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# REGULATION OF POPULATION SIZE OF STREET PIGEONS IN LJUBLJANA, SLOVENIA

DOBEIC M

*Faculty of Veterinary Medicine, University of Ljubljana*

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*Problems related to street pigeons in cities are relevant from the aspect of environmental hygiene, as well as the epizootic risk. In Ljubljana, Slovenia, a research study is being performed with the purpose of reducing the number of pigeons by contraception and to achieve improvement in the health status of the population. A total of 2038 pigeons were supplied with hormonally treated maize Ornisteril® (Virbac) daily during the intensive mating season at several feeding sites in Ljubljana. 293 birds were caught for clinical, parasitological, microbiological and serological examinations of the health status of the pigeon population in Ljubljana. The results of the treatment with Ornisteril® show that the number of pigeons in the wider city centre was decreased by 24.3% in three years. A strong infestation of ecto- and endoparasites, mostly Columbicula columbae and Trichomonas gallinae was present. The immunological reactivity of pigeons to Chlamydophila psittaci, was examined and it was shown that the number of positive reactors decreased by 23% to 11.8%. No clinically diseased pigeons were found. Analyses to determine the presence of Salmonella sp., indicated 4.3% (6 cases) incidence of isolation of Salmonella strain bacteria in pigeons in 2000, i.e. S. sinthia. In one case S. typhimurium was isolated from the cloacal smear. In 2001 no bacteria of the strain Salmonella were found in pigeons.*

*Key words: street pigeon (Columba livia domestica), contraception, health status, Ljubljana, Slovenia*

## INTRODUCTION

The street pigeon, *Columba livia domestica,* is a subspecies of the domestic pigeon living free in the urban environment. It is also called *Columba livia, forma urbana.* The urban environment and some rural areas are ecological niches for pigeons, where they live in close cohabitation with man (Dobbertin, 1975). The biology and ethogram of pigeons living in cities have been adapted to the environment, which offers extremely favourable conditions for irrepressible growth of the pigeon population. This results in excessive populations, as well as an impaired balance between population size and conditions in the environment (Haag, 1991). Considering their adaptability and capability of fast reproduction – usually, a monogamous couple has 6-11 young each year – street pigeons represent a relatively high potential epizootic risk, particularly with regard to the transmittability of *Chlamydophila psittaci* and *Salmonella sp*. to man (Vućmilo *et al*., 1989, Dovč, 1998).

Pigeons breed all year round allthough most young pigeons are hatched in the spring and fewest in late autumn. Pigeons live for 2.4-2.9 years (Haag, 1990). Most pigeons live in city centres where their number is 50% higher than in peripheral areas, where living conditions are less favourable. City centres with the highest density of pigeons will have the most infected pigeons. In addition, street pigeons pollute the environment with their faeces (Kosters and Korbel, 1997). Therefore, the pollution of a specific environment, particularly in city centres and areas of special protection, and the epizootic risk are reasons for monitoring and controlling the number and health of pigeon populations. There are various approaches to this control, but most often measures include mechanical protection of buildings, a ban on feeding pigeons, egg collection, repelling of pigeons (Dobeic and Pintarič, 1996), and contraception (Vater, 1999). Some experiments with cytostatic drugs have also been carried out (Arbeiter *et al*., 1975). Contraception is one way to reduce the population of street pigeons (Vater, 2000). Research hitherto and experience show that in a few years the population can be reduced by as much as 30%. The use of hormone - treated maize (Ornisteril®) results in a reduction of female pigeon fertility. This measure is being taken in Ljubljana, the capital of Slovenia, as a research project carried out with general agreement of the public and societies for animal protection, and including the financial support of the Municipal Community.

## MATERIALS AND METHODS

### *Feeding sites and feeding*

Based on field observations of the sites, number of pigeons, accessibility to food and water, and nesting places, it was decided where sites intended for feeding pigeons with Ornisteril® Virbac (France) should be located. We selected areas where flocks of pigeons stay during their morning feeding.

The Ornisteril® maize, 30g per pigeon, was put down between 8 a.m. and 2 p.m at the selected feeding sites every day. The Ornisteril® maize is a feeding mixture ready for use. Its active substance is progesterone: 10 mg of progesterone is bound to 100 g of maize (0.01%). The number of pigeons in the flock was counted or estimated each time at each site. The Ornisteril®, which was not eaten, was removed and weighed at each feeding site separately. Over 3 years, 17 feeding sites were supplied every day in a regular sequence, i.e. at a regular time. Pigeons were treated from the first warm period in the spring, when the intensive mating season begins in February or March, up to July, and then from the end of August to the autumn frost, when mating intensity decreases. The number of feeding days, depending on weather conditions, should be at least 150 days, which we defined every year separately.

*Number of pigeons*

The population size was defined on the basis of observations and analyses of the documented material by using video and photographic equipment. The data collected were presented as figures, and daily activity of pigeons in flocks of was established at the feeding sites monitored. The number of pigeons was established every year before the start of Ornisteril® treatment and after the end. Pigeons in flocks of up to 100 birds were counted every day separately. Otherwise their number was counted by the help of photo documentation.

*Surveying general condition and health status in pigeons*

To establish the general condition and health status of the pigeon population we caught 14% of the population at certain feeding sites. The birds were then examined and the results analysed. The pigeons were caught in nets and after the examination, they were set free. Each pigeon was weighed and clinically examined. The following data were recorded:

- feeding status
- age on the basis of phenotypic characteristics (pupil, wax gland, primary and tail feather, shape of head)
- presence of injuries
- possible signs of disease
- possible feather damage and ectoparasites.

The following samples were taken from each pigeon:

- faeces samples for endoparasite examination
- cloacal smear for *Salmonella* and *Chlamydophila psittaci* examination
- oropharyngeal smear for *Trichomonas* examination
- blood samples from the wing vein to detect the presence of antibodies against *Chlamydophila psittaci*

The presence of *Chlamydophila psittaci* was established by means of an EIA test (Clearview Chlamidia test, Unipath Limited, England). The presence of Ig-G antibodies against C. psittaci was detected by indirect immunofluorescence (IIF).

*Salmonella sp* were diagnosed on the basis of incubation in a tetrathionate culture at 37°C for a period of 20 to 24 hours. Colonies were transplanted to XLD and Rambach agar, and then they were incubated for the following 20 to 24 hours at 37°C. Suspicious colonies were transplanted to a selective agar according to Drigalski. Blue S colonies were determined by API 20 E (Biomerieux), and particular O and H serovars by "slide agglutination".

Ectoparasites were examined under the light microscope and endoparasites in faeces by means of the floatation method, sedimentation method and Whitlock method. Oropharyngeal smears were examined for *Trichomonas gallinae* under the light microscope.

## RESULTS

On the average 2038 (depending on the year) pigeons were fed at 17 feeding sites for a period of three years (1999-2001). Research work was oriented to feeding sites A, B, C, and D. These sites are locations in the wider centre of Ljubljana. Site A was an urban area including 5 different feeding sites in the city centre, site B was 1 feeding site, 2 km to the north of the city centre, site C was an urban area with 1 feeding site, 3 km to the north-west of the city centre, site D was 1 feeding site 1 km to the south-east of the city centre. A total of 35.3 g of treated maize (Ornisteril®) was consumed per pigeon per day, which means that mean consumption of hormone was 3.53 mg per pigeon per day.

*Decrease in the number of pigeons*

Pigeon counts before the beginning of adding hormone-treated maize to the food and after the end of the last season, showed that the number of pigeons in flocks at the feeding sites (A, B, C, D) in urban areas decreased in total by 24.3% (Table 1).

Table 1. The size of pigeon flocks at different feeding sites in Ljubljana, at the beginning of the project in 1999 and at the end of 2001

| Urban area | Year 1999 (N) | Year 2001 (N) | Variance between 1999 and 2001 (%) |
|---|---|---|---|
| Site A | 794 | 688 | -13.3 |
| Site B | 90 | 94 | +4.4 |
| Site C | 245 | 72 | -70.6 |
| Site D | 178 | 135 | -24.2 |
| Total | 1307 | 989 | -24.3 |

*The age of the pigeons*

Pigeons that were caught at feeding sites A, B, C, D and randomly on the other 9 feeding sites were divided into those younger than one year and those of one year or older. In 2000 the share of birds younger than one year amounted to 22.3% (N=31 out of 139), whereas the share of birds one year old or older was 77.6 % (N=108 out of 139). In 2001 the share of birds younger than one year amounted to 40.7% (N=62 out of 152), whereas the share of birds one year old or older was 59.2 % (N=90 out of 152) (Table 2).

Table 2. The estimated share of pigeons less than 1 year old or older at different feeding sites

| Year | Site | >1 year old | | <1 year old | |
|---|---|---|---|---|---|
| | | N | % | N | % |
| 2000 (N=139) | A | 65 | 72.2 | 25 | 27.8 |
| | B | 10 | 83.3 | 2 | 16.7 |
| | D | 10 | 90.9 | 1 | 9.1 |
| | Other* | 23 | 88.5 | 3 | 11.5 |
| 2001 (N=152) | A | 29 | 53.7 | 25 | 46.3 |
| | B | 6 | 85.7 | 1 | 14.3 |
| | D | 12 | 75.0 | 4 | 25.0 |
| | Other* | 43 | 57.3 | 32 | 42.7 |

* Other – feeding site C and random sample

*Condition*

The condition of the pigeons was estimated by assessing their appearance and by weighing them. Mean body mass of the pigeons in both 2000 and 2001 was 308 g including birds of all ages and both sexes. The body mass between compared groups of pigeons on the feeding sites A, B, D and other, was significantly different ($p<0.05$) through 2000 and 2001. Most birds appeared to be healthy except those strongly infested with ectoparasites.

*Ectoparasites*

The degree of infestation with previously defined ectoparasites is shown in Table 3.

Table 3. The number of infested birds and the degree of infestation with ectoparasites

| Degree of infestation | Number of cases and share (%) | Year 2000 (N=139) | | | | Year 2001 (N=152) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | D | Other* | A | B | D | Other* |
| 0 | N | 38 | 5 | 1 | 3 | 10 | | 3 | 12 |
| | % | 42.2 | 41.7 | 9.1 | 11.5 | 18.5 | | 18.8 | 16.0 |
| + | N | 40 | 7 | 9 | 18 | 40 | 6 | 12 | 58 |
| | % | 44.4 | 58.3 | 81.8 | 69.2 | 74.1 | 85.7 | 75.0 | 77.3 |
| ++ | N | 11 | | 1 | 5 | 4 | 1 | 1 | 5 |
| | % | 12.2 | | 9.1 | 19.2 | 7.4 | 14.3 | 6.3 | 6.7 |
| +++ | N | 1 | | | | | | | |
| | % | 1.1 | | | | | | | |

* Other – feeding site C and random sample

The following strains of external parasites were detected: *Columbicula columbae, Goniocotes spp., Campanulotes spp., Lipeurus spp.* The most frequent external parasite in pigeons was *Columbicula columbae*. All parasites belonged to the order Mallophaga. Their presence induces discomfort and damage to the feathers. The strength of infestation was graded from 0 (“no damage to feathers”), to +++ (“serious damage to feathers”). We observed that most pigeons were infested mildly in 2000 (53.2%, N=74) and 2001 (76.3%, N=116), some birds more seriously in 2000 (12.2%, N=17) and 2001(7.2%, N=11), and just one pigeon very seriously in 2000. There were no significant ($p>0.05$) differences in the infestation level between different feeding sites or different years.

*Endoparasites*

Table 4 shows the number of pigeons from which *Trichomonas gallinae* was isolated from tracheal smears.

Table 4. Isolation of *Trichomonas gallinae* from tracheal smears

| | | 2000 (N=141) | | | | 2001 (N=152) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | D | Other* | A | B | D | Other* |
| Negative | N | 87 | 12 | 9 | 23 | 19 | 1 | 4 | 29 |
| | % | 94.6 | 100.0 | 81.8 | 88.5 | 35.2 | 14.3 | 25.0 | 38.7 |
| Positive | N | 5 | | 2 | 3 | 35 | 6 | 12 | 46 |
| | % | 5.4 | | 18.2 | 11.5 | 64.8 | 85.7 | 75.0 | 61.3 |

*Other – feeding site C and random sample

A positive reaction occurred in 10 out of the 141 pigeons caught, which is 7.0 % of the animals examined in 2000. In 2001 a positive reaction was established in 99 out of 152 (65.1%) birds examined. A significant ($p<0.05$) proportional relation was found between the degree of infestation with ectoparasites and the isolation of *Trichomonas gallinae* from tracheal smears. A similar significant relation ($p<0.05$) was found between the age and the isolation of *Trichomonas gallinae.*

*Chlamydophila psittaci*

After examining the flock, clinical symptoms of *Chlamydophila psittaci* infection were not found. Serologically a positive reaction was established in 33 out of 141 pigeons caught, which is 23.4 % of all the birds examined in 2000 (Table 5., Figure 1.). In 2001 a serologically positive reaction occurred in 18 (11.8 %) out 152 of the birds examined (Table 5., Figure 1.) In 14 (9 %) pigeons, titers of 1:20 were established, which was defined as a questionable reaction. The number and share of serologically positive cases including titres are shown in Table 6 and Figure 2.

Table 5. The absolute and relative number of pigeons serologically positive to *Chlamidophila psittaci*

| | Serologically positive cases | | | |
|---|---|---|---|---|
| | Year 2000 | | Year 2001 | |
| | N | % | N | % |
| Site A (N=92/54) | 19 | 20.7 | 6 | 11.1 |
| Site B (N=12/7) | 4 | 33.3 | | |
| Site D (N=11/16) | 3 | 27.3 | 1 | 6.3 |
| Other sites together (N=26/75)* | 7 | 26.9 | 11 | 14.7 |
| TOTAL (N=141/152) | 33 | 23.4 | 18 | 11.8 |

(N=number of examined pigeons:2000/2001)
*Other – feeding site C and random sample

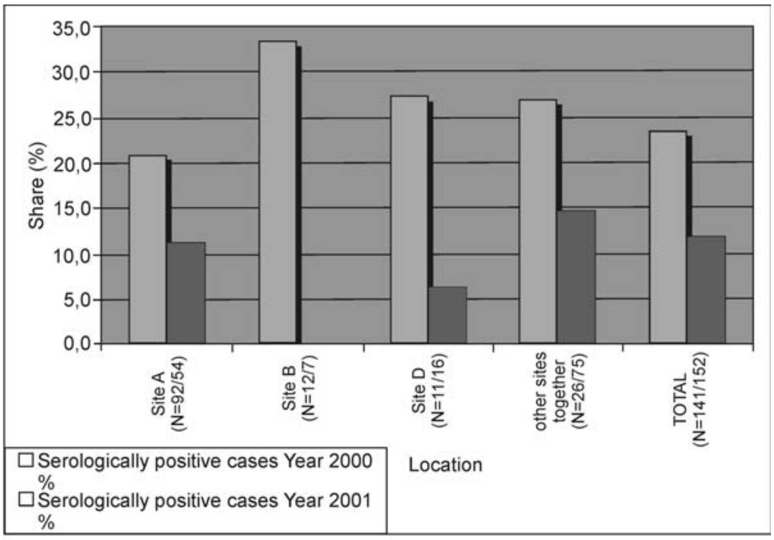


Figure 1. Serologically positive cases of *Chlamydophila psittaci* in pigeons by different feeding sites
*Other – feeding site C and random sample

Table 6. The relative number of positive cases showing different serological titers for *Chlamydophila psittaci*

| % | Year 2000 (N=141) | | | | Year 2001 (N=152) | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | D | Other | A | B | D | Other |
| Negative | 79.3 | 66.7 | 72.7 | 76.9 | 83.3 | 100.0 | 87.5 | 72.0 |
| 1:20 | | | | | 5.6 | | 6.3 | 13.3 |
| 1:40 | 12.0 | 33.3 | 27.3 | 19.2 | 1.9 | | | 4.0 |
| 1:80 | 4.3 | | | 3.8 | 5.6 | | 6.3 | 5.3 |
| 1:160 | 2.2 | | | | 1.9 | | | 5.3 |
| 1:320 | 2.2 | | | | | | | |
| 1:640 | | | | | 1.9 | | | |

*Other – feeding site C and random sample

There were no significant (p>0.05) differences in the number of serologically positive reactors for *Chlamydophila psittaci* between the years or groups of animals at feeding sites A, B, D, and other.

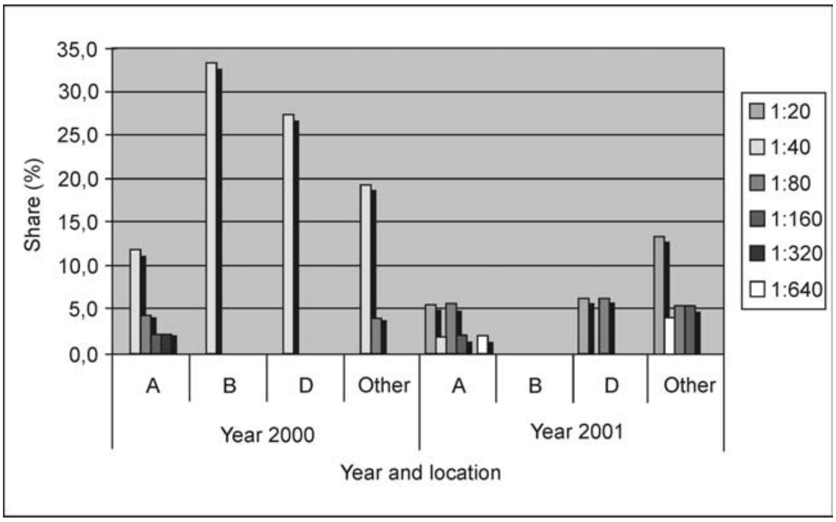


Figure 2. The share of positive reactions for *Chlamydophila psittaci* at different feeding sites in 2000 and 2001

*Other – feeding site C and random sample

*Salmonella spp.*

In 2000, analyses for the presence of *Salmonella spp*. in pigeons on feeding sites A, B, C, D and other revealed bacteria of the *Salmonella* strain, i.e. *S. sinthia* in 4.3 % (6 out of 141 pigeons). In one case, *S. typhimurium* was isolated from a cloacal smear. In 2001, we found no bacteria of the *Salmonella* strain.

## DISCUSSION

The problems related to controlling and monitoring the population of street pigeons involve many factors, the most important of which are public opinion, legal protection of animals, difficulty of executing work, long duration of the investigation until the first achievements are identified, and the high costs involved. Any achievement ensues only if all the activities are carefully planned and interconnected. Individual, locally limited attempts, such as repelling and catching pigeons, and protection of buildings and monuments are only partial and temporary solutions. The street pigeon population can only be reduced at the level of the entire local community, city or a wider rural environment (Kosters and Korbel, 1997).

In our research study, which involved the treatment of pigeons with Ornisteril® in Ljubljana, Slovenia, we have obtained certain findings. We treated 2038 pigeons at 17 feeding sites, depending on the different states of pigeon flocks each year. We constantly monitored 8 feeding sites (A, B, C, D), and randomly an other 9 feeding sites. In addition to systematic contraception we carried out additional activities, including informing the public and partial restriction of general feeding of pigeons by bird lovers. We thus accomplished a reduction in the mean number of pigeons in the wider city core by 24.3 %. We were also interested in the proportion of younger pigeons to those older than one year, which was the only possible criterion for determining the age of the birds. Considering the anticipated results of the contraception treatment we expected a reduction in the number of pigeons younger than one year. On average we found that the share of pigeons younger than one year increased from 22.3% to 40.7% between the years 2000 to 2001. This is an important conclusion which seems illogical, but we can explain it by the strong exchange of the older generation with the young one. Since Ornisteril® reduces the population in the best situation by only 30%, the rest of the young generation could develop normally. Many questions appear about other influences on the success of Ornisteril® treatment, which should be explained in the future. Thus in the first three years of treatment, the results are still preliminary.

We also found that the condition of the pigeons was improving from year to year: the mean body mass of the pigeons was 308 g, including birds of all ages and both sexes. Significant differences ($p<0.05$) occured between compared groups of animals through the years 2000 and 2001.

The behaviour of the pigeons also changed as the result of everyday feeding. Small groups of only a few pigeons started to unite into larger flocks (Haag, 1994, Kos, Dobeic, 2000), which improved the efficiency of the treatment. In this trial, Ornisteril® represented a constant source of food, which visually characteristically improved the general condition of the sample population of pigeons.

Although the pigeons showed no clinical signs of the investigated diseases before the treatment, the results indicated a lower proportion of infectedness (*Chlamydophila, Salmonella)*, which can be explained by increased immunity of the pigeon population.

Comparing the presence of parasitic agents we found that most pigeons were infested mildly in 2000 (53,2%, N=74) and 2001(76.3%, N=116) with the external parasites *Columbicula columbae, Goniocotes spp., Campanulotes spp.* and *Lipeurus spp.*

Positive reactions for the endoparasite, Trichomonas gallinae, occured in 10 out of 141 pigeons (7.0 %) in 2000, and 99 out of 152 (65,1%) in 2001.

There was a significant ($p<0.05$) proportional relation between the degree of infestation with ectoparasites, and the age, and the isolation of *Trichomonas gallinae* from tracheal smears. The latter is connected with a decrease in general immunity and the susceptibility of pigeons highly infested with ectoparasites.

The reason for the much stronger infestation of pigeons in the second year of investigation may be the bigger share of the young population, in which immunity is not so well developed as in the older population.

*Chlamydophila psittaci* antibodies were detected in 33 of 141 pigeons caught in the first year (23.4 %). During 2001, 11.8 % of the birds examined had a positive serological reaction. Thus the immunologic reactivity to *Chlamydophila psittaci* in pigeons is not always a reliable criterion of the flock infectedness. A low antibody titre can indicate healed old infections, but on the other hand it may also indicate intestinal infections and a lack of systemic response to the presence of bacteria. In stressful situations and other simultaneous infections they can penetrate the blood and cause a systemic infection (Dovč *et. al*., 2001)

*Salmonella sp*. *S. sinthia* were isolated in 4.3 % (6 cases) of the pigeons in 2000. In one case *S. typhimurium* was isolated from a cloacal smear. In 2001, we found no bacteria of the *Salmonella* strain. This denotes a low epizootic risk. Since samples were taken only from cloacal smears and not from the intestines as well, which could have been done only if the birds had been killed, we should probably anticipate a higher rate of infection. Regular and hygienic food as represented in by Ornisteril® may help avoid the infections and increase the immunity of the birds.

We found that the pigeons were not infected with diseases hazardous for human health, but they were highly infested with intestinal parasites, which may indicate reduced immunity and consequently higher susceptibility to other agents, including the pathogens of zoonoses.

## CONCLUSIONS

Unfortunately all the results are still preliminary and the research work is continuing. Because of the very large and heterogeneous polygon, characterised by urban areas in different locations in the city of Ljubljana, it was very difficult to put some urban places (feeding sites) at the same level as others. Moreover, the conditions for research work and treatment changed very often. We tried to feed all the pigeons equally, so that all the birds had a meal, irrespective of their condition, rank, sex, or age. We found that regular feeding with Ornisteril® improved the general condition of the pigeon population in Ljubljana, by observing that there were many fewer poor looking and exhausted pigeons when the situation at the beginning of the research and that in 2001 were compared. Infectious diseases caused by *Chlamydophila psittaci* and *Salmonella sp.* decreased in the last year of research, while parasitic diseases increased. It was assumed that the reason was the increased share of young pigeons more susceptible to parasitic invasions in comparison with older generations. All those assumptions should be confirmed or disproved by further research.

The application of hormone-treated maize in practice showed efficiency in pigeon population reduction, but we believe that it needs support by other actions, such as collecting eggs and a feeding ban. Namely, Ornisteril® treatment should not be used alone as an independent measure.

Address for correspondence:
doc. dr. Martin Dobeic,
Institute of Environmental and Animal Hygiene with Ethology,
Faculty of Veterinary Medicine, University of Ljubljana,
Gerbičeva 60, 1000 Ljubljana, Slovenia,
Martin.Dobeic@vf.uni-lj.si

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## REGULACIJA BROJNOSTI POPULACIJE GRADSKOG GOLUBA U LJUBLJANI, SLOVENIJA

DOBEIC M

## SADRŽAJ

Problematika prisustva golubova u gradovima ogleda se u higijeni okoline a isto tako u vidu epizootiološkog rizika. U Sloveniji (Ljubljana) je u toku postupak smanjenja broja golubova i poboljšanja zdravstvenog stanja populacije kontracepcijom. U periodu intenzivnog parenja u Ljubljani je prosečno 2038 golubova dnevno tretiranio Ornisterilom® (Virbac). Radi sticanja uvida u zdravstveno stanje populacije golubova u Ljubljani uhvaćeno je 293 primeraka i vršena su klinička,

parazitološka, mikrobiološka i serološka ispitivanja. Tretman Ornisterilom® je za tri godine doveo do smanjenja broja golubova u širem gradskom centru za 24,3%. Ustanovljena je jaka infestacija sa endo- i ektoparazitima a najviše su bili zastupljeni *Columbicula columbae i Trichomonas gallinae.* Utvrđivanjem imunološke reaktivnosti golubova na *Chlamydophila psittaci* ustanovili smo sniženje broja pozitivnih reaktora sa 23% na 11,8%. Klinički obolelih golubova nije bilo. Prisutnost *Salmonelle spp.* kod golubova u 2000 godini iznosila je 4,3 %. Uglavnom je Izolovana *S. sinthia* a kod jenog goluba je iz kloakalnog brisa izolirana *S. typhimurium.* U 2001. godini kod golubova nismo ustanovili bakterije iz roda *Salmonella.*