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Territory Shift of Male Schrenck's Reed Warblers
Acrocephalus bistrigiceps for the Improvement of
Mating and/or Breeding Success

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The Schrenck's Reed Warbler *Acrocephalus bistrigiceps* is a marsh-nesting warbler endemic to the far-eastern area of Asia. It is a summer resident in eastern Russia and China, and in northern Japan. In Japan, this warbler inhabits grassland, mostly in patchy habitat adjacent to reedbeds that are occupied by the Great Reed Warbler *A. arundinaceus*. A male sometimes mates with two more females simultaneously or successively, and becomes polygynous (KAGAWA, 1989; UEDA & YAMAOKA, 1994). Some males shift their territories several times during the breeding season. In the course of our study of a small population of the Schrenck's Reed Warbler, we found territorial shifting amongst half of the males in the sample. KAGAWA (1989) suggested two likely causes for territory shift: (1) direct interspecific competition with the sympatric Great Reed Warbler, and (2) the opportunity to improve the chances of mating. In this report, we examine some instances of territory shift by Schrenck's Reed Warbler males, and we suggest probable causes for this behavior.

Field work was undertaken at Akigase paddy field (36° 52' N, 137° 35' E, 8 m a.s.l.) from May to August, in 1992. The study area was a 46.2 ha paddy field located on a bank of the Arakawa River in Saitama Prefecture, 30 km north of Tokyo. Small patches of grassland, swamps, and reedbeds are scattered throughout this paddy field (See UEDA & YAMAOKA, 1994, for a more detailed description). The habitat of the Schrenck's Reed Warbler were at the edge of the reedbed, in an isolated grass patch in the paddy field, and in the grasslands adjacent to the reedbed. Nesting of the Schrenck's Reed Warbler appeared to be plentiful in the area.

Warblers were caught with mist nets, and then banded and individually marked with a combination of color rings. A total of six males established their territories in the study area. All of these males were captured and marked immediately after their arrival. Seven breeding females were also captured and marked within their mate's territory. However, we failed to capture three females nesting in the area.

Observations were made 3 to 4 days per week from late May to late August. The behavior of the males was observed at distances of 10 to 20 m with binoculars (9X) and a telescope (20X). Territories were plotted on maps by joining the points at which aggressive encounters (including songs) occurred. Once a warbler's nest had been located, we checked its contents regularly to determine clutch size and breeding success.

Schrenck's Reed Warblers arrived at the breeding ground intermittently from late May to late June. Of the six males who established territories in the area, all but one stayed until mid-August. Two of the six territorial males become polygynous, while

the three other males mated with two different females successively. A total of 11 breeding attempts were made by 7 banded and 3 unbanded females; one females (CR) bred successively with two different males in their territories (Fig. 1).

Distribution of territories was patchy, because of the scattered distribution of grasslands. Most territories were established at small patches of grassland or at the grassy edge of a reed bed. Four of the six initial territories (66.7%) were isolated, while the other two were close together in a reed bed. Five of the seven nests (71.4%), in which at least one egg was laid, were built in grasslands with tall goldenrod growing in the area. Vacant grassland was observed in the study area throughout the season.

Territory shift was observed in three of the six males. Males OO, PP and RR shifted their territories at least once during the season (Fig. 1). The average distance between the two successive territories was 109.0 ± 29.9 m (SD, $n=5$). Territory shift occurred in males when no mates were acquired in their territories (as was the case with male OO in its 1st and 2nd territories and male PP in its 2nd and 3rd territories), or when they lost their female mates through breeding failure (PP and RR). On the other hand, males who mated and/or bred successfully did not shift their territory until at least the incubation stage (BB, GG and WW). The breeding season of the Schrenck's Reed Warbler was from late May to late August in the study area. Territory shift occurred until mid-breeding season. The last instance occurred with male PP on 3rd July.

Early in the season, male OO settled on the area adjacent to male RR's territory. It sang frequently for two weeks, but failed to attract a mate. Then, this male shifted its territory to an isolated grass patch in the paddy field 120 m distant from the original. Four days later, the grasses in this patch were cut down by farmers and the habitat was turned into an inadequate breeding area. The male left the secondary territory and returned to an area adjacent to its original territory. There, it finally mated successfully with a female.

Male PP had a mate (EE) immediately after his arrival (Fig. 1); however, the mate disappeared before egg-laying. The male shifted his territory immediately after the

Fig. 1. Breeding scheme of the Schrenck's Reed Warbler in 1992. Large font capitals show territorial males and small font capitals denote females. (••••) nest building, (oooo) egg laying, (----) incubation, & (—) feeding young. Triangles show the territory shift. An arrow shows mate-change by a female.

disappearance of the female. The second territory was a marsh about 120 m distance from the initial one. The male, however, failed to mate there. One week later, this male shifted its territory to a grass patch 90 m from the second one, but again failed to a mate. Two days later the male shifted its territory once again, and within 10 days it had acquired a mate (GO) (Fig. 1).

Male RR had a mate (WW) at the edge of a reedbed early in the season. The female changed the nest site several times during the nest building stage: the last nest fell prey to predators during the egg laying stage (Fig. 1). The female disappeared immediately after the nesting failure. The male then shifted its song post to the center of a reedbed, which had been left vacant after the disappearance of the Great Reed Warbler who had occupied it previously. At this territory, the male acquired another mate (Fig. 1).

A unique characteristic of the territorial system of the Schrenck's Reed Warbler is the shifting of territories by some males. As was mentioned above, territorial shift was observed in half of the males in this study. A similar finding occurred in a study reported by KAGAWA (1989). In Kagawa's study, 10 of the 20 males he observed moved from an initial territory to another territory. His suggestions of possible explanations for this behavior were noted above.

The Schrenck's Reed Warbler is much smaller than the Great Reed Warbler. We sometimes observed a Schrenck's Reed Warbler being chased or driven away by a Great Reed Warbler. Nevertheless, the chase was never intense. The Schrenck's Reed Warbler usually took back its song post immediately after being chased. We found no instance where a Schrenck's Reed Warbler's territory was taken by a Great Reed Warbler.

It seemed apparent that the interspecific competition over a suitable nesting site (reedbed) was strong between both species. We observed a difference in arrival times at the breeding ground between the Schrenck's Reed Warbler and the Great Reed Warbler. The latter arrived at the study area early in May, while the former arrived late in the same month. When the Schrenck's Reed Warbler came late in May, there were no vacant territory sites in the reedbeds. Nonetheless, many grass patches were available to the Schrenck's Reed Warbler for nesting. Reedbeds might have been more suitable as nest sites, but none were left unoccupied by the Great Reed Warbler. Competition for nest sites seemed strong between these two *Acrocephalus* species, but an ecological segregation occurred because of the lag difference in breeding ground arrival time and an asymmetry of competitive ability. In this study, direct interspecific competition for nesting sites with Great Reed Warblers was not a cause of territory shift by Schrenck's Reed Warblers.

With the polygynous Fan-tailed Warbler *Cisticola juncidis*, some males which establish a territory in a peripheral habitat attempt to hold a second territory elsewhere (UEDA, 1993). As the season progressed, the sample of Fan-tailed Warbler males spent more time in secondary territories than in first territories, eventually shifting their activity centres to secondary territories. As a result, mating success was improved. In the present study, five of the six Schrenck's Reed Warbler males acquired two mates. Each of three males mated with two females in the initial territory. One male (OO) had no mate in the initial territory, and two males (PP and RR) failed their first breeding attempts. In a manner similar to the subjects in Ueda's study, the latter three males shifted their territories and improved their mating chances (Table 1).

Territory shift was not observed during the late breeding season. Perhaps this might be ascribed to a decrease in the number of mating opportunities with newly settling females. This evidence supports a hypothesis that territory shift in the Schrenck's Reed Warbler is most likely a strategy for the improvement of mating and breeding success.

Table 1. Effects of mating and breeding success due to the territory shift of male Schrenck's Reed Warblers.

Males	No. of mates in each territory				Breeding success at the initial territory**
	1st	2nd	3rd	4th	
BB	2				yes
GG	2				yes
WW	2*				yes
RR	1	1			no
OO	0	0	1		no
PP	1	0	0	1	no

*Successive polygyny.

**The nest lasted at least until hatching.

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LITERATURE CITED. KAGAWA, T., 1989. Interspecific relationship between two sympatric warblers, Great Reed Warbler *Acrocephalus arundinaceus* and Schrenck's Reed Warbler *A. bistrigiceps*. *Jap. J. Ornithol.* **37**: 129-144. (In Japanese, with English summary). ●UEDA, K., 1993. Effects of neighbours: costs of polyterritoriality in the Fan-tailed Warbler *Cisticola juncidis*. *Ethology Ecology & Evolution* **5**: 177-180. ●UEDA, K. & YAMAOKA, A., 1994. Polygyny in Schrenck's Reed Warbler *Acrocephalus bistrigiceps*. *Ibis* **136**: 492-493.

コヨシキリ *Acrocephalus bistrigiceps* のなわばり移動と配偶・繁殖成功. コヨシキリ *Acrocephalus bistrigiceps* のオスでは繁殖途中に頻繁になわばりを移動するという現象が知られている. このなわばりの移動の意味については, 香川 (1989) が近縁種オオヨシキリ *A. arundinaceus* との種間競争によって, 身体の小さいコヨシキリがなわばりの放棄を余儀なくされるという仮説と, 配偶がうまくいかなかった場合になわばりを移動するという仮説を提示している. 著者らはコヨシキリになわばりの移動が, どちらの要因によって起こっているかを解明するために, 1992年に埼玉県浦和市大久保の荒川左岸の河川敷内にある水田地帯で, なわばり移動と配偶・繁殖成功についての調査を行った. この年は6羽のオスが渡来し, なわばりを持ったなわばりはアシ原, アシ原に隣接する草原, 水田中にパッチ状に点在する小さな草原につくられることが多かった. アシ原はそのほぼすべてがオオヨシキリになわばりによって占められているため, 繁殖期後期にオオヨシキリが渡去するまではアシ原の中央部にはコヨシキリはなわばりをもてなかった. なわばりを持ったオスの半数, 3羽が繁殖期間内に1回以上のなわばり移動を行なった. なわばり間の距離は 109.0 ± 29.2 m ($\bar{x} \pm SD$) であった. これら3羽のオスのうちの2羽は最初のなわばりで配偶者が得られなかったこと, また残りの1羽では明らかにつがい形成を行なった相手のメスが産卵前に消失したことがなわばり移動の理由であると思われた. また2回目, 3回目のなわばり移動をおこなったオスの場合も, 人為的攪乱 (草刈り) があった1回をのぞけば, そのなわばりにおいて配偶者が得られなかったことが原因であると思われた. 一方, なわばりを移動しなかった3羽のオスはすべて最初のなわばりにおいて配偶者を獲得し, 繁殖ステージもかなりの段階まで進んだオスであった. これらのオスはすべて同じなわばりで2回目のメスを獲得して一夫二妻になった. コヨシキリにおける頻繁ななわばり移動はオオヨシキリとの種間競争によって, 身体の小さいコヨシキリがなわばりの放棄を余儀なくされるのではなく, そのなわばりにおいて配偶者が得られなかった場合, または初期に繁殖が失敗した場合に起こることが明らかになった.

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