Published by Associazione Teriologica Italiana
Hystrix, the Italian Journal of Mammalogy
Volume 25 (2): 121–123, 2014
OPEN ACCESS
Available online at:
http://www.italian-journal-of-mammalogy.it/article/view/10992/pdf
doi:10.4404/hystrix-25.2-10992

Short Note

Alien rose-ringed parakeets (*Psittacula krameri*) attack black rats (*Rattus rattus*) sometimes resulting in death

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Keywords:
Invasive species
parrots
impacts
urban predators

Article history:
Received: 18 November 2014
Accepted: 22 December 2014

Acknowledgements
We thank the staff of García Sanabria Park, María Luisa Park and Royal Alcázar of Seville for allowing us access to these enclosures. Thanks to Emiliano Mori for comments that improved the manuscript. Field work was supported by Fundación Repsol and the Spanish Ministry of Economy and Competitiveness (project AIC-A-2011-0706). The authors would like to acknowledge the support provided by the ParrotNet COST – European Cooperation in Science and Technology- Action, allowing fruitful discussions on data provided in this paper.

Abstract

The rose-ring parakeet (*Psittacula krameri*) is one of the most successful invasive birds in its establishment worldwide. Studies addressing its potential impact on native biota mostly focus on birds and little is known about how these and other parakeet species interact with native mammals. Here, we report 21 aggressions of rose-ringed parakeets towards black rats (*Rattus rattus*) in urban parks in Seville (Southern Spain) and Tenerife (Canary Islands). Either solitary parakeets or, more often, groups of up to 18 attacked rats when they climbed trees close to parakeet nests. Most attacks ended when the rats descended to the ground. However, in two instances (9.5 % of the aggressions) the attacks resulted in the death of the rats as a result of falling to the pavement. These observations add further complexity to a biological invasion, where introduced parakeets have negative impacts on a predator and thus, some native bird species may benefit from their antipredator behavior. More attention should be paid to the interactions between native mammals and the non-native parakeets introduced worldwide.

Biological invasions are considered among the main causes of biodiversity loss (Clavero and García-Berthou, 2005). Since the mid-twentieth century, the introduction of exotic species has accelerated at an alarming rate (Hulme, 2009), mainly as a consequence of international trade (Meyerson and Mooney, 2007). Wild birds are among the most commonly traded vertebrate taxa (Carrete and Tella, 2008a), with a number of species having been accidentally introduced in recent times (Carrete and Tella, 2008b; Blackburn et al., 2010). Among these, parrots are one of the most heavily traded groups, mainly because of their attractiveness as pets (Tella and Hiraldo, 2014). Thirty-eight percent of birds offered for sale in Spanish pet shops between 2004 and 2005 were parrots belonging to 72 different species (Carrete and Tella, 2008b). Not surprisingly, several parrot species have established non-native populations worldwide (Lever, 2005; Menchetti and Mori, 2014).

Introduced parrots may have a variety of ecological and economic impacts (Menchetti and Mori, 2014). Regarding ecological impacts, most research focuses on how introduced parrots affect native avifauna (e.g., Strubbe and Matthysen, 2007, 2009; Hernández-Brito et al., 2014). However, very little information is available on how they interact with native mammals. Mori et al. (2013) observed red squirrels preying on chicks at two rose-ringed parakeet (*Psittacula krameri*) nests, while an adult Barraband's parakeet (*Polytelis swainsonii*) was responsible for the death of an adult red squirrel (*Sciurus vulgaris*) in Italy. Another report documents rose-ringed parakeets killing an adult red squirrel in France (Clergeau et al., 2009). More recently, Menchetti et al. (2014) recorded a fatal attack by a rose-ringed parakeet of a Leisler's bat (*Nyctalus leisleri*) in Italy. Here, we report several cases of rose-ringed parakeets attacking and even causing the death of black rats (*Rattus rattus*) in Spain.

Observations of aggressions by non-native rose-ringed parakeets towards black rats were made in 2011, 2012, 2013 and 2014 in urban parks of Seville (Southern Spain), and Santa Cruz de Tenerife (Canary Islands). The two parks in Seville in which aggressions were recorded were Royal Alcázar (37°23′1.8″N / 5°59′29.6″W) and María Luisa Park (37°22′31.57″N / 5°59′19.59″W). Rose-ringed parakeets breed in both parks, with María Luisa Park holding the largest breeding nucleus in Seville (159 active nests in 2013; Hernández-Brito et al., 2014). Observations in Santa Cruz de Tenerife were made at García Sanabria Park (28°28′19″N / 16°15′13″W), where the breeding population of rose-ringed parakeets reached 12 pairs in 2014 (D. Hernández-Brito, unpubl. data).

We observed 21 aggressions and attacks of rose-ringed parakeets on black rats, 16 in Seville and 5 in Tenerife. Interactions occurred when rats climbed trees where rose-ringed parakeets were nesting or trees in the vicinity of nests. When a rat was detected (Fig.1), rose-ringed parakeets first emitted loud alarm calls and then chased and attacked the rat using physical aggressions, sometimes biting it and producing visible wounds. All observed attacks were of solitary rats. Attacks were carried out by solitary parakeets or, more frequently, by groups of up to 18 individuals recruited from the surrounding breeding pairs (Fig.2A). In most cases, parakeets stopped the attack when rats escaped and descended or fell to the ground. Attacks caused the death of two rats in María Luisa Park. In the first event, a rat fell to the ground from a height of 15 meters when it was attacked by five rose-ringed parakeets in the treetops of a London plane. The rat fell directly onto the pavement, dying upon impact. The second rat died under similar circumstances; the rat

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was on a London plane with a rose-ringed parakeet nest and was attacked by six parakeets, failed to hold on to the branches and fell to the pavement from a height of 12 meters.

The number of observations as well as the time of the day at which they were recorded suggests that attacks by rose-ringed parakeets towards rats are not anecdotal, but rather a difficult to observe behavior. Our observations were mostly carried out during scheduled field-work aimed to assess interactions between rose-ringed parakeets and native avifauna (Hernández-Brito et al., 2014), so most attacks were recorded in the morning or early afternoon (Fig.2B). In the twilight hours, rose-ringed parakeets gather in large flocks and leave for the roost (Pithon and Dytham, 1999; Hernández-Brito and Luna, unpubl. observ.). Only breeder females stay in their nest over night when their pairs return to the communal roost in the breeding season (Butler, 2003). Therefore, we expect more attacks would have been recorded if our observations included the crepuscular period before parakeets return to the roost, given the nocturnal behavior of rats (Hooker and Innes, 1995; Cox et al., 2000).

Rats (Rattus sp.) are often invasive predators, and their negative effects on native and endemic avifauna in oceanic islands are well known Atkinson (1985); Traveset et al. (2009). On the other hand, urbanization changes the abundance and richness of predator communities Chace and Walsh (2006), and thus rats can reach high population densities in the cities McKinney (2008). They can wipe out small populations of exotic parrots, as Scortecci (1953) recorded in the vicinity of a zoo in Italy, where a colony of monk parakeets (*Myiopsitta monachus*), the first established in this country (Spanò and Truffi, 1986), ceased to exist as a result of rat predation on parakeet eggs and chicks. At this point, and although we do not have direct evidence in the wild, black rats are potential predators of rose-ringed parakeet nests and even of adults (while incubating or sleeping, as has been recorded in captivity; J.L. Tella and M. Carrete, unpubl. observ.), so these aggressions may serve the same purpose as attacks on red squirrels, also known predators of parakeet nests (Mori et al., 2013). This aggressive behavior, along with the aggressiveness of rose-ringed parakeets towards avian predators, could explain why the nests of some bird species are aggregated in the proximity of nesting rose-ringed parakeets in Seville (Hernández-Brito et al., 2014). Although rose-ringed parakeets may displace (Hernández-Brito et al., 2014) and even kill coexisting bats, which compete for nesting cavities (Menchetti et al., 2014), other bird species may be favored by the antipredatory behavior of parakeets, thus increasing their breeding success. Three bird species (common blackbird *Turdus merula*, spotless starling *Sturnus unicolor* and collared dove *Streptopelia decaocto*) breeding in the proximity of rose-ringed parakeets joined the parakeets in chasing the rats in four cases. Together, these observations suggest that species benefit from other species' aggressiveness toward predators (e.g., Blanco and Tella, 1997),

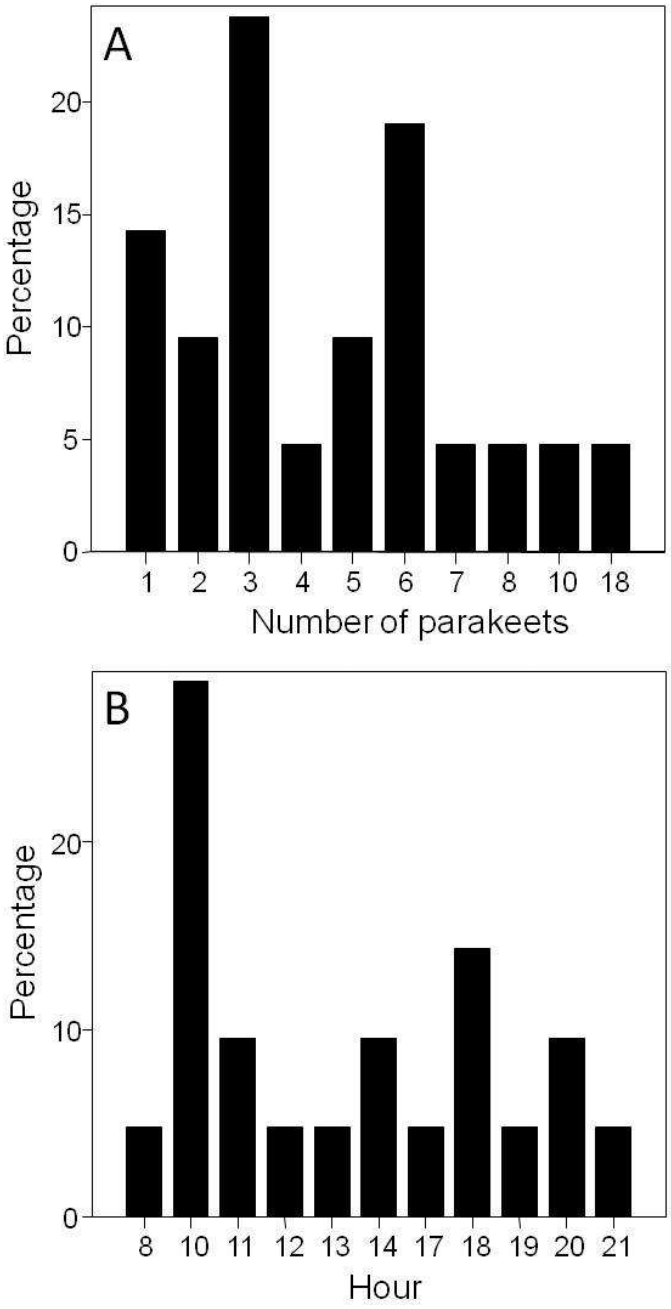

Figure 2 – Percentage of cases showing A) the number of rose-ringed parakeets involved in attacks on rats; and B) the time of day when attacks were recorded.

Figure 1 – Instance of a black rat persecuted and attacked by a rose-ringed parakeet in Maria Luisa Park, Seville, May 25 2013. Darkness prevented a better quality image (Photo: D. Hernández-Brito).

and indicate that the impact of rose-ringed parakeets on native fauna may be both negative and positive depending on the species considered and its conservation status (Hernández-Brito et al., 2014).

Despite the fact that non-native populations of rose-ringed parakeets have spread throughout at least 35 countries (Butler, 2003), research aimed to assess their impact on native fauna has focused mostly on birds and has centered on only a few European cities (Strubbe and Matthysen, 2007, 2009; Orchan et al., 2013; Hernández-Brito et al., 2014). More attention should be devoted to their interactions with more elusive mammals, such as rats and bats, with a widespread occurrence in cities worldwide.

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Associate Editor: L.A. Wauters