Proceedings of the Ninth International Conference on Urban Pests
Matthew P. Davies, Carolin Pfeiffer, and William H Robinson (editors) 2017
Printed by Pureprint Group, Crowson House, Uckfield, East Sussex TN22 1PH UK

CONTROLLING URBAN PIGEON POPULATIONS HUMANELY

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Abstract Pigeons (*Columba livia*) are considered a major pest problem around the world. Management tools such as netting, spikes, gels and other approaches such as flying predatory birds can help, but these often move the problem elsewhere. Ovistop® containing nicarbazin can reduce pigeon numbers through contraception. Nicarbazin treated corn can reduce pigeon numbers by 30% year on year for up to five years and maintain low pigeon numbers thereafter. Combined with other pigeon management products, it represents a modern, integrated pest management solution to this pest problem.

Key words Feral, bird, contraception, nicarbazin.

INTRODUCTION

The Feral Pigeon (*Columba livia* var. *domestica*) is a descendent of the Rock Dove which lives on cliffs in coastal regions but has adapted well to living in urban environments. The move to areas of human habitation and their close association with man (synanthropy) has been greatly influenced by their use as a food source, both for meat and eggs, illustrated by a wide variety of man-made dovecote type structures that exist around the world. Today we are used to seeing pigeons in our urban environment. To some they are part of the landscape and provide a natural link to nature that may otherwise be lacking in cities. Others get pleasure in feeding them. Pigeons love cities as they provide ideal roosting spots (Sacchi et al., 2002). The public habit of feeding pigeons does not help; this not only provide ideal roosts but the free availability of human waste food helps pigeons to succeed in urban situations.

When pigeons are present in high numbers, they can present a hazard. Health and safety concerns come from a build-up of faecal matter which apart from being unsightly, when wet can cause slippage. The acidity can cause damage to stone and paintwork (Bassi and Chiatante, 1976) with an associated increase in cost to pay for the removal (Nomisma, 2013). Our heritage and outdoor works of art are most vulnerable (Pochon and Jaton, 1968). There is an associated potential risk to health, as pigeons have been found to carry several transmissible diseases (WHO, 2008). The primary means of transmission is through the droppings, which when dry, the infection vector (virus or bacteria) becomes powdered and floats up into the air as dust, which can be inhaled. Those with weakened immune systems are most vulnerable. Organisms include Cryptococcal meningitis, Salmonella (Haesendonck et al., 2016) and Listeria, Viral Encephalitis, *E. Coli*, Histoplasmosis, Campylobacteriosis (Gargiulo et al., 2014). Feral pigeons are commonly infected with the zoonotic bacterium *Chlamydophila psittaci*, the agent of psittacosis (also known as ornithosis) in humans (Magninoet al., 2008). Several surveys across Europe have detected high percentages of infection in feral pigeon populations (Vázquez et al., 2010). Those who work in the pest and facilities management sector are often most at risk as they often provide the cleaning services to remove unwanted guano.

There are two main categories pf products to manage pigeons. Bird deterrent or displacement tools, although sold as bird control products, do not affect pigeon numbers but seek to make environments unattractive for feeding, nesting and roosting. These include nets, spikes, wires, electrocution strips, gels, lasers, flying birds of prey and use of mimic predators. There are a wide range of such products that, if well deployed, can be very effective. However, if not well maintained birds can quickly exploit any weaknesses.

True control approaches that affect pigeon population numbers, include shooting, trapping, use of nest boxes and egg replacement. The most popular of these, the culling of birds through trapping and shooting, can be effective at reducing pigeon numbers in the short term but require strict adherence to the appropriate laws, regarding the use of firearms and to animal welfare. Unless the programme is implemented regularly, pigeon populations have a strong ability to recover quickly, often to a higher level than before (Sol and Senar, 1992, 1995).

Why are pigeons so troublesome? As always, it is important to understand the biology of the pest (Murton et al., 1972). Adult pigeons typically live 3-5 years depending on food resources, natural predation and human interference. All columbiformes are monogamous (pairing with one mate for life) and their pest status is heavily linked to their ability to breed all year round, climate allowing. They create a flimsy nest on accessible ledges, on a building or in the roof void of buildings (Murton et al., 1972). Two eggs are usually laid on each occasion, which hatch in 17-19 days. The squab lasts 30 days, growing through the fledgling stage to a juvenile at 6 months. Often breeding pairs will lay a new batch of eggs as soon as the previous ones have hatched. Juveniles are also capable of breeding from 6 months. These factors combined create a scenario where 2 pigeons can increase in number in a short period (theoretically 8-16 additional pigeons per year). This is why culling strategies have a short-term effect, as the recovery potential is so strong.

A hierarchy exists within a colony of pigeons. Typically, 15% are dominant, experiencing low mortality as they have good access to resources and freely reproduce; 55% are subdominants that occasionally reproduce and 30% are juveniles. Although young pigeons can breed, this is rare, as they are poorer competitors than adults and are more vulnerable to starvation and disease with higher mortality rates than adults (Sol, D. et al., 1998). However, juvenile dispersal within a given city is significant with 30% of fledglings capable of dispersal each year as they move to new colonies where conditions may be better (Hetmanski, T. 2007). To influence pigeon numbers long term, a different approach is required.

MATERIALS AND METHODS

Various products have been used in the past to interfered with breeding but these had an imperfect use profile (Dolbeer, 1980). Nicarbazin is a complex of two compounds (4,4'-dinitrocarbanilide (DNC) and 4,6-dimethyl-2-pyrimidinol (HDP)) that has been used as a coccidiostat in broiler chicken feeds since the 1950s (Jones et al., 1990), as a feed additive for the prevention rather than the treatment of disease, even in chicken destined for human consumption (Ott et al., 1956). At recommended doses however, treatment can affect egg laying hens, reducing hatchability and interrupting egg laying (Jones et al., 1990). Nicarbazin is not a hormone. It compromises the integrity of the egg's vitelline membrane, allowing yolk and albumen to mix (Sherwood et al., 1956). The effect is temporary and birds recover fully 4–6 days after being taken off treated food (Yoder et al., 2005; Barbato and MacDonald, 2006).

It was this side effect of nicarbazin which Italian veterinarians and researchers decided to exploit to reduce problem pigeon populations. The fertility effect on pigeons was first verified in studies on racing pigeons and proposals for urban pigeons quickly followed (Martelli et al., 1993), and trials by Ferri et al. (2009) led to the first effective presentation of nicarbazin for pigeon population management. Developed in collaboration with Acme Drugs, Italy (Ovistop®), this uses natural whole maize grains containing 800 ppm nicarbazin, applied at 8-10 g of maize grains, per pigeon per day, for a minimum of 5 days a week, from March to October.

RESULTS AND DISCUSSION

Ferri (2009) applied treated maize to 552 colonies (85,562 pigeons) and the resulting infertility led to a significant reduction (from 28% to 71%) of the number of pigeons in different Italian urban colonies. (Figure 1 shows results for Udine). Similar field effects were demonstrated in studies in Carpi, Parma and Forlì (Bursi et al., 2001) which showed a reduction of in the pigeon population of approximately of 48%, 8 months following daily administration (Table 1), while Albonetti et al., (2015) considered the efficacy of nicarbazin in the containment and reduction of a population of feral pigeons in the city of Genoa, Italy over an 8 year period (2005-2012). A reduction was observed over the first 4 years (35% to 45%) and a further decrease (65% to 70%) over the subsequent 4 years (Table 2). In Modena, the population has similarly been treated and pigeon numbers monitored since 2008 (Figure 2) (Ferri, 2016). In all studies, to be effective, it was important to first estimate the population and colonies within a given area, to determine the number of feeding points, to decide whether to use manual or automatic application and the daily dose to be delivered. Pigeons can quickly become habituated to being fed but before any treatment, plain maize kernels are used for a minimum of two weeks, to confirm that the correct locations have been chosen and that the pigeons will eat. Regular corn is then replaced with a nicarbazin treatment. As populations decrease, less product is required, but the remaining population needs to be continuously fed for the treatment to be effective.

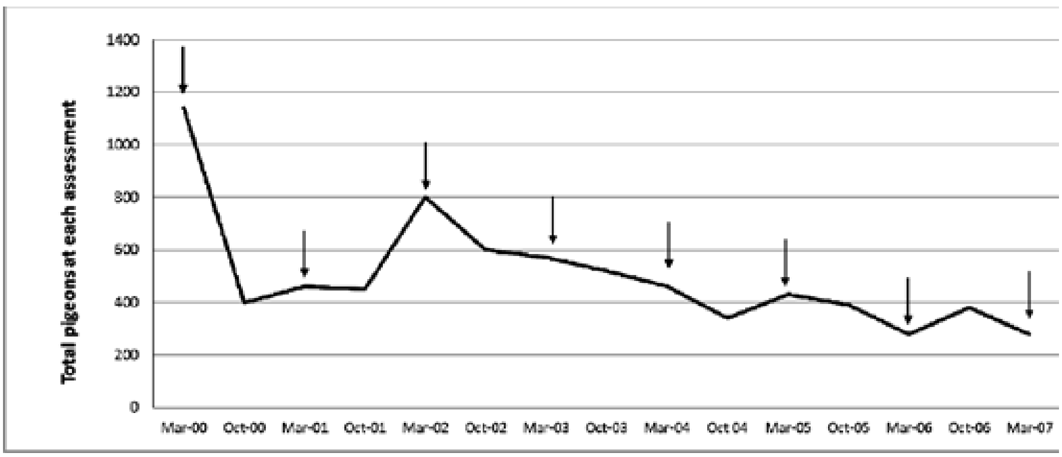

Figure 1. Pigeon population reduction effect in Udine, Italy over 7 years 2000-2007 (Ferri, 2009). Arrows indicate start of application of treatment.

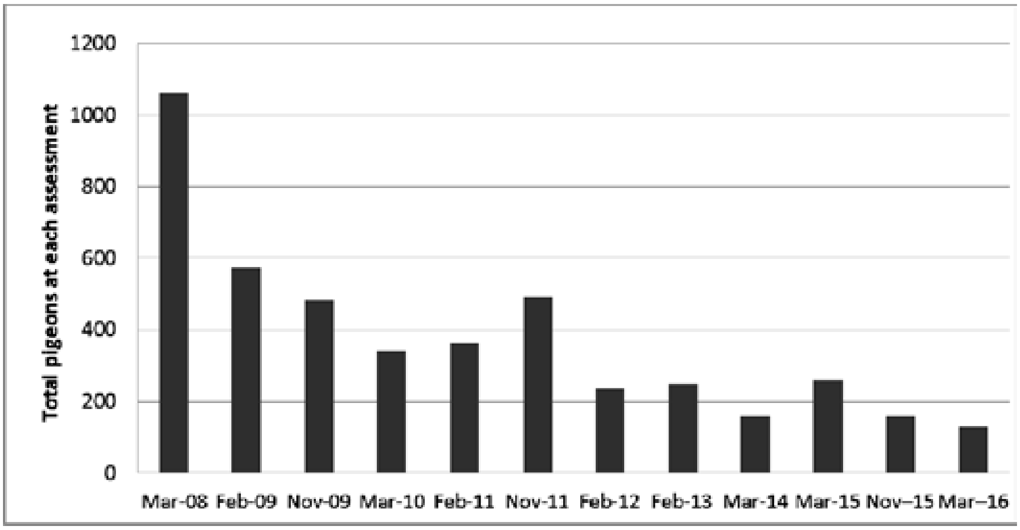

Figure 2. The population reduction effect of 8 years of pigeon treatment with nicarbazin treated maize in Modena 2008 – 2016. (Ferri, 2016)

The major benefit of nicarbazin, when compared to other fertility treatments, is its safety and environmental profile. There are no risks to other birds. In addition to the low toxicity, the risk to non-target birds is principally controlled by the large size of kernels and careful distribution, to feed those birds present only at the time of application.

Table 1. Changes in pigeon numbers at 4 Italian cities after short (4 months) and long treatments (7 to 8 months) with nicarbazin treated maize (Bursi et al., 2001).

Year	Location	Dura-tion	Start	End	% Reduction
1996	Carpi	Long	512	418	18%
1997	Forli	Short	200	63	68%
1997	Parma	Long	3219	1618	49%
1997	Carpi	Long	745	365	51%
1997	S Felice sul Panaro	Long	280	100	64%
	Total		**4956**	**2564**	**48%**

Table 2. Efficacy of nicarbazin over 8 years to reduce pigeons in Genoa, Italy. (Albonetti, et al., 2015).

	Mean pigeon numbers at each location each year (presented using a relative index number, base 100, to best describe trend)			
Year	**Station 1. Casaregis Street**	**Station 2. Tommaseo Square**	**Station 3. Cecchi Street**	**Control station 4. Scio Square**
2005	107.8	199.4	148.9	155.0
2006	59.0	143.7	120.0	196.6
2007	65.5	146.5	123.2	258.8
2008	58.2	103.4	93.1	239.7
2009	23.9	53.6	64.0	216.6
2010	28.5	56.0	56.7	220.2
2011	25.9	62.0	40.9	259.6
2012	26.9	59.5	45.3	173.8
Reduction	**75%**	**70%**	**70%**	

There is no risk posed to raptors that eat pigeons that have consumed nicarbazin. When pigeons ingest nicarbazin, they metabolize it rapidly and it breaks down into the two components. When a raptor eats a pigeon treated with nicarbazin, the nicarbazin exists in a dissociated form and is consequently inactive because it cannot be absorbed or the remaining inactive nicarbazin, that could be consumed, is irrelevant due to the scarce amount that remains (WHO, 1999; UN et al., 2000). Regarding granivorous species, the size of the maize kernels stops them being ingested by birds of smaller sizes than a pigeon. There is similarly no harm to the health of the pigeons (Yoder, Miller, and Bynum 2005). Clinical tests on pigeons treated with nicarbazin have not shown any adverse side effects nor anatomical or functional modifications with regards to their tissue or organs (Ubaldi and Fusari, 2000). The effect on egg laying is reversible, with egg laying returning 4-6 days after cessation of feeding. It is key to the success of any bird management programme that the public are advised to stop feeding the pigeons.

CONCLUSION

Nicarbazin is an effective tool to reduce pigeon numbers. At a recommended application of 8 grammes of product per pigeon per day, in the first year of treatment, there is a reduction of approximately 20-30% and after 4-5 years, a reduction of approximately 80% of the initial population. This reduction has been seen in all control programs that have been correctly implemented (Avery, 2006). The Italian experience is now leading to a much wider international adoption. Nicarbazin treated maize is being used in Singapore to manage pigeons (Hassan, 2015) and is now being applied to control 85,000 pigeons in the city of Barcleona (El Mundo, 2016). It is expected other towns, cities and facilities will also benefit as the approach becomes more widely understood.

REFERENCES CITED

Albonetti, P., A. Marletta, I. Repetto, and E. Sasso. 2015. Efficacy of nicarbazin (Ovistop®) in the containment and reduction of the populations of feral pigeons (*Columba livia var. domestica*) in the city of Genoa, Italy: a retrospective evaluation. Veterinaria Italiana. 51 (1): 63-72. doi: 10.12834/VetIt.337.1448.3.

Avery, M. 2006. Effects of nicarbazin bait on pigeon reproduction. USDA/APHIS National Wildlife Research Center, Gainesville, Florida Experiment Station.

Barbato, G. and A. MacDonald. 2006. Pekin Duck model for action of nicarbazin on fertility. Pennsylvania State University.

Bassi, M., and D. Chiatante. 1976. The role of pigeon excrement in stone biodeterioration. Ini. Bìodein. Bull. 12 (3): 73-79.

Bursi, E., A. Gelati, M. Ferraresi, G. Zannetti. 2001. Impiego della nicarbazina nel controllo della riproduzione del colombo randagio di città. Annali della Facoltà di Medicina Veterinaria, Università di Parma http://hdl.handle.net/11381/1463941.

Dolbeer, R.A. 1980. The challenge of cost-benefit determinations in bird-damage control programs. Great Plains Wildlife Damage Control Workshop Proceedings. http://digitalcommons.unl.edu/gpwdcwp/242/.

El Mundo. 2016. Barcelona, primera gran ciudad en controlar las palomas con anticonceptivos. http://www.elmundo.es/cataluna/2016/11/25/583878bfe5fdeadd098b45d4.html (Jan, 2017).

Ferri, M., M. Ferraresi, A. Gelati, G. Zannetti, A. Ubaldi, B. Contiero, E. Bursi. 2009. Use of Nicarbazin in the control of urban pigeon colonies in Italy in 1990-2007. Ann. Fac. Medic. Vet. di Parma. (29): 91 -102.

Ferri, M. 2016. pers comms. The effect of 8 years application of Ovistop in Modena 2008 -2016.

Gargiulo, A., T. Russo, R. Schettini, K. Mallardo, M. Calabria, L.F. Menna, P. Raia, U. Pagnini, V. Caputo, A. Fioretti, and L. Dipineto. 2014. Occurrence of enteropathogenic bacteria in urban pigeons (*Columba livia*) in Italy. Vector-Borne and Zoonotic Diseases, 14(4).

Hassan, Nadia J. 2015. Trial underway to control pigeon problem. Channel News Asia. www.channelnewsasia.com/news/singapore/trial-underway-to-control/2240094.html (January, 2017).

Haesendonck, R., G. Rasschaert, A. Martel, E. Verbrugghe, M. Heyndrickx, F. Haesebrouck, and F. Pasmans. 2016. Feral pigeons: A reservoir of zoonotic *Salmonella enteritidis* strains. Veterinary Microbiology. 195: 101-110.

Hetmanski, T. 2007. Dispersion asymmetry within a feral pigeon population. Acta Ornithologica, 42 (1), 23-31.

Jones, J.E., I. Solis, B.L. Hughes, D.J. Castadldo, and J.E. Toler. 1990. Reproduction responses of broiler-breeders to anticoccidial agents. Poultry Science. 69:27-36.

Martelli, P., L. Bonati, A. Gelati, M. Ferraresi, L. Montella, E. Cabassi, and G. Zannetti. 1993. Effects of nicarbazin on pigeon reproduction. Preliminary notes. Acts of the Italian Society of Veterinary Science. 47: 1283.

Murton, R.K., C.F.B. Coombs, and R.J.P. Thearle. 1972. Ecological studies of the Feral Pigeon *Columba livia*. Flock behaviour and social organization, J. Appl. Ecol., 9 (3), 875-889.

Murton, R.K, R.J.P. Thearle, and J. Thomson. 1972. Ecological studies of the Feral Pigeon Columba livia. Population, breeding biology and methods of control, J. Appl. Ecol., 9 (3), 835-874.

Nomisma, 2013. Valutazione dei costi economici e sociali dei colombi in ambiente urbano.

Ott, W.H., S. Kuna, C.C. Porter, and C. Cuckler. 1956. Biological studies on nicarbazin, a new anticoccidial agent. Poultry Science 35:1355-1367.

Pochon, J. and C. Jaton. 1968. Facteurs biologiques de l'alteration de la pierre. In: Biodeterioration of materials. Microbiological and allied aspects. A. H. Walters and J. Elphick (Eds), Elsevier Pub. Co., London: 258-268.

Sacchi, R., A. Gentilli, E. Mazzetti, and F. Barbieri. 2002. Effects of building features on density and flock distribution of feral pigeon *Columba livia* in an urban environment. Canadian Journal of Zoology 80: 48-54.

Sol, D., Santos, D.M., and J. Garcia. 1998. Competition for food in urban pigeons: The cost of being juvenile. The Condor 100:298-304.

Sol, D. and J.C. Senar. 1992. Comparison between two censuses of feral pigeon *Columba livia* from Barcelona: an evaluation of seven years of control by killing. Butll. GCA, 9: 29-32.

Sol, D. and J.C. Senar. 1995. Urban pigeon populations: stability, home range and the effect of removing individuals. Can. J. Zool., 73: 1154-1160.

Ubaldi, A. and A. Fusari. 2000. Il fattore sicurezza nell'impiego della nicarbazina a scopo terapeutico e anticoncezionale.

United Nations, World Health Organization (WHO), Food & Agriculture Organization (FAO), Jt. Exp. Comm. on Food Additives (JECFA) 2000. Evaluation of certain veterinary drug residues in food (nicarbazin). 888: 66-72.

Vázquez, B., F. Esperón, E. Neves, J. López, C. Ballesteros, M.J. Muñoz. 2010. Screening for several potential pathogens in feral pigeons (*Columba livia*) in Madrid. Acta Veterinaria Scandinavica (52) 45.

World Health Organization (WHO) 1999. FAO Food and Nutrition Paper 41 (11). Residues of Some Veterinary Drugs in Animals and Foods.

World Health Organization. 2008. Public health significance of urban pests - ISBN 978-92-890-7188-8: 239 - 288.

Yoder, C. A., L.A. Miller, and K.S. Bynum. 2005. Comparison of nicarbazin absorption in chickens, mallards and Canada geese. National Wildlife Research Center, Fort Collins, CO. Poultry Science. 84: 1491-1494.