



Biological control of possums

Landcare Research and its collaborators are developing biological control for possums.

Possums are not native to New Zealand. They were introduced about 150 years ago from Australia to establish a fur trade. They now occupy about 95% of New Zealand.

Why is biological control needed?

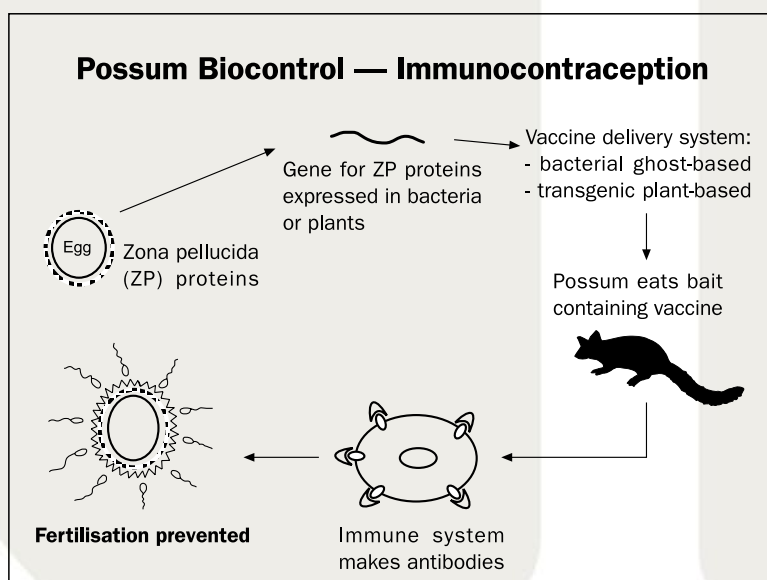
- New Zealand has a huge possum population—perhaps 60 million
- Possums seriously damage native forests and prey on endangered native animals
- Possums carry bovine tuberculosis (Tb) and infect cattle and deer
- High Tb levels in livestock threaten New Zealand's international trade
- A long-term solution is needed for possum impacts on native plants and animals
- There are increasing concerns about public acceptability and animal welfare aspects of current control methods

How will biological control work?

Biological control (immunocontraception) vaccines will reduce possum breeding. The vaccines target the egg coat around the possum egg. The possum egg is surrounded by a protein layer called the zona pellucida (ZP), which is made up of three different proteins, ZP1, ZP2 and ZP3. ZP proteins have been used to develop effective contraceptive vaccines for other species like pigs and horses. Vaccines will stop female possums producing eggs and/or interfere with the fertilisation of any eggs produced. That way, no or very few baby possums will be born, so possum numbers will decline as the adults die off and there are insufficient young to replace them. The biological control vaccine based on the egg proteins will be made into baits and fed to possums from bait stations.

Progress

Experimental contraceptive vaccines developed by Landcare Research show the potential of this approach for controlling possums. In trials on captive possums, vaccinated females were four times less likely to produce offspring than untreated females. Possum ZP2 and ZP3 have now been tested in possums, and reduced breeding by 70–80%. Ideally, the chosen proteins should not occur elsewhere in the body (so the vaccine will act only against sperm or eggs) and should occur only in possums. Parts of the possum ZP3 and ZP2 proteins (epitopes) have been identified that appear to be unique to possum eggs. An initial trial vaccinating possums with one of the ZP3 epitopes produced a 60% decrease in fertility but did not affect the fertility of mice or chickens. Other epitopes are being identified and tested.



Although these early tests have been successful, there is still a lot of research to be done. At the same time as we are developing a vaccine, we are also working out how to distribute it to possums. The contraceptive vaccine could be given to possums in bait, i.e. as an oral contraceptive. Researchers are investigating the use of bacterial ghosts and transgenic plants to deliver such a vaccine. For bacteria, this involves genetically modifying a harmless strain to produce possum ZP proteins in their cell walls. The bacteria are then killed and the shells of the empty bacterial cells or "ghosts" are given to the possum. The possum's immune system recognises the bacterial ghost as foreign, and produces antibodies against them. At the same time, it is tricked into developing antibodies against the possum egg protein, causing a contraceptive effect. Bacterial ghosts and, similarly, transgenic plants that have been genetically modified to produce possum proteins like ZP3 could be made into baits and fed to possums in bait stations. When possums eat the bait, their immune system produces antibodies against the ZP protein and that renders females infertile. Researchers have recently finished testing bacterial ghosts containing possum ZP2 and found that these reduced breeding significantly. We aim to have a "prototype" contraceptive bait for limited testing by 2008, and a product for field use by 2013.

Why not just use poisons or traps?

When possums are controlled using poisons or traps, the surviving animals may breed better and live longer, probably because there is less competition for food and nest sites. Possum numbers then build up again quickly. Using biological control as well as conventional control will slow down the rate at which possum numbers build up. We estimate that such integrated possum control might need to be done only one-third as often as current control with poisons or traps alone.

What benefits will biological control bring?

Using biological control in conjunction with conventional control has the potential to

- reduce the frequency and hence the cost of possum control
- reduce the amounts of poison used for conventional control
- reduce the risks to non-target species
- reduce possible environmental contamination

How safe will it be?

It is impossible to guarantee absolute safety. Development of the biological control bait involves the latest in biotechnology. The bait will not contain any live genetically modified organisms. The risk to anything other than possums will be minimised by

- using specific parts of the sperm and egg proteins that are only likely to affect possums
- using the baits in bait stations that restrict access by other species

In addition, the safety of the bait will be thoroughly tested before it is made available for controlling possums, both to protect non-target species and to determine that it has no unwanted side effects in the possums.

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