AQUEOUS EXTRACTS EFFECTIVENESS OF DIFFERENT PLANT PARTS OF *Parthenium hysterophorus* (L.) AGAINST OKRA SUCKING INSECT PESTS IN VIVO CONDITIONS

Asad Ullah4, Nadia Saeed[1], Abdur Rahman[2], Shehzad Zareen[5], Irum Gul[6], Azaz Ahmad[4], Uzair Ahmad[2], Javaid Iqbal[4], Anum Riaz[7], Zaheer Abbas[4], Fawad Khan[4], Ejaz Un Nabi[4]

[1] Department of Zoology, GPGC Mandian, Abbottabad, KP Pakistan
[2] Department of Plant Protection, The University of Agriculture Peshawar
[3] Department of Horticulture, The University of Agriculture Peshawar
[4] Department of Entomology, The University of Agriculture Peshawar
5 Kohat University of Science and Technology
6 Department of Zoology, Kohat University of Science and Technology
7 Government Graduate College for Women Shorkot City

Abstract

Study was conducted to determine the effectiveness of different plant parts of the *Parthenium hysterophorus* in comparison with confidor 20% SL (Imidacloprid) against the sucking pests of okra crop. The experiment was performed with RCBD at the Agriculture Research Institute Tarnab, Peshawar, during 2020 with five different treatments, each treatment was replicated three times. The results revealed that maximum control in aphids infestation was recorded in confidor (4.95 plant^{-1}) treated plot while minimum was recorded in parthenium stem extract (19.28 plant^{-1}) over the control treated plot (19.66 plant^{-1}). Similarly, highest control in whiteflies infestation were also recorded in confidor (4.69 plant^{-1}) while minimum was recorded in parthenium leaf extract (10.11 plant^{-1}) over the control plot (25.71 plant^{-1}). In case of jassids infestation, maximum control was also observed in confidor treated plot (2.76 plant^{-1}) while minimum infestation was recorded by parthenium leaf extract (4.71 plant^{-1}) over control plot (10.71 plant^{-1}). As from the result of okra cultivar, it is obvious that confidor treatment significantly given maximum output (1196.7 kg ha^{-1}) whereas minimum yield was observed in control plot (526.7 kg ha^{-1}).

Keywords: *Abelmoschus esculentus,* aphids, confidor, jassids, *Parthenium hysterophorus,* whiteflies

Introduction

Okra (*Abelmoschus esculentus* L) from the family Malvaceae, commonly called as Bhendi and is also known as lady's finger all around the world (Naheed *et al*., 2013). Pakistan ranked 5th in competition with major okra producing countries. It contributes around 2% of the world's total okra production (Gulsen *et al.*, 2007). Yield of okra in Pakistan is lower in comparison to the world major okra producing countries because of many reasons, among them insect pests cause major problems. Several types of insects have been noted causing damages to the okra crop from vegetative to reproductive stage (Reddy, 2017). Some sucking insect pests of okra are aphids (*Aphis gossypii* G.), jassid (*Amrasca biguttula*) and whiteflies (*Bemisia tabaci* G.). Insect infestation reduces the growth as well as it can also transmit pathogenic disease agents to the okra crop (Dhaliwal *et al*., 1981). Aphid (*A. gossypii* G) is the major pest of okra. It took the top position among all the vegetable pests. *A. gossypii* directly damages by feeding, which causes curling and deformation of young leaves and twigs, or indirectly damages by contaminating the fruits and leaves with honeydew (Meena, 2020). Whitefly (*B. tabaci*) is the vector of "Yellow Vein Mosaic Disease" that causes damages in okra (Salim, 1999). It also transmits "Cotton Leaf Curl Virus" that results in upward curling of the leaf, stunted growth and thickened veins of okra crop leads to reduced yield (Ahmed *et al*., 2002; Harrison *et al*., 1997). Jassid (*A. bigutulla*) is a very important insect in the tropic and subtropic regions because of its ecological conditions that are beneficial all year around for the progress and advancement of the insect. It's one of the important pest that attacks okra crop (Singh and Sachan, 2001). It puts greatest amount of eggs and turn out to be appropriate position for existence and eating (Hussain *et al*., 1979). Pesticide chemicals are used for the controlling of insect pests, but pesticide use is very toxic and hazardous to human health and environment. Besides, pesticides also produce harmful effects against natural enemies (i.e., lady bird and predatory spiders) and pollinators (i.e., honeybee), it greatly affects the natural ecology (Solangi and Lohar, 2007). Bio-insecticides are practiced in commercial agriculture and horticulture presently that serves as an effective alternative to pesticides because of their potential insecticidal properties. Bio-pesticides can work effectively on the associated problems and thus it is of great interest for the growers as well as researchers (Kumar *et al*., 2003). Bio-insecticides have an advantage over chemicals that these are not expensive and are easily available. Another benefit is that these are not toxic to mammals, pollinators and these are also

environmentally safer with an ease in biodegradability. *Parthenium hysterophorus* L. (Asteraceae), is also known as parthenium. It is a weed globally affecting many countries. Parthenium was first identified in Australia in 1955 and declared as a noxious plant in 1975 (Reddy, 2017). Confidor 20% SL (Imidacloprid) is a systemic insecticide. It is used in many forms for the control of sucking insect pests involving aphids, whitefly, jassid and thrips etc. The substance succeeds by impeding the spread of provocations in the nervous system of insect. Precisely, it triggers a jam in a neuronic pathway (nicotinergic) which is extra present in insects. The jam directs to the growth of organic chemical (acetylcholine), it is an important neurotransmitter, that results the insect immobility, as well as ultimately killing of the insect. It is effective on contact. Keeping in view the significance of okra and plant extracts application counter to sucking insect pests mainly aphid, jassid along with whitefly control. This study was performed to evaluate the toxicity of aqueous extracts of different plant parts of *P. hystrophorus* against sucking insect pests of okra and their study their effects on its total yield.

Materials and Methods

The experiment entitled as "Aqueous extracts effectiveness of different plant parts of *Parthenium hysterophorus* (L.) against okra sucking insect pests" was performed at Agriculture Research Institute Tarnab, Peshawar, Pakistan, during 2020. The trial was executed under RCBD with five different treatments which includes; leaves extracts (2%), flowers extracts (2%), stem extracts (2%), confidor 20% SL (Imidacloprid) and control and each treatment was triplicated.

Preparation of Parthenium solution

Parthenium plants were collected from local field and different parts of plant were dried in the sun for four days then separate manually and crushed with help of crusher. After crushing, 70 gm of powder from each plant part weighted and put in muslin cloth also mixed with 2 gm of detergent. The solution was covered in muslin cloth and dip in one lit of boiled water for 24 hours at 80 to 85^{o}C and manually fully squeezed the extract. This procedure gives us 7% solution. Furthermore, as per following method, the extracted solution was diluted into 2% concentration for field application. With help following method we were diluted this solution in 2% for field application.

$C_1V_1=C_2V_2$

Where,

C1= Concentration of Stock solution
V1= Volume of Stock solution
C2= Concentration of solution required for application in field
V2= Volume of solution required for application in field.

Population density of sucking insect pests

Number of sucking insect pests per plant were recorded one day before spraying and after 24 hours, 48 hours, 72 hours, 5 days, 7 days, 10 days and 15 days after spraying and the overall mean was presented.

Yield (kg ha^{-1})

The yield was calculated with following formula:

$$\text{Yield (kg/ha)} = \frac{\text{Yield per plot (kg)}}{\text{Area of plot (m}^2\text{)}} \times 10{,}000\text{m}^2$$

Statistical examination

Data were analyzed for mean separated through LSD at 5% significance level to utilized statistical program (Statistix 8.1).

Results and Discussions

Aphids infestation

Management of aphids infestation shown in Table 1. Before spray showed significant differences among all the treatments. Day after spray, maximum number of infestation was recorded in control treatment (21.33) while minimum number of infestation was recorded confidor treated plot (10.33) followed by parthenium leaf extract (14.66) while there were no significant differences found between parthenium flower extract and parthenium seed extract (15.33 and 21.30). After 2 days of application, there were significant difference found between confidor (8.33), parthenium leaf extract (12.66) and parthenium flower extract (13.33) followed by parthenium seed extract (20.30) over control treated plot (20.33). After 3 days of application, maximum infestation was recorded in control plot (19.33) whereas minimum infestation was recorded in confidor (6.33). Amongst botanicals, there was significant difference found between parthenium leaf extract (10.66), parthenium flower extract (11.33) and parthenium seed extract (19.30). Similarly, 5 days after application, highest infection was recorded in control

treatment (18.33) while minimum infestation was recorded in confidor treated plot (4.33) followed by parthenium leaf extract (8.66), parthenium flower extract (9.33) and parthenium stem extract (18.30). After 7 days of spray, maximum infestation was recorded in control plot (17.33) whereas minimum infestation was recorded in confidor (2.66). Among botanicals, there was significant difference found between parthenium leaf extract (7.66), parthenium flower extract (8.33) and parthenium seed extract (17.30). After 10 days of spray, highest infestation was recorded in control treated plot (20.00) while lowest was recorded in confidor (1.33). No significant differences were found between parthenium flower extract (11.00) and parthenium leaf extract (11.66) but significantly different from parthenium stem extract (18.66). In this observation a slight increased were noticed. Increased were further continued up to 15 days after spray. The highest infestation was observed after 15 days of spray in control treatment (21.00) while lowest infestation in aphid population were recorded in confidor (1.20). Among botanicals, parthenium flower extract (13.00) and parthenium leaf extract (13.66) having non-significant difference found but significantly different from parthenium stem extract (19.28). Overall mean aphids infestation was maximum in control treatment (19.66) whereas minimum infestation was recorded in confidor (4.95). Among tested botanicals, no significance was found between parthenium leaf extract (11.38) and parthenium flower extract (11.66) but significantly different from parthenium stem extract (19.28). In conformity to the present findings, Bailey (2007) recorded that plant extracts play a vital role while decreasing the population of sucking insect pest. Similarly, Konar *et al.* (2013) and Ghosal *et al.* (2013) studied that imidacloprid (17.8%) effectively controlled aphids population in okra. Furthermore, Maienfisch *et al.* (2000) showed that imidacloprid recorded maximum control towards many sedative insect pest such as aphids. The parallel result was recorded in average aphids reduction by imidacloprid treatment (1.78) as follow by thiamethoxam (1.80) and acetamiprid (1.82) as compared to control plot (11.53) where the population were gradually increased. Imidacloprid (84.54%) was observed effective treatment over other treatments such as thiamethoxam (84.36%), acetamiprid (84.25%). The present investigation is also in line with findings of Misra, (2002); Kumar *et al.*, (1999); Sreelatha and Divakar, (1997), reported that imidacloprid was effectively controlled the population of aphids.

Whiteflies infestation

Table 2 showed percent infestation of whitefly in okra crop. Day before spray significant difference was found among all the treatments *viz.*, 15.33, 17.33, 18.00, 19.66 and 28.00. After 1 day of spray, maximum infestation was recorded in control treatment (27.00) while minimum infestation in whitefly infestation was recorded in confidor treated plot (12.00). Among botanicals, parthenium leaf extract (14.33) significantly different from parthenium flower extract (15.00) and parthenium stem extract (18.00) in all tested botanicals significantly different from each other and parthenium leaf extract showed best performance over other botanicals. After 2 days of spray, highest infestation was recorded in control treated plot (26.00) whereas lowest infestation in whitefly infestation was recorded in confidor treated plot (9.33) was significantly different from one another while significant difference was also recorded in all botanicals treatments *viz.*, parthenium leaf extract (12.00), parthenium flower extract (12.00) and parthenium stem extract (16.00). Similarly, after 3 days of spray, maximum infestation was recorded in control treatment (25.00) while significantly minimum infestation was recorded in confidor treatment (6.66). Significant differences were also found among botanicals, *viz.*, parthenium leaf extract (9.00), parthenium flower extract (10.00) and parthenium stem extract (15.00). Highest infestation was recorded after 5 days of application in control treated plot (24.00) and minimum infestation was recorded in confidor treated plot (2.33). Similarly, in case of botanicals significantly maximum infestation was recorded in parthenium stem extract (6.66) followed by parthenium flower extract (8.00) while minimum infestation was recorded parthenium leaf extract (13.66). After 7 days of application, maximum control was recorded in confidor treated plot (1.66) followed by parthenium leaf extract (8.33), parthenium flower extract (9.00) and parthenium stem extract (15.00) over control treatment (25.00). After 10 days of application a slight increase was observed in whitefly infestation except confidor. Maximum infestation in whitefly was recorded in control treated plot (26.00) while minimum infestation was recorded in confidor treated plot (0.66). Among botanicals, significant increase in whitefly population was recorded in parthenium leaf extract (9.66) followed by parthenium flower extract (10.00) and parthenium stem extract (16.66). After 15 days of application, maximum control was recorded in confidor treated plot (0.03) as followed by parthenium leaf extract (11.33), parthenium flower extract (12.33) and parthenium stem extract (17.66) as compared with control treated plot (27.00). Overall mean aphids infestation was maximum recorded in confidor treated plot (4.69) followed by

parthenium leaf extract (10.11) then parthenium flower extract (10.90) and parthenium stem extract (16.00) over control treated plot (25.71). Present research findings are accordance to the findings of Baidoo and Mochiah (2016) studied that garlic extracts showed best control next to ginger and parthenium extracts. Similarly, Raghuraman and Ajanta (2011) reported that significantly effective control against whitefly and leafhopper population was recorded by imidacloprid (17.8% SL) and consequently increased was recorded okra yield.

Jassids infestation

Table 6 showed that day before spray significant difference was found among all the treatments. Day after spray maximum infestation was recorded in control plot (12.66) while minimum infestation in jassids was recorded in confidor treated plot (7.00). Among botanicals, parthenium leaf extract (7.00) significantly different from parthenium stem extract (8.00) and parthenium flower extract (9.66). After 2 days of spray, highest infestation was recorded in control treated plot (11.33) whereas lowest infestation in jassids was recorded at confidor treated plot (4.66) was significantly different from one another while significant difference was also recorded in all botanicals treatments *viz.*, parthenium leaf extract (5.33), parthenium flower extract (6.33) and parthenium stem extract (8.33). Similarly, after 3 days of spray, maximum infestation was recorded in control treatment (10.00) while significantly minimum infestation was recorded in confidor treatment (3.33). Significant differences were also found among botanicals, *viz.*, parthenium leaf extract (3.66), parthenium flower extract (4.66) and parthenium stem extract (7.00). Highest infestation was recorded after 5 days of application in control treated plot (8.66) while minimum infestation was recorded in confidor treated plot (2.33). Similarly, in case of botanicals significantly maximum infestation was recorded in parthenium stem extract (2.00) followed by parthenium flower extract (3.33) while minimum infestation was recorded parthenium leaf extract (5.66). After 7 days of application, maximum control was recorded in confidor treated plot (1.00) followed by parthenium leaf extract (4.00), parthenium flower extract (5.33) and parthenium stem extract (6.66) over control treatment (9.66). After 10 days of application, maximum infestation in jassids was recorded in control treated plot (10.66) while minimum infestation was recorded in confidor treated plot (1.00). Among botanicals, significant increase in jassids population was recorded in parthenium leaf extract (5.00) followed by parthenium flower extract (6.33) and parthenium stem extract (8.00). After 15 days of

application, maximum control was recorded in confidor treated plot (0.33) as followed by parthenium leaf extract (6.00), parthenium flower extract (7.33) and parthenium stem extract (10.00) as compared with control treated plot (12.00). Overall mean aphids infestation was maximum in confidor treated plot (2.76) followed by parthenium leaf extract (4.71) then parthenium flower extract (5.90) and parthenium stem extract (7.90) over control treated plot (12.71). Ethanol extracts from plants like *Xanthium strumarium* L. (Asteraceae), *Tanacetum parthenium* L. (Asteraceae) and *Hypericum calycinum* L. (Hypericaceae) show maximum mortality in *M. persicae* at the highest concentration (12%) (Erdogan and Yildirim, 2016). Our findings are in-line with findings of Ghosalwad *et al.* (2008), reported that imidacloprid 17.8% at 40 g a.i. was found most effective. Similarly, Aarwe et al. (2015) showed that the most effective treatment was thiamethoxam 25WG @ 50 g a.i./ha recorded whereas imidacloprid and emamectin benzoate were moderately effective against the infestation of jassids. Whereas according to Preetha *et al.* (2009), Acharya *et al.* (2002) and Maienfisch *et al.* (2000) thiamethoxam and imidacloprid was found similar level of protection towards jassids infestation. In contrast to our findings, Jatay (2013) recorded the minimum population of jassids in treatment imidacloprid.

Estimated yield of okra

As from the result of Table 4, it is obvious that confidor treatment significantly maximum net return was recorded (1196.7 kg ha^{-1}) as compared to other treatments. Among botanicals, parthenium leaf extract showed greater output (908.0 kg ha^{-1}) followed by parthenium flower extract (882.0 kg ha^{-1}) and parthenium stem extract (765.0 kg ha^{-1}) whereas minimum yield was observed in control plot (526.7 kg ha^{-1}).

Table 1: Mean population reduction in aphids plant^{-1} in okra during 2020.

Treatments	DBS	1DAS	2DAS	3DAS	5DAS	7DAS	10DAS	15DAS	Mean
Parthenium leaf extract	17.33^{b}	14.66^{c}	12.66^{c}	10.66^{c}	8.66^{c}	7.66^{c}	11.66^{c}	13.66^{c}	11.38^{c}
Parthenium flower extract	18.33^{b}	15.33^{a}	13.33^{c}	11.33^{b}	9.33^{b}	8.33^{b}	11.00^{c}	13.00^{c}	11.66^{c}
Parthenium stem extract	23.00^{a}	21.30^{a}	20.30^{b}	19.30^{a}	18.30^{a}	17.30^{a}	18.66^{b}	19.66^{b}	19.28^{b}
Confidor	13.33^{c}	10.33^{d}	8.33^{c}	6.33^{d}	4.33^{d}	2.66^{d}	1.33^{e}	1.20^{d}	4.95^{d}
Control	22.33^{a}	21.33^{a}	20.33^{a}	19.33^{a}	18.33^{a}	17.33^{a}	20.00^{a}	21.00^{a}	19.66^{a}
$LSD_{(0.05)}$	1.64	0.48	0.48	0.48	0.48	0.59	0.90	0.90	0.33

Mean followed with same letters in columns are non-significant at 5 % level of probability

Table 2: Mean population reduction in whitefly per plant in okra during 2020.

Treatments	DBS	1DAS	2DAS	3DAS	5DAS	7DAS	10DAS	15DAS	Mean
Parthenium leaf extract	17.33^{c}	14.33^{d}	12.00^{c}	9.00^{d}	6.66^{d}	8.33^{c}	9.66^{c}	11.33^{c}	10.11^{d}
Parthenium flower extract	18.00^{c}	15.00^{c}	12.00^{c}	10.00^{c}	8.00^{c}	9.00^{c}	10.00^{c}	12.33^{c}	10.90^{c}
Parthenium stem extract	19.66^{b}	18.00^{b}	16.00^{b}	15.00^{b}	13.66^{b}	15.00^{b}	16.66^{b}	17.66^{b}	16.00^{b}
Confidor	15.33^{d}	12.00^{e}	9.33^{d}	6.66^{e}	2.33^{e}	1.66^{d}	0.66^{d}	0.03^{d}	4.69^{e}
Control	28.00^{a}	27.00^{a}	26.00^{a}	25.00^{a}	24.00^{a}	25.00^{a}	26.00^{a}	27.00^{a}	25.71^{a}
$LSD_{(0.05)}$	0.90	0.48	0.48	0.48	1.23	1.41	1.51	1.49	0.73

Mean followed with same letters in columns are non-significant at 5 % level of probability

Table 3: Mean population reduction in jassids per plant in okra during 2020.

Treatments	DBS	1DAS	2DAS	3DAS	5DAS	7DAS	10DAS	15DAS	Mean
Parthenium leaf extract	9.00^{d}	7.00^{d}	5.33^{c}	3.66^{c}	2.00^{c}	4.00^{d}	5.00^{d}	6.00^{d}	4.71^{d}
Parthenium flower extract	10.00^{c}	8.00^{c}	6.33^{c}	4.66^{c}	3.33^{c}	5.33^{c}	6.33^{c}	7.33^{c}	5.90^{c}
Parthenium stem extract	11.00^{b}	9.66^{b}	8.33^{b}	7.00^{b}	5.66^{b}	6.66^{b}	8.00^{b}	10.00^{b}	7.90^{b}
Confidor	9.00^{d}	7.00^{d}	4.66^{c}	3.33^{c}	2.33^{c}	1.00^{e}	1.00^{e}	0.33^{e}	2.76^{e}
Control	14.00^{a}	12.66^{a}	11.33^{a}	10.00^{a}	8.66^{a}	9.66^{a}	10.66^{a}	12.00^{a}	10.71^{a}
$LSD_{(0.05)}$	0.84	0.59	1.94	2.33	1.91	0.90	0.68	0.59	1.01

Mean followed with same letters in columns are non-significant at 5 % level of probability

Table 4: Estimated yield of okra kg ha^{-1}

Treatments	Estimated Yield kgha^{-1}
Parthenium leaf extract	908.0^{b}
Parthenium flower extract	882.0^{c}
Parthenium stem extract	765.0^{d}
Confidor	1196.7^{a}
Control	526.7^{e}
$LSD_{(0.05)}$	24.61

Mean followed with same letters in columns are non-significant at 5 % level of probability

Conclusions and Recommendations

The current research work concluded that confidor was effective against aphids, whitefly and jassids in both spray but with passage of time the decreased was noticed in its efficacy. Similarly, parthenium leaf extract showed more reduction in aphids, whitefly and jassids as compare parthenium flower extract while in case of parthenium stem extract reduction in pest population was lower recorded. The higher yield was observed in confidor treatment as followed by parthenium leaf extract and parthenium flower extract, whereas in parthenium stem extract, lower yield was recorded. As from the result of okra cultivar, it is obvious that confidor treatment significantly maximum net return was recorded while minimum yield was recorded in control plot so research recommended confidor for controlling aphids, whitefly and jassids infestation in okra crop.

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