

**FOOD AND FEEDING BEHAVIOR  
OF A CAPTIVE COSTA RICAN LEAST PIGMY OWL  
*GLAUCIDIUM MINUTISSIMUM RARUM*  
GRISCOM. (AVES: STRIGIDAE)**

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**ABSTRACT**

A captive nearly mature least pigmy owl *Glaucidium minutissimum rarum* Griscom from Limón Province was found to eat a very wide variety of animals and animal parts. When capturing prey or taking food she always closed her eyes shortly before contacting the food, apparently to avoid eye damage; she had the ability to regurgitate pellets of indigestible material in the order in which it was consumed. With the exception of sea turtle meat, meat from vertebrates was accepted readily; she ate worms, crustaceans and a leech but rejected whole or fragmented scorpions. Cryptic orthopterans and other cryptic insects were readily eaten, and many aposematic Lepidoptera and Hemiptera were rejected. However, aposematic romaleinid grasshoppers were consumed, and cryptic walking sticks and some moths were rejected.

On 27 July 1974 we purchased a nearly mature starving least pigmy owl (*Glaucidium minutissimum rarum* Griscom) in the main market of Limón, Limón Province, Costa Rica. The bird was named Wol, which is owl spelt wrongly. Our intent was to document her feeding behavior and preferences with respect to aposematic coloration, distastefulness, mimicry and specificity. Unfortunately she died accidentally in October of the same year. Here we offer our brief observations of her foods and feeding behavior since the feeding behavior of this species is unknown in the wild and we have no hope of completing the study.

The normal habitat of this species of owl is low in the vegetation, along evergreen rainforest edges, over swamps, etc.; the species ranges from México to Paraguay

(Slud, 1964). S. Smith (1975 personal communication) notes that it also flies high in the vegetation. This owl is among the smallest species of owls, and thus raptors, in the New World.

## Methods

All feeding tests were conducted in her cage, which was a wooden bird cage 70 x 40 x 40 cm and in which she flew from perch to perch. She was finger trained and flew complacently about the room if allowed free flight. Probably owing to both starvation and inexperience, she could not fly at the time of purchase. Wol's weight was not taken at the time of purchase, but 4 weeks later she weighed 69 grams on an empty stomach and her body weight fluctuated between 67 grams and 78 grams from then on. All wild animals fed to her were obtained on the Pacific coast side of Costa Rica. Her sex and juvenile status was determined by dissection.

### PREY CAPTURE

Wol fed at any hour of the day or night and oriented visually to prey or food items. She took food from our hands with her bill, rather than feet. Although at first very incompetent at capturing living animals, she clumsily pounced on immobilized prey. The greatest reason for missing immobilized or active prey was that she invariably shut her eyes a fraction of a second before arriving at the food item. If she missed, she kept her eyes shut while feeling about with her feet on the cage floor for the animal. This feeling was done by lifting one foot at a time and slapping it down a few millimeters away from its previous position. She sometimes moved backwards as well as forwards in this behavior, and the direction of movement appeared to be unrelated to the location of the prey item. When the prey was found, she opened her eyes.

Once a prey item was in her foot, Wol brought it up to her mouth while standing on the other foot, just as a parrot lifts a seed or fruit to its mouth. However, in striking contrast to a parrot, the owl always closed her eyes just before the food item got to her bill. Her eyes remained closed as long as the intact food item was in contact with her bill.

We hypothesize that eye closing is to avoid having her eyes scratched by the tarsal claws and spines on long hind legs of grasshoppers and katydids, animals which she consumed very eagerly. It may also serve to avoid being damaged by noxious ejected secretions from bugs and other insects that she would learn to avoid.

When tearing prey apart, she sometimes held it in her left foot, sometimes in her right.

Wol had the ability to consume an object with bones or chitinous parts, later consume another object, later still regurgitate a pellet containing the indigestibles of

the first meal, and finally later on regurgitate a second pellet containing the indigestibles of the second meal. For example, she would eat five tettigoniid grasshoppers, followed by two anolis lizards, then regurgitate the grasshopper pellet followed by an anolis pellet.

## PREY PREFERENCES

**Vertebrates.** She readily ate small chunks of raw chicken white meat and pieces of raw lean and fatty beef. She even ate raw marinated chips of beef and raw hamburger, with sage and onions added. Fragments of sliced and pre-packaged ham were eaten once eagerly, and then regurgitated in a compact ball with no apparent digestion. After that, she refused to eat ham. She readily consumed about ten grams of fresh Pacific Ridley's turtle meat [*Lepidochelys olivacea* (Esch.)] and then regurgitated the entire mass. Lean beef and large grasshoppers and katydids were her daily staple, and she ate at least 15 grams of the two combined per day.

When offered a freshly killed 10.4 g [*Glossophaga soricina* (Pallas)] nectivorous bat she started tearing at the posterior end and ate the entire animal including the long bones of the wings. This feat required all day. The afternoon of the following day she repeated the act with another *Glossophaga* of the same size. Three days later she ate a freshly killed parulid warbler [*Basileuterus rufifrons* (Swainson)\*] that weighed 10.3 g. She began with the head and consumed all parts, feathers included, except for one foot. She consumed the head in 20 minutes and spent the rest of the day on the remainder of the animal. The regurgitated pellet contained the feathers and bones and weighed 0.2–0.3 g. She regularly ate weaning white laboratory mice, but had not yet learned to capture fully active mice at the time of her death. The entire mouse was digested and no pellet produced.

Lizards were eaten very readily. At least three species of *Anolis* lizards were eaten in entirety, usually starting with the head end first. A living 10 cm long crippled skink was dropped into her cage after she was quite accustomed to catching crippled *Anolis* lizards. Four times she grabbed the skink and all four times only a slight wiggle caused its extremely smooth body to squirt out of her talons. After this, we killed the skink and she managed to hold onto it long enough to eat it.

When a dead, two feet long, green vine snake (*Leptophis*) was pushed into her cage, she ignored it. When we wiggled it about, she continued to ignore it until it was about 2 cm away, when she grabbed it behind the head with one foot, lifted it to her mouth, and attempted to tear a piece off. It was too tough for her to penetrate and she eventually dropped it in the bottom of the cage and ignored it.

\* Slud (Bull. Amer. Mus. Nat. Hist. 128. 1964) includes *Basileuterus delatreei* Bonaparte and *B. delatreei nesochrysus* Sclater but not *B. rufifrons* (Swainson) among the parulids of Costa Rica. Ridgway (Bull. U.S. Nat. Mus. 50. 1902) restricts *rufifrons* to Mexico and northern Central America. Dickey & van Rossem (Field Mus. Nat. Hist. Zoo. 23. 1938) consider *B. delatreei* a subspecies of *rufifrons*. The Editor.

**Non-insect invertebrates.** Large (10–15 cm) earthworms were eaten eagerly. They were held in the middle and gulped down entire or occasionally torn to bits. A 6 cm aquatic leech (Hirundinea) was likewise consumed without hesitation. A *Pseudothelphusa* terrestrial crab, 2.5 cm across the carapace, was consumed entirely except for the large claw; the crab was torn to bits as it was eaten. Cooked shrimp was readily eaten and retained.

Eight cm long black scorpions [*Centruroides margaritatus* (Gervais)] were never attacked, dead or alive. Even broken fragments of scorpion, interspersed with bits of beef, were rejected, presumably by smell. At first she simply ignored a dead scorpion on the floor of her cage. Later she learned that if she jumped on the paper in the floor of the cage at an angle, the paper shot out of the slot at the end of the cage. She then used this means to eject scorpions lying on the paper in the bottom of her cage.

**Insects – Orthoptera.** Cryptically colored tettigoniid katydids and other similar orthopterans were Wol's favorite food. She always accepted them without hesitation and would eat as many as ten before becoming satiated. The leathery fore-wings and sometimes the long hind legs were discarded.

Commonly she grabbed the hopper around the middle with her foot and then bit off the head and ate it. She then ate her way to the other end, often swallowing the abdomen with one gulp. Specifically, she ate 3 adult *Insara bolivari* (Griffini) (5 cm long, greenish brown, phaneropterine tettigoniid), 3 other green phaneropterine tettigoniids, several hundred *Ancistrocercus inficitus* (Walker) (5 cm long, mottled brown, pseudophylline tettigoniid; this is the species that apparently uses wasp nests for protection from predators during the day (Downhower and Wilson, 1973), 36 adult *Orophus tessellatus* (Saussure) (2–3 cm long, pink, gray, brown or green phaneropterine tettigoniids common on foliage), 3 adult *Scorpiorinus nigridentis* (Stol) (5 cm long, green pseudophylline tettigoniids found in large rolled leaves in the daytime), 5 *Conocephalus angustifrons* (Redtenbacher) (green, 3 cm long conocephaline tettigoniid), 2 *Neoconocephalus affinis* (Beauvois) (green or brown, 5 cm long copiphorine tettigoniid), 12 *Orophus mexicanus* (Saussure) (2–3 cm long, gray, brown, or green phaneropterine tettigoniid common on foliage), and numerous pseudophylline tettigoniid nymphs (2–4 cm long, green to mottled gray-brown).

She also readily ate somewhat cryptic acridids, gryllids and similar orthopterans. Nymphs of mottled brown eneopterine gryllids, extracted from their diurnal hiding places in hollow twigs, were eaten in series of 3 to 10 individuals (1.5–3 cm long). She ate tens of the brown cyrtacanthacridine *Schistocerca nitens* (Thunberg) (4–7 cm long). She ate 5 green or dark green gomphocerine *Silvitettix* (Acrididae on herbaceous vegetation, 1.5–2.5 cm long), 2 trybliophorine *Rhcnoderma* (Acrididae cryptically colored to match twig surfaces, 2–3 cm long), 6 green and brown gomphocerine *Orphulina punctata* (De Geer) (Acrididae from foliage, 2–3 cm

long), and 12 ommatolampine *Osmilia flavolineata* (De Geer) (Acrididae, from foliage, brown, 4 cm long). However, she also ate in entirety 4 melanopline *Ampelophilus meridionalis* (Bruner). This acridid is bright red and iridescent green and spends most of its day walking slowly and ostentatiously about on the foliage of *Solanum* spp., and is presumably aposematic and distasteful to some animals.

Surprisingly, she also ate the two species of romaleine grasshoppers that were offered to her. The first, *Taeniopoda* sp., is about 5 cm long and weighs up to 5 g when alive. It has bright yellow forewings and red and black hindwings. It makes almost no attempt to escape and displays the hindwings when approached. It is generally regarded as aposematic. When offered a large female, she ate the head and then pulled out the gut through the neck. She ate all the body and then stripped the gut of its contents, ate the gut wall, and discarded the gut contents. The second species of romaleine, *Chromacris colorata* (Serville), is thinner and 5 cm long. The forewings and thorax are yellow and bright green and the hindwings are red and black. It walks slowly about on the foliage and displays the red wings when disturbed. The red and black nymphs feed on various species of Solanaceae, as do the adults. They are assumed to be aposematically colored by field naturalists. She ate two males and two females in entirety without hesitation, and much later produced apparently normal pellets containing their remains.

Cockroaches were generally ignored unless she was quite hungry. She had a great deal of difficulty picking them up even when dead, owing to their slippery surface. She rejected, after tasting, a male of *Litopeltis bispinosa* (Saussure) (Epilamprinae, Blaberidae) but then ate it several hours later when no other food had been offered.

Walking sticks received a mixed reception. A 15 cm beige *Pseudobacteria* (Phibalosomatinae, Phasmatidae) was repeatedly jumped on but every time she only succeeded in getting a leg to her mouth, which was then rejected. After eight such attacks, she gave up and from then on just played with it. Later, I tore it to bits and offered the pieces, but she rejected them, implying that they tasted bad. The walking stick was quite active until placed in her cage, but then became motionless and would not move even when attacked. She readily ate three adults of *Pseudophasma menius* (Westwood) (Pseudophasmatinae, Phyllidae). This 7 cm brown walking stick has full developed hind wings which show dull red in flight (presumably flash colors).

**Odonata.** Dragonflies of all colors and sizes were eaten readily. She discarded the wings. She ate at least ten individuals of *Gynacantha nervosa* Rambur.

**Lepidoptera – Butterflies.** Small and apparently non-aposematic butterflies were eaten readily, sometimes with the wings attached and sometimes after removing the wings. She ate 4 *Anartia fatima* (Fabricius) (Nymphalidae) and 8 small brown skippers (Hesperiidae) in one meal. She readily ate a large brown and white spotted satyrid (*Tisiphone maculata* Hopffer). On the other hand, she twice rejected one of

the bright red, blue and black *Callicore astala* Guerin and twice rejected the yellow, black and white pierid *Leodonta dysoni* (Doubleday). She also rejected 4 black, white and transparent-winged ithomiine butterflies after tearing the abdomen off one of them. Three species of brown and black barred and one black and red heliconiine were rejected without even tasting them. This was undoubtedly her first contact with these animals.

**Moths.** The wings were almost always first removed from moths before eating them. Small brown noctuids were eaten without hesitation. All sphinx moths offered were eaten [2 *Manduca pellenia* (Herrich-Schäffer), 3 *Pachylia ficus* (L.), 6 *Eumorpha anchemola* (Cramer), 2 *Xylophanes ceratomioides* (Grote & Robinson) and 2 *Xylophanes titana* (Druce)]. These species all have highly cryptic yellow-brown-green-gray mottled forewings and spend the day hiding on similarly colored substrates. Their only defense against her appeared to be the tapered hard abdomen, dense soft abdominal scales and rapidly vibrating wings. Especially with the larger species, she often dropped the moth repeatedly when attempting to pick it up. She would grab it around the middle of the abdomen with her foot, and the vibrating slippery body would then shoot out of her grasp. Once she had the moth pinned down, her first act was to bite off the head, then discard the wings. She then ate the thorax and as much of the abdomen as she could before it finally slipped out of her grasp and fell.

She readily ate two large brown moths (Notodontidae, *Naprepa* sp. and Lasiocampidae, *Prorifrons* sp.); the larvae of both these families are generally well protected by distasteful chemicals and urticating hairs.

Small brightly colored moths were generally rejected. A yellow and black striped pericopid (*Josiomorpha triangulifera* Hering) and a red, black and white pericopid (*Pericopis cerialis* Druce) were rejected several times. She bit the head off of a yellow, orange and black ctenuchid (*Eucereon flavicaput* Hampson) and then rejected it, and rejected without contact a brown ctenuchid with yellow and black body stripes (*Eucereon tripunctatum* Druce).

Saturniidae were more complex. Both sexes of the large pink and brown *Rothschildia meridana* Rothschild were readily eaten once the wings had been ripped off and discarded. This moth shows no display behavior and presumably relies on being cryptic. It will fly in the daytime if disturbed. *Rhescuntis erythrinae* (Fabricius) is an equally or more cryptic large species with brown, beige and gray wings. When attacked in the daytime, however, it folds its wings over its back and curls the abdomen downward, displaying a row of yellow dots down the side of the abdomen. The male also displays a large yellow hair pencil beneath the wing. The first (a female) offered when Wol was very hungry was eaten down through the thorax; the abdomen was emphatically rejected. Four later individuals on later days were totally rejected by sight alone. Three species of medium sized saturniids with cryptic brown or gray wings were repeatedly rejected. All "played possum" when

attacked, folded the red wings over the back, and curled the abdomen downward in a prominent display; *Ormiscodes* nr. *semirosea* (Walker) has a black abdomen with red rings, *Dirphia flora* Schaus has a red and black abdomen with an orange tip and white dots up the sides, and *Molippa* sp. has an orange and black dorsally ringed abdomen.

**Hemiptera.** Adult bugs were generally distasteful to her. She grabbed, ate whole, and immediately spit out with a flick of the head a live *Hypselonotus interruptus* Hahn; this distinctively colored 1.5 cm long coreid bug is dark brown with a yellow band across the back and red and white bands on the underside. It smells foul to us as does the following species. *Phthia lunata* (Fabricius) is a slightly larger coreid with a nearly identical dorsal color pattern to *H. interruptus*. It is presumably a Müllerian mimic of the latter species. A *P. lunata* was treated in exactly the same manner as the *H. interruptus* and from then on, she showed no interest in either species, no matter how hungry. A day later we gave her a 2 cm long and black adult *Archimerus chiriquinus* Distant (Coreidae) (it had yellow tips to the antennae). She took it in her foot, bit at its head, and immediately dropped it. She fell off her perch and bounced violently around her cage snapping her head back and forth. Large clear drops of tears or saliva were shaken off in all directions. When she calmed down about 4 minutes later, she even refused her favorite tettigoniids and ten minutes elapsed before she ate one.

**Coleoptera.** Small to medium sized cryptically colored beetles were eaten readily. She generally tore them into 2 or 3 pieces before swallowing. She ate numerous 1.5–3 cm brown and gray cerambycids, 3 adult *Caryoborus* bruchids (brown, 1 cm long), 3 adult *Anomala granulipyga* Bates scarabs (green, 1.5 cm long), and numerous melolonthine scarabs (brown, 1–2 cm long). She also readily ate 2 of the black and white morphs of *Arescus bicolor* Gray hispid chrysomelids that live in rolled *Heliconia* leaves; these beetles, brightly colored and polymorphic, are presumably Batesian mimics of a wide variety of beetles and other small model insects. The body of an 8 cm long prionine cerambycid was too tough for her to be able to penetrate, though she tried.

**Hymenoptera.** She readily grabbed and quickly ate a 3 cm long freshly killed black and yellow female *Eulaema tropica* (Linnaeus) bee. This animal has a very violent sting when alive, but we were afraid to test it on the owl. The bee was eaten at 7:30 am and the pellet containing the bee appeared at 1:15 pm. Likewise, she readily ate a freshly killed 3 cm long black *Xylocopa* carpenter bee. She readily grabbed and ate a moribund queen *Bombus volucelloides* Gribido (black with a white tip to the abdomen, 2.5 cm long).

## Discussion

This least pigmy owl ate a wide variety of small animals when offered to her, but definitely disliked scorpions, bad-tasting bugs and butterflies and certain kinds of

meat. Her eventual acceptances of insects matched expectations based on their colors, with the exception of the romaleine grasshoppers. These classically aposematic insects feed on toxic plants yet were quite readily eaten by the owl. Interestingly, VanTyne (1929) recorded a toucan feeding aposematic *Tropidacris* romaleine grasshoppers to their young in Panamá. Her acceptance of many different kinds of prey is not surprising, since she was a carnivore and because of the wide variety of animals eaten by owls in general (e.g., Earhart and Johnson, 1970; Souther, 1954, 1969; Errington *et al.*, 1940).

That she fed at all hours of the day (and night) is likewise not surprising, as one often sees members of the genus *Glaucidium* abroad in the daytime. Slud (1964) describes the least pigmy owl as flying about in the daytime in Costa Rican lowland rainforest, and Dudgeon (1900) even saw an Indian *Glaucidium cuculoides* Vigors take a quail on the wing in the middle of the day.

Smith (1975) has shown clearly that totally naive Costa Rican motmots [*Eumomota superciliosa* (Sandbach)] have a very strong fear reaction to models painted like coral snakes. Wol's immediate avoidance of scorpions and rejection of brown and black banded heliconiine butterflies without touching them may likewise be genetically based avoidance. Since we did not rear her from an egg, we cannot know that she never contacted these animals in nature. However, her late fledgling status and nearly total inability to fly at the time of purchase suggests that she was captured as a nestling and thus was very unlikely to have learned these reactions. On the other hand, she undoubtedly grew up in a hole in a rainforest tree, a place where she could have learned about scorpions and a place where there could be very intense selection for traits that would cause a nestling to avoid a scorpion. Of course, in any such tests with fresh animals one cannot eliminate the possibility that the rejected animals simply smell bad and this forms the basis for rejection. It is noteworthy that Wol would not eat pieces of scorpion offered along with fresh beef.

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## Resumen

Un ejemplar juvenil, de sexo femenino del mochuelo menor *Glaucidium minutissimum rarum* Griscom, procedente de la Provincia de Limón y comprado en el mercado de la localidad se mantuvo en cautiverio durante unos meses con el fin de estudiar el comportamiento alimentario de este pájaro en relación a dietas variadas y a la selección natural de alimentos.

Las observaciones comprueban que esta especie de búho consume alimentos de origen animal, muy variados. Cuando capturan la presa o inmediatamente antes de llevarse el alimento al pico, el pájaro cierra los ojos, tal vez para evitar escoriaciones o heridas de una presa que se resiste.

Aparentemente, el mecanismo digestivo le permite evacuar desechos en el mismo orden o secuencia en que fueron consumidos diferentes alimentos, a juzgar por el estudio de las sustancias regurgitadas y de la excreta.

Con excepción de la carne de tortuga marina, el pájaro aceptó carne de otros vertebrados, de gusanos, crustáceos y moluscos pero rechazó escorpiones enteros o fragmentados, ofrecidos puros o mezclados con otros alimentos, tal vez por acondicionamiento genético y seleccionando por olfato.

Ortópteros y otros insectos crípticos fueron aceptados sin titubeos pero rechazó lepidópteros y hemípteros de coloración aposemática como regla general; sin embargo, aceptó saltamontes romalefnidos de coloración aposemática y rechazó fásmidos crípticos y algunas mariposas heteróceras.

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