The Efficacy of OvoControl® (0.5% nicarbazin) in the Management of Feral Pigeons (*Columba livia*)

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ABSTRACT: In a joint program, Innolytics and the USDA National Wildlife Research Center collaborated in the development of nicarbazin as an avian contraceptive, initially for resident Canada geese and subsequently for feral pigeons. Unfortunately, the introduction of the original goose product, OvoControl G, in 2005, was a commercial failure. Political and social barriers as well as goose reproductive biology effectively thwarted attempts to establish the new technology with any meaningful market success. The introduction of the pigeon contraceptive has been less difficult and the new technology continues to gather momentum. Nevertheless, given the focus on instant results and gratification, contraceptive technology for birds – which works over time – continues to be challenging, and broad market acceptance remains elusive. Especially for short-lived and rapidly reproducing species, however, the market continues to replace outdated or ineffective techniques with the safer and more effective contraceptive tools.

KEY WORDS: bird control, birth control, *Columba livia*, contraceptives, fertility control, pigeon control, wildlife contraception

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INTRODUCTION

The fundamental rules of population dynamics are well established. Kirkpatrick (2010) described the two processes that provide the basis of naturally occurring population management either as 1) increasing or decreasing mortality, or 2) increasing or decreasing reproductive rate. With few exceptions (i.e., insect growth regulators), virtually all pest control for rodents, insects, and birds has been based on increasing the rate of mortality. Conversely, contraceptive techniques address the problem by decreasing the reproductive rate or fertility.

Members of the pest and wildlife control markets consistently demand a) immediate, and b) tangible action from tools and products used in their trade. In the case of bird control, the stated goal is often to have the birds "gone today." This leads to a strong bias for toxicant use by the industry. Unfortunately, many of the most effective avicides (strychnine, fenthion, parathion, endrin) were banned for commercial use by the U.S. Environmental Protection Agency (EPA) more than 25 years ago for non-target safety issues. Due to growing public concern for environmental impact and the humane treatment of birds, developing new avicides would be costly and time-consuming. Decreasing reproduction among rapidly reproducing species is the most viable alternative for effective bird abatement.

BACKGROUND

Unlike the realm of rodents or insects, mitigation options for pest birds are limited. By far the most common are based on physical exclusion (nets, spikes, electrical tracks, coils, etc.) or harassment (noise, sounds, repellents, effigies, gel, etc.). While appropriate for certain sites, at larger facilities where the flocks simply move to the next best location, these techniques are not necessarily suitable candidates even when used concurrently. Pigeon abatement is based on either a) increasing mortality, or b) reducing reproduction. Increasing mortality is typically achieved by live trapping (and euthanization), shooting (not especially practical in urban or industrial areas), or toxicants (poisoning). Reducing reproduction is achieved with a contraceptive or sterilant.

From a social, political, and commercial point of view, all of the techniques have their advantages and disadvantages. Nevertheless, with the notable exception of contraception, all of the tools have in common relatively rapid action and tangible results – the two essential product attributes for the pest and wildlife control communities.

Lethal control methods of birds, especially toxicants, even for pest birds, are increasingly unacceptable in our society. Banned in most of the modern world, toxicants that result in dead and dying birds in urban areas can have chaotic consequences. Furthermore, in a rapidly reproducing species including feral pigeons, lethal methods provide only a fleeting illusion of control, since the remaining birds quickly backfill the population through increased reproduction, or neighboring flocks that move into the newly vacant habitat.

Exclusion methods (nets, spikes, electrical strips) are very popular for bird damage mitigation and some of the few non-lethal techniques that can "get rid of the birds today." Unfortunately, these methods only move the birds around and have no impact on the overall population. Additionally, the cost of the equipment and installation on anything other than a modest structure can be prohibitive.

With the encouragement and support of several federal agencies, Innolytics and the USDA National Wildlife Research Center (Fort Collins, CO) participated in the co-development of nicarbazin as a contraceptive, initially for resident Canada geese (*Branta canadensis*) and subsequently for pigeons (*Columba livia*). Unfortunately, the original goose product, OvoControl G (EPA Reg. No. 80224-5), registered in 2005, was a commercial failure, and Innolytics allowed the registration to expire in 2012.

The marketing post-mortem reveals the following *biological* causes for the failure:

- Life span – without predation and effective hunting, resident geese have an estimated life span of

between 10 and 24 years (Mowbray et al. 2002), a time horizon far too long for most damage abatement programs (e.g., a golf course superintendent who prefers the birds gone today).
- Breeding cycle – geese breed just once a year, between March and April (Mowbray et al. 2002). Sustaining a seasonal business is challenging and, in this case, the logistics and financing were simply too much to overcome.

Far more challenging than the biology, however, were the *political*, *regulatory*, *and social barriers* (MacDonald and Wolf 2009). For example, the hunting community including state regulatory agencies were opposed to the use of a contraceptive in a huntable species, and they would not issue the necessary depredation permits. The US Fish and Wildlife Service imposed stringent permitting requirements prior to each use, and in another case the State of Illinois declared the product "illegal." These obstacles effectively thwarted attempts to establish the new technology with any degree of success in the market.

Although the barriers to entry for a pigeon contraceptive were less complicated and controversial, the introduction and market adoption of OvoControl P (EPA Reg. No. 80224-1) for pigeons still encountered significant resistance from the pest and wildlife control community. Consistent with the original product, OvoControl G, OvoControl P (0.5% nicarbazin) for pigeons was initially registered by EPA as a Restricted Use Pesticide. Unfortunately, due to the lack of immediate and tangible effects, licensed applicators were not apt to adopt a contraceptive product to manage pest birds. Based on the poor adoption rate and low potential for environmental risk or harm, in 2010 Innolytics successfully petitioned the EPA Office of Pesticide Programs (OPP) and was granted a change in use designation to unrestricted-use (*aka* General-Use) for OvoControl P. This change in use designation allowed Innolytics to bypass licensed applicators, who were reluctant to use a contraceptive, and market directly to end-users at pigeon-impacted facilities.

Unlike Canada geese, feral pigeons are offered no protection under the Migratory Bird Treaty Act or any other state or federal legislation. They are not hunted and not considered "game" by the states. As such, the hunting community does not have a role in the use of contraceptives in this pest species.

As opposed to Canada geese, pigeons represent a significantly more attractive target for contraceptive control. The reasoning begins with their biology:
- With up to six clutches annually, and two eggs per clutch, pigeons are prolific breeders (Johnston and Janiga 1995), and
- In contrast to many other pest birds, pigeons have a relatively short lifespan of just two to three years under typical urban conditions (Johnston and Janiga 1995).

These two biological characteristics, rapid breeding and short lifespan, represent biological metrics critical for the success of contraception in pest birds, having a profound effect on the pigeon population and attrition rate.

DISCUSSION

The efficacy of avian contraception can be measured two ways: a) How effective is the contraceptive action, in the case of OvoControl, in keeping eggs from hatching, and b) How effective is the contraceptive in reducing the population of birds?

These are very different parameters that must be evaluated separately, with the first one much easier to control and measure. The evidence supporting nicarbazin for fertility control (preventing eggs from hatching) is well established. The original documentation of nicarbazin's interference with egg hatchability was reported by Ott et al. (1956) in domestic chickens (*Gallus gallus domesticus*). The effect was described in further detail in a series of publications (Jones et al. 1990a, 1990b, 1990c; Hughes et al. 1991). The effect of nicarbazin on egg hatchability was subsequently documented in studies encompassing three separate families of birds (Anseriformes, Galliformes, Columbiformes), and for five additional birds: pigeons (Avery et al. 2008), Canada geese (Bynum et al. 2005, Fagerstone et al. 2010), Japanese quail (*Coturnix japonica*; Miller et al. 2000), Mallard ducks (*Anas platyrhynchos*; Yoder et al. 2005), and Pekin ducks (*A. platyrhynchos domesticus*; Reinoso et al. 2007, Reinoso 2008).

Although the compound is very effective in preventing eggs from hatching, the applicator or end-user is not necessarily concerned about contraceptive efficacy, but rather how well, and more importantly, how rapidly does the technique reduce the population of birds. As opposed to monitoring egg hatching in lab studies, monitoring population decline rates in free-ranging and highly mobile birds in controlled field studies is far more challenging. Furthermore, the data from field studies of this nature and scope are often considered equivocal.

Nevertheless, a large-scale, multi-year study with nicarbazin (Ovistop, 800 ppm nicarbazin) in pigeons was reported in Genoa, Italy. The publication summary provides the following description:

> *The study describes a retrospective evaluation of efficacy between the years of 2005 and 2012. The observations focused on four (4) non-migratory feral pigeon colonies located in well-defined areas of Genoa, Italy. Three of these colonies were treated for 12 months each year with 10 grams of Ovistop per bird /day for 5 days each week; the fourth colony was treated with a placebo (control). Each colony and the relative area where the colony was located were monitored daily. A population reduction was observed over the initial four (4) years in the range of 35 to 45%. A further decrease of 65 to 75% was observed over the subsequent four (4) years. This phenomenon was recorded across the board in the three (3) treated flocks compared to the overall stable trend observed for the control. As no external or exceptional anthtropic or natural factors were observed, it can be concluded that, given the results observed, the drug seemed effective in reducing the treated bird populations.* (Albonetti et al. 2015)

Genoa represents a prototypical urban area in Italy, with many of the same characteristics conducive to pigeons as in North America: adequate food, water, and quality harborage. Applied consistently and over a period of time, the application of Ovistop illustrated an initial reduction and subsequent maintenance of the lower pigeon population over the monitoring period of eight years. As is so common in abatement programs that focus on increasing mortality (trap, shoot, or poison), there was no rebounding of the bird population observed in the treated flocks.

Although Ovistop (nicarbazin) reduced and maintained a smaller population of birds, the performance of the formulation is not consistent with the level of control generally reported with the use of OvoControl P. The Italian formulation of nicarbazin (Ovistop) has some functional limitations, including:

1) The Ovistop formulation is limited to a concentration of 800 ppm, since higher levels result in decreased palatability and lower consumption. Bynum et al. (2005) reported that pigeons, Muscovy ducks (*Cairina moschata*), and Canada geese have a taste aversion to nicarbazin. At 800 ppm, the concentration of nicarbazin in Ovistop is relatively low, and therefore the physical dose for pigeons of 10 grams bait relatively high, more than 30% of the daily pigeon diet. With 10 grams of an 800-ppm nicarbazin bait, each bird is receiving an estimated 8 mg of nicarbazin. Based on the research conducted by Avery et al. (2008), 8 mg represents a sub-optimal dose. OvoControl is formulated to contain 5,000 ppm of nicarbazin in five grams of bait, just 15% of the diet, and an estimated 25mg/pigeon per day. The low concentration of nicarbazin in Ovistop may account for some of the lower than expected performance of the product in the Genoa study.
2) Since Ovistop is formulated on whole corn, the multi-layer formulation is subject to cracking, splitting, and chipping. Even during transportation, a portion of the coating is found in the bottom of the bag and these "fines" contain a high concentration of nicarbazin. During application, the bait is scattered on hard street surfaces, exasperating the phenomena. Cracked Ovistop particles expose technical grade nicarbazin, further reducing acceptance by the pigeons.
3) Finally, the Ovistop baiting protocol provides instructions to apply the bait by hand broadcasting just five days a week. Unfortunately, after a few days without a dose, the concentration of DNC in the plasma drops precipitously low (Yoder et al. 2005) and will likely be below the contraceptive effect level. For optimal contraceptive effects, nicarbazin should be dosed daily.

The annual population decline rate supported by Innolytics' original field study data at a treated site was 46% (MacDonald and Wolf 2009). Since its introduction, OvoControl programs have been deployed at a wide range of commercial and industrial sites, including oil refineries, power plants, chemical manufacturing, steel mills, rail facilities, breweries, automobile assembly, college campuses, hangers, hospital complexes, hotels, and other large industrial venues. These are most often facilities where moving the birds around with physical exclusion is not effective at reducing bird related damage.

In order to document efficacy under larger-scale conditions, instead of conducting multi-center field studies, Innolytics has have relied primarily on anecdotal data from users of OvoControl in successfully managing their respective pigeon infestations. The figures consistently reported from commercial application sites is a population reduction of roughly 50% annually, and subsequently an equilibrium of approximately 5% to 10% of the starting population.

While a 50% annual reduction is very attractive to some audiences, others, including the pest and wildlife control community, are disappointed with the relatively slow and gradual, yet predictable rate of decline. Pest and wildlife controllers and most of their customers initially demand more rapid and tangible techniques, consistent with the philosophy of "get rid of the birds today." It is also interesting to note those situations where a contraceptive control tool is not necessarily appropriate and has not been adopted to any great extent. Residential use, for example, is effectively zero. The technology simply does not lend itself to smaller structures or areas.

CONCLUSIONS

The introduction of new technology generally requires a group of early adopters to generate the initial interest in a new tool or technique. This core group and their experiences represent the starting point in a marketing program for any new product. Unfortunately, due to the delay of immediate and tangible action, customers are often reluctant to invest months or even years in the long-term evaluation of a contraceptive program.

Although long-term efficacy and population control is superior, given the customers' focus on instant results and gratification, the introduction of contraceptive technology for managing bird populations has been difficult and broader market acceptance remains elusive. Nevertheless, the volume of OvoControl sold by Innolytics continues to accelerate as new customers replace outdated or ineffective techniques with this safer, more effective, bird-friendly contraceptive tool.

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