



# A tiny, powerful answer to the European ragweed invasion

By Dr Urs Schaffner & Julia Dennis  
Centre for Agriculture and Biosciences  
International (CABI), Switzerland

In China, *Ophraella communa*, a small dark brown ragweed leaf beetle, is known as an omen of relief. Since 2001 it has spread from Nanjing City across several provinces, eliminating ragweed or *Ambrosia artemisiifolia* in its path. This, of course, has huge potential benefits for regions of the world which are plagued by ragweed. This is the invasive alien species that clogs agricultural productivity and is best known for releasing neuroallergens that instigate annual hay fever for millions of people. Despite the acknowledged unpopularity and punitive costs associated with ragweed in Europe, and the success of the ragweed leaf beetle so far in Asia, this insect has never been allowed within European Union borders.

But now, even without regulatory consent, it has found its way in, and is suppressing ragweed quickly as it spreads from northern Italy into Switzerland. It will likely impact other ragweed-heavy regions in a short time with the potential to reduce the seasonal effects of the weed in the EU. It is rare to discover a breakthrough natural enemy like this which has so quickly and effectively suppressed a harmful invasive species, and has the potential to exist and thrive in different environments in the region. In Europe this would be the first case in history of this kind of biological control success.

This tiny beetle should mean hope not just for current EU allergy sufferers but also those who could be affected as ragweed continues to spread north across the continent due to climate change. For researchers in the field of ecosystems and invasive species management this is an opportunity to show first-hand to the public and to policy makers that sustainable cost-effective biological control is possible in the EU before it is too late. Today's biological control approaches take into account that if a development like *O. communa* can be harnessed it must first be carefully investigated.

This is the mission now undertaken by the EU-wide COST Action consortium of field researchers, ecologists, economists and human-health scientists who will quantify benefits and put forth new strategies for ragweed management, a field which is currently dominated by mechanical (mowing and pulling) and chemical (spraying with herbicide) means. For a cure to ragweed we will also be looking to the public to help track and monitor the spread of this alien invasive species through mobile app technology. Scientists and policy makers are up against the clock.

But before legislators act we as scientists also have a responsibility to weigh the potential risks posed by the spread of *O. communa* as a powerful biological control agent. There is a reason that countries such as Australia, which also experiences ragweed invasions, have not welcomed this tiny insect in the past. It is our job to study what this and other biological control measures against invasive species can do to Europeans and the ecosystems on which they depend.

## How big is the Ragweed problem?

Ragweed originates from North America, appearing across the Atlantic in the early 1860's when it was known as 'red clover'. This alien weed first touched down in the United Kingdom, Germany, the Netherlands and France around the same time and moved throughout Europe. There are over 30 countries interested in collaborating in the EU COST Action to fight ragweed, demonstrating its reach and impact in the EU in a relatively short time. Reports spell out that the few countries where ragweed is not yet so prevalent will see its effects soon as climate change draws warmer weather and new species northward.

Today an estimated €4.5bn is spent on addressing the ragweed ►



invasion in the EU, which includes the medical costs of treating its potentially life-threatening symptoms such as asthma attacks. As allergy sufferers are well aware, the effects of ragweed-induced hay fever range from irritated eyes and nose to chronic sinusitis and asthma. Results from heavily-infested south-eastern Europe indicate that every fourth person develops allergic rhinitis and asthma when exposed to ragweed pollen. In urban areas ragweed runs along roadsides and river banks and quickly populates vacant lots. Even if it's not visible nearby, ragweed pollen has been found over 400 miles from the source. High aerial concentrations of immensely allergenic ragweed pollen cause rates of sensitisation among Europeans ranging from 15% to 60%, leading to allergic rhinitis and severe asthma in over 20% of the population.

Loss of labour productivity and expenses spent on prescription and over-the-counter treatments alone are in the billions. Ragweed is one of the most destructive and quickly spreading invasive species in the world, but there are many others which collectively pose a significant threat to the global economy, natural biodiversity and, most alarmingly, the future of food security. For Hungary alone the costs inflicted by ragweed on human health have recently been estimated at €100m annually, and on agriculture an additional €130m annually. The total cost of damage from invasive species worldwide reaches \$1.4trillion each year. The threat to humans is only half the story as invasive alien species reportedly contribute to an estimated 40% of all animal extinctions. According to the UNEP, invasive species like ragweed are on a par with global warming as a threat to global food security.

### What is Biocontrol?

While biological control of invasive species is widely used on other continents it is not widely understood in the EU nor are its benefits and risks. Biological control of invasive species, often termed classical biological control, aims to permanently reduce the pest's density below an economic or ecological threshold by introducing specialist natural enemies from the weed's native range. Decisions by national competent authorities to release or not to release candidate biological control agents are based on the results from many years of pre-release studies during which the biology, host-specificity and impact of candidate biological control species are studied. Hence classical biological control should not be confused with the release of polyphagous predatory species, such as the voracious cane toad, that feed on a lot of different hosts, including native species, and that have led to ecological disasters.

This year the EC has put out a European-wide directive for research of prevention and management opportunities against invasive species, ringing the alarms for action now against further damage from alien species like ragweed. For the first time classical biological control is explicitly mentioned as a means to control invasive species. This reflects the growing awareness also in Europe that, unlike conventional management options such as herbicide application, classical biological control has the potential to permanently suppress invasive species.

### What do we do and don't know about *O. communis*

Our recent collaborative study with partners from Italian and Swiss universities shows the beetle has arrived in Europe - this is certain. Of 150 sites surveyed the beetle was already present in 80% of these sites, and is quickly destroying established ragweed plants and bringing down pollen levels fast.

Though the cause of its appearance in the EU is yet unknown it may have been brought in from international air traffic or commercial exchange through the Milano Malpensa International Airport, in the province of Varese, where the highest densities of the beetle have been found. It has since spread quickly to other ragweed-heavy regions of Northern Italy and Southern Switzerland. However it is also possible that ►



**Before *Ophraella communa*.**

the beetle was purposely introduced to combat Ragweed outside of the regulatory framework. There is a history where exotic organisms that were under consideration for biological control of insect pests or weeds were deliberately collected in the area of origin and released without careful pre-release studies and without permission.

However it arrived, the impact of the beetle has been swift and severe. Subsequent monitoring by our team over a 3-month period revealed that up to 100% of ragweed was attacked and destroyed. Damage-levels were high enough to completely eliminate further growth, thereby effectively suppressing the weed and its harmful effects. In areas where we have seen *O.communa* appear we have also seen a dramatic reduction in the amount of pollen, dropping over 70-80% in one season so far. This is one of the focuses for this coming year to further document these changes more closely in the field and in the lab. For the EU public the mission is to turn research results into relief in the long term of ragweed management.

It's already evident that it is a potential answer that could become the first successful case of biological control over an invasive species ever in Europe. But before any steps are taken to mass-rear and mass-release the beetle in the EU as they have done in China, our task force under

the EU Cost-Action is aimed at investigating all potential benefits, along with the risks.

As ragweed has long been a costly problem with medical and agricultural impacts the study of possible biological control agents, including this ragweed leaf beetle *O.communa*, has come up in the past. Ragweed is part of a larger family of plants, some of which are not noxious pests. In fact ragweed is a cousin of *Helianthus annuus*, otherwise known as the common sunflower. Previous testing has shown that the beetle can survive on sunflower under no-choice conditions, meaning there were no other viable options where it could survive. A concern that sunflower could also be considered a possible host for the ragweed leaf beetle now that it has arrived in the EU, is still being investigated. However, in preliminary tests in both Europe and China, scientists found little to no damage by the beetle on sunflower when introduced in a natural habitat with alternative choices to eat and destroy, like Ragweed. In any event this is still being closely tested and monitored, as sunflower is a major crop for which there is a major trade market in the EU both in agriculture, oil production and distribution. In 2008 the EU produced 2.1 million tonnes of sunflower oil, largely grown in France. Trade in seed oil from



**After *Ophraella communa*.**

sunflowers is in decline, as soya and palm oil increase their share of the market, but it was still estimated to be worth \$2bn as of 2009. Besides offering long-term solution for invasive species management, biological control is also attractive from an economic point of view. In Australia the successful biological control program against ragweed provides revenues of Aus\$103 for every \$1 invested.

### **The future for Ragweed**

This breakthrough in biological control could be the start of a new chapter for invasives management in the EU, but that is ultimately up to policy makers.

The SMARTER COST Action against Ragweed, the largest collaboration of researchers across disciplines and spanning 30 countries, was initiated last year by Professor Heinz Müller-Schärer of the University of Fribourg and our Ecosystems Management team at CABI in Switzerland. The goal is to develop habitat-specific management recommendations against ragweed across Europe, setting a model for the sustainable management of all invasive alien plants of European-wide interest.

As the SMARTER Cost Action community continues to delve into

the potential impact of the ragweed leaf beetle, researchers will look to the public to help them gain an accurate picture of the spread and status of ragweed on the continent. The SMARTER Ambrosia Reporter mobile phone app will allow other research professionals and the public to locate, map and monitor ragweed throughout Europe. A pilot project will focus on Switzerland and the Netherlands and later expand across the EU research community.

There is reason to be hopeful that biocontrol using this natural enemy to ragweed could present enormous benefits to the EU, as it has in China, but only after investigation into the impacts on European ecosystems ■

### **+ More Information**

[www.cabi.org](http://www.cabi.org)