

Disease Survey of Rice in Lao PDR and Control of Sheath Diseases

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Abstract

The objectives of this study are to identify rice diseases, and study its significant effects in Lao People Democratic Republic Lao (PDR). The study carried out survey and collection of rice diseases in major rice production fields, identification of rice disease causal agents, analysis of pathogenicity, epidemic, and etiology; and identification of effective methods for controlling sheath blight diseases. The rice disease survey and collection were conducted in three (3) provinces in Lao PDR (particularly in the north, central and south provinces) during 2015-2016 wet and dry seasons. The diseases found were sheath blight, sheath spot, blast, brown spot, narrow brown spot, and bacterial leaf blight. Sheath diseases were found to be the most important among the samples. Characteristics of sheath disease pathogen were grouped using morphological characteristic, molecular technique, and pathogenicity test. Nineteen (19) isolates of *Rhizoctonia* were characterized and reported, among them seven (7) isolates were *Rhizoctonia solani* and 12 isolates were *R. oryzae*. The *R. solani* mycelia on potato dextrose agar (PDA) were light brown to brown, sclerotia brown color, and globose to irregular shape. On the other hand, *R. oryzae* mycelia on PDA were brown and orange brown. and sclerotia globose to irregular shape, dark brown or light-yellow color. The PCR amplification of ITS1-5.8S-ITS2 of *Rhizoctonia* spp. DNA sequencing was performed; the PCR products obtained were about 750 base pairs for all isolates. The sequence bases of PCR products were compared to the GenBank database. The results show that isolates SMN1-5, SMC1-2 and VNN were similar to *R. solani* strain RSR 8 (KF570302) with 98% identity; *R. solani* strain AG1-1AKA (KJ577141) with 99% identity and *R. solani* isolates RASC8 (JF701711) with 97% identity, *Rhizoctonia* isolate VHN1-3 were found similar to *R. oryzae* isolate VC 241 (KT362102) with 99% identity; *Rhizoctonia* isolates SMN1-7 and VHN had 99% similarity to *R. oryzae* isolate VC241 (KT362102) and *R. oryzae* isolate VC51 (KT 362129), respectively. The pathogenicity of all *Rhizoctonia* isolates were tested *in vitro*, the result revealed that the isolates VSV1-2 of *R. oryzae* inoculated on rice sheath produced largest lesion average wound area of 303 mm² compared with isolate SMN1-5 of *R. solani* with average area of 191 mm². All 19 isolates were pathogenic to rice cultivar. This study indicates that the *R. solani* can invade the sheath and leaves of rice cultivar (Tadokham 8), However, *R. oryzae* only invades sheath.

Control of sheath blight was experimented in laboratory and green house. On dual culture test between *Trichoderma* spp. and *Rhizoctonia oryzae*, it was found that three (3) isolates, T8 and T13 *T. asperellum* and *T. koningii* 67 showed high percentage of inhibition against mycelium of pathogen, compared to others. The percentages of inhibition were 88%, 81%, and 81%, respectively. For *R. solani* the inhibition mycelia 41%, 37%, and 36%, respectively.

Result on mycoparasitism indicated that the hypha of *Trichoderma* spp. coiled pathogen hypha and leads to the death of the parasitized fungus. The result in green house trials demonstrated three (3) effective isolates of antagonists in suppression 2 isolates *R. oryzae* and *R. solani*. *T. asperellum* T18 and T13 were applied as the best method to control *R. oryzae* by foliar spray. The wound area lesion of sheath spot was 15 mm² and 25 mm², compared to control treatment and percent of disease suppression which were 92% and 87%, respectively. For *T. koningii* 67 was applied as the best method to control *R. oryzae* by root dip treatment. The wound area lesion of sheath spot was 24 mm² and percent of disease suppression was 87%. *T. asperellum* T18 was applied as the best method to control *R. solani* by soil treatment. The wound area lesion of sheath blight was 67 mm² and percent suppression of *R. solani* disease was 61%. *T. asperellum* T13 and *T. koningii* 67 were applied as the best method to control *R. solani* by soil treatment, root dip, and foliar spray. The wound area lesion of sheath blight was 70 mm² and 96 mm², compared to control treatment and percent of disease suppression which were 60% and 50%, respectively. Integrated control by using *Trichoderma* spp. and fungicides on *R. oryzae* showed that *T. asperellum* T18 with captan, *T. koningii* 67 with captan and *T. asperellum* T13 with mancozeb expressed percent disease suppression of 75%, 74% and 73%, respectively. Application of fungicides (captan and mancozeb) alone was not different to combination treatment with percent disease suppression which were 76% and 71%, respectively. Interestingly, integrated use between *Trichoderma* spp. and fungicides against *R. solani* resulted clearly that T13 with mancozeb, T18 with captan and T18 with mancozeb showed percent disease suppression of 75%, 71% and 71%, respectively. Whereas the application of fungicides (mancozeb and captan) alone obtained the percent disease suppression only 57% and 53%. This indicated that antagonist fungi *Trichoderma* spp. T13, T18 and 67 can be applied in combination with mancozeb and captan for control sheath diseases. However, field experiments are needed to confirm greenhouse experiment.