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CLEOME VISCOSA L., AN EFFECTIVE MEDICINAL PLANT IN IMPROVEMENT OF GROWTH OF MASH BEAN

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ABSTRACT

Cleome viscosa L. is a medicinal plant used to cure many bacterial and fungal diseases. *C. viscosa* plant parts (leaves, stem and capsules) were used to test its activity against root rotting fungi and growth of mash bean plant. Aqueous extract was prepared in different concentrations and applied in soil as soil drenching and seed treatment. Results recorded that both methods gave effective results of growth promotion where all growth parameters were increased when stem and leaves extract was used at concentration of 75 % w/v while root infecting fungi was reduced at 100 % w/v concentration.

KEY WORDS: Aqueous extract, *Cleome viscosa* L., root rot fungi, soil dressing and seed coating.

INTRODUCTION

Cleome viscosa Linn. is an Asian spider flower or tick weed belongs to family Cleomaceae. It is commonly known as “dog mustard” or “wild mustard” (Edeoga *et al*., 2009). It is widely distributed in warm, humid habitat throughout the tropics including Americas, Africa, Asia and the plains of India and Pakistan (Nadkarni, 1982). *C. viscosa* is a medicinal plant showed various pharmacological activities such as anthelmintic, antimicrobial (Devi *et al*., 2006; Sudhakar *et al*., 2006), analgesic and anti-inflammatory (Parimala *et al*., 2003), immunomodulatory (Tiwari *et al*., 2004), antipyretic (Devi *et al*., 2003), psychopharmacological, antidiarrheal (Devi *et al*., 2002) and hepatoprotective activities (Gupta *et al.,* 2009). The plant parts contains various chemical constituents like leaves contain high phenolic and flavonoid content which serve as potential antioxidant and show free radical scavenging activity (Gupta *et al*., 2012; Elias *et al*., 2012). The seeds have high nutritive value containing 18.3% oil (Rukmini and Deosthale, 1979). It is commonly used in traditional system of medicines as it contains different bioactive phytochemicals which shows various biological activities (Williams *et al*., 2003; Mali, 2009). The oil contain a mixture of five fatty acids, seven amino acids and sugar sucrose (Rukmini and Deosthale, 1979) and rich in linoleic acid, flavonoids, isoflavonoids, polyphenols, biogenic aldehydes, fat soluble pigments and other fatty acids such as palmitic acid, stearic , oleic acid (Deora *et al.*, 2003; Calo *et al*., 2015). Viscocic and Viscosin (a monomethoxyflavone), cleosandrin (a novel umbelliferone derivative) is a phytochemical obtained from the ethanol extract of the seed (Gupta and Dutt, 1938; Ramchandran, 1979).

Microorganisms such as pathogenic bacteria and fungi are threat for plants and humans. Soil borne pathogens are the most devastating problem for the entire world as it reduces crop performance and decreases yield (Panth *et al*., 2020). Soil borne pathogen such as *Rhizoctonia* spp., *Verticillium* spp., *Sclerotinia* spp., *Pythium* spp., and *Phytophthora* spp. can cause 50-75% yields losses for many crops such as wheat, cotton, maize, vegetables, fruits and ornamentals (Mihajloviz *et al.,* 2017). Productivity of mung beans is reduced due to these soil borne fungal pathogens and viral diseases (Panday *et al*., 2018; Nair *et al*., 2017). *Macrophomina phaseolina* (Tassi) Goid was reported to causes charcoal rot (Kaur *et al*., 2012) and yield loss up to 25 to 48% in south Asia (Iqbal and Mukhtar, 2014). *M. phaseolina* has a very wide host range and attacks the root and basal stem (Sackston, 1981). *Rhizoctonia solani* causes potato rhizotonisis (Larkin, 2020) and responsible for excess of commercially significant plant diseases (Ah-Fong *et al*., 2017; Crutcher *et al*., 2018). *R. solani* exists as active mycelium in soil and attacks more than 2000 species of plants (Parameter, 1970) while *Fusarium* spp. cause wilting of different crop plants.

Many methods are presently being used to control various plant pathogens including wilt pathogens (species of *Fusarium*, *Rhizoctonia* and *Macrophomina*) (Babu *et al.*, 2008; Raghavendra *et al.*, 2002). The main purpose of the present study is to investigate the activity of *C. viscosa* against root rotting fungi by using different methods on mash bean.

MATERIALS AND METHODS

Cleome viscosa L. was collected from different areas of University of Karachi. The plant parts (stem, leaves and capsules) were washed under running tap water and dried for a week in a room temperature, crushed separately in the electrical grinder to make fine powder. Powdered plant parts (10 g) were dissolved in 90 mL of sterilized distilled water to prepare stock solution. This stock solution was further diluted to prepare 75 and 50 % concentrations using sterilized distilled water. Seeds of mash bean (*Vigna radiata* L. Wilczek) sterilized using 1% sodium hypochlorite, washed thrice with distilled water and dried. Surface disinfected seeds were treated with 100, 75 and 50% extract of plant parts for 5-10 minutes and air dried. The soil was collected from the experimental plot of Department of Botany, University of Karachi and plastic pots were filled with it containing 300 g soil. Treated seeds were sown in each pot (5/pot). Untreated seeds served as control. Each treatment was replicated thrice and data were collected after thirty days of germination. In another set of experiment, seeds of tested crops were sown in pots and 10 mL of different concentrations of 100, 75, 50% w/w of plant extracts were poured separately in each pots. A control set was also placed containing 10 mL of sterilized distilled water. After thirty days of germination, growth parameters in term of shoot length, root length, root weight and shoot weight, number of root nodules and leaves were determined. The roots of each treatment and control were tested for root colonizing fungi and it was calculated by the following formula

$$Colonization\ percentage = \frac{Number\ of\ infeted\ root\ peices}{Total\ number\ of\ root\ peices} \times 100$$

RESULTS

Results obtained from seed treatment of mash bean seeds showed that all growth parameters increased using *C. viscosa* parts (leaves, stem, capsules) extract when used at 50 and 100 % concentration when compared to control. Maximum shoot length was recorded when leaves extract used at 75 % concentration followed by 75 % stem extract. 100 % capsules extract improved shoot weight while root length and weight was increased using stem and leaves extract at 75 % concentration. Number of nodules increased when stem and leaves extract used at 75 % concentration. It was interesting to note that growth of mash bean increased from 50 to 75 % parts extract while highest concentration (100 % extract of all parts) showed decrease in length and weight of shoot and root (Table 1). *C. viscosa* extract also gave pronounced effect on root colonization by root pathogenic fungi. Stem extract at 100 % concentration reduced *Fusarium oxysporum* and *Rhizoctonia solani* colonization while *Macrophomina phaseolina* was much reduced when leaves extract was used at 100 % concentration (Table 1).

Table 1. Effect of seed treatment with extracts of *Cleome viscosa* parts with different concentrations on mash bean growth and control of root infecting fungi.

Treatments		Growth parameters					Colonization % of root infecting fungi		
Parts	Concentration (%)	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Number of nodules	*F. solani*	*R. solani*	*M. phaseolina*
Control	0	8.13	0.32	12.8	0.12	3	73.33	73.33	93.33
Leaves	50	8.33	0.426	14.06	0.176	5	39.99	35.55	28.88
	75	10.9	0.506	14.76	0.28	10	33.33	31.1	13.32
	100	8.9	0.436	14.16	0.266	6	17.77	17.77	2.22
Stem	50	8.2	0.48	13.36	0.406	2	46.66	24.44	20
	75	10.53	0.526	15.26	0.47	10	31.1	19.99	13.33
	100	8.56	0.513	14.83	0.34	6	8.88	13.33	11.1
Capsules	50	8.33	0.45	14.33	0.31	5	35.55	24.44	15.55
	75	9.16	0.48	14.96	0.32	6	22.22	19.99	6.66
	100	9.0	0.53	14.43	0.27	6	11.11	19.99	6.66
$LSD_{0.05}$	Parts	1.007	0.600	1.836	0.055	1.77	15.108	13.51	9.494
	Concentration	1.155	0.0619	2.105	0.066	2.064	17.461	15.624	10.959

In another method of using extract is soil drenching with different concentrations (50, 75 and 100 %) resulted that shoot length was improved when capsules extract used at 75 % w/v while leaves extract at 75 % gave maximum shoot weight. Stem extract at 75 % w/v showed maximum root length and number of nodules followed at 75 % leaves extract while root weight was improved using 75 % leaves extract (Table 2). However, *C. viscosa* showed much effect on root pathogenic fungi particularly *R. solani* and *M. phaseolina* as these fungi were completely reduced when leaves and stem extract at 100 % used. *F. oxysporum* was also reduced when stem extract at 100 % used followed by 75 % stem extract (Table 2).

Table 2. Effect of soil drenching with extracts of *Cleome viscosa* parts with different concentrations on mash bean growth and control of root infecting fungi.

Treatments		Growth parameters					Colonization % of root infecting fungi		
Parts	Concentration (%)	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Number of nodules	*F. solani*	*R. solani*	*M. phaseolina*
Control	0	10.7	0.37	9.06	0.053	3	80	60	53.33
Leaves	50	12.2	0.38	15.2	0.163	8	31.1	31.1	48.88
	75	14	0.55	15.33	0.29	9	26.66	8.88	44.44
	100	14.6	0.52	14.06	0.153	9	19.99	0	14.06
Stem	50	12.36	0.47	14.8	0.206	3	31.11	31.11	46.66
	75	14.57	0.52	15.43	0.26	12	3.33	24.44	44.44
	100	14.46	0.48	13.16	0.16	10	2.22	0	0
Capsules	50	14.63	0.483	13.66	0.15	3	24.44	26.66	58.88
	75	14.96	0.52	13.8	0.24	11	6.66	11.1	53.33
	100	14.8	0.45	13.03	0.076	9	4.44	8.88	31.11
$LSD_{0.05}$	Parts	1.34	0.043	1.626	0.037	1.457	17.001	11.692	14.751
	Concentration	1.55	0.0516	1.880	0.043	1.684	19.628	13.498	17.032

It is concluded both methods were effective in increment of growth parameters and reduction of root infecting fungi. However, soil drenching method with *C. viscosa* extract gave complete reduction of *R. solani* and *M. phaseolina.*

DISCUSSION

The use of chemicals as pesticides has posed a serious threat to humans and the environment. It has been demonstrated that many plants and plant products may be used as effective antimicrobials against various fungal diseases (Awuah, 1994). The therapeutic effect of *Cleome viscosa* is due to the presence of the phytochemicals which exhibit curative properties against many diseases like fever, malaria, diarrhea (Chopra *et al.*, 1956). Krishnamoorthy *et al.* (2020) recorded that the essential oil of *C. viscosa* shows remarkable effect against pathogenic *Candida albicans.* Presently, 75 % extract of stem and leaves improved the plant length and weight as compared to control. Literature showed that presence of antioxidant enzymes in medicinal plants plays vital role in plant growth, differentiation and development of hormone catabolism. Also peroxidase play important role in induction and initiation of roots in plants (Moncousin and Gaspar, 1983). Durak and Kutman (2021) observed that seed treatment with aqueous extract of *Salix babylonica* leaves and bark improved seedling growth and establishment of maize under control and stress condition.

Present results indicated that *C. viscosa* plant parts extracts reduced the infection in roots by root infecting fungi particularly *R. solani* and *M. phaseolina* in mash bean roots when 100 % stem and leaves extract was used as soil drenching. Most of the medicinal plants contains number of phytochemicals like flavonoids and tannins exhibited antifungal activity associated with disease suppression (Mboto *et al.,* 2009; Naswa and Kamal, 2012; Sesan *et al.*, 2015). As these secondary metabolites form complexes with proteins present in external layer of fungal cells results in possible death of the pathogen (Rongai *et al.,* 2017).

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