ALLELOPATHIC INFLUENCE OF POPPY (*Papaver somniferum* L.) ON EMERGENCE AND INITIAL SEEDLING GROWTH OF RED RICE (*Oryza punctata* L.)

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ABSTARCT

Allelopathy plays crucial role in effective weed control. Opium (*Papaver somniferum* L.) crop release different allelochemicals at maturity which have potential to act as natural weed killer in different crops. Phytotoxic effect of poppy (*P. somniferum*) was examined on emergence and initial seedling growth of red rice (*Oryza punctate* L.). Aqueous extract of different plant parts (leaves, stem and flower) was used at various concentrations (0.25%, 0.5%, 1%, 2%, 4% and 8%) along with distilled water as control. The aqueous extracts of leaves, stem and flower of *P. somniferum* significantly inhibited the emergence, seedling growth as well as root length (cm), shoot length (cm), fresh weight (g) and dry weight (g) of *O. punctata.* Maximum mean emergence time (9.18 days) and minimum shoot length (1.13 cm) emergence index (0.89) and emergence percentage (6.67%) was observed under fruit extract at 8% concentration. *P. somniferum* aqueous extract of stem at 8% concentration took maximum time to complete 50% emergence and gave minimum root length, fresh weight, and dry weight of *O. punctata.* Based on these finding it can be concluded that the phyto-chemicals present in *P. somniferum* can be used as eco-friendly *O. punctata* growth inhibitor to manage this weed in crops especially under organic cropping.

Keywords: Emergence, inhibitory, phytotoxic, plant parts, promotor, seedling growth, weed growth.

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INTRODUCTION

Crop plants suffers stress caused by unwanted weeds through competition for water, light nutrients and space. Stress created by weed plants results in an increasing mortality of whole crop plant, reduced growth, decreases in output and quality (Gallandt and Weiner, 2001). Reduction in wheat yield from 20 - 60% due to weed infestations (Turk and Tawaha, 2002). Loses in different crops due to weeds infestation in Pakistan are 20 to 30%. In cereal crops, the losses due to weed infestations are approximately 30, 40, 4 and 5 billion rupees for wheat, rice, gram and maize, respectively (Anonymous, 2005).Therefore, it is necessary to control the weeds before critical competition period to enhance the yield of crop (Macias *et al.,* 2002).Different methods are used to control weeds such as biological, chemical, mechanical, and cultural weed control (Melander *et al.,* 2005). In modern agriculture production system weeds efficiently controlled by use of chemical herbicides (Bajwa, 2014). The use of chemical for effective weed control result in low quality of product, weed resistance, environmental pollution (Macias *et al.,* 2002). Extreme and continuous application of same type of herbicides has resulted in resilient weed populations and this phenomenon urged upon the misuse of allelopathic possible of crop plants (Ferreira and Reinhardt, 2010). Allelochemicals could be used as tool to control weeds and resistance (Jabran*et al.,* 2015). Allelopathic plants have ability to inhibit the initial weeds growth (Chung *et al.,* 2006).

Opium (*P. somniferum*) a common medicinal plant, belonging to family Papaveraceae. (Labanca*et et al.,* 2018). Many researchers reported that opium crop release different allelochemicals at maturity which inhibit growth of various plants including crops and weeds. According to Alam and Islam (2002) water extract of some weeds might have promotry or inhibitory effect on germination and initial seedling growth of target weed. Different plants have different potential on target weed or crop plant.Water extract of wild onion leaves produced inhibitory impact on wheat crop germination and initial growth of seedling (Baber *et al.,* 2009).Opium is most important dominant and competitive broad-leaves weed in winter cereals reported to have allelopathic effect, the water extracts from fresh plant parts of opium significantly inhibit germination of both barley and wheat crop (Ravlić*et al.,* 2012). Ghodake *et al.,* (2012) reported that allelochemicals inhibited the seed germination by blocking hydrolysis of nutrients reserve. Crop plants for example opium (*P. somniferum*), sunflower (*Helianthus annuus*), eucalyptus (*Eucalyptus camaldulensis*), turnip rape (*Brassica compestris*), and other species had allelopathic effects against weed growth (Skrzypek *et al.,* 2015). It is needed to examine the phytotoxic effects of *P.somniferum* aqueous extracts on *Oryza punctata* germination and initial seedling growth. To control weeds many alternative strategies like as non-chemical control by using aqueous extracts (bio-herbicides) of weed plants (Cirujeda*et al.,* 2008). Bio-herbicides are eco-friendly for weed management and easily biodegradable than synthesized herbicides (Ghafarbi *et al.,* 2012). Water extract of opium is natural and has no chemical hazards on target crop and helpful in inhibiting weeds and enhancing the productivity of crop. This experiment was conducted to explore allelopathic potential of aqueous extracts of parts such as leaves, stem and flower of opium plant to control the *Oryza punctata* (red rice) weed germination and initial seedling growth specifically.

MATERIALS AND METHODS

Experiment was conducted in 2017 in weed science laboratory at Department of Agronomy, University of Agriculture Faisalabad, Pakistan. The objective of this experiment was to evaluate the allelopathic potential of aqueous extracts of *P. somniferum*on summer weed *O. punctata*. The study was arranged in completely randomized design (CRD) with factorial arrangement having three replications.

Collection of *P. somniferum* plant parts

To prepare aqueous extract of *P. somniferum* plant parts. Plants of *P.*

*somniferum*were collected from Agronomic Farm, University of agriculture Faisalabad at maturity and dried for two weeks at ambient temperature. After sun dry different parts of plants were separated and chopped into about 2 cm pieces for extract formation.

Preparation of aqueous extract

Aqueous extracts of various plants parts of *P. somniferum* were prepared by adding 10g of chopped dried plant material into 100ml of distilled water in bottles separately at ratio of 1:10 w/v and left for at least 24 hours at room temperature. These aqueous extracts were made from each desired part of opium such as leaves, stem, fruit and flower etc. Then the material was passed through a muslin cloth to attain the water extracts of different parts of *P. somniferum*. That process gave the 10% extract, from this 67.2ml extract were added in 16.8ml distilled water to make final volume 84ml that was considered as stock solution. From this stock solution we made further dilutions that are (0.25%, 0.5%, 1%, 2%, 4%, 8%).

These dilutions were made by using equation

$C_1V_1 = C_2V_2$

Each dilution has 42ml total volume. Each dilution of each extract placed in separate bottles and then tagged these bottles by name of each dilution with its plant name too carefully for their easy utilization in next procedure.

Laboratory experiment

To check the allelopathic effect 21 treatments combinations of *P. somniferum*were applied on *O. punctata*. Five seeds of red rice were placed in every petri plates having filter paper double layer. Then 7ml of opium extracts dilutions of each part i.e. leaves, stem, flowers and fruits were added in recommended petri plates having 3 replications foreach dilution. One treatment was kept as control and moist with distilled water. Then to reduce evaporation petri plates were covered and rapped with scotch tape. The petri plates were kept at temperature of 30°C and each treatment were again moistened after one week. The data regarding emergence of seeds were recorded every day for the period of 14 days. After that period removed the emerged seedlings from the petri plates and observed the different parameters like shoot length, root length, fresh and dry weight. Fresh weight was recorded immediately after harvesting while the dry weight of seedlings was observed after drying in oven for two days at 60 °C. To check allelopathic potential used different concentrations (0%, 0.25%, 0.5%, 1%, 2%, 4% and 8%) and three different plant parts (leaves, stem and flower) of *P. somniferum* on *O. punctata*.

DATA RECORDED

Emergence percentage of *O. punctata* (%)

Number of emerged seeds were counted daily up to 14 days after which the emergence ceased. The emergence % was calculated by using following formula.

$$Emergence\ (\%) = \frac{Number\ of\ emerged\ seeds}{Total\ number\ of\ seeds} \times 100$$

Emergence index of *O. punctata*

The emergence index was observed as per association of official seed analysis (1983) by using the following formula

$$GI = \frac{No.\ of\ emerged\ seeds}{Days\ of\ first\ count} + - - - - + \frac{No.\ of\ emerged\ seeds}{Days\ of\ final\ count}$$

Time to 50% emergence of *O. punctata*

The time to attain 50% germination or emergence (T_{50} or E_{50}) was calculated according to the formula of Coolbear*et al.* (1984**)**

$$T\mathbf{50} = ti + \left[\frac{\frac{N}{2} - ni}{nj - ni}\right](tj - ti)$$

Mean emergence time of *O. punctata*

Mean emergence time (MET) was examined by the equation of Ellis and Reborts (1981).

$$\text{MET} = \sum(Dn) / \sum n$$

Growth attributes of *O. punctata*

All seedlings from each petri plate were separated 14 days after germination. After that root and shoot length was measured by using meter rod from base level to top of the plants. Fresh seedlings weight was examined by separating seedlings from petri dish and measuring by using digital weight balance. Dry weight of seedlings was recorded by oven drying the seedlings at 60 ^{0}C for 48 hours then weighted to get average dry weight of seedling by using digital balance.

Statistical Analyses

Data analyses were carried out by using the Statistics software (version, 8.1Statistix, Tallahassee, FL, USA). The least significant difference (LSD) test was employed to compare the means at 5% Probability level.

RESULTS AND DISCUSSION

1. Emergence percentage of *O. punctata* (%)

Emergence percentage of red rice significantly influenced by the application of *P. somniferum* aqueous extracts at different concentrations. Data were presented in Table-1. Among different plant parts of *P. somniferum,* highest emergence was recorded from aqueous extracts of leaves (88.57%) while statistically at par with stem extract of *P. somniferum*. Lowest emergence percentage (63.81%) was recorded from fruit extract. Leaves showed the hermetic influence on emergence percentage of *O. punctata*. Among different concentration of aqueous extracts, highest concentration (8%) significantly reduced emergence of red rice (48.89%) than control (93.33%). The interaction effect of different concentrations and plant parts showed significant on emergence percentage. Maximum emergence (100%) of red rice was recorded from leaf extract having concentration of 4 and 8% but at par with stem extract with 1 and 2% concentrations while maximum inhibition in emergence were recorded when red rice seeds treated with fruit aqueous extract of opium having 8% concentration. Emergence inhibition of red rice was increase with the increase in aqueous extract concentrations. Our consequences are in conformity with the observations of Jabran *et al.* (2015) stated that test species showed significant inhibitory effect on the emergence percentage when compared with lower concentrations, higher concentrations of extract significantly reduced the emergence percentage. Nadeem *et al.* (2020b) reported that Water extracts of leaf of *C. tinctorius* at 8% concentration result in lowest *E. cruss-galli* emergence index.

2.Emergence index of *O. punctata*

Emergence index (EI) was intended to assist the germination rate of germinating seed with respect to time. Aqueous extracts of *P. somniferum* significantly influenced the emergence index of *O. punctata* seedlings presented in Table-2. The highest emergence index of *O. punctate* seedlings was observed under control at 0% (5.03) i.e. which is statistically similar to all the concentrations except 1 and 8% concentration, while the lowest emergence index (3.07) observed at 8% which however was at par with 1%. Plant parts of *P. somniferum* have significant effect on emergence index of *O. punctata* seedlings. Leaves produced the stimulatory effect on emergence index of *O. punctata* seedlings whereas the fruit have ultra-low dose response at lower concentrations up to 0.5%. Fruits have low dose effect on all concentrations. Stem also have inhibitory influence at 1%. The interaction between different plant parts and their different concentrations was also significant. At all concentrations the leaf extract resulted in highest emergence index (9.15) while the fastest emergence was examined with fruit extracts at almost all concentration. Leaves gave the highest values of emergence index at 4%. Leaves have stimulatory effect on all concentrations and the fruit extract showed inhibitory influence on all concentrations. Stem and fruit produced the low dose response at lower concentration up to 0.5%. Like our results (Rashid *et al.,* 2008) stated that aqueous extracts of *S. marianum* aqueous significantly reduced the germination index of test species than control and an increase in inhibitory effect was observed by enhancing the

extracts concentration. Khan et al. (2011) perform experiment to observe the impact of *S. marianum* aqueous extracts on *Glycine max, P. vulgaris, C. arietinum,* and *V. radiata* germination. By the influence of extracts of test species significantly decreased the germination index as compared to the control and increase in inhibitory effect was observed by enhancing the extracts concentration

3.Time to 50% emergence of *O. punctate* (days)

It is an important parameter regarding seed emergence with respect to time (Table-3). Water extracts of *P. somniferum*on exert significantly allelopathic influence on time taken for 50% germination of *O. punctata* seedlings. The different concentrations of *P. somniferum* produced non-significant effect. The more time taken to 50% emergence of *O. punctata* (3.56 days) seedlings was given by 2% concentration whereas less time to 50% emergence was recorded at 0.25% (2.74 days). Among various parts of plant, maximum days (3.67 days) was taken by the treatment that received stem aqueous extract while leaf and fruit are statistically at par. The interaction effect of different plant parts was found significant. Stem extract of *P. somniferum* produced the stimulatory effect regarding all concentrations. Highest value of time taken to 50% emergence at 8%, fruit extract produced the enhancing effect at higher concentrations (1.50 days) and maximum days was taken by the treatment receiving aqueous extract of stem (5.42 days) having 8% concentration Leaf also showed the low dose response for time to 50% emergence. Allelopathic effect of *R. dentatus* water extracts was shown effective in enhancing the time to 50% germination of *Helianthus annus* and seedlings of *T. aestivum*. By the effect of extracts of *R. dentatus*, an increase in time to 50% germination was obtained at higher concentration when compared with control (Anjum and Bajwa*,* 2005). According to Nadeem *et al.* (2020a) who reported that all the concentrations of *C. tinctorius* enhance the time to complete 50% emergence of *O. punctata* with 8% concentration Similar inhibitory effects of aqueous extracts

4. Mean emergence time of *O. punctate* (days)

Data related to mean emergence time (MET) were presented in Table-4. Among various plant parts extracts, the leaf extract resulted in higher mean emergence time (9.07 days) while the fastest emergence was examined with fruit extracts (3.46 days) at all concentration. Among various concentrations of aqueous extract showed non-significant results while the interaction among plant parts and different concentrations showed, fruit extract with 8% concentration promote the MET of red rice (1.67 days). Leaves extract of *P. somniferum* at 2% concentration delayed MET of red rice (9.18 days) whereas statistically at par with all other concentrations of leave extract. The growth inhibitory effect of leaf might be due to the presence of chemicals that inhibited the growth of germinating seeds. Similar to our observations (Rose and Anitha*,* 2012) directed that aqueous extracts of *E.hrita* at different concentration produced inhibitory impact on groundnut and mean emergence time was inhibited by different plant parts and extracts concentration. More delayed germination (higher MET) of rice with higher (5%) than lower (2.5%) concentration of aqueous extract of *Vicia sativa* has also been reported by previous researchers (Zohaib et al., 2014).

5. Shoot length of *O. punctate* (cm)

Shoot length of *O. punctate* (red rice) significantly influence by the aqueous extracts of different plant parts of *P. somniferum* (opium) and their concentration (Table-5). The smallest shoot length (2.78 cm) was observed among different plant parts with the aqueous extracts of fruit of opium whereas, longest shoot lengths (3.51 cm) were recorded under stem aqueous extracts of *P. somniferum*. With the increase in aqueous extract concentrations, the shoot lengths were reduced. However, up to 0.5% the influence of increased concentration was non-significant. Whereas, with each unit increased in concentration from 1% to 8% the shoot length was decreased. The

interaction among different concentration and plant parts was also significant. It is observed that the concentration which was kept as control gave the longest shoots (4.01 cm) that might be statically similar with the leaf extract application at the concentration of 0.25%. The stem extract of opium had stimulatory influence on the shoot length of red rice at lower concentrations at 2.00% concentration. The fruit and leaf extracts gave the stimulatory influence at lower extract concentrations. The applications of lower concentration of leaves extracts caused in significantly higher concentration associated with control. While, the application of fruit extract enhanced the shoot length up to the concentration of 0.5%. The fruit and leaves showed the stimulatory effect at low concentrations. Might have been due to hormetic effect the shoot length enhanced. The lower concentration of aqueous extract of different plant parts of opium chemicals might be act as hormones for red rice to enhance its growth. Same results were presented by Cheema *et al.* (2003) the lower concentrations hormetic influence of aqueous extracts of different plant parts as they act as hormones for plant growth. The shoot length was inhibited by the inhibitory influence of opium water extracts has also been stated by the verdicts of Khaliq *et al.,* (2009). The delayed germination and slow growth of seedlings can be attributed to the reduction in shoot length. The significant modifications were detected between water extract of different plant parts concerning shoot length. Baber *et al*. (2009) also supported that the differences in allelopathic potential of various plant parts were significant and extreme values of shoot length were recorded with stem.

6. Root length of *O. punctata* (cm)

Different plant parts and their different concentration of *P. somniferum* (opium) significantly influenced the root length of *O. punctata* (Table-6). However, among extract of various plant parts showed non-significant results. With the rise in aqueous extracts concentration, the root lengths were decreased. However, up to 0.5% the influence of increased concentration was non-significant. However, increase in concentration from 1% to 8% the root length was decreased. Among different concentrations highest root length was observed in control (2.85 cm) treatment whereas lowest root length (0.88 cm) was observed from the treatment received aqueous extract with 4% concentration. The root length was inhibited by the inhibitory influence of opium water extracts has also been described by the verdicts of Khaliq *et al.* (2009). The delayed germination and slow growth of seedlings can be attributed to the reduction in root length. Ahmad *et al.* (2014) also supported that the differences in allelopathic potential of various plant parts were non-significant and extreme values of root length were recorded with stem. Nadeem *et al.* (2020b) revealed that foliar application of *C. tinctorius* leaf extract inhibits the root length of barnyard grass.

7. Fresh weight of *O. punctata (*g)

Aqueous extracts of various plant parts and their different concentration of *P. somniferum* had significant influence on fresh weight of *O. punctata* (Table-7). Various plant parts, produce non-significant effect while in case of various concentrations of aqueous extract significantly reduced the red rice fresh weight was observed. Maximum value of fresh weight (56.29 g) was recorded from the treatment that were received aqueous extract having 2% concentration however statistically at par with all other concentration except 8%. While lowest fresh weight (20.22 g) was noted from the 8% concentration. Among interaction between various plant parts of opium and different concentrations the highest fresh weight was observed from stem extract having 2% concentration while fruit extract having 8% concentration killed, he tests species. it's may be due to the presence of allelochemicals that inhibit the red rice growth. Our findings are similar with the observations of Khasraw *et al.* (2016) documented that seedling growth of various crops was reduced by the influenced of aqueous extracts of opium. The less germination

and slow growth of seedlings can be attributed to the reduction in fresh weight. The non-significant modifications were detected between water extract of different plant parts concerning fresh weight. Chon *et al.* (2005) also supported that the differences in allelopathic potential of various plant parts were non-significant and extreme values of fresh weight were recorded with stem extract as seedlings grow more on stem extract application than other opium plant parts extracts.

8. Dry weight of *O. punctate* (g)

Dry weight is a vital indicator of dry matter production of plants as affected by the different allelochemicals. Different parts of plant and their different concentration of aqueous extracts of *P. somniferum* had significant influence on the dry weight of *O. punctate* (red rice) (Table-8). The less dry weight (3.72 g) was recorded among different plant parts with the leaves aqueous extracts of opium because of reduced growth of red rice seedlings whereas, higher values of dry weight (20.86 g) were examined with the foliar application of fruit aqueous extracts of *P. somniferum*. With the increase in concentration of aqueous extracts, the dry weight of red rice was decreased as at higher concentrations seedlings growth was gone to reduce due to allelopathic effects of allelochemicals of opium at higher concentration. However, up to 0.5% the influence of increased concentration was non-significant. However, with each unit increase in concentration from 1% to 8% dry weight was decreased. Lowest dry matter (2.78 g) was recorded from the high concentrated 8% aqueous extract while highest dry matter was produced from the treatment that were received 2% extract (19.79 g). The lower doses produced higher biomass as compared to the untreated check perhaps due to hormesis (Table-8). The interaction among different concentrations and plant parts was non-significant. It is recorded that the concentration which was kept as control gave the higher values of dry weight due to no interference of allelochemicals at 0.00% concentration which is actually distilled water called control that might be statically similar with the stem extract application at the concentration of 0.25%. According to findings of Nadeem et al., (2020b) that application of aqueous extracts of different C. tinctorius parts at higher concentration (8%) result in reduction in seedlings dry weight of E. cruss-galli. Cseke *et al.* (2016) also supported that the differences in allelopathic potential of various plant parts were significant and extreme values of dry weight were recorded with fruit as seedlings grow more on fruit extract application than other opium plant parts extract.

Allelopathic effect of *P. somniferum* was observed on the emergence and initial seedling growth of *O. punctata.* The aqueous extracts of *P. somniferum* exert inhibitory and also in some cases stimulatory allelopathic influence (hormesis) on root length, shoot length, fresh weight and dry weight as well as on emergence of *O. punctata* weed that was depending upon the concentration of extracts. It is summed up from this study that the phyto-chemicals present in this crop at higher concentration can help in biological control of *O. punctata* weed.

CONCLUSIONS

Allelopathic effect of *P. somniferum* was observed on the germination and initial seedling growth of *O. punctata.* In this research work the aqueous extracts of *P. somniferum* exert inhibitory and also in some cases stimulatory allelopathic influence on root length, shoot length, fresh weight and dry weight as well as on germination of *O. punctata* depending upon the concentration of extracts. It is summed up from this study that the phyto-chemicals present in this crop at 8% concentration help in biological control of *O. punctata* weed.

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Table-1. Emergence percentage of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Emergence percentage (%)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	86.67ab	93.33ab	80.0abc	73.33a-d	86.67ab	100.00a	100.00a	**88.57a**
Stem	93.33ab	86.67ab	100.00a	100.00a	93.33a	93.33a	40.00e	**86.67a**
Fruit	100.00a	86.67ab	86.67ab	53.33cde	66.67b-e	46.67de	6.67f	**63.81b**
Mean	**93.33a**	**88.89ab**	**88.89ab**	**75.56b**	**82.22ab**	**80.00ab**	**48.89c**	

Means not sharing a letter in common differ significantly at 5% level of significance.
HSD: Concentration = 16.727, Plant parts = 2.107, Concentration × plant parts = 19.781

Table-2. Emergence index of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Emergence index							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	7.47bcd	8.32abc	6.78cd	5.98d	6.99bcd	9.15a	8.65ab	**7.62a**
Stem	3.44ef	3.31efg	3.83e	4.11e	3.44ef	3.53ef	0.48hi	**3.16b**
Fruit	4.17e	3.56ef	3.42ef	1.69ghi	2.06fgh	1.67hi	0.08hi	**2.35c**
Mean	**5.03a**	**5.06a**	**4.68ab**	**3.93bc**	**4.17ab**	**4.72ab**	**3.07c**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration = 0.894, Plant parts = 0.725, Concentration × plant parts = 0.863

Table-3. Time to 50% emergence of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Time to 50% emergence (days)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	2.83bcd	2.67bcd	2.75bcd	3.17bc	3.25bc	2.50cd	2.50cd	**2.81b**
Stem	3.06bc	3.25bc	3.17bc	3.50bc	3.42bc	3.92b	5.42a	**3.67a**
Fruit	3.08bc	2.31cd	3.00bc	2.33cd	4.00b	3.42bc	1.50d	**2.81b**
Mean	**2.99^{NS}**	**2.74**	**2.97**	**3.00**	**3.56**	**3.28**	**3.14**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration= ^{NS}, Plant parts = 0.482, Concentration × plant parts = 1.411
^{NS}= Non-significant

Table-4. Mean emergence time of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Mean emergence time (days)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	9.08a	8.96a	9.09a	9.16a	9.18a	8.90a	9.06a	**9.07a**
Stem	3.70cde	3.87cde	3.87cde	4.27cd	3.84cde	4.31cd	5.92b	**4.25b**
Fruit	3.77cde	3.11def	3.62de	2.78ef	4.78bc	4.48bcd	1.67f	**3.46c**
Mean	**5.52a**	**5.31a**	**5.53a**	**5.40a**	**5.94a**	**5.89a**	**5.55a**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration= ^{NS}, Plant parts =0.535, Concentration × plant parts = 1.441
^{NS}= Non-significant

Table-5. Shoot length of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Shoot length (cm)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	4.52ab	3.95a-d	3.77a-d	3.66 a-e	2.62d-g	2.26e-h	1.18gh	**3.14ab**
Stem	3.16b-f	3.87a-d	3.96a-d	4.17abc	5.05a	2.54d-g	1.80fgh	**3.51a**
Fruit	4.37abc	3.80a-d	3.55b-e	1.76fgh	2.89c-f	2.27e-h	0.80h	**2.78b**
Mean	**4.01a**	**3.87a**	**3.76a**	**3.19ab**	**3.52a**	**2.35b**	**1.26c**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD for concentration = 1.17, for plant parts = 0.73, for Interaction = 1.263

Table-6. Root length of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Root length (cm)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	3.97a	1.76bc	1.14c-g	1.36cde	1.06c-h	0.72e-i	0.48f-i	**1.50^{NS}**
Stem	1.42cde	1.73bc	1.48b-e	1.26c-f	2.27b	1.53b-e	0.30hi	**1.43**
Fruit	3.18a	2.28b	1.58bcd	0.88d-i	0.81c-i	0.38ghi	0.13i	**1.32**
Mean	**2.85a**	**1.92b**	**1.40c**	**1.17cd**	**1.38c**	**0.88d**	**0.30e**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration = 0.518, Plant parts= ^{NS}, Concentration × plant parts = 0.911
^{NS}= Non-significant

Table-7. Fresh weight of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Fresh weight (g)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	67.33ab	51.83a-d	49.33a-d	53.61a-d	38.44bcd	34.66cd	27.33de	**46.07^{NS}**
Stem	41.33bcd	47.33a-d	46.66a-d	60.00abc	74.00a	48.83a-d	33.33cd	**50.21a**
Fruit	41.33bcd	58.00a-d	53.33a-d	54.55a-d	56.44a-d	45.55a-d	26.00e	**44.17a**
Mean	**50.00a**	**52.38a**	**49.77a**	**56.05a**	**56.29a**	**43.01a**	**20.22b**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration = 6.982, Plant parts = ^{NS}, Concentration× plant parts = 28.447
^{NS}= Non-significant

Table-8. Dry weight of *O. punctata* as influenced by aqueous extract concentrations of leaf, stem and fruits of *P. somniferum.*

Plant Parts	Dry weight (g)							
	Concentration							Mean
	Control	0.25%	0.5%	1%	2%	4%	8%	
Leaf	7.00^{NS}	3.60	4.38	3.91	3.60	3.06	1.13	**3.72c**
Stem	11.00	13.00	12.00	20.00	27.67	14.16	7.22	**15.01b**
Fruit	17.33	28.00	25.00	25.83	28.78	21.11	0.99	**20.86a**
Mean	**11.78b**	**14.86ab**	**13.79ab**	**16.58ab**	**19.79a**	**12.78ab**	**2.78c**	

Means not sharing a letter in a common differ significantly at 5% level of significance**.**
HSD: Concentration = 7.005, Plant parts = 2.456, Concentration × plant parts = ^{NS}
^{NS}= Non-significant

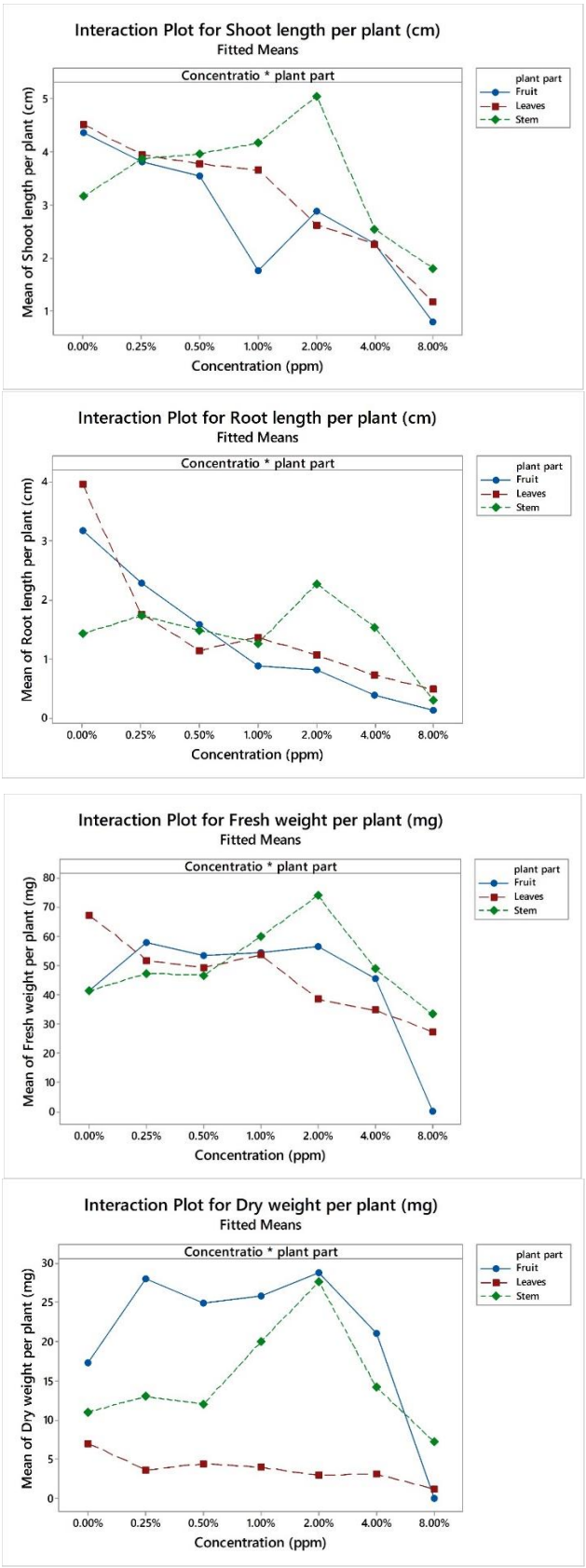

Figure.1: Interaction between treatment means of shoot length, root length, fresh weight and dry weight of *O. Punctata* under the influence of aqueous extracts of different parts of *P. Somniferum.*

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