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Allelopathic Effect of Aqueous extract of *Erythroxylum monogynum* Roxb. on Germination and Growth of *Solanum lycopersicum* Mill. var. PKM-1

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Abstract: ***Seed germination performance is one of the most essential development stages in medicinal and aromatic plants that may be unfavourably affected by the phytochemicals released from other plants in the soil environment. The present research was conducted in the laboratory to study the allelopathic effect of Erythroxylum monogynum Roxb. to the germination and growth parameters of Solanum lycopersicum Mill. var. PKM-1. Various concentrations of leaf and stem aqueous extracts from Erythroxylum monogynum (0%, 5%, 10%, 15%, 20% and 25%) were valued. Results noted that seed germination, plumule length, radicle length, fresh weight and dry weight of S.lycopersicum were notably decreased by leaf and stem extracts compared with control treatments. Roots were greater affected than shoots; leaf extract was more reduced than stem extract. These result revealed that the inhibitory and stimulatory effect potency may be due to the presence of these allelochemicals like phenols, saponins, tannins and sterols etc., in the aqueous leaf and stem extracts of E. monogynum from the present study.***

Keywords: Allelopathy, aqueous extract, germination, *Erythroxylum monogynum, Solanum lycopersicum* var. PKM-1.

1. Introduction

Allelopathy was defined as the direct or indirect detrimental or profitable effects of one plant or another through the production of biochemical compounds that escape into the environment [1]. Allelopathy is also regarded as bio-chemical warefare. Plants suppress the seed germination and growth of other plants by means of producing toxic chemicals, i.e. allelopathins or allelochemicals. Allelochemicals are plant secondary metabolites essentially produced from medicinal and aromatic plants [2]; have been classified, including the flavonoids, glycosides, alkaloids, terpenoids, phenolic acids, glucosinolates and coumarins. These chemical essences are known to be exuded by plants to inhibit emergence or growth of the other plants; allelopathic results of these compounds are often noted to occur early in the life cycle, causing suppressed of seed germination and seedling growth. These compounds reveal a extensive expanse of mechanisms of activity and interpretations of mechanisms of activity are complicated by the reality that particular compounds can have multiple phytotoxic effects [3].

Allelopathic chemicals can be present in any portion of the plant. Allelochemicals are displayed by plants as conclusion products, by-products and secondary metabolites and are contained in the roots, stem, leaves, flowers, inflorescence, fruits and seeds of the plants of these plant parts leaves seem to be the highest conforming producers of these allelochemicals. Mathela (1994)[4] observed that the secondary metabolites (flavonoids, steroids, diterpenoids and glycosides) of some medicinal and aromatic plants recorded for allelopathic action. Alagesaboopathi and Tamilazhagan (2010)[5] reported that as the concentration of extracts of *Andrographis lineata* increased, the growth of the plant decreased. Alagesaboopathi (2011)[6] observed that leaves, stem and root extracts of *Andrographis paniculata* singificantly decreased germination and seedling growth in *Sesamum indicum.* Ademiluyi (2013)[7] studied allelopathic effect of *Tithonia diversifolia,* which showed inhibition in germination and seedling growth of *Tridax procumbens.* There are several reports allelochemicals from this plant negatively concern plants like *Tinospora cordifolia, Sesbania grandiflora*, *Oudneya africana* [8-10].

Erythroxylum monogynum Roxb. belonging the family of Erythroxylaceae, commonly called Bastard Sandard, Red Cedar in English and locally known as Devadara, Sembulichan in Tamil. Its medicinal claims have included treatment of skin disorders, diaphoretic, diuretic and stomach problems [11, 12]. Leaf juice given internally as a cooling beverages and jaundice and stem bark decoction is used for treat of hiccups [13]. Stem bark decoction is managed for cure of itches [14].

It is also used to hepatoprotective activity [15,16]. Various parts of the plant are used in Indian traditional medicine for many therapeutic values. The infusion of bark and wood is used as stimulant and also in mild cases of dyspepsia and continued fever [17]. *E. monogynum* have been noted for its antibacterial properties [18]. The different parts of *E. monogynum* are used as medicine for many sickness and ailments. Hence, in this study was carried out to conclude the allelopathic effects of *Erythroxylum monogynum* aqueous leaf and stem extracts on the seed germination and seedling growth of *Solanum lycopersicum* var. PKM-1. This investigation was conducted under laboratory conditions.

2. Materials and methods

Samples from the mature fresh leaves and stem of *E. monogynum* were collected from the natural habitats, Shevaroy Hills, Salem district of Tamil Nadu, India. The freshly collected leaves and stem were washed thoroughly in tap water, shade dried at room temperature (28°C) for 15 days, then powdered in grinders and sieved. For leaf and stem extract, 25 g. leaf and stem powder was soaked in 150 ml double distilled water for 48 hr. to get 25% extract. By dilutions with double distilled water 5, 10, 15, 20 and 25% concentrations of extracts were prepared.

The seeds of *Solanum lycopersicum* Mill. (var. PKM 1) selected for the present investigation were procured from Tamilnadu Agricultural University, Coimbatore, Tamilnadu, India. The seeds of *Solanum lycopersicum* (Tamil - Thakkali; English - Tomato) var. PKM - 1 were surface sterilized with 0.2% mercuric chloride for 1 min. to eliminate the fungal spores on the seeds. Then the seeds were washed with double distilled water for several times to eliminate the mercuric chloride. The seeds were soaked in different concentrations of extracts for 24 hr. The trial was done in 11 cm dia petriplates line with sterile cotton. Each petriplate contained 10 uniform sized seeds, while seeds double distilled water were maintained as control separately, which were irrigated with 15 ml of distilled water on alternative days. The experimental design was a randomized entire block with three replicates for each treatment and control. Measurement of germination percentage, radicle and plumule length, fresh weight and dry weight were carried out using standard methods. Each treatment of this trial was carried out with three replications and repeated two times. The data obtained were analysed by factorial analysis of variance (ANOVA) to determine significant ($P < 0.05$) effects.

3. Results and Discussion

In the present research leaf and stem extracts of *Erythroxylum monogynum* inhibited the seed germination of *Solanum lycopersicum* var. PKM-1. Highest inhibitory effects was noted with concentrated leaf extracts. Maximum inhibition (79%) was recorded with concentrated leaf extract. Leaf and stem aqueous extracts of *E. monogynum* on *S. lycopersicum* showed a gradual reduction in all parameters. The decrease in percent *S.lycopersicum* var. PKM-1 seed germination in the *E. monogynum* leaf aqueous extract treatments ranged between 20 to 74% compared to 86% germination in the control. The decrease in germination percentage of *S. lycopersicum* var. PKM-1 seed germination in the *E. monogynum* stem aqueous extract treatments expanded between 25 to 85% compared to 92% germination in the control.

The seed germination, plumule and radicle length was inhibited in all concentrations (Tables 1-2). The decrease was concentration dependent. The aqueous extracts of two extracts also retarded the plumule lengths of *S.lycopersicum* (Tables 1-2). The degree of retardation also increased with increase in the concentrations of the extracts. Statistical analysis at 5% level (t-test) revealed that, apart from comparison between 5 and 25 g. extract concentrations, there were no important differences in the development length of radicle in the varying extract concentrations as well as those of the control in stem and leaf extracts. The extracts of *E. monogynum* also caused vital reduction in seedling growth of *S.lycopersicum.* The extracts not only decreased the plumule and radicle length of *S.lycopersicum* seedlings but also reduced the fresh and dry weight. The reduction in the fresh and dry weight may be due to stunted and meagre vegetative growth of *S.lycopersicum* seedling. This reduction may be due to phytotoxic action of phytoconstituents present in aqueous extracts of *E.monogynum*.

The results of present investigation showed that the leaf and stem extracts of *E.monogynum* was inhibitory in *S.lycopersicum.* Abdul Raoof and Siddiqui (2012)[19] reported that leaves and stem extracts of *Tinospora cordifolia* significantly reduced germination and seedling growth of weed plants (*Chenopodium album* L., *Chenopodium murale* L., *Cassia tora* L., and *Cassia sophera* L.). Alike results have been reported by Namkeleja *et al.,* 2014 [20]. Some recent studies indicating the phytotoxic / allelopathic effect of aqueous extracts of medicinal plants include *Ageratum conyzoides* [21], *Andrographis paniculata* [6], *Vitex negundo* [22], *Ocimum basilicum* [23] and *Andrographis paniculata* [19].

Allelopathy has been implicated to be responsible in several cases for no germination, stunted growth and sometimes out correct eradicate of plants [24]. Allelochemical action of plants is measured by the sensitivity of roots in the bioassay [25]. The results are in relation with earlier investigations reporting that effectiveness of receiver plants to allelochemicals was concentration dependent of inhibitory substances with a reply threshold [26,27]. Furthermore, the permeability of allelochemicals to root tissue was noted to be larger than that to plumule tissue [28].

The aqueous leaf and stem extracts of *E.monogynum* showed inhibitory produces on seed germination, plumule length, radicle length, fresh weight and dry weight of *S.lycopersicum.* The *E.monogynum* leaf and stem extracts inhibited the germination and development of *S.lycopersicum* in the present study. Hence, they must have been trustworthy for the inhibition of seed germination, growth and dry matter collection of radicle and plumule of the plant were progressively reduced with the heighten in the concentration of the extract. Further investigations are necessity to isolate and characterize the assumed allelochemicals in *E.monogynum* and the interaction that could be indicative for the noticed inhibition of seed germination and plant growth.

4. Conclusion

The concentration dependent inhibitory properties of the aqueous stem and leaf extracts of *E.monogynum* on the germination and seedling growth of *S.lycopersicum* propose that the plant has allelopathic effect and obtain allelochemicals. These allelochemicals could be the essential purpose for the restricted growth of other plant species near

their colony. Isolation and characterization of those allelocehmicals from *E.monogynum* could be performance as regulate for the development of biodegradable, environment friendly novel real herbicides and substitute it for chemical herbicides for sustainable weed control. However, greater study is needed to further assure the allelopathic effect of *E.monogynum* and laboratory and field conditions.

Table 1: Effects of *Erythroxylum monogynum* Roxb. on Germination and Growth of *Solanum lycopersicum* Mill. var. PKM-1

Extracts conc. (%)	*Germination (%)*	*Radicle length (cm.)*	*Plumule length (cm.)*	*Fresh weight (g.)*	*Dry weight (g.)*
Control	86 ± 6.3	5.3 ± 0.4	6.4 ± 0.3	0 ± 0.721	0 ± 0.30
5	74 ± 8.1	4.9 ± 0.2	5.7 ± 0.1	0 ± 0.092	0 ± 0.04
10	63 ± 5.4	4.3 ± 0.1	5.1 ± 0.2	0 ± 0.67	0 ± 0.03
15	51 ± 7.5	4.1 ± 0.6	4.8 ± 0.5	0 ± 0.50	0 ± 0.02
20	47 ± 3.8	3.9 ± 0.2	4.2 ± 0.6	0 ± 0.46	0 ± 0.02
25	20 ± 2.7	2.5 ± 0.3	1.8 ± 0.3	0 ± 0.39	0 ± 0.02

Table 2: Effects of *Erythroxylum monogynum* Roxb. aqueous extracts of stem on Germination and Growth of *Solanum lycopersicum* Mill. var. PKM-1

Extracts conc. (%)	**Germination (%)**	**Radicle length (cm.)**	**Plumule length (cm.)**	**Fresh weight (g.)**	**Dry weight (g.)**
Control	92 ± 2.6	6.5 ± 0.2	6.1 ± 0.4	0 ± 0.673	0 ± 0.27
5	85 ± 5.4	5.3 ± 0.1	5.6 ± 0.1	0 ± 0.084	0 ± 0.04
10	78 ± 2.7	4.8 ± 0.3	5.1 ± 0.3	0 ± 0.070	0 ± 0.03
15	56 ± 7.1	4.5 ± 0.2	4.3 ± 0.2	0 ± 0.64	0 ± 0.03
20	43 ± 5.2	2.9 ± 0.6	2.6 ± 0.4	0 ± 0.47	0 ± 0.02
25	25 ± 4.8	1.6 ± 0.4	1.7 ± 0.3	0 ± 0.30	0 ± 0.02

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