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# Studies on allelopathic effects of some bryophytic extracts on seed germination of *Trigonella foenum-graecum* l

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**Abstract**
The present work embodies the germination behavior of fenugreek seeds in response to different bryophytic extracts. The *Riccia sps.* and *Anthoceros sps*. are very abundant in Konkan region during the month of August to October. The aqueous extracts and methanolic extracts of *Riccia sps.* and *Anthoceros sps*. were tested to study the effects on seed germination and seedling growth of *Trigonella foenum-graecum* L. (fenugreek). Initiation of germination adversely affected by the increase in concentration of extract in organic solvent but in aqueous extract seed germination was not delayed significantly. Total time taken for the completion of germination varied between the bryophyte species, concentration and the solvent used.

**Keywords:** Germination, *Riccia*, *Anthoceros*, bryophytes, extracts

## Introduction
Allelopathy is a common biological phenomenon by which one organism produces biochemicals that effect the growth, survival, development, and reproduction of other organisms. These biochemicals are known as allelochemicals and have positive or negative effects on target organisms. Plant allelopathy is one of the modes of interaction between receptor and donor plants and may exert either positive or negative effects.

Bryophytes living on variety of habitats represented a group of plants, which were exposed to different environmental and biotic dangers by virtue of their miniature size. Perhaps, for this reason, many of the secondary metabolites especially terpenoids and phenolic compounds of quite numerous chemical structures are synthesized as defense system. These chemical substances act as defensive mechanism against herbivores and pathogens from attacking them. Possibly, it may be one of the reasons why many bryophytes grow in more and less in pure turf and cushion or mats. These allelochemicals also known as allomones have an advantage to the plant that produces them by preventing the growth of other plant species that may compete for water, nutrition, soil, CO2 and sunlight.

Allelopathic interactions have been studied in vascular plants since the beginning of the 20$^{th}$ century, while the first studies of allelochemicals in bryophytes trailed several decades later (Watson, 1981) [10].

Huceck and Schreiber (1972) reported some allelochemicals from some bryophytes, which possess growth regulatory activities. Asakawa, *et al.* (1976) [3] stated that higher plants sometimes do not grow in these places inhabited by certain bryophytes because some liverworts give off allelochemicals.

The crude extract of bryophytes shows inhibitory activities against germination, root elongation and second coleoptiles growth of rice, wheat, lettuce and radish (Asakawa, 1981) [2]. Asakawa *et al.* (1979 a, 1982) [4, 5] reported that sesquiterpene lactones isolated from liverworts have plant growth inhibitory effects on the germination and root elongation of rice husk at concentration of 50-200 ml, while sesquiterpene dialdehydes, polygodial and diterpene dialdehydes, etc. had a weak inhibitory effect. Contrary to the liverworts, little is known about the secondary compounds from mosses. Garvrillava (1970) stated that the aqueous extracts of *Polytrichum comroune* and *Sphagnum sps inhibits* the growth of *Pinus* and *Picea* seedlings, but stimulate the growth of *Larix* seedlings.

Huneck and Meinunger (1990) [8] studied the effects of Bryophytes (52 mosses and 29 liverworts) on germinating seeds and root and shoot growth of Cress after 5 days in room temperature. They found different types of reactions 1) Bryophytes that promote growth of shoots. 2) Bryophytes that promotes growth of the roots. 3) Bryophytes that retarded growth of the both roots and shoots. Chemicals with allelopathic activity are present in many plants and in various organs and have potential as either herbicides or templates for new herbicides classes (Duke, *et al.* 2000) [6].

The present research was carried out to study the allelopathic effects of some bryophytic extracts on the seed germination and early seedling growth behaviors of fenugreek seeds. Fenugreek is an annual plant of family Fabaceae, with leaves consisting of three smalls obovate to oblong leaflets. It is grown worldwide as a semiarid crop. It's seeds and leaves are common ingredients of many dishes from the Indian subcontinent and have been used as a culinary ingredient since ancient times.

## Material and Methods
### Collection and Identification of Bryophytes
The selected two liverworts i.e. *Riccia* and *Anthoceros* were collected in months of July and first week of August by regular and repeated field visits from Dapoli area. Fresh plants with proper reproductive organs were collected. The plant was kept in separate polyethylene bags and sealed immediately. The collected plant materials were sorted out on basis of their characters.

### Preparation of bryophyte extract
The collected bryophytic materials were washed to remove soil particles and blotted. Extract were prepared from entire thallus. Water and methanol were used as extraction solvent. To prepare extract, 5gm fresh material of *Riccia* and *Anthoceros* separately with pinch of sand in mortar and dissolve in 50 ml of solvent and shaken on rotary shaker

(200 r.p.m.) for 1hour and filtered with Whatman filter paper No. 1. Final volume was made up to 100cc by adding respective solvent and considered as full concentration (100%). Then this extract was diluted to 70%, 50% and 20% concentration (Sharma, *et.al*, 2009) [1].

**Bioassay**

For each bryophytic species and for each extract, the Petri plates were prepared in triplicate. The Petri plates were lined with a thin layer of cotton and filter paper and were sterilized. 20 seeds of *Trigonella foenum-graecum* L. (Fenugreek) were placed in each petri plate to observe behavior of the seed germination in various concentration of bryophytes extract in different solvents. Control plates were prepared in same manner for each test. In each Patri plate 10cc of extract was poured. For organic solvent after pouring 10cc extract in petri plate the solvent was evaporated aseptically at 35° C and 20seeds were placed and 5cc of distil water was added. It was assumed that allelochemicals dissolved in organic solvent were absorbed in filter paper. In control of each concentration, solvents of same concentration but without bryophyte extract were used.

The experiments were done at room temperature (25º C – 28º C) and were carried out for 30 days. The seeds were considered germinated if the radical exceeded 3 mm in length. (Sharma, *et.al*, 2009) [1].

**Observations**

The allelopathic effect of different bryophytic extracts on the seed germination is shown in table no. 1

**Table 1:** Percentage of seed germination

| Bryophyte species | Solvent Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water | | | | Methanol | | | |
| | Control | 20% | 50% | 70% | Control | 20% | 50% | 70% |
| *Anthoceros sps.* | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| *Riccia sps.* | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Number of days taken for initiation of seed germination in fenugreek seeds as affected by different bryophytic extract are shown in Table No. 2.

**Table 2:** Number of days taken for initiation of seed germination in fenugreek seeds

| Bryophyte species | Solvent Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water | | | | Methanol | | | |
| | Control | 20% | 50% | 70% | Control | 20% | 50% | 70% |
| *Anthoceros sps.* | 02 | 03 | 03 | 04 | 03 | 07 | 08 | 07 |
| *Riccia sps.* | 02 | 02 | 03 | 04 | 03 | 08 | 07 | 06 |

The actual number of days taken for completion of germination of fenugreek seeds as affected by different bryophytic extracts are given in Table No.3

**Table 3:** The actual number of days taken for completion of germination of fenugreek seeds

| Bryophyte species | Solvent Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water | | | | Methanol | | | |
| | Control | 20% | 50% | 70% | Control | 20% | 50% | 70% |
| *Anthoceros sps.* | 03 | 06 | 05 | 04 | 04 | 10 | 12 | 15 |
| *Riccia sps.* | 03 | 04 | 04 | 05 | 04 | 09 | 10 | 12 |

**Result and Discussion**

The present study shows the growth regulatory behavior of *Riccia* sps and *Anthoceros* sps. aqueous and methanolic extracts on seed germination and growth performance of fenugreek. The germination of fenugreek seeds was 100% in each of the control experiments. However, different degrees of germination were found in various concentrations of bryophytic extracts. In controlled condition germination was initiated within 2 days, while it was delayed by 1 to 2 days in aqueous extracts and 5 to 6 days in lipophilic extract of bryophytes. As compare to aqueous extract, methanol extracts of both bryophytes show more negative effect on initiation and completion of seed germination of fenugreek seeds i.e. slowdown the seed germination process. It may be due to sesquiterpene lactones, sesquiterpene dialdehydes, polygodial and diterpene dialdehydes, etc. (Asakawa *et al.*, 1979, 1982) [4, 5].

sIn controlled condition the germination was completed within 48 hrs. However, irrespective of concentration, germination was delayed by 2 to 3 days in aqueous extracts and 8 to 13 days in Methanol extracts.

Both, *Riccia* sps and *Anthoceros* sps. shows little bit similar effects on initiation and on completion of fenugreek seed germination in both aqueous and methanol extracts. With increased concentrations of both aqueous and methanol extracts, delays the initiation and completion of seed germination of fenugreek.

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