Monitoring long term effects of a crop protection product on birds: a case study in citrus orchards in Italy

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Introduction

A common higher tier refinement option for wildlife is conducting field effect studies for the weight of evidence approach according to EFSA (2009). In the past, it was commonly agreed between the parties involved in study planning, that applications (i.e. pesticide exposure to birds) were set to the onset of breeding. This was considered a worst-case scenario to explore potential long-term (i.e. reproductive) effects of exposed individuals irrespective of the actual GAP of the product, applied later in the season or even outside the reproductive period. However, within the last few years a recurring regulatory concern in Europe of this design is that short-term exposure at any time of the year could have long-term effects on later reproduction. The current study aimed to investigate potential long-term reproductive effects on exposed birds after insecticide use against Mediterranean fruit flies (*Ceratitis capitata*) in the late season, and to cope with the logistic difficulties to follow exposed individuals between years.

Methods

The study was conducted in conventional orange orchards in Sicily, Italy.

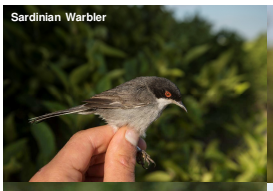
The selected orchards were treated with an insecticide three times between July and August 2016.

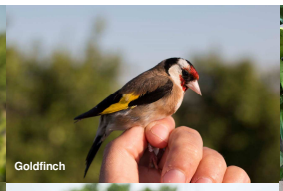
- Intensive bird trapping and ringing in 2016 within the two months of applications and shortly afterwards was conducted
- Intensive bird trapping from April to June 2017 (i.e. the reproductive season following treatment of orchards in 2016) was conducted to re-trap and track birds exposed in 2016
- radio-telemetry was applied to search for nest sites of exposed birds to monitor breeding success

Results

Individuals of the following bird species used the orchards in late 2016 and were re-captured in the breeding period of 2017:

SPECIES EXPOSED IN 2016 AND RECAPTURED IN 2017	No. of exposed individuals	Mean no. of recaptures per individual	Tracked individuals for nest searching
Blackbird	14	1.9	2
Cetti's warbler	2	2.5	-
Cirl bunting	3	2.3	1
Goldfinch	25	1.1	8
Great tit	15	2.8	6
Greenfinch	1	2.0	-
Jay	5	1.0	-
Linnet	8	1.4	-
Reed warbler	1	1.0	-
Sardinian warbler	46	1.9	13
Serin	3	2.0	-
Spanish sparrow	70	1.3	8
Subalpine warbler	2	1.5	-
Tree sparrow	22	1.7	9
Total	**217**	**1.6**	**47**





In total, 42 nests of birds known to be exposed to the insecticide were found (via radio-telemetry and trapping at nest sites). For 37 of them, it was possible to record the fate (see table below)

ACTIVE NESTS SURVEYED IN 2017	Fledged	Predated	Abandoned
All active nests (n = 162)	41.4 % (n = 67)	43.2 % (n = 70)	15.4 % (n = 25)
Nests of exposed birds (n = 37)	56.8 % (n = 21)	35.1 % (n = 13)	8.1 % (n = 3)

Despite the variability in the recapture rate for the different species, the majority of recaptured individuals were evidently reproductively active - 91.7 % of all exposed and recaptured birds

Most successful nests from exposed birds belonged to tree sparrows and great tits, nesting in nest boxes and cavities (n = 19). The total number of tree sparrows and great tits fledglings from exposed parents was 81 (45/13 nests and 36/6 nests respectively)

Conclusion

This study and its results show how registration relevant reproductive data can be recorded (even) for birds exposed late in the season, when the breeding period is already completed. However, whilst such studies are possible in orchards and similar permanent crops, this design might be difficult in yearly crops with field rotation in terms of sufficient sample sizes of breeding pairs/area. Nevertheless, when the application rates applied in orchards are higher than in the latter, it might be an option to extrapolate data to rotational field crops, where nesting densities of birds are much lower. Overall, there was no evidence for any reproductive effects such as reduced breeding success or higher mortality of young reared by birds evidently exposed in the previous season in treated citrus orchards compared to all birds monitored. Literature data indicate similar success rates in natural habitats for great tit in Mediterranean bush habitats, ranging from 43.5% to 57.1% (Bellavita & Sorace, 1991 in Gustin et al. 2010; for similar breeding success in great tits from Sicilian oak woods and reforested pine trees see Massa et al. 2011).

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