Parasites in the city

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Introduction

Urbanization is an ongoing worldwide process which occurs at a growing rate. Half of the human population now lives in cities and the UN World Urbanization Prospects report predicts that 60% of the habitants of our planet will reside in urban environment by 2030 (UNPD 2005), leading to a dramatic increase of urban centers size. This severe change of land-use is expected to have a considerable impact on ecosystems, wildlife biodiversity and animal ecology. Although studies have documented demographic changes in wildlife resulting from urban development, only recently have the physiological consequences of urbanization been examined. For example, a crucial factor that was seldom considered is the health and/or parasitic rate of urban populations compared to rural ones.

Here, we monitored the degree of gut infection by coccidian parasites in male house finches (*Haemorhous mexicanus*) in eight sites along a gradient of urbanization in the Phoenix metropolitan area. Coccidians (genus *Isospora*) are protozoans single-celled obligate parasites that infect the gut of their hosts. In addition, we measured the degree of urbanization by quantifying the human population density in a 1km radius around each of our trapping sites. Our prediction was that urban birds may experience some chronic stress which may negatively impact their immunity and increase their infection by parasites.

Methods

In August and September 2011, 160 male house finches were trapped (N=20 birds per site). Birds were trapped in downtown Phoenix, Estrella Mountain Regional Park, Gilbert, Chandler, South Mountain Regional Park, Mesa, The Phoenix Zoo and the Arizona State University campus (Figure 1.).

The oocysts of coccidia are deposited in the fecal material of the host ready to infect the next host. Thus, analysis of fecal matter for oocysts provides insight into the level of infection by coccidians inside the host. Fecal samples were collected in the afternoon upon capture and preserved in 1mL of 2.2% potassium dichromate (Brawner *et al.* 2000). Samples were floated in a formaldehyde-sugar solution and centrifuged for 8 minutes at 2100 rpm. Samples were estimated under a microscope from a scale of 0-5: 0= absence of oocysts; 1=1-10 oocysts; 2=11-100 oocysts; 3=101-1000 oocysts; 4=1001-10,000 oocysts; 5=greater than 10,000 oocysts.

Population density around survey sites was estimated from 2010 US Census data. Total population around study sites was estimated from the aggregate population in census blocks encompassed in 1-km radius circles around survey points. The population in census blocks at the outer edge of the buffer area that were bisected by the circle perimeter was estimated from the ratio of block area within the circle relative to the total block area.

Figure 1. Location of field sites across the Phoenix Metropolitan area

Figure 2. Coccidian load in relation to the human population density in the 1km radius around each trapping sites

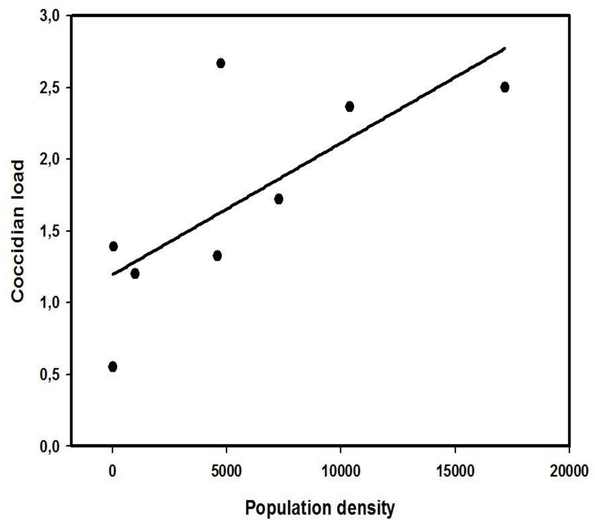

Figure 3. Male house finch (*Haemorhous mexicanus)*

Results

In this study, the coccidian loads were highly variable (Figure 2.) between sites with a minimum infection load of 0.55 in Estrella Mountain Regional Park (the most rural site) and a maximum of 2.67 in Chandler. In addition, coccidian load was significantly correlated with the degree of urbanization measured by the human population density around each trapping sites ($F_{1, 6}=7.01$, $P=0.04$).

Discussion

The result of this study shows for the first time a positive and significant relationship between the rate of urbanization and the parasite load along a gradient of urbanization in animals. Two non exclusive hypotheses may explain this result. First, the higher density of birds in urban areas may elevate the transmission of parasite by direct contact or oral-fecal routes. In addition, aggregation of resources in cities (feeders, human waste…) attracts high density of birds in some specific areas and may accentuate this phenomenon (Bradley & Altizer, 2006). Second, the chronic stress (hormonal and oxidative stresses) potentially experienced by urban birds may have significant effects on their immunity and susceptibility to parasites.

Continued urbanization could put wildlife at risk for increased infection and disease transmission. Thus, understanding how the host-parasite interaction is affected in urban environments is crucial in order to design better conservation attempts to protect wild organisms.

References

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Thanks to Birdzilla.com for the picture
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Thanks to Google.com for map of Phoenix Metropolitan area
http://maps.google.com/

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