



## Short Note

**Italian red squirrels and introduced parakeets: victims or perpetrators?**Emiliano MORI<sup>a,1</sup>, Leonardo ANCILLOTTO<sup>b,1</sup>, Mattia MENCHETTI<sup>c,\*</sup>, Claudia ROMEO<sup>d</sup>, Nicola FERRARI<sup>e</sup><sup>a</sup>Dipartimento di Scienze della Vita, Università degli Studi di Siena, Siena, Italy<sup>b</sup>Dipartimento di Biologia e Biotecnologie "Charles Darwin", Università degli Studi di Roma "La Sapienza", Roma, Italy<sup>c</sup>Dipartimento di Biologia, Università di Firenze, Sesto Fiorentino (Fi), Italy<sup>d</sup>Dipartimento di Biologia, Università degli Studi di Milano, Milano, Italy<sup>e</sup>Dipartimento di Patologia Animale, Igiene e Sanità Pubblica Veterinaria, Università degli Studi di Milano, Milano, Italy**Keywords:***Sciurus vulgaris italicus*  
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**Abstract**

This paper deals with the first records of interactions between Italian red squirrel (*Sciurus vulgaris italicus*) and introduced parakeets. We observed two nest predations exerted by red squirrels upon rose-ringed parakeet (*Psittacula krameri*) chicks in Latium, while an adult Barraband's parakeet (*Polytelis swainsonii*) was responsible for the death of an adult squirrel in Southern Tuscany. To assess the extent of the impact of these alien birds on the conservation of the endemic squirrel populations, further research is needed. These observations highlight the complex interactions that may arise between alien and native species, supporting that active monitoring and management of introduced populations should be a priority.

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Recent phylogeographical studies recognized the Italian red squirrel (*Sciurus vulgaris italicus*) as a well-defined and divergent subspecies of Eurasian red squirrel, distributed in the Northern Apennines from Emilia Romagna to Abruzzi (Grill et al., 2009). The main threats to this Italian endemic taxon are represented by habitat fragmentation (Mortelliti et al., 2009) and by the presence of an expanding population of Eastern grey squirrel (*Sciurus carolinensis*), a North American alien species recently introduced in Umbria and known as one of the worst threats for the conservation of the native red squirrel in Europe (Gurnell et al., 2004; Martinoli et al., 2010).

Impacts of introduced parakeets on indigenous cavity-nesting species have been widely studied, with special regards to native birds (e.g., Chapman 2005; Strubbe and Matthysen 2007; Lin Neo 2012; Orchan et al. 2012). Competition between these birds and arboreal mammals (squirrels, dormice and bats) is only occasionally reported (Gebhardt, 1996; Dubois, 2007). In general, squirrels are known to be nest predators (Callahan, 1993; Martin, 1993; Schmidt et al., 2001) and, in the United Kingdom, introduced grey squirrels are the only recorded predators of naturalized rose-ringed parakeets (*Psittacula krameri*) (Shwartz et al., 2009). Predation on introduced parrot nests by red squirrels has been suggested but, up to now, never confirmed: in France, rose-ringed parakeets have been seen harassing and pushing away red squirrels from feeder boxes (P. Clergeau, unpublished). In another case, three individuals of rose-ringed parakeets were observed killing an adult red squirrel, maybe to defend their nest from an attack attempted by the rodent (Japiot, 2005). In Italy, 21 species belonging to Psittaciformes are recorded (Mori et al., 2013), but their interactions with native red squirrels are not documented.

Here we report the first two records of predation upon rose-ringed parakeet nestlings by Eurasian red squirrels and a direct killing of an

adult red squirrel by an individual of Barraband's parakeet (*Polytelis swainsonii*).

Both predation events on parakeet nestlings took place during summer 2011 inside the urban park of Villa Ada, a green area of approximately 150 ha, open to the public. The park is located near the confluence of the Tiber and Aniene rivers, in the northwestern part of Rome (41° 56' 13.51" N, 12° 30' 11.82" E, WGS84). Despite being well known, the presence of a large red squirrel population inside Villa Ada park is of unclear origin (Cignini et al., 1997; Bertolino et al., 2000), while reproductive colonies of rose-ringed parakeets are known for the urban area of Rome since late 70's (Zocchi, 1982). Predations by red squirrels on two different rose-ringed parakeet's nests were observed on the 24<sup>th</sup> of June and the 7<sup>th</sup> of July 2011. Both nests were inside tree-holes on large domestic Stone Pines (*Pinus pinea*), at about 10-15 meters above the ground. The two nest-trees are both located along a tree-lined path surrounded by a Stone Pine plantation and are approximately 500 meters away from each other. In both cases the predation followed the same sequence of behaviours: a group of adult rose-ringed parakeets (1 male-1 female and 1 male-1 female-1 subadult respectively) were heard emitting loud alarm vocalizations and were observed flying around the nest trunk. Afterwards, an adult red squirrel was observed climbing down from the tree canopy onto the main trunk until it reached the tree-hole. During the squirrel's descent, the adult parakeets flew around it emitting loud alarm vocalizations, but no direct physical contact was observed between the parakeets and the squirrel. On both occasions the squirrel got inside the tree-hole, emerging from it a few (10-15) seconds later with a living featherless parakeet nestling in its mouth. Then the animal rapidly escaped through the canopy towards adjacent trees. While the squirrel was inside the nest, adult parakeets hung by the nest entrance without entering or inspecting it. After the squirrel left the tree, the parakeets ceased vocalizing and immediately got inside the nest hole. Both sites were monitored for three hours after the predation events, but the squirrels did not come back to the nest. In one case, the squirrel was observed consuming the parakeet

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**Figure 1** – Necropsy of the red squirrel injured by Barraband's parakeet. The fracture of the occipital bone and the large subcutaneous hematoma on the back are evident.

nestling on a tree branch, about 50 meters away from the predated nest. The different color phases (Wauters et al., 2004) of the preying squirrels, red morph in one case and black morph in the other, indicated that predations were performed by different individuals.

The killing of an adult squirrel by a Barraband's parakeet (*Polytelis swainsonii*) was observed during a birdwatching session in a coastal pinewood (*Pinus pinea* and *P. halepensis*) of about 4 ha, near Follonica (Tuscany, Central Italy: 42° 56' 00.29" N, 10° 43' 41.84" E, WGS84). The resident population of this parakeet is composed only by three colour-ringed individuals (one male and two females). This population is present since August 2011 but it is not yet considered naturalized since the only breeding attempt, recorded in 2012, failed for unknown causes. On the 22<sup>nd</sup> of July 2012, one of the female parakeets was observed attacking an adult male red squirrel on a branch of Aleppo Pine (ca. 4 m above soil level). The parrot repeatedly pecked at the head and the back of the squirrel, accompanying the attack with loud alarm calls. The squirrel tried to defend itself by covering its back with the tail and moving along the branch, but after a few seconds, it fell dead to the ground. The carcass was recovered and necropsy was performed at the Department of Animal Pathology, Hygiene and Veterinary Public Health of the University of Milan. The analyses confirmed that the death of the squirrel was due to a head trauma, with an extended fracture of the occipital bone (Fig. 1). Moreover, a large subcutaneous hematoma was observed on the back of the animal, in correspondence to a wound compatible with the beak of the parakeet. The lesions are both consistent with two possible hypothesis: (1) the squirrel, stunned by the bird pecks, fell off the branch and died because of the impact with the ground; (2) the skull was fractured directly by bird pecking and the squirrel fell down when already dead. In both cases the parakeet attack caused the squirrel's death. It is not known what triggered the attack, but we may suppose that the squirrel had usurped the cavity used by the bird for roosting or, as potential nest-predator (Schlogel, 1985; Gurnell, 1987), it had destroyed the beginning of a nest. From these first observations, it appears that the red squirrel acts as predator towards parakeet chicks, but it may also suffer harassment by adult individuals, that can result in its death. Body-sizes and ethology of both parakeet species involved in these interactions are similar (del Hoyo et al., 1977), so we suggest that these different interspecific relationships (nestling predations vs. aggression against squirrel) may be due to different nest defence success levels, possibly linked to different behavioural traits in the two species.

Therefore, considering the high sensitivity of red squirrels towards different introduced species (Bertolino et al., 2000) and the expansion of Psittaciformes species in Italy (Mori et al., 2013), further investigation is needed to determine the impact of these exotic birds on the endemic red squirrel. Particular attention should be paid to human-modified habitats where synurbanization of wildlife populations can occur, increasing the chances of interaction between native and alien species (Luniak, 2004). Finally, impacts of not yet naturalized species are often overlooked in the scientific literature, but since the scenario of interactions between native and alien species can be very complex and unpredictable, we feel that a rapid understanding of the potential impacts of an introduced species is essential to prevent further threats for the survival of native populations, as recommended by Genovesi and Shine (2004). ☺

## References

- Bertolino S., Currado I., Mazzoglio P.J., Amori G., 2000. Native and alien squirrels in Italy. *Hystrix* 11(2): 65–74. doi:10.4404/hystrix-11.2-4150
- Callahan J.R., 1993. Squirrels as predators. *Great Basin Nat.* 53(2): 137–144.
- Chapman T., 2005. The status and impact of the rainbow lorikeet (*Trichoglossus haematerodius moluccanus*) in South-Western Australia. Miscellaneous Publication, Department of Agriculture, Government of Western Australia.
- Cignini B., Cristaldi M., Sartoretti A., 1997. Lo scoiattolo *Sciurus vulgaris* L., 1785 nella città di Roma. *Ecologia Urbana* 9(2-3): 14–15.
- del Hoyo J., Elliott A., Sargatal J., 1977. Handbook of the Birds of the world. Vol. 4. Sanguine to Cuckoos. BirdLife International, Cambridge.
- Dubois P.J., 2007. Les oiseaux allochtones en France: status et interactions avec les espèces indigènes. *Ornithos* 14: 329–364. [in French]
- Gebhardt H., 1996. Ecological and economics consequences of introductions of exotic wildlife (birds and mammals) in Germany. *Wildl. Biol.* 2: 205–211.
- Genovesi P., Shine C., 2004. European Strategy on Invasive Alien Species, final version. Convention on the Conservation of European Wildlife and Natural Habitats. Council of Europe, Strasbourg.
- Grill A., Amori G., Aloise G., Lisi I., Tosi G., Wauters L.A., Randi E., 2009. Molecular phylogeography of European *Sciurus vulgaris*: refuge within refugia? *Mol. Ecol.* 18: 2687–2699.
- Gurnell J., 1987. The natural history of squirrels. Facts on File Publications, New York.
- Gurnell J., Wauters L.A., Lurz P.W.W., Tosi G., 2004. Alien species and interspecific competition: effects of introduced eastern grey squirrels on red squirrel population dynamics. *J. Anim. Ecol.* 73: 26–35.
- Japiot X., 2005. Psittacides en villes d'Europe. Mairie de Paris, Direction des Parcs, Jardin et Espaces Verts, Service de l'Ecologie Urbaine, Section Etudes et Prospectives Environnementales, Pole Biodiversité. [in French]
- Lin Neo M., 2012. A review of three alien parrots in Singapore. *Nature in Singapore* 5: 241–248.
- Luniak M., 2004. Synurbanization – adaptation of animal wildlife to urban development. In: Shaw W.W., Harris L.K., Vandruff L. (Eds.). Proceedings of the 4<sup>th</sup> International Symposium on Urban Wildlife Conservation. Tucson, AZ. 50–55.
- Martin T.E., 1993. Nest predation and nest sites. *BioScience* 43: 523–532.
- Martinoli A., Bertolino S., Preatoni D.G., Balduzzi A., Marsan A., Genovesi P., Tosi G., Wauters L.A., 2010. Headcount 2010: the multiplication of the grey squirrel introduced in Italy. *Hystrix* 21(2): 127–136. doi:10.4404/hystrix-21.2-4463
- Mori E., Di Febbraro M., Foresta M., Melis P., Romanazzi E., Notari A., Boggiano F., 2013. Assessment of the current distribution of free-living parrots and parakeets (Aves, Psittaciformes) in Italy: a synthesis of published data and new records. *It. J. Zool.* 80(2): 158–167. doi:10.1080/11250003.2012.738713
- Mortelliti A., Santulli Sanzo G., Boitani L., 2009. Species' surrogacy for conservation planning: caveats from comparing the response of three arboreal rodents to habitat loss and fragmentation. *Biodiv. Cons.* 18: 1131–1145.
- Orchan Y., Chiron F., Shwartz A., Kark S., 2012. The complex interaction network among multiple invasive bird species in a cavity-nesting community. *Biol. Inv.* 15(2): 429–445. doi:10.1007/s10530-012-0298-6.
- Schmidt K.A., Goheen J.R., Naumann R., Ostfeld R.S., Schaub E.M., Berkowitz A., 2001. Experimental removal of strong and weak predators: mice and chipmunks preying on songbird nests. *Ecology* 82: 2927–2936.
- Schlogel N., 1985. Eichhornchen frisst Amsel. Falke 32: 321. [in German]
- Shwartz A., Strubbe D., Butler C.J., Matthysen E., Kark S., 2009. The effect of enemy release and climate conditions on invasive birds: a regional test using the rose-ringed parakeet (*Psittacula krameri*) as a case study. *Div. Distrib.* 15: 310–318.
- Strubbe D., Matthysen E., 2007. Invasive ring-necked parakeets *Psittacula krameri* in Belgium: habitat selection and impact on native birds. *Ecography* 30: 570–588.
- Wauters L.A., Zaninetti M., Tosi G., Bertolino S., 2004. Is coat-colour polymorphism in Eurasian red squirrels (*Sciurus vulgaris* L.) adaptive? *Mammalia* 68(1): 37–48.
- Zocchi A., 1982. Un cacatua delle Molucche nel parco di Villa Doria Pamphili a Roma. *Boll. Centro Studi Conservazione Psittaciformi* 2(1): 54–56. [in Italian]

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