

Multiple insecticide tolerant strain of an egg parasitoid, *Trichogramma chilonis*

Technology description:

Trichogramma chilonis, is an egg parasitoid of lepidopteran pests in many crops. *T. chilonis*, (strain- MITS) is tolerant to multiple insecticides (organo-chlorine, organo-phosphate, pyrethroids, oxadiazine spinosyn and IGR) with a high resistance factor up to 76.5. No such parasitoid is currently available in the country. The existing *T. chilonis* culture are not effective in fields with insecticide applications, whereas multiple insecticide tolerant strain of *T. chilonis* parasitize harmful insect's eggs to the tune of about 60 % compared to <5% by other strains in sprayed condition. However, at normal condition, i.e., under unsprayed both behave in similar way. This strain can be used in all vegetable crops particularly brinjal, tomato and others @ 50,000/ha/release.

Economic analysis:

MITS of *Trichogramma chilonis* tested in 400 acres during 2013 and 2014 showed that number of sprays brought down from ten to three in brinjal & tomato.

Direct savings by farmers = Rs. 4400/acre, therefore savings for 400 acres = Rs.17.60 lakh



High temperature tolerant strain of egg parasitoid *Trichogramma chilonis*

Technology description:

Trichogramma chilonis, strain, HTTS, developed at NBAII, is tolerant also to high temperature (32-40°C). Therefore it can be used efficiently by farmers in higher temperature regions. Once emerged, these parasitoids would parasitize eggs of most lepidopteran pests, such as sugarcane borers, cotton bollworms, corn borers, rice stem borer, leaf folder and many others.

Benefits /Utility:

High temperature tolerant strain of *T. chilonis* can be used in high temperature and drought affected fields.

Field release:

Cut each Tricho cards into 16 pieces. For one ha, 3 cards are required. Place 48 pieces uniformly spaced on lower side of leaf or on leaf whorl.



Pesticide tolerant strain of aphid lion *Chrysoperla zastrowi sillemi*, an important predator of sucking pests

Technology description:

The common green lacewing, *Chrysoperla zastrowi sillemi* is an important biological control agent of sucking pests in different agroecosystems. A strain of *C. zastrowi sillemi* (PTS-8) with tolerance to different groups of pesticides has been developed. PTS-8 recorded highest resistant factor (RF) for acephate (6.3), fenvalerate (7.6) and endosulfan (2.1). Biochemical assays revealed that the PTS-8 has got higher detoxifying enzymes as compared to susceptible population. Biocontrol potential of PTS-8 strain is better than the susceptible strain under pesticide stressed condition.

Benefits /Utility:

No such strain is currently available in the country. The existing strains are not effective in insecticide affected fields, whereas pesticide tolerant *Chrysoperla* feed on insect pests under pesticide and high temperature stressed cropping systems. The strain can be used against sucking pests and other lepidopteran pests on cotton, vegetables and other crops.

Field release:

Two releases @ 14,000/larvae/ha for each release is recommended at an interval of 15-20 days. This has also brought down the number of sprays.

Bio-formulation of salinity tolerant isolate of *Trichoderma harzianum* for biological management of plant diseases

Technology Description:

It is a bioformulation of a fungal antagonist *Trichoderma harzianum* which has salinity tolerance (up to 2M NaCl). It has good biocontrol potential against soil borne pathogens that has been verified by pot and field experiments with groundnut and sorghum. There is no salinity tolerant formulation of *Trichoderma* available in the market.

Benefit/utility:

This bio-formulation of salinity tolerant isolates of *Trichoderma* with biocontrol potential is applicable to the crops grown in sodic soil, and it not only helps in disease control but also induces salinity tolerance to crop plants with increased seed germination and growth.

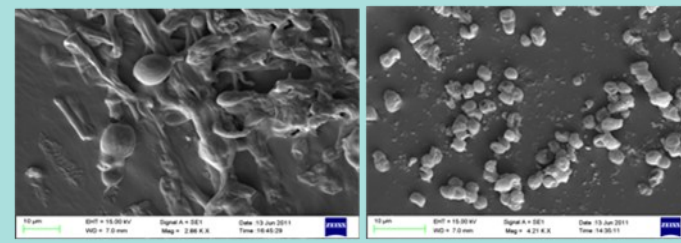
Bio-formulation of carbendazim tolerant isolate of *Trichoderma harzianum* for biological management of plant diseases

Technology Description:

It is a bio-formulation of a fungal antagonist *Trichoderma harzianum*. The formulation has the carbendazim-tolerant isolate of *T. harzianum*. The carbendazim-tolerance is up to 500 ppm. It has good biocontrol potential against soil borne pathogens that has been verified by pot and field experiments with groundnut and sorghum

Benefits/ utility:

This bio-formulation of carbendazim tolerant isolate of *T. harzianum* with biocontrol potential is applicable to different crops. Combined effectiveness of carbendazim-tolerant *Trichoderma* along with carbendazim will be effective against different soil pathogens.



Powder based formulation of *Pseudomonas fluorescens*, a DAPG producing abiotic stress tolerant bacterial isolate for rainfed and stressed agricultural soils

Technology Description:

The bioformulation is developed with an efficient abiotic stress tolerant. Bacterium which survives in high temperature (50 °C), salinity (1.5M NaCl) and drought conditions (up to -10.28 Mpa). The isolate produces plant growth promoting enzymes like phosphatase, proteases, chitinase, cellulase and ACC deaminase. It also produces DAPG. The isolate effectively inhibited *Sclerotium rolfii*, *Rhizoctonia solani* and *Fusarium oxysporum*.

Benefits /Utility:

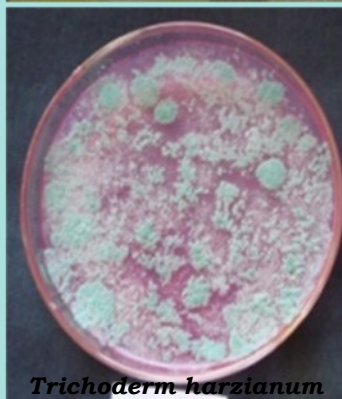
P. fluorescens is a well known PGPR. *Pseudomonas fluorescens* (NBAIL PFDWD) is proved to be a plant growth promoter additionally having abiotic stress tolerance. The formulations of this isolate can be used in disease management of pulses, rice, legumes and vegetables grown in rainfed and stressed soils.



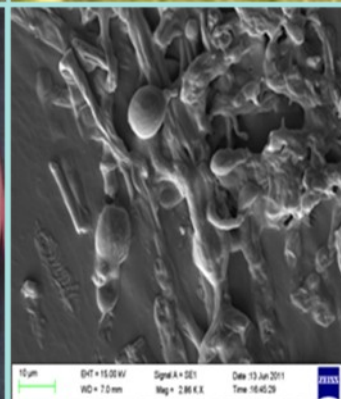
Trichogramma chilonis



Chrysoperla zastrowi sillemi



Trichoderma harzianum



10 µm DHT = 15.00 kV Signal = SE1 Date = 13 Jun 2011 WD = 7.0 mm Mag = 2.00 kX Time = 16:45:29



Biological Control of Pests of Tomato, Brinjal, Cotton, Sugarcane and Rice using Stress Tolerant Natural Enemies

Technologies developed under the following NAIP-ICAR Project

Effect of abiotic stress of natural enemies of crop pests *Trichogramma*, *Chrysoperla*, *Trichoderma*, *Pseudomonas* and mechanism of tolerance to these stresses

ALL THESE PRODUCTS CAN BE USED IN ORGANIC FARMING. THESE ARE ALSO AVAILABLE FOR COMMERCIAL PRODUCTION



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