# ABSTRACT

Chilli plants are easily infected by *Fusarium* species and cause enormous loss of food products as well as plants worldwide. Therefore, a suitable method is required for prevention and reduction of *Fusarium* species affecting chilli plants. This research explored the possibility of using lactic acid bacteria (LAB) as bio-control against *Fusarium* species on chilli plants. A total of 21 LABs were isolated from different sources 14 from soil, 7 from fermented chilli fruits and 3 ATCC strains. Four *Fusarium* species were isolated from different plants parts and identified as *Fusarium oxysporum* f. sp. *lycopersici, F. solani, F. acuminatum* and *F. proliferatum*. Screening using dual overlay assay showed that 14 from 21 LAB isolates inhibited *Fusarium* species with zone of inhibition 4.0 to 60.0 mm after 48 h incubation at 28°C. The supernatants of *Lb. acidophilus* ATCC314, *Lb. plantarum* ATCC8014 and three other LAB isolates were identified as *Lb. plantarum*1–LAB MSS1 (isolated from soil), *Pediococcus pentosaceus*1-LAB MSS5 (isolated from soil) and *Lb. plantarum*1–LAB FF11 (isolated from fermented chilli fruits) using API Kit and 16rDNA genotypic identification showed strong antifungal activity against all targeted *Fusarium* species. The supernatants of five LAB isolates showed mycelial growth inhibition against all *Fusarium* species especially *F. solani* CS (isolated from chilli seeds). The antifungal activity of the LAB supernatants was affected by enzyme treatment; the antifungal activity was in the range of 7.44 to 86.83% depending on LAB and *Fusarium* species Pepsin reduced the antifungal activity of supernatants LAB-CFS MSS1, IDLAB6 and FF11 against *F. oxysporum* f. sp. *lycopersici*- CL. The antifungal activity was significantly ($P<0.05$) reduced by pH of supernatant. Loss of antifungal activity of LAB supernatant was observed at pH 6 to 9, reduced at pH 2 and 5, but maintained at pH 3 and 4. Heating LAB-CFS at temperatures 80°C and 90°C for 30 min and 121°C for 15 min resulted in loss of antifungal activity in MSS5, IDLAB6 and FF11 against *F. acuminatum*-FC, while other LAB maintained the antifungal activity (3.09 to 97.75%) after 72 h incubation at 30°C. Application of LAB-CFS to seed prior to sowing enhanced seed germination by 97% but not for seeds infected with the fungi; the germination rate was reduced to 50.00%. However, chilli seeds treated with supernatant of LAB-FF11 and cells of LAB-MSS1 significantly ($P<0.05$) increased the germination rate to about 98% even when the seeds were sowed in soils infected with the fungi. Significant shoot and root elongation was observed when the seeds were treated with CFS of LAB-FF11 before sowing with an average of 11.60±0.57 cm after 16 day incubation in the dark. Plants treated with LAB MSS1 (group II) showed broadest width canopy of 80.83±10.51 cm, significantly ($P<0.05$) higher compared to LAB FF11 (group IV) and other groups. Inoculating *F. solani*-CS to soil resulted in abnormal growth of chilli plants (Group VI) and plant height reached 143.67±0.41 cm than plants treated with LAB cells and control plants. Fungi infected plants showed an increase in dry weight of plants (77.32 g) and the water content was 77.03% which was less than plants from others group after 65 days of transplanting. The productivity (number of fruits/plant) was significantly ($P<0.05$) higher (56.33±06.11) in plants treated with LAB FF11 (group IV) compare to other groups. Growth of plants without LAB or fungi was slow and productivity was 2% per plant. Plants receiving treatments LAB MSS1 (groups II) LAB MSS1 and *F. solani* (group III), LAB FF11 (group IV), and LAB FF11 and *F. solani* (group VI) produced chilli fruits which ripened and turned to red within 90 d, and plant growth continued until more than 110 d. However,

plant infected with *F. solani* (Group VI) started to show plant death after 65 days. Both *Fusarium* species and the *Lb. plantarum* (MSS1 and FF11) LAB were found to be endophytic in nature. Treatment of seeds and soil with selected LAB either as cells or supernatant resulted in rapid growth of plants in the presence of *Fusarium* species Therefore, this study demonstrated that selected LAB either cells or their supernatants could be used as bio-control against *Fusarium* species infecting chilli plants. Treating the seeds or soil using LAB either cells or supernatants enhanced plant growth, improved the productivity of chilli plants and also suppressed the growth of *F. solani*.