SUMMARY & CONCLUSION
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The plant disease of gummy stem blight is a common disease that severely affects the cucumber family, particularly the gherkin crops in all the gherkin growing fields of Southern part of Karnataka. About 50% to 55% of PDI was recorded during the field survey that altered the crop production and yield which in turn affected the economic condition of the farmers. There are no early reports on the disease gummy stem blight of gherkin in the Karnataka state as well as in India. Therefore, efforts were made to identify the pathogen, study the symptomatology of the disease and control the disease by applying eco-friendly methods, especially, the integrated disease management practice by using bioagents and as well as fungicides, both in vitro and in vivo conditions.

The causative organism of gummy stem blight was identified as D. bryoniae by studying culture and morphological characteristics. The pathogenicity test was conducted to study the disease symptoms and to confirm the Koch’s postulate.

The gummy stem blight disease is presently managed by application of chemical fungicides and by sowing disease resistant plant variety. However, because of the adverse effects of chemical fungicides on the environment, the alternative methods such as integrated disease management practices are taking lead. The use of beneficial microbes from the soil mycoflora for controlling the plant diseases has been of interest because of its ecofriendly nature. The concept of exploiting the resident fungi is mainly based on its antagonistic efficacy. In this approach, in vitro antifungal assay was considered as beneficial. In the present work, an effort was made to utilize and evaluate locally available resources, particularly the native antagonists operating in the rhizospheric soil from the gherkin fields. Their efficacy in managing the growth
of *D. bryoniae* in *in vitro* and *in vivo* conditions was carried out for the management of gummy stem blight of gherkin.

The dual culture studies and volatile compound test were conducted to evaluate the native rhizospheric bioagents. Out of the four tested bioagents, *T. harzianum* showed significant results when compared to the others bioagents which can be attributed to its rapid growth. *A. terreus* also showed good antagonistic activity both in dual culture and volatile compound test. *Penicillium purpurogenum*-1 and 2 showed moderate activity against *D. bryoniae*.

The mycoparasitic mechanisms between the bioagents and *D. bryoniae* were recorded using compound microscopic studies and SEM analysis. *T. harzianum* showed over growth and coiling on pathogen which gave an idea about the morphological changes of the pathogenic mycelia and also showed the hyperparasitic action by longitudinally attaching to the pathogen leading to hyphal depression of *D. bryoniae*. *A. terreus* hypha grew densely on the pathogenic surface and completely destroyed it by penetrating inside by forming intra-mycelial growth and protruded out for sporulation. The spores accumulated and completely covered the pathogen hyphae which lead to the destruction of pathogen mycelia. Both *P. purpurogenum*-1 and *P. purpurogenum*-2 also showed hyperparasitic action on pathogenic mycelium. *P. purpurogenum*-1 mycelia grew parallel to the pathogen and produced a hook that penetrated the pathogen mycelia and destroyed it. Whereas, *P. purpurogenum*-2 mycelia multiplied and completely accumulated on the hyphae of pathogen by producing spores which led to heavy hyphal degradation of pathogen mycelia.

The effect of non-volatile compounds produced by the bioagents on the growth of *D. bryoniae* revealed that the cultural filtrate of all the four bioagents were
effective in suppressing the pathogen growth. However, among the treatments applied, *T. harzianum* proved to be significantly promising bioagent. It suppressed the pathogenic growth at all the concentrations which was on par with the commercially available fungicides Kavach and Aliette. *A. terreus, P. purpurogenum-1* and *P. purpurogenum-2* were effective only at 20% concentrations.

The Poision food technique was employed for screening sensitivity of *D. bryoniae* to different fungicides. The fungicides viz. Aliette, Indofil, Kavacha, Nativo and Sectin were investigated at concentrations ranged between 0.1% and 0.025%. It was observed that all the fungicides significantly and effectively inhibited mycelial growth of pathogen. Amongst the five tested fungicides, Indofil and Nativo proved to be the most effective with 100% growth inhibition at the lowest 0.025% concentration compared to Aliette which showed 100% inhibition at 0.01% concentration. However, Kavach and Aliette were least effective against the pathogen even at higher concentration of 0.2 % which was in contrast with the recommended dosage.

The green house studies *A. terreus* isolate amended pots showed minimal disease incidence and induced plant growth when compared to other bioagents ammended pots. In *P. purpurogenum-1* isolate treated pots, moderate percentage of disease incidence was observed. Whereas *T. harzianum* isolate treated pots showed maximum percentage of disease incidence and it was found to be least effective against *D. bryoniae* which pathogen was in contrast with *in vitro* studies. The plant growth in *P. purpurogenum-1* treated pot showed highest shoot length. *A. terreus* treated pot also showed much higher than the control pots. The number of leaves was also highest in case of plants treated with *A. terreus* and lowest in *T. harzianum* treated plants.
Hence from the current study, though *T. harzianum* was found most effective in inhibiting the mycelial growth of *D. bryoniae* *in vitro* studies, it was clear that both *A. terreus* and *P. purpurogenum* are efficient for managing *Didymella bryoniae* both *in vitro* and *in vivo* conditions. Each isolate has individual prospective, not only in reducing the disease incidence but also in promoting the plant growth by increasing the shoot length and number of leaves. Further exploration is necessary to comprehend the definite description between the isolates and the pathogen and their stability in field conditions.