Ornis Fennica 74:149–152. 1997

Brief report

Interspecific hybridization between the Siberian Tit *Parus cinctus* and the Willow Tit *Parus montanus* produces fertile offspring

Antero Järvinen

Järvinen, A., Kilpisjärvi Biological Station, P. O. Box 17 (P. Rautatiekatu 13), FIN-00014 University of Helsinki, Finland

Received 5 March 1997, accepted 23 May 1997

1. Introduction

In the 1980s, several cases of mixed breeding between the Siberian Tit *Parus cinctus* and the Willow Tit *P. montanus* were reported from northern Finland (Hildén & Ketola 1985, Järvinen et al. 1985, Järvinen 1987, 1989a). Some of these breedings were successful and produced fledglings. In recent years, obvious hybrids between the two tit species have been captured at Finnish bird observatories (Hildén & Nikander 1987). However, until now the fertility of the hybrids has remained a mystery. In this paper, I report the first piece of evidence showing that a hybrid between the Siberian Tit and the Willow Tit can produce offspring.

According to a recent estimate, the European population of the Siberian Tit is 240 000 pairs of which the Finnish population comprises 21% (Mikkola-Roos 1996). The long-term population trend of the Siberian Tit in Finland is sharply declining. Originally the decrease was probably due to amelioration of climate, but since the 1950s, extensive forest management in northern Finland has played a major role (Saari et al. 1994 and references therein). However, towards the end of the 20th century, amelioration of climate caused by global warming may have negatively affected Siberian Tit and other northern bird species (Järvinen 1994a, b, 1995). Here I relate the increased frequency of mixed breedings during the last ten years to the decreased Siberian Tit population in northernmost Finland.

2. Study area

The study area lies at Kilpisjärvi (northwestern Finnish Lapland; 69°03´N, 20°50´E) in the mountain birch forest zone. Mountain birch forests are marginal habitats for the Siberian Tit, which prefers coniferous forests (Saari et al. 1994). The number of breeding pairs and breeding success of the Siberian Tit have been monitored at Kilpisjärvi since 1966 (the author has been responsible for the field work since 1973). The number of nestboxes suitable for the species has been about 100 annually, and they have been checked regularly throughout the breeding season. Since the diameter of mountain birches seldom exceed 10 cm at Kilpisjärvi, few nests in natural holes have been found there.

3. Results

In 1995, a female Siberian Tit paired with a male Willow Tit. The first of eight eggs was laid on 28

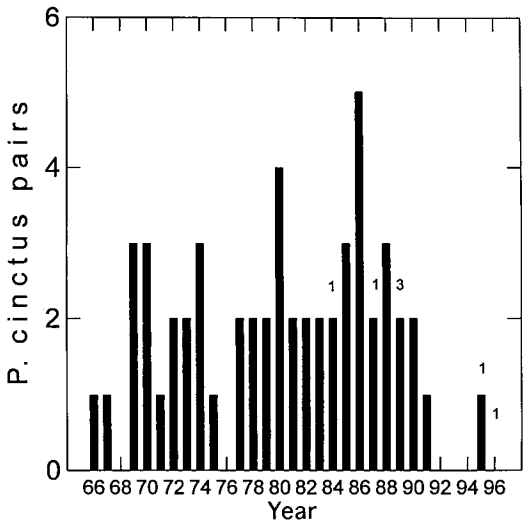

Fig. 1. Number of breeding Siberian Tit pairs in mountain birch forest in NW Finnish Lapland in 1966–1996. Numbers above the bars indicate the frequency of mixed pairs between the Siberian Tit and the Willow Tit in the same area.

May. Both parents fed seven nestlings. The nestlings were ringed and they all fledged. The crown of the fledglings was black, but not so glossy as that of the Willow Tit. Their back and flanks were reddish, thus resembling those of the Siberian Tit.

In 1996, one of the seven hybrid offspring of the previous summer, a male identified by the ring number, nested with a female Siberian Tit in another nest-box about six kilometres from the birth place of the hybrid offspring. The first of the seven eggs was laid on 1 June, but only two young fledged from this nest. Five eggs were unfertilized. The plumage of the male was a mixture of those of the Siberian and Willow Tits: the crown was dark brown and matt-finished, back reddish brown. The nestlings resembled their hybrid farther.

The feeding activity of the parents was observed during four one-hour periods around noon. On 24 June (age of nestlings 2 days), only the hybrid male fed the nestlings 12 times/hr. On 25 June, the male fed them 9 times/hr and the female once. On 1 July (age 9 days) and 5 July (13 days) the parents shared feeding duties as follows: male 7 and 5 times/hr, female 2 and 6 times/hr.

In 1966–1996 (31 years), the number of breeding pairs of the Siberian Tit in the nest-boxes varied between 0 and 5. In the 1990s, the population has been especially low (Fig. 1). The first mixed breeding between the Siberian Tit and the Willow Tit was observed in 1984, followed by 1987, 1989 (3 cases!), 1995 and 1996 (Fig. 1). In six of seven cases, the Siberian Tit was the female partner of the pair (1984 the female was a Willow Tit). In 1989, one of the three Siberian Tit females had two mates, a Siberian Tit and a Willow Tit (see Järvinen et al. 1985, Järvinen 1987, 1989a).

The breeding success of the mixed pairs was relatively poor: 1984, only 2 eggs, no hatchlings and no fledglings; 1987, 9–9–7; 1989, 9–9–3, 9–9–4 and 8–7–7; 1995, 8–7–7; 1996, 7–2–2.

4. Discussion

A species comprises a population or set of populations that are capable of successfully interbreeding and producing fertile offspring under natural conditions (e.g. Gill 1990: 485–506). The fertility of a hybrid between the Siberian Tit and the Willow Tit reported here indicates that these tits are closely related. It is interesting that in a recent study of the phylogeny of *Parus* species based on molecular methods, the Siberian Tit was observed to lie rather close to two North American species, the Black-capped Chickadee *P. atricapillus* and the Carolina Chickadee *P. carolinensis*, but not to the Willow Tit (Kvist et al. 1996).

In the hybrid nest only two of the seven eggs produced a fledgling. The five unhatched eggs were unfertilized (or the embryos had died very early). The feeding rate of the parents was rather low in 1996, varying between 7 and 12 times/hr. On average, Siberian Tit parents feed normal broods of 7–11 young 16 times/hr, and the feeding rate of the male decreases as the nestlings grow older (Hannila & Järvinen 1987). However, the hybrid male was an active feeder, and the low hatching percentage was not due to the male's inadequate care of his mate.

In mountain birch forest, the Willow Tit is more numerous than the Siberian Tit both in summer (Järvinen & Rajasärkkä 1992) and in winter at feeding tables (own obs.). Thus, since the density of the Siberian Tit in the northern periphery of the species' breeding range is as low as 0.1–0.4 pairs/km^2 and the distance between two si-

multaneously occupied nests is very long (1–6 km even before the decline in 1990s, Järvinen 1982), Siberian Tits may have had difficulties in finding a mate of their own species and have accepted a mate of a closely related species.

In addition to my data (Fig. 1), local bird watchers have observed a dramatic decline in the number of Siberian Tits at the pine forest limit in NW Finnish Lapland in the 1990s (L. Pappila, pers. comm.). The Siberian Tit populations have declined also in pine forests in NE Finnish Lapland, but the reasons for the decline are unknown (no changes in the structure of forests and breeding success; Veistola & Lehikoinen 1994). Veistola and Lehikoinen (1994) suggest that poor food availability in late summer and autumn may have caused the decline. Hildén and Ketola (1985) have reported one mixed breeding between the Siberian Tit and the Willow Tit in a pine forest.

The decline of the Siberian Tit population in NW Finnish Lapland seems to be real (Fig. 1) and needs explanations. Many factors have probably contributed to the decline (climate change, food availability, habitat changes, etc.). In addition to possible harmful effects of global warming (Järvinen 1994a, 1995), the lowered productivity of mixed pairs may have accelerated the decline. The number of fledglings produced by the seven mixed pairs observed at Kilpisjärvi (mean 4.3) was lower than that reported by Saari et al. (1994) for the Siberian Tit in Finland (mean in seven areas varied between 5.0 and 7.7 fledglings/nest, the mean for Kilpisjärvi being 5.1; see also Hildén & Ketola 1985). However, my data are too small to allow statistical comparison between mixed and non-mixed nests in the same years. The Siberian Tit is a northern taiga species, and mountain birch forest is a suboptimal and marginal habitat for it (Saari et al. 1994). The rarity of the Siberian Tit in mountain birch forests may have promoted mixed breeding.

Siberian Tit populations may disappear in mountain birch forests if conditions change for the worse in the whole distribution area. During the last decades, spring and early summer temperatures have increased in NW Finnish Lapland. Accordingly, the breeding success of southern bird species (e.g. the Pied Flycatcher *Ficedula hypoleuca*) has improved (Järvinen 1989b, unpubl.).

Selostus: **Lapintiaisen ja hömötiaisen risteymä on fertiili**

Kesällä 1995 lapintiaisnaaras pesi hömötiaiskoiraan kanssa Kilpisjärven tunturikoivikossa ja tuotti seitsemän lentopoikasta. Seuraavana kesänä yksi risteymäjälkeläisistä (koiras) pesi lapintiaisnaaraan kanssa samalla alueella ja sai kaksi lentopoikasta. Ensimmäistä kertaa lapintiaisen ja hömötiaisen risteymä, joita tunnetaan Kilpisjärveltä (7) ja Kuusamosta (1), varmistettiin lisääntymiskykyiseksi. Sekaparit ja risteymän fertiilisyys viittaavat lapintiaisen ja hömötiaisen lähisukulaisuuteen. Vuosina 1966–1996 lapintaiskanta on Kilpisjärvellä hiipunut (Kuva 1). Kirjoituksessa pohditaan lapintiaisen harvinaistumisen syitä. Ilmaston ja biotoopin muutokset ovat luultavasti vaikuttaneet lapintiaiseen, mutta sekaparien yleistyminen ja sen aiheuttama pesimätuloksen heikentyminen ovat voineet vauhdittaa harvinaistumista lajin levinneisyysalueen reunalla (Kuva 1).

References

Gill, F. B. 1990: Ornithology. — W. H. Freeman & Company, New York.

Hannila, J. & Järvinen, A. 1987: Feeding activity of hole-nesting passerines during the nestling period in northern Lapland. — Acta Reg. Soc. Sci. Litt. Gothoburgensis. Zoologica 14: 102–108.

Hildén, O. & Ketola, H. 1985: A mixed pair Parus cinctus and P. montanus nesting in Kuusamo. — Ornis Fennica 62: 26.

Hildén, O. & Nikander, P. J. 1987: Syksyn 1986 vaelluslinnut (Summary: Occurrence of irregular migrants in Finland in autumn 1986). — Lintumies 22: 134–138.

Järvinen, A. 1982: Ecology of the Siberian Tit Parus cinctus in NW Finnish Lapland. — Ornis Scand. 13: 47–55.

Järvinen, A. 1987: A successful mixed breeding between Parus cinctus and Parus montanus in Finnish Lapland. — Ornis Fennica 64: 158–159.

Järvinen, A. 1989a: More mixed breedings between Parus cinctus and P. montanus in Finnish Lapland. — Ornis Fennica 66: 123.

Järvinen, A. 1989b: Patterns and causes of long-term variation in reproductive traits of the Pied Flycatcher Ficedula hypoleuca in Finnish Lapland. — Ornis Fennica 66: 24–31.

Järvinen, A. 1994a: Global warming and egg size of birds. — Ecography 17: 108–110.

Järvinen, A. 1994b: Lapintiaiset katoamassa? (Summary: Declining breeding populations of the Siberian Tit in

NW Finnish Lapland). — Linnut 29/5:31.

Järvinen, A. 1995: Effects of climate change on mountain bird populations. — In: Guisan, A., Holten, J. I., Spichiger, R. & Tessier, L. (eds.), Potential ecological impacts of climate change in the Alps and Fennoscandian mountains: 73–74. Imprimerie Nationale, Geneve.

Järvinen, A. & Rajasärkkä, A. 1992: Population fluctuations in two northern land bird communities: effect of habitat, migration strategy and nest-site. — Ornis Fennica 69: 173–183.

Järvinen, A., Ylimaunu, J. & Hannila, J. 1985: A mixed nesting pair Parus montanus and P. cinctus in Finnish Lapland. — Ornis Fennica 62: 25–26.

Kvist, L., Ruokonen, M., Orell, M. & Lumme, J. 1996: Evolutionary patterns and phylogeny of tits and chickadees (genus Parus) based on the sequence of the mitochondrial cytochrome b gene. — Ornis Fennica 73: 145–156.

Mikkola-Roos, M. 1996: Kosteikkojen linnuston suojeluarvo — uusi menetelmä arviointiin (Summary: A new method for evaluation of the conservation value of wetlands). — Linnut 31: 8–19.

Saari, L., Pulliainen, E., Hildén, O., Järvinen, A. & Mäkisalo, I. 1994: Breeding biology of the Siberian Tit Parus cinctus in Finland. — J. Orn. 135: 549–575.

Veistola, S. & Lehikoinen, E. 1994: Lapintiaisen vähenemisen syistä (Summary: The reasons for the decline of the Siberian Tit populations). — Linnut 29/6: 31.