outbursts

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spotlight on integrated pest management

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# Working the bugs out for farmers worldwide

## *Virginia Tech entomologist uses his passion for bugs to save farmers in the developing world*

*By Kelly Izlar*

As a child, Rangaswamy "Muni" Muniappan loved collecting beetles – especially jewel beetles. True to their name, jewel beetles are big and brightly colored with glossy, iridescent bodies. They scuttle around the underbrush and bore through dying or dead tree branches. Once, when the budding scientist was on the hunt for beetles, he thought he saw one flash in the tangled trunks of a banyan tree near his home outside of Coimbatore, India.

He reached in to snatch it before it could scurry off and found that, instead of a treasure, he was clutching an angry bombardier beetle. Bombardier beetles are known to "bomb" their foes by spewing a hot, acrid fluid from glands in their abdomen. Muniappan lobbed it back, but he wasn't fast enough – he got a face-full of stinging beetle juice. It was extremely painful. The splatter marks on his cheeks and forehead almost immediately turned white. In the days that followed, they grayed out and finally blackened into blotches of burnt skin.

You might think this would be a scarring experience for a child or that this would spoil all the beetle-fun and cause him to swear off insects forever. But in this case, you would be wrong.

Muniappan went on to become a world renowned entomologist, specializing in biological control and integrated pest management research.

When asked about the bombardier beetle incident, he shrugged.

"Well, I learned which ones not to touch."

After earning a master's degree in agricultural entomology from the University of Madras and a Ph.D. in entomology from Oklahoma State University, Muniappan spent 20 years as the associate director of the Agricultural Experiment Station at the University of Guam. During this time, he traveled the world meeting entomologists, plant pathologists, virologists, and other researchers who study the subtle, complicated relationship between insects and their environment. Among other things, Muniappan researched how to control insect pests and diseases using natural mechanisms like pheromones, parasitoids, and other insects.

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*Muni Muniappan displays the underside of a bitter gourd leaf – a popular vegetable in south Asia – that has been attacked by whitefly. This destructive pest attacks the underside of leaves, secreting a "honeydew," giving rise to a white, sticky mold.*

*Bombardier beetle*

**INSIDE: Virginia Tech researcher saves the livelihoods of farmers in Asia**

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## Bugs *continued*

In 2006, Muniappan accepted the position of director and principal investigator for the Integrated Pest Management Innovation Lab at Virginia Tech.

### Human-friendly solutions to human-made problems

Approaches to improving the world tend to fall into one of two categories: helping people or helping the environment. The Integrated Pest Management Innovation Lab aims to do both simultaneously. Funded by the U.S. Agency for International Development, the program improves the livelihoods of farmers in developing countries by working with local scientists to find the best solutions to pest problems. It's not easy for farmers in these places. Aside from the usual struggles they contend with -- soil quality, water, changing markets, rising farm costs – they must fight unfamiliar pests and diseases.

Why unfamiliar? First, climate change has affected ecosystems in unexpected ways causing unanticipated and costly challenges. Second, transportation has advanced so rapidly over the past century that an individual can travel from Mexico to India (more than 9,000 miles) in 20 hours. And while insects cannot book a flight, they are frequent stowaways on exported crops and ornamental plants.

The papaya mealybug did just that. In its home country of Mexico, it had evolved alongside natural predators that kept its population in check. But in the late 1990s, it hitched a ride with a plant smuggler and made its way to Asia. Papaya is an important commercial crop in many Asian countries and a regular part of the daily diet, especially in India. The papaya mealybug quickly gained a foothold in the region, and without the policing of natural predators, it promptly feasted on the tasty, orange fruit.

In a panic, farmers hosed their crops with pesticides, which not only knocked the ecosystem out of whack, but also was toxic for those who lived and worked in the area. It was no use; the next yield loss was even larger, and the mealybug was moving into other crops.

But before the damage was irreparable, Muniappan launched a natural control program. He identified the voracious little bug, and by tracing its route backward, was able to identify the natural predators that had kept the mealybug on a leash: parasitic wasps from Mexico. The wasp lays its eggs inside the mealybug larvae, and when the eggs hatch, the young wasps eat the larvae.

Muniappan connected local authorities with the right channels to import the wasps so they could be carefully released. Experts estimate that the Integrated Pest Management Innovation Lab's counterattack saved up to $309 million the first year and will save more than $1 billion over five years, while saving the environment by minimizing pesticide use.

This is just one of many creative answers to serious agricultural problems that have been pioneered by the Integrated Pest Management Innovation Lab with Muniappan at the helm. And while he makes it clear that the program didn't invent most of the techniques, he is proud of the way it has been able to deliver and apply the information.

"We're getting the technology to the people who need it most," said Muniappan. "We reduce pesticide use, which makes for a safer environment. We can increase food production and improve health. We are making a difference in the lives of poor people in developing countries."

*The Papaya mealybug (Paracoccus marginatus) is a pest insect that was introduced into India from Mexico and Central America. The introduction of this species has caused damage to papaya cultivation in South India.*

# Saving the livelihoods of thousands of farmers in Asia

*A papaya leaf shows mealybug infestation.*

When Muniappan discovered sticky residue on a papaya leaf in Indonesia in the spring of 2008, he had no idea this would lead him on a mission that would result in saving the livelihoods of thousands of farmers in Asia. Yet this is exactly what happened.

Muniappan had been carrying out a survey on the island of Java when he found a papaya tree infested with the papaya mealybug at the Bogor Botanical Gardens. He placed the insects he believed responsible for the destruction into tiny alcohol-filled vials he carried. Back in the U.S., he obtained confirmation: The insect in question was, as he suspected, the papaya mealybug, or Paracoccus marginatus.

Several months after his Indonesia finding, Muniappan confirmed the presence of the nefarious insect in South India as well.

The significance of these discoveries was not lost on this internationally sought-after pest expert. If an infestation of papaya mealybug were left unchecked, it could destroy thousands of acres of papaya orchards and spread to other tropical countries throughout Asia. Many people would lose their livelihoods. In South and Southeast Asia, papaya is grown not only for local consumption, but also for commercial export to Europe and the United States.

*Muniappan checks okra plants in a field in India for pests and diseases.*

While papaya is an exotic fruit for us in the northern hemisphere, it is one that many of us use unknowingly in a variety of ways every day. Papain, a product of papaya, is used in the production of chewing gum and shampoo, toothpaste and tooth whiteners, as a meat tenderizer, and in the brewing and textile industries.

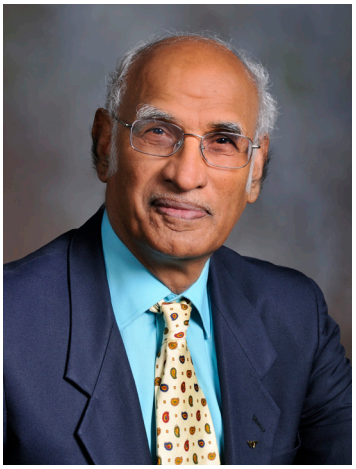
And even though the pest is called the papaya mealybug, it feeds on other plants as well, including cassava, beans, eggplant, melons, hibiscus, plumeria, pepper, sweet potato, tomato, citrus, mangoes, and mulberries — a key component in the silk industry, vital to India's economy.

Muniappan advised scientists to contact government authorities in both Indonesia and India. The wheels of government turn slowly, so it wasn't until August of 2010 that local extension agents released the parasitic wasps in southern India. Six months later, the tactic had proven so successful that farmers in the south of India held a celebration in the town of Sathyamangalam, in the foothills of the Western Ghats. A big tent was pitched in a cleared field, hundreds of farmers and government officials came, speeches were given, and the event was covered by Indian news media. Muniappan gave a talk as well, about the origins, spread and control of papaya mealybug around the world.

The event was satisfying for two reasons, according to Muniappan. "They recognized the contribution of our program in controlling the papaya mealybug in India," he said. "And it was rewarding to know that we had helped a country conquer a devastating scourge."


*Muniappan briefs reporters in Tiruchchirappalli, India, on the importance of integrated pest management techniques at an educational field day event.*

# Making an impact



Rangaswamy "Muni" Muniappan is an entomologist who has specialized in biological control and integrated pest management research in the tropics for more than 35 years. His experience focuses on the biological control of invasive weeds such as Chromolaena odorata, Lantana camara, Coccinia grandis, and Mimosa diplotricha. He also specializes in insect pests of tropical fruit and vegetable crops such as mealybugs, scale insects, whiteflies, caterpillars, and weevils.

Muniappan worked as the associate director of the Guam Agricultural Experiment Station for 20 years. He also served as a consultant for the Food and Agricultural Organization, the Secretariat of the Pacific Community, GTZ, and the Australian Centre for International Agricultural Research.

As the program director for IPM Innovation Lab, Muniappan works with the U.S. Agency for International Development (USAID) and project partner institutions in the United States and developing countries in Asia, Africa, Eastern Europe, the Caribbean and Latin America. In addition to his duties with OIRED, he currently serves as chairman of the global working group on Chromolaena for the International Organization for Biological Control.

A recognized expert, Muniappan has published more than 200 research and extension articles.

# On a mission...

***To raise the standard of living while creating sustainable development***


*Outside of Addis Ababa, Ethiopia, Muniappan confers with an Ethiopian entomologist, one of many scientists from around the world who came to learn about the invasive tomato leaf miner, Tuta absoluta. Left uncontrolled, this destructive moth, no bigger than an eyelash, could wipe out a large portion of the world's most important crops and push tomato prices to all-time highs.*

***"We are making a difference in the lives of people in developing countries."***

*- Muni Muniappan*

## Learn More...

- **Integrated Pest Management website: http://www.oired.vt.edu/ipmcrsp/**
- **Combating the tomato leafminer: http://tinyurl.com/TutaAbsoluta**
- **Muni Muniappan Profile: http://tinyurl.com/oiredMuni**

**Integrated Pest Management**, or IPM, is a systems approach to reducing damage caused by pests to an acceptable level without harming the environment. IPM includes the adoption of pest-resistant varieties of crops; biological and physical control methods; environmental modification; biopesticides; and when absolutely necessary, nonresidual, environmentally friendly, and low mammalian-toxic chemical pesticides.

IPM is needed in all areas of the developing world. Pests – insects, diseases, weeds, vertebrates – respect no borders and spread through plant and animal migration, wind, and water. Human activity, including trade in plant and animal products, also contributes to this expansion.

By addressing IPM, researchers have found that they touch a whole spectrum of development issues. IPM is, in fact, such a powerful tool that it allows for:

- reducing pesticide use
- reducing crop loss
- reducing damage to natural ecosystems
- reducing the loss of biodiversity
- increasing farmer income
- increasing the involvement of women in decision-making
- making export crops more attractive
- improving research and education capabilities

www.outreach.vt.edu

For information on the Integrated Pest Management program, contact:
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