



REGULAR ARTICLE

ALLELOPATHIC EFFECTS ON SEEDLINGS GROWTH OF *TRIGONELLA FOENUM GRAECUM* AND *CORIANDRUM* *SATIVUM*

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SUMMARY

In present investigation, Allelopathic (negative interaction) effect was studied on *Trigonella foenum graecum* L. and *Coriandrum sativum* L. seedlings. Seeds of these crops were grown in combinations on its own extracts with different dilution. The seedling growth were studied in terms of radicle length, dry weight, total nitrogen and carbohydrate contents at 3rd, 5th and 7th day interval immediately after radicle emergence. *Trigonella* seedlings showed growth inhibition in all dilutions of its own seed extracts up to 7th day. Likewise, *Coriandrum* seedlings also showed growth inhibition at all three days interval in all dilution when grown in *Trigonella* extract. Furthermore, *Trigonella* and *Coriandrum* seedlings exhibited growth inhibition when grown in their own seed extract. *Trigonella* was however, showed less growth inhibition as compared to *Coriandrum* when grown in coriander seed extracts. The total nitrogen and carbohydrate contents were low in both *Trigonella* and *Coriandrum* seedlings grown at the seed extracts of each comparatively to control.

Key words: *Coriandrum*, *Trigonella*, Inhibition, leachates, Nitrogen

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1. Introduction

The world demand for food increases day by day because of the population growth which leading to exceed the food supply. Although, there is lose of yield due to insects, weeds and diseases, and also some of the phytotoxic chemicals secreted by one group of plants resulting yield lose of other group of plants. There are some interaction existing in nature between plants with its associates and one of them is allelopathy [1, 2]. The allelopathic interactions are found in wide variety of plants. The beneficial effect can be called positive allelopathy, the detrimental effect negative allelopathy. A large number of weeds and tree possess negative allelopathic properties, which have growth inhibiting effect on crops [3]. Negative allelopathic effects can be manifested as reduced crop germination and seedling growth, inhibition of symbiotic nitrogen fixation by legumes, and reduced nutrient

uptake [4]. The most studied aspects of allelopathy are the allelopathy in agriculture. Currently the researchers are mainly focused their research to study the effects of weeds on crops, crops on weeds, and crops on crops. Research is also going on the use of allelochemical as natural growth regulator or as natural herbicide to promote sustainable agriculture.

The *Trigonella foenum-graecum* (Fenugreek) is medicinal herb Fenugreek is used both as an herb (the leaves) and as a spice (the seed). It is cultivated worldwide as a semi-arid crop. It is frequently used in curry its seeds mainly used for stomach upset, swelling (inflammation) of the upper air passages or throat, appetite, for lowering blood carbohydrate, and for softening the stool. It has also been used as a gargle to relieve sore throat. It has anti microbial activity because

its aqueous extracts from all parts also inhibits the mycelia growth of some fungi. Its allelopathic effects on seed germination were demonstrated by Haouala [5].

Coriandrum sativum belongs to the family Apiaceae, has been used as a folk medicine for the relief of anxiety and insomnia in Iran. Experiments in mice support its use as an anxiolytic [6]. In holistic and traditional medicine, it is used as a carminative and digestive aid. In recent year mixed cropping has been practiced in the agriculture system due to the lack of agricultural land and some crops grown together, but ultimately their yield is affected. Inhibitory effects on germination and establishments of crops caused by residues of either crops or weeds have lead to investigation of the release of toxic compounds from such residues. *Trigonella* and *Coriandrum* are herbaceous plants growing in the same weather and farmers were tried to cultivate them together in the field. But these plants exhibits strong allelopathic interaction at their initial stage of seedling growth after germination. In both of these plants yields were affected by the presence of each other. Therefore the present investigation was undertaking to study the allelopathic interaction by growing the seedlings of *Trigonella* and *Coriandrum* together with their own seed extracts. The inhibition in growth including some biochemical parameters were studied at three different time intervals.

2. Materials and Methods

Plant material

Fresh seeds of *Trigonella foenum graecum* L. and *Coriandrum sativum* L. were procured from IARI, New Delhi.

Vigour analysis of seeds

The embryo from seeds were taken for vigour analysis and kept in TzCl₂ (Tetrazolium chloride) for approx. three hour. The colour of the living material was turned pinkish red indicating that seed were 100% viable.

Growth study

The seeds of *Trigonella* and *Coriandrum* were imbibed in distilled water after surface sterilization with 0.1% HgCl₂. The imbibed seeds were germinated in Petri plate supplied with the seed extracts of both *Trigonella* and *Corianderum* separately in three different dilutions 1:10, 1:20 and 1:50. Where 1 indicates 1gm seeds per 100 ml distilled water was used as stock. Distilled water grown seedlings were used as positive control. Seedlings after radicle emergence were used to study the negative allelopathic interaction. The radicle length, dry weight was recorded on 3rd, 5th and 7th day after radicle emergence. The leachates were also collected and its pH was taken at same day's interval.

Biochemical analysis

Total nitrogen estimation: Total nitrogen was estimated at 3rd, 5th and 7th day after radicle emergence in seedlings and leachates by the method of Snell and Snell [7]. In this method all nitrogen presented in a dry matter was converted into ammonium sulphate. This ammonium sulphate gives red colour with nessler reagents, which was read at 445 nm on spectrophotometer. Nitrogen was estimated with the help of standard curve made by taking different concentrations of standard ammonium sulphate and expressed as mg g⁻¹ DW.

Total carbohydrate estimation: Total carbohydrate was estimated by the method of Hedge and Hofriter [8]. The dry organic matter was reacted with 2.5N HCl on water bath for 3 hour to convert into 5 hydroxy methyl furfural. This gives green colour with anthrone reagent. The carbohydrate was estimated by the standard curve prepared by different concentrations of glucose using the formula below and expressed as mg g⁻¹ DW.

$$= \frac{\text{Mg of glucose}}{\text{Volume of the test sample}} \times 100$$

3. Result and Discussion

The growth of both plants (*Trigonella* and *Coriandrum*) was inhibited in all dilutions of the seed extracts. The length of radical in *Trigonella* seedlings grown in *Trigonella* seed extract in 1:10 dilution was similar as control at 3rd day while the inhibition in the radical length was started at 1:20 dilutions at 3rd day onwards. The higher growth inhibition was found in 1:50 dilutions at 7th day after radical emergence (Fig. 1). The coriander seedlings also showed growth inhibition when grown in *Trigonella* seed extract in all dilutions at all days (Fig. 2). The inhibition of growth was more in *Coriandrum* seedlings as compared to *Trigonella* seedlings.

Fig. 1: The radicle length of *Trigonella* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts.

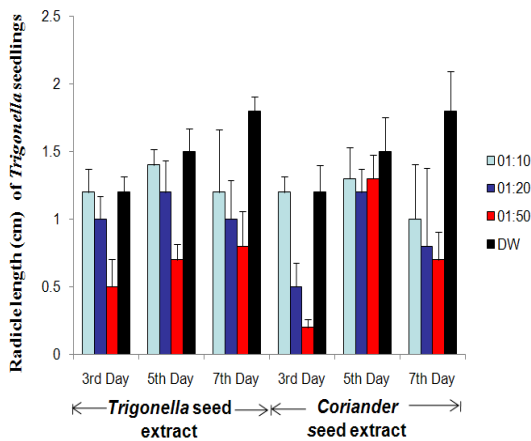
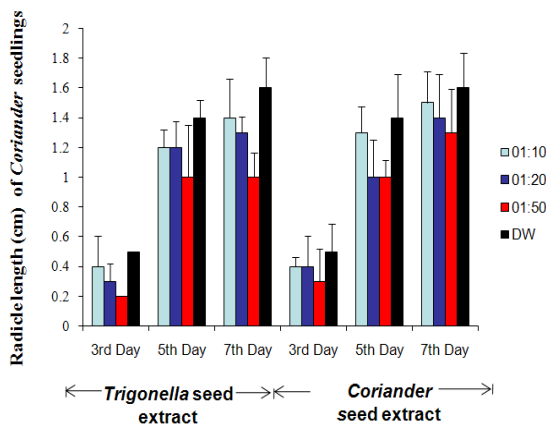


Fig. 2: The radicle length of *Corianderum* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts.



In *Coriandrum* seed extracts, the *Trigonella* seedlings showed growth inhibition in 1:20 and 1:50 dilution. The growth of radical was

highly suppressed at 7th day in 1:50 dilution. At 1:10 dilution the growth was however, similar to that of control (Fig. 1). The *Coriandrum* seedlings showed growth inhibition at 3rd day onwards in all dilutions. The growth inhibition of the *Coriandrum* seedlings was lower than the *Trigonella* seedling showed in latter stage (Fig. 2). The growth inhibition of both plants *Trigonella* and *Coriandrum* was cleared in present study, thereby indicating that both the plants negatively interact with each other. However, both of these plants were not analysed for the production of any allelochemicals. As Blair pointed out that laboratory bioassays for allelopathy may not have ecological relevance in the field [9]. Experiments were also conducted separately in natural conditions (data not shown), both the crop grown in the close vicinity considerably inhibits the growth of one another initially, but finely *Trigonella* completely suppress the growth of *C. sativum*. The dry weight of the *Trigonella* seedlings grown in *Trigonella* seed extracts showed the reduction from 3rd day onward and in 1:50 dilution at 7th day the dry weight reduction was more than control (Fig. 3). The *Coriandrum* seedlings showed a reduction in dry weight grown at 1:50 dilution of *Trigonella* seed extract (Fig. 4). The dry weight of the *Trigonella* seedling grown in *Coriandrum* seed extracts was more than its own seed extract at all the day's interval. While *Coriandrum* seedlings dry weight was severely reduced than distilled water grown plants. The reduction in dry weights also confirmed the allelopathic potential of the crop.

Fig. 3: Dry weight of *Trigonella* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts.

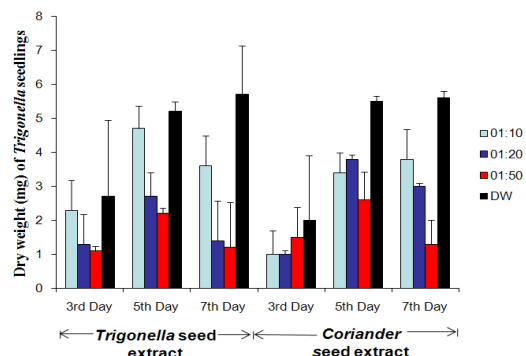
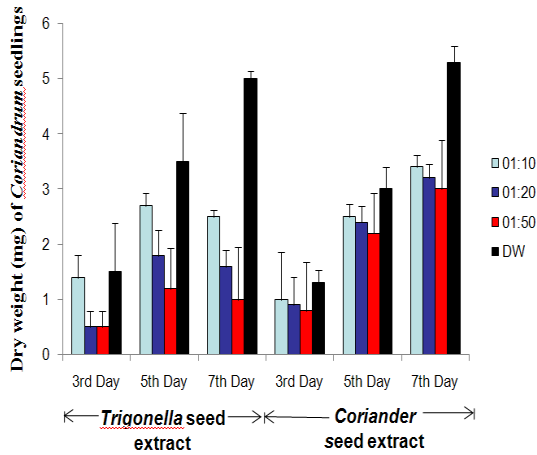


Fig. 4: Dry weight of *Coriandrum* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts.



Total nitrogen content was lower in *Trigonella* seedlings (Fig. 5) grown in *Trigonella* seed extracts at 3rd and 5th days than control but at higher dilution of extracts it was lower down further. In the *Coriandrum* seedlings, total nitrogen contents (Fig. 6) were decreased in all the used dilution of *Trigonella* seed extracts than distilled water grown plants. *Trigonella* seedling grown on *Coriandrum* seed extract showed a significant reduction in total nitrogen content. Similarly the *Coriandrum* seedlings were also showed more reduction in its own seed extracts than distilled water grown control.

Fig. 5: Total nitrogen content of *Trigonella* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts

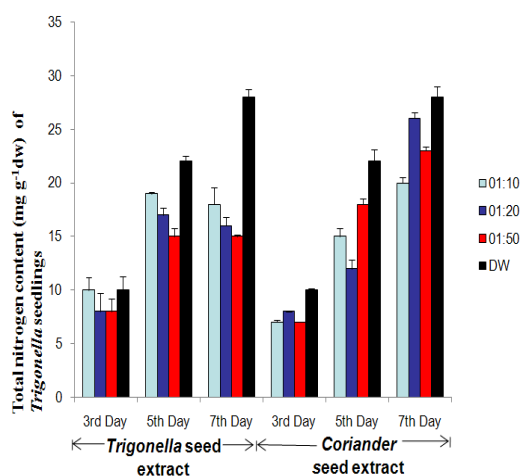
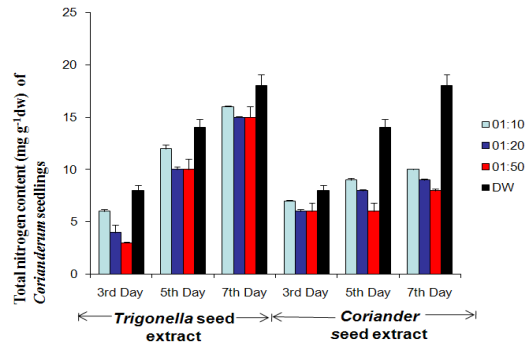


Fig. 6: Total nitrogen content of *Coriandrum* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts



Total carbohydrate content in *Trigonella* (Fig. 7) and *Coriandrum* seedlings (Fig. 8) were almost similar with control grown at their own extracts, but the carbohydrate content was lower down when they grown on each extracts. The total nitrogen contents of the seedlings grown in extracts of each were reduced than their distilled water grown control. Nitrogen is the main part of amino acids of protein and the protein inhibition was resulting in the growth inhibition of the germinating seedlings. The carbohydrate level was decrease in the seedlings grown at the extracts of one another. It means that the presence of other plant seed extract, the germination process of one group of plant is inhibited up to a certain extent and it doesn't matter that this interaction is continuing latter stage of plant. These observations also explain why one crop residues (like seed coat, roots, leaf and stem) have their highest inhibitory activities during the establishment of other crop [10]. Each crop differed in their inhibitory activities in field and in laboratory conditions.

Fig. 7: Total carbohydrate content of *Trigonella* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts

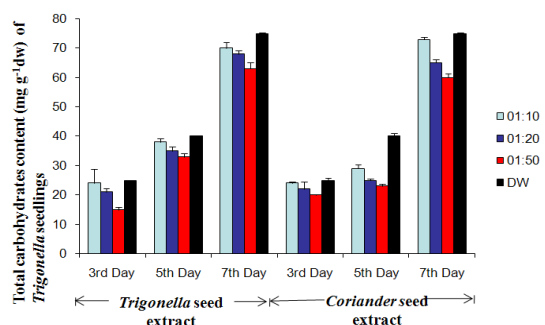
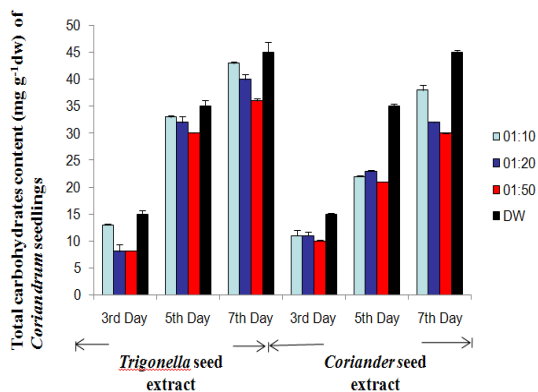


Fig. 8: Total carbohydrate content of *Coriandrum* seedlings at different days interval in *Trigonella* and *Coriandrum* seed extracts



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