

Time Budget of Thai Native Cocks (*Gallus gallus domesticus*) under Semi-Natural Conditions

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Abstract

In order to ask sensible questions about the extent to which intensively kept chickens suffer through being deprived of the opportunity to perform natural behaviors, we need a baseline against which to compare behavior in intensive systems. The aim of this study was to investigate time budgets and activity patterns of Thai native cocks during non-breeding (September-November) and breeding seasons (December-February) under semi-natural conditions. From September 2015 to February 2016, a total of twelve mature Thai native cocks were chosen as focal animals. All animals were selected from three mixed-age and -sex flocks, kept all year round in semi-natural enclosures. The behavior of the cocks was individually recorded using scan and behavior sampling methods by two trained observers between 6.00 and 18.00 h for two consecutive days. A time budget analysis showed that the cocks spent the majority of daytime resting (34%) following by walking (32%) and ground pecking (24%), respectively. Daytime perching was performed independently in all cocks which averaged 15 minutes. Dustbathing behavior showed a marked peak around mid-day from 11.00 to 13.00 h and on average birds performed one 4 min bout. Cocks performed more crowing and mating behavior during the breeding season. Overall, our results support the hypothesis that reproductive behavior of Thai native cocks increased abruptly during the breeding season similar to their wild ancestors.

Keywords: Behavior; Breeding season; Native Chicken; Semi-natural conditions; Time Budget.

1. Introduction

The ancestor of the domestic fowl is the red jungle fowl (*Gallus gallus*). Modern forms of these jungle fowl are still found today in south-east Asia and the domesticated chicken can be regarded as a subspecies (*Gallus gallus domesticus*). Estimates vary but domestication is thought to have occurred about 8,000 years ago for ceremonial purposes, because of its beautiful plumage, and for cockfighting. The Romans had a well-developed poultry industry, with breeds

selected for high egg production. But following the decline of Roman Empire, egg production did not again reach a commercial scale until the 19th century, when selection for breeds of birds to specialize in either egg production or meat production started in earnest [1,2].

In the past decade, animal welfare has been increasingly recognized in importance in animal experiments, zoos and commercial livestock operations. A number of national or international recommendations, principles,

codes, and laws focus on animal welfare, while consumers are demanding higher standards for food safety and animal welfare [3]. The fourth of the 'Five Freedoms' proposed by the Farm Animal Welfare Council [4] is the "freedom to express natural behavior". According to one definition, natural behavior is the repertoire of different behaviors that animals show when they are kept in an environment where they can carry out the behaviors formed over the course of evolution [5]. The performance of behaviors observed in the wild should be used as a benchmark for evaluating the well being of captive animals. However, this is problematic for several reasons: firstly wild animals are more active due to their need to search for food and maintain vigilance for predators. For example, red jungle fowl in their natural habitat are difficult to observe for long periods of time because its visibility is often obscured by dense vegetation in which it escapes for cover [6]. Secondly, finding animals in the wild is time-consuming. Lastly, natural environments are fairly unpredictable and outside of the researcher's control [7, 8]. For many species, including red jungle fowl, we have little or no information in the wild. In order to follow the natural behavior of species, one has to follow their behavior in near-to-nature situations such as semi-natural enclosures [5]. The objective of this study was to investigate time budget and activity patterns of Thai native cocks under semi-natural conditions. We hypothesized that seasons would affect the reproductive behavior in Thai native cocks.

2. Materials and Methods

2.1 Environment and Animal

Three mixed-age and sex flocks of Thai native chickens were kept all year round under semi-natural conditions. The flocks consisted of up to 30-40 birds. Each flock was raised in separate areas of Ang-Thong province (Latitude 14° 35' 12" N and Longitude 100° 27' 27" E), measuring about 1-2 ha. Each area contained large trees and

the areas that allowed animals to perform natural behaviors such as ground pecking, ground scratching and dustbathing. All chickens were fed at the feeding sites, once a day at about 07.30 h with leftover rice. Additional food was obtained through foraging on pasture. Fresh water was available at all times.

2.2 Behavioral observations

Due to the breeding season of red jungle fowl in Thailand starting in December and lasting until May [9], animal behavior observations were carried out seasonally between September 2015 and February 2016. The observations were divided into two periods depending on reproductive activity, i.e. non-breeding (September-November 2015) and breeding seasons (December 2015-February 2016). At the beginning, a total of twelve mature Thai native cocks were chosen as focal animals. Four focal cocks per flock were selected. They were identified on the basis of plumage color and pattern and their photographs; identification was facilitated by the use of binoculars (Monarch 10x42 DCF, Nikon, China). The focal animals were observed in their behaviors by two trained observers between 6.00 and 18.00 h for two consecutive days, over the course of the 6-month experiment. Two types of observation were made: instantaneous scan sampling and behavior sampling [10]. To determine changes in time budget, the behaviors were recorded using instantaneous scan sampling at 1 minute intervals. Behaviors recorded included ground scratching, ground pecking, walking, resting, preening, drinking, and aggression. In addition, all occurrences of social behavior (mating, wing flapping and crowing) and comfort behavior (perching and dustbathing) were recorded using behavior sampling. The time and light intensity were recorded using a digital illumination meter (Extech EA31, Taiwan), when each focal animal accessed a perch for night-time resting or flew down to the ground in the morning.

2.3 Statistical analysis

Social facilitation by the four cocks within a flock meant that individual animals were not considered to be independent replicates. The data were therefore analyzed using mean values for each flock providing the unit of replication. Time spent in each activity and the incidents of social behavior were summed over the day, and daily sums were averaged over the two consecutive day periods. All mean values were calculated per 12 hour observation. Paired *t*-tests were used to determine whether differences in the average duration and frequency of behaviors between non-breeding and breeding seasons were different from zero. All analyses were performed using statistical software from SAS Institute Inc. (version 6.12). Data are presented as mean $\pm$ standard deviation.

3. Results and Discussion

The diurnal time budgets of Thai native cocks for each season are summarized in Table 1. There were no significant differences between seasons in total time spent in each general activity ($P>0.05$). The cocks spent the majority of the daytime resting (34%), following by walking (32%) and ground pecking (24%), respectively. This observation is consistent with that found by

Dawkins [11], which a flock of about 50 captive-bred red jungle fowl kept in Whipsnade Zoo, to the north of London, was studied. Dawkins found that in 60% of all minutes during the active part of the day, hens were seen to be ground pecking, in 60% they were walking and in 34% they were ground scratching. It is notable that these values were higher than those found that in the current study because this author used a different method, i.e. one-zero sampling, for recording behavior. One-zero sampling is usually less satisfactory than instantaneous sampling and does not give true estimates of durations or frequencies [10]. Collectively, both the results of Dawkins [11] and the present study indicated that foraging activities (walking, ground pecking and ground scratching) are innate behavior and important to chickens for some possible reasons. The birds appear to forage on the 'off-chance' that they may uncover high-quality food or prey items, or to obtain information for the future. The finding that hens exhibit a phenomenon called *contrafreeloading*, where they will expend effort foraging for food, even when the same food is freely available [12], supports the idea that foraging is an important way of obtaining information to secure future food supplies [13].

Table 1. Mean time and number of incidents spent in various activities by cocks during non-breeding and breeding seasons.

Behavior	Season						P-value
	Non-breeding			Breeding			
General activity (min per 12 hour)							
Ground scratching	20.63	±	13.50	27.04	±	14.35	0.0558
Ground pecking	157.63	±	21.89	186.83	±	23.35	0.1570
Walking	228.25	±	10.69	227.42	±	10.26	0.7875
Resting	254.63	±	22.14	236.22	±	17.79	0.1407
Preening	53.08	±	3.94	37.33	±	14.09	0.2591
Drinking	3.21	±	3.60	3.21	±	2.67	0.9962
Aggression	2.58	±	1.61	1.96	±	1.04	0.4596
Comfort behavior (min per 12 hour)⁺							
Perching	14.57	±	4.77	15.96	±	7.17	0.4334
Dustbathing ⁺⁺	2.54	±	0.85	4.72	±	1.40	-
Social behavior (bout per 12 hour)⁺							
Crowing	28.50	±	0.21	44.17	±	5.48	0.0373
Wing flapping	31.29	±	9.52	40.83	±	14.46	0.1110
Mating	0.71	±	0.75	2.63	±	0.64	0.0130

⁺ Recorded by behavior sampling

⁺⁺ Values were not comparable

Chickens are diurnal animals that seek night rest on perches when darkness is falling [2]. In this study, cocks started perching for the night or flying down to the ground in the morning when the light intensity was lower than 15 lux or about 30 min before sunset or sunrise. Yeates [14] reported the times of flying down in the morning and of perching in the evening related to the times of morning and evening civil twilight. Cocks also accessed the perch during daytime. This behavior occurred intermittently throughout the day, ranging from 2 to 6 times. This is in accordance with earlier findings in wild red jungle fowl [15, Wanghongsa, personal communication] that perching during the day was associated with a short resting or preening bout and only the lower perches, such as stumps or lower branches of trees, were then used. In contrast, chickens preferred to roost on high perches at night. This behavior has been interpreted as an important means of protection against ground predators [16]. The

average perch height used by wild red jungle fowl during the night was usually over 4 meters. Perch height preference at night was apparently adaptive for avoiding nocturnal predation or disturbance by large mammals e.g. elephant [17]. There was a significant seasonal effect on crowing and mating behaviors. During breeding season, cocks experienced an increase of nearly 50% in the frequency of daytime crowing, while the mating frequency increased up to 270%.

Figure 1 shows the distribution of crowing during the two seasons. During breeding season, it shows a clear diurnal rhythm being unevenly spread throughout the day. Two large peaks occurred during the early morning and evening. During non-breeding season, however, cocks tended to spend more time crowing in the morning. As mentioned above, the breeding season of red jungle fowl in Thailand begins in December and lasts until May [9]. During this period cocks established territories with harems of

hens that they defend against other males. Cocks crowed with more frequency in the morning; however, crowing sometime occurred at other times of day. Daily crowing is subject to an internal biological clock and external stimuli such as light and crowing by other individuals [18]. Seasonal changes associated with the endocrine function affect the reproductive activities of some birds such as vocalization and aggression [19, 20]. However, further studies are needed to confirm this association in red jungle fowl.

Figure 2 shows the hourly variation of time spent on mating activity. During breeding season, sexual activity was spread out through the day and higher mating

frequencies occurred during mid-day and evening. The pattern of mating behavior was consistent with previous reports (e.g. Duncan [21]) with more mating occurring late in the day. The daily cycle of mating in breeding birds is also related to the egg-laying cycle. Mating is therefore most frequent in fowl in the afternoon because their eggs are laid in the morning [22]. In contrast, there were only small peaks in the morning and evening during non-breeding season. Overall, our results confirm earlier findings that breeding behaviors, except wing flapping, in Thai native cocks, were affected by seasonal changes similar to red jungle fowl in the wild [17].

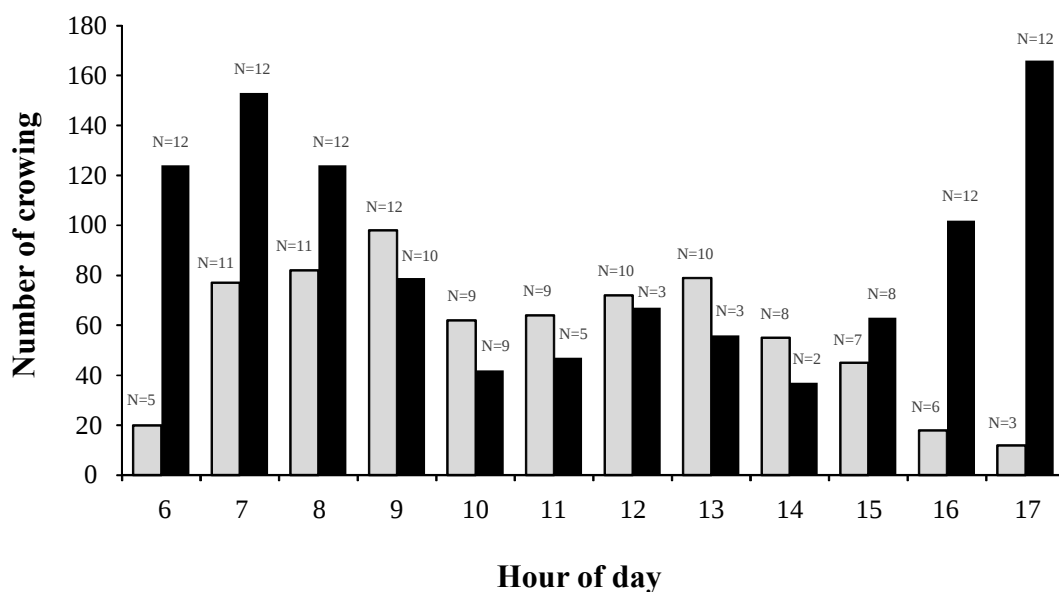


Figure 1. Distribution of crowing bouts by cocks during non-breeding (grey) and breeding seasons (black) throughout the observation periods. N indicates the number of different cocks which contributed to the columns.

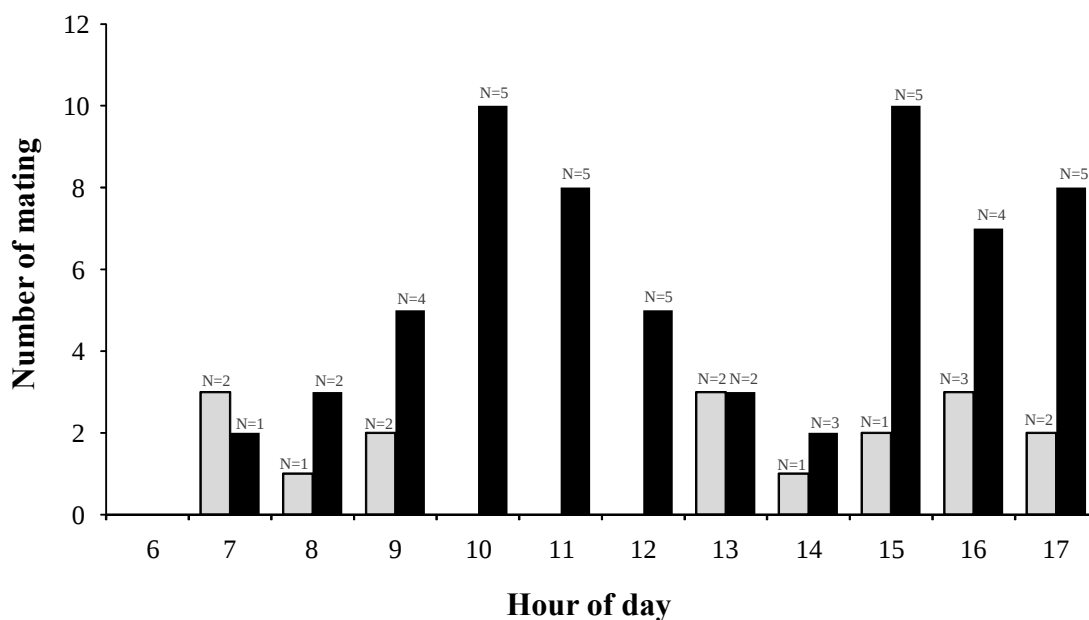


Figure 2. Distribution of mating bouts by cocks during non-breeding (grey) and breeding seasons (black) throughout the observation periods. N indicates the number of different cocks which contributed to the columns.

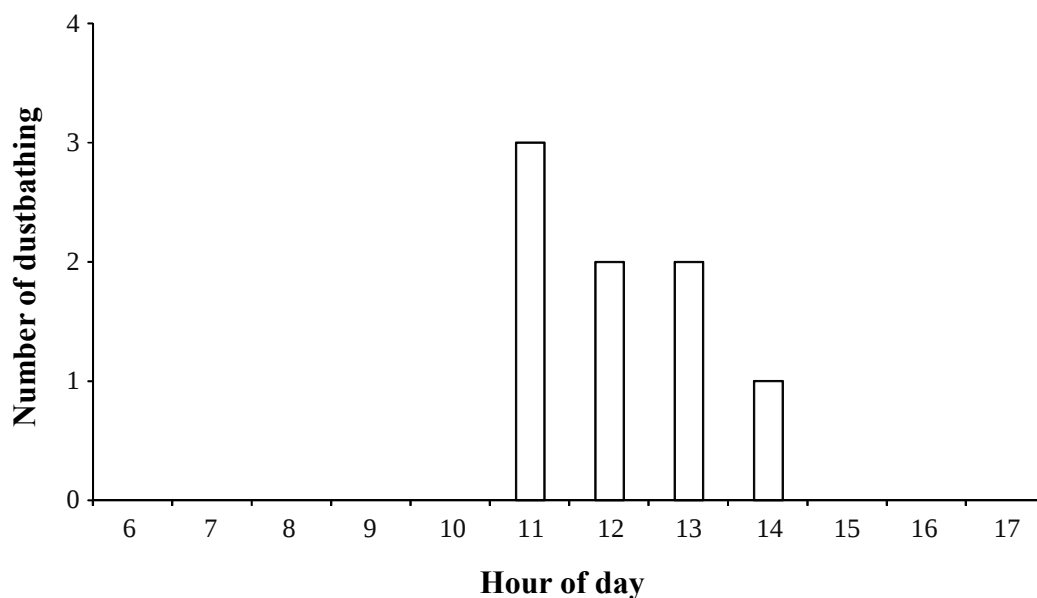


Figure 3. Distribution of dustbathing bouts by a few cocks throughout the observation periods.

Figure 3 shows the distribution of dustbathing during breeding and non-breeding seasons. Throughout the observation periods, very few cocks performed dustbathing from 11.28 h until 14.10 h. This observation is in good agreement with those reported in laying hens [23, 24] and Thai fighting cocks [25]. In the present study, some birds did not dustbathe in either the breeding or non-breeding seasons, or both. Thus, it was not possible to perform a statistical test for this behavior. Dustbathing shows distinct daily rhythms, but occur infrequently. On average, fowl dustbathes every 2-3 days. Vestergaard [23] examined the diurnal rhythm of dustbathing in White Leghorn hens by continual observation over ten days. It was found that the hens dustbathed on five out of the ten observation days; however, there was a large variation ranging from 2 to 9 days. The shorter observation periods, i.e. two consecutive days, in our study could possibly explain why we found that very few chickens performed dustbathing.

4. Conclusion

Under semi-natural conditions, cocks allocated a large proportion of their time to foraging activities including walking, ground pecking and ground scratching. Crowing and mating were performed with more frequency during breeding season. This would imply that seasonal change influences breeding behavior in Thai native cocks.

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