CURRENT STATUS OF AGRO-MICROBIAL GERMPLASM IN VIETNAM

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Abstract

The agro-microbial germplasm unit in Vietnam was established in 1994. The main activities are collecting, maintenance, isolation, evaluation, taxonomy, documentation and research on application ability of microorganisms in agriculture. 703 strains of bacteria, actinomyces, yeasts and filamentous fungi imported or isolated are collected and maintained by The agro-microbial germplasm unit. The different preservation methods has been used to maintain living ability and biological activity of microorganisms such as by slant agar, sterile distilled water, liquid paraffin, freeze-drying, methylcellulose, liquid nitrogen freezing. These strains has been collected from soils, root nodules or root samples and screened based on biological activities (nitrogen fixing, phosphorous solubilizing, silicate dissolving, cellulose degradation, plant growth promoting, tolerant to high temperature, salt tolerant, polysaccharide synthesis, anti-pathogenic bacteria, fungi and etc.). Bergey's taxonomy key, standard KIT, BIOLOG or sequence analysis of 16S/28S rRNA genes was used for taxonomy. The agro-microbial strains were documented, evaluated and utilized in agriculture. At present, 130 out of 703 strains have been introduced to research and production of microbial organic fertilizers and microbial inoculants.

Key words: Agriculture culture collection, maintenance, biological activity, microbial organic fertilizers, microbial inoculants.

INTRODUCTION

Microorganisms play an extremely important role in development strategies of biotechnology. They are basic materials for genetic engineering, microbial technology and fermentation technology. Maintenance of microorganisms has a great significance in any research Lab and microbial technology. The agro-microbial germplasm unit in Vietnam was established in 1994. This paper showed the current status of agro-microbial germplasm in Vietnam.

MATERIALS AND METHODS

Materials

- Microorganism strains: 703 trains including 622 bacteria, 48 actinomyces, 12 yeasts and 21 filamentous fungi.

- Media: YMA, Ashby, DAC, Gause, Pikovskaya, King B, SPA, PDA, czapech, Hansen, etc.

- Chemicals and equipment used in the research belonged to the Department of Microbiology, Soils and Fertilizers Research Institute.

Methods

- Maintenance of microorganisms: Preserving on slant agar, semi solid agar, methylcellulose, freezing (-20^{o}C), freeze-drying or liquid nitrogen based on TCVN 8741:2011; TCVN 9298:2012; TCVN 9299:2012.

- Isolation of microorganisms based on methods of Nguyen Lan Dung *et al.*, 1976.

- Evaluation of bioactivity of microorganisms followed by TCVN 6166:2002, TCVN 8564:2010, TCVN 6167:1996, TCVN 8565:2010, TCVN 10785:2015, TCVN 9300:2012, TCVN 8566:2010, TCVN 10784:2015, TCVN 6168:2002.

- Taxonomy of microorganisms: Bergey's taxonomy key based on Peter H.A. Sneath *et al*, 1989; standard KIT or BIOLOG; sequence analysis of 16S/18S rRNA genes and compared with sequenses of international gene bank EMBL by FASTA 33 method.

RESULTS AND DISCUSSION

Maintenance of microorganisms

703 strains including bacteria, yeasts and filamentous fungi were maintained in the agro-microbial germplasm unit belonging to the Soils and Fertilizers Research Institute. Among them, 604 strains were collected from Son La, Bac Can, Hoa Binh, Ha Noi, Hung Yen, Vinh Phuc, Thai Nguyen, Ninh Binh, Nam Dinh, Nghe An, Thanh Hoa, Quang Tri, Tay Nguyen etc., that have isolated from soil, nodule or root samples and 99 strains were imported from American, Australia, China, Germany, India, Russia, Scotland, Taipei, Thailand, etc.

Slant agar, semi solid agar, freezing (-20^{o}C), liquid nitrogen or freeze-drying were used to maintain different strains in short term, middle term or long term. The results was shown in table 1.

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Table 1. Method for maintenance of microorganism

Method for maintenance	Quantity	Genus
Slant agar	703	*Agrobacterium, Athrobacter, Azotobacter, Azospirillum, Bacillus, Bradyrhizobium, Enterobacter, Lactobacterium, Pseudomonas, Rhizobium, Streptomyces, Candida, Pichia, Rhodotorula, Saccharomyces, Aspergillus, Chetomium, Fusarium, Penicilium, Rhizoctonia, etc.*
Semi solid agar	22	*Azospirillum*
Freezing (-20°C)	226	*Azospirillum, Azotobacter, Bacillus, Lactobacterium, Pseudomonas, Streptomyces,*
Liquid nitrogen	43	*Azotobacter, Azospirillum, Bacillus, Bradyrhizobium, Lactobacterium, Pseudomonas, Streptomyces*
Freeze-drying	12	*Azospirillum, Azotobacter, Bacillus, Bradyrhizobium, Salmonella*

Isolation and evaluation of microorganisms

Microbial isolations were screened based on biological activities (nitrogen fixing, phosphorous solubilizing, silicate dissolving, cellulose degradation, plant growth promoting, polysaccharide synthesis, tolerant to salt, tolerant to low pH, tolerant to high temperature, anti-pathogenic bacteria-fungi, etc.). The results are shown in table 2.

Table 2. Quantity of microorganisms isolated and imported

Genus	Origin	Quantity	Bioactivity
Bacteria: *Agrobacterium, Athrobacter, Azospirillum, Azotobacter, Bacillus, Bradyrhizobium*, *Enterobacter, Lactobacterium, Pseudomonas, Rhizobium, Paenibacillus, ...*	Isolated Imported	532 90	Nitrogen fixing, phosphorous solubilizing, silicate dissolving, cellulose degradation, plant growth promoting, anti pathogenic bacteria - fungi, polysaccharide synthesis, tolerant to salt, tolerant to low pH, tolerant to high temperature, produce lactic acid, ...
Actinomyces: Streptomyces	Isolated Imported	47 1	Phosphorous solubilizing, cellulose degradation, anti pathogenic bacteria - fungi, ...
Yeast: *Candida, Lipomyces, Pichia, Rhodotorula, Saccharomyces*	Isolated Imported	10 2	Fermentation, produce carotenoit, anti pathogenic bacteria - fungi, ...
Filamentous fungi: *Aspergilus, Chetomium, Fusarium, Penicium, Penicilium, Rhizoctonia, Trichoderma, ...*	Isolated Imported	15 6	Phosphorous solubilizing, cellulose degradation, anti pathogenic bacteria - fungi, ...
Total		*703*	

The results from table 2 showed that the quantity of strains at the agro-microbial germplasm unit is small in comparison with the world's culture collection. Therefore, isolation and selection of microorganisms should be continued.

Aiming to supply user with essential information, isolated strains have been evaluated on the characteristics and the biological activity, especially, their multi-functional activity. The results are shown in table 3.

The results from table 3 showed that a lot of strains of Vietnam agro-microbial collection had the multi-functional activity. This is an importance in exploitation and utilization of microorganisms.

Taxonomy of microorganisms

The taxonomy is necessary for documentation as well as for utilization. However, It need a lot of expense and time-consuming. Bergey's taxonomy key or standard KIT or BIOLOG or sequence analysis of 16S/18S rRNA genes was used for taxonomy (Table 4).

Exploitation and utilization of microorganisms

Now, 130 trains have been introduced to research, training, production of biofertilizers and microbial inoculants. Those microbial isolations have great value for production of microbial fertilizers or microbial inoculants are shown in table 5.

Table 3. Quantity of microorganisms evaluated the bioactivity

Bioactivity	Bacteria	Actinomyces	Yeast	Filamentous fungi
Nitrogen fixing	390			
Phosphorous solubilizing	16			3
Cellulose degradation	15	48		8
Silicate dissolving	7			
Protein/lipid solubilizing	3			
Plant growth promoting	100			
Anti pathogenic bacteria - fungi	90	5	4	8
Fermentation			4	
Polysaccharide synthesis	17		2	

Table 4. Taxonomy of microorganisms

Method for taxonomy	Quantity
Bergey's taxonomy key	472
Standard KIT (API 20E, API 20NE, API 50CH)	4
BIOLOG	10
Sequence analysis of 16S/18S rRNA genes	84

Table 5. Quantity and purpose for using of microorganisms

Purpose for using	Quantity
Produce of biofertilizers and microbial inoculants	40
Treatment of agricultural waste	18
Biocontrol	20
Standard strain	20
Trainning	32
Total	*130*

CONCLUSION AND RECOMMENDATION

Conclusion

703 strains including bacteria, yeasts and filamentous fungi have been maintained at the agro-microbial germplasm unit in Vietnam agricultural culture collection of Soils and Fertilizers Research Institute. Slant agar, semi solid agar, freezing (-20^{o}C), liquid nitrogen or freeze-drying have been used to maintain the existent capacity and biological activity of microorganisms. Cultures have been screened based on biological activity. Bergey's taxonomy key, standard KIT, BIOLOG or sequence analysis of 16S/28S rRNA genes was used for taxonomy.

Cultures have been documented, researched, evaluated and utilized in agriculture. At present, 130 strains have been introduced to research, training and produce of biofertilizers and microbial inoculants.

Recommendation

Continue to maintain and to enhance the exploitation of valuable microbial genetic resources in agriculture.

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BIO-EFFICACY PERFORMANCE OF DUPONT(TM) PREVATHON® 5 SC ON CONTROLLING SUGARCANE BORERS IN THE SOUTH EAST OF VIETNAM

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Abstract

DuPont(TM) Prevathon® 5 SC with the active ingredient *Chlorantraniliprole* was able to control sugarcane borers and provided long residue up to harvest. The best effective use rate from both technical and economic perspectives was drenching into the sugarcane rows 1.5 kg/ha. In addition to the lethal impact on young instars of sugarcane borers, this product indirectly helps the leaves greener, better crop vigor and growth. DuPont(TM) Prevathon® 5 SC was also safe for the population of natural enemies for sugarcane borers.

Keywords: DuPont(TM) Prevathon® 5 SC, *Chlorantraniliprole*, sugarcane, sugarcane borers, insecticides.

INTRODUCTION

The total sugarcane growing area of Vietnam was 309.400 ha and the average yield was about 64.7 tons/ha in 10.5 CCS in crop season of 2013 - 2014. This supplied 20.0 million tons of raw sugarcane to 41 mills throughout the country. In comparison with regional and global average yield, sugarcane in Vietnam had lower yield than that in Thailand with 77.3 tons/ha, and little higher than global average yield of 70.2 tons/ha (MARD, 7/2014). One of the critical reasons leading to low yield and quality is the damage of sugarcane pests, particularly borers. Annually, the damage caused by these insect pests approximately accounts for 20 - 40% yield loss (Do Ngoc Diep, 2005; Nguyen Duc Quang *et. al.*, 2011). These days, the insecticides use for controlling sugarcane borers has long been known, however, search for appropriate products in terms of good efficacy, safety for environment and natural enemies is not easy and turns to be a critical need. Recently, in the insecticides market, DuPont(TM) Prevathon® 5 SC consists of *Chlorantraniliprole*, has high efficacy on chewing insects, short pre-harvest interval, friendly for environment and helpful insects. This active ingredient owns a novel mode of action in which to be a potent activator of insect ryanodine receptors. It causes internal store depletion and leads to insect paralysis and death. In order to evaluate the efficacy of DuPont(TM) Prevathon® 5 SC on sugarcane borers including dose optimization, appropriate application methods, we conduct a trial in Tay Ninh where sugarcane is considered one of the most important crops.

MATERIALS AND METHODS

Materials

- The trial consisted of 5 treatments with insecticides and 1 untreated check:

+ Treatment 1: Prevathon® 5 SC, at 1.0 kg/ha, foliar application;

+ Treatment 2: Prevathon® 5 SC at 1.5 kg/ha, foliar application;

+ Treatment 3: Prevathon® 5 SC at 1.0 kg/ha, soil drenching;

+ Treatment 4: Prevathon® 5 SC at 1.5 kg/ha, soil drenching;

+ Treatment 5: Furadan 3 G at 30.0 kg/ha, broadcast;

+ Treatment 6: Untreated check.

Methods

The method used in the study was followed by QCVN 01-38:2010/BNNPTNT "National technical regulation on Surveillance method of plant pests" (PPD, 2010) and NIPP (1997):

Trial layout: RCBD, 3 replications.

Plot area: 33.6 m^2 (4 row with 7 m length, row to row 1.2 m).

Date of application: 06th November 2014 (90 days after transplanting),

Date of harvest: 15th Jul 2015.

Water volume: 450 L/ha for foliar application; 1.000 L/ha for soil drenching.

Sugarcane variety: VN84-4137, ratoon first season.

- Location: Material zone of Nuoc Trong Sugar JSC Company in Tan Hoi commune, Tan Chau district, Tay Ninh province.

Data collection:

+ Collect data only from 0.3 m on 2 middle rows of each plot.

+ Date of data collection: before application, 15, 30, 45, 60, 90, 120 and 180 days after application and before harvest.

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