Rufous Hawk-Cuckoo Ju-ichi (Jpn) *Hierococcyx hyperythrus*

Morphology and classification

Classification: Cuculiformes Cuculidae

The classification of the Rufous Hawk-Cuckoo has been established recently. They are included in genus *Cuculus* along with Common (*Cuculus canorus*) and Lesser Cuckoos (*C. poliocephalus*) in many classification system, but they are classified as *Hierococcyx hyperythrus* in the latest classification system of Cuculiformes (Payne 2005). Genus *Hierococcyx* is a sister group of genus *Cuculus* in terms of molecular phylogeny and includes the Large Hawk-Cuckoo (*H. sparverioides*) and the Common Hawk-Cuckoo (*H. varius*) which are distributed in South and Southeast Asia. The two species are usually classified under genus *Cuculus* along with the Rufous Hawk-Cuckoo, but they are especially similar to hawks as the English name of "hawk-cuckoo" implies and different in call from genus *Cuculus*.

Photo 1. Adult Rufous Hawk-Cuckoo. [Hiroshi Uchida]

Total length:	305-330 mm	Wing length:	180-210 mm
Tail length:	135-145 mm	Culmen length:	20-23 mm
Tarsus length:	22-24 mm	Weight:	99.0-147.8g

The measurements are after Enomoto (1941).

Appearance:

Both male and female are charcoal gray on the upper part with white and orange bands on the tail. The throat is white, and the chest and belly are pale orange. The eye rings are bright yellow. Non-adult birds have feathers with orange bands on the back. They look similar to a male Japanese Sparrowhawk.

Vocalization:

Males shriek "Joo-ichi, Joo-ichi" with an accent on the second syllable. They occasionally babble "Jubi-jubi-jubi" when in a dispute with each other. Females also make this sound.

Distribution and Habitat

Distribution:

Rufous Hawk-Cuckoos visit as a summer resident in Japan (north of Kyushu), South Korea and the Amur River valley, China and Russia to breed, but there is no detailed information about their range north of Siberia. They winter in the tropic and subtropic forests of Southeast Asia (Payne 2005).

Habitat:

In Japan they breed in forests from low mountains to a subalpine zone in the southern part of Honshu (the largest island of Japan). They breed in forests of the lowlands in high latitudes. Since they depend entirely on their host species for their breeding, they usually occur in forests along a mountain stream where their hosts prefer to build a nest. Since the three host species which I will describe later are sympatric or parapatric, and generally occupy different areas of the same river system according to altitude, it is assumed that Rufous Hawk-Cuckoos can efficiently parasitize these species by moving along a stream.

Life history

Breeding system:

Rufous Hawk-Cuckoos are obligate brood parasites. They primarily parasitize Blue-and-white Flycatchers (*Cyanoptila cyanomelana*), Siberian Blue Robins (*Luscinia cyane*) and Red-flanked Bluetails (*Tarsiger cyanurus*), without raising own young (Higuchi 1998). There is no detailed information about the mating system, but they are probably promiscuous as Common Cuckoos (Davies 2000).

Nest:

Rufous Hawk-Cuckoos do not build a nest. Instead, the host species build a cup-shaped nest using moss (Blue-and-white Flycatchers), leaves of a broad-leaved tree (Siberian Blue Robins) and needles and twigs of a coniferous tree (Red-flanked Bluetails) in holes on a slope or at the foot of a tree.

Egg:

Since Rufous Hawk-Cuckoos are brood parasites, females lay one egg in each host's nest. It is unknown, however, how many eggs one female lays in a single breeding season, though it would be similar to the number of eggs a female Common Cuckoo lays in a breeding season, about 25 eggs in total. Rufous Hawk-Cuckoos lay relatively large eggs among all cuckoos. The size is 28.1mm by 19.9mm and the volume amounts to 5.7ml (Higuchi 1998), while the egg size of the Common Cuckoo is about 3.4ml in volume (Kruger & Davies 2004). Considering that Rufous Hawk-Cuckoos are roughly similar in weight to Common Cuckoos, the difference in egg volume between the two species is surprising. Eggs of Rufous Hawk-Cuckoos are usually pale blue or bluish green, but some of them have light brown speckles. The eggs are somewhat similar to those of the Siberian Blue Robin, which are turquoise blue, but they are quite different from those of the Blue-and-white Flycatcher and the Red-flanked Bluetail, which have light brown speckles on the white background. The egg coloration of parasitic birds is generally similar to that of their hosts so that their eggs may evade detection by hosts (Moksnes & Roskaft 1995). It is not clear why Rufous Hawk-Cuckoos have not evolved elaborate mimicry in eggs.

Incubation and nestling periods:

The eggs that Rufous Hawk-Cuckoos lay in the nest of Red-flanked Bluetails hatch about 13 days after laying, as parasitic cuckoo chicks need to hatch earlier than their hosts to remove the eggs of their hosts from the nest. The incubation period of the Rufous Hawk-Cuckoo is shorter than that of the Red-flanked Bluetail whose eggs hatch in about 14 days. Common Cuckoo eggs hatch about 12 days of incubation (Davies 2000). Rufous Hawk-Cuckoo chicks that are raised by Red-flanked Bluetail host parents fledge about 18 days after hatching. The nestling period of Rufous Hawk-Cuckoos is longer than that of their host chicks, which fledge in from 11 to 14 days, but is similar to that of Common Cuckoos. There is no detailed information about the eggs laid in Blue-and-white Flycatcher and Siberian Blue Robin nests.

Migration:

Rufous Hawk-Cuckoos winter in tropical and subtropical regions in Southeast Asia, and migrate to the breeding grounds in Japan, Korea, Northern China and Siberia as a summer resident. They first arrive in Honshu (the main island of Japan) in early May and lay eggs from mid -May to early August according to their host's breeding seasons. They are assumed to leave the breeding grounds for wintering around October.

Topics of ecology, behavior and conservation

Adult birds

Rufous Hawk-Cuckoos sing and call so loudly that you can hear them very well from a distance, but they are rarely observed because they are extremely cautious. You would need the luck of the devil to see them hiding in the dense leaves of a tree canopy, when you are guided by their songs and calls to them. Therefore, there is little or no detailed information on their ecology.

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Toshiaki Hirano

♪ http://www.bird-research.jp/1_shiryo/koe/juuichi_0805_hyogo_kaji.mp3
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Nestlings

It is not easy to study the nestlings as well, not only because the nests of their hosts are cryptic and thus they are difficult to spot but also because the parasitism frequency is usually not so high. For instance, only 9% of Red-flanked Bluetail nests are parasitized in a year on average. Despite that, the nestlings of the Rufous Hawk-Cuckoo have highly unusual features as follows.

The nestlings have a bright yellow skin not only in the mouth but also on the underpart of the wings where the bare skin is exposed partially. (Photo 2. Left). Moreover, when host parents bring food to the nest, the nestlings raise and shake their wings to show off the yellow patches (Photo. 2. Right).

Photo 2. A Rufous Hawk-Cuckoo nestling and the mouth of a Red-flanked Bluetail nestling (left). A Rufous Hawk-Cuckoo nestling displaying the wing patches towards a Red-flanked Bluetail host that came to feed it (right).

Hawk-cuckoo nestlings show this behavior more frequently when they are hungry (Tanaka & Ueda 2005). At the least they might use the yellow patches as a signal to solicit food. We carried out an experiment to examine how the hosts reacted to experimental manipulations on the yellow patch of Rufous Hawk-Cuckoo nestlings. The provisioning rates were significantly reduced to the nestlings in a condition that their patches were painted black (the experimental group) compared to those in conditions which nestlings did not receive manipulations (control group I) and which their patches were painted a transparent solvent (control group II) (Fig. 1: Tanaka & Ueda 2005). The study showed that the yellow wing patches of Rufous Hawk-Cuckoo nestlings have the function of stimulating their hosts to feed more food to them. The hosts were occasionally observed to try to place food into the yellow wing patches, mistaking them for the mouth of the nestlings (Tanaka et al. 2005). Like Common Cuckoos, Rufous Hawk-Cuckoo nestlings also put the eggs and chicks of the hosts on their back and eject them from the nest a little after they hatch to monopolize the nest. Therefore, the hosts which try to feed the yellow patches can mistake them for the mouths of their own chicks. The yellow patches probably make an illusion in host parents' mind that there are several chicks in the nest. It is reasonable to assume that this illusion is responsible for the increased provisioning.

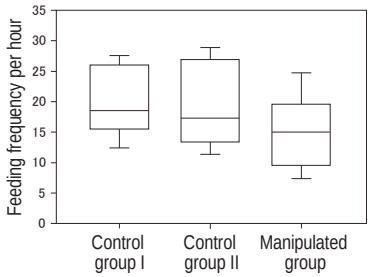

Fig. 1. The feeding frequency decreased significantly only in the manipulated group where the wing patches were painted black. Modified from Tanaka & Ueda (2005).

Colors the host species perceive as a signal

The color of the skin of Rufous Hawk-Cuckoo chicks is bright yellow to us, but it is now widely known that birds have a different vision than we humans have. My colleagues and I measured the reflectance spectrum of light in the visible range of birds (300-700nm) with a spectrophotometer and compared the mouth color of Red-flanked Bluetail nestlings to those of the hawk-cuckoo chicks' mouth and the wing-patch, in reference to the assumed visual performance of the adult Red-flanked Bluetails, by accounting the sensitivity of photoreceptor cells (single-cones) on birds' retina. The result showed that the colors of the mouth and the wing patches of Rufous Hawk-Cuckoo nestlings reflected both UV and yellow much more strongly than the mouth color of Red-flanked Bluetail nestlings, suggesting that the color of the mouth and the wing-patch of the hawk-cuckoo would be considerably different from the mouth color of bluetail chicks (Fig. 2). In general, mouth colors of chicks function as an important food-solicitation signal to parents. Since Rufous Hawk-Cuckoo nestlings are larger in size and need a greater amount of food, it is assumed that the strong coloration of the Rufous Hawk-Cuckoo chicks might have evolved as a "supernormal stimulus (the pattern of a stimulus which is more effective than stimuli found in normal conditions: Yamagishi et al. 2004)" to urge their host parents to feed a larger amount of food to their nestlings (Tanaka in print, Tanaka et al. in press).

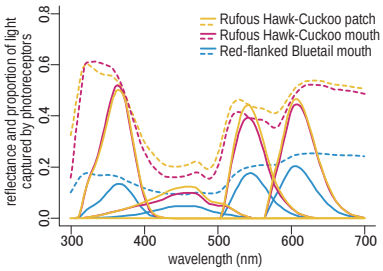

Fig. 2. Dotted lines show reflected spectra and solid lines show portions that the retinal cones of the host species can receive, which are called photon capture and constitute perceived colors. The reflectance spectra of the Rufous Hawk-Cuckoo are especially higher in the ultraviolet range (< 400nm) than that of the Red-flanked Bluetail chicks.

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I am interested in the behavior and evolution of animals and engaged in the study of this field. Presently "colors through the eyes of birds" is my major theme. I would like to continue to study other birds and animals as well as Common Cuckoos and Rufous Hawk-Cuckoos.

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