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Role of natural product waste on viability and yield parameters of wheat (*Triticum aestivum)*

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Abstract: Effect of *Cymbopogon citratus (lemon grass)* extract at different growth and development stages for disease control in wheat cultivars were studied in lab and open field conditions. Experiments were conducted for three months to control seed borne diseases in wheat TD-1 variety by using waste material of *C. citratus* (lemongrass). Seeds surface treatment with alcoholic extracts of *C. citratus* stem 20-40% significantly reduce the diseases in 20-40% concentration at the time of sowing and germination. Seeds treatment with this extracts effect on plant growth and obtained healthy yield. Best results were obtained in between 20-30% concentration in term of germination, number of spikes, shoot and root length/ weight as compared to 10 % and control. The penetration of extract gave protection to wheat seeds by infection and reduction of soil born diseases.

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INTRODUCTION

Seed deterioration by fungi, bacteria, insects, virus and other pathogens occur during storage[1], fungi being the commonest agent. It is estimated that world losses food grain due to diseases at 133 metric tons per annum[2]. Wheat (*Triticum aestivum* L) being a major cereal occupies an eminent place in the economy of the country as it provides about 60% of the calories and 50% of the protein to the human race[3,4]. Wheat crop is subjected to a number of diseases, which reduces its overall production because wheat plants in all stages of its growth and all in the natural environment are subjected to various physiological and biological stresses that interfere to its normal growth and development. Actual number of wheat diseases is unknown but nearly 200 have been reported from all over the world. Over 100 infectious diseases caused by pathogen and with weeds are transmissible from plant to plant. Amongst these about 50 are generally seeds borne and 35 are caused by fungi[5]. In Pakistan, 50 diseases are reported to occur which have great financial repercussions. The result considered most destructive but the problem of seed borne diseases is also of great importance and can not be neglected. Various chemicals and fungicides evaluated for the control of seed and soil born mycoflora of wheat under field and green house condition[6,7]. Chemical treatments of seeds are effective but it could be toxic to other living organisms. In view of the problems associated with the use of synthetic fungicide, research for newer and safer treatment has been initiated which are non toxic, non- polluted as well as increase the seed germination and yield of crop. In recent years considerable research activity has occurred in the Asia pacific region on the potential for plant extract to control seed born pathogens. Crude extract from plant material have been found to significantly inhibit the mycelial growth of many phyto pathogenic fungi[8,9]. Methyl spirit and aqueous crude extract of neem leaves and kernels protect the beans and maize against two insects for five months[10]. Treatment of seed surface reduces disease caused by fungi and bacteria found on the seeds. Herbal seed treatment control seed pest by parasitizing the pest organisms, competing for food on the root system or producing toxic compound that inhibit pathogen growth. Garlic bulb extract inhibited the spore germination and mycelial growth of seed born fungal pathogen of jute[11]. The experiments showed that the plant extracts suppressed the growth of insect and in preserving the seeds and have played significant role in reducing the incidence of seed born pathogens and in the improvement of seed quality and emergence of plant in the field. Fungal pathogens in the soil can rot the seed before it emerges from the soil or kill plants as they emerge. Treatments encourage healthy root system.

The *Cymbopogon citratus* (Lemon grass) belongs to the family Gramneae (poaccea), commonly known as sweet grass family. Lemon grass is a tall, aromatic perennial grass that is native to tropical and cultivated in West Indies, central and South America and tropical region. The essential oils from some species of genus *C. citratus* were analyzed for their composition due to high citral contents in the essential oils of the plants[12] and biological studies such as β-glucuronidase inhibitor, antifungal and antibacterial agents[13.] Fresh *C. citratus* grass contains about 0.4% of volatile oil. The oil contains citral, myrcene (12 to 25%), diterpene, methylheptenone, citronellol and other alcoholic aldehydes. *C. citratus* in low toxicity used as a fragrance, flavoring and in folk medicine as an

antispasmodic, hypotensive, anticonvulsant, antiemetic, antirheumatic, antiseptic and for treatment of nervous and GI disorders. In Chinese medicine lemon grass is used in the treatment of headaches, abdominal pain and rheumatic pain[14]. The evolution of beneficial effects of lemon grass stem extract on one wheat variety is the main aim of this study.

MATERIALS AND METHODS

Collection and extraction of cymbopogon citrates stem

C. citratus (Lemon grass) procured from a field at PCSIR Labs Complex Karachi. Stem were collected after leaves cutting. 15 kg stem was dried in dryer for three days at 50^0C, ground, sieved and socked in 75 L ethanol for three weeks x 3 times. The ethanolic extract was concentrated to a gum (712g)[15].

Preparation of solution

The gum was dissolved in water to make stock solution 95% by which further dilutions of 40%, 30%, 20% and 10% were made and used for seed treatment.

Sampling of material

Freshly harvested seeds of wheat were provided by Tandojam University. TD-1 variety of wheat seeds were used for the present study. The diseased seeds were separated from the visually healthy ones, washed with distilled water and quick dried on screen in shade.

Treatment of seeds

Seeds were soaked for 50 minutes in each dilution @ 50ml/100 sterilized water was taken as control and dried on the screen in shade for one hour before the sowing day.

Phytotoxicity

The phytotoxicity of the extract with respect to seed germination and fungus growth on wheat seeds was assayed by the technique followed by Dikshit et al., 1983. According to this method 50ml of each dilution of extract was thoroughly mixed with 100 seeds for 50 minutes and poured into sterilized Petri plates, covered by double layered moistened Whatman no.1 filter paper. Seeds soaked only in the distilled water serve as the control .The Petri plates were kept in germinator with 18hrs in light at 22^0C and 6hrs in dark at 18^0C. Seed germination as well as seedling growth was recorded at different intervals; the data presented are based on the mean values of five replicates each with 100 seeds.

Field experiment

Experiment was conducted in the field of PCSIR Labs Complex Karachi from November 2007 to March 2008. A plot of land measuring 15x 10 meters was selected for the experiment. Land was divided in to two rows and eight columns in a randomized complete block design with four replications per treatment, and control. Treated seeds were sown in the experiment beds. Each treatment was replicated three times. The soil was tilled three times within two weeks before applying the treated seeds so as to facilitate the release of any residue left for prior experiment. The soil was watering in alternate days and weeds were regularly removed during the experiment. At harvest plants growth and yield parameters including fresh weight of root, shoots and no. of spikes were determined. The experiment was conducted with three replications per treatments and data from each experiment were subjected to an analysis of variance with significant difference and mean identified by Duncan multiple range tests.

RESULTS AND DISCUSSION

Experiments were conducted during November 2007-March 2008 and data gathered during the month of March to May 2008. Table 1 indicates that all growth parameter increased after seed surface treatment to different concentration of *C. citratus* stem extract. significent result is obtained when 20% concentration of extract is used as it gave highest root length 15.3 cm, shoot weight 86.60 gm, greater number of spikes 14.12. Figure 1, 2 and 3 showed that 30% and 40% concentrations gave best result in term of root weight and shoot length. The efficacy of 30% alcoholic extract for seed treatment is highest (91.75%) viability was recorded, which is lowest (81.5) in 10% concentration. 20% to 30% concentrations gave higher stimulatory effect on plants growth, yield and were found to be more efficacious then 10%, 40% and control. When 20% concentration of extract was used the shoot weight and no. of spikes are greater (Figure 4 and 5). Best result is obtained for germination of wheat cultivars at 30% concentrations of *C. citratus* extract (Figure 6). In 10% to 40% concentration plants achieved significant growth in all terms with compared to control.

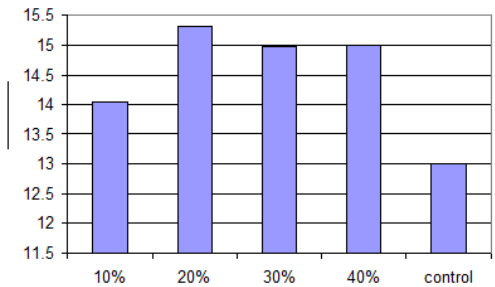

Figure 1: Comparison of root length at different concentrations of *Cymbopogon citratus* extract.

Use of *C. citratus* stem extract as seeds surface treatment greatly reduced pathogenic effect on wheat seed at the time of sowing and germination and provided protection against soil born diseases and estimated nutrients as growth promoter.

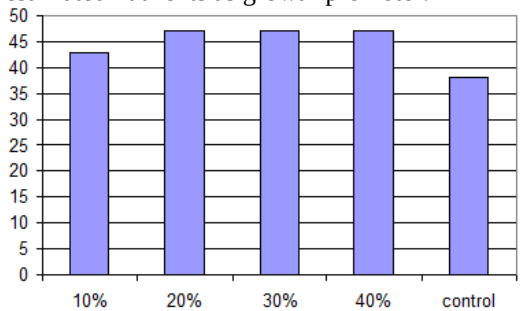

Figure 2: Comparison of root weight at different concentrations of *Cymbopogon citratus* extract.

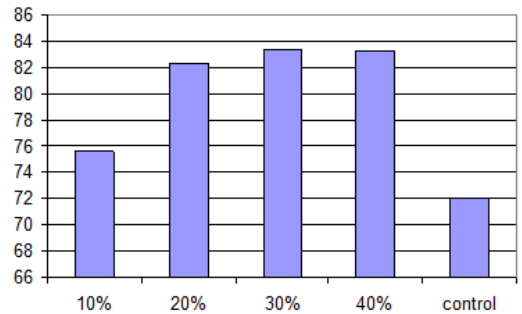

Figure 3: Comparison of shoot length at different concentrations of *Cymbopogon citratus* extract.

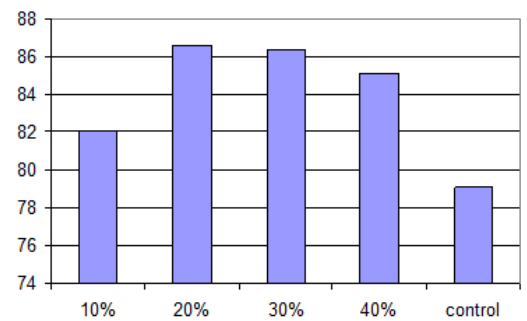

Figure 4: Comparison of shoot weight at different concentrations of *Cymbopogon citratus* extract.

In general the significantly greater shoot and root weight of the treated seeds were found when grown in soil with *C. citratus* extract as compared to untreated seeds. This treatment could be attributed to the reduction of diseases and also serve as a growth promoter or organic manures. The damaging effect on seeds may have been mashed by the plant extract. One mechanism of plant extract explained the evaluation of lemon grass oil as antibacterial on *E. coli* determined that the oil elicit more alternation on the host including filamentation[16]. The oil contains citral, accumulation of citral in certain lemon grass leaf and yield of essential oil in the plant has been evaluated[17].

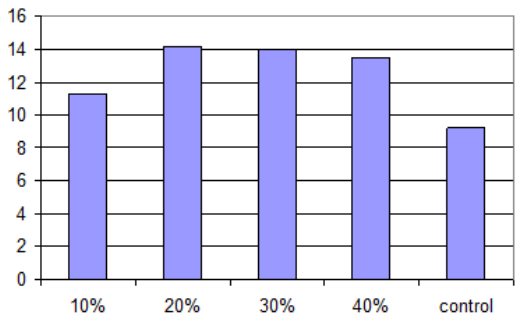

Figure 5: Comparison of number of spikes at different concentrations of *Cymbopogon citratus* extract.

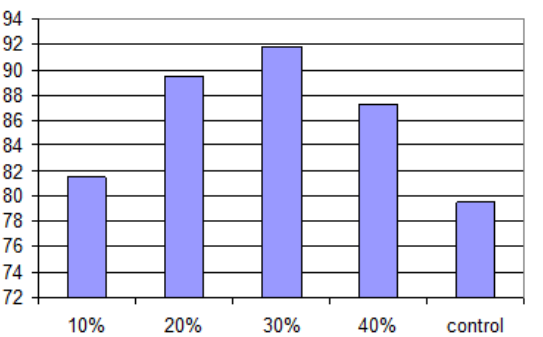

Figure 6: % Germination of wheat cultivars at different concentrations of *Cymbopogon citratus* extract.

Table 1: Effect of different concentration of *Cymbopogon citratus* extract on the growth parameter of wheat cultivar.

No.	Concentration of *Cymbopogon citratus* extract	Root length (cm)	Root weight (gm)	Shoot length (cm)	Shoot weight (gm)	No. of spikes	Germination (%)
1	10%	14.05±0.31	42.97±0.25	75.59±0.36	82.03±0.05	11.25±0.43	81.5±0.86
2	20%	15.31±0.47	47.07±0.27	82.34±0.36	86.60±0.43	14.12±0.13	89.5±0.5
3	30%	14.98±0.316	47.07±0.206	83.35±0.25	86.37±0.39	14.0±0.07	91.75±0.43
4	40%	15.0±0.39	47.19±0.23	83.22±0.39	85.16±0.20	13.5±0.5	87.25±1.2
5	control	13.0±0.07	38.21±0.25	72.0±0.6	79.12±0.25	9.2±0.43	79.5±0.5

Other compounds found in the oil are myrcene (12% to 25%), diterpene, methylheptenone, citronellol, linalol, fernesol, terpineol and other alcohols, aldehydes, and more than a dozen of other minor fragrant compounds. The essential oil of the species of the genus of citrus and *C. citratus* analyzed for their antimicrobial, antifungal and antibacterial agent[18]. Lemon grass extract did not affect the seedling development[19].

It is estimated that this extract can be easily used for the healthy crop production where the chemical preservative is not advisable because of the penetration of toxic substances and it is also hazardous for farmers. The possibility of stimulatory effect on soil micro-organisms needs further testing[11.]

Efforts to determine the effects of a wide range of medicinal plants on seeds treatment and plant development need to be intensified[4,7]. Extract of *Allium stavium* significantly reduced seed infection by *Drechslera oryzae* and treated seeds are significantly higher viability[2.] Regarding disease incidence the highest value (94.29%) was recorded with +ve control while the lowest (19.04%) was recorded with seeds treated with pathogen and irrigated with pathogen and irrigated with neem extract[20]. This approach surrounds the germinating seed with protection from the diseases causing fungi, soil born pathogens that cause damping off and other soil born diseases[21-23]. Since diseases control using natural products and anemic is gaining much impetus, data on the effect of medicinal plants on the activity of fungus seed rot and other diseases antagonistic would be vital to assess the plants role in the integrator pests management program[24,25.]

The quality of seeds of improved varieties of wheat is also considered as most important input for good production. Only the healthy seed can give economic benefits to the grower, it can maintain the production, which fetches higher value in the market. Therefore availability of healthy seeds be conformed otherwise most of the seed borne diseases could become responsible for the production loss.

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