

Eastern Bluebird

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Manipulation of caterpillars for consumption by Eastern Bluebirds

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IT WAS A SURPRISINGLY WARM and sunny day on 15 November 2011. The following observations took place in Oxford County, just outside of the small village of Drumbo.

Unfortunately, I was at my desk working on a report, and was not outside enjoying one of the last warm days of fall. At around 13:00hrs, I took a brief moment to look out my window, into the

backyard. A bird quickly caught my gaze as it fluttered across the backyard and landed in an apple tree (*Malus* sp.). Knowing it wasn't just a House Sparrow (*Passer domesticus*) or an American Robin (*Turdus migratorius*), I quickly ran to get my binoculars which were sitting in another room. By the time I came back, there was a bird perched on the metal fence in front of the tree.

Before long, the bird flew from the fence to the ground where it pecked at the ground and then quickly flew into a Honey Locust (*Gleditsia triacanthos*) tree only 5m in front of the back sliding door out of which I was looking. It was a male Eastern Bluebird (*Sialia sialis*). By this time, I noticed three other bluebirds in the backyard, either on the metal fence or in the trees near the fence.

I quickly put the binoculars on the bird that flew into the locust tree. It had a grayish brown caterpillar in its bill and was looking around. Then it suddenly lowered its head and adjusted its hold on the caterpillar, which was still moving. Then, to my surprise, it started to beat the caterpillar against the tree branch on which it was perched (the branch was approximately 1.75m above the ground). The bluebird was holding onto the back quarter of the caterpillar. I quickly thought to start counting how many times it was hitting the caterpillar against the branch. Moving its head back and forth at about a 45-degree angle, it kept hitting the caterpillar against the branch, stopping only to occasionally look quickly from side to side. It would then re-adjust the caterpillar in its bill, only to start beating it again. The sun was above and behind the bluebird as I watched which made me able to observe something that at a different view point or time of day I would not have been able to see. About halfway through the time I observed this bird, I saw a liquid being knocked out of the

caterpillar, the sunlight reflecting liquid droplets as they flew through the air. I was greatly astounded by this. Two thoughts ran through my mind, was this bluebird perhaps beating the caterpillar against the branch for some reason other than to just kill it before eating it or was this meant to expel the excrement that is in the caterpillar or to expel toxins that the caterpillar uses as a defence. Either way I saw this as a remarkable behaviour evolved to deal with caterpillars.

In the end, I observed this bluebird hit the caterpillar a total of approximately 118 times, before it swallowed it. This I thought was a bit of overkill, since less than halfway through this process I noticed the caterpillar did not move during the times when the bluebird would stop and quickly readjust its hold on the caterpillar or during the three occasions it laid it on the branch for a few seconds before picking it up again. Shortly after finishing its meal the bluebird flew out of the locust tree, moving around the backyard with the other bluebirds. I continued to watch the bluebirds, hoping to see another bird catch and eat a caterpillar.

Before long I observed another male bluebird fly up from the ground and land in the same locust tree, with what appeared to be the same type of caterpillar. This bird sat on a branch approximately 2m above the ground. The male bluebird showed the same behaviour as the previous bird, it banged the caterpillar again and again against the branch it was perched on, but while it

was readjusting it in its beak, the bluebird dropped the caterpillar. The bluebird immediately flew down to the ground after it, found it and flew back up to the tree. It quickly began the behaviour once again, and continued to do so after the caterpillar was clearly not moving any more. I counted this bird hitting the caterpillar against the tree branch 130 times.

After this observation, the group of bluebirds moved around the backyard and then to the front of the house, where they sat in a maple tree (*Acer* sp.) preening and not foraging. After about fifteen minutes I observed another bluebird which was perched in a maple tree fly down to the ground, grab a caterpillar and fly up to another maple tree. The caterpillar this bird caught was a small inchworm type of caterpillar which was smooth, and greyish-brown in color. When this bird landed in the maple tree, before long it began rearranging the caterpillar in its bill by opening and closing its mouth, not using the branch it was perched on at all. Then suddenly, while rearranging the caterpillar in its mouth, the bluebird fumbled it and the caterpillar fell down to the ground. This bird surprisingly did not dive after it to pick it back up, it just sat in the tree looking around as if nothing happened.

Before long the bluebirds moved back around the house, once again to the backyard. I observed a female or immature bluebird which was perched in the locust tree fly down and land on the grass. It hopped two times reached

forward and grabbed a caterpillar in its bill and flew back into the locust. Due to the light conditions, I could not find the bluebird for one or two minutes. When I found where it had landed, it was on a branch 3m above the ground. The bluebird was holding the caterpillar at one end, with three quarters of it hanging out of its bill, and banged the caterpillar five times in the same back and forth motion I had observed previously. The bluebird then stopped, placed the caterpillar on the tree branch, picked it back up, adjusted its hold on it by opening and closing its beak and moving its head in the direction it was trying to adjust its hold. The caterpillar by this time was no longer moving on its own. The bluebird adjusted its hold one last time, banged the caterpillar three more times against the tree branch and then quickly swallowed it whole.

After observing what I thought to be a very interesting and unusual feeding behaviour, several questions regarding bluebirds ecology and some of the specific behaviours I observed, came to mind. I wondered whether or not caterpillars are a main food item for bluebirds, as I considered infrequent handling of caterpillars might explain what I thought to be excessive beating of them against branches.

Bluebirds are known to be largely insectivores, with as much as 68% of their yearly diet being insects, the remainder being wild fruits including cherries, raspberries, and blackberries, dogwood, sumac, serviceberry, poison

ivy, and elderberry (Ritchison 2000, Martin *et al.* 1961, Beal 1915). Beal (1915) examined the stomach contents of 855 Eastern Bluebirds, which were collected over every month of the year in the United States. His data indicated that around 10.5% of the Eastern Bluebirds diet over the year was Lepidoptera (in the form of caterpillars and moths). This was the third largest of the insect groups that comprised their diet. The largest part of their insect diet was Orthoptera (grasshoppers, crickets, katydids), with beetles being the second largest (Beal 1915). Pinkowski (1977) considered food items of >2cm as large food items for Eastern Bluebirds. It is therefore not surprising that the bluebirds I observed were foraging on large, high protein food (caterpillars) in November, which is invaluable to supplementing their fat stores to help them get through cold nights. According to the literature, caterpillars form a regular part of a bluebird's diet, and therefore the behaviour I observed was not likely due to inexperience in consuming caterpillars.

Although the feeding behaviour of the Eastern Bluebirds I observed was new to me, some of the behaviours I observed have been noted by others. The literature on Eastern Bluebirds indicates that they regularly hunt from low perches (Pinkowski 1977). The foraging tactics bluebirds use include dropping from a perch, flycatching, gleaning, flight gleaning and hopping on the ground (Ritchison 2000, Pinkowski 1977). The foraging behav-

iours I described, in my observations of the Eastern Bluebirds capturing caterpillars during the autumn, were dropping from a perch and hopping on the ground. Pinkowski (1977) indicated that the relative frequency of the various foraging tactics employed by Eastern Bluebirds varied between seasons, but the main tactic used in all seasons was dropping from a perch.

With caterpillars comprising a regular part of the bluebird diet, the obvious question to me was what are the reasons for beating caterpillars so aggressively against their perch? Is it to expel bad tasting toxins, to make the body more pliable for ingestion, or possibly remove hairs from the body of the caterpillar? Why would they beat a soft-bodied invertebrate like a caterpillar so many times? I also wondered what the liquid I saw expelled from one of the caterpillars could possibly be.

In the literature, I was able to find some general references to both Eastern and Western (*Sialia mexicana*) Bluebirds being known to commonly beat invertebrate prey against perches before consumption (Stern 2007). The articles I was able to find, which contained detailed descriptions of bluebirds beating their prey against their perch, were of rare observations where bluebirds were observed catching vertebrate prey. Pinkowski (1974) observed an Eastern Bluebird catch a shrew, which was taken in the bluebird's bill to a perch where it held the shrew by its head and repeatedly banged it against branches. Pinkowski

noted the shrew was dead in 3 to 4 minutes, but the bluebird continued to bang the prey after it was dead.

Pinkowski (1974) also noted that the shrew was always held and manipulated by the beak, and never by the feet. Similarly, Stern (2007) observed a Western Bluebird catch a lizard that was on a fence post, by only using its bill. The bluebird landed on the fence post on which it caught the lizard on and banged the lizard's head on the post twice. Flanigan (1971) observed an Eastern Bluebird carrying a 20 cm snake in its bill; the bluebird landed on the roof of a low building and beat the snake against the roof for several minutes.

I was not able to find any detailed information in the literature on how Eastern Bluebirds manipulate caterpillars or other specific invertebrates for ingestion. Ritchison (2000) noted that Eastern Bluebirds use one of two methods to subdue/prepare their prey, either they beat the prey against a perch or holding prey in their bill they apply pressure with the cutting edges of the bill. Ritchison (2000) indicated generally that food preparation can include the bluebird removing legs and wings of some insects and that they may also crush the head and thorax. The rationale for why the bluebirds must prepare their prey was not noted (i.e. whether it is to remove indigestible parts or to make the prey easier to swallow) nor was how preparation may vary for different prey items.

I was, however, able to find some references to other bird species which beat prey against perches such as the bee-eaters (family Meropidae), which predominantly eats bees (Brooks 1989). In the case of bee-eaters they are not immune to the venom in the stingers and sacs of bees, so with their long bill they beat and rub their prey against a branch or stone (Brooks 1989). In doing this, they cause the venom, fragile body parts, and some fluids to be expelled from the body allowing once toxic prey to then be eaten relatively whole (Brooks 1989)

As I suspected, the behaviour I observed was very likely the result of a very purposeful preparation of the caterpillar before it was eaten.

I knew generally that some species of caterpillars and butterflies contain toxins, such as the Monarch (*Danaus plexippus*), which make them an undesirable prey item so I looked into this as a possible reason for the behaviour I observed (Schappert 2004). Caterpillars are the larval stage in the life cycle of butterflies and moths and as they are very vulnerable at this life stage many have developed special protective adaptations including being very hairy, spiny or due to their host plant contain bitter or poisonous juices that are distasteful to predators (Carmichael and Vance 2004, Morris 1980). The two caterpillars I saw being eaten were medium to large in size and were partly

hairy. I believe the caterpillars I observed the bluebirds eating were either Fall Webworm (*Hyphantria cunea*) or Gypsy Moth (*Lymantria dispar*). This assumption is based on their appearance and the widespread occurrence of these species in late summer and early fall. These two species are not particularly hairy or spiny. Therefore, the behaviour I observed was not due to caterpillars being spiny or very hairy (like a banded woolly bear caterpillar [*Pyrrharctia Isabella*]). After my observations of the bluebirds, I searched the backyard for 20 minutes but could not find a specimen of the caterpillar to identify. I guess my inability to find a caterpillar to identify is a good testament to the bluebird's keen eyesight and ability to see near-

ultraviolet (UV) light which can enable them to more readily spot some prey items.

As a common protective adaptation in caterpillars is to contain some kind of poisonous or distasteful juices, I suspect that this is one of the main reasons for the repeated beating of caterpillars prior to consumption. Certain moth caterpillars are known to spit repellent liquid at their enemies, which is stored in the gut (WTMA no date). The liquid is extracted from their food plants and stored in a special part of their gut ready for use when needed. As I observed liquid being expelled from a caterpillar during the process of beating it against a branch, this seems like a logical explanation for the behaviour.

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Perhaps the excessive beating of caterpillars against a perch for over a hundred times is the bluebird's attempt to eliminate as much of the toxins and repellent liquids as possible prior to consuming the prey item. An interesting question then is whether the behaviours I observed to prepare caterpillars for consumption are an inherent behaviour or a learned behaviour which is taught to young birds by the adults.

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