Fertility control for invasive pest mammals – Fare we making progress?

Hinds, L.A.
CSIRO Ecosystem Sciences, GPO Box 1700, Canberra, ACT 2601, Australia, lyn.hinds@csiro.au
Invasive Animals CRC, University of Canberra, ACT, Australia

DOI: 10.5073/jka.2011.432.003

Management of exotic or native invasive mammals at a landscape scale is complex and time-consuming. Current conventional techniques require repeated application and may or may not be species specific, and some methods (shooting, poisoning) are becoming increasingly unacceptable to the general public, particularly in urban and peri-urban environments. Fertility control was proposed as another potential tool for vertebrate pest management more than 3 decades ago. Since then the approach has gained public acceptance because it is perceived as a more species specific and humane approach. However, so far, no fertility control products have been developed which can be easily delivered to wildlife populations on a broad-scale. Ideally, a fertility control agent needs to induce permanent sterility leading to reduced recruitment in the pest population. It also must be easily delivered to reach an appropriate proportion of the target population, be species specific with minimal side-effects (behavioural or social structure changes), and be environmentally benign and cost effective.

Reproductive targets for fertility control include disrupting either the hormonal feedback associated with the hypothalamic-pituitary-gonadal axis, the function of the gonads, fertilisation, and/or implantation. Later stages of pregnancy and lactation could also be targeted but these raise animal welfare concerns.

The use of steroidal (e.g. synthetic progesterone) and non-steroidal hormone implants (e.g. agonists against gonadotrophin releasing hormone, GnRH) to disrupt hormonal regulatory feedback has been quite successful. However, their delivery is problematic and expensive at the population level because each individual must be captured for treatment.

Another approach has been the development of immunocontraceptive vaccines in which the body's immune response targets a self hormone (e.g. GnRH) or other reproductive antigen (such as follicle or egg coat proteins, sperm proteins, implantation or other uterine or oviduct proteins). While GnRH and porcine egg coat (zona pellucida) injectable immunocontraceptive vaccines have been shown to be very effective, their delivery also requires individual capture and, in some cases, booster immunisations. Remote delivery using darts has been successful for some vaccines, but cost and time are limiting application at the population level.

Using viruses to deliver immunocontraceptive vaccines was extensively researched for rabbits, foxes and mice in Australia, but this work ceased for technical reasons. In New Zealand, recombinant vaccinia virus is being assessed for delivery of disease vaccines and immunocontraceptive vaccines for possums.

Many plant extracts have been screened for their effects on gonadal function, implantation and/or the subsequent progress of a pregnancy. Some effects (abortions, suppression of lactation) raise welfare concerns. However, the main problem is the rapid reversibility of their effects after treatment ceases, and poor palatability at the required doses.

Chemosterilants have always been of interest, with one chemical, 4-vinylcyclohexene diepoxide (VCD) currently being tested for its sterlising effects in rodents. VCD causes depletion of ovarian primordial follicle populations, but it is not species specific and requires delivery over a prolonged period (>10 days). Although formulation for oral delivery is likely to be feasible, the challenge remains to specifically target the chosen pest species at a population level. The inclusion of a plant extract in food baits which also contain a chemosterilant could enhance the effects of both agents and lead more rapidly to infertility. Ovarian-specific phage peptides may also have potential here.

Oral delivery of any of the above agents, particularly of immunocontraceptive vaccines, remains a major challenge – protecting the reproductive antigens from degradation in the gut, stimulating uptake via mucosal immune sites and generating sufficient antibody responses to inhibit reproductive processes is extremely difficult.

Will fertility control work in all species? Certainly the potential of fertility control as a management tool is considered high for species with high fecundity, high natural adult mortality rates and rapid turnover and where the effects of sterilisation may exceed an increase in juvenile or adult survival due to a lowering of birth rates.

It could also be used to prevent or reduce population growth after other techniques have been applied to reduce numbers, particularly in long-lived species. If only fertility control was applied in long-lived species, then until natural mortality reduced population size, the infertile animals would continue to cause as much impact as fertile animals. This would not be of value to the land manager in the short term.

In conclusion fertility control has potential and obviously appeals to the public as a humane approach. However, considerably more needs to be done to develop fertility control approaches which can be delivered efficiently and cost effectively at a population level.