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Allelopathic Effect of Litchi Leaf Extract on Seed Germination of Pea and Lafa

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Abstract—*The allelopathic effect of aqueous solution of litchi (Litchi chinensis) leaf extract on germination of pea (Pisum sativum) and lafa (Malva verticillata) seeds were evaluated in the Dept. of Pomology & Post Harvest Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. Both the seeds of pea and lafa were treated with five treatments of litchi dried leaf aqueous extract solution (T_1: 0%, T_2: 2%, T_3: 5%, T_4: 10%, and T_5 15%). The germination percentage and radical growth behaviour of both pea and lafa seeds were recorded in laboratory under ambient condition. Seed germination of pea and lafa was recorded maximum (100% & 99.50%, respectively) with T_1, whereas, germination was recorded lowest (15.75% & 10.00 %, respectively) with T_5 expressing a strong allelopathic germination inhibitory effect of litchi.*

Keywords*: Allelopathy, Aqueous Leaf extracts, Litchi, Seed Germination, Pea, Lafa.*

1. INTRODUCTION

The term *allelopathy* is derived from Greek compounds *allelo* and *pathy* (meaning "mutual harm" or "suffering") and was first coined by Hans Molisch [1] meant that a plant releases compounds to either stimulate or inhibit the growth of other plant sharing the same habitat in natural and agricultural ecosystem [2,3]. It is also termed as "the release of phytotoxins by the plants"[4]. It has the direct or indirect, harmful or beneficial effect of plant species on another by allelopathic substances to the surrounding environment [5] by release of biochemicals, known as allelochemicals, through leaching, root exudation, volatilization, residue decomposition, and other processes in both natural and agricultural systems [6]. Many plants and plant organ reported to have allelopathic substances [7]. Plant produces a wide variety of secondary metabolites that play important role in complex interactions among living organism in the natural environment, known as allelochemicals [8]. The most commonly found allelochemicals are cinnamic and benzoic acids, flavonoids, different terpenes [9]. Among these chemicals, certain allelochemicals alter the plant growth habit, physiological process of other plants like suppression of seed germination. Several studies indicated that the allelopathic effect of leaf extract of different fruit plants had inhibitory action on germination, root growth of crop and weed seeds. The inhibitory property of allelopathy is a natural phenomenon and it may utilize for weed management due to its eco-friendly nature [10,11,12]. The effect of litchi leaf aqueous extract was recorded in several trials for germination and growth behaviour study of *mung* bean, lentil, bean [13], lettuce, barnyard grass, cress, alfalfa, timothy, Italian ryegrass [14], barnyard grass, amaranth [15], *Bidens pilosa*, *Eleusine indica* and *Portulaca oleracea* [12], maize and wheat [16]. Litchi (*Litchi chinensis* Sonn.) is an important fruit crop of West Bengal. Many growers utilize the orchard interspaces for growing of different vegetable intercrops during the non-bearing stages of litchi plants. The report of effect of allelopathic chemicals of litchi is absent in literature for this sub-Himalayan Terai region of West Bengal. Keeping this point in mind, a trial was conducted to know the phytotoxic effect of aqueous extracts of litchi leaf on germinating seeds of two vegetables, namely pea (*Pisum sativum*) and one local leafy vegetable, i.e., laffa (*Malva verticillata*) at the laboratory of the Dept. of Pomology & Post Harvest Technology, Uttar Banga Krishi Viswavidyalaya during 2015.

2. MATERIALS AND METHODS

The litchi leavers were collected from the Litchi Mother Plant Block of Instructional Farm under the Dept. of Pomology & Post Harvest Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar. Leaves were air-dried till complete moisture is lost and grinded into a fine powder in an electrical grinder for further extraction. These extracts were diluted and filtered to get different concentrations of aqueous extracts of 0%(T_1), 2%(T_2), 5%(T_3), 10%(T_4) and 15%(T_5) solutions. Then 15-20 ml of each aqueous extracts was separately added in each Petri dish. Twenty seeds of each pea and laffa seeds were placed on filter paper that was previously placed on each Petri dish. Each treatment was replicated into thrice. 15-20 ml distilled water was added for control instead of aqueous extract of litchi. The seeds were observed every day and

number of germinated seeds was recorded. Extract/distilled water was added just to moisten the seeds whenever required. The Petri dishes were kept under natural light dark cycle at the laboratory. The emergence of the radical from the seed was regarded as germinated and germination was recorded 2nd, 4th and 7th day. The root lengths of the seedlings were also recorded on 7th day of the experiment. Ratio of elongation was calculated as [17]. Relative elongation ratio of root (RER)=mean root length of tested plant/mean root length of control×100. A 10 cm diameter clean Petri dish was used in which with two round sheets of 10 cm diameter filter paper was placed. The observations were analyzed in Complete Randomized Design (CRD) [18].

3. RESULTS AND DISCUSSION

The germination percentage and root growth behaviour of both pea and lafa seeds were recorded in laboratory under ambient condition. The observation of germination percentage was statistically significant for all the treatments of both pea and laffa, except the difference of T_4 and T_5 of the laffa seed germination on 4th day observation. The germination percentage of both pea and laffa were lowest with highest concentration of aqueous extract of litchi (T_5=15%) for 2nd, 4th and 7th day after treatments. The germination percentage of seeds was maximum under control (T_1:treated with distilled water) in both pea (100%) and laffa (99.50%). From Table 1 and Table 2, it is clear that the root length of both pea and laffa were influenced by the litchi leaf extract and root length was recorded lowest for pea (0.67 cm) and laffa (0.60cm) with the highest concentration of litchi leaf extract (T_5=15%), and it was highest with control (T_1:treated with distilled water) in both pea (1.42cm) and laffa (1.28cm) . The relative elongation ratio of roots were decreased with the higher concentration of litchi leaf extract for both pea and laffa seed germination study and found lowest at T_5 (15%) with 46.88 for laffa and 46.88 for pea, respectively. The inhibitory effect of litchi leaf extract might be due to presence of allelopathic compounds presents in litchi leaves which were identified as epicatechin, procyanidin A2, kaempferol-3-O-galactose and 4-hydroxybenzaldehyde [12].

Table 1: Germination behavior of pea

Treatments	Germination percentage (%)			Root length (cm)	RER
	2nd day	4th day	7th day		
T_1 (Control)	77.00(62.32)	94.50(77.10)	100.00(90.00)	1.42	100.00
T_2 (2%)	42.50(40.63)	73.50(59.21)	75.50(60.56)	1.13	79.58
T_3 (5%)	28.00(31.63)	58.00(49.69)	59.50(50.59)	0.9	63.38
T_4 (10%)	16.50 (23.82)	32.50(34.45)	33.75(35.23)	0.82	57.75
T_5 (15%)	6.00(13.28)	10.75(19.10)	15.75(23.34)	0.67	47.18
S.Em.±	3.35	3.04	2.87	0.09	-
C.D. at 5%	10.20	9.25	8.72	0.27	-

Values in parenthesis are the angular transformed value, RER= Relative elongation ratio of root

Table 2: Germination behavior of laffa

Treatments	Germination percentage (%)			Root length (cm)	RER
	2nd day	4th day	7th day		
T_1(Control)	96.00(78.62)	98.50(83.88)	99.50(87.96)	1.28	100.00
T_2 (2%)	54.00(47.32)	61.50(52.02)	69.50(56.89)	1.02	79.69
T_3 (5%)	26.50(30.83)	35.00(36.22)	38.50(38.29)	0.87	67.97
T_4 (10%)	10.00(18.21)	16.00(23.15)	21.00(26.94)	0.77	60.16
T_5 (15%)	0.00(0.00)	8.00(16.02)	10.00(18.15)	0.60	46.88
S.Em.±	2.21	3.04	2.79	0.09	-
C.D. at 5%	6.74	9.26	8.49	0.28	-

Values in parenthesis are the angular transformed value, RER= Relative elongation ratio of root

Similar reports were also stated by the workers from various regions. Germination percentage of wheat (56%) and maize (31%) was recorded with 2 percent litchi leaf aqueous extract, whereas, it was 88 and 53% respectively, in control. Root length of maize and wheat was also affected with litchi leaf extract [16]. The germination percentage of *mung* bean, lentil and bean had lowered (21.6%, 74.7% and 82.7%, respectively) by litchi leaf extract compare to control (37.3%, 82.7% and 96.0%, respectively) [13]. The germination percentage and root length of spiny amaranth is lowered (43.2% and 0.74 cm, respectively) compare to control (60.80% and 1.052 cm, respectively) by litchi leaf extract [15].

4. CONCLUSION

Seed germination of pea and lafa was recorded maximum (100% & 99.50%, respectively) with T_1 (control), whereas, germination was recorded lowest (15.75% & 10.00 %, respectively) with T_5 (=15%) expressing a strong allelopathic germination inhibitory effect of aqueous extract of litchi leaves.

REFERENCES

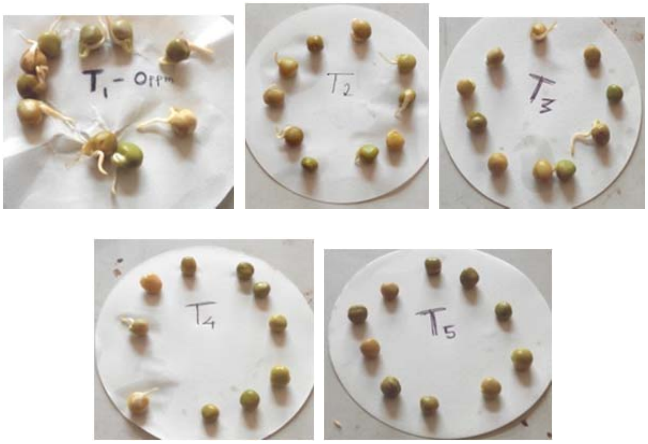
[1] Mallik, M.A.B. and Williams, R.D. Allelopathic growth stimulation of plants and microorganisms. *Allelopathy Journal* , 16**,** 2005, pp.175-198.

[2] Molish, H. *Der Einfluss einer Pflanze auf die andere Allelopathie.*, Fischer, Jena. 1937

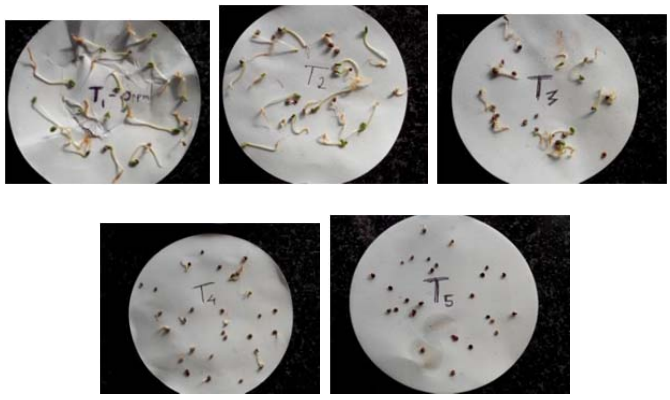
[3] Muller, C.H. Allelopathy in the environmental complex. In: *Handbook of Vegetation Science PartVI: Vegetation and Environment* (Eds., B.R. Strain and W.D. Billings), pp 73-85. Dr W. Junk BV Publisher, The Hague. 1974.

[4] Bais, H. P., Vepachedu, R., Gilroy, S., Callaway, R. M. and Vivanco, J. M. Allelopathy and exotic plant invasion: from molecules and genes to species interactions. *Science,* 301, 2003, pp. 1377-1380.
[5] Rice, E. L. *Allelopathy*. 2nd Ed. London: Academic press. 1984.
[6] Annononymous. Accessed from http://edis.ifas.ufl.edu/pdffiles/HS/HS18600.pdf on 17.7.2016.
[7] Inderjirt, I. Plant phenolics in allelopathy. *Bot Rev.*, 62, 1996, pp. 186–202.
[8] Tripathi, R.S., Singh, Rai, J.P.N. Allelopathic potential of *Eupatorium adnophorum* a dominant rederal weed of Meghalya. *Proc. Indian Natl. Sci. Acad.*, 47, 3, 1981, pp. 458-465.
[9] Singh, H.P., Batish., D.R., Kaur, S. and Kohli, R.K.. Phytotoxic Interference of *Ageratum conyzoides* with Wheat (*Triticum aestivum*). *J. Agron. Crop. Sci*., 189, 5, 2003, pp. 341-346
[10] Han, X., Z. Cheng, H. Meng, X. Yang and I. Ahmad. Allelopathic effect of decomposed Garlic (*Allium sativum* L.) stalk on lettuce (*L. sativa* var. c*rispa* L.). *Pak. J. Bot.*, 45, 1, 2013, pp. 225-233
[11] Khanh, T.D., Hong, N.H., Xuan, T.D., Chung, I.M. Paddy weed control by medicinal and leguminous plants from Southeast Asia. *Crop Protect*, 24, 2005, pp. 421–431.
[12] Wang, C. M., Jhan, Y. L., Yen, L. S., Su, Y. H., Chang, C. C., Wu, Y. Y., Chang, C. I., Tsai, S. Y., Chou, C. H. The allelochemicals of litchi leaf and its potential as natural herbicide in weed control. *Allelopathy Journal*; 32, 2, 2013, pp.157-173
[13] Roy, B., Sarker, B. C., Uddin, M.N., Roy, B. C. and Jalal, S. Comparative growth regulatory activities of fruit leaves extracts and allelochemicals on pulse crops. *Journal of Science and Technology*, 8, 2010, pp. 95-102
[14] Islam, A.K.M., Khan, M, M, S, I and Kato-Noguchi, H. Allelopathic activity of *Litchi chinensis* Sonn. *Acta Agriculturae Scandinavica, Section B — Soil & Plant Science*, 63, 8, 2013, pp. 669-675
[15] Jalal, S, Roy, B., Sarker, B. C., Uddin, M.N. and Roy, S. R. Growth inhibitory effect of ten fruit leaves on selected weeds**.** *J. Agrofor. Environ.*,4, 1, 2010, pp. 101-104
[16] Khan, R. A., Iqbal, K., Hussain, A. and Azeem, S. Effect of different concentrations of aqueous leaf extracts of some plants on the germination and seedling growth of maize, *Z. mays L.* and wheat (*T. aestivum* L.)**.** *International Journal of Environment*, 3, 3, 2014, pp. 264-274
[17] Rho, B.J. and Kil, B.S. Influence of phytotoxication from *Pinus rigida* on the selected plants *J. Nat. Sci*., 5, 1986, pp. 19-27
[18] Gomez, K. A. and Gomez, A. A. In: *Statistical Procedures for Agricultural Research. 2nd ed*., John Wiley and Sons, New York, 1983

Apparently weed free space at basin area of litchi orchard in Cooch Behar district of West Bengal



Seeds germination of pea under different treatments of litchi leaf extract



Seeds germination of laffa under different treatments of litchi leaf extract