

## **Supplementary Materials**

### **Supplementary Text**

#### **Video recording and equipment installation**

In the Spanish population, we tied the mini video-camera (JCHENG Mini Hidder surveillance camera) to a rigid wire, and centered the camera at the top of the nest box. The infrared filter was removed, and an external source of infrared light (i.e. not detected by hoopoes nor human eyes) was installed at the top of the nest box. The camera was connected to an external recorder (mini\_dvr, eBoTrade) with a 32MB SD card that allowed recording approximately 10 hours in high quality and more than 24 hours in low-medium quality. Both the camera and the recorder were connected to an external 12V battery (12AH). Mostly for the second part of the breeding season, we also used a power relay module with adjustable timing cycle (Walfront9wflcd48go, ASIN B074VVKW4K) to turn off the apparatus during the night automatically. Moreover, to assure that camera was properly sited and connected, we also used an external screen (KKMoon 3,5" TFT LED, OWSOO-EU) that was plugged to the video recorder and allowed us to watch the inside of the nest boxes, and check whether the camera was properly sited and the recorder functional. The batteries, the recorder and the power relay module were included in a plastic bag that, with the help of leaves, stones and other natural materials, was hidden on the floor, under the nest boxes. The cables connecting the camera to the recorder were also camouflaged around the tree trunk or wall. Finally, we used infrared light connected to another small battery that was camouflaged and sited on the top of the nest box.

In Austria, a Hyundai day/night outdoor infrared camera were installed inside each nest box, on the upper region of the sidewall. The camera was connected to a video server and the recording were stored on a USB stick. The whole apparatus was connected to a power source and the equipment (camera, pole, cables, etc.) was stored in a plastic bag and well hidden. For each nest, the video server was programmed for recording three hours during the morning (6:00–9:00 a.m.) and another three hours during the afternoon (5:00–8:00 p.m.).

In both countries, females were in most occasions inside the nest boxes when video recording and equipment installation. If they did not fly out before we inspected the nest, they were caught by hand and maintained in cotton bags during the installation of the recording equipment. Before leaving the area, we returned the female to the nest box, whom usually stayed inside. The females that did depart the nest returned shortly thereafter. Some few inferred events of sibling cannibalism were not recorded because of either, video recording equipment failures, or because it occurred during the no recorded time.

#### **Supplementary Videos S1 to S5**

##### **Supplementary Video S1. Hoopoes accepting artificially provided food.**

**Download here:** [http://www.eeza.csic.es/documentos/users/jsoler/EMS\\_video\\_5.mp4](http://www.eeza.csic.es/documentos/users/jsoler/EMS_video_5.mp4)

Three and a half minutes of video showing the use of experimental food (unfrozen crickets) supplied to a hoopoe nest. Experimental food can be seen at the beginning of the video at the upper-left part of the screen. The female hoopoe arrived to the nest with a pupa and fed one of the nestlings with it. Later, she detected the experimental food and used the crickets to feed nestlings of varying size. Curiously, one of the nestlings accidentally introduced its head inside an empty eggshell for a while.

##### **Supplementary Video S2. Hoopoe female's feeding attempts with different prey including a sibling.**

**Download here:** [http://www.eeza.csic.es/documentos/users/jsoler/EMS\\_video\\_1.mp4](http://www.eeza.csic.es/documentos/users/jsoler/EMS_video_1.mp4)

Six minutes of video, showing the typical large nestling body-size-hierarchy in hoopoe broods as well as the feeding behavior of females. The first one and a half minutes shows how a female

hoopoe feeds a beetle larva to the nestlings. Typically she did not simply feed one offspring but offered the prey to more than one nestling, even introducing and removing the larva from the open gape of several chicks. After one minute and 32 seconds, she decided to leave the prey to one of the nestlings, which finally swallowed it. Later, the female spent some time in nest sanitation duties and, at 2' 28" of the video, she picked up one of the smallest alive nestlings and tried to feed older siblings with it. She failed in this first attempt and the prey sibling fell to the nest-box floor. Less than one minute later she picked up the same sibling prey and, again, tried to feed older siblings with it. At this time, after several attempts, she managed to introduce the head of the prey into the mouth of an older nestling, which finally swallowed its younger sibling. At 5' 26" of the video, the female took up another small nestling and started to feed another older sibling with it.

**Supplementary Video S3. Cannibalistic hoopoe mother eating her own offspring.**

**Download here:** [http://www.eeza.csic.es/documentos/users/jsoler/EMS\\_video\\_3.mp4](http://www.eeza.csic.es/documentos/users/jsoler/EMS_video_3.mp4)

Twenty seconds video where a brooding female took a recently died small offspring and swallowed it. The cannibalistic female did previously try to feed older offspring with the offspring prey when it was still alive.

**Supplementary Video S4. Nestling depredation by conspecific hoopoe.**

**Download here:** [http://www.eeza.csic.es/documentos/users/jsoler/EMS\\_video\\_4.mp4](http://www.eeza.csic.es/documentos/users/jsoler/EMS_video_4.mp4)

One-minute video where a conspecific depredation was recorded. It can be seen how the hoopoe aggressively attacks one of the older nestlings. Finally, the predator hoopoe took one of the small nestlings that were begging for food and flew away from the nest box with the chick in its beak. This was probably not the male of the nest.

**Supplementary Video S5. Hoopoes taking off a hatchling from the eggshell to use it to feed older nestlings.**

**Download here:** [http://www.eeza.csic.es/documentos/users/jsoler/EMS\\_video\\_6.mp4](http://www.eeza.csic.es/documentos/users/jsoler/EMS_video_6.mp4)

Two and a half minutes of video shows a hatching egg at the top-left corner of the nest box and how the female helped the hatchling to get out of the eggshell (0:08). Later on (0:50) the female with her bill grasped the hatchling, which was partially within the eggshell, but left it on the nest floor when receiving a prey from the male that she used to feed a large offspring. Afterwards, she started again to "help" the nestling to get out of the eggshell and, finally (1:55), she grasped the hatchling again, and although the male arrived with another prey, the female fed the hatchling to an older, bigger sibling. The egg started to hatch one and a half hours before this video commences. This video therefore shows when the hatchling was almost ready to leave the shell.