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Genetic diversity and host-specific adaptation of *Beauveria bassiana* improve efficacy against *Spodoptera frugiperda* larvae under laboratory conditions

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Abstract

The objective of this study was to identify and characterise three indigenous strains of *Beauveria bassiana*: BB11 and BB115, isolated from insects, and DL1.1, isolated from soils. Their identification was confirmed through 18S rRNA gene sequencing and BLAST analysis. The study also aimed to analyse their genetic diversity and to evaluate their effectiveness against the larvae of the invasive fall armyworm (FAW, *Spodoptera frugiperda*). Although the three strains were confirmed as *Beauveria bassiana*, they showed distinct genetic profiles. In all strains, we observed the transversion mutation (T → A) at site 6. However, the insect-derived strain BB115 showed greater genetic diversity with specific transitions occurring at multiple sites: 664 (A → G), 712 (T → C), and 763 (C → T). Additionally, a transversion at site 917 (C → G) was identified in BB115. Finally, strain DL1.1 showed a distinctive transversion mutation at site 574 (T → G), which set it apart from insect-derived strains BB115 and BB11. Bioassays with the three B. bassiana strains revealed higher mortality rates in 2nd instar than 3rd instar FAW larvae. BB115 caused 67 % mortality in 2nd and 45 % in 3rd instar larvae, while BB11 caused 55 % and 39 % mortality, respectively. DL1.1 showed lower efficacy, with 31 % and 28 % mortality in 2nd and 3rd-instar FAW larvae. Survival times of FAW larvae varied significantly between strains ($p < 0.001$), with insect-derived strains BB115 and BB11 showing the lowest average survival, killing L2 larvae in 7.6 ± 0.5 and 9.5 ± 0.5 days, respectively, compared to 12.9 ± 0.3 days for the soil-derived DL1.1. Strain BB115 demonstrated the most rapid action on both 2nd instar and 3rd instar FAW larvae, showing its effectiveness in targeting younger FAW larvae. These findings emphasise the potential of insect-derived B. bassiana strain BB115 as a promising biocontrol agent, with a faster onset of action than typically observed in other strains, thus meeting the expectations of farmers seeking alternatives to synthetic insecticides. Future research should test insect-derived strains in the field or complex environments and explore if and how the observed mutations are involved in the infections of insect hosts.

Keywords: *Beauveria bassiana*, molecular characterisation, pathogenicity, *Spodoptera frugiperda*

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