AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 02, Issue: 12 (December, 2025)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Development of Biopesticides from Indigenous Microorganisms for Local Horticultural Systems

*Piyush Choudhary
RNT College of Agriculture, Kapasan (MPUAT, Udaipur), Rajasthan, India
*Corresponding Author's email: pc952165@gmail.com

Horticultural crops such as fruits, vegetables, flowers, and spices play a major role in the agricultural economy. However, these crops face continuous threats from insect pests, fungal diseases, bacterial infections, and viral pathogens. Over-reliance on chemical pesticides has led to several problems, including environmental pollution, soil degradation, health hazards, residue accumulation, and the development of pesticide resistance in pests. To address these challenges, the development of biopesticides derived from indigenous microorganisms has emerged as a sustainable, eco-friendly, and cost-effective alternative. Indigenous microorganisms (IMOs) are naturally adapted to the local climate, soil, and cropping systems, making them highly effective for local horticultural ecosystems.

Indigenous Microorganisms and Their Relevance

Indigenous microorganisms are native microbial communities found in soil, leaf surfaces, compost, plant roots, and natural habitats. These include beneficial bacteria, fungi, actinomycetes, yeasts, and even certain viruses that can act as biological control agents.

Why indigenous microorganisms are important:

- They are **well adapted** to the local environment.
- They show **high compatibility** with local horticultural crops.
- They survive longer due to natural adaptability.
- They reduce dependency on synthetic pesticides.
- They promote ecological balance and soil health.

These characteristics make IMOs suitable candidates for developing **locally efficient biopesticides**.

Types of Indigenous Microorganisms Used for Biopesticide Development

1. **Beneficial Bacteria**
- *Pseudomonas fluorescens*, *Bacillus subtilis*, *Bacillus thuringiensis*
- These bacteria produce antibiotics, enzymes, and toxins harmful to pathogens and insect larvae.
- They help in controlling soil-borne diseases like wilt, damping-off, and root rot.

2. **Beneficial Fungi**
- *Trichoderma harzianum*, *Beauveria bassiana*, *Metarhizium anisopliae*
- Fungal biopesticides are effective against insect pests and fungal pathogens.
- Trichoderma acts as a mycoparasite and protects plants from fungal infection.

3. **Entomopathogenic Viruses**
- NPV (Nuclear Polyhedrosis Virus) for *Helicoverpa* and *Spodoptera* control
- These viruses infect and kill insect larvae specifically, without harming humans or beneficial insects.

4. **Actinomycetes**
- *Streptomyces* species
- Produce antimicrobial compounds that help in disease suppression.

5. **Yeasts**
- Certain yeast strains inhibit post-harvest pathogens and improve fruit shelf life.

Steps in Developing Biopesticides from Indigenous Microorganisms

1. Isolation of Microorganisms

Samples are collected from local soils, compost pits, plant rhizosphere, or leaf surfaces. Indigenous microbes are isolated using culture plates and selective media.

2. Screening for Antagonistic Activity

Each isolated microbe is tested in laboratory conditions against major pathogens and insect pests common in local horticultural crops. Only the most effective strains are selected.

3. Mass Multiplication

Selected microbial strains are multiplied in large quantities using suitable substrates such as molasses, rice bran, jaggery solution, or cereal media.

4. Formulation Development

The microorganisms are converted into stable formulations like:
- Wettable powder (WP)
- Liquid suspension (LS)
- Granules (GR)
- Tablets or concentrated solutions

These formulations increase shelf life and make application easier.

5. Field Testing

Trials are conducted in farmer fields to evaluate the effectiveness of the biopesticide under local climatic and soil conditions.

6. Quality Control and Standardization

Parameters like microbial population count, shelf life, moisture content, and contamination level are monitored to ensure consistency.

Applications in Local Horticultural Systems

Indigenous biopesticides can be used in multiple ways:

1. **Seed Treatment**
- Trichoderma or Pseudomonas coating to protect against seed- and soil-borne diseases.
2. **Soil Application**
- Granular or liquid formulations mixed with compost and applied near the root zone.
3. **Foliar Spray**
- Bacillus or fungal spores sprayed on leaves to control foliar diseases like leaf spots, blights, and mildews.
4. **Post-harvest Protection**
- Yeast-based biopesticides used on fruits to reduce spoilage.
5. **Integrated Pest Management (IPM)**
- Indigenous biopesticides can be combined with botanical extracts, cultural practices, and resistant varieties for effective crop protection.

Benefits of Using Indigenous Microorganism-Based Biopesticides

- **Eco-friendly and sustainable**
- **Safe for humans, animals, and beneficial insects**
- **Cost-effective** for small and marginal farmers
- Reduces **chemical pesticide residues** in produce
- Improves **soil fertility, microbial activity, and nutrient cycling**
- Reduces pest resistance development
- Enhances crop yield and quality over long-term use

Challenges and Future Opportunities

Challenges:
- Shorter shelf life of some microbial formulations

- Lack of awareness among farmers
- Need for improved storage and transport conditions
- Variability in performance due to environmental factors

Future Scope:

- Development of **multi-strain blended biopesticides**
- Use of nano-carriers for improved delivery
- Expansion of microbial biofactories for mass production
- Integration with AI- and GIS-based pest monitoring
- Strengthening policies to promote indigenous biopesticides at community level