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Health status of free-living pigeons in the city of Santiago

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A total of 100 free-living urban pigeons (*Columba livia*) were captured in the city of Santiago, Chile, in order to evaluate, for the first time, their health status. Negligible antibody titres (1 to 3 log₂) were detected in 22% of the birds against a strain of the paramyxovirus (PMV) serotype 1. No pigeons had antibodies against PMV serotype 7 and avian influenza. *Salmonella* sp. belonging to serogroups B and D were isolated from the intestinal tract of three pigeons (3%). The protozoa *Haemoproteus columbae*, *Plasmodium* sp., and *Leucocytozoon* sp. were not detected in any pigeons. *Trichomonas gallinae* was detected in 11%, without observation of either clinical signs or gross pathological changes at necropsy. Sixty-seven percent of the birds showed the presence of the chewing lice *Columbicola columbae* and *Campanulotes bidentatus* compar, and 1% harboured the mite *Laminosioptes cysticola*. Seven species of nematodes were identified. The frequency at which each species was detected was; *Tetrameres* sp. (14%), *Capillaria annulata* (1%), *Capillaria columbae* (11%), *Capillaria obsignata* (1%), *Ascaridia columbae* (5%), *Dispharynx spiralis* (2%), and *Gongylonema ingluvicola* (2%). The class *Cestoda*, found in one pigeon, was represented by the species *Aporina delafondi*. No trematodes were detected in the sampled birds.

Introduction

The feral pigeon (*Columba livia*) population has increased in most larger cities world-wide. In Basel, a Swiss city, regulation programmes to control the 'pigeon problem' were started a few years ago (Haag-Wackernagel, 1995). Pigeons are protected by law in Chile, and permission by the governmental authorities is needed to capture them. Neither demographic nor sanitary studies of the feral pigeon population have been conducted in Santiago, the Chilean capital city of approximately 4.5 million inhabitants. During the past 5 years, more and more people have asked us about methods of controlling this population, mainly because of damage to private and/or public possessions. On the other hand, the role of pigeons in the transmission of diseases to both humans and domestic species has been well documented by different authors (Weber *et al.*, 1979; Alexander *et al.*, 1982, 1985; Haag & Gurdan, 1990; Orlandella *et al.*, 1992).

Considering the possibility that the free-living pigeon population may be a threat to the well-es-

tablished poultry industry, and because of the possible importance of these birds to human health, the aim of this study was to provide information of the sanitary status of feral pigeons in Santiago. This study considered serology to avian influenza virus and paramyxoviruses (PMV); it also considered isolation attempts of *Salmonella* sp., and the identification of external and internal parasites harboured by these birds.

Materials and Methods

Birds

One-hundred free-living pigeons (53 females and 47 males) were captured at four different locations (Nunoa, Santiago, Providencia, Pintana) of the city of Santiago (authorization number 967, 1996, Ministry of Agriculture) between March 1996 and March 1997. Birds were captured either with traps or directly from lofts by night. The specimens captured were heterogeneous in size and age. All birds were killed by chloroform inhalation and subsequent decapitation.

Sera

Blood samples were obtained before euthanasia from each bird by wing vein puncture. Sera were obtained and stored (-20°C) until

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used for serological testing. All sera were tested individually for the presence of antibodies against PMV serotypes 1 and 7, and avian influenza virus.

Haemoparasites

Fresh blood samples were obtained from each bird for the possible presence of haemoparasites. Blood smears were fixed with methanol (pH 7.0) and stained with Giemsa. Smears were evaluated under a light microscope.

Necropsy

All birds were examined for the presence of external parasites. All ectoparasites detected were sampled for subsequent identification. Birds were then necropsied and gross pathological lesions recorded.

Viral serology

Antibodies against avian PMV reference strains belonging to the serotypes 1 and 7 were tested by haemagglutination inhibition (HA) tests (Gough & Alexander, 1983). Antibody titres were expressed as the log₂ reciprocal of the highest dilution of serum inhibiting four HA units of virus. Antibody to avian influenza was tested by agar gel immunodiffusion (Beard, 1989). PMV serotype 7 and avian influenza serology were conducted at the Central Veterinary Laboratory, UK; for this purpose, all sera were lyophilized prior to submission.

Bacteriology

Approximately 200 mg faeces were obtained from the rectum of each bird for an attempt to isolate *Salmonella* sp. *Salmonella* isolation was conducted according to accepted procedures (Mallinson & Snoeyenbos, 1989) with minor modifications regarding the incubation temperature (37°C instead of 42°C) using the Rapaport—Vassiliadis broth (Baltimore Biology Laboratories, Maryland, USA), *Salmonella*—*Shigella* agar (Difco Laboratories, Detroit, USA) and McConkey agar (Baltimore Biological Laboratories). *Salmonella* identification was based on routine biochemical reactions and by agglutination with a *Salmonella* O antiserum Poly A-I and Vi (Difco Laboratories) and a *Salmonella* O antiserum group B and D (Probac, Sao Paulo, Brazil).

Parasitology

Oropharyngeal swabs were obtained immediately after the birds had been killed for the presence of *Trichomonas gallinae*; samples were mounted on slides with NaCl and examined immediately under a light microscope.

The digestive tract was divided into four segments; oesophagus-crop, proventriculus, ventriculus, and intestine. Each segment was thoroughly washed, the content stained with iodine solution, and examined for the presence of endoparasites.

Results

The results of the parameters studied in the feral pigeons are presented as a group because there were no important differences among them depending on the sampling location, age, or sex.

Avian viruses serology

Antibody titres to PMV serotype 1 were detected in 22% of the tested birds. Titres varied between 1 and 3 log₂; of which 1 log₂ was the most frequent value found (73% of the positive birds), while 3 log₂ was detected in only one bird. All serum samples were negative for the presence of anti-

bodies against the PMV serotype 7 strain and the avian influenza virus strain.

Salmonella sp. isolation

Salmonella sp. could be isolated from the intestinal tract of three pigeons (3%). One salmonella strain was identified as group B, both other strains shared antigenicity with groups B and D. No gross lesions were detected in these birds.

Protozoa

Blood smears of all pigeons were negative to *Haemoproteus columbae*, *Plasmodium* sp., and *Leucocytozoon* sp. *T. gallinae* was detected in 11% without observing either clinical signs or gross pathological changes.

External parasites

Sixty-eight percent of all birds showed varying degrees of external common parasite infestations. Sixty-seven percent of the birds showed the presence of chewing lice. As shown in Table 1, 49% of the birds harboured only one parasite species; 41% *Columbicola columbae* and 8% *Campanulotes bidentatus* compar. The remaining 18% harboured both species simultaneously. One bird (1%) showed the presence of the cyst mite (*Laminosioptes cysticola*). This bird, however, did not show any lesions either in breast or in neck muscles.

Internal parasites

Twenty-five percent of the birds showed varying degrees of roundworm (nematodes) infestations. Eight birds, 31% of the positive pigeons, harboured two to four different genus; the remaining 69% were infested by a single parasite species. One bird (1%) showed a presence of cestodes. As shown in Table 1, seven species of nematodes were identified in the sampled pigeons. The frequency of each parasite species was *Tetrameres* sp. (14%), *Capillaria annulata* (1%), *Capillaria columbae* (11%), *Capillaria obsignata* (1%), *Ascaridia columbae* (5%), *Dispharynx spiralis* (2%), and *Gongylonema ingluvicola* (2%). The class cestoda, found in one pigeon, was represented by the species *Aporina delafondi*. No trematodes were detected in the sampled birds.

Pathological changes

Only pigeons affected by *Tetrameres* sp. and *A. delafondi* showed gross pathological changes at necropsy. Pigeons affected by *Tetrameres* sp. showed haemorrhagic nodules and thickening of the wall of the proventriculus. The bird harbouring

Table 1. External and internal parasites detected in free-living pigeons (*Columba livia*) of the city of Santiago, Chile

Parasite species	Incidence (%) ^a
<i>Campanulotes bidentatus</i> compar	8
<i>Columbicola columbae</i>	41
<i>Laminosioptes cysticola</i>	1
<i>Tricomonas gallinae</i>	11
<i>Ascaridia columbae</i>	5
<i>Capillaria annulata</i>	1
<i>Capillaria columbae</i>	11
<i>Capillaria obsignata</i>	1
<i>Dispharynx spiralis</i>	2
<i>Gongylonema ingluvicola</i>	2
<i>Tetrameres</i> sp.	14
<i>Aporina delafondi</i>	1

^aPercentage of pigeons in which each parasite was detected.

A. delafondi showed a partial obstruction of the intestinal lumen.

Discussion

In the present study, we sampled 100 feral pigeons. When studying free-living birds, many external factors (animal welfare, capturing methods, laws, etc.) have a determining influence on the number of samples that can be included in the research work. In our opinion, the validity of sanitary results, particularly those obtained in free-living animal populations, are dependent not only on the number of specimens tested, but also on other important factors such as the ecological and ethological behaviour of the species, as well as the epizootiological and other characteristics of the studied pathogens, the diagnostic tools, etc. Pigeons live in communities showing a gregarious instinct. Despite their predilection for particular feeding places, they might fly to relatively distant locations and interact with specimens of other communities. Paramyxoviruses and avian influenza virus are highly contagious. *Salmonella* species are contagious in a lower degree and a large number of parasites would need a closer relationship with the target to be transmitted successfully. Based on these general aspects, we believe that the virus serology results obtained herein can be well extrapolated to the free-living pigeon population of the city, while the salmonella and the parasitology findings may vary to a lower extent within different pigeon communities.

Negligible antibody titres to PMV serotype 1 were detected in 22% of the tested birds. The results for PMV serotype 1 (Newcastle disease virus (NDV)) were expected because no outbreaks of NDV have been reported in any bird species during the past two decades in Chile. This country

has been recognized as free of velogenic NDV strains since 1992 by the US governmental office (USDA). In a radius of about 30 km from Santiago downtown, at least four medium-size chicken-layer farms are located with a total chicken population of about 450 000. Only the lentogenic B1 and La Sota NDV strains have been used by the Chilean poultry industry to vaccinate against PMV serotype 1.

The present results showed absence of antibodies against a PMV serotype 7 reference strain, a dove PMV serotype detected originally in the US (Alexander *et al.*, 1981). All birds also showed an absence of antibodies against avian influenza virus. This antibody-negative status of the pigeon population against both viruses was expected because neither PMV serotype 7 nor avian influenza have ever been diagnosed in Chile. Moreover, there are no reports of the presence of these agents in neighbouring countries. This result is also in agreement with findings in other wild bird species (Toro *et al.*, 1997).

Salmonella sp. belonging to groups B and D were isolated from the intestinal tract of three pigeons (3%) showing no gross lesions. Casanovas *et al.* (1995) detected 1.5% of salmonella-positive samples after examining 400 cloacal swabs of urban pigeons in the city of Barcelona; 66% (four isolates) were *S. typhimurium*. According to the Chilean governmental reference laboratory ISP (Public Health Institute), from a total of 917 human salmonella isolates obtained from sick persons during 1994, 84.4% belonged to salmonella serogroups B and D (Fernández, 1995). Although the number of pigeons sampled in the present study does not allow a definitive assessment of the prevalence of salmonella in the feral pigeon population of Santiago, we believe that further epidemiological studies are needed in view of the possible importance of this agent both for the commercial poultry and the human populations (Niida *et al.*, 1983).

Blood smears of all pigeons were negative to *Haemoproteus columbae*, *Plasmodium* sp., and *Leucocytozoon* sp. The specific vectors of these parasites have never been detected in Chile. However, to our knowledge, no research oriented specifically to establishing the presence of these vectors has ever been conducted in this country. On the other hand, if the prevalence of these parasites is low, the sample size of this study may have been insufficient (100 birds captured throughout a 1-year period) to assure their detection. Therefore, according to our results, we would conclude either an absence or, at least, a very low prevalence of these hematozoa in the feral pigeon population of Santiago.

In the present study, *T. gallinae* was detected in 11% without observing either clinical signs or gross pathological changes at necropsy. Ostrand *et al.* (1995) found a prevalence

of 14% for 1993 in mourning doves (*Zenaidura macroura*) in Fillmore, UT. Despite the prevalence detected by these authors, they reported the finding of only one bird with oral lesions.

Haag & Gurdan (1990) detected 85.3% of malophagian infestation in feral pigeons of the city of Basel. The present results showed 68% of all birds showed varying degrees of external parasite infestations. According to Harlin (1994), *C. columbae* is the most common malophagian parasite of pigeons. The present findings (41% infestation with *C. columbae*) agreed with this author.

According to Harlin (1994), in the US, the nematodes *Ascaridia*, *Tetrameres*, *Capillaria*, *Ornithostrongylus*, and *Dispharynx* are of concern; cestodes are occasionally encountered and trematodes are rarely. Haag & Gurdan (1990) detected 12.4% nematodes, 7.7% cestodes and 2.9% trematodes in urban pigeons of the city of Basel. The tendency of the frequencies of the different endoparasites detected in the present study were in agreement with those reports (25% nematodes; 1% cestodes; 0% trematodes) with a relative higher presence of nematodes versus cestodes and trematodes in urban pigeons. In agreement with Panigrahy *et al.* (1982), the captured pigeons infested with *Tetrameres* sp. showed varying degrees of lesions characterized by haemorrhagic nodules and thickening of the wall of the proventriculus. The partial obstruction of the intestinal lumen detected in the bird harbouring *A. delafondi* may be explained by the size of this parasite (6 cm).

The parasite species *D. spiralis*, *G. ingluvicola*, *Tetrameres* sp., and *C. obsignata* detected in the captured pigeons may be of concern since, according to Ruff (1991), they may be transmitted to commercial poultry.

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RÉSUMÉ

Statut sanitaire des pigeons de la ville de Santiago

Cent pigeons bisets (*Columba livia*) ont été capturés dans la ville de Santiago du Chili dans le but d'évaluer, pour la première fois, leur statut sanitaire. Des titres, négligeables d'anticorps (1–3 log₂) ont été détectés chez 22% des oiseaux vis-à-vis d'une souche de paramyxovirus (PMV) de sérotype 1. Aucun pigeon n'avait d'anticorps vis-à-vis du PMV de sérotype 7 ni vis-à-vis de l'Influenza aviaire. Des salmonelles appartenant aux sérogroupes B et D ont été isolées à partir du tractus intestinal de 3 pigeons (3 %). Aucun des protozoaires: *Haemoproteus columbae*, *Plasmodium* sp., et *Leucocytozoon* sp. n'ont été détectés chez aucun des pigeons.

Trichomonas gallinae a été détecté chez 11% des oiseaux sans qu'il y ait observation de symptômes ni de lésions macroscopiques lors de l'autopsie. Soixante sept pour-cent des oiseaux ont hébergé des poux broyeur *Columbicola columbae* et *Campanulotes bidentatus* et 1% d'entre eux la mite *Laminosioptes cysticola*. Sept espèces de nématodes ont été identifiées. La fréquence à laquelle chaque espèce a été détectée a été de 14% pour *Tetrameres* sp., 1% pour *Capillaria annulata*, 11% pour *Capillaria columbae*, 1% pour *Capillaria obsignata*, 5% pour *Ascaridia columbae*, 2% pour *Dispharynx spiralis*, et 2% pour *Gongylonema ingluvicola*. En ce qui concerne les cestodes, seule l'espèce *Aporina delafondi* a été observée chez un pigeon. Aucun trématode n'a été détecté dans les échantillons des oiseaux.

ZUSAMMENFASSUNG

Gesundheitszustand freilebender Tauben in der Stadt Santiago

Insgesamt 100 freilebende Stadtauben (*Columba livia*) wurden in der Stadt Santiago, Chile, gefangen, um zum ersten Mal ihren Gesundheit-

szustand zu untersuchen. Bei 22% der Vögel wurden unerhebliche Antikörpertiter ($1 - 2 \log_2$) gegen einen Stamm des Paramyxovirus (PMV) vom Serotyp 1 nachgewiesen. Keine der Tauben hatte Antikörper gegen den PMV-Serotyp 7 und aviäre Influenza. Salmonellen der Serogruppen B und D wurden aus dem Darmtrakt von drei Tauben (3%) isoliert. Die Protozoen *Haemoproteus columbae*, *Plasmodium* sp. und *Leucozytozoon* sp. wurden bei keiner einzigen Taube festgestellt. *Trichomonas gallinae* wurde in 11% der Tiere nachgewiesen, ohne dass klinische Symptome oder bei der Sektion makroskopische pathologische Veränderungen festzustellen waren. Siebenundsechzig Prozent der Vögel waren mit den Federlingen *Columbicola columbae* und *Campanulotes bidentatus* (compar) befallen und 1% hatte die Milbe *Laminosioptes cysticola*. Sieben Nematodenarten wurden nachgewiesen. Die Nachweishäufigkeit der einzelnen Arten war: *Tetrameres* sp. 14%, *Capillaria annulata* 1%, *Capillaria columbae* 11%, *Capillaria obsignata* 1%, *Ascaridia columbae* 5%, *Dispharynx spiralis* 2% und *Gongylonema ingluvicola* 2%. Die in einer Taube festgestellte Klasse *Cestoda* war durch die Spezies *Aporina delafondi* vertreten. In den untersuchten Vögeln waren keine Trematoden nachweisbar.

RESUMEN

Estado sanitario de los palomas de vida libre en la ciudad de Santiago

Se capturó un total de 100 palomas (*Columba livia*) de vida libre en la ciudad de Santiago (Chile), con la finalidad de evaluar su estado sanitario. Se detectaron cantidades insignificantes de anticuerpos ($1-3 \log_2$) contra una cepa de paramyxovirus (PMV) serotipo 1. Ningún paloma presentaba anticuerpos contra PMV serotipo 7 e influenza. A partir del tracto intestinal de tres palomas (3%) se aisló *Salmonella* sp. perteneciente a los serogrupos B y D. No se detectaron los protozoos *Haemoproteus columbae*, *Plasmodium* sp., y *Leucozytozoon* sp. en ninguno de los palomas. Se detectó *Trichomonas gallinae* en un 11% de éstos, aunque sin observación de sintomatología clínica ni lesiones macroscópicas en la necropsia. Un sesenta y siete por ciento de las aves manifestaron la presencia de los piojos masticadores *Columbicola columbae* y *Campanulotes bidentatus*, y un 1% era portador de el ácaro *Laminosioptes cysticola*. Se identificaron siete especies de nematodos; éstas, se observaron con la siguiente frecuencia: *Tetrameres* sp. (14%), *Capillaria annulata* (1%), *Capillaria columbae* (11%), *Capillaria obsignata* (1%), *Ascaridia columbae* (5%), *Dispharynx spiralis* (2%), y *Gongylonema ingluvicola* (2%). La clase cestoda se detectó en un paloma, concretamente la especie *Aporina delafondi*. No se detectaron trematodos en las aves muestreadas.