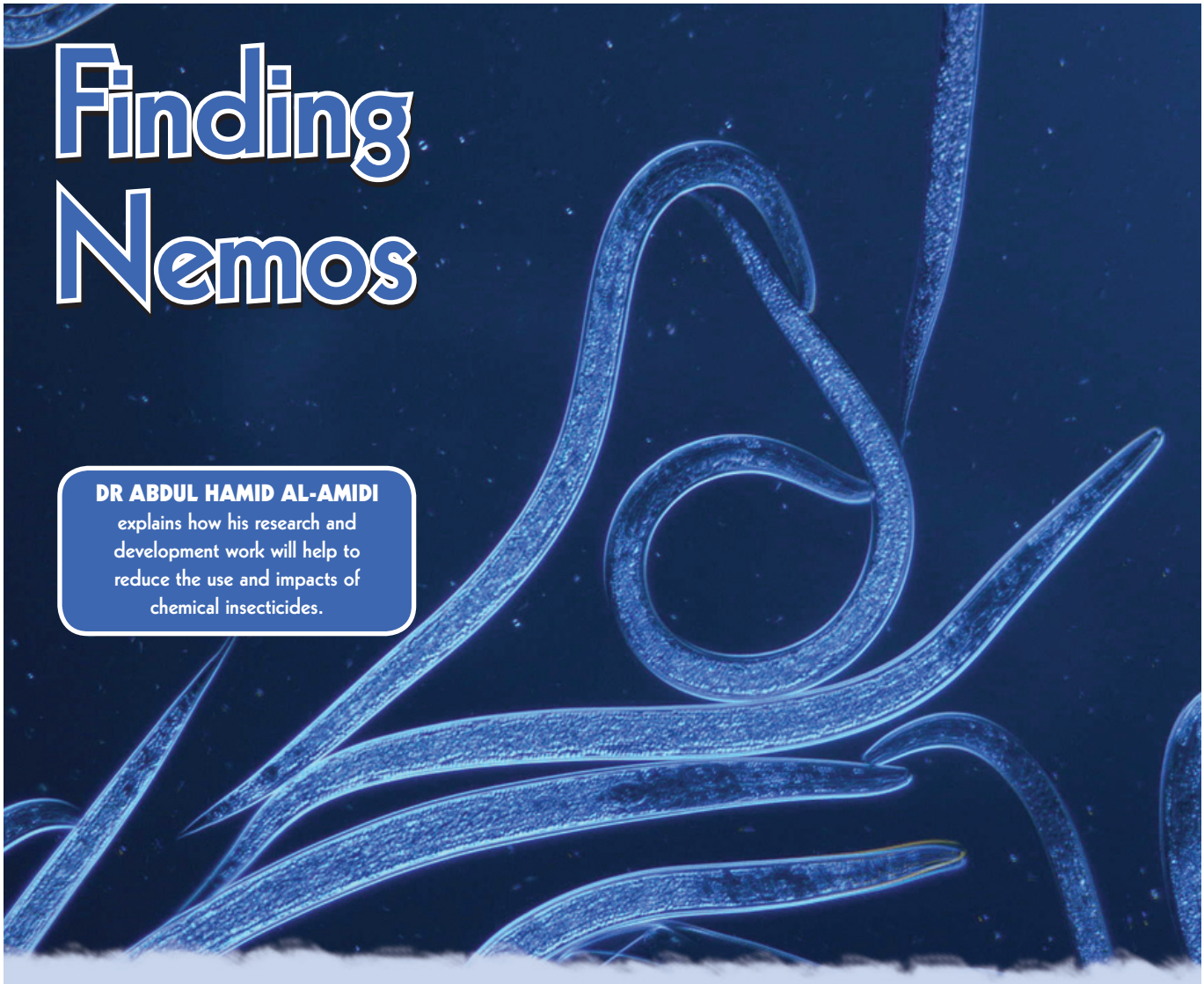
Finding Nemos



DR ABDUL HAMID AL-AMIDI explains how his research and development work will help to reduce the use and impacts of chemical insecticides.

There is an increased concern about pesticide safety and environmental quality worldwide. There is also an increasing consumer demand in Ireland to reduce the use of chemical pesticides in food production and to improve food safety standards and to ensure that maximum residue of chemical pesticides levels in fruit and vegetable do not exceed the EU and Irish standards.

For many years scientists have studied the effects of chemical pesticides on wildlife and man, and most of their findings point to a minefield: The overuse and misuse of chemical pesticides has led to the poisoning of our seas and rivers, killing our fish, polluting our drinking water; it has also damaged our soil and made it unsuitable for our plants to grow. All of course resulting in the poisoning of our human bodies through a bio-accumulation process, as some of the chemical pesticides get into our food chain. An example of chemical side effects is Dinoseb (Nitrophenolic Herbicide), which can cause birth defects, sterility, cancer, damage to the immune system, and adverse ecological effects. Other examples like DDT, Aldrin, and Aieldrin cause major damaged to wildlife and to humans alike. Although these chemical were banned in Europe and in the USA, they are still in use in most developing countries. The irony is that most of these countries export their fruit and vegetable - with such dangerous chemical residue - back to Europe and to the USA. Such imports include bananas, coffee and many other fruit and vegetables! These are but a few examples of many. Unfortunately, we do not yet know the extent of possible side effects of most chemical pesticide used in our food production. The full impact on human and wildlife may only become known in years to come. The overuse of chemical pesticides has also led to a phenomenon where the majority of insect pests have developed a resistance to most chemical pesticides. Unfortunately, the beneficial insects in our gardens and farms have been endowed with little resistance. And we have to keep in mind that 99% of all insects cannot be considered as pests. Only 1% of insects do damage to our food production!

As a consequence, we are killing most beneficial insects and keeping the bad ones. This sets a new challenge to gardeners, farmers and scientists: How to control our harmful pests without using chemical pesticides? One possibility is the use of biological control agents. Biological control agents that are used for pest control in the horticultural and agricultural sectors have shown great potential. Of the agents currently in use, nematodes, or more specifically, beneficial nematodes, offer the most wide-ranging opportunities. But like all bio-control agents, the use of nematodes has both advantages and disadvantages:

THE ADVANTAGES

Beneficial nematodes are tiny round worms (microscopic) and lethal to more than 250 insect pest species, yet are safe for animals and plants. Unlike chemicals, or even some biological control agent such as Bacillus thuringiensis, nematode applications do not require masks or other safety equipment. They do not leave any residues and do not pollute underground water or rivers. Most biological control agents may require days or weeks to kill the insect pest. However once nematodes penetrate the target pest, they kill it, in just 24 to 48 hours. Field studies shows that, these nematodes do not attack non-targets such as bees, bumblebees, earthworms and other beneficial creatures. Nematodes

do not require specialised application equipment as they are compatible with standard agrochemical equipment including pressurised mist and aerial sprayers. Application via irrigation systems has encouraged commercial growers' to favour using nematodes.

THE DISADVANTAGES

One of the major disadvantages of the current use of beneficial nematode products is economic viability. Traditionally the beneficial nematodes sold in the market, as a mean of bio-insecticidal control, contain only a single nematode species, and are only able to target a single pest, or one group of insect pest. As a result, where a multitude of insect pests attack plants, beneficial nematodes have generally not been viewed as economically viable: While a chemical pesticide may control a wide range of insect species (both beneficial and non-beneficial) in just one application, the traditional nematode products will require several applications of several different species, resulting in additional products and labour costs.

Furthermore, commercial growers will not adopt biological control agents which do not provide efficacy comparable with standard chemical insecticides.

DEVELOPING MIXED SPECIES APPLICATIONS

Many scientists and nematodes producers have tried to use mixed beneficial nematodes species with different foraging strategies: ambusher attacking insect pests on the top of the soil and cruisers deep in the soil. Prior to 2006, none of the attempted mixed species yielded a better control than the original, single nematodes species.

Enter **SuperNemos.** In the research and development of SuperNemos, I experimented with several combinations to find a way to improve the performance of the beneficial nematodes. Most single nematode species only perform between 40-60% when applied to the soil. In 2006, my research efforts provided a surprising coherent of different beneficial nematodes species, which were made to compete with each other and to aggressively seek different insect pests species in just one application. Several tests were prepared using a variety of pot plants, deliberately infected with different insect pest species. With the assistance of Orla and Paul Woods of Kilmurry Nursery, further trials in polythene tunnels gave astonishing results. Orla and Paul have been monitoring the invention since 2007, and have described the protection against all typical soil born insect pest larvae including vine weevil and sciarid fly as "outstanding".

Further assistance was provided by Pat FitzGerald of FitzGerald Nurseries, who, for many years, had used a non-chemical approach for the control of pest occurrences. Pat kindly provided full access to his nursery and micro-propagation laboratory facilities, where his staff also assisted in the trial preparation. Seven separate pot plant trials were undertaken to compare the SuperNemos assortment with a single species application of beneficial nematodes. The results were extremely promising: SuperNemos gave a reduction in pest levels between 70% to 86% compared to the usual standard of 40% to 52% for the single species application (under the nursery conditions).

THE FIELD TEST CHALLENGE

The real challenge for SuperNemos began when they were field trailed by Phil Sommers (strawberry grower). At the time, Phil commented that, "using conventional treatments was only giving him a single year out of the strawberry plants before the vine weevils took over. Now, with the SuperNemos they were producing fruit for three years. And that SuperNemos are in or around the same price as chemical alternatives, but they are doing a much better job.". Before the field experiments began, his crops had been suffering heavily due to vine weevils and in July of 2007 he witnessed the loss of over 60,000 plants in one field alone! Following the attack, Phil applied SuperNemos to an adjoining field, which contained 70,000 plants. For control purposes, several rows were left untreated. Immediately after application, extensive soil samples were taken to check for the presence of SuperNemos. Both the treated and the untreated rows were examined and monitored over the winter. The results were significant as all treated plants recorded full protection and Phil commented that using conventional treatments was only giving him a single year out of the strawberry plants before the vine weevils took over. Now, with the SuperNemos they were producing fruit for three years. And that SuperNemos are in or around the same price as chemical alternatives, but they are doing a much better job.

A further trial, at the nearby farm of Watty Furlong in Co Wexford, which contained only a 7,000 plants, gave a similar result: 90% control of vine weevils on his strawberry crop.

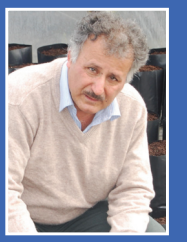
LOCAL ADAPTABILITY

This invention opens a door of opportunity, to choose different beneficial nematodes species, and formulated according to the invention, to be more effective against any outbreak of insect pests in different growing conditions. For example, if there is a major problem with vine weevils and minor infestation with fungus gnats or moth larvae, a special formulation may be used to suit this particular problem, or if there is a large infestation by sciarid larvae in glasshouses plus minor problems with vine weevils and other insect pest species, a different formulation to deal with the situation can be applied.

LOCAL PRODUCT WITH INTERNATIONAL APPLICATIONS

Perhaps the biggest advantage to arise from the development of Supernemos is that it can be adapted to any country in the world through the use of locally sourced nematode species. At present, E-Nema in Germany is producing SuperNemos according to our formulation: This includes one native Irish species and two species from Europe, as all of these species have been used in Ireland for a long time. In the near future, my company, Nemos Horticultural Ltd, is planning to produce several bio-control agents for green flies, scale insect other pests. This will be in line with our aim to reduce the use of harmful chemical in food production.

Beneficial nematodes are very effective in the soil because they work to kill the immature stages of insect pest larvae before they became adults. It is important to note that as SuperNemos are living organisms, they must be handled carefully according to instructions provided, to maintain their effectiveness. To achieve its full potential it is important to provide the right environmental conditions before applying the nematodes; in other words it is very important to follow the instructions to the letter.



Dr Abdul Hamid Al-Amidi is the inventor of SuperNemos, and holds an MSc and a PhD in biological control from NUI, St Patrick's College, Maynooth.
He worked with Teagasc Kinsealy Research Centre (1987-1989), on the use of biological control in the mushroom industry. He also worked with Fungal Biotechnology, BioResearch Ireland in UCD (1994-2001), for pests and diseases control in mushroom compost with special emphasis on bio-control (ie, as an alternative to chemical pesticides). From 1997-2001 he worked as Technical director for Bio-Cara Ltd (biological pest control and organic products). At present he works with the Dublin Institute of Technology and is the founding director of Nemos Horticultural Ltd.
For further information on SuperNemos visit:
www.nemo.ie