

Male aggressiveness and the possible occurrence of group territoriality in the Brambling *Fringilla montifringilla*

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Abstract

Bramblings are nomadic birds with an interesting breeding ecology. Their nests are often aggregated in groups of two to eight nests. Such aggregated nesting may indicate the existence of group territories, probably formed for anti-predatory purposes. The male Bramblings show much variation in colour pattern during the breeding season, with individuals ranging from completely black-hooded to virtually female-like grey-hooded. The colour pattern is probably age dependent, but may also be correlated with social status. The present study of breeding Bramblings was performed during the summer 1998 at Ammarnäs, County of Västerbotten, Sweden. We simulated an intrusion in the breeding territory, using an artificial intruder (a decoy) and a tape recorder with Brambling song, to find evidence for the group territory hypothesis and to investi-

gate the possible correlation between male plumage pattern and aggressiveness. Only intermediate males (type 2) and black-hooded males (type 1) (i.e. no female-like males), were observed during experiments at 13 nests. The type 2 males were slightly more active and aggressive towards the intruder-decoy (an intermediate male), when tested close to the nest, than were the type 1 males. The decoy was never attacked by more than one male at a time, but there were more than one male present in 77% of the experiments, which does not exclude the possibility for the existence of a group territory.

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Introduction

The Brambling *Fringilla montifringilla* is a common breeding bird in the subalpine birch forests in northern Sweden. Bramblings are migratory birds, flock forming in autumn and winter, and territorial during the breeding season. They change breeding site almost every year and it has been suggested that this species, which is nomadic outside the breeding season, may retain its nomadic behaviour during the selection of breeding sites from year to year, and its occurrence in different areas during different years may depend on the food supply (Hogstad 1985, Lindström 1987).

The breeding behavior of the Brambling may demonstrate a great difference in the underlying selective pressures compared with other subalpine species and even with its close relative, the Chaffinch *Fringilla coelebs* (Irving 1960, Newton 1967, Mikkonen 1983). According to a study of Bramblings in northern Finland the male Bramblings appear in the breeding area in the beginning of May, and will soon

thereafter begin their courtship display (Mikkonen 1985). The males display in groups, sitting in neighbouring trees. With the arrival of the females, the song of the males becomes more intensive. The males do not have any fixed territories, but continue to display in groups that frequently change both display site and members. During the courtship display the male attracts the female solely with his own appearance and song, and not by means of a good nesting territory. The first pairs form about four days after the arrival of the females. Mating starts at the display territory of the male, before a nesting site has been chosen. After mating the female chooses the nest site, usually within the display territory, but sometimes in another place. During this period both of the birds defend the territory around the nest. While the male attacks other males at longer distances from the nest, the female attacks intruders of both sexes closer to the nest (Mikkonen 1985).

The Bramblings often nest in loose groups of two to eight pairs, as a consequence of the females



choosing nest site in or close to the collective display territory (Montell 1917, Udvardy 1956, Mikkonen 1985). The territorial boundaries are diffuse at first, but stabilise later (Conder 1949, Mikkonen 1985). Foraging during the breeding usually takes place outside the nesting territory (Mikkonen 1985). During the field work with Bramblings at Ammarnäs in northern Sweden, we tried to find evidence for the "group territory hypothesis", which states that neighbouring Brambling pairs defend a common territory around their nests. If the aggregated nesting of this species indicates the existence of a group territory, probably formed for anti-predatory purposes (e.g. Crook 1965, Lack 1968), we would expect that the neighbouring Bramblings are attacking or mobbing an intruder together. We designed and performed field experiments with an artificial intruder (a decoy) during the summer 1998.

During the field work we also investigated the possible correlation between male plumage pattern and aggressiveness, and tested the response of the males on a conspecific intruder. The breeding plumage of the Brambling males show high individual variation. While some males have a shiny black

hood, others have variable amounts of grey-brown feathers on the nape. It has even been observed that some males may even have a breeding plumage almost identical to females (Silverin unpublished data). It is not known how these differences affect male behaviour and reproductive success. This colour variation may have a function in the signalling of individual social status (Hogstad & Röskaft 1986). If that is so, it can be expected that males with brighter colours and stronger contrasts have higher social status and are more aggressive. By using a decoy, placed on a branch close to the nest, we had the possibility to compare the response and aggressiveness of males with different plumage patterns.

Method

The field experiment was conducted at Ammarnäs, County of Västerbotten, Sweden (65°58'N, 16°07' E) from the 20 June to the 2 July 1998. The observed Brambling pairs bred mainly in two areas at Tjulträsk, which are surveyed annually by the LUVRE project (area A4 and A5). The vegetation in the area is subalpine birch forest.

During the preparations for the experiments the area of Tjulträsk was visited to find and mark all Brambling nests. We had marked 13 nest in the same breeding stage (last eggs were just laid) before the experiments were started. We carried out experiments (10 minutes each) at three occasions with two or three days' interval at each individual nest. During the tests the possible aggressive behaviour of breeding males with different colour pattern and the number of territory defending males were observed. All observations were made during the mornings, mainly between 5 and 11 a.m.

A Brambling decoy was mounted on a branch and a tape recorder with Brambling song was placed underneath it. The decoy was placed at 2 m from the nest in the first experiment, at 5 m from the nest in the second, and at 15 m from the nest in the third experiment. From an observing distance of 15–20 m the following activities were noted at each nest:

- 1) the time when the nest owning male and/or the second male first appeared within 20 m of the decoy,
- 2) the number of attacks and attack frequency of males, who caused a "physical injury" to the decoy at each nest,
- 3) the position of the males and their movements in relation to the decoy at various distances within 20 m of the decoy,
- 4) the singing activity of the nest owning (and the second) males.

To investigate the correlation between the coloration

of the male and its aggressiveness, we classified the males' plumage into three groups:

- type 1: males with entirely shining black hood
- type 2: males with some grey feathering on the nape
- type 3: males with female-like pattern

The decoy was of type 2.

For the calculation of levels of significance we used the Fisher Exact Probability Test, the Mann-Whitney U-test (indicated by U) and the Wilcoxon Signed Rank Test (indicated by T).

Results

During the experiments we found only males of type 1 and 2. At nine of the 13 nests examined, the nest owning males were of type 1. We found no significant difference in the number of attacks between type 1 and type 2 males ($p=0.22$, Fisher's Exact Probability Test). In spite of this, there was a tendency towards type 2 males attacking more frequently (Table 1). The decoy was never attacked by more than one male at a time.

Movement activity (number of movements in relation to the decoy/min) did not differ significantly between the experiments within any of the two male types. Neither was there any significant difference in activity between the two groups (Table 1).

The time when nest-owning type 1 males first appeared closer than 20 m from the decoy did not differ significantly between the three experiments.

Table 1. The number of attacking males and the average number of movements in relation to the decoy/min at the different distances from the nest.

Antalet attackerande hanar och genomsnittliga antalet förflyttningar i förhållande till bulvanen per minut vid olika avstånd från boet.

Distance between nest and decoy	Number of type 1 males that appeared (total n= 9)	Number of type 2 males that appeared (total n= 4)	Number of second males that appeared (total n= 13)	Number of attacking males	Average number of movements in relation to the decoy/1 min		
<i>Avstånd mellan bo och bulvan</i>	<i>Antal hanar av typ 1 som kom fram</i>	<i>Antal hanar av typ 2 som kom fram</i>	<i>Antal andra hanar som kom fram</i>	<i>Antal attackerande hanar</i>	<i>Genomsnittligt antal förflyttningar i förhållande till bulvanen per minut</i>		
				Nestowner type 1	<i>boägare</i> type 2	Nestowner type 1	<i>boägare</i> type 2
2 m	9	3	6	0	1	1. 93	2. 62
5 m	6	4	7	2	1	2. 17	2. 21
15 m	7	3	6	1	2	2. 05	1. 95

Table 2. The average time of the first appearance of males and the average distance of the males to the decoy. The number of males that appeared at the different distances from the nest are the same as shown in Table 1.

Genomsnittlig tid till första uppdykande av hane och genomsnittligt avstånd till bulvanen. Antalet hanar på olika avstånd från boet är samma som i Tabell 1.

Distance between nest and decoy <i>Avstånd mellan bo och bulvan</i>	Average time of first appearance (s)			Average distance of the males to the decoy (m)		
	<i>Genomsnittlig tid till första uppdykande</i>			<i>Genomsnittligt avstånd mellan hane och bulvan (m)</i>		
	type 1 nest owner	type 2 nest owner	second male	type 1 nest owner	type 2 nest owner	second male
2 m	147	100	220	10.85	6.27	11.83
5 m	170	113	240	7.80	7.57	12.29
15 m	111	320	360	10.07	8.5	11.92

Type 2 males appeared near the intruder considerably quicker in the first experiment (when the decoy was placed 2 m from the nest) than in the third experiment (with the decoy at 15 m from the nest) ($T=3$, $n=4$, $p<0.05$). In the third experiment type 2 males appeared after significantly longer time than type 1 males ($U=2$, $n1=3$, $n2=7$, $p<0.05$) (Table 2). At ten of the 13 nests a second male appeared within 20 m of the decoy. The time of its first appearance did not differ significantly between the experiments (Table 2).

Type 2 males kept relatively closer to the decoy than type 1 males, but the differences were not statistically significant. No significant differences were found in the comparison of the average distance of the birds to the decoy between the three experiments within each male type (Table 2).

All four breeding males of type 2 responded to the song of the intruder at some time of the experiments. The corresponding figure for type 1 males was three out of nine. Singing second males were heard at seven of the 13 nests.

Discussion

Nine of 13 observed breeding Brambling males in our study were of type 1, i.e. with a completely black hood. According to a study of the colour pattern of the Brambling, 80% of the individuals with shining black hoods were adult males. Among males with more grey in the head plumage there were both adults and immatures (Hogstad & Röskaft 1986). Brambling males moult early in the spring, but there are probably some small differences in colour and

pattern between the males also in winter. In that case it can be suspected that the plumage pattern in some way shows the status of the individual and is an "honest signal" about its condition and fighting ability (Rower 1975, Fugle et al. 1984, Järvi & Bakker 1984). The darkness of the head plumage was also positively correlated with body size and wing length (Hogstad & Röskaft 1986). For northern birds with a short breeding season it may be important to minimise aggressiveness to avoid wasting energy on fights (Emlen & Oring 1977, Greenwood 1980). In this case "honest signals" could be an adaptation for saving energy.

Hogstad & Röskaft (1986) discuss two hypotheses to explain why some males delay their plumage maturation. The first hypothesis – Delayed Maturation Hypothesis – predicts that individuals avoid the costs of conspicuous plumage when their chance of breeding during that season is limited (Selander 1972, Procter-Gray & Holmes 1981). The second hypothesis – Female Mimicry Hypothesis – proposes that young males can increase their chance of breeding when they mimic females and in that way avoid the aggressiveness of the adult males (Rohwer et al. 1980). The latter hypothesis could explain why type 1 males, with a completely black head, were less inclined to attack the decoy (which had a type 2 head pattern), than were type 2 males, with some grey feathers on the head.

Type 2 males kept closer to the decoy than type 1 males, when it was close to the nest. When the decoy was placed 15 m from the nest, the type 2 males lost interest in it and appeared after significantly longer time than type 1 males. The time of first appearance

for type 1 males did not differ significantly between the three experiments. The Brambling nests at Tju-tråsk sometimes lay very close together (with distance varying between c. 30 and 60 m), and during the 15 m experiments it was sometimes difficult to decide which one of the males around the decoy that was the nest owner. This in turn makes it difficult to establish the territorial boundaries with certainty. It is possible that type 2 males defend a smaller territory, but as we could only observe four breeding type 2 males, a small sample size indeed, the problem must be studied more thoroughly before any conclusions can be drawn.

The activity (movements in relation to the decoy/ 1 min) did not differ between the two male types, neither in comparisons within each type. The movements around the decoy were largely the same for both types in all the experiments. On several occasions we noted that, after more careful investigation, the Bramblings ceased to see the decoy as a bird and instead turned their attention to the tape recorder.

100% of the type 2 males and 33% of the type 1 males responded to the intruder's song (tape recorder) at some time during the experiments. This agrees with their overall higher level of activity around the nest. According to Udvardy (1956) and Mikkonen (1985), the Brambling song is not aggressive, but only sexual, so the song of an intruder would only stimulate the male to sing more vigorously. Our observations took place at a rather late stage in the breeding season when the singing activity probably had decreased. However, a certain increase in the singing activity of the neighbours could almost always be noted during the experiments. A general observation was that none of the males responded to the song of the intruder if they were closer than 10 m from it (the average for nest owning males was 25 m and for second males 27 m).

The decoy was never attacked by more than one male, although there were second males within 20 m distance at 10 of the 13 nests. The only territorial fights we observed (on three occasions) took place during the 15 m experiments with type 1 males. In these cases the aggressiveness could have come out of an agitated situation. One of the fights took place after the nest owner had attacked the decoy, another came after the nest owner together with a neighbour had had a fight with a Three-toed Woodpecker *Picoides tridactylus*. Our general opinion is that aggressiveness between neighbours is very uncommon and that neighbours are allowed to come to investigate the decoy/intruder. This could indicate the existence of some kind of group territories, but as

our observations took place at the end of the egg laying period, the general level of aggressiveness could be naturally low. For birds, that are group-living outside the breeding season, display and breed in small groups and that are practising breeding nomadism, the existence of group territories, where predators can be mobbed, is possible. Brambling often breed inside Fieldfare *Turdus pilaris* colonies, probably for anti-predatory reasons. It would be interesting to investigate if the aggressiveness of the Brambling male is correlated with the distance to Fieldfare nests, e.g. if Brambling nesting close to Fieldfare nests are less aggressive.

An interesting, but very subjective, observation was that during almost all attacks that occurred, the male seemed not to have a clear idea about the location of the female. Before the Brambling female builds its nest, the male chooses a display site and the female chooses a nest site after the mating. The territory is established as the nest building begins and is subsequently expanded. Probably there is a period with a small territory with unstable boundaries centred on the female (Mikkonen 1985). Even if the boundaries of the territory stabilises with time, the main purpose of the territory seems to be to guard the female.

As we noted above, the time for our experiments was a little too late in the breeding schedule. Because the egg laying was just finished, the level of aggressiveness might have been lower than earlier in the breeding season. A similar experiment should be carried out at several stages during the breeding season to get a clear picture of the possible variation in activity and aggressiveness during different periods. By playback experiments with the song of the neighbour the interactions between neighbours could be studied. The colour pattern of the decoy could also be varied, the response of the different male types on different patterns could be investigated. It would be interesting to test the Female Mimicry Hypothesis, i.e. that blacker males do not attack males with female-like plumages, even if they sound like males. A combined study could be carried out, where decoy experiments are made, followed by examination of blood samples. This could give information on the correlation between hormone levels (e.g. testosterone), colour pattern and aggressiveness.

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Sammanfattning

Grupprevir och hanarnas aggressivitet hos häckande bergfinkar *Fringilla montifringilla*

Bergfink är i Sverige en typisk norrlandsfågel och en mycket vanlig art i landets subalpina björkskogar. Enligt en studie av berg- och bofinkar i norra Finland dyker de första bergfinkshanarna upp i häckningssområdet i början på maj och börjar med sitt uppvaktningsspel redan innan honorna anländer. De spelar i grupper sittande i var sitt träd. Med honornas ankomst blir hanarnas sång kraftfullare. Under uppvaktningssceremonin visar hanen upp bara sin egen attraktivitet, utan att använda ett revir som lockobjekt. Bergfinksbona ligger ofta i lösa grupper om 2 till 8, som följd av bosättningarna inom ett spelområde. Födosök sker oftast fortfarande utanför reviret (Mikkonen 1985). Det har föreslagits att sådana häckningsgrupperingar bildas för att skydda bon för predatorer eller andra inkräktare och att fåglar i en sådan grupp därigenom försvarar ett gemensamt revir.

Häckande bergfinkshanar visar upp en rik färgvariation i sin fjäderdräkt från individer med glänsande svart huvud till honlika gråfärgade exemplar. Färgvariationen är förmodligen åldersberoende men det är inte känt, hur dessa skillnader påverkar hanarnas beteendemönster och sexuella framgång. Man kan tänka sig att en sådan variation har uppkommit, för att visa individens sociala status (Hogstad & Röskaft 1986). I så fall kan man förvänta sig att fåglar med starkare färger och kontraster har högre social status och uppvisar mer ihållande aggressivitet.

Denna undersökning genomfördes under sommaren 1998 med häckande bergfinkshanar i Ammarnäs (65°58' N, 16°07' E), Västerbottens län. För att undersöka frågan om ett möjligt grupprevir och testa den potentiella kopplingen mellan hanens fjäderdräkt och dess aggressivitet, simulerade vi intrång i reviret med hjälp av en uppmonterad bergfinksattrapp och en bandspelare med bergfinkssång.

Metod

Fältexperimentet genomfördes i Ammarnäs i Västerbottens län under tidsperioden 20 juni – 30 juni. De observerade bergfinksparen häckade huvudsakligen i två områden vid Tjulträsk, vilka årligen inventeras inom LUVRE projektet (yta A4 och A5) Vegetationen i området är subalpin björkskog.

Vi hade markerat 13 bo i området vilka befann sig i samma häckningstadium (fågeln hade just lagt

sina sista ägg) innan vi påbörjade undersökningarna. Vi genomförde tre experiment med en eller två dagars intervall vid varje bo. Under experimentet fäste vi en uppstoppad bergfink på en gren och hängde en bandspelare med bergfinkssång under den. Observationerna gjordes från 15–20 m håll. Under fältobservationerna noterades tidpunkten när hanarna dök upp, deras beteende och sångaktivitet under 10 minuter. Attrappen sattes upp i experiment I: 2 meter från boet, i experiment II: 5 meter från boet och i experiment III: 15 meter från boet. För att undersöka korrelationen mellan hanens färgtäckning och dess aggressivitet, delade vi in hanar i tre grupper: typ nr 1 – hanar med helt svarta huvud, typ nr 2 – hanar med grått inslag i nacken, typ nr 3 – hanar med honlik färgtäckning. Attrappen var av typ nr 2.

Resultat

Under experimentet påträffade vi häckande hanar av enbart typ 1 och typ 2. Vid 9 av de 13 undersökta bona var den boägande hanen av typ 1. Vi hittade ingen signifikant skillnad i antal attacker mellan typ 1 och typ 2 hanar. Trots det kunde man konstatera en tendens till fler attacker bland typ 2 hanar (Tabell 1). Attrappen anfölls aldrig av mer än en hane. Typ 2 hanar dök upp i inkräktarens närhet betydligt snabbare i första experimentet (när attrappen var 2 m från boet) än i tredje experimentet (attrappen 15 m från boet) (Tabell 2). Under tredje experimentet visade typ 2 hanar sig efter signifikant längre tid än typ 1 hanar. Vid 10 bo av 13 fanns det fler än en hane i närheten (närmare än 20 m) av attrappen under experimenten. Rörligheten (antal förflyttningar i förhållande till attrappen/ 1 min) skilde sig inte mellan de tre olika experimenten (Tabell 1). Typ 2 hanar höll sig relativt närmare inkräktaren än typ 1 hanar, men trots denna tendens hittade vi inga signifikanta skillnader (Tabell 2). Fyra av 4 häckande hanar av typ nr 2 svarade under någon av experimenten till inkräktarens sång. Motsvarande siffror för typ 1 hanar var 3 av 9. Sångfrekvensen (sångtiden/totala tiden) var signifikant högre hos typ 2 hanar. Sjungande icke boägande hanar hördes vid 7 bon av 13.

Diskussion

Nio av 13 undersökta häckande bergfinkshonar i vår studie var av typ 1, dvs helt svarta på huvudet. Hos

nordliga fåglar, med kort häckningssäsong, kan det vara viktigt att hålla ner aggressiviteten och inte slösa energi på strider. I så fall kan ”ärliga signaler” vara en adaptation till att leva energisnålt. Man kan misstänka att fjäderdräkten hos bergfinkshonar på något sätt betecknar status hos individer och är en ”ärlig signal” om fågelns kondition och stridsförmåga. Hogstad och Rödskaft (1986) konstaterade, att bland sk typ 2 bergfinkshonar finns det både juveniler och adultar. De har bl.a. föreslagit en sk ”Female Mimicry” hypotes, som säger att unga hanar kan öka sina chanser att häcka när de efterliknar honor och på detta sätt undgår adulta hanars aggressivitet. Detta kan delvis förklara varför hanar med helt svart huvud (typ 1) inte var lika benägna att attackera attrappen (med typ 2 färgtäckning) som hanar med gråare huvud i detta experiment.

Hanar med gråare huvud höll sig relativt närmare attrappen än svarthuvade hanar när den var nära boet. På längre avstånd, dvs när attrappen var uppställt 15 m från boet, tappade de gråare hanarna intressen för attrappen och visade sig efter signifikant längre tid än svartare hanar. Det är möjligt att gråare hanar skyddar ett mindre revir, men eftersom vi bara kunde observera 4 häckande hanar med gråfläckigt huvud, behöver man öka stickprovstorleken och undersöka problemet mycket noggrannare, innan man drar några slutsatser. 100 % av typ 2 hanar och 33% av typ 1 hanar svarade någon gång under experimenten på inkräktarens sång. Enligt Mikkonen (1985) har bergfinkssången ingen aggressiv inverkan på fåglarna utan bara stimulerande och skall locka fåglarna att samlas och sjunga mer och kraftfullare.

Attrappen anfölls aldrig av fler än en hane trots att det vid 10 bon av 13 fanns fler än en hane närmare än 20 m från attrappen. De enda revirstriderna vi såg (det hände 3 gånger), ägde rum under experiment med typ 1 hanar vid 15 meters avstånd från boet. Vår allmänna uppfattning är, att aggressivitet mellan grannar är mycket ovanlig och att grannarna även ”får lov” att komma och inspektera inkräktaren. Detta kan tyda på att bergfinkarna har en sorts grupprevir, men eftersom alla observationer skedde i slutet av äggläggningen kunde den allmänna aggressiviteten vara naturligt låg. Hos fåglar som är grupplevande mellan häckningssäsongerna och spelar och häckar i grupper är existensen av grupprevir, där de bland annat kan gemensamt mobba predatorer, tänkbar.