*J. Phytol. Res.* 21(2) : 285-288, 2008

# ALLELOPATHIC POTENTIAL OF *VICIA SPP. ON WHEAT (TRITICUM AESTIVUM* L.)

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Allelopathic effects of aqueous extracts from shoot and root of *Vicia spp.* were studied on the seed germination, seedling length and dry weight of wheat. The four aqueous extracts (5%, 10%, 15% and 20% of *Vicia* spp. reduced all the test parameters in 7 days old wheat plants. The *Vicia* extracts reduced the germination and seedling growth of wheat. The degree of inhibition was dependent on the concentration of extracts. Shoot extract was more inhibitory than root extract. This showed that better growth of these weeds occurred during initial stage of growth in rabi fields.

**Keywords :** Allelopathic; Aqueous extracts; Dry matter; Inhibition; Seed geremination; Seedling growth; *Vicia hirsuta* L.; *Vicia sativa* L.; Wheat.

## Introduction

Allelopathy refers to the beneficial or harmful effects of one plant on another plant both crop and weed species by the release of chemicals from plant parts by leaching, root exudation, volatilization, residue decomposition and other processes in both natural and agricultural system. Such chemical which impose allelochemics released into the environment by a species is directly responsible for the survival as well as dominance of that species and reduction or even elemination of associated plant species[1,2].

The genus *Vicia* L. (Leguminosae, Fabaceae) comprises about 180 species extensively distributed in temperature zone of both hemisphere[3] of which *Vicia hirsuta* and *V. sativa* are dominant weeds species associated with wheat crop and cause considerable damage to vigour and yield of crop. Hence, these studies were undertaken to find the allelopathic effects of aqueous extracts of shoot and root of *Vicia* species on the seed germination and seedling growth and dry weight of wheat seedlings.

## Material and Methods

Shoot and root of *V. hirsuta* and *V. sativa* L. were collected from around RD & DJ College campus, Munger (24° 30N, 86° 30'E and 45 m above seal level) during February and March 2006 and chopped into small pieces. Extracts were prepared by crushing 10 g of respective organs in a mixer with 100 ml distilled water. The mixture was stored for 72 h before filtering in Whatman (No. 1) filter paper and the filtrate brought to 100 ml with addition of water. This consistute the stock solution from which desired concentration (5%, 10%, 15% and 20%) were prepared by dilution with distilled water.

Each bioassay consisted of placing 25 seeds of wheat in a sterile petridish (11 cm dia) which contained one filter paper and 10 ml test solution for each treatment. Controls were maintained with equal quantity of distilled water. Seeds were allowed to germinate under room temperature (20°±2°C) and covered petridishes were opened periodically for aeration.

Seed germination and linear growth of radicle and plumule of wheat were measured after 7 days on account of their very low dry weight, 10 seedlings were dried together to constant dry weight at 80°C for 72 h. in a hot air oven, weighed and mean dry weight per seedling were calculated. Mean dry weight was used for computing standard deviation. Finally, results were subjected to students 't' test to see significance[4].

## Results and Discussion

The allelopathic effects of different concentrations of aqueous extracts from shoot and root of *Vicia spp.* were inhibitory to all parameters viz. seed germination, seedling length and seedling dry weight of wheat (Table 1, 2; Figs. 1-3).

Inhibition values calculated for seeds of wheat indicated that the inhibition increased progressively as the concentrations of aqueous extracts of *V. hirsuta* and *V. sativa* enhanced (Table 1, 2; Fig. 1). Effect of different aqueous extract concentrations of root of *V. sativa* showed the inhibition was more (62%) as compared to *V. hirsuta (48%)* in wheat seedling germination at the highest concentration (20%). The inhibition of seed germination

**Table 1.** Effects of aqueous extract of *Vicia hirsuta* shoot and root on seed germination (%), seedling length (cm) and dry weight (mg) of radicle and plumule of wheat after 7 days (mean ±S.D.).

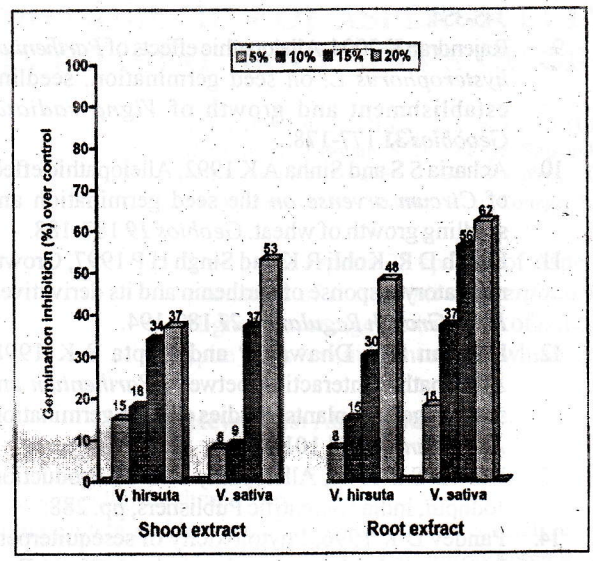
| Plant extract | Aqueous extract concentration (%) | Germination (%) | Seedling length (cm) | | Dry weight (mg) | |
|---|---|---|---|---|---|---|
| | | | Radicle | Plumule | Radicle | plumule |
| Control | 0 | 89 | 7.56±1.32 | 8.74±1.24 | 1.80±0.04 | 1.14±0.02 |
| Shoot | 5 | 76 | 7.30±1.20 | 8.33±1.40 | 1.78±0.05 | 0.80±0.05 |
| | 10 | 73 | 7.14±1.43 | 8.20±0.77 | 1.76±0.05 | 0.78±0.05 |
| | 15 | 59 | 6.94±1.44 | 7.48±1.77 | 1.71±0.08 | 0.72±0.40 |
| | 20 | 56 | 6.12±1.34 | 7.46±1.55 | 1.59±0.06 | 0.65±0.71 |
| | Mean | 66 | 6.87±0.45 | 7.86±0.40 | 1.71±0.07 | 0.73±0.06 |
| Shoot | 5 | 81 | 6.52±1.98 | 7.80±1.3 | 1.58±0.06 | 0.91±0.02 |
| | 10 | 76 | 6.42±1.67 | 7.10±2.33 | 1.54±0.04 | 0.89±0.01 |
| | 15 | 63 | 6.38±1.76 | 6.89±2.4 | 1.46±0.05 | 0.87±0.02 |
| | 20 | 46 | 6.20±1.96 | 6.65±1.96 | 1.40±0.22 | 0.75±0.04 |
| | Mean | 66.5 | 6.38±0.11 | 7.11±0.40 | 1.49±0.06 | 0.85±0.06 |

All differences significant at 1% level.

**Table 2.** Effects of aqueous extract of *Vicia sativa* shoot and root on seed germination (%), seedling length (cm) and dry weight (mg) of radicle and plumule of wheat after 7 days (mean ±S.D.).

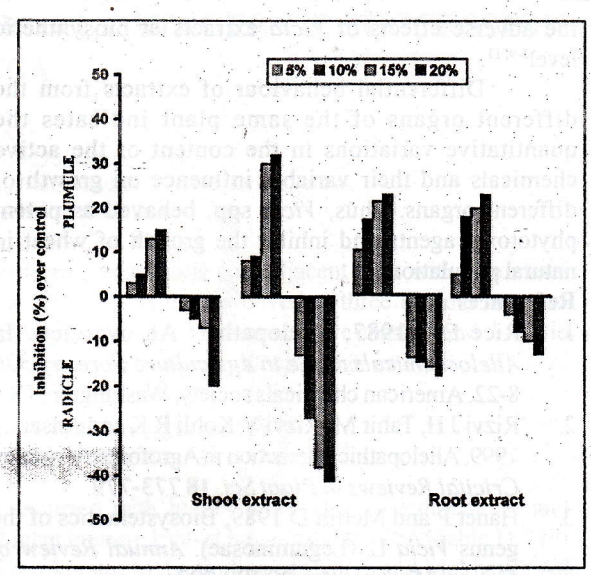
| Plant extract | Aqueous extract concentration (%) | Germination (%) | Seedling length (cm) | | Dry weight (mg) | |
|---|---|---|---|---|---|---|
| | | | Radicle | Plumule | Radicle | plumule |
| Control | 0 | 96 | 7.11±1.01 | 8.88±1.51 | 1.56±0.04 | 0.85±0.01 |
| Shoot | 5 | 88 | 6.18±1.46 | 6.8.16±1.28 | 1.54±0.03 | 0.71±0.02 |
| | 10 | 87 | 5.12±0.74 | 8.0±1.19 | 1.53±0.05 | 0.07±0.02 |
| | 15 | 60 | 4.35±0.83 | 6.0±0.97 | 1.52±0.06 | 0.61±0.01 |
| | 20 | 45 | 4.21±0.46 | 5.85±1.40 | 1.32±0.03 | 0.60±0.01 |
| | Mean | 70 | 4.96±0.78 | 7.0±1.08 | 1.48±0.09 | 0.66±0.05 |
| Shoot | 5 | 79 | 6.90±1.30 | 7.47±1.72 | 1.41±0.06 | 0.73±0.03 |
| | 10 | 60 | 6.39±1.83 | 7.23±1.71 | 1.37±0.05 | 0.60±0.01 |
| | 15 | 42 | 6.17±0.99 | 6.99±1.04 | 1.37±0.04 | 0.60±0.03 |
| | 20 | 36 | 6.02±1.47 | 6.77±1.81 | 1.02±0.03 | 0.59±0.01 |
| | Mean | 54.25 | 6.37±0.33 | 7.11±0.26 | 1.30±0.15 | 0.63±0.05 |

All differences significant at 1% level.



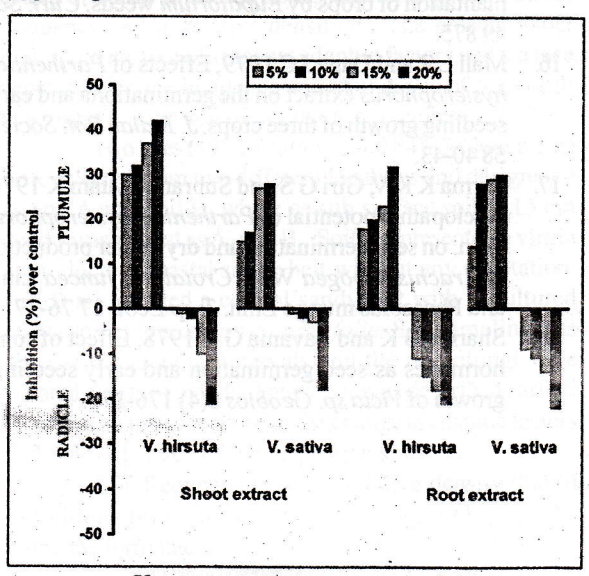

*Vicia extract concentration (%)*

**Fig.1.** Effect of shoot and root aqueous extract of *Vicia* spp. on germination of wheat.




*Vicia extract concentration (%)*

**Fig.2.** Inibitory effects of shoot and root of *Vicia* spp. aqueous extract on seedling length of wheat.




*Vicia extract concentration (%)*

**Fig.3.** Inibitory effect of shoot and root of *Vicia* spp. on dry weight of radicle and plumule of wheat.

in wheat seedling was less (8%) in *V. hirsuta as compared to V. sativa* (18%) at the lowest concentrations (5%) over the control. In shoot aqueous extracts the inhibition of wheat seedling germination was higher (53%) in case of *V. sativa* as compared to *V. hirusta* (37%) at 20% concentration over the control.

With increase in concentration of extract a greater reduction in seed germination is indicative of the presence of germination inhibitors in extract. The magnitude of inhibition varied in wheat and is in cnformity with other scientists[1,5-9]. Such inhibitory effects of various extracts of *Vicia* spp. might be attrebuted to the presence of toxic chemicals in the extracts which have affected the process of seed germination in wheat[10-14].

All concentrations of extract inhibited the seedling length of wheat (Table 1, 2; Fig. 2). Progressive inhibition was observed in the linear growth of radicle and plumule with proportionate increase in concentration of the extraact. The inhibitory effects of shoot extract was more as compared to the root extracts. Such observation was suggestive of the presence of inhibitory substance in higher quantity in shoot extract of *V. hirsuta* and *V. sativa* as compared of the root extract. Thus, the growth of wheat seedling was adversely affected more by *V. sativa* than *V. hirsuta* and followed the order *V. sativa* > *V. hirsuta*. Similar observations were reported earliar[15-18].

Reduction in dry weight of seedling after affect of aqueous extracts of shoot and root of *Vicia* spp. were recorded similar to inhibition in seedling length. (Table 1, 2; Fig. 3). Reduction in the dry weight of seedlings (radicle and plumule) of wheat with the increase in the concentrations of the extract, suggested that allelochemics present in *Vicia* spp. caused reduction in the growth by reducing the dry matter content in the plant. It indicates

the adverse effects of *Vicia* extracts at biosynthetic level[5-9, 11].

Differential behaviour of extracts from the different organs of the same plant indicates the quantitative variations in the content of the active chemicals and their variable influence on growth of different organs. Thus, *Vicia* spp. behaved as potent phytotoxic agents and inhibit the growth of wheat in natural population.

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