

Sexual Selection Mechanisms in Zebra Dove *Geopelia striata* L.
การคัดเลือกทางเพศ (Sexual selection) ในนกเขาขาว *Geopelia striata* L.

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ABSTRACT

In many birds, display, plumage colour and songs of males are the information that females use for mate selection. In zebra doves *Geopelia striata* L., males and females are not different in morphology but they are different in vocalization and display behaviour. The male uses acoustic display to court the female before pairing. The vocalization, therefore, of zebra dove may have the important role in sexual selection particularly for female mate choice. It was found that the females showed preferences for males with high calls rate although the difference was not significant between the selected and unselected male groups (calls per bout (Independent Sample T-Test: $t=0.881$, $p=0.392$) and calls per day (Independent Sample T-Test: $t=0.168$, $p=0.869$)). The females showed significant preference for the selected male groups by walking (Independent Sample T-Test: $t=2.665$, $p=0.026$) and flying (Independent Sample T-Test: $t=4.000$, $p=0.003$) to reach the males and they copulated with only the selected males. Call rate seem likely to indicate a male's energy reserves and thus could be important information for females choosing males as mates.

บทคัดย่อ

ในนกหลายชนิด การแสดงท่าทาง สีขนของขน และเสียงร้องของเพศผู้เป็นข้อมูลที่เพศเมียใช้ในการเลือกคู่สืบพันธุ์ ในนกเขาขาว *Geopelia striata* L. เพศผู้และเพศเมียมีลักษณะภายนอกที่ไม่แตกต่างกัน แต่เพศผู้มีเสียงขันและการแสดงท่าทางที่ใช้ในการเกี้ยวพาราสีเพศเมีย ดังนั้นเสียงขันของนกเขาขาวเพศผู้จึงน่าจะมีบทบาทสำคัญในการเลือกคู่สืบพันธุ์ของเพศเมีย จากการศึกษาพบว่าเพศเมียแสดงความพึงพอใจต่อเพศผู้ที่มีอัตราการขันต่อชุด และอัตราการขันต่อวัน สูง มากกว่าเพศผู้ที่ขันน้อย แม้ว่าความแตกต่างนี้ไม่มีนัยสำคัญทางสถิติระหว่างกลุ่มของเพศผู้ที่ถูกเลือกและไม่ถูกเลือก (อัตราการขันต่อชุด (Independent Sample T-Test: $t=0.881$, $p=0.392$) และอัตราการขันต่อวัน (Independent Sample T-Test: $t=0.168$, $p=0.869$)) และเพศเมียความพึงพอใจต่อเพศผู้ที่เลือกอย่างมีนัยสำคัญด้วยการเดิน (Independent Sample T-Test: $t=2.665$, $p=0.026$) และบิน (Independent Sample T-Test: $t=4.000$, $p=0.003$) ไปหาเพศผู้ที่พึงพอใจ และการผสมพันธุ์เกิดขึ้นเฉพาะกับเพศผู้ที่ได้รับความพึงพอใจเท่านั้น อัตราการส่งเสียงขันจึงมีนัยเป็นสิ่งที่ชี้นำถึงพลังงานที่สำรองไว้ของนกเขาขาวเพศผู้ซึ่งเป็นข้อมูลสำคัญที่เพศเมียใช้ในการเลือกเพศผู้เป็นคู่สืบพันธุ์

Key Words : Sexual selection, Zebra dove *Geopelia striata* L., Mate choice

คำสำคัญ : การคัดเลือกทางเพศ นกเขาขาว (*Geopelia striata* L.) การเลือกคู่สืบพันธุ์

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Introduction

Sexual selection is a process that produces traits that affect an individual's ability to acquire mates. Sexual selection can be divided into 2 types: intersexual selection, in which members of one sex choose certain mates of the other sex and intrasexual selection, in which individuals of one sex compete among them for access to the other sex.

It is usually males that compete for access to females in order to mate with them, while females usually seem to be choosing among males as mates. This difference between the sexes arises from the differences in the factors that limited their reproductive success. The fertility of females is limited by egg production while fertility of males is limited by the number of mates. Another reason that controls sexual selection is parental investment which is any investment by the parents in an offspring that increase the offspring's chance of surviving and reproductive success. The reproductive success of the sex that invests less in offspring (usually males) is limited by their ability to mate with the sex that invests more (usually females). And the reproductive success of the sex that invests more is limited by resource necessary for investment, not by access to the other sex. When the females invest more than males, selection should act on females to be choosiness for mates that will invest in offspring and/or will give good genetic material to offspring (Drickamer *et al.*, 2002).

In many birds, display, plumage colour and songs of males are the information that females use for mate selection. Nolan and Hill (2004) proposed that female captive house finches *Capodacus mexicanus* use males' songs to justify

mate choice. By playback trials of male's songs, female house finches show preference for long songs and for songs presented at a faster rate. Song length and rate each seem likely to indicate a male's energy reserves, and thus could be important sources of information for females choosing mates. In addition, plumage colour also plays a role in mate choice. Paired males are more colourful than unpaired male. Variation in male plumage colouration is a function of dietary intake of carotenoid pigments (Hill, 1990).

In barn swallow *Hirundo rustica*, white tail spots play an important role in female mate choice. White tail spots in the barn swallow are secondary sexual characters subject to sexual selection. Paternity studies of barn swallows have shown that males with long tail, and hence with large tail spots, sire more offspring in their nests than short-tailed males (Kose *et al.*, 1999). Furthermore, non-feather part colouration is also an attractive trait. Female zebra finches *Taeniopygia guttata* prefer males with redder beaks and high song rate, which are both condition-dependent traits (Rutstein, 2004).

In zebra doves *Geopelia striata*, males and females are not different in morphology (Lekakul & Round, 1991) but they are different in vocalization and display behaviour. Male zebra dove use acoustic display to court the female before pairing, the advertising calls is high in the initial phase of courting; it is increasing to the highest level in the second week of courtship. After pairing, nesting and copulation occur, the advertising calls decrease and be rarely found after the female laying eggs (Phromchan, 2004). The vocalization, therefore, of zebra dove may have the important role in sexual selection particularly for female mate choice.

In songbird, song has been proposed to function in mate choice, and such a role has been demonstrated experimentally in number of species. In house finches *Carpodacus mexicanus*, females showed mate choice in male's song characteristics which reflected a male's energy reserves, and could be important sources of information for females choosing mates (Nolan & Hill, 2004). Birdsong has been shown to be subjected to female preferences for large repertoire size, high production rates or particular song variants (Secondi *et al.*, 2002).

Acoustic variation across cooing individuals may broadcast information about sex, age, and strength, but the message can only become available to the doves themselves if they are able to detect and recognize the variation (Slabbekoorn, 2004).

In zebra dove *Geopelia striata*, sound types are grouped into three classes according to the difference in sound frequencies of their advertising calls. Class A is the low-frequency-birds, class B is the medium-frequency-birds and class C is the high-frequency-birds. This classification is in accordance with the local practice which based solely on listening experience. All of these three groups' calls always consist of three parts in each call; the first part, the second part and the ending part. In all birds, the first part has only one element as same as the ending part. And the elements of the middle part are between 1 to 5 elements (Fig.1). But the number of elements in the middle part is not difference among song classes (Liengpornpan and Meesawat, 2004).

By comparing, the beginning part, the middle part and the ending part, the numbers of element of the beginning part and the ending part do

not vary as much as the middle part. Moreover, call duration, frequency, and call rate differ throughout the male zebra doves.

Females may choose the males with their complex advertising call, which depend on the numbers of element, the call duration, the frequency of call and number of calls in one calling bout.

Materials and methods

Thirty domesticated 8-12 month-old zebra doves *G. striata* (10 females and 20 males) were used in this study. All birds never been mated before.

A mate choice trial was run between dawn and evening (06.00-18.00) in a mate choice cage (Fig. 2) with 3 parallel chambers for holding males and females. A female was hold in the middle chamber, allowing her to examine each call of the males.

The advertising calls of 20 male zebra doves were recorded with a cassette recorder. All recordings were translated into the computerized sound spectrograms using Avisoft-SASLab Light Software. The spectrograms were used for analyzing the numbers of element, call length and frequency of the male calls (Fig. 1).

A male from each mate choice trial (selected or unselected male) were kept together with female and compared the time that the 2 groups of male spent before the copulation occurred. We used independent sample *t* tests to investigate differences in male call rates, female responses and the times spent before the copulation occurred between selected and unselected males.

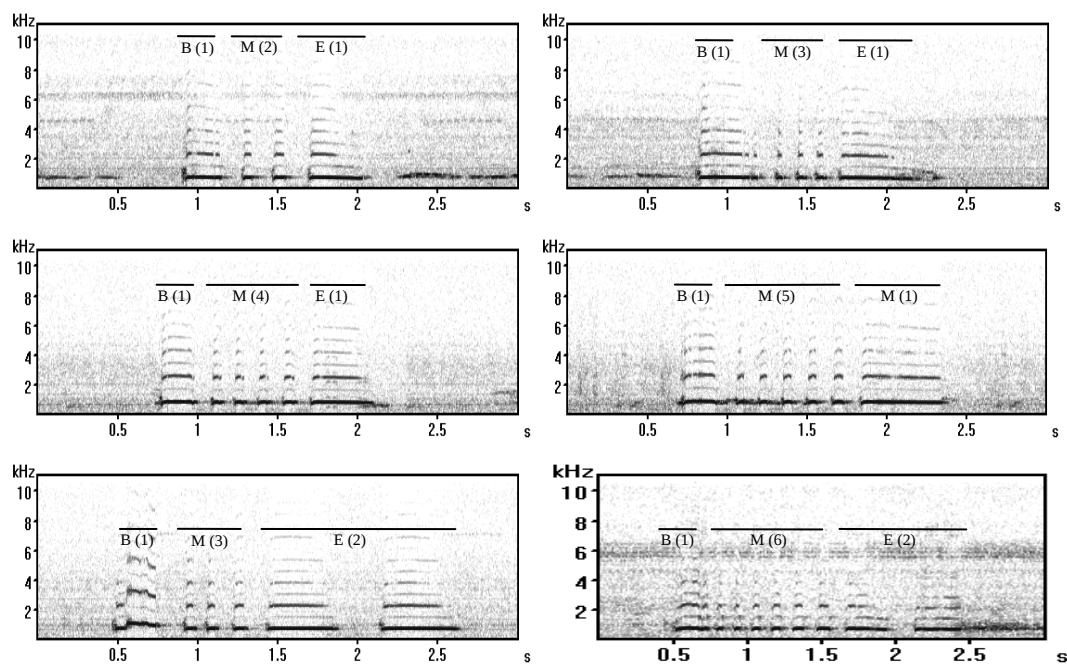


Figure 1 The male zebra dove advertising call spectrograms show the difference in numbers of element in the middle part and ending part (B=Beginning part, M=Middle part, and E=Ending part), (The number in the bracket () is the number of each element in each part.)

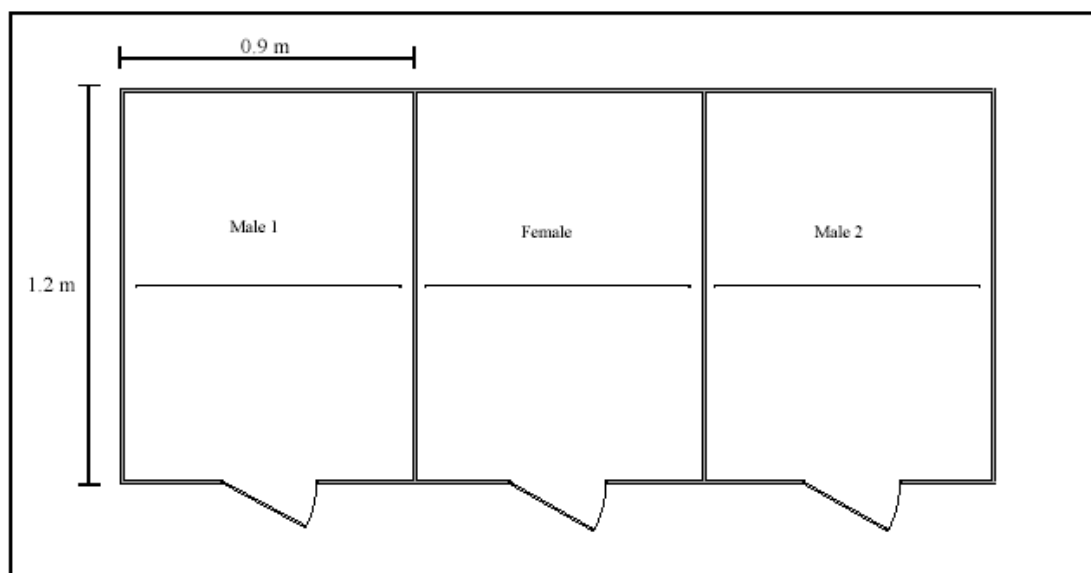


Figure 2 The mate choice cage with 3 parallel chambers for holding males and females. A female was hold in the middle chamber, allowing her to examine each call of the males. Blind between each chamber with wooden boards 25 cm from the perch to make the males and female could not see each other directly.

Results and discussion

It was found that the females showed preferences for males with high calls per calling bout (Independent Sample T-Test: $t=0.881$, $p=0.392$) and high calls per day (Independent Sample T-Test: $t=0.168$, $p=0.869$) although the difference of call rate was not significant between the selected and unselected male groups (Table 1).

The females showed significant preference for the selected male groups by walking (Independent Sample T-Test: $t=2.665$, $p=0.026$) and flying (Independent Sample T-Test: $t=4.000$, $p=0.003$) to reach the males (Table 2).

When they was placed together with the males, the groups of selected male spent lower but not significant time than the unselected groups did (Independent Sample T-Test: $t=-1.615$, $p=0.150$) and the females copulated with only the selected males (Table 3).

Advertising call of zebra dove is under the influence of testosterone which deals with sperm production and sex characteristics as well as reproductive behavior of the animal (Supasi *et al.*, 2005). In budgerigars *Melopsittacus undulates*, females choose their mates on the basis of the time that they invest in courtship singing (Massa *et al.*, 1996).

Call rate seem likely to indicate a male's condition (e.g. health and fertility) and energy reserves thus could be important information for females choosing males as mates. The high rates of advertising calls affect the males mating success.

Table 1 The mean±S.D. of advertising call rate of male zebra doves

Groups	Call rate (mean±S.D.)	
	Call/Bout	Call/Day
Selected	11.22±8.55	232.92±262.59
Unselected	7.42±9.05	205.98±403.45
P	0.392	0.869

Table 2 The mean±S.D. of female responsive behaviours per day

Groups	Female responsive behaviours per day (mean±S.D.)		
	Calling	Flying	Walking
Selected	1.68±2.08	3.97±3.11	1.93±2.29
Unselected	0.92±2.53	0.05±0.10	0.00±0.00
P	0.471	0.003	0.026

Table 3 The mean±S.D. of times spent before the copulation occurred

Types of pairs	Days spent (mean±S.D.)	Copulation
With Selected Males	4.60±6.99	Occurred
With Unselected Males	12.75±8.18	Not occurred
P	0.150	

Conclusions

The female zebra doves choose their mates based on the rate of advertising call per calling bout and per day. The males with high call rate can be more attractive to the females than the low call rate males do. The advertising call rates of zebra doves affect their mating success and play an important role in sexual selection mechanism in this species.

Acknowledgements

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References

- Drickamer, L. C., Vessey, S. H., and Jakob, E. M. 2002. *Animal Behavior: Mechanisms, Ecology, Evolution*. New York: McGraw-Hill.
- Hill, G. E. 1990. Female house finches prefer colourful males: sexual selection for a condition-dependent trait. *Animal Behaviour*, 40, 563-572.
- Kose, M., Mand, R., and Moller, A.P. 1999. Sexual selection for white tail spots in the barn swallow in relation to habitat choice by feather lice. *Animal Behaviour*, 58, 1201-1205.
- Lekagul, B. and Round, P.D. 1991. *Guide to the Birds of Thailand*. Bangkok: Sahakarn.
- Liengpornpan, S. and Meesawat, K. 2004. Pattern, frequency and duration of zebra Dove (*Geopelia striata*) song. *Thaksin. J. Vol.7* (1): 51-57.
- Massa, R., Galanti, V. and Bottoni, L. 1996. Mate choice and reproductive success in the domesticated budgerigar, *Melopsittacus undulates*. *Italian Journal of Zoology*. 63: 3. 243- 246
- Nolan, P.M. and Hill, G.E. 2004. Female choice for song characteristics in house finch. *Animal Behaviour*. 67: 403-410.
- Phromchan, P. 2004. Courtship behaviour of Zebra Dove (*Geopelia striata*). Senior Project in Biology. Faculty of Science. Prince of Songkla University (in Thai).
- Rutstein, A. N. 2004. Mate attractiveness and primary resource allocation in the zebra finch. *Animal Behaviour*. 68. 1087-1094.
- Secondi, J., DeBakker, M. and Cate, C.T. 2002. Female responses to male coos in the collared dove (*Streptopelia decaocto*). *Behaviour*. 139: 1287-1302.
- Slabbekoom, H. 2004. *Encyclopedia of animal behavior Volume 1*. London: Greenwood.
- Supasi, S., Wuteerapol, S. and Sukchotiratana, M. 2005. The effect of testosterone on various behaviors of Zebra Dove (*Geopelia striata* Linn.). 31st Congress on Science and Technology of Thailand at Suranaree University of Technology.