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Short Report  
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A wild Borneo orangutan carries large numbers of branches on the neck for feeding and nest building in the Danum Valley Conservation Area

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INTRODUCTION

Orangutans regularly build nests (Prasetyo *et al.*, 2009) like other great apes (Fruth & Hohmann, 1996). Nests are mainly constructed to provide a place for resting and protection from potential risks such as predation, heat loss, and parasites carried by insects like mosquitoes (McGrew, 2004). Immature orangutans acquire sufficient nest-building skills before separating from the mother (van Noordwijk *et al.*, 2009). As the body size, cognition, and safety requirements continue to develop following infancy, the nest-building skills probably continue to be refined into adulthood (for more details, see Russon *et al.*, 2007). Juvenile and adolescent orangutans are believed to acquire nesting skills through horizontal and/or modes of social transmission (Russon *et al.*, 2007). Thus, nesting behaviour is generally reported as a cultural variants in orangutans, with 9 of the 35 cultural behavior variants showing nesting behaviour (van Schaik, 2009). Leaf-carrying behaviour, which is

defined as the collection of nest materials before reaching the nest site (rather than afterwards), is a newly identified variant of orangutan nest-building behaviour (Russon *et al.*, 2007; van Schaik *et al.*, 2009). For example, Russon and colleagues (2007) showed the acquisition processes of leaf-carrying behaviour at some rehabilitation/re-introduction sites. However, literature reporting the occurrence of nest building and branch (or leaf) carrying behaviour in the wild remains scarce (Russon *et al.*, 2007), although studies do exist on nest-site selection (i.e. preferred sites) and preference of species of nesting-tree (Sugardjito, 1983; Ancrenaz *et al.*, 2004; Prasetyo *et al.*, 2009). This report describes the direct observation of a single adult female orangutan in the wild that carried large numbers of fruit-laden branches for both feeding and nesting.

METHODS

The study area was located in the Danum Valley

Conservation Area (DVCA; 438 km²), East Borneo, Sabah, Malaysia. The DVCA is a Class I Protection Forest Reserve that was established by the Sabah State Government in 1996, and is managed by the Sabah Foundation (Yayasan Sabah Group) for conservation, research, education, and tourism. The study was initiated in March 2005, and conducted in a primary forest (lowland dipterocarp forest) of approximately 2 km², which was situated along the Danum River, a tributary of the Segama River (510101700N, 11714405000E, 231-384 m a.s.l.) (Kanamori *et al.*, 2010). Between 2005 and 2007, the mean, maximum, and minimum temperature of this region was 27.1, 31.7, and 22.6 °C, respectively. The annual rainfall in this area ranged from 2,350 mm to 3,083 mm (Kanamori *et al.*, 2010; Data source: The Royal Society Southeast Asia Rain Forest Research Program, unpublished).

We observed 44 identified orangutan individuals between March 2005 and December 2010. Of the 44 animals, 24 were observed for a total period of more than six months, and were regarded as ‘residents’. These, 24 individuals included six adult males (three flanged and three unflanged) and five adult females, one adolescent male and two adolescent females, three juvenile males and two juvenile females, and five infants. These 24 residents were well habituated to observers. We followed all 24 resident orangutans from their morning nest sites to their nocturnal nest sites every day, or until they were lost from view. We recorded their daily activities (i.e. feeding, resting, travelling, and others) and food consumed at every one min intervals by direct observation, following a standardised method of orangutan data collection (Morrogh-Bernard *et al.*, 2002). A total of 524 observation days were assimilated for 37 individuals, from March 2005 to December 2010. However, the main subject of this study was a female orangutan named Sheena. Sheena was

studied from 2005 onwards, with her nesting behaviour being observed on 12 days in total from March 2005 to December 2008. Within the same period, the average frequency of observed nesting behaviour by residents (14 of the resident orangutans) was 10.6 days (range, 1-21 days). In 2005, Sheena’s age was estimated at ca. 10 years old (adolescent female), as the orangutan was no longer dependent on the mother, but had a smaller body size than adults with infants. The orangutan became pregnant between May and July 2010, after infertility for at least four years despite several copulation events.

OBSERVATION

This observation was made by two of the authors (NK and HK) and two assistants on 5 November 2010. At 15:20, one pregnant female named Sheena started feeding on the seeds of *Lithocarpus* sp. (Fagaceae). At 16:10, the orangutan started making a nest in the same tree (at a height of about 30 m). After six min, it left the nest to again feed on the seeds. At 16:23, it placed more than five fork branches across its neck (Fig. 1, Electronic Resource 1), and then returned to the nest. The length of branches was more than 1 m, and each branch had plenty of seeds. This tree was located at the foot of a hill; the authors and an assistant climbed the hill to observe the nest from the same height, while the other assistant continued the observation from under the tree. The observations at the nest height were initiated at 16:29, at a distance of about 30 m from the tree.

At 16:29, Sheena sat in the nest, and fed on the seeds of the collected branches of *Lithocarpus* sp. (Fig. 2, Electronic Resource 2). At 16:45, the orangutan removed all the branches from its back and held them with both hands. Then, it placed the branches on the nest as a lining. At 16:48, the

Fig. 1. Sheena carried branches on its neck.

Fig. 2. Sheena fed on the seeds of *Lithocarpus* sp. on the nest.

orangutan lied down on the nest. At 16:49, it left the nest again, and ate the same seeds at a location 10 m beneath the nest. Following this, it again collected at least five forked branches and placed them on its neck. At 16:54, it returned to the nest, and fed on the seeds of the branches on its neck

(Electronic Resource 3). At 17:06, it removed the branches from around its neck, and placed them on the nest as lining (Electronic Resource 3). At 17:07, it lied down in the nest (Electronic Resource 3). Until 17:12, it rested in the nest, at which point the authors and assistants stopped the observations for the day.

DISCUSSION

The behaviour observed in this study has five distinctive characteristics: (1) carrying branches for nesting, (2) carrying branches for feeding, (3) carrying (forked) branches on the neck, (4) carrying branches of the same tree, and (5) carrying large numbers of branches at once. Most of these characteristics have been separately reported in the wild and rehabilitated orangutans, but not grouped together. Wild orangutans customarily carry one or two branches containing fruits for short distances (i.e. next to the previous feeding tree) or sometimes up to 150 m from the parent tree (Rijksen, 1978). Similarly, collecting and carrying some branches for nesting material after reaching the nesting site has also been observed in the wild (MacKinnon, 1974; Prasetyo *et al.*, 2009). MacKinnon (1974) reported that orangutans carry the branches for nesting by holding them between their teeth, in a foot, under one arm, or between the chin and shoulder. Leaf carrying (collection of branches before reaching the nest site) is considered a cultural behaviour, and has been recorded in several populations: in one wild population (Tuanan, Indonesia) and in six rehabilitated populations (Russon *et al.*, 2007; van Schaik *et al.*, 2009). In Tuanan orangutans collect the branches of special tree species for building nests. These trees are almost exclusively *Camposperma* sp., which, in fact, have mosquito repellent properties (van Schaik *et al.*, 2009). It has not been confirmed whether *Lithocarpus* sp. also has mosquito repellent

properties. However, this tree species may be primarily selected for feeding, rather than for anti-mosquito effects or other functions. MacKinnon (1974) also reported observations of orangutans feeding on leaves, shoots, or fruits while sitting on their nests. At our study site, some individuals were observed to occasionally carry one forked branch on their neck for feeding. To summarise, most characteristics of this observed behaviour (1-4) have been previously reported, i.e. orangutans carrying a few branches, occasionally placing the branches on the neck, as well as for feeding and nest building (Rijksen, 1978; MacKinnon, 1974; Prasyto *et al.*, 2009). However, characteristic (5), i.e. carrying large numbers of branches at once, has not been previously reported.

This behaviour is probably a cultural behaviour that has recently spread across Danum Valley, rather than an innovative behaviour by Sheena. Similar behaviour has also been observed in the same conservation area. Specifically, prior to 2009, Cede Prudente, a Malaysian animal photographer, shot a video in which a flanged male placed large numbers of branches on his neck for nest building in the vicinity of the Danum Valley Field Center (YouTube: <http://www.youtube.com/watch?v=3eVYCEeZBAo>). This site was located 11 km from our study site. Both orangutans (Sheena and the flanged male) belong to the same population within the conservation area. It is possible that several individuals living inside the conservation area share this behavioural pattern. Prior to November 2010, this behaviour was not displayed by the orangutans in our study site, neither by Sheena nor by the other individuals. However, our study site did not cover the entire home range of Sheena. Therefore, it is possible that the orangutan observed another individual, living outside our study area, carrying several branches on the neck for nest building and/or feeding.

It is often discussed as to whether a newly observed variant behaviour in primates is acquired by social transmission (van Schaik & Pradhan, 2003) or by individual learning (Galef, 1992). There is no evidence that Sheena acquired this behaviour by social transmission. However, Sheena was observed to share a nest made by a resident unflanged male in 2006, whereas the other adult residents were never observed to share a single nest with the other adults (except one pair of adolescent male - adolescent female). Therefore, it is possible that Sheena had the opportunity to observe this behaviour when it was in close proximity with other individuals.

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(要約)

ダナムバレー森林保護区の野生ボルネオ・オランウータンが採食と 巣作りの為に大量の枝を肩にのせて運搬した事例の報告

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オランウータンは他の大型類人猿と同様に、毎日新しい巣を作る。巣は快適な休息をもたらす、潜在的な危険（捕食、体温の低下、寄生虫などの病原体）を防ぐ一方、巣作り行動は、認知科学の面からも興味深い行動である。野生オランウータンが巣を作る樹種や場所の選好性に関する研究はあるものの、巣作り行動の詳細に関する研究は少ない。本論文では1頭の野生のオトナ雌が、採食と巣作りの為に大量の枝を運搬した事例を報告する。2010年11月、シーナという1頭のオトナ雌（推定15歳）がブナ科の *Lithocarpus* 属の一種を採食していた。夕方、シーナは同じ木に巣を作った後、二股にわかれた枝（大量の果実と葉がついていた）を5本以上、肩にかけて巣に戻った。枝についていた *Lithocarpus* の種子を採食した後、シーナは残りの枝を巣材として使った。シーナは同じ行動 - 大量の枝を運び、採食した後、巣材に使う - をもう1回繰り返し、巣の中で就寝した。これらの行動は30mほど離れた斜面で観察し、高品質の写真とビデオ映像を撮影した（電子資料1として公開）。オランウータンが1〜2本の枝を巣作りや採食の為に運搬する事例は、本調査地でも他の調査地でも観察されている。しかしこのように大量の枝を巣作りと採食の為に運搬するという行動は、他の調査地からは今まで報告されていない。一方、本調査地から約11km離れた場所で、オトナ雄の同じような行動（大量の枝を肩にかけて運び、巣材として使う）が2009年より以前に観察されている。以上より、今回観察された行動は、シーナが新しく始めた行動というより、他個体から伝搬した行動だと考えられる。

Key words: culture, bed, great ape, orang-utan, leaf-carrying

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