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Chlamydial infections in feral pigeons in Europe: Review of data and focus on public health implications

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ABSTRACT

Feral pigeons (*Columba livia domestica*), which thrive in most European towns and cities, are commonly infected with the zoonotic bacterium *Chlamydophila psittaci*, the agent of psittacosis (also known as ornithosis) in humans. A number of surveys carried out over the last thirty years across Europe have detected high seropositivity values and high percentages of infection in feral pigeon populations. Overall, when considering data from 11 European countries, seropositivity values to *C. psittaci* in the sampled populations ranged from 19.4% to 95.6%. In most surveys, the complement fixation test was used, and antibodies were detected in 19.4–66.3% of the samples, with a median of 46.1%. Indirect immunofluorescence and ELISA tests were employed less frequently, but led to the detection of higher percentages of seropositivity (23.7–67.7% and 35.9–95.6%, respectively). Attempts to grow *C. psittaci* in cell culture or embryonated chicken eggs were successful in 2–42.3% and 0–57.1% of samples, respectively, antigen detection methods were positive in 2.3–40% of samples, while conventional PCR and real-time PCR using different genomic targets detected the organism in 3.4–50% of samples. Twenty-five *C. psittaci* isolates from pigeons were typed as *ompA* genotype B ($n = 14$), E ($n = 10$) and E/B ($n = 1$).

The huge increase of feral pigeon populations in Europe is a major cause of concern for the detrimental effect of pigeon droppings on environmental hygiene, in addition to the extensive damage due to the fouling of buildings and monuments. The most important pathogenic organism transmissible from feral pigeons to humans is *C. psittaci*, with 101 cases of disease reported in the literature. Exposure to *C. psittaci*-contaminated dust, direct contact with pigeons through handling and, to a lesser extent, through pigeon feeding have been identified as hazardous exposures in more than half of the human cases, while loose or transient contacts with feral pigeons have been mentioned in about 40% of the cases.

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Education initiatives as to the communication of a health risk resulting from contact with pigeons and pigeon excreta should primarily be targeted at individuals who may be exposed to *C. psittaci*-contaminated dust, such as demolition/construction workers. Recommendations to this category of workers include wearing protective clothes with hoods, boots, gloves and air filter face masks when removing pigeon faeces from roofs, garrets and buildings, especially if working indoors. Monitoring for *C. psittaci* infections in these workers over time should also be considered. Children should be warned not to handle sick or dead pigeons, and immunocompromised individuals should be advised to carefully limit their contact to feral pigeons.

Culling of pigeons by shooting or poisoning is both unethical and ineffective as the place of the killed birds in the population is quickly filled by new juveniles or immigrating birds from neighbouring areas. Pigeon-deterring systems, such as nets and plastic or metal spikes applied to buildings and monuments will prevent their fouling, and the administration of contraceptive drugs may allow size regulation of the pigeon populations. Nevertheless, the measure that will ultimately lead to permanent reduction and will establish healthy sustainable populations is the restriction of indiscriminate feeding by pigeon lovers. The erection of dovecotes and artificial breeding facilities should be considered for providing shelter and a balanced diet to the birds, as well as a chance of interaction for pigeon lovers in a hygienically controlled environment.

1. Introduction

Feral pigeons (*Columba livia domestica*), also known as "urban", "street" or "city" pigeons, are descendants of the domesticated form of the free-living Rock Dove, or Rock Pigeon (*Columba livia* Gmelin, 1789). During their domestication of more than five thousand years, hundreds of pigeon breeds were produced according to the desires and wishes of man (Haag-Wackernagel, 1998, 1999). Domestication in pigeons is characterized amongst others by a high annual reproduction success, tameness and selection against aggressiveness in males. These features may partly be responsible for the enormous thriving success of the feral pigeon in our cities around the world. In regions where no rock pigeons live, feral pigeons are derived from escaped domestic pigeons, such as the semi-domesticated dovecote pigeon, and from lost homing and fancy pigeons (Haag-Wackernagel, 2003).

After World War II, feral pigeon populations hugely increased worldwide in most larger cities (Simms, 1979) to a level of concern for city administrators and communal health officers. Besides being responsible for the massive fouling of buildings and monuments, feral pigeons were in fact often shown to be naturally infected with a number of viruses, bacteria, fungi and protozoa that are pathogenic to humans (Haag-Wackernagel and Moch, 2004). *Chlamydophila psittaci* (Everett et al., 1999; Garrity et al., 2004), an obligate intracellular bacterium which is the agent of avian chlamydiosis in birds and psittacosis in humans, is the most prevalent organism in feral pigeons worldwide. As a consequence, feral pigeon populations have been repeatedly blamed as vectors for the transmission of *C. psittaci* infections to humans.

COST Action 855 (http://www.vetpathology.unizh.ch/forschung/CostAction855.html), a Europe-wide research network on animal chlamydioses and their zoonotic implications, has recently provided a forum for researchers from several countries to discuss the public health risks associated with chlamydiosis in feral pigeons.

The purpose of this communication is to (i) review the ecology of feral pigeons and the measures that can be adopted to obtain healthy sustainable feral pigeon populations, (ii) review the methods for detection of chlamydiae and chlamydial antibodies in feral pigeons and the present data on the prevalence of chlamydiosis in avian populations established in several European countries, and (iii) discuss the zoonotic relevance of chlamydial infections in feral pigeons.

2. The ecology of feral pigeons in the urban environment

Feral pigeons are a valuable enrichment of the urban environment and are one of the few animal species able to survive in our noisy and hectic cities. They also represent a tourist attraction and may have a cleaning up function by eating discarded food. In addition, the feeding and care of feral pigeons are rewarding spare-time activities for many people who enjoy the company of animals, and bring pleasure to a fraction of dedicated citizens, especially to children. In addition, feral pigeons are an interesting study subject with a high scientific and educational value for hobby ornithologists, as well as for biology scientists.

Today, the feeding of pigeons by "pigeon lovers" is mainly responsible for the establishment of large pigeon populations in our cities and a supplemental input for their increase is provided by rubbish and seasonally occurring natural food, such as grass and tree seeds in parks and gardens (Haag, 1984). The extensive food supply indeed provides the ecological basis for the large populations that occur in most cities of the world (Haag-Wackernagel, 1993, 1995, 2002; Kösters et al., 1994). Pigeons in fact do not need to commute on risky flights to look for more natural food supplies in the countryside and are minimally threatened by predatory birds, whose populations have been drastically decimated over the years by hunting and by deliberate or accidental poisoning. Regular feeding of pigeons by their feeders throughout the year allows pigeons extra time for breeding, so that some individuals