

Hoopoes *Upupa epops* preying on Pine Processionary Moth *Thaumetopoea pityocampa* pupae, with a note on kleptoparasitism by Woodchat Shrikes *Lanius senator*

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Some insectivorous birds are important natural predators of the Pine Processionary Moth, one of the most serious forest pests in southern Europe. Although predation occurs mainly on eggs and caterpillars, sometimes Hoopoes *Upupa epops* also feed on pupae. Here I report several observations of such predation for the first time in Spain, as well as the opportunistic behaviour shown by two Woodchat Shrikes *Lanius senator* that also fed on the pupae previously extracted from the ground by the Hoopoes.

Key words: Hoopoe, *Upupa epops*, Woodchat Shrike, *Lanius senator*, Pine Processionary Moth, *Thaumetopoea pityocampa*, Lepidoptera, predation behaviour, kleptoparasitism, NE Iberian Peninsula.

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Rebut: 30.06.98; Acceptat: 30.10.98

The Pine Processionary Moth *Thaumetopoea pityocampa* is one of the most important forest pests in southern Europe. The caterpillars are gregarious and live in conspicuous communally built silk nests. They feed on a great variety of both natural and introduced pines and other conifers (*Pinus halepensis*, *P. nigra*, *P. sylvestris*, *P. pinaster*, *P. canariensis*, *Cedrus atlantica*, etc.), and during outbreak years they can defoliate trees and cause growth losses of up to 35% of the annual growth (Laurent-Hervouët 1986). Larval development takes place

approximately between September-October and February-March, though there is considerable variation due to latitude and altitude. At the end of the growth period, larvae descend in groups from the trees and begin a wandering phase (the well-known nymphose procession) in search of a good pupation site. Pupation occurs at depths of 5-20 cm, depending on soil conditions, inside a silk cocoon. In most cases, pupae concentrate at forest edges or in glades, not far from the pines. Moths emerge from the pupae during the summer months.

Date/ Data	Feeding site/ Lloc d'alimentació	No. Hoopoes/ N. de puputs	No. empty cocoons/ N. de capolls buïts
08.07.97	path edge/ vora d'un camí	2	3
28.04.98	path edge/ vora d'un camí	1	13
07.05.98	path edge/ vora d'un camí	1	13
07.05.98	path edge/ vora d'un camí	4	>10
07.05.98	forest glade/ clariana d'un bosc	4	15

Table 1. Predation of Pine Processionary Moth *Thaumetopoea pityocampa* pupae by Hoopoes *Upupa epops* in a plantation of *Pinus halepensis* in the Aiguamolls de l'Empordà Natural Park (Alt Empordà, NE Spain).

Taula 1. Observacions de depredació de pupes de Thaumetopoea pityocampa per part de puputs Upupa epops en una plantació de Pinus halepensis en el Parc Natural dels Aiguamolls de l'Empordà (Alt Empordà, NE d'Espanya).

Natural predators of *T. pityocampa* have been reported by many authors. Invertebrate predators and parasites are particularly diverse and have been recorded for all stages, from egg to adult (e.g. Dajoz 1980). Vertebrate predators consist mainly of insectivorous birds that prey on eggs, larvae and pupae. According to Ceballos (1971) and González Cano (1981), the Great Tit *Parus major*, Blue Tit *Parus caeruleus* and Coal Tit *Parus ater* are the most important predators of caterpillars in Spanish pine forests, although several other species, especially the Cuckoo *Cuculus canorus* and Great Spotted Cuckoo *Clamator glandarius* also consume them (Valverde 1953, Laferrère 1956, Mestre Raventós 1969, Montoya 1981, Cramp 1985). However, the only bird species known to feed on pupae is the Hoopoe. Although Ceballos (1969) had already suggested that Hoopoe might be a potential predator of *T. pityocampa* pupae, the first direct evidence was provided by Battisti (1986). This author found that Hoopoes were able to localize and extract up to 60% of the pupae buried in some Austrian Pine *Pinus nigra* forests in the Italian Venetian Pre-Alps.

During the last two years I have recorded this same predatory behaviour in a plantation of small pines (*Pinus halepensis*) near Vilàut, in the Aiguamolls de l'Empordà Natural Park (Alt Empordà, NE Spain). Observations were made on 8th July 1997, 28th April 1998 and 7th May 1998, mainly on a path crossing the pine plantation (Table 1). Hoopoes walked on the ground while jabbing left and right with the bill as described by Cramp (1985). Once *T. pityocampa* cocoons had been located, usually at the edges of the path, they were seized in the bill tip and hammered against the ground until broken, and the pupae inside extracted and consumed. Empty cocoons were always left on the ground, thus permitting easy quantification of the number of pupae consumed.

It is interesting to note the gregarious foraging behaviour exhibited by the Hoopoes most of the times (Table 1). On 7th May, for example, a single individual was seen searching for pupae at 3 p.m., but two hours later it had been joined by three other birds and all four were foraging together. Battisti (1986) also observed Hoopoes foraging in groups of two or three individuals, mainly in open areas such as

fire belts and roads. Although Hoopoes usually feed solitarily, small flocks have been reported by several authors (cf. Cramp 1985) and this behaviour may help them to locate and exploit some particular food items such as *T. pityocampa* pupae.

During the first of these series of observations, a curious interaction between the Hoopoe and another species, the Woodchat Shrike *Lanius senator*, was also noted. While feeding on pupae, the two Hoopoes were joined by two Woodchat Shrikes. The shrikes were evidently attracted by the food consumed by the Hoopoes, as clearly demonstrated by their subsequent behaviour: together with the Hoopoes and with no signs of aggression they began to feed on some pupae that were lying on the ground.

This opportunistic behaviour is worthy of remark and may be viewed as a kind of kleptoparasitism allowing the Woodchat Shrike to broaden the spectrum of its usual diet. Although Woodchat Shrikes sometimes capture prey while hopping on the ground (Hernández 1993), because of their relatively short bill they would be unable to locate buried pupae of *T. pityocampa*. Two pairs of Woodchat Shrikes bred in the area where the observations were made. The site was visited weekly during spring and summer months, and fledglings of both breeding pairs were first noticed on 8th July. It is possible, therefore, that the unusual foraging behaviour of the Woodchat Shrikes was related to their need to satisfy high energetic requirements at that time.

Although Hoopoes are sometimes kleptoparasitized by other birds, they typically show some sort of escape or aggressive behaviour (M. Martín-Vivaldi pers. com.). In contrast, Hoopoes and Woodchat Shrikes shared the food during a few seconds without any apparent dispute. Both species, however, quickly left the area as the observer's presence was detected, and so the complete behaviour sequence could have been missed.*

ACKNOWLEDGEMENTS

Very helpful comments on a previous version of the MS were provided by Manuel Martín-Vivaldi and Ángel Fernández. M.T. Lockwood kindly revised the English version. Raúl Aymí helped with the bibliographical research.

RESUM

Predació de pupes de la Processionària del pi Thaumetopoea pityocampa per la Puput Upupa epops amb una nota de cleptoparasitisme del Capsigrany Lanius senator

Alguns ocells insectívors són importants predadors de la Processionària del pi, un dels flagells més importants dels boscos del sud d'Europa. Encara que la predació es dona principalment sobre aus i erugues, de vegades les puputs *Upupa epops* també mengen pupes. En aquest treball s'aporten per primera vegada a Espanya diverses observacions d'aquesta predació així com el comportament oportunístic realitzat pel Capsigrany, el qual també va menjar pupes que ja havien estat extretes del terra per les puputs.

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