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Evaluation of Allelopathic Effect of a Hemeparasitic Mistletoe Plant, *Dendrophthoe falcata* (L.F.) Ettingsh on *Oryza sativa* and *Vigna radiata*

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Abstract

The allelopathic effect of *Dendrophthoe falcata* plant samples collected from *Artocarpus heterophyllus* host tree on germination and radicle growth of paddy and green gram seeds were evaluated. Significant positive allelopathic (inhibitory) effect on germination and radicle growth of paddy and green gram seeds was noted in general between the concentrations of *Dendrophthoe falcata* plant sample extracts and this inhibitory effect was concentration dependent. The positive allelopathic (inhibitory) potential of plants may help to induce identifying and purification of allelopathic substances and to investigate their bioactivities.

Keywords: Allelopathy, *Dendrophthoe falcata*, Mistletoe, Hemiparasite, *Artocarpus heterophyllus*, Ethanol extract, Paddy, Green gram, Seed germination, Radicle length.

Introduction

Commonly cited effects of allelopathy include reduced seed germination and seedling growth. However, known sites of action for some allelochemicals include cell division, pollen germination, nutrient uptake, photosynthesis, and specific enzyme function. Allelopathic inhibition is complex and can involve the interaction of different classes of chemicals with mixtures of different compounds sometimes having a greater allelopathic effect than individual compounds alone. Different plant parts, including flowers, leaves, leaf litter and leaf mulch, stems, bark, roots, soil, and soil leachates and their derived compounds, can have allelopathic activity that varies over the growing season. The basic approach used in allelopathic research for agricultural crops has been to screen both crop plants and natural vegetation for their capacity to suppress weeds. To demonstrate allelopathy, plant origin, production, and identification of allelochemicals must be established as well as persistence in the environment over time in concentrations sufficient to affect plant species. In the laboratory, plant extracts and leachates are commonly screened for their effects on seed germination with further isolation and identification of allelochemicals from greenhouse tests and field soil, confirming laboratory results. Interactions among allelopathic plants, host crops and other non-target organisms must also be considered. Furthermore, allelochemistry may provide basic structures or templates for developing new synthetic chemicals.

The genus *Dendrophthoe* is evergreen, shrubby, partial parasites, distributed in the tropical and sub-tropical regions of the world. The whole hemiparasitic,

Mistletoe plant, *Dendrophthoe falcata* (L.f.) Ettingsh, (also known as Syn.: *Loranthus longiflorus* Desr.,) belongs to Loranthaceae, is used in indigenous system of medicine to cure many health disorders (Patil *et al*., 2011). The members of the genus have many bioactivities and bioactive principles (Kacharu and Krishnan, 1979; Balaram *et al*., 1981; Rastogi and Mehotra, 1993; Ramachandran and Krishnakumari, 1990; Osadebe *et a*l., 2004). Since, the plant is an obligate hemiparasite, grow on many host plants, its biochemical composition and bioactivities are also influenced by the host plants. In this study, the allelopathic potential of *Dendrophthoe falcata* leaf, tender shoot and bark samples, collected from *Artocarpus heterophyllus* host tree, was evaluated by using paddy and green gram seeds.

Materials and Methods

Plant material

The hemiparasitic mistletoe plant, *Dendrophthoe falcata* (L.f.) Ettingsh was collected from the host tree of *Artocarpus heterophyllus*, at Marthandam area, Kanyakumari district, Tamil Nadu. The plant was identified by BSI, Coimbatore, Tamil Nadu, and the voucher specimen is preserved in the Department of Botany, S.T. Hindu College, Nagercoil, Kanyakumari District, Tamil Nadu.

Preparation of dry powder samples

Fresh leaf, bark and tender shoot samples of *D. falcata* collected from *A. heterophyllus* host tree were washed to remove the dust and dried separately for about two weeks at room temperature (30ºC±2ºC) to get a constant weight. The dried plant materials (leaf, bark & tender shoot) were ground to powder separately by mechanical device, stored and used in this work throughout the study period.

Preparation of plant extracts

The dry powder (50g) of *D. falcata* leaf, bark and tender shoot samples was extracted with 50% aqueous ethanol by boiling under reflux for 3h. The extract was filtered and evaporated to dryness to yield the dry extract. The dry extract was stored in a refrigerator and used for allelopathic studies.

Seed germination and Seedling growth

Viable paddy (*Oryza sativa*) and green gram (*Vigna radiata*) seeds were obtained from the Raj agriculture stores, Nagercoil. The seeds were placed evenly in sterilized plastic bowl lined with cotton. Each bowl contained 20 seeds. Then equal volume of (10ml) of varying concentration of the ethanol extracts (1, 2, 5, 10, 20 mg/ml) were taken into each bowl. Similar volume of distillated water was used as control. Three replications were maintained for each treatment including control. The bowls were kept in laboratory condition for 5 days to observe the growth behavior of seedlings. The moisture content of the bowls of all treated and control were maintained with distilled water throughout the period of study. Allelopathic behavior was evaluated by recording the number of germinated seeds and radicle length after 72 and 120h. The seed germination percentage and percent inhibition of radicle growth (RG) were calculated by the following formula:

$$Germination\ percentage = \frac{Number\ of\ seeds\ germinated}{Total\ number\ of\ seeds\ used} \times 100$$

$$\%\ inhibition\ of\ RG = \frac{Treated\ mean\ RG - Control\ mean\ RG}{Control\ mean\ RG} \times 100$$

Results and Discussion

Allelopathic effect of *Dendrophthoe falcata* on Seed Germination

The allelopathic (inhibitory/cytotoxic) nature of the ethanol extracts of *D. falcata* leaf, bark and tender shoot samples was assessed by estimating the percent seed germination and radical growth parameters in the paddy (*O. sativa*) and green gram (*V. radiata*) seeds treated with the extracts at different concentrations on 3rd and 5th day after treatment and the recorded data are presented in Tables 1 to 4; Figure 1.

Effect on seed germination of paddy

From the results, it is evident that there is a reduction in the germination of paddy seeds with increasing concentrations (1, 2, 5, 10 & 20mg/ml) of *D. falcata* leaf, tender shoot and bark sample extracts at different periods of observations (72h and 120h) as compared to control (Table 1; Figure 1-1A). The variation in the percent seed germination of paddy was significant

between concentrations of extracts and between the extracts of plant samples at 1% and 5% level of significance, respectively while it was non-significance between the periods of observation (72h and 120h), in general. However, the germination of paddy seeds was more at low concentration (1mg/ml) and low at high concentration (20mg/ml) of *D. falcata* plant extracts. The reduction in percent seed germination of paddy was ranged from 8.33% to 78.33% in leaf extracts of the *D. falcata* while the reduction was ranged from 6.67% to 70% in bark sample extract and from 3.33% to 80% in tender shoot sample extracts. The reduction of percent germination was highly affected on 5th day. At low concentration, the leaf extract (1mg/ml) of *D. falcata* showed 100 % seed germination at 72h and 120h period of observation.

Table 1: Allelopathic effect of *Dendrophthoe falcata* ethanol extracts of leaf, tender shoot and bark samples, collected from *Arotocarpus heterophyllus* host tree, on seed germination of *Oryza sativa* (%).

***Dendrophthoe falcata* ethanol extracts used**		**Percent seed germination of *Oryza sativa***						**One-way ANOVA (between extract conc.) F-value**
		Concentration of *Dendrophthoe falcata* extracts (mg/ml)						
		Control	**1 mg/ml**	**2 mg/ml**	**5 mg/ml**	**10 mg/ml**	**20 mg/ml**	
Leaf extract	**@72h**	100.00 ±0.00 (0.00)	100.00 ±0.00 (0.00)	91.67 ±2.36 (-8.33)	66.67 ±2.36 (-33.33)	55.00 ±4.08 (-45.00)	21.67 ±6.24 (-78.33)	**259.19****
	@120h	100.00 ±0.00 (0.00)	100.00 ±0.00 (0.00)	90.00 ±0.00 (-10.00)	61.67 ±2.36 (-38.33)	48.33 ±2.36 (-51.67)	21.67 ±6.24 (-78.33)	**364.79****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**1.50**^{NS}	**6.73**^{NS}	**6.01**^{NS}	**0.00**	
Tender shoot extract	**@72h**	100.00 ±0.00 (0.00)	96.67 ±4.31 (-3.33)	90.00 ±4.08 (-10.00)	81.67 ±4.71 (-18.33)	66.67 ±6.24 (-33.33)	23.33 ±6.24 (-76.67)	**108.88****
	@120h	100.00 ±0.00 (0.00)	96.67 ±4.31 (-3.33)	8.50 ±4.08 (-21.50)	75.00 ±4.08 (-25.00)	63.33 ±4.71 (-36.67)	20.00 ±4.08 (-80.00)	**167.60****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**11.92***	**3.44**^{NS}	**0.55**^{NS}	**0.60**^{NS}	
Bark extract	**@72h**	100.00 ±0.00 (0.00)	93.33 ±2.36 (-6.67)	81.67 ±6.24 (-18.33)	65.00 ±4.08 (-35.00)	53.33 ±10.27 (-46.67)	30.00 ±0.00 (-70.00)	**75.22****
	@120h	100.00 ±0.00 (0.00)	93.33 ±2.36 (-6.67)	80.00 ±8.16 (-20.00)	61.67 ±6.24 (-38.33)	51.67 ±8.49 (-48.33)	30.00 ±0.00 (-70.00)	**69.23****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**0.08**^{NS}	**0.60**^{NS}	**0.05**^{NS}	**0.00**	
One-way ANOVA (between extracts) F-value		**0.00**	**3.32***	**4.30***	**11.07****	**3.48***	**2.65**^{NS}	

@ -Percent seed germination estimated at 72h and 120h after treatment.
Values within parenthesis indicate the percent change [increase (+) or decrease (-)] over control; n=3;
NS -Non significance; * -Significance at 5% level (p=0.05) ** -Significance at 1% level (p=0.01);

Effect on seed germination of green gram

The germination of green gram seeds treated with ethanol extracts of *D. falcata* leaf, tender shoot and bark samples show gradual reduction with increasing concentration in both periods of observation (Table 2; Figure 1-1B). The variation in the percent seed germination between the concentrations of extracts at both periods (at 72h and 120h) of observation was significant at 1% level of significance, whereas the variation between extracts was non-significant at low concentrations (1mg/ml, and 2mg/ml) and significant at higher concentrations (5mg/ml, 10mg/ml and 20mg/ml). But, the variation noted between periods of observation was non-significant in all the three extracts of plant samples. When compared to control, the extracts of *D. falcata* plant samples shows inhibitory effect with their increasing concentrations and period of observation. Maximum inhibitory effect was noted at high concentrations and less at low concentrations. The reduction of green gram seed germination ranged from 11.67% (at 1mg/ml) to 89.67% / 83.33% (on 3rd/5th day) at 20mg/ml level of leaf extract, whereas the tender shoot extract treated seeds reduced the germination from 3.33% (at 1mg/ml) to 60.00% (at 20mg/ml) and the bark extract treated seeds reduced the seed germination from 1.67% (at 1mg/ml) to 66.67% (at 20mg/ml). In general, the leaf and bark extracts of *D. falcata* shows less inhibitory effect on the seeds germination of paddy than the green gram, while it was reversed in the tender shoot extract.

Table 2: Allelopathic effect of *Dendrophthoe falcata* ethanol extracts of leaf, tender shoot and bark samples, collected from *Arotocarpus heterophyllus* host tree, on seed germination of *Vigna radiata* (%).

***Dendrophthoe falcata* ethanol extracts used**		**Per cent seed germination of *Vigna radiata***						**One-way ANOVA (between extract conc.) F-value**
		Concentration of *Dendrophthoe falcata* extracts (mg/ml)						
		Control	**1 mg/ml**	**2 mg/ml**	**5 mg/ml**	**10 mg/ml**	**20 mg/ml**	
Leaf extract	**@72h**	100.00 ±0.00 (0.00)	100.00 ±0.00 (0.00)	88.33 ±2.36 (-11.67)	73.33 ±2.36 (-26.67)	45.00 ±4.08 (-55.00)	10.33 ±2.36 (-89.67)	**683.31****
	@120h	100.00 ±0.00 (0.00)	100.00 ±0.00 (0.00)	88.33 ±2.36 (-11.67)	71.67 ±2.36 (-28.33)	41.67 ±2.36 (-58.33)	11.67 ±2.36 (-83.33)	**1023.90****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**0.00**	**0.74^{NS}**	**1.50^{NS}**	**0.48^{NS}**	
Tender shoot extract	**@72h**	100.00 ±0.00 (0.00)	96.67 ±4.71 (-3.33)	91.67 ±2.36 (-8.33)	81.67 ±6.24 (-18.33)	65.00 ±4.08 (-35.00)	41.67 ±2.36 (-58.33)	**101.60****
	@120h	100.00 ±0.00 (0.00)	96.67 ±4.71 (-3.33)	91.67 ±2.36 (-8.33)	75.00 ±4.08 (-25.00)	61.67 ±2.36 (-38.33)	40.00 ±4.08 (-60.00)	**147.94****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**0.00**	**2.40^{NS}**	**1.50^{NS}**	**0.38^{NS}**	
Bark extract	**@72h**	100.00 ±0.00 (0.00)	98.33 ±2.36 (-1.67)	93.33 ±4.71 (-6.67)	83.33 ±2.36 (-11.67)	58.33 ±2.36 (-41.67)	38.33 ±2.36 (-61.67)	**252.55****
	@120h	100.00 ±0.00 (0.00)	98.33 ±2.36 (-1.67)	91.67 ±0.09 (-8.33)	83.33 ±2.36 (-11.67)	58.33 ±2.36 (-41.67)	33.33 ±2.36 (-66.67)	**564.30****
One-way ANOVA (between period) F-value		**0.00**	**0.00**	**0.37^{NS}**	**0.00**	**0.00**	**6.73^{NS}**	
One-way ANOVA (between extracts) F-value		**0.00**	**0.72^{NS}**	**1.69^{NS}**	**6.53****	**28.79****	**83.82****	

@ -Percent seed germination estimated at 72h and 120h after treatment.
Values within parenthesis indicate the percent change [increase (+) or decrease (-)] over control;
NS -Non significance; ** -Significance at 1% level (p=0.01); n=3;

Allelopathic effect of *Dendrophthoe falcata* on Radical Growth

Effect on the radical growth of paddy

The allelopathic effect of *D. falcata* leaf, tender shoot and bark extract on radical growth of paddy seeds was recorded on 3rd day (72h) and 5th day (120h) after treatment and the data presented in table 3; figure 1-2A. The length of radical were significantly decreased with increasing concentration of *D. falcata* leaf, tender shoot and bark sample ethanol extracts as compared to control. The radical growth paddy was promoted significantly at low concentrations (1 and 2mg/ml) and inhibited at higher concentrations of bark extract on 3rd and 5th day observations, whereas the leaf and tender shoot extracts show significant inhibitory effect on the radical growth of paddy at all concentrations and on both periods of observation as compared to control. Percent inhibition of radical growth was increased with increasing extract concentration and the period observation. The variation noted in radical growth of paddy treated with *D. falcata* extracts was generally significant between extracts and between periods of observation and between concentrations of seed treatment at 1% level of significance (Table 3; Figure 1-2A).

Table 3: Allelopathic effect of *Dendrophthoe falcata* ethanol extracts of leaf, tender shoot and bark samples, collected from *Artocarpus heterophyllus* on radicle growth of *Oryza sativa.*

***Dendrophthoe falcata* ethanol extracts used**		**Radicle growth (cm/pl) of *Oryza sativa***						**One-way ANOVA (between extract conc.) F-value**
		Concentration of *Dendrophthoe falcata* extracts (mg/ml)						
		Control	**1 mg/ml**	**2 mg/ml**	**5 mg/ml**	**10 mg/ml**	**20 mg/ml**	
Leaf extract	**@72h**	1.50 ±0.33 (0.00)	1.17 ±0.16 (-22.00)	1.08 ±0.11 (-28.00)	0.73 ±0.06 (-51.33)	0.46 ±0.02 (-69.33)	0.13 ±0.02 (-91.33)	**30.10****
	@120h	4.17 ±0.46 (0.00)	3.91 ±0.25 (-6.24)	3.77 ±0.12 (-9.59)	3.08 ±0.06 (-26.14)	2.35 ±0.03 (-43.65)	0.19 ±0.06 (-95.44)	**134.34****
One-way ANOVA (between period) F-value		**66.73****	**255.65****	**819.18****	**2301.04****	**8243.31****	**2.70**^{NS}	
Tender shoot extract	**@72h**	1.50 ±0.33 (0.00)	1.29 ±0.09 (-14.00)	1.09 ±0.03 (-27.33)	0.74 ±0.03 (-50.67)	0.39 ±0.04 (-74.00)	0.21 ±0.02 (-86.00)	**38.88****
	@120h	4.17 ±0.46 (0.00)	4.06 ±0.38 (-2.64)	3.98 ±0.95 (-4.56)	3.67 ±0.26 (-11.99)	2.31 ±0.23 (-44.60)	0.35 ±0.02 (-79.62)	**23.02****
One-way ANOVA (between period) F-value		**66.73****	**150.94****	**27.74****	**375.98****	**202.92****	**945.23****	
Bark extract	**@72h**	1.50 ±0.33 (0.00)	2.62 ±0.09 (+74.67)	2.11 ±0.09 (+40.67)	1.09 ±0.21 (-27.33)	0.40 ±0.02 (-73.33)	0.21 ±0.02 (-86.00)	**94.83****
	@120h	4.17 ±0.46 (0.00)	4.97 ±0.31 (+19.18)	4.84 ±0.09 (+16.07)	2.93 ±0.34 (-29.74)	0.75 ±0.12 (-82.01)	0.20 ±0.05 (-95.20)	**172.97****
One-way ANOVA (between period) F-value		**66.73****	**159.00****	**1380.17****	**63.60****	**24.83****	**0.10**^{NS}	
One-way ANOVA (between extracts) F-value		**40.04****	**127.90****	**48.91****	**135.18****	**232.12****	**172.84****	

@ -Radicle length measured at 72h and 120h after treatment. n=3;
Values within parenthesis indicate the percent change [increase (+) or decrease (-)] over control;
NS -Non significance; ** -Significance at 1% level (p=0.01);

The inhibitory effect of leaf extract on radical growth of paddy was ranged from 22% (at 1mg/ml) to 91.33% (at 20mg/ml) on 3rd day and on 5th day it was 6.24% to 95.44%; in bark extract it was ranged from 27.33% (at 5mg/ml) to 95.20% (at 20mg/ml); and in tender shoot extract it was ranged from 14% (at 1mg/ml) to 86% (at 20mg/ml) on 5th day and 2.64% (at 1mg/ml) to 79.62% (at 20mg/ml) on 5th day observation.

Effect on the radical growth of green gram

The allelopathic effect of *D. falcata* leaf, tender shoot and bark sample extracts on the radical growth of green growth in different concentrations was estimated on 3rd day (72h) and 5th day (120h) after seed treatment and the data are presented in table 4; figure 1-2B. The different concentrations (1, 2, 5, 10, and 20mg/ml) of *D. falcata* leaf, bark and tender shoot extracts inhibited radical growth of green gram on both growth periods (72h and 120h). The radical growth of green gram was significantly decreased with increasing concentration of *D. falcata* ethanol extracts on both periods of observation. Maximum radical growth was noted at low concentration (1 and 2mg/ml) of leaf and bark extracts as compared with control on 3rd day and 5th day of observations, while it was minimum at higher concentration (20mg/ml). Leaf sample greatly affect the radical growth at higher concentration as compared with bark and tender shoot extract of *D. falcata* (Table 4).

Table 4: Allelopathic effect of *Dendrophthoe falcata* ethanol extracts of leaf, tender shoot and bark samples, collected from *Artocarpus heterophyllus* radicle growth of *Vigna radiata*.

***Dendrophthoe falcata* ethanol extracts used**		**Radicle growth (cm/pl) of *Vigna radiata***						**One-way ANOVA (between Extract conc.) F-value**
		Concentration of *Dendrophthoe falcata* extracts (mg/ml)						
		Control	**1 mg/ml**	**2 mg/ml**	**5 mg/ml**	**10 mg/ml**	**20 mg/ml**	
Leaf extract	**@72h**	2.12 ±0.38 (0.00)	3.59 ±0.44 (+69.34)	2.59 ±0.65 (+22.17)	1.51 ±0.11 (-28.77)	0.55 ±0.08 (-74.06)	0.09 ±0.07 (-95.75)	39.11**
	@120h	4.29 ±1.09 (0.00)	6.59 ±0.59 (+53.61)	5.80 ±1.29 (+35.20)	4.08 ±0.22 (-4.90)	1.68 ±0.32 (-60.84)	0.14 ±0.03 (-96.74)	32.20**
One-way ANOVA (between period) F-value		**10.60***	**49.84****	**14.85****	**327.52****	**69.90****	**3.00NS**	
Tender shoot extract	**@72h**	2.12 ±0.38 (0.00)	2.99 ±0.15 (+41.04)	2.72 ±0.83 (+28.30)	2.52 ±0.98 (+18.87)	1.11 ±0.02 (-47.64)	0.51 ±0.17 (-75.94)	9.35**
	@120h	4.29 ±1.09 (0.00)	5.40 ±0.11 (+25.87)	2.89 ±1.25 (-32.63)	2.36 ±1.45 (-44.99)	1.25 ±0.17 (-70.86)	0.74 ±0.29 (-82.75)	11.44**
One-way ANOVA (between period) F-value		**10.60***	**503.59****	**0.04NS**	**0.03NS**	**2.01NS**	**1.40NS**	
Bark extract	**@72h**	2.12 ±0.38 (0.00)	1.79 ±0.57 (-15.57)	1.47 ±0.42 (-30.66)	1.37 ±0.17 (-35.38)	0.70 ±0.02 (-66.98)	0.63 ±0.17 (-70.28)	8.91**
	@120h	4.29 ±1.09 (0.00)	3.57 ±1.10 (-16.78)	2.90 ±0.58 (-32.40)	2.70 ±0.53 (-37.06)	1.05 ±0.43 (-75.52)	0.73 ±0.03 (-82.98)	10.99**
One-way ANOVA (between period) F-value		**10.06***	**6.19NS**	**11.96***	**17.13***	**1.98NS**	**1.01NS**	
One-way ANOVA (between extracts) F-value		**6.39****	**25.78****	**7.34****	**5.01***	**9.05****	**10.43****	

@ -Radicle length measured at 72h and 120h after treatment; n=3;
Values within parenthesis indicate the percent change [increase (+) or decrease (-)] over control;
NS -Non significance; * -Significance at 5% level (p=0.05) ** -Significance at 1% level (p=0.01);

Percent inhibition of radical growth was increased with increasing concentration and time of observation. Inhibition percentage of *D. falcata* leaf extracts on radical growth was high (95.75% on 3rd day and 96.74% on 5th day) than bark and tender shoot extracts of *D. falcata*. The inhibitory effect of extracts on green gram radical growth was more on 5th day observation than 3rd day observation.

In general the leaf and tender shoot extracts of *D. falcata* shows favourable effect on the radical growth of green gram at low concentrations and inhibitory effect at higher concentrations as compared to other extracts on both days of observation. Similar observations were also made in the radical growth of paddy seeds treated with bark extracts of *D. falcata*. The reduction of radical growth more in the paddy seeds as compared to green gram seeds treated with leaf and tender shoot extracts. Similar allelopathic study was also made by Chandrakasan and Neelamegam (2012) to compare the allelopathic effect of aqueous extracts and leachates of *Loranthus longiflorus* Desr. (Syn.: *Dendrophthoe falcata*) leaf collected from different host plants (Koyya, Madylai and Sapota) on paddy seeds. They reported that the leaf extracts and leachates showed negative allelopathic (stimulatory) effect at low concentrations and positive allelopathic (inhibitory) effect at higher concentrations.

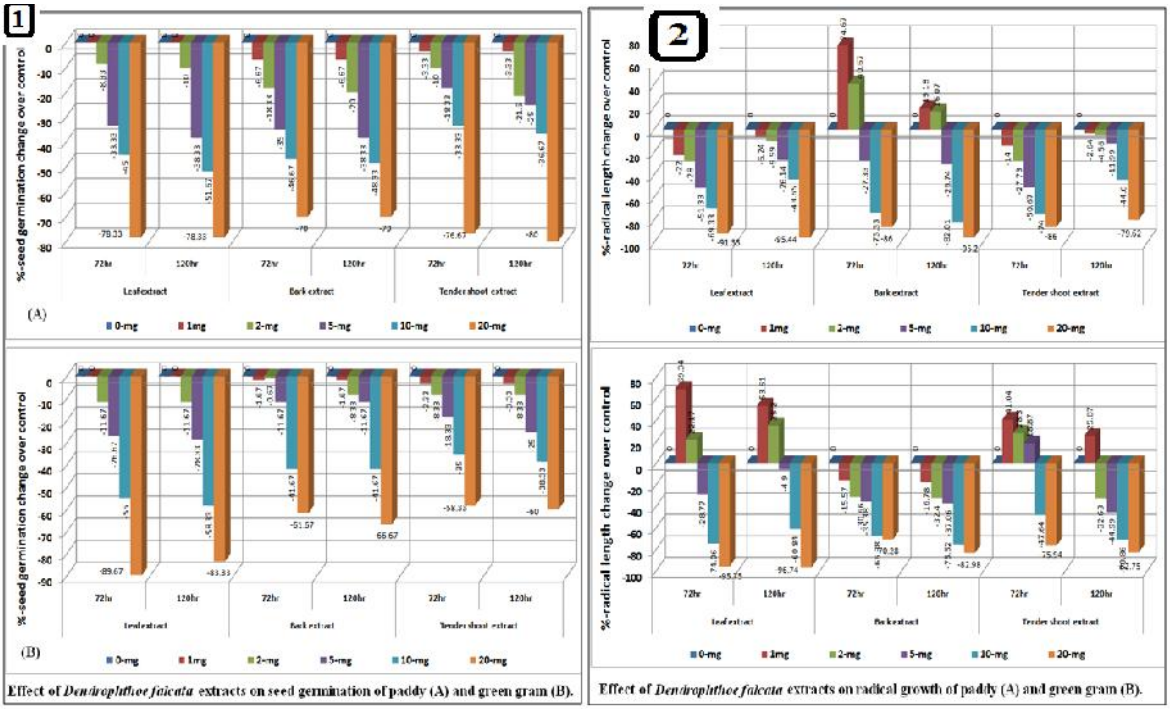

Figure 1: Allelopathic effect of *Dendrophthoe falcata*, ethanol extracts of leaf, tender shoot and bark samples collected from Artocarpus heterophyllus host tree, on seed germination (1) and radical growth (2) of paddy (A) and green gram (B).

Allelopathy refers to the beneficial or harmful effects of one plant on another plant, both crop and weed species, from the release of biochemicals, known as allelochemicals, from plant parts by leaching, root exudation, volatilization, residue decomposition, and other processes in both natural and agricultural systems. Allelochemicals are a subset of secondary metabolites not required for metabolism (growth and development) of the allelopathic organism. Allelochemicals with negative allelopathic effects are an important part of plant defense against herbivory (i.e., animals eating plants as their primary food) (Fraenkel 1959; Stamp 2003).

The allelopathic (inhibitory/cytotoxic) nature of the ethanol extracts of *D. falcata* leaf, bark and tender shoot samples was assessed by estimating the percent seed germination and radical growth parameters in the paddy (*O. sativa*) and green gram (*V. radiata*) seeds treated with the extracts at different concentrations and the observations made on 3rd and 5th day after treatment. In general, the leaf and bark extracts of

D. falcata shows less inhibitory effect on the seeds germination of paddy than the green gram, while it was reversed in the tender shoot extract. Effects of allelochemicals on seeds germination appear to be mediated through a disruption of normal cellular metabolism rather than through damage or organelles (Mohamadi and Rajaie, 2009). In conclusion, results of this study showed that the extracts of *D. falcata* have phytotoxic effects on seeds germination and seedling growth of paddy and green gram. The inhibition of seed germination and seeding growth at high concentrations of *D. falcata* may be due to the presence of high concentrations of various phytocompounds screened in this study. Allelopathic potentials of these plants which induces identifying and purification of allelopathic substances

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