste and left overnight after properly mixing it with water. The liquid was filtered on next day using the fine muslin cloth and diluted to 2, 3, 4, 5 and 6% concentration for determining lethal concentration (LC₅₀) of the botanicals. Among these 5% showed the highest mortality in aphid and mites and thus, 5% concentration of the botanicals were selected for the present study. To evaluate the effect of foliar spray of various treatments against mites and aphid, their counting was made on three randomly selected plants from each plot and collected leaves were examined under stereo zoom binocular microscope at 4x magnification. Mite and aphid population was counted per leaf before spray and 1, 3, 5 days after spraying and the effectiveness of botanicals against these pests were statistically analysed using Fisher Test after square root transformation.

3. Results and Discussion

It was evident from the present investigation that all the botanicals viz., Datura leaf extract (5%), Basil leaf extract (5%), Curry leaf extract (5%), Wood apple leaf extract (5%), *Polygonum hydropiper* leaf extract (5%), Pestoneem (3ml/l) were found effective in controlling the aphid, *Aphis gossypii* and False spider mite, *Brevipalpus californicus*, in gerbera. Among the treatments *P. hydropiper* (5%) was found to be the most effective treatment reducing the *A.gossypii* population up to 77.11, 89.32 and 94.06 per cent at 1, 3 and 5 days after spraying, respectively and was at par with Basil leaf extract (5%), Curry leaf extract (5%), Wood apple (5%) and Pestoneem (3ml/l) in the year 2014-15. However Datura leaf extract was found to be less effective which resulted only 71.26, 72.43 and 74.87 per cent reduction of aphid population after 1, 3 and 5 days after spraying, respectively (Table1). In the year 2015-2016 similar results were obtained as *P. hydropiper* (5%) maintained its superiority and was found to be most effective in reducing *A. gossypii* population up to 79.34 per cent at 1 day after spraying, 93.77 and 94.26 per

cent at 3 and 5 days after spraying respectively and was at par with Wood apple leaf extract (5%), that recorded 88.38 and 92.71 per cent reduction of *A.gossypii* population after 3 and 5 days after spraying, respectively. Other botanicals like Basil leaf extract (5%) resulted in 77.25 and 81.50 per cent reduction in aphid population after 3 and 5 days after spraying, respectively and were at par with Curry leaf extract (5%) and Pestoneem (3ml/l) in the year 2015-2016 (Table2). Datura leaf extract (5%) showed lowest reduction that resulted in 69.32 and 75.14 per cent reduction after 3 and 5 days after spraying, respectively. The *P. hydropiper* was reported to be superior in management of mustard aphid (*Myzus persicae*) that were exposed to 5% extract of *P. hydropiper* showed maximum mortality^[8]. Similarly Datura leaf extract showed lowest efficacy in controlling cotton aphid, *Aphis gossypii* population among other biopesticide in Tomato^[9].

In case of *B. californicus* in the year 2014-2015 *P. hydropiper* was found to be most effective in reducing the population up to 80.61 per cent at one day after spraying and was at par with Datura leaf extract (5%), Basil leaf extract (5%), Wood apple leaf extract (5%) and pestoneem (3ml/l) at 1 day after spraying. *P. hydropiper* maintained its superiority showing highest reduction of *B.californicus* population up to 91 and 95.59 per cent at 3 and 5 days after spraying respectively and was at par with wood apple leaf extract and pestoneem. Other botanicals like datura leaf extract, Basil leaf extract and pestoneem resulted in 82.04, 80.48 and 83.39 per cent reduction in mite population, respectively (Table3). Other botanicals like Datura leaf extract and Basil leaf extract showed 87.26, 87.84 per cent reduction in mite population, respectively. Whereas the lowest reduction of *B.californicus* population was recorded by curry leaf extract.

Similarly in 2015-2016, *P. hydropiper* was found to be most effective resulting 81.42 per cent reduction of mite population 1 day after spray and was at par with Datura leaf extract (5%) and Wood apple leaf extract (5%). *P. hydropiper* maintained its superiority resulting 89.07 per cent reduction in mite population at 3 days after spraying which was at par with Datura leaf extract(5%), Basil leaf extract(5%), Curry leaf extract (5%), Wood apple leaf extract(5%) and Pestoneem (3ml/l). *P. hydropiper* was found to be most effective resulting 96.17 per cent reduction of mite population which was at par with Wood apple leaf extract (5%) and Pestoneem (3ml/l) five days after spraying (Table4). Curry leaf extract resulted in lowest reduction of mite population at 1, 3 and 5 days after spraying. The exposure of nymphs and adult to aqueous extracts of *P. hydropiper* caused mortality up to 100 per cent and 89.92 per cent respectively at various concentrations^[10]. A laboratory test was conducted for testing *Datura stramonium* for acaricidal activity against mite species and it was found that the compound was toxic to all active stages of the flat mite, *Brevipalpus phoenicis*^{[11][12]}

Table 1: Per cent reduction of *Aphis gossypii* due to botanicals in 2014-15

| Treatments | Dose | Mean number of aphid per leaf (pre-treatment) | Percent reduction of aphid per leaf at different days after spraying (post treatment) | | |
|--|------|---|---|------------------|------------------|
| | | | 1DAS | 3DAS | 5DAS |
| T1: Datura leaf extract (<i>Datura stramonium</i>) | 5% | 11.9 | 71.26 (57.54) | 72.43 (58.31) | 74.87 (59.87) |
| T2: Basil leaf extract (<i>Ocimum basilicum</i>) | 5% | 11.1 | 72.79 (58.50) | 75.94 (60.69) | 81.08 (64.16) |
| T3: Curry leaf extract (<i>Murraya koenigii</i>) | 5% | 13.8 | 73.62 (59.08) | 76.73 (61.14) | 81.88 (64.75) |
| T4: Wood apple (<i>Aegle marmelos</i>) | 5% | 11.5 | 71.65 (57.80) | 82.60 (65.35) | 93.04 (74.66) |

| | | | | | |
|---|-------------|------|------------------|------------------|------------------|
| T5:Patharua bihlangani (<i>Polygonum hydropiper</i>) | 5% | 11.8 | 77.11 (61.41) | 89.32 (70.91) | 94.06 (75.82) |
| T6: Pestoneem (<i>Azadirachta indica</i>) | 3ml/l | 10.5 | 71.61 (57.80) | 77.52 (61.68) | 91.04 (72.54) |
| T7: Control | Water spray | 11.9 | +5.55 | +9.16 | +13.1 |
| S.Ed(±) | | 1.42 | 1.22 | 3.33 | 3.32 |
| CD at (0.05) | | NS | 2.67 | 7.26 | 7.23 |

DAS- Days after spray; Figure in parenthesis are angular transformed values.
Data are mean of six observations; + indicates per cent increase in population.

Table 2: Per cent reduction of *Aphis gossypii* due to botanicals in 2015-16

| Treatments | Dose | Mean number of aphid per leaf (pre-treatment) | Percent reduction of aphid per leaf at different days after spraying (post treatment) | | |
|---|-------------|--|--|------------------|------------------|
| | | | 1DAS | 3DAS | 5DAS |
| T1: Datura leaf extract (<i>Datura stramonium</i>) | 5% | 10.3 | 66.11 (54.39) | 69.32 (56.35) | 75.14 (60.07) |
| T2: Basil leaf extract (<i>Ocimum basilicum</i>) | 5% | 12 | 72.58 (58.37) | 77.25 (61.48) | 81.50 (64.53) |
| T3: Curry leaf extract (<i>Murraya koenigii</i>) | 5% | 12.3 | 72.52 (58.37) | 76.71 (61.14) | 81.12 (64.23) |
| T4: Wood apple (<i>Aegle marmelos</i>) | 5% | 11.8 | 75.42 (60.27) | 88.38 (70.00) | 92.71 (74.32) |
| T5:Patharua bihlangani (<i>Polygonum hydropiper</i>) | 5% | 12.2 | 79.34 (62.94) | 93.77 (75.46) | 94.26 (76.06) |
| T6: Pestoneem (<i>Azadirachta indica</i>) | 3ml/l | 13.6 | 77.42 (61.61) | 83.08 (65.65) | 89.41 (71.00) |
| T7: Control | Water spray | 12.4 | +5.34 | +8.82 | +10.7 |
| S.Ed(±) | | 0.83 | 1.22 | 3.33 | 3.22 |
| CD at (0.05) | | NS | 2.67 | 7.26 | 7.23 |

DAS- Days after spray; Figure in parenthesis are angular transformed values.
Data are mean of six observations; + indicates per cent increase.

Table 3: Per cent reduction of *Brevipalpus californicus* due to botanicals in 2014-15

| Treatments | Dose | Mean number of mite per leaf (pre-treatment) | Percent reduction of mite per leaf at different days after spraying (post treatment) | | |
|---|-------------|---|---|------------------|------------------|
| | | | 1DAS | 3DAS | 5DAS |
| T1: Datura leaf extract (<i>Datura stramonium</i>) | 5% | 23 | 80.31 (63.65) | 82.04 (64.90) | 87.26 (69.04) |
| T2: Basil leaf extract (<i>Ocimum basilicum</i>) | 5% | 18.6 | 78.22 (62.17) | 80.48 (63.72) | 87.84 (69.56) |
| T3: Curry leaf extract (<i>Murraya koenigii</i>) | 5% | 19.8 | 75.15 (60.07) | 80.45 (63.72) | 86.96 (68.78) |
| T4: Wood apple (<i>Aegle marmelos</i>) | 5% | 15.1 | 76.15 (60.73) | 86.22 (68.19) | 94.70 (76.69) |
| T5:Patharua bihlangani (<i>Polygonum hydropiper</i>) | 5% | 15.9 | 80.61 (63.87) | 91.06 (72.54) | 95.59 (77.75) |
| T6: Pestoneem (<i>Azadirachta indica</i>) | 3ml/l | 17.1 | 75.61 (60.40) | 83.39 (65.88) | 90.93 (72.44) |
| T7: Control | Water spray | 20 | +3.3 | +6.1 | +9.0 |
| S.Ed(±) | | 2.8 | 2.8 | 5.94 | 5.28 |
| CD at (0.05) | | NS | 5.8 | 12.3 | 10.9 |

DAS- Days after spray; Figure in parenthesis are angular transformed values.
Data are mean of six observations; + indicates per cent increase.

Table 4: Per cent reduction of *Brevipalpus californicus* due to botanicals in 2015-16

| Treatments | Dose | Mean number of mite per leaf (pre-treatment) | Mean number of mite per leaf at different days after spraying (post treatment) | | |
|--|-------|---|---|------------------|------------------|
| | | | 1DAS | 3DAS | 5DAS |
| T1: Datura leaf extract (<i>Datura stramonium</i>) | 5% | 25.6 | 81.13 (64.23) | 82.85 (65.50) | 87.85 (69.56) |
| T2: Basil leaf extract (<i>Ocimum basilicum</i>) | 5% | 20.4 | 79.06 (62.73) | 80.58 (63.79) | 87.12 (68.95) |
| T3: Curry leaf extract (<i>Murraya koenigii</i>) | 5% | 18 | 75.05 (60.00) | 77.38 (61.55) | 84.55 (66.82) |
| T4: Wood apple (<i>Aegle marmelos</i>) | 5% | 21.6 | 81.34 (64.38) | 83.79 (66.19) | 95.55 (77.75) |
| T5: Patharua bihlangani (<i>Polygonum hydropiper</i>) | 5% | 18.3 | 81.42 (64.45) | 89.07 (65.50) | 96.17 (78.61) |
| T6: Pestoneem | 3ml/l | 19.9 | 78.79 | 81.60 | 94.87 |

| | | | | | |
|-------------------------------|-------------|------|---------|---------|---------|
| (<i>Azadirachta indica</i>) | | | (62.51) | (64.60) | (76.82) |
| T7: Control | Water spray | 18.4 | +4.66 | +8.00 | +9.8 |
| S.Ed(±) | | | 3.06 | 2.64 | 5.17 |
| CD at (0.05) | | NS | 6.38 | 5.49 | 10.7 |

DAS- Days after spray; Figure in parenthesis are angular transformed values.

Data are mean of six observations; + indicates per cent increase.

4. Conclusion

Out of six botanicals, *Polygonum hydropiper* (5%) was found to be most effective against aphid population which resulted in 94.06 per cent reduction in 5 days after application in the year 2014-2015 and 94.26 per cent in the year 2015-2016. Similarly in case of false spider mite out of six botanicals, *P. hydropiper* (5%) was found to be most effective with 95.59 per cent reduction in mite population in 5 days after application in the year 2014-2015 and 96.17 per cent in the year 2015-2016.

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