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Short note

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The impact of *Psittacula krameri* (Scopoli, 1769) on orchards: first quantitative evidence for Southern Europe

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Birds often cause severe damage to agricultural crops, particularly at the harvest stage [1–3]. In this regard, the assessment of their crop damage is the key to developing methods to reduce such damage and to delineate management policies [4–5].

Among non-native species, the ring–necked parakeet *Psittacula krameri* (Scopoli, 1769), with an afro-indian distribution, has invaded several areas of Europe in recent decades, and ranks among the world's most successful introduced birds [6]. Although the species has long been considered a potential economic threat to agriculture (depredation on fruits, feeding on orchard fruits, maize and oil-seed crops [7–9]), damage to crops has been largely evaluated in countries where this species is native [e.g., 8, 10–13]. Nevertheless, although data on diet are locally available [e.g., 14–15], excluding occasional reports [16–18], quantitative data on the specific impact on orchards are still scanty in Europe and entirely lacking for Southern Europe.

In this note we report the evidence for an impact of ring–necked parakeet on a suburban almond orchard inside the metropolitan area of Rome that holds one of the largest densities of ring-necked parakeet in Europe [19–22].

The study was conducted in the South East section of the "Appia Antica" regional park (1600 ha-wide), within the experimental fields of the CREA-OFA Research Center (between 41°48′04.7″ N / 12°33′54.9″ E and 41°47′13.2″ N / 12°34′10.3″ E; 50 m a.s.l., Rome, central Italy). In the surrounding landscape there are patches of Mediterranean forests with Holm Oak (*Quercus ilex*) and Downy Oak (*Quercus pubescens*) and residual disturbed woods of Turkey Oak (*Quercus cerris*) connected with hedgerows in a predominantly agricultural matrix. Riparian forests, dominated by the White Willow (*Salix alba*) with scarcity of undergrowth, and riparian reed beds dominated by Giant Reed (*Arundo donax*) are also present [19–20]. The total area occupied by the Research Center is about 66 hectares, all contiguous. The experimental field consists of about 6000 varieties of fruit species grown in Italy (mainly *Prunus*

armeniaca, *P. dulcis*, *P. avium*, *P. persica*, *P. domestica*, *Actinidia chinensis*, *Malus domestic*, *Pyrus communis*).

We focused our quantitative survey only on the almond orchard (*Prunus dulcis*). The cultivated area occupied by this type of orchard was a rectangular patch of 0.8 hectares in total (about 100 in length × 80 m in breadth; n = 452 trees) within a wider field of about 2 ha including mixed cultivations of other species. This field is used specifically for experimental organic farming (only treatments with total absence of pesticides). The physical structure of almond trees is relatively homogeneous with plants having a trunk average diameter (at chest height) of 26 (± 5.47) cm, by about 2.5 meters in height (age: 15 years).

The study was carried out in September 2017 when the almond fruits are ripe, and furthermore it is the end of the breeding period of ring–necked parakeets so that juveniles may also forage on fruits [23]. A previous census using point count method (n = 120; sessions with fixed time: 5 min.) in all experimental orchards estimated a number ranging between 0-3 ind./session (G. Assogna, unpublished data). To obtain data on the impact of parakeets on almond fruits, first we randomly selected a set of trees (n = 48) inside the almond orchard sample, using a random number generator. Then, we counted the number of total available almond fruits occurring on each tree, checking for the almond fruits with evident damage caused by ring-necked parakeet (about four hours in the sampling effort in a single sampling day). All the fruits that showed evident damage from scarification and rupture (as shown in Fig. 1) were counted. We assigned the damage on almonds to the specific action of parakeets, considering

Fig. 1 – Fruit damage caused by ring-necked parakeet, *Psittacula krameri*, on almonds (Rome, central Italy; for quantitative data, see results).

that they completely break the fruit (individuals eat the almond fruits by breaking the exocarp and the mesocarp, thus extracting the seed contained within the endocarp, the inedible fleshy part; [12]).

From field data, we obtained: (i) the frequency (for each tree and for the total; n = 48 trees) of almonds damaged out of the total of almond records, (ii) the mean number of available almonds/tree and damaged almonds/tree. We compared the frequencies using a χ^2 test; we correlated variables (almond vs. damaged almonds, and tree distance from edge vs. percentage of almonds damaged) using a non-parametric Spearman rank correlation test (2 tail; [24]), using the SPSS 13.0 software [24].

Of 3270 almonds recorded, 1036 (31.68%) showed signs of damage due to the feeding action carried out by ring–necked parakeets (Fig. 1). The mean number of almonds available on trees was 46.54 (±18.27, n = 48). Among them, a mean number of 21.58 (±11.31) almonds showed signs of damage by ring–necked parakeet. Percentages of fruits damaged from the total of almonds available differed markedly among trees (from 2.78 to 90.69%; $\chi^2 = 57.13$; $p < 0.001$ between extreme values). We showed a direct significant correlation between almonds available on trees and almonds damaged ($r_s = 0.752$, $p<0.001$, n = 48; Spearman rank correlation test, 2 tail, Fig. 2). We also observed a significant relationship between percentage of fruit damaged and distance (in m) of almond trees to the orchard edge ($r_s = 0.445$, $p = 0.002$, n = 48; Spearman rank correlation test, 2 tail).

Ring-necked parakeet seems to be the only non-native species locally impacting on this crop. Indeed, we have not observed individuals or signs of feeding attributable to the introduced monk parakeet, *Myiopsitta monachus*, known to be a species potentially damaging crops [23], despite the occasional presence of this species in the study site [20]; it is, however, more localized when compared to the ring-necked parakeet [25].

Previous research has highlighted that in Europe the ring–necked parakeet is an opportunistic granivorous-frugivorous species mainly foraging in parks and gardens, on ornamental non-native plants, and also exploiting human food sources [26–27]. For example, in Rome (Italy), parakeets eat *Ulmus* sp. samaras, *Melìa azedarach* fruits and *Quercus ilex* acorns [14]. Our data add further evidence for our continent (the first for Southern Europe; see [16–17]) of an impact of this introduced bird on almond orchards.

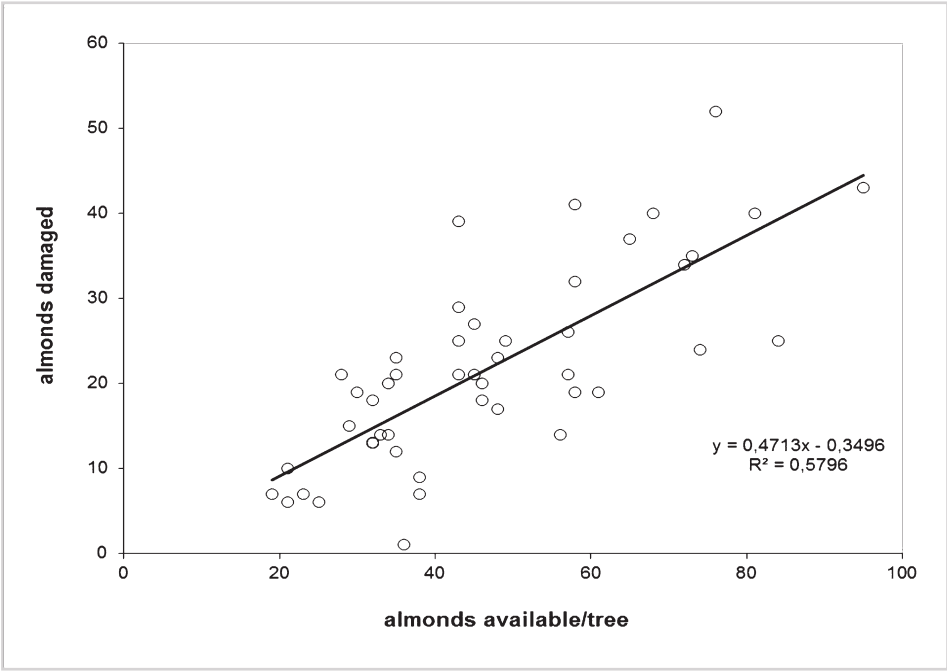

Fig. 2 – Relationship between available vs damaged almonds by ring-necked parakeet, *Psittacula krameri.* The equation of the better-fit line (linear) and coefficient of variation (R^2) have been reported.

Almond cultivation is widely diffused in Mediterranean contexts [28]. Our evidence highlights that, where these parakeets occur, the level of damage could be significant (about 30% of fruits damaged) and highly dependent (i) on fruit availability (significant correlation between almonds available and almonds damaged) and (ii) on the distance of trees from the orchard edge (significant correlation between percentage of almond damaged and tree distance from the edge). However, our data could be considered conservative: indeed, although we carried out this study immediately before the harvest period, damage could have further increased in subsequent days (until harvesting) since parakeets prefer progressively more mature fruits.

Actually, ring–necked parakeet is mainly localized in urbanized contexts [22] while almond cultivations are mainly distributed in rural landscapes [29]. In our case study, the impact observed might be due to a particular circumstance, i.e. the co-occurrence of an extensive experimental orchard located in a suburban landscape where ring–necked parakeet is very common [19–20]. Nevertheless, the progressive urbanization of rural landscapes (for central Italy: [30]) and the recent exponential expansion of ring–necked parakeet also in areas surrounding urban sites (for central Italy: [31]) make probable the potential impact of this species on orchards and other crops in the future.

In addition to ecological impacts on native species [21, 32–34], the economic impacts of ring-necked parakeet on agriculture have highlighted the need to expand effective management options [35]. Thus, it could be necessary to plan, even now, for the use of technical measures to reduce the impact of the ring-necked parakeet on these productive agro-ecosystems [9].

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References

1. Binimelis R., Born W., Monterroso I. & Rodríguex-Labajos B. (2007). Socio-economic impact and assessment of biological invasions. *In*: Nentwig W. (ed.) *Biological invasions*: 332–348. Springer, Berlin, New York.
2. Anderson A., Lindell C.A., Moxcey K.M., Siemer W.F., Linz G.M., Curtis P.D., Carroll J.E., Burrows C.L., Boulanger J.R., Steensma K.M.M. & Shwiff S.A. (2013). Bird damage to select fruit crops: The cost of damage and the benefits of control in five states. *Crop Protection* 52: 103–109. https://doi.org/10.1016/j.cropro.2013.05.019
3. Linz G.M., Bucher E.H., Canavelli S.B., Rodriguez E. & Avery M.L. (2015). Limitations of population suppression for protecting crops from bird depredation: A review. *Crop Protection* 76: 46–52. https://doi.org/10.1016/j.cropro.2015.06.005
4. Bruggers R.L., Rodriguez E. & Zaccagnini M.E. (1998). Planning for bird pest problem resolution: a case study. *International Biodeterioration & Biodegradation* 42: 173–184. https://doi.org/10.1016/S0964-8305(98)00046-8
5. Strubbe D., Shwartz A. & Chiron F. (2011). Concerns regarding the scientific evidence informing impact risk assessment and management recommendations for invasive birds. *Biological Conservation* 144: 2112–2118. https://doi.org/10.1016/j.biocon.2011.05.001

6. Strubbe D. & Matthysen E. (2009). Establishment success of invasive ring-necked and monk parakeets in Europe. *Journal of Biogeography* 36: 2264–2278. https://doi.org/10.1111/j.1365-2699.2009.02177.x

7. Dhindsa M.S. & Saini H.K. (1994). Agricultural ornithology: an Indian perspective. *Journal of BioScience* 19: 391–402. https://doi.org/10.1007/BF02703176

8. Ahmad S., Khan H.A. & Javed M. (2012). An estimation of Rose-Ringed Parakeet (*Psittacula krameri*) depredations on Citrus, Guava and Mango in orchard fruit farm. *International Journal of Agriculture & Biology* 14: 149–152.

9. Khan H.A., Javed M., Tahir A. & Kanwal M. (2013). Limiting the rose-ringed parakeet (*Psittacula krameri*) damage on guava (*Psidium guajava*) and mango (*Mangifera indica*) with an ultrasonic sound player in a farmland of Faislabad, Pakistan. *African Journal of Agricultural Research* 8: 6608–6614.

10. Babu R.S. & Muthukrishnan T.S. (1987). Studies on the damage by *Psittacula krameri* (Scopoli) and *Passer domesticus* (Linnaeus) on certain crops. *International Journal of Pest Management* 33: 367–369. https://doi.org/10.1080/09670878709371185

11. Sandhu P.S. & Chakravarthy S. (1982). Rose-ringed parakeet damage to almonds at Ludhiana in Punjab. *Indian Journal of Agricultural Sciences* 523:14–21.

12. Sushil K. (1994). Seed damage of tree *Terminalia arjuna* Bedd. by rose-ringed parakeet (*Psittacula krameri*) (Scopoli). *Indian Journal of Forestry* 17: 151–153.

13. Khan H.A., Beg M.A. & Khan A.A. (2004). Breeding habitats of the Rose-Ringed Parakeet (*Psittacula krameri*) in the cultivations of Central Punjab. *Pakistan Journal of Zoology* 36, 133–138.

14. Fraticelli F. (2014). The rose-ringed parakeet *Psittacula krameri* in a urban park: demographic trend, interspecific relationships and feeding preferences (Rome, central Italy). *Avocetta* 38: 23–28.

15. Menchetti M. & Mori E. (2014). Worldwide impact of alien parrots (Aves Psittaciformes) on native biodiversity and environment: a review. *Ethology Ecology & Evolution* 26: 172–194. https://doi.org/10.1080/03949370.2014.905981

16. Moran S. & Keidar H. (1993). Checklist of vertebrate damage to agriculture in Israel. *Crop Protection* 12: 173–182. https://doi.org/10.1016/0261-2194(93)90105-R

17. Fletcher M. & Askew N. (2007). Review of the status, ecology and likely future spread of parakeets in England. Central Science Laboratory, York.

18. Kloen H., Lommen J.L., van Drongelen L. & Guldemond J.A. (2014). Landbouwschade door halsbandparkieten. Schade-inventarisatie en risicoschatting. Publicatienummer CLM856, CLM Onderzoek en Advies, Culemborg.

19. Scarafino C., Taffon D. & Battisti C. (2008). Comunità ornitiche in ambienti antropizzati (Parco dell'Appia antica, Roma): differenze ecologiche e stagionali. *Rivista italiana di Ornitologia* 78: 37–45.

20. Taffon D., Giucca F. & Battisti C. (2008). *Atlante degli Uccelli nidificanti nel Parco regionale dell'Appia antica.* Provincia di Roma, Assessorato alle politiche dell'agricoltura e dell'ambiente, Gangemi, Roma.

21. Dodaro G. & Battisti C. (2014). Rose-ringed parakeet (*Psittacula krameri*) and starling (*Sturnus vulgaris*) syntopics in a Mediterranean urban park: evidence for competition in nest-site selection? *Belgian Journal of Zoology* 144 (1): 5–14.

22. Pârâu L.G., Strubbe D., Mori E., Menchetti M., Ancillotto L., Kleunen A.V., White R.L., Luna A., Hernandéz-Brito D., Le Louarn M., Clergeau P., Albayrak T., Franz D.,

Braun M.P., Schroeder J. & Wink M. (2016). Rose-ringed Parakeet *Psittacula krameri* populations and numbers in Europe: a complete overview. *The Open Ornithology Journal* 9: 1–13. https://doi.org/10.2174/1874453201609010001

23. Senar J.C., Domènech J., Arroyo L., Torre I. & Gordo O. (2016). An evaluation of monk parakeet damage to crops in the metropolitan area of Barcelona. *Animal Biodiversity and Conservation* 39: 141–145.
24. Dytham C. (2011). *Choosing and using statistics*. *A Biologist's Guide*. Wiley and Blackwell, New York.
25. Di Santo M., Vignoli L., Battisti L. & Bologna M.A. (2013). Feeding activity and space use of a naturalized population of Monk Parakeet, *Myiopsitta monachus*, in a Mediterranean urban area. *Revue d'Écologie (Terre Vie)* 67: 1–8.
26. Strubbe D. & Matthysen E. (2010). A radiotelemetry study of habitat use by the exotic Ring-necked Parakeet *Psittacula krameri* in Belgium. *Ibis* 153: 180–184. https://doi.org/10.1111/j.1474-919X.2010.01074.x
27. Clergeau P. & Vergnes A. (2011). Bird feeders may sustain feral Rose-ringed parakeets *Psittacula krameri* in temperate Europe. *Wildlife Biology* 17: 248–252. https://doi.org/10.2981/09-092
28. Delplancke M., Alvarez N., Benoit L., Espindola A., Joly H.I., Neuenschwander S. & Arrigo N. (2013). Evolutionary history of almond tree domestication in the Mediterranean basin. *Molecular Ecology* 22: 1092–1104. https://doi.org/10.1111/mec.12129
29. Pinto-Correia T. & Vos W. (2004). Multifunctionality in Mediterranean landscapes – past and future. *In*: Jongman R. (ed.) *The new Dimension of the European Landscapes*: 135–164. Wageningen FRONTIS Series, Springer, Dordrecht.
30. Romano B. & Zullo F. (2014). Land urbanization in Central Italy: 50 years of evolution. *Journal of Land Use Science* 9: 143–164. https://doi.org/10.1080/1747423X.2012.754963
31. Brunelli M., Sarrocco S., Corbi F., Sorace A., Boano A., De Felici S., Guerrieri G., Meschini A. & Roma S. (2011). *Nuovo Atlante degli Uccelli Nidificanti nel Lazio*. Edizioni ARP (Agenzia Regionale Parchi), Roma.
32. Strubbe D. & Matthysen E. (2009). Experimental evidence for nest-site competition between invasive ring-necked parakeets (*Psittacula krameri*) and native nuthaches (*Sitta europaea*). *Biological Conservation* 142: 1588–1594. https://doi.org/10.1016/j.biocon.2009.02.026
33. Strubbe D., Matthysen E. & Graham C.H. (2010). Assessing the potential impact of invasive ring-necked parakeets *Psittacula krameri* on native nuchaches *Sitta europaea* in Belgium. *Journal of Applied Ecology* 47: 549–557. https://doi.org/10.1111/j.1365-2664.2010.01808.x
34. Le Louarn M., Couillens B., Deschamps-Cottin M. & Clergeau P. (2016). Interference competition between an invasive parakeet and native bird species at feeding sites. *Journal of Ethology* 34: 291–298. https://doi.org/10.1007/s10164-016-0474-8
35. Lambert M.K., Massie G., Yoder C.A. & Cowman D.P. (2010). An evaluation of Diazacon as a potential contraceptive in non-native rose-ringed parakeets. *Journal of Wildlife Management* 74: 573–581. https://doi.org/10.2193/2008-531

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