

— SHORT COMMUNICATION —

**The Common Leadwort *Plumbago europaea* L.
as a natural trap for the wintering Goldcrests *Regulus regulus*:
a case study from Adriatic islands**

Jenő J. PURGER^{1*}, Eduard KLETEČKI², Balázs TRÓCSÁNYI³, Jasmina MUŽINIĆ⁴,
Dragica PURGER⁵, Gabriella L. SZÉLES⁶ and József LANSZKI⁶

¹ Department of Animal Ecology, Institute of Biology, University of Pécs, Ifjúság útja 6, 7624 Pécs, Hungary

² Croatian Natural History Museum, Demetrova 1, 10000 Zagreb, Croatia

³ Duna-Drava National Park Directorate, Tettye tér 9, 7625 Pécs, Hungary

⁴ Department of Ornithology CASA, Gundulićeva 24, 10000 Zagreb, Croatia

⁵ BioRes, Barackvirág u. 27, 7624 Pécs, Hungary

⁶ Department of Nature Conservation, University of Kaposvár, P.O. Box 16. 7401 Kaposvár, Hungary

Received: 22 August 2011

Accepted after revision: 29 December 2011

Goldcrests *Regulus regulus* are found wintering in high numbers from October to April in the Adriatic coast and islands, feeding mainly on insects in the undergrowth and on the ground. Common Leadwort *Plumbago europaea* L. continues to flower on stone walls well into October, exposing its sticky calyx and seed capsules for at least 30 days, meaning a threat to small birds by clinging to their feathers. The entangled feathers restrain the birds in their free movement, which either die or become easy prey for cats, rats or birds of prey. As estimated from plant coverage rate (0.63% of stone walls) and the number of observed birds “captured” by Common Leadwort (5), at least 47 Goldcrests could have been killed by this natural trap in the built-in area of the island of Olib (0.388 km²) during one month. At lower coverage rates (<0.1%) such as in the outer areas of the island of Olib and in the outskirts and central areas of neighboring Silba island, such losses could be much lower, but because of the considerable distribution overlap between of this plant species and the wintering areas of Goldcrests, this mortality factor should not be overlooked.

Key words: natural trap, mortality, threatening factor, Mediterranean island.

INTRODUCTION

Goldcrest *Regulus regulus* is the smallest bird species in the Palaearctic, weighing only 4.5-7.0 g (Cramp, 2000). From October to April, it is found wintering in the Adriatic coastal region and islands in great numbers (Kralj, 1997; Rucner, 1998). From autumn it feeds mainly on insects in the undergrowth and on the ground (Cramp, 2000; Šere, 2008). Decline in

survival rates of migratory small passerine birds throughout Europe may be directly related to excessive hunting and trapping pressures in Mediterranean countries. Such pressure is particularly high in islands (Crick & Jones, 1992; Blondel *et al.*, 2009). On the island of Olib (Croatia) the observed mortality threats to wintering Goldcrests include factors such as domestic cats (Purger *et al.*, 2008) or, in special cases, even stronger spider webs (Lanszki *et al.*, 2008). During fieldwork on the same island, in the village of Olib on 19 October, 2008 one Goldcrest was found lying helplessly on the road, with its feath-

* Corresponding author: tel.: +36 30 3249928, fax: +36 72 501527, e-mail: purger@gamma.ttk.pte.hu



FIG. 1. Above: Goldcrest made immobile by the sticky seeds of Common Leadwort; Below left: Goldcrest with feathers stuck together; Below right: Common Leadwort.

ers stuck together. We removed the small, sticky, cylindrical propagula from the bird, which were identified as the fruits of the plant besides the bird (Fig. 1). On the dry stone wall next to the bird, Common Leadwort *Plumbago europaea* L., an herbaceous, creeping, half-shrubby multi-branched plant was in bloom. The inflorescence is a heavily branched raceme with sets or trusses of pink or purple flowers. The tubular calyx composed of five fused sepals has five elevated longitudinal ribs that bear prominent stalked large glandular trichomes. These stipitate glands secrete a sticky substance, thick gluey mucilage (Wilson, 1890). Since the fruits are shed from the plant with the persisting calyx, the bristles and sticky secretions of the calyx of this species aid in seed dispersal by animals ensuring an attachment to the coat or plumage of these (Fahn & Werker, 1972; Fahn, 1979; Albert *et al.*, 1992; Schlauer, 1997). Common Leadwort is a legally protected plant in Croatia (Anonymous, 2006). The plant grows on field tracks especially besides traditional stone walls, dry habitats by the roadsides and bloom between June and late October (Tutin *et al.*, 1972).

Based on our observations the question arose whether Common Leadwort acts as a natural trap, or the cases we recorded were only occasional incidences.

MATERIALS AND METHODS

We surveyed coverage rates of Common Leadwort along transects, and performed population estimations for small passerine birds in island of Olib and the neighboring Silba island, including both residential areas and village outskirts.

Olib Island is situated in the Zadar archipelago (Middle Dalmatia, Croatia, 44° 22' N, 14° 46' E). The island is 9.5 km long stretching in a N-S direction. Its width is only 1.4 km in the middle spreading up to 5.8 km, with a total area of 26.13 km² (Magaš & Faričić, 2002). The vegetation consists of Mediterranean forests of Pubescent Oak *Quercus pubescens* and Holm Oak *Q. ilex* and their successional stages (Horvat *et al.*, 1974). The only settlement and harbor, Olib existed since Roman times. The human population is low with only 147 inhabitants in 2001 (Magaš & Faričić, 2002). In the outer zones of the island there are

extensively managed olive groves and long-abandoned gardens, whereas inside the village traditional gardening is practiced. Gardens and lands in the outer zones are bordered by traditional dry stone walls built from stones removed from the soil during the course of centuries, lining both sides of the country tracks, reaching about 1.0-1.5 m height. The island of Silba, a smaller island (14.98 km²) with similar natural history, is located about 1.8 km west of Olib, its only settlement Silba having a population of 265 inhabitants in 2001 (Magaš & Faričić, 2002). The research was performed between 19-29 October, 2008. Walking along all the streets of Olib village, coverage rates of Common Leadwort on stone walls was estimated. In cases of single specimen occurrences we applied a value of 0.25 m², whereas at aggregations of the plant we calculated a plant-covered area of 0.5 m² along one meter of wall length. The survey was performed along 18 routes in the inner areas of Olib village (at a mean \pm SE route length of 306 \pm 35.6 m, totaling 5502 m), and along 31 routes (mean \pm SE: 729 \pm 99.6 m, totaling 22609 m) in the outskirts. On the neighboring island of Silba, Common Leadwort surveying was performed in the same period, along two routes in the village (436 m and 1100 m) and on nine routes in the outer areas (mean \pm SE: 857 \pm 79.8 m, totaling 7711 m). During these surveys, we recorded every case when evidence of passerine birds (mostly feathers) was found on the plant or in its immediate surroundings. The surveying of passerine birds was carried out in the village of Olib, with the help of a GPS unit, along seven transects of 50 m in width (mean \pm SE: 352 \pm 33.9 m), totaling a route of 2466 m in length. The total number of bird individuals was measured for each species in the transects, then the numbers counted in the transects were standardized for 1000 meter lengths, and mean values (\pm SE) were calculated for density values of each transect line (Bibby et al., 1992). Testing for differences between village and outer areas and between the villages Olib versus Silba was performed using two-sample *t*-tests, following arcsin transformation of coverage data.

RESULTS AND DISCUSSION

Common Leadwort was found to be present mostly inside the villages, on traditionally built dry stone walls. Based on our estimations, the calculated stone walls coverage in the areas of Olib was significantly higher (two-sample *t*-test: $t_{47} = 7.46$, $p < 0.001$) inside the village (0.63 \pm 0.162%) than in outer areas (0.01

\pm 0.008%). In the island of Silba, it was found to exist only on walls inside the village (0.01 \pm 0.019%). The majority of walls on Silba are new, constructed of concrete, which is probably the main reason why Common Leadwort coverage is lower than that in Olib. During the survey in the village of Olib, 921 individuals of 19 bird species were observed in total. Among smaller bird species, Goldcrest (9.2%) was the most frequent, but European Robin *Erithacus rubecula* (4.6%), European Serin *Serinus serinus* (2.7%), Black Redstart *Phoenicurus ochruros* (1.9%) and Common Chiffchaff *Phylloscopus collybita* (0.1%) were also observed. During the transect surveys there were four additional cases when we found evidence of the indirect effect of Common Leadwort plants on small birds. Due to the sticky substance, the small-bodied birds were restricted in their movement or even became totally unable to fly. Therefore, they easily fell victim to cats living all around the island or other predators, e.g. the Black Rat *Rattus rattus* which is present in high densities in the settlement, or Eurasian Sparrowhawk *Accipiter nisus* which is quite frequent around this time of the year. More specifically, 1) Goldcrest fine feathers were found in considerable numbers on 23 October, 2) Goldcrest feathers and the bird remains were spotted beside Common Leadwort plant on the same day, 3) a flightless bird hopping about beside a Common Leadwort with feathers stuck together was caught by a cat while being observed, and 4) Goldcrest feathers and remains were discovered near a Common Leadwort specimen on 24 October. Fine feathers were found on the plants, while remnants of tail feathers and primaries were found nearby, on the ground. All five instances were recorded in inner areas of Olib, but no similar cases were observed in the village of Silba or its outer areas. No other birds than the smallest Goldcrest were found being trapped by the gluey Common Leadwort plant.

Having surveyed a substantial part (0.123 km²) of the residential areas of the village of Olib (ca 0.388 km²), we have recorded five cases of birds stuck into Common Leadwort during a period of 10 days. Estimated number of cases on the whole area (0.388 / 0.123 = 3.15) is 3.15 \times 5 = 15.75. Goldcrests arrive in the island for wintering in October when Common Leadwort still continues to flower (Fig. 1). The overlap of Goldcrest wintering period and Common Leadwort flowering is approximately 30 days (therefore the figure 15.75 for ten days was multiplied by 3 equals to 47.25). Throughout that period, in the en-

tire inner area of Olib the gluey Common Leadwort could trap at least 47 Goldcrests, considering that 0.63% of stone walls were covered by this plant. Goldcrest mortality can also be influenced by the actual time overlap between Common Leadwort flowering and Goldcrest arrival and stay. Furthermore, although our investigation lasted 10 days in total, the surveying of roads and the recording of the behavior of Common Leadwort as a natural trap in transects actually took only one day, thus our estimation is more likely to be underrated, therefore our estimation is actually the minimum possible value of loss.

With low Common Leadwort coverage rates such as measured in the island of Silba (<0.1%), the effect of this plant on small passerines is probably negligible. Goldcrest wintering areas are in substantial overlap with the distribution area of Common Leadwort, meaning that the sticky seedheads of this plant in the final weeks of flowering in October can pose a considerable mortality factor.

ACKNOWLEDGEMENTS

We would like to thank Attila Lengyel for the useful comments on the manuscript. Mobility for the research was facilitated by the Hungarian-Croatian Intergovernmental S&T Co-operation Programme (project No. CRO-17/2006).

REFERENCES

- Albert VA, Williams SE, Chase MW, 1992. Carnivorous plants: phylogeny and structural evolution. *Science*, 257: 1491-1495.
- Anonymous, 2006. Zakonska zaštita 2006 / Legal status in Croatia 2006: Z2-Zaštićene biljke (NN: 7; 16.1.2006), IdRef: 8452.
- Bibby CJ, Burgess ND, Hill DA, Mustoe S, 1992. *Bird census techniques*. Academic Press, London.
- Blondel J, Aronson J, Bodiou J-Y, Boeuf G, 2009. *The Mediterranean region: biological diversity in space and time*. Oxford University Press, Oxford.
- Cramp S, 2000. *The complete birds of the western Palearctic*. CD-Rom edition. Oxford University Press, Oxford.
- Crick HQP, Jones PJ, 1992. The ecology and conservation of Palearctic-African migrants. *Ibis*, 134: 1-132.
- Fahn A, 1979. *Secretory tissues in plants*. Academic Press, London, New York.
- Fahn A, Werker E, 1972. Anatomical mechanisms of seed dispersal. In: Kozłowski TT, ed. *Seed biology*. Academic Press, New York: 151-221.
- Horvat I, Glavač V, Ellenberg H, 1974. *Vegetation Südo-steuropas*. Gustav Fischer Verlag, Stuttgart.
- Kralj J, 1997. Ornitofauna Hrvatske tijekom posljednjih dvjesto godina. [Croatian ornithofauna in the last 200 years]. *Larus*, 46: 1-112.
- Lanszki J, Kletečki E, Trócsányi B, Purger JJ, 2008. From the ornithological notebook (Croatia): Goldcrest *Regulus regulus*. *Acrocephalus*, 29: 190-191.
- Magaš D, Faričić J, 2002. The problems of the contemporary socio-geographic transformation of the Olib Island. *Geoadria*, 7: 35-62.
- Purger JJ, Kletečki E, Lanszki J, Trócsányi B, 2008. From the ornithological notebook (Croatia): Firecrest *Regulus ignicapillus*. *Acrocephalus*, 29: 191.
- Rucner D, 1998. *Ptice hrvatske obale Jadrana*. Hrvatski prirodoslovni muzej – Ministarstvo razvitka i obnove, Zagreb.
- Schlauer J, 1997. "New" data relating to the evolution and phylogeny of some carnivorous plant families. *Carnivorous Plant Newsletter*, 26: 34-38.
- Šere D, 2008. From the ornithological notebook (Croatia): Goldcrest *Regulus regulus*. *Acrocephalus*, 29: 121.
- Tutin TG, Burges NA, Cater AO, Edmondson JRE, Heywood VH, Moore DM, Valentine DH, Walters SM, Webb DA, 1972. *Flora Europaea*. Vol 3. University Press, Cambridge.
- Wilson J, 1890. The mucilage- and other glands of the Plum-bagineae. *Annals of Botany*, 4: 231-271.