Indian Journal of Weed Science (2022) **54**(3): 341–344
http://dx.doi.org/10.5958/0974-8164.2022.00064.8

RESEARCH NOTE

Stimulatory effect of sesame on the germination and seedling growth of *Melochia corchorifolia* L.

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Received: 26 April 2022 | Revised: 6 June 2022 | Accepted: 9 June 2022

ABSTRACT

Severe infestation of *Melochia corchorifolia* L. (Chocolate weed) in sesame (*Sesamum indicum* L.) fields of Onattukara tract of Kerala, India evoked to conduct studies on the allelopathic effect of sesame plant parts leachate and blended extract on the germination and seedling growth of *M. corchorifolia*. Results revealed that, the tested concentrations of sesame leachate and blended extract had stimulatory effect on germination and growth of this weed. Further, sesame leachate had higher stimulatory effect than blended extract on germination and seedling growth of *M. corchorifolia*. The highest concentration of sesame leachate (1:2.5 w/v) recorded the greatest stimulatory effect. The stimulatory effect of sesame leachate on the germination and growth of *M. corchorifolia* might be the reason for the severe infestation of *Melochia corchorifolia* in sesame fields.

Keywords: Allelopathy, Chocolate weed, Germination, *Melochia corchorifolia*, Seedling vigour, Sesame, Weed ecology

Sesame (*Sesamum indicum* L.) is the oldest indigenous oilseed crop cultivated in the tropical regions of India, for its edible seeds. A higher oil content (46-64%) and dietary energy (6355 kcal/kg) makes it a very common food ingredient all over the world (Kaul *et al.* 2020). Sesame is a popular oilseed crop of Kerala from ancient times, especially as a summer crop in the rice fallows of Onattukara tract, which is the major sesame growing tract of Kerala extended over an area of 2800 ha in three major taluks, *viz*. Karunagapally, Karthikapally and Mavelikkara of Kollam and Alappuzha districts of Kerala, India. Rice-rice-sesame is the major cropping sequence of Onattukara. Currently, the farmers of Onattukara are facing a major threat from *Melochia corchorifolia* L. (Chocolate weed), a member of Malvaceae family. *M. corchorifolia* has been spreading fast in the sesame fields causing havoc to the farmers. The seeds of this weed resemble sesame and germinate along with sesame, gaining competitive advantage over the crop causing severe yield reduction.

Allelopathy is defined as any direct or indirect influence of one plant on the other plants through the release of chemicals (Subtain *et al.* 2014). Allelopathic effects are selective in nature, concentration dependent and can either stimulate or inhibit the growth and development of companion plants (Cheema *et al.* 2004). Application of allelopathic water extracts of sorghum at lower concentrations enhanced the germination and growth attributes of wheat (Anwar *et al.* 2003). Sesame is a potential allelopathic crop containing allelochemicals like saponins, flavonoids, tannins, phenols, alkaloids, *etc*. (Fasola and Ogunsola 2014).

The infestation of *M. corchorifolia* weed was found relatively less in lowland paddy and other upland crops. These differences in occurrence of *M. corchorifolia* evoked the interest in possible allelopathic effect of sesame on the germination and growth of *M. corchorifolia*. In this context, the present study was conducted with an objective to investigate the allelopathic effect of sesame on the germination and growth attributes of *M. corchorifolia*.

Sesame plants used for the experiment were raised during March to June (2021) in the ûeld of Onattukara Regional Agricultural Research Station (ORARS), Kayamkulam, Kerala, India. The field was located at 8.93° N and 76.39° E at 3.05 m MSL. Fresh sesame plant samples at active growth stage (30 DAS) were collected carefully from the field without damaging the roots. The roots were cleaned in clean water to remove the dirt and soil adhered to the roots. Allelopathic study was conducted with blended

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extract and leachate of sesame.

Preparation of blended extract: Plants were chopped into small pieces of 2 cm length using a fodder cutter. The plant material was ground with distilled water in a blender. The ground material was weighed (100 g each) and mixed with 250 mL, 500 mL, 1000 mL and 2000 mL distilled water to make blended extract solutions of four different concentrations of 1:2.5, 1: 5, 1: 10, 1: 20 (w/v) respectively. The blended extract was shaken for 24 h at room temperature on an orbital shaker (Orbital shaker S01, Stuart Scientific Co. Ltd) at 100 RPM and the resultant mixture was filtered through four layers of cheesecloth. The blended extracts prepared were stored in sealed plastic bottles and kept in refrigerator at 4°C until further use.

Preparation of leachate: Plants were chopped into small pieces of 2 cm length using a fodder cutter. The leachate was prepared by soaking the weighed plant (100 g each) material for 48 h in 250 mL, 500 mL, 1000 mL and 2000 mL distilled water to make leachates of 4 different concentrations of 1:2.5, 1: 5, 1: 10, 1: 20 (w/v) respectively. The leachates thus collected were filtered and used for treating *M. corchorifolia* seed samples.

Germination bioassay: *M. corchorifolia* seeds were collected from matured plants. Seeds were allowed to dry for 2 weeks at 25°C, sieved to remove extraneous matter and stored in air tight plastic containers. Mechanically scarified seeds were used for the experiment. Scarification was done on the day of the experiment. Mechanical scarification was done by spreading the seeds on a wooden board and rubbing with emery cloth, by moving the cloth 10 cm up and down three times (Mobli *et al*. 2020). Emery cloth of the firm John Oakey and Mohan with grit range 16-220 was used to scarify the seeds.

Twenty-five matured *M. corchorifolia* seeds were placed in petri dish (9 cm diameter) containing a layer of filter paper. Separate experiments were conducted for blended extract and leachate. The experiments were conducted in completely randomized design with four treatments comprising different concentrations, *viz*. 1:2.5, 1: 5, 1: 10, 1: 20 (w/v) and a control, replicated four times. The filter papers placed in petri dish were moistened with 5 mL of different concentrations of blended extract/ leachate. Control treatments were moistened using distilled water. The germinated seeds were counted at 24 h intervals for seven days. Seeds with 2 mm emerged radicle were considered as germinated. Experiments were conducted simultaneously and experiments were repeated for conformation. On 8th day, seedlings were collected without damaging the root system. Seedling fresh, root and shoot length were measured and average was worked out. The samples were dried in hot air oven at 65 ± 5°C to constant weight. The seedling dry weight was expressed in g/plant. Based on the above observations, seedling emergence percentage, speed of germination (Bartlett 1973), seedling vigour index I and II (Abdul-baki and Anderson 1973) were worked out.

1) Germination percentage $= \frac{\text{Total number of seeds emerged}}{\text{Total number of seeds}} \text{x } 100$

2) Speed of germination (SG) = $n_1/d_1 + n_2/d_2 + \ldots\ldots\ldots + n_x/d_x$.

Where, n_1 is the number of seeds germinated on 1st day, n_2 is the number of seeds germinated on 2nd day…….n_x is the number of seeds germinated on x^{th} day, d_1 is the 1st day , d_2 the 2nd day and d_x the x^{th} day.

3) Seedling vigor index I (SVI I) = Seedling length (cm) × Germination percentage

4) Seedling vigor index II (SVI II) = Seedling dry weight (g) × Germination percentage

Analysis of variance technique for CRD (Cochran and Cox 1965) was used for the statistical analysis of the experimental data and the significance was tested using F test. Wherever the F values were found significant, critical difference was calculated at five per cent probability level.

Effect of sesame on germination of *M. corchorifolia*

Leachate of sesame was observed to have stimulatory effect on the germination of *M. corchorifolia* seeds. But blended extract of sesame did not have any significant effect (**Table 1**). A germination percentage of 49.33% was observed with leachate of 1: 2.5 (w/v) concentration and was on par with the concentration of 1:5 (w/v). Control recorded the lowest germination percentage (41.33%). Speed of germination was also influenced by sesame leachates of different concentrations (**Table 1**). Higher values of 4.65 and 4.55 were observed by leachates of concentration 1: 2.5 (w/v) and 1: 5 (w/v), respectively and the control treatment recorded the lowest value (4.033). Leachates also had a positive effect on the seedling vigour index I and II (**Figure 1**). The highest value for seedling vigour index I was exhibited by 1: 2.5 (w/v) concentration and was at par with 1: 5 (w/v) concentration. Seedling vigour index II was found to be significantly higher (5.58) for leachate of 1: 2.5 (w/v) concentration. Control treatment recorded the lowest value for both seedling vigour index I and II. Blended extract did not have any significant effect.

Stimulatory effect *M. corchorifolia* might be

due to the selective permeability of seed coat of *M. corchorifolia* to the allelochemicals present in the sesame leachate. Wang *et al*. (2010) observed that leachates of wheat stubbles at higher concentration (100% and 50%) enhanced the seed germination and seedling fresh weight and radicle length of cucumber seedlings due to the presence of allelochemicals present in the leachates which stimulated á- amylase activity. Root exudation, leaching from the above ground plant parts, volatilization and decomposition of plant parts are the ways by which allelochemicals are released in to the rhizosphere of the plant. Stimulatory effect of sesame leachate on the germination and seedling growth of *M. corchorifolia* might be the reason for severe infestation of *M. corchorifolia* in sesame fields of *Onattukara* tract.

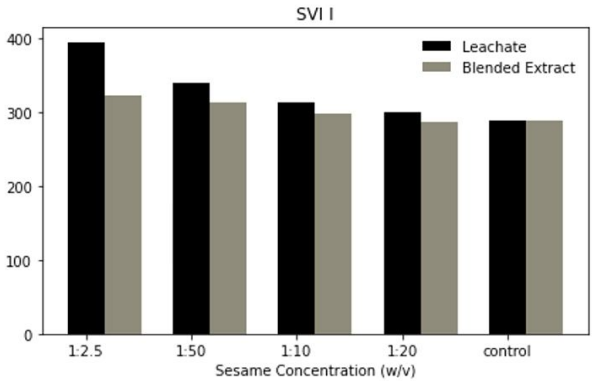
Effect of sesame on growth attributes of *M. corchorifolia*

The results on the bioassay studies revealed that the sesame leachate and blended extract had significant stimulatory effect on the growth attributes of *M. corchorifolia* seedlings. However, the response was found to be concentration dependent and higher concentration resulted in higher values for the growth attributes. Sesame leachate at the highest concentration (1: 2.5 w/v) recorded the highest seedling fresh weight (0.137 g) and was on par with leachate of concentration 1:5 (w/v) which recorded a seedling fresh weight of 0.132 g. The lowest concentration recorded the lowest seedling fresh weight (0.120 g) and remained comparable with the control. Seedling fresh weight of *M. corchorifolia*, recorded with higher concentration of sesame leachate (1:2.5 w/v) was 14.16 per cent greater than control.

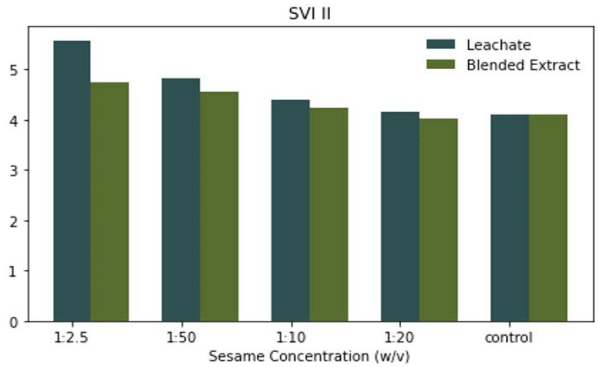
Blended extract of sesame also showed a positive effect on the seedling fresh weight of *M. corchorifolia* (**Table 1**). However, the effect was not as pronounced as in the case of leachate. Higher concentration (1: 2.5 w/v) recorded higher seedling fresh weight of 0.127 g and was on par with 1: 5 and 1:10 w/v concentrations. Control recorded the lowest seedling fresh weight (0.120 g). Higher concentration of blended extract (1:2.5 w/v) showed 5.8 per cent increase in seedling fresh weight of the weed compared to control.

Seedling dry weight of *M. corchorifolia* also followed the same trend as that of seedling fresh weight. As the concentration of leachate decreases, a decline in seedling dry weight was observed (**Table 1**). The highest concentration of sesame leachate (1: 2.5w/v) resulted in the highest dry weight and it was on par with 1.5 w/v concentration. The lowest dry weight was recorded by the control. An increase of 13.4 per cent in seedling dry weight was observed in the highest concentration (1:2.5 w/v) as compared to control. Similarly, the highest concentration of blended extract of sesame (1: 2.5 w/v) resulted in the highest seedling dry weight which was at par with 1: 5 and 1:10 (w/v) concentrations. The lowest concentration (1:20 w/v) and the control recorded the lowest dry weight.

Seedling shoot length of *M. corchorifolia* was also significantly influenced by sesame leachate and blended extract (**Table 1**). As in the case of seedling weight, a higher shoot length of 5.17 cm was observed in 1:2.5 (w/v) concentration (the highest concentration) and it was at par with 1: 5 (w/v) concentration. Shoot length was found to decrease with the decrease in concentrations and the control recorded the lowest shoot length. The increase in seedling shoot length observed at higher concentration of sesame leachate (1.25 w/v) was 10.7 per cent over control. Blended extract of higher concentrations (1:2.5 and 1:5 (w/v)) also resulted in higher seedling shoot length. Increase in seedling shoot length at higher concentration (1.2.5 w/v) was to the tune of 5.8% over control.



LSD: Leachate: 12.478, Blended Extract: 9.956



LSD: Leachate: 0.169, Blended Extract: 0.211

Figure 1. Effect of sesame whole plant leachate and blended extract on seedling vigour index I (SVI I) and seedling vigour index II (SVI II) of M. *corchorifolia*

Table 1. Effect of sesame whole plant leachate and blended extract on germination and seedling growth of *M. corchorifolia* seedlings

Sesame whole plant leachate and blended extract concentration (w/v)	Germination (%)		Speed of germination		Seedling fresh weight (g)		Seedling dry weight (g)		Shoot length (cm)		Root length (cm)	
	Leachate	Blended extract	Leachate	Blended extract	Leachate	Blended extract	Leachate	Blended extract	Leachate	Blended extract	Leachate	Blended extract
1: 2.5	49.33	45.33	4.65	4.43	0.137	0.127	0.110	0.104	5.17	4.93	2.63	2.47
1: 5	45.33	44.00	4.55	4.25	0.132	0.125	0.106	0.103	4.97	4.80	2.53	2.43
1 : 10	44.00	42.67	4.14	4.08	0.122	0.124	0.100	0.098	4.73	4.67	2.40	2.37
1: 20	42.67	41.33	3.99	3.90	0.120	0.120	0.098	0.097	4.70	4.67	2.35	2.30
Control	41.33	41.33	4.00	4.00	0.120	0.120	0.097	0.097	4.67	4.66	2.33	2.30
LSD (p= 0.05)	5.035	NS	0.404	NS	0.007	0.005	0.005	0.005	0.312	0.190	0.126	NS

Sesame leachate alone had significant effect on the root length of *M. corchorifolia* (**Table 1**). Leachate at higher concentrations [1:2.5 (w/v) and 1:5 (w/v)] recorded higher root length of 2.63 cm and 2.53 cm, respectively compared to lower doses. The control recorded the lowest value of 2.33 cm.

Both the leachate and blended extract of sesame had stimulatory effect on the growth attributes of *Melochia corchorifolia* which might be due to the growth promoting effect of allelochemicals present in the sesame leachate and blended extract. Zhu *et al.* (2005) reported that allelopathic effects of plants depend on their types and concentrations. The enhancement in shoot length and seedling fresh and dry weight of maize with fresh shoot aqueous extract of *Tithonia diversifolia* due to the accumulation of some allelochemicals in large amounts (Oyerinde *et al*. 2009); stimulated shoot and root growth of *Lactuca sativa* and *Cassia mimosoides* with leaf extracts of *Euphorbia serpens* (Dana and Domingo 2006) and *Phytolacca americana* (Kim *et al.* 2005) respectively were reported earlier.

Sesame leachate and blended extract had stimulatory effect on the seedling growth of *M. corchorifolia*. which could be inferred that, leachates from the decomposed residues of sesame and leachates might have stimulatory effect on germination and growth of *M. corchorifolia*. This could be the plausible reason for the heavy infestation of *M. corchorifolia* in sesame fields. Hence, to reduce the infestation of *M. corchorifolia*, it is suggested that alternative crops should be raised for three to four years for reducing the weed seed bank of *M. corchorifolia*.

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