

Invasive box-tree moth *Cydalima perspectalis*, a new food resource for Great Spotted Cuckoo *Clamator glandarius*

Bernat Garcia Espluga^{1*} & Miquel Àngel Garcia-Reàdigos¹

The box-tree moth *Cydalima perspectalis* has become in recent years a highly invasive insect species in central and southern Europe, where it is now a devastating plague on both natural and ornamental stands of box trees *Buxus sempervirens*. This paper describes the use of *C. perspectalis* larvae as a food resource by two Great Spotted Cuckoos *Clamator glandarius*. Observations took place in southern Catalonia (NE Iberian Peninsula) on eight non-successive days over a period of 30 days in April–May 2020. The cuckoos were detected in both the morning and afternoon as they thoroughly scrutinized the branches of box trees and ate the caterpillars they found. Although this plague species of moth had already become highly abundant and defoliated many box trees in some regions of Catalonia, this was the first time it had been detected at this site and the third year it had been recorded in southern Catalonia, where it had arrived in 2018. This observation shows the plasticity of the feeding behaviour of certain species such as the Greater Spotted Cuckoo, which can quickly adapt to feeding on new food resources as they become available.

Key words: Box-tree moth, Great Spotted Cuckoo, box tree, invasive species, food resource, biocontrol agent.

¹Carrer d'Ansedó, núm 1, 1r 4a, Raval de Crist, Roquetes, Tarragona, Catalunya, 43529.

*Corresponding author: bespluga@gmail.com

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Human activity has greatly modified biological processes over space and time (Banks *et al.* 2015) and one such alteration consists of transporting and introducing species beyond their normal biogeographical barriers, from where they can spread and establish viable populations (Blackburn *et al.* 2011). This phenomenon entails readjustments in the ecological food chain in which the new predator and prey dynamics occur (Bellard *et al.* 2016). Understanding these dynamics is key when assessing the imbalances that alien species generate and when studying potential biocontrol agents that can mitigate or eradicate the impact of exotic species on ecosystems (Carlsson *et al.* 2009).

The box-tree moth *Cydalima perspectalis* (hereafter BTM) belongs to the family *Crambi-*

dae and is native to subtropical regions of eastern Asia (Mally & Nuss 2010). However, it was accidentally introduced into Europe as a parasite of ornamental *Buxus* spp. plants, specifically into SW Germany, where it was first recorded in 2007 (Krüger 2008, Bassols & Oliveras 2014). Ever since, this moth has spread rapidly across central and southern Europe and in Catalonia it was first recorded in Besalú in July 2014 (Bassols & Oliveras 2014). The most worrying aspect of the BTM invasion is its devastating effect on stands of the box tree *Buxus sempervirens*; the repeated defoliation and damage inflicted on these trees' bark eventually leads to their death (Kenis *et al.* 2013, Artola *et al.* 2018). The BTM is able to complete two generations and start a third partial generation every year but in

winter it enters into diapause as a caterpillar (Artola *et al.* 2018).

A few bird species are known to predate BTM in Europe: Black Redstarts *Phoenicurus ochruros* eat both larvae and adults; Redstarts *Phoenicurus* spp., Tits *Parus* spp. and Jackdaws *Corvus monedula* feed on larvae; and House Sparrows *Passer domesticus*, Barn Swallows *Hirundo rustica* and House Martins *Delichon urbicum* have been seen to capture and ingest adult moths (Sangerman 2018, data taken from www.ornitho.cat). In this paper we report the first sightings of Great Spotted Cuckoo *Clamator glandarius* (henceforth GSC) feeding on BTM larvae.

In spring 2020, two GSC were observed eating BTM caterpillars in Barranc de Sant Antoni (Tortosa, Tarragona province, 40°47'16"N 0°29'33"E) on eight non-successive days. The Barranc de Sant Antoni has steep sides and dense box scrub on its shady slope. These plants were infested by BTM in spring 2020 for the first time and by the end of April the extent of the defoliation was clearly noticeable. The GSC is known to breed locally near the river Ebro and in 2020 the first cuckoo was detected in the area on 1 March. However, it was not until 28 April that two birds were observed feeding on BTM caterpillar (see <https://www.youtube.com/watch?v=rgjxINuoDcc&t=111s>).

The cuckoos' foraging behaviour consisted of sitting on box branches and thoroughly scrutinizing the tree for caterpillars; as soon as a BTM larva was detected, it was rapidly captured and ingested (Figure 1). Pupae, protected inside silky cocoons stuck between leaves, were also eaten by the birds whenever they found them. Nevertheless, some BTM larvae were able to escape

predation successfully: the weight of the GSC made the box branches swing and caterpillars responded by lowering themselves to the ground along silken threads. The GSC were not observed foraging on the ground in the dense undergrowth. The GSC were reported in the same patch of box trees every day the site was visited between 28 April and 19 May (on eight days in total), regardless of the time of the day (see Table 1). The Barranc de Sant Antoni was not visited again until 27 May and the GSC were not relocated on that day or on any subsequent day. It is worth mentioning that on 13 May a Jackdaw *Corvus monedula* joined the GSC in feeding on BTM caterpillars. This behaviour was only observed on one day for around 15 minutes at about 21:00 h. The Jackdaw moved from branch to branch capturing insects with its beak and eating them just a few metres away from the cuckoos.

Our observations suggest that the GSC spent most of the day feeding almost exclusively on BTM larvae for at least one month once the caterpillars had reached plague proportions. Although the BTM and GSC do not overlap in their natural world distribution, the evidence suggests that the GSC is rapidly able to adjust its feeding behaviour to new ecological opportunities. Even though the plague had already become serious and devastated box trees in some regions of Catalonia, it was first detected in southern Catalonia in 2018 (Joan Mestre, pers. comm.) and first infested wild box trees in 2019. Therefore, the presence of the BTM was recent when found in Barranc de Sant Antoni in the spring 2020. This observation shows the plasticity of the feeding behaviour of species such as the GSC, which can quickly change to consuming exotic

Table 1. Observation days and time period in which Great Spotted Cuckoos (GSC) were observed eating box-tree moth larvae. On 13 May, GCS were seen foraging for BTM together with a Jackdaw.

Període d'observació dels cucuts reials menjant larves de la papallona del boix. El 13 de maig els cucuts reials es van observar menjant les larves junt amb una gralla.

Date	Hour	No of GSCs	No of Jackdaws
28 April 2020	9.00 – 11.30	2	-
29 April 2020	9.30 – 12.00	1	-
2 May 2020	19:30 – 21.30	2	-
4 May 2020	18.00 – 20.15	2	-
9 May 2020	8.00 – 10.00	2	-
13 May 2020	19.30 – 21.00	2	1
15 May 2020	8.30 – 10.00	2	-
19 May 2020	8.00 – 9.30	2	-



Figure 1. Great Spotted Cuckoo foraging on a box tree infested with box-tree moths, Barranc de Sant Antoni, 9 May 2020 (Photo: Bernat Garcia Espluga).

Cucut reial menjant en boixos infestats de la papallona del boix, Barranc de Sant Antoni, 9 de maig de 2020.

species as they become available. Similar cases of rapid adaptation have been observed in Glossy Ibis *Plegadis falcinellus* and the Apple Snail *Pomacea maculata* (Bertolero & Navarro 2018), and the Honey Buzzard *Pernis ptilorhynchus* and the Asian Wasp *Vespa velutina* (Macià et al. 2019).

Although the GSC's low population densities in Catalonia probably preclude any potential role for this cuckoo as a biocontrol agent of BTM, we did observe highly intense exploitation of this moth's caterpillars, which may have some negative effects on its populations, as has occurred in the case of the native processionary moth *Thaumetopoea pityocampa* (Barbaro & Battisti 2011). Given these circumstances, it would seem logical to further protect and favour the GSC as a potential ally in the struggle to contain the relentless expansion of the BTM.

Resum

La papallona invasora del boix *Cydalima perspectalis*, un nou recurs alimentari per al cucut reial *Clamator glandarius*

La papallona del boix *Cydalima perspectalis* és una

espècie amb elevada capacitat invasiva al centre i sud d'Europa, i una plaga devastadora per a les extensions de boix *Buxus sempervirens*, tant naturals com ornamentals. Aquesta nota descriu l'explotació de larves de *C. perspectalis* com a recurs alimentari per part d'una parella de cucut reial *Clamator glandarius*. L'observació va tenir lloc a les Terres de l'Ebre en vuit dies no successius al llarg d'un mes, durant l'abril i el maig. Els ocells van ser detectats tant al matí com a la tarda escrutant minuciosament branques de boix i menjant erugues. Aquesta va ser la primera evidència de presència de l'arna en l'emplaçament d'estudi, i ja assolida densitats elevades, deixant alguns boixos severament defoliats. Aquesta observació mostra la plasticitat del comportament alimentari d'algunes espècies, com el cucut reial, que poden canviar ràpidament a l'ús de nous recursos alimentaris a mesura que estiguin disponibles.

Resumen

La polilla invasora del boix *Cydalima perspectalis*, un nuevo recurso alimenticio para el críalo europeo *Clamator glandarius*

La polilla del boix *Cydalima perspectalis* es una especie con elevada capacidad invasiva en el centro y sur de

Europa, y una plaga devastadora para las extensiones de boj *Buxus sempervirens* tanto naturales como ornamentales. Esta nota describe la explotación de larvas de *C. perspectalis* como recurso alimenticio por parte de una pareja de críalo *Clamator glandarius*. La observación tuvo lugar en el sur de Cataluña por ocho días no sucesivos a lo largo de un mes, durante abril y mayo. Los pájaros fueron detectados tanto por la mañana como por la tarde escrutando minuciosamente ramas de boj y comiendo orugas. Esta fue la primera evidencia de presencia de la polilla en el lugar de estudio, y ya alcanzó densidades elevadas, dejando algunos bojes severamente defoliados. Esta observación muestra la plasticidad del comportamiento de alimentación de algunas especies, como el críalo, que pueden cambiar rápidamente al uso de nuevos recursos alimenticios a medida que están disponibles.

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