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Terrestrial Biodiversity and Ecosystems

Male and Female Reproductive Strategies in the Emerald Treefrog (*Zhangixalus prasinatus*), A Lek-chorusing Anuran

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Host: Prof. Yuying Hsu 許鈺鸚教授

[Doctoral Dissertation Defense Presentation]

~Attendee must wear mask~
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Abstract

Sexual selection operates through male-male competition and female choice to influence organisms' reproductive success. Sexual selection theory predicts that males and females should adopt different mating strategies to increase their reproductive success: males seek more mating opportunities, whereas females choose to mate with high-quality mates. In the lek-breeding system, males aggregate in areas where they perform physical or acoustic displays to attract females, allowing females to compare and choose their mates. Endurance rivalry (interaction-independent male-male competition) and female choice are two important mechanisms of sexual selection in lek-breeding systems that contribute to the variation in male mating success. Endurance rivalry is when males compete for opportunities to mate by spending more time in leks than others. The endurance rivalry suggests that, because high-quality males can afford to have high lek attendance, females have a higher chance of mating with good-quality males even when they mate randomly. The good gene hypothesis proposes that females can pass good genes on to their offspring by choosing males that display elaborate morphological and/or behavioral traits. Because ornaments and advertisement displays are costly to produce, these traits reflect the males' genetic quality. However, the relative importance of endurance rivalry and female choice to males' mating success in the same species is rarely evaluated.

Moreover, polyandrous mating (i.e., females mate with multiple males during a fertile period) has been observed in many species, including lek-breeding species. Why females mate with more than one male is puzzling since females usually do not increase their reproductive success by mating with multiple males. One adaptive hypothesis for polyandrous mating to females is that polyandrous mating can ensure eggs' fertilization (fertilization insurance hypothesis). By contrast, polyandrous mating can occur where females are forced to accept superfluous mates against their preference. In the situation that females choose males for high quality to improve offspring fitness, polyandrous mating may impose indirect costs on females since a proportion of their offspring will sire by lower-quality (non-preferred) males. Although polyandrous mating has been observed in some lek-breeding species, the studies on the benefits and costs of polyandrous mating to females in lek-breeding species are few.

The emerald treefrog (*Zhangixalus prasinatus*), a lek-chorusing treefrog that has been observed with polyandrous mating, was used as the study organism to investigate the importance of endurance rivalry or female choice to males' mating success and the effects (cost and benefit) of polyandrous mating on females' reproductive success in this dissertation.

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This dissertation has four chapters. Chapter 1 introduces the hypotheses of how endurance rivalry and female choice can influence male mating success and the hypotheses of how polyandrous mating provides female benefits and costs. In the same chapter, I also described the breeding behavior of *Z. prasinatus* and the aims of this dissertation. Chapter 2 investigates how endurance rivalry and female choice might jointly influence male mating success and shape males' morphological traits in *Z. prasinatus*. The main results of this chapter showed that (1) male lek attendance was positively correlated with body size and condition, and males with higher lek attendance had higher mating success, (2) the dominant frequency of males' advertisement calls was negatively correlated with body size and males producing lower frequency calls have higher mating success, (3) male body size, but not body condition, had a non-significant positive relationship with mating success and (4) females show a preference for calls with lower dominant frequencies in two-choice playback. Overall, both endurance rivalry and female choice play an important role in the mating success of male emerald treefrogs in the field, and both are influenced by male body size/condition. Chapter 3 investigated benefits and costs of polyandrous mating to female *Z. prasinatus*. I examined whether polyandrous mating increased clutch fertilization (benefits), and whether polyandrous mating reduced offspring fitness (costs). The main results of this chapter showed that (1) no (positive) effect of the number of mating males on clutch fertilization, and (2) no (negative) effect of polyandrous mating on clutch embryo viability. (3) Multiple paternity was detected in polyandrous clutches by molecular parentage analysis, and primary males (chosen by female) were found to sire more offspring than peripheral males (non-chosen by female) in polyandrous clutches. I (4) did not find any fathers' quality (body size, body condition, and lek attendance) predicted offspring's performances (which links to fitness). Finally, I found neither that (5) the primary males had better quality (larger body size, better body condition, and higher lek attendance) than the peripheral males in a polyandrous mating event, (6) nor that primary males' offspring had better fitness-related performances than peripheral males' offspring. These results showed polyandrous females obtained no benefits from increasing fertilization and did not suffer the indirect genetic cost. The results suggest that when a male is not chosen by a female, joining a mating group as a peripheral male could serve as an alternative strategy to obtain reproductive success. Therefore, I suggest that polyandrous mating in *Z. prasinatus* is driven by the males so that it only benefits peripheral males but not females. That females do not suffer severe costs from polyandry could be the potential reason for the high frequency of polyandrous mating in the field population. In Chapter 4, I summarized the results of Chapters 2 and 3, and proposed future work on investigating sexual selection in *Z. prasinatus*.