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Wir widmen diese Arbeit dem Andenken an Ingemar Hjorth, der vor 10 Jahren im Tsunami ums Leben kam.

Courtship and copulation behaviour in Caucasian black grouse *Tetrao mlokosiewiczi* – display walking and head shaking

Siegfried Klaus, Ilja Ukolov and Hans-Heiner Bergmann

Werbe- und Paarungsverhalten des Kaukasischen Birkhuhns *Tetrao mlokosiewiczi* – Imponierlauf und Kopfschwenken

Die Auswertung neuer Videoaufnahmen zum Höhepunkt der Balz des Kaukasischen Birkhuhns im Teberda-Schutzgebiet (NW-Kaukasus) ergab Einsichten in bisher unbekannte Verhaltensweisen: Der paarungsbereite Hahn nähert sich dem Weibchen durch schräges Heranlaufen, wobei 1 (oder 2) Flügel in schnellem Rhythmus nach unten gespreizt werden. Vor der paarungsbereiten Henne sinkt der Hahn ruckartig zu Boden und beginnt mit horizontalem Kopfschwenken. Danach kann es zur Kopulation (Aufsteigen von hinten, Nackenfederfassen, Abstützen mit den Flügeln, kein Flattern, Dauer 3–6 s) kommen, wenn das Weibchen durch Hocken und Flügelspreizen zur Paarung auffordert. Das rhythmische Flügelspreizen ist von anderen Tetraoniden nicht bekannt. Kopfschwenken kommt auch bei Haselhuhn, Chinahaselhuhn und wenigen anderen Tetraoniden (auch Phasianiden) vor, die an der Basis des Stammbaums stehen, nicht aber bei Birk- oder Auerhuhn. Das Verhalten wird als „ursprünglich" gedeutet, das Kaukasische Birkhuhn würde demnach den Birkhuhnvorfahren näherstehen als das Birkhuhn.

Key words: Caucasian black grouse, *Tetrao mlokosiewiczi*, courtship behaviour, copulation behaviour, Teberda-reserve Russia

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The Caucasian black grouse is one of the least studied species within the subfamily of Tetraonids. The species is listed in the Red Book of Russia (Boronin 1984) as "lower risk, near threatened" (Storch 2000). Field studies have been increasing since Potapov & Pavlova (1977) and Potapov (1982, 1985) published their detailed observations carried out in the Teberda Reserve in the northwestern Caucasus Mountains. The most extensive long-term field work has been performed by Vitovich (1986) in the same reserve, followed by our cooperative work (Bergmann et al. 1991, Klaus et al.

1987, 1988, 1990, 2003, Klaus & Vitovich 2003). Recently, the distribution and habitat use of this species has been studied and conservation recommendation made in Aserbaijan (Sultanov et al. 2003, Etzold 2005), Georgia (Gokhelashvili et al. 2003), and Turkey (Isfendiyaroglu et al. 2007), which have added considerably to our knowledge of the species elsewhere in the Caucasus.

We report here new insights into the organization of courtship and preparation of copulation in the Caucasian black grouse. During 6–9 May 2014, one of the authors (I. U.) succeeded in recording (camera Canon 7D+Canon 500mm f/4 and audio recorder Tascam DR-05+Sennheiser MKE-300) courtship and copulation by video at the same lek (altitude 2,400–2,500 m a.s.l.) visited by us in 1987, 1988, and 1989 in the Teberda Reserve. In contrast to the steep slopes normally used for courtship, the birds observed here preferred a small flat plateau. The new recordings are consistent with most of the behaviour described before. In addition, we describe in detail two types of behaviour, not noticed earlier, due to the large distance between our hide and the courting and copulating birds and lower quality of our 16 mm film recordings. We use the terminology of Hjorth (1970). For drawings of typical behaviour patterns and sonograms see our papers cited above.

1. **Display walking** (fig. 1A): While standing near the female (estimated distance 0.5–2 m), the male moved his lowered and half-spread wings up and down quickly, on one or both sides of the body (probably causing a weak rustling sound of the hard primaries touching the toes, tarsus, or the lateral plumage). The white shoulder patch oscillated in size during this short performance.

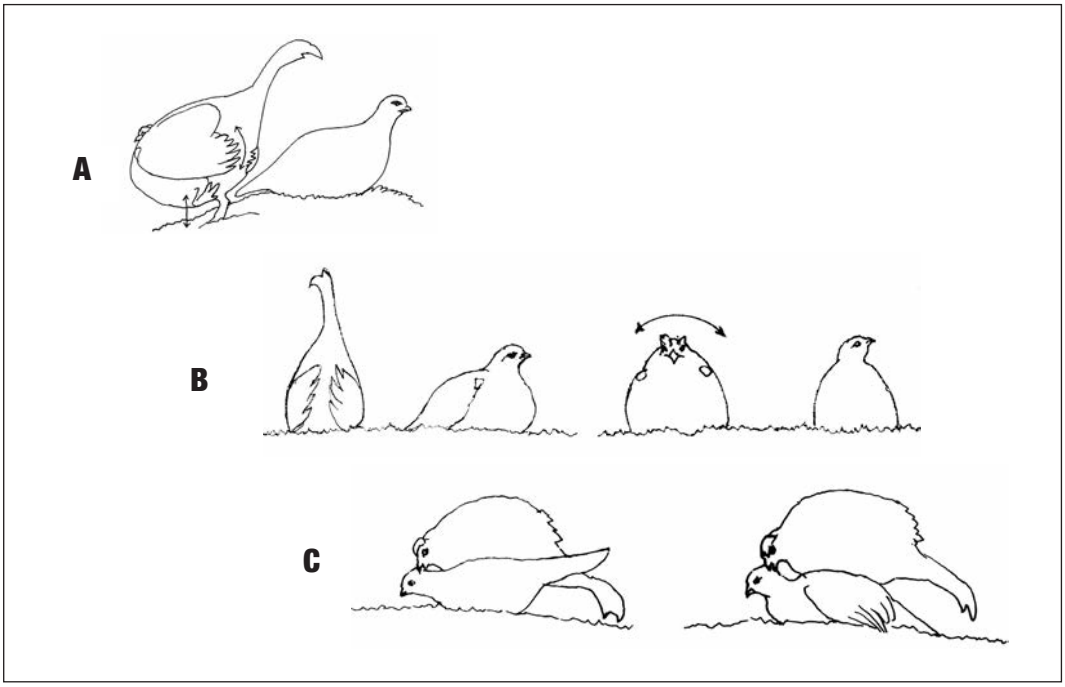

Fig. 1. A. Display walking: Courting Caucasian black grouse male near to the crouching female, showing rapid movements of the wing (s) and harping by toes. B. Head shaking: Prior to copulation, both male and female crouching and head-turning of the male. C: Copulation – male clasping female's neck feathers. – *A. Imponierlauf: der werbende Kaukasusbirkhahn spreizt in rascher Frequenz die Handschwinge(n) nach unten und reibt diese an den Zehen. B. Kopfschwenken: vor der Kopulation hocken sich Männchen und Weibchen nieder und schwenken die Köpfe horizontal. C. Paarung: Das Männchen fasst mit dem Schnabel die Nackenfedern des Weibchens.*

Tab. 1. Copulations of Caucasian black grouses *Tetrao mlokosiewiczi* observed at Teberdinskij zapovednik/NW-Caucasus – *Beobachtete Kopulationen von Kaukasischen Birkhühnern* Tetrao mlokosiewiczi *im Teberda-Schutzgebiet (NW-Kaukasus).*

No	date	Day time	duration (s)	territory central	territory marginal	Supporting using wings	Crasping females crest	Reference
1	15. V. 1975	4.30	10	+	—	+	-	Vitovich (1986)
2	21. V. 1975	6.10	15	—	+	+	-	Vitovich (1986)
3	18. V. 1987	4.25	3-4	—	+	+	+	Klaus et al. (1988)
4	19. V. 1987	4.50	4-5	—	+	+	+	Klaus et al. (1988)
5	20. V. 1987	5.30	5	—	+	+	+	Klaus et al. (1988)
6	22. V. 1987	4.28	7	—	+	+	+	Klaus et al. (1988)
7	08. V. 2014	6.43	5	+		+	+	Ukolov (unpubl.)

2. **Head shaking** (fig. 1 B): After finishing the run, the male crouched demonstratively, sometimes in a depression in the grassy ground and started shaking his head (10–20 movements). Sometimes, a weak "click" sound was heard during head shaking. Head shaking by the female was not clearly seen, because she changed her position often. Display walking, crouching, and head shaking were repeated several times during a 2 min continuous recording.

As described earlier (Klaus et al. 1988, 1990, 2003, Tab. 1), the copulating male grasped the female's crest feathers (fig. 1 C), as in other grouse. This was clearly shown in the new recordings made in 2014. Vitovich (1986), who observed only 2 copulations, reported that grasping does not occur (cited in Potapov 1985, 1989, 2013). This mistake was possibly due to high grass vegetation covering the birds. Tab. 1 summarizes the data from 7 copulations observed to date. In 5 cases grasping was clearly seen.

Time course (in seconds) during precopulation and copulation (2 min continuous sequence): 000: Crouching and head shaking of the male, followed by wing lowering and spreading run, 010: crouching, head shaking, 020: display walk, 035:display walk, 050: crouching, head shaking, 060:display walk, copulation, 065: end of copulation, female shaking body, male lying down, shaking plumage for 12 s, 080: flutter jump, 090: flutter jump, 100: flutter jump, 120: flutter jump.

Discussion

As a special feature, display of the Caucasian black grouse is characterized by instrumental sounds during flutter jump and territorial flight first described by Noska (1895), Lorenz (1897) and

Fig. 2. Flutter jumping male (phot. Ilya Ukolov, May 7, 2014, Teberda). – *Flattersprung des Männchens.*

Fig. 3. Flutter jumping male (phot. Ilya Ukolov, single pictures composed, May 7, 2014). – *Flattersprung eines Männchens (phot. Ilya Ukolov, zusammengesetzte Serie aus Einzelfotos, 7. Mai, 2014).*

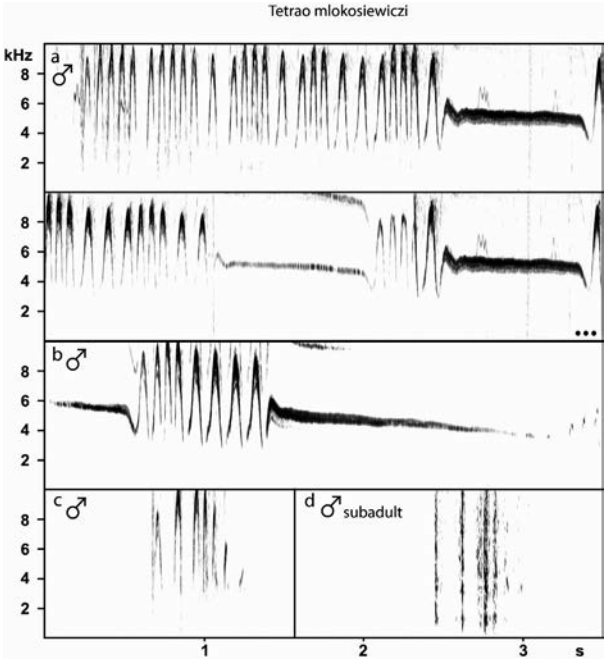

Fig. 4. Sonograms of instrumental sounds produced by the wings of male Caucasian black grouse (recordings by Ilya Ukolov, May 7 and 8, 2014). a, b – adult male territorial flight and gliding, c – adult male flutter jump, d – yearling male flutter jump (less developed performance). – *Sonagramme instrumentaler Lautäußerungen, produziert durch die Flügel der Männchen (Aufn. Ilya Ukolov, 7. Mai 2014). a, b – altes Männchen: Revierflug und Gleiten, c – adultes Männchen, Flattersprung, d – Flattersprung eines Jährlingsmännchens (unvollständige Ausführung).*

Averin (1938). Here we concentrate on the new findings in courtship behaviour.

The display walking with rapid up-and-down movements of the wings (not touching the ground) prior to copulation is an unique behaviour in the Caucasian black grouse, and has never been reported in either capercaillie species nor in the black grouse. From the video it was impossible to determine if the wing(s) were making a hissing sound when touching the tarsus or toes, like the tail feathers in the Spruce grouse and Siberian grouse. In German a special term "harfen" (harping) is used for this phenomenon; sound production when the primaries touch the toes. This is known in some displaying phasianids (Schenkel 1956), but also in ruffed grouse (W. Scherzinger, unpubl., Bergmann et al. 1996) and occasionally in capercaillie. Because the solid primaries and/or alula (figs .4, 5) in the "wing-beat display" (Hjorth 1970) produce the whistling sound (fig. 4) during flutter jump and territorial flight (Potapov & Pavlova 1977, Vitovich 1986, Bergmann et al. 1991), a stimulating instrumental sound during the display walk would be a possible assumption. Unique in grouse is the fact that there is no tail spreading in the ground display of the courting male (tail is spread during flutter flight and during confrontation). The folded tail is vertically erected like a flag and is visible on the grass-covered lekking ground.

The relatively small white shoulder patch of the male clearly oscillates in size during this walking display in close proximity to the female. Hjorth (1970) interpreted the function of such a "shoulder patch display" of male grouse during the communication with females in the sense of "do not fear me" (appeasement).

Head shaking by both sexes to demonstrate readiness to copulate has been recorded both in the hazel grouse and the Chinese grouse (Bergmann et al. 1996, Klaus et al. 1996, 2009). In the ruffed grouse, courtship display, head shaking, and turning (head jerking according to Hjorth 1970) is most impressive due to the prolonged neck feathers, the "ruff". Head shaking prior to copulation is also typical in the two species of spruce grouse and in the dusky and sooty grouse (Schroeder, pers. comm.). It is also known in Siberian grouse (Andreev, Hafner, Klaus, unpubl.). In addition, some of the pheasant species show this behaviour (Schenkel 1956, Möller pers. comm.). It seems that head shaking is typical in grouse species that are basal in the phylogenetic tree (Gutierrez 2000, Luccini et al. 2001). The question of whether head-shaking is an ancient feature in phasianid species and is lacking in some species due to reduction should also be discussed in the framework of systematics. For this purpose, new genetic methods should be used to compare the Caucasian black grouse with black grouse, and the genera *Bonasa, Tetrastes, Lagopus, Falcipennis,* and *Dendragapus*. Morphology and behaviour support the view that the Caucasian black grouse is more basal in the phylogenetic tree than the black grouse (Potapov & Pavlova 1977, 1982, 1985). These arguments have been summarized by Klaus et al. (1990, 2003).

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Electronic supplementary material. The recordings used to produce spectrogram in Fig. 4 are available from http://og-bayern.de/?page_id=7919

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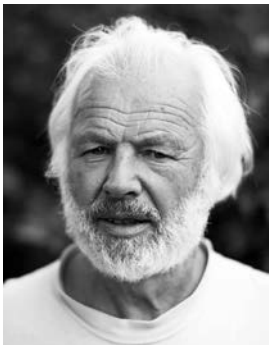

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