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EFFECT OF *PROSOPIS JULIFLORA* (Sw.) DC. IN THE CONTROL OF ROOT ROT FUNGI OF COWPEA (*VIGNA UNGUICULATA* L.) AND MUNG BEAN [*VIGNA RADIATA* (L.) WILCZEK]

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Abstract

Present investigation was carried out for the control of root infecting fungi by using wild plant. Soil amendment with leaves, stem and flower powder of *Prosopis juliflora* @ 0.1,1 and 5% w/w for the control of root infecting fungi like (*Fusarium* spp., *Rhizoctonia solani* and *Macrophomina phaseolina*) Results obtained showed significant suppression of root rot fungi and significantly enhanced the growth parameters like shoot and root length and weight, leaf area and number of nodules per plant. *Prosopis* stem and leaves powder @ 0.1 and 1% were found effective for the enhancement of plant height and weight of cowpea and mung bean.

Introduction

Organic amendment with botanical toxicant have shown promising results in the control of soil borne root infecting fungi (Ghaffar, 1995). The disease causing organisms which adversely affect the crop productivity. The charcoal rot fungus *Macrophomina phaseolina* has a very wide host range and attacks the root and basal stem (Sackston, 1981). Mostly disease causing organisms the soil borne pathogens viz., *Macrophomina phaseolina* (Tassi) Goid, *Rhizoctonia solani* (Kiihn) and *Fusarium* spp., attack roots limiting nutrition uptake and produce root rot disease complex resulting in the death of plants. The genus *Fusarium* contain a number of species which have been recognized for a long time as being important plant pathogens (Booth, 1971; Nelson *et al*., 1983) an average yield loss of 2.2 ha in pea was observed due to root rot diseases caused by *Fusarium solani* and *F. oxysporum* with complete loss in many cases (Tu, 1987). Similarly *Macrophomina phaseolina* produce charcoal rot of 500 species of plants (Sinclair, 1982) where at least 72 hosts have been reported from Pakistan (Mirza & Qureshi, 1978; Shahzad *et al.*, 1988).

Rhizoctonia solani exist as active mycelium in soil and attacks more than 2000 species of plants (Parameter, 1970) of which at least 63 hosts have been reported from Pakistan (Mirza & Qureshi, 1978). *Rhizoctonia solani* (Kiihn) and *Fusarium* spp. cause wilting of different crop plants. Wilt has become a major disease causing significant reduction in yield. The wilting of different plants is characterized by yellowing of foliage drooping of apical shoot to ultimate death of whole plant. The pathogen is a soil inhabiting fungus and form in the senescing tissues of the diseased plant and may survive in the soil for many years. There are many methods which are presently being used to control various plant pathogens including wilt pathogens (*Fusarium*, *Rhizoctonia* and *Macrophomina*). Babu *et al*., (2008) investigate that plant extract and their compounds to control fungal pathogen. He found that plant extract significantly inhibited the radial growth of isolated fungus. The formulation studies of plant extract can be successfully devised as fungicides using a simple process with minimum instrumentation and few chemical agents. These formulations may be considered suitable for seed and foliar treatment. Amongst the plant extracts used *Azardiachta indica* was found most effective at 20% concentration followed by *Rheum emodi*, *Eucalyptus globulus*, *Artemessia annua* and *Ocimum sanctum* Successful attempts have been made for belonging to twelve families (Russel & Mussa, 1977) and *Prosopis juliflora* (Raghavendra *et al*., 2002). Plant extracts were used to control *Fusarium*. Antifungal property of *Polyalthia longifolia* extracts against *Macrophomina phaseolina* has been reported (Datar, 1999). Present work was therefore carried out on affect of *P. juliflora* powder in the control of root rot fungi.

Materials and Methods

Collection of material: *Prosopis juliflora* plant parts were collected from University of Karachi campus air dried and ground in a grinder.

Soil used: Soil used was obtained from experimental plot of Department of Botany, University of Karachi. The sandy loam soil containing (sand, silt, clay, 70, 11 and 10%), pH ranged from 7.1-9.65 with moisture holding capacity (MHC) of 49% (Keen & Raczkowski, 1922), total nitrogen 0.077-0.099% (Mackenzie & Wallace, 1954), 3-7 sclerotia/g of *M. phaseolina* g-1 as found by wet sieving technique (Sheikh & Ghaffar, 1975), 5-20% of *R. solani* on sorghum seeds used as baits (Wilhelm, 1955) and *Fusarium* spp., 2000 cfu g-1 as assessed by soil dilution technique (Nash & Synder, 1962).

Soil amendment: Soil amendment with *Prosopis juliflora* leaves, stem and flower powder @ 0.1, 1 and 5% w/w and surface sterilized seeds sown in 8 cm diam., plastic pots, each containing 300 g soil and watered regularly to maintain sufficient moisture required for the growth of plants. The pots were kept in screen house in randomized complete block design with three replicates per treatment. Seeds treated with sterile distilled water served as control. Growth parameters like shoot and root length and weight, leaf area and number of nodules were recorded after 30 days of seed germination.

Determination of root infecting fungi: To determine the incidence of root rot fungi, one cm long root pieces after washing in running tap water were surface sterilized with 1% $Ca(OCl)_2$ and transferred on PDA plates supplemented with Penicillin @ 200 mg and streptomycin @ 200 mg/liter at 5 pieces per plate. Petri dishes were incubated at room temperature and after one week, infection of roots by root infecting fungi was recorded.

Statistical analysis: Data were subjected to analysis of variance (ANOVA) followed by the least significant difference (LSD) test at P = 0.05 and Duncan's multiple range test to compare treatment means, using statistica software according to Sokal & Rohlf (1995).

Experimental Results

Results obtained showed significant enhancement of growth parameters of mung bean and cowpea when soil was amended with *Prosopis* stem, leaves and flower powder @ 0.1, 1 and 5% w/w. In mung bean and cowpea germination increase 100% when soil was amended with *Prosopis* stem, leaves powder @0.1, 1 w/w (Fig. 1). Shoot length and shoot weight significantly increased when soil was amended with *Prosopis* leaves powder used @ 0.1%. There was significant increase in root length and root weight when soil was amended with *P. juliflora* leave powder @ 1% (Fig. 2). Where as leaf area and no. of nodules were significantly increase when soil was amended with leaves powder @ 0.1%. Soil amendment with *P. juliflora* parts powder showed significant suppression of root rot fungi like *Fusarium* spp., *R. solani* and *M. phaseolina.* Highest reduction ($p<0.001$) in infection of *Fusarium* spp. and *R. solani* on mung bean and cowpea was observed when soil was amendment with leaves powder @ 0.1%. There was significant reduction in *M. phaseolina* infection when soil amendment was carried out with leaves powder @ 1% (Fig. 3). Of the three parts powder of *P. juliflora* used leaves powder @ 1% w/w was effective for the enhancement of growth parameters and reduction of root rot fungi.

Discussion

In the present study soil amendment with *Prosopis juliflora* parts showed significant reduction in root rot infection of *Fusarium* spp., *R. solani* and *M. phaseolina* in cowpea and mung bean. Of the various wild trees *Prosopis juliflora* has shown antimicrobial activity *In vitro* where active compound was identified is juliflorine (Ahmad *et al.,* 1986). *P. juliflora* has been reported to contain alkaloids (Ahmed *et al.,* 1989) terpenoid diketone(Ahmad & Sultana 1989) where juliflorine was found as an antimicrobial compound (Ahmed *et al.,* 1986). Tariq *et al*., in 2008 observed that germination of potato tubers, plant weight, height, root length and shoot length increased when *A. marina* and *R. mucronata* plant parts were used at 1 and 5% concentrations. Tariq *et al*., (2007) observed that germination and plant growth parameters were significantly increased in mash bean and okra plants when leaves and stem powder of *R. mucronata* were used at 5% concentration. Mehdi *et al*., in 2000 showed that *R. mucronata* used alone or in combination with *Paecilomyces lilacinus* significantly suppressed root infecting fungi. Dawar *et al*., (2007) studied that leaves, stem, bark and fruit powder of *Eucalyptus* sp., has potential to reduce the infection of root infecting fungi viz., *Fusarium* sp., *R.solani* and *M. phaseolina*. Neem cake has shown promising results in the control of root infecting fungi (Alam, 1990; Abid *et al*., 1992). Similarly seaweeds *Stoechospermum marginatum*, neem cake and cotton cake showed promising results in the control of root infecting fungi on sunflower (Ehtheshamul-Haque *et al*., 1998). *Eucalyptus* essential oil is considered to have marked antiseptic action against infectious bacteria, viruses and fungi (Inouye *et al*., 2001).

Amendments provide energy and nutrients to soil, drastically changing the environment for the growth and survival of crops and micro-organisms (Drinkwater *et al*., 1995). Organic soil amendments are commonly used in the agricultural system to recycle nutrients and energy as well as to improve soil conditions for plant growth (Hadar *et al*., 1992; Muchovej & Pa-covsky, 1997). Some organic amendments suppress soil-borne plant pathogens and control plant-parasitic nematodes (Rodriguez-Kabana, 1986; Ali *et al*., 2001). In general, soil amendment with toxic plants suppresses plant pathogens directly by releasing toxic substances like phenols, and indirectly enhancing soil micro-organisms that inhibit phyto-pathogens (Ali *et al*., 2001; Shaukat *et al*., 2001). Use of fungicides possed a serious threat to human health and to the existing human ecogeographical conditions as some of them have already been proved to be either mutagenic, carcinogenic. The use of plant extract in the management of plant diseases is gaining importance. Application of plant extract which are easily available for controlling plant diseases are non pollutive, cost effective, nonhazardous and do not disturb ecological balance. *Fusarium* is one of the common soil inhabiting plant pathogenic fungus which causes diseases such as wilt of brinjal, pigeon pea, guava, gram tomato etc. Several others species of this genus are responsible for huge loses to their respective host crop. Natural chemicals and their use for integrated plant protection is one of the focus of research workers all over the world (Kiran *et al*., 2006). Mixtures of biocontrol agents with different plant colonization patterns may be useful for the biocontrol of different plant pathogens via different mechanisms of disease suppression. Moreover, mixtures of biocontrol agents with taxonomically different organisms that require different optimum temperature, pH and moisture conditions may colonize roots more aggressively, improve plant growth and efficacy of biocontrol. The greater suppression and enhanced consistency against multiple cucumber pathogens were observed using strain mixtures of PGPR (Raupach & Kloepper, 1998). Present results suggest that *P. juliflora* provide significant results in the control of root infecting fungi and to increase the productivity of crop.

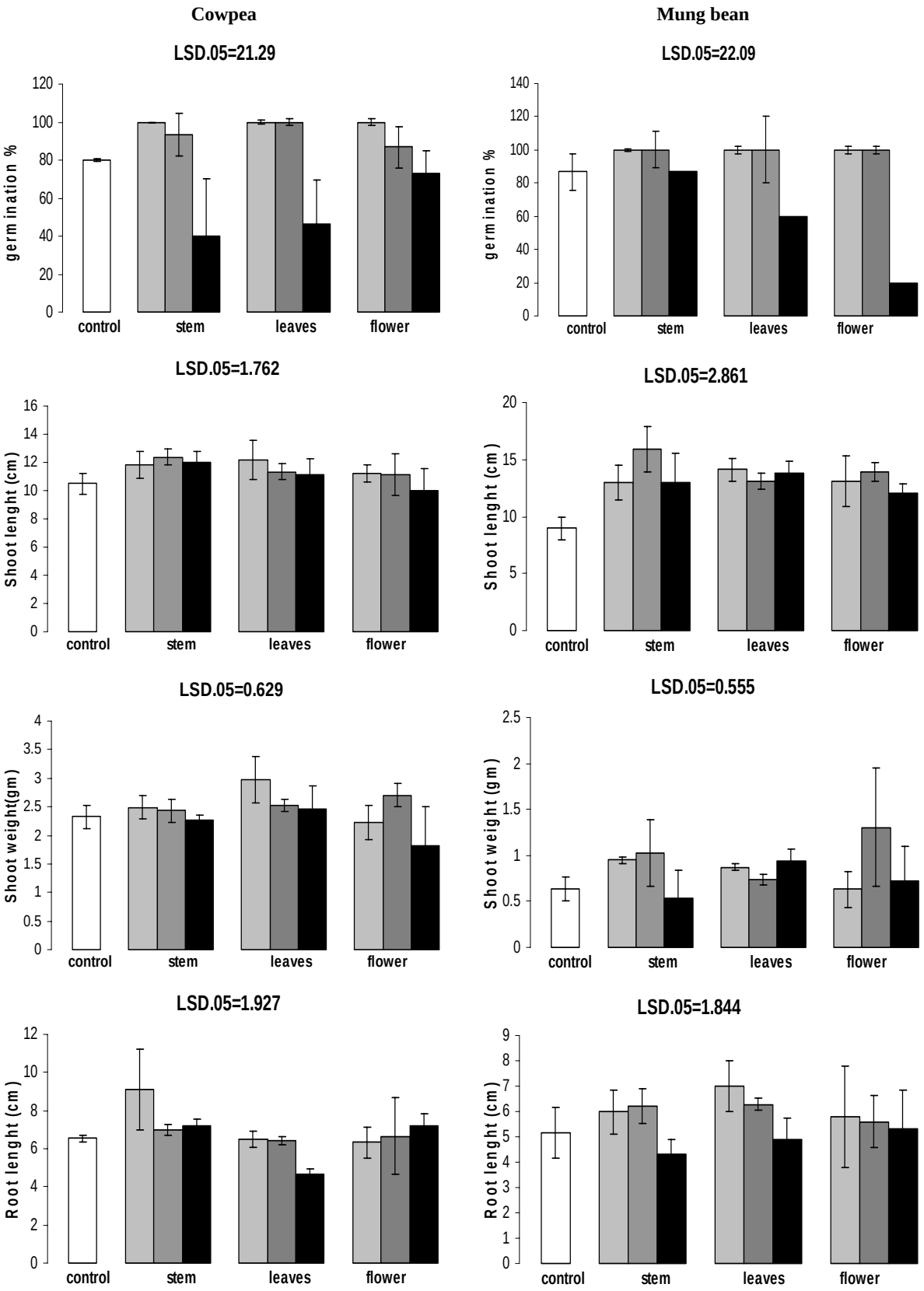

Fig. 1. Effect of soil amendment with *P. juliflora* parts on growth parameters of cowpea and mung bean.
0.1% 1% 5%

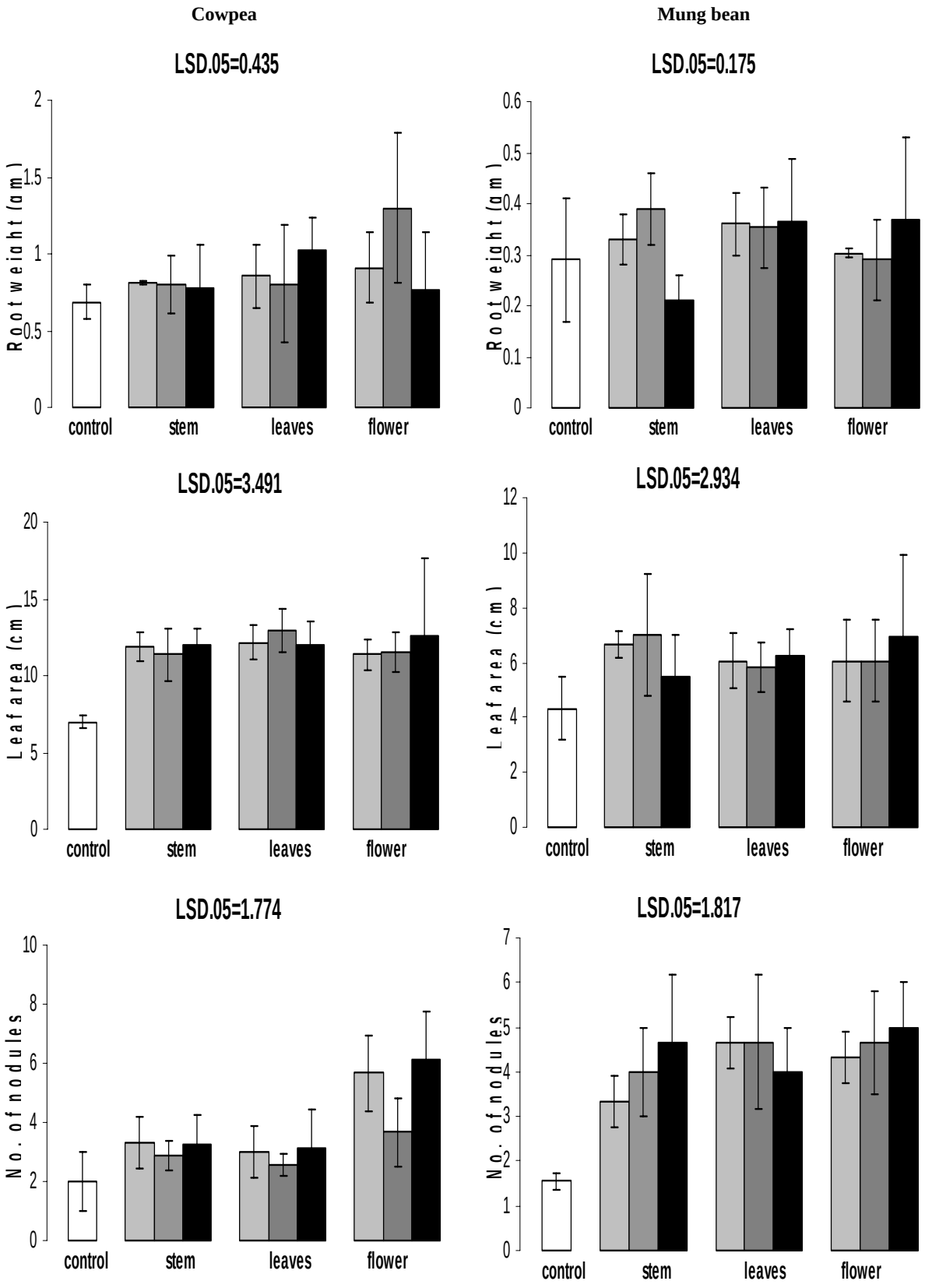

Fig. 2. Effect of soil amendment with *P. juliflora* parts on growth parameters of cowpea and mung bean.
0.1% 1% 5%

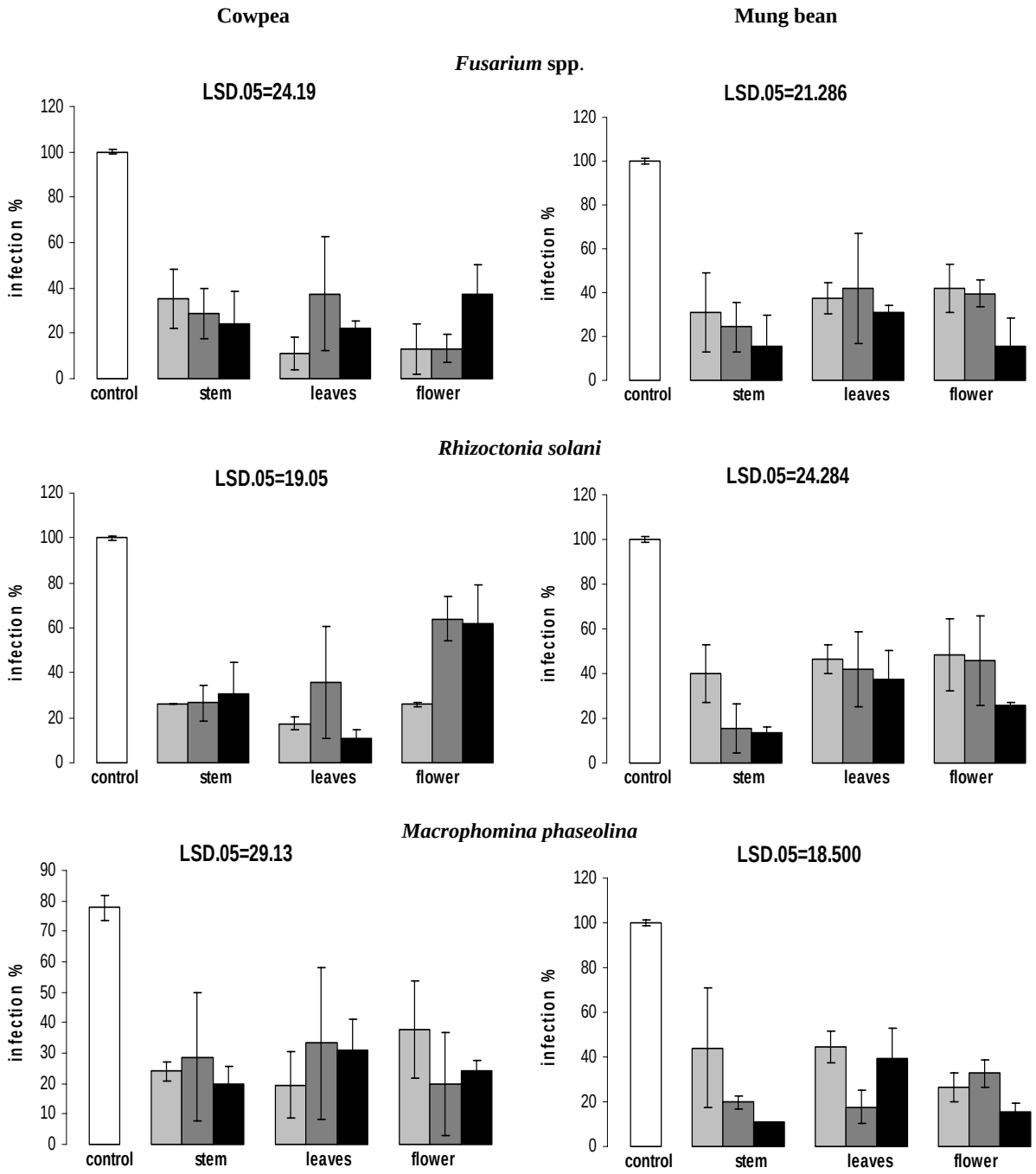

Fig. 3. Effect of soil amendment with *P. juliflora* parts in the control of root rot fungi.
0.1 0.1 % 1% 5%

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