

# Predation attempts on Hoopoe *Upupa epops* nests in a rural Mediterranean area of central Italy

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**Abstract** - Seventeen predation attempts on four Hoopoe *Upupa epops* nests in an heterogenous agricultural Mediterranean area of central Italy were recorded during breeding seasons 2020-21. Camera traps identified 7 different predators' species, mainly Western whip snake *Hierophis viridiflavus* and Black rat *Rattus rattus*. Uropygial secretions and hissing calls from chicks and incubating female inside the breeding cavity always saved the clutches, while no active defense was performed by parents if outside the nest.

**Keywords:** *Upupa epops*, uropygial secret, anti-predatory strategy, Castel di Guido.

**Riassunto** - Tentativi di predazione su nidi di upupa *Upupa epops* in un'area rurale mediterranea dell'Italia centrale.

Attraverso l'utilizzo di fototrappole sono stati registrati 17 tentativi di predazione da parte di 7 specie diverse di predatori su 4 nidi di Upupa *Upupa epops*, in un'area agricola mediterranea vicino Roma, durante la stagione riproduttiva 2020-2021. La difesa attraverso l'utilizzo di secrezioni maleodoranti dall'uropigio e l'emissione di forti sibili da parte dei pulcini e/o della femmina in cova hanno sempre sventato gli attacchi, mentre nessuna difesa al nido è stata portata avanti dagli adulti quando si trovavano all'esterno di esso.

**Parole chiave:** *Upupa epops*, secreto uropigiale, strategia antipredatoria, Castel di Guido.

The Hoopoe *Upupa epops* breeds in a wide variety of cavities (Cramp, 1998), mainly on trees below 3 m height (Martín-Vivaldi *et al.*, 1999). The Hoopoe's preference to nest so close to the ground could be the result of an adaptation to the well-known scarcity of nesting cavities for hole-nester birds (Newton, 1994). Nesting so close to the ground, however, exposes the clutches to attacks by predators such as small mammals and snakes (Martín-Vivaldi *et al.*, 1999).

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For this reason, Hoopoe nestlings produce a foul-smelling fluid from the uropygial gland and copious expulsion of liquid feces that are thrown against the predator (Cramp, 1998). Similarly, females also show a marked increase in the size of the uropygium and the volume of the smelly product secreted when incubating (Martín-Vivaldi *et al.*, 2009; Martín-Vivaldi *et al.*, 2010); nestlings and incubating female secretions have the same colour and odor, due to the presence of high densities of symbiotic bacteria (Martín-Vivaldi *et al.*, 2009).

During 2020 and 2021 breeding seasons, four Hoopoe breeding sites, located in mature tree cavities within one meter from the ground, were discovered in an extensive rural area on the Castel di Guido farm near Rome (central Italy) (Piccoli *et al.*, 2019) (Fig.1). A camera trap was placed in front of each nest that could produce 10-second footage at 1920x1080 resolution (Full HD 1080p) when triggered by a motion detector. The interval between one footage and the next was 15 seconds. The footage was collected from mid-May to mid-July as part of a more complete research on the reproductive biology of the species (Annessi *et al.*, 2022). The fledging success of the pairs was detected for three nests, and resulted in three, four and five young per clutch.



Fig. 1 - One of the four Hoopoe nests observed at the base of a ripe olive tree during the 2020-21 breeding seasons in Castel di Guido (Rome). Photo extracted by a camera trap footage. / Uno dei quattro nidi di upupa osservati alla base di un olivo maturo durante le stagioni riproduttive 2020-21 a Castel di Guido (Roma). Foto estratta da una ripresa con fototrappola.

A total of 17 predation attempts by 7 different predator species were detected during both egg incubation (35%) and chick growth (65%). All cases in which the predator faced the nest entrance and attempted to enter the nest were considered predatory attacks (Fig. 2). The most frequent predation attempts were carried out by Western whip snake *Hierophis viridiflavus* (28%) and Black rat *Rattus rattus* (28%) (Tab. 1).



Fig. 2 - Predation attempts by Little owl *Athene noctua* (A-B) and Western whip snake *Hierophis viridiflavus* (C-D) at Hoopoe nests during the 2020-21 breeding seasons in Castel di Guido (Rome). Photos extracted by a camera trap footage located near a nest. / Tentativi di predazione da parte della civetta *Athene noctua* (A-B) e del biacco *Hierophis viridiflavus* (C-D) nei confronti dei nidi di upupa durante le stagioni riproduttive 2020-21 a Castel di Guido (Roma). Foto estratte dalle riprese di una fototrappola posizionata nei pressi di un nido.

Tab. 1 - Predator species and the relative number of predation attempts recorded at 4 Hoopoe breeding sites during the 2020-21 breeding seasons in Castel di Guido (RM). / Specie di predatori e numero relativo di tentativi di predazione registrati in 4 siti riproduttivi di *Upupa* durante le stagioni riproduttive 2020-21 a Castel di Guido (RM).

Predator species	Attempted predation (nest with eggs)	Attempted predation (nest with chicks)
Western whip snake <i>Hierophis viridiflavus</i>	0	5
European asp <i>Vipera aspis francisciredi</i>	0	1
Common magpie <i>Pica pica</i>	0	1
Little owl <i>Athene noctua</i>	0	1
Red fox <i>Vulpes vulpes</i>	1	1
Black rat <i>Rattus rattus</i>	4	1
Domestic cat <i>Felis silvestris catus</i>	1	1

During attacks, the breeding female and/or the chicks (aged > 10 days), in addition to the foul-smelling liquid, also emitted a loud hissing sound. The latter could reinforce the defensive behaviour especially toward reptiles and birds, whose sense of smell is less well developed. When predation was attempted, the parents, if outside the nest, never attacked the predator and always escaped silently.

In conclusion, all observed predatory attacks failed, supporting the hypothesis that due to the specific strategies adopted, the Hoopoe can reproduce with success even in cavities very close to the ground.

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#### REFERENCES

- Annessi M., De Biase A. & Montemaggiore A., 2022 – Diet and foraging ecology of the Hoopoe *Upupa epops* in a Mediterranean area of Central Italy. *Avocetta*, 46 (2): 77-85.
- Cramp S. (ed.), 1998 – The complete birds of the Western Palearctic on CD-ROM. *Oxford University Press*.
- Martín-Vivaldi M., Palomino J. J., Soler M. & Soler J. J., 1999 – Determinants of reproductive success in the Hoopoe *Upupa epops*, a hole-nesting non-passerine bird with asynchronous hatching. *Bird Study*, 46 (2): 205-216.
- Martín-Vivaldi M., Ruiz-Rodríguez M., Soler J. J., Peralta-Sánchez J. M., Méndez M., Valdívía E., Martín-Platero A. M. & Martínez-Bueno M., 2009 – Seasonal, sexual and developmental differences in hoopoe preen gland morphology and secretions. Evidence for a role of bacteria. *Journal of Avian Biology*, 40 (2): 191-205.
- Martín-Vivaldi M., Pena A., Peralta-Sánchez J. M., Sánchez L., Ananou S., Ruiz-Rodríguez M. & Soler J. J., 2010 – Antimicrobial chemicals in hoopoe preen secretions are produced by symbiotic bacteria. *Proceedings of the Royal Society B, Biological Sciences*, 277 (1678): 123-130.
- Newton I., 1994 – The role of nest sites in limiting the numbers of hole-nesting birds: a review. *Biological conservation*, 70 (3): 265-276.
- Piccoli A. P., De Lorenzis A., Luchenti I. & Canestrari L., 2019 – Spatial Distribution and Habitat Utilization of Reptiles in a Mediterranean Area (Castel di Guido, Rome, Italy). *International Journal of Environment, Agriculture and Biotechnology*, 4 (6): 1711-1719.