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ARTIFICIAL BLACK GROUSE (*TETRAO TETRIX* L.) BREEDING IN TUSCANY (APPENNINE REGION OF ITALY)

COMPORTAMENTO E PERFORMANCE DEL GALLO FORCELLO (*TETRAO TETRIX* L.) ALLEVATO A FINI Sperimentali NEL PARCO DELL'ORECCHIELLA (TOSCANA)*

MARCO BAGLIACCA ⁽¹⁾, GISELLA PACI ⁽¹⁾, GIORGIO CALZOLARI ⁽²⁾,
MAURIZIO FOLLIERO ⁽³⁾, PAOLO MANI ⁽⁴⁾

SUMMARY

Captive breeding of black grouse (*Tetrao tetrix* L.) is justified because this species is declining in most of the alpine areas, at the edge of its distribution area. Only reared black grouse originating from the alpine population, can be used for re-introducing the species in the alpine areas where it has disappeared or is endangered. For this reason in 1988 the Orecchiella natural park (48.95°N, 1200m a.s.l.) started the captive breeding. The experimental breeding has been always based on fixed pairs; it started with 6 pairs originating from East Alps. In 1993-94, eight young birds, obtained from eggs coming from Central Alps, were taken for crossbreeding. There are altogether 18 males and 13 females. The pens built in 1988 were provided with complete net floors and some additional pens were built in 1993 and in 1996. Nutrition was based on a three-phase feed (laying, growth, and rest). Since it was not possible to use merely artificial feed, some natural long-fibre supplementary feed (Pinus mugo for adults, and Vaccinium myrtillus for growing birds) with siliceous grit is always given. The laying period in the experimental breeding farm starts in May and ends in July (mean 5 eggs/female). Eggs are artificially incubated (99.7°F, 47%R.H.). The incubation period is 24.5 days. The mean hatchability is 40%. Chicks are reared in commercial heated cages for the first 4 weeks before transferred to the pens. Pairs are formed in the winter. The behaviour of the caged black grouses shows the typical seasonal course of the specie and no stereotypies, index of stress condition, can be observed with this breeding technology..

Key words: black grouse, *Tetrao tetrix*, captive breeding, performance, behavior.

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⁽¹⁾ Dipartimento di Produzioni Animali – Direttore Prof. Dario Cianci.

⁽²⁾ Tenuta Presidenziale di S.Rosso – Direttore Dott. Giorgio Calzolari.

⁽³⁾ Ministero delle Politiche Agricole – Ufficio Amministrazione di Lucca – Direttore Dott. Fabio Cappelli.

⁽⁴⁾ Dipartimento di Patologia Animale – Direttore Prof. Francesco Tolari.

RIASSUNTO

L'allevamento in stretta cattività del gallo forcello (*Tetrao tetrix* L.) è stata iniziato dal Parco Naturale dell'Orecchiella (48.95°N, 1200 m s.l.m.) in considerazione del fatto che la specie è in netto declino in tutto l'arale alpino Italiano (confine sud dell'area di distribuzione) e solo soggetti allevati autoctoni, possono essere impiegati per progetti di ripopolamento o reintroduzione della specie nelle aree alpine dove la stessa è fortemente ridotta o completamente scomparsa. L'allevamento è sempre stato basato sul mantenimento dei riproduttori in coppia fissa; è iniziato con sei coppie provenienti dalle alpi trentine ma, nel 1993-94, otto giovani soggetti provenienti dalle alpi centrali sono stati utilizzati per rinsanguamento; attualmente sono presenti 18 maschi e 13 femmine. I parchetti iniziali, costruiti nel 1988 sono stati modificati nel 1993 fornendoli di pavimento in rete e nuove strutture, completamente rialzate dal suolo sono stati realizzate nel 1996. L'alimentazione in cattività è basata sulla distribuzione *ad libitum* di tre mangimi sbriolati (depositazione, accrescimento e riposo). Poichè si è dimostrato impossibile l'utilizzo del solo mangime concentrato, l'alimentazione viene costantemente integrata con alimenti supplementari naturali apportatori di fibra lunga (fronde di pino mugo per gli adulti e sfalci di mirtillo per giovani e adulti). Le performance riproduttive realizzate nel corso del decennio mostrano che la deposizione nell'allevamento in cattività inizia a maggio e termina in luglio (media 5 uova per femmina). Le uova vengono incubate artificialmente (99.7°F, 47%R.H) dopo una conservazione di 7 giorni. Il periodo di incubazione dura 24.5 giorni. La schiusa media è del 40%. I pulcini sono allevati in gabbie calde commerciali per le prime quattro settimane prima di essere trasferiti nei parchetti sopraelevati all'aperto. Le coppie dei riproduttori vengono formate nell'inverno successivo alla nascita. Il comportamento degli animali mostra le variazioni stagionali tipiche della specie allo stato selvatico e non sono state osservate stereotipie comportamentali con la tecnica di allevamento adottata.

Parole chiave: Gallo forcello, *Tetrao tetrix*, allevamento, performance, comportamento.

INTRODUCTION

The useful of Black grouse captive breeding (*Tetrao tetrix* L.) arises because this specie is declining in most of the alpine areas where it has still its southern habitat. The species in fact is completely disappeared in Northern Apennine where several fossils can be found (Couturier M. et A., 1980) and some isolated individuals were captured till one-two centuries ago (Bagliacca e coll., 1993, Savi 1829, Schembi 1813). For this reason in 1988 the bureau of Lucca of the Ministry of Agriculture started the captive breeding of back grouses with the aim to produce birds for release in the Alps and, after a study of feasibility, in Northern Apennine.

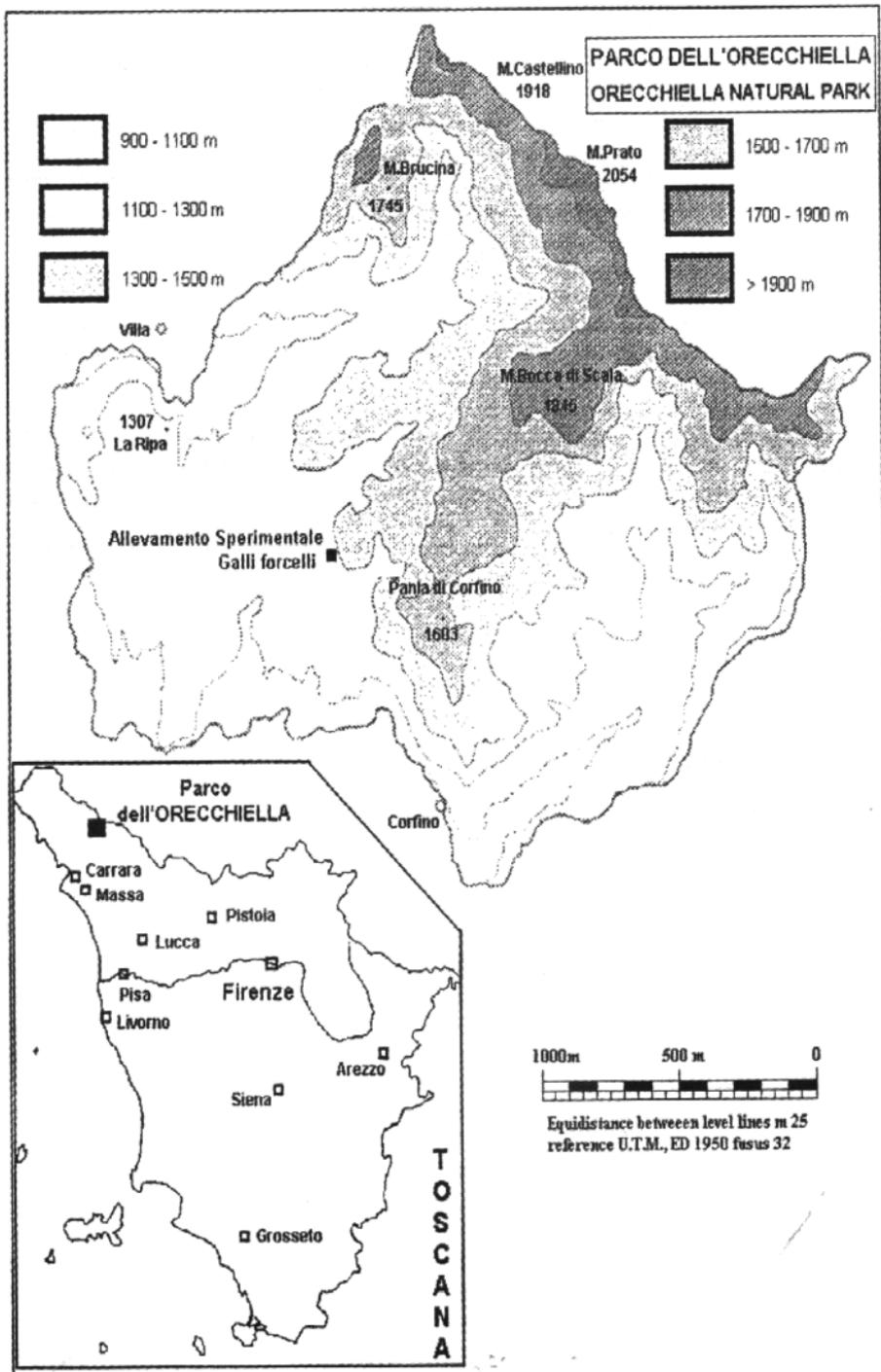


Fig. 1. Location of the experimental breeding station. (Ipsometric plant).

MATERIALS AND METHODS

Location of the Experimental Breeding Station

The Experimental breeding station is located inside the Orecchiella Natural Park (Lat. $48^{\circ} 95' 00''$, Long. $6^{\circ} 10' 00''$), closed to Pania di Corfino on the Southern slopes of the Orecchiella mountain (Fig. 1).

The altimetric range ($900 \div 2050$ m a.s.l.), the climatic condition which characterises the area (Fig. 2), and the typical flora of the park: European beech (*Fagus sylvatica*), sweet chestnut (*Castanea sativa*), mountain pines (*Pinus mugo*) mixed with pastures, then heath with shrubs (family Ericaceae) characterised by dwarf bilberry (*Vaccinium myrtillus*) with infrequent presence of *Rhododendrum* sp. and grassland (Mirola e coll., 1986; Tomei e coll., 1990), fit to grouse habitat requirements.

Cages

The experimental breeding has been always based on fixed couples and started with 6 couples coming from East Alps. In 1993-4, eight young animals, obtained from eggs coming from Central Alps, were taken for crossbreeding. Actually there are 18 males and 13

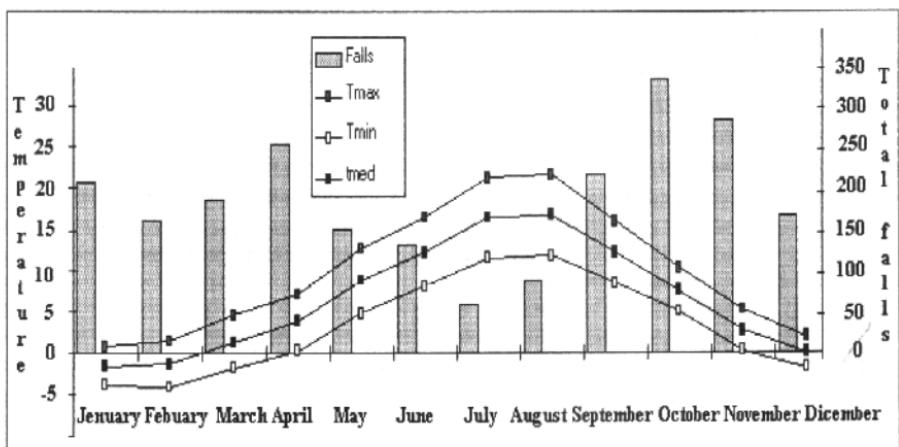


Fig. 2. Total falls, max, min, and medium temperature observed in Boscolungo (1340 m a.s.l.) average of ten years.

females. The breeding station (1100 m a.s.l.) is located near the reception of the park on the border between woodland and grassland. The original pens, built in 1988, were characterised by two areas: cm 200*350 outside on the ground, and cm 197.5*187 inside on net floor. The animals could go from the display area to the nest area through a square hole (side 20 cm) which could be reached with a sloping table.

On account of parasitological problem in 1993 the cages were modified to interrupt the Os-faecal circle (completely up built net floor pens: net cm 3*1, high from floor 90 cm; display area outside cm 144*242*h70, refuge and nest area inside cm 200*200). In 1996 each nest area was divided into two parts by a wooden division (4 cm thick) and new cages were built on the other side of the pens, to double the breeding capacity. New holes were made to connect the nest areas with the display areas (side 28 cm) and new wooden doors were built in the North side to protect the animals from the wind (55cm width, 79cm height). Each year, one month before egg laying, a box (32 cm width; 28 cm height, and 42 cm deep) with a front and a rear square opening (side 17 cm) is placed in the nest area for the females.

Feeding

Nutrition is based on a three-phase feed: laying, growth, and rest (Tab. I). Since the use of the artificial pelleted feed alone is not possible, a natural long fibre supplementing feed with siliceous grit is always given: *Pinus mugo*, for adults, *Vaccinium myrtillus*, leaves and stems, for adults and growing animals. The *myrtillus* leaves and stems are essential during the growth (1-70/90 days) because, beyond to furnish the long fibre always necessary, are particularly rich of ascorbic acid (Hanssen e coll., 1979, 1982); the *Pinus mugo* is necessary during all the other periods but especially in Autumn, to guarantee a correct digestion and healthy metabolic profile, (Tab. II) (Bagliacca e coll., 1994). During egg laying a calcium carbonate grit is *ad libitum* given for females.

Often, such feeding is integrated with vitamins and natural foods, varying in quality and quantity according to the availability (bilberry, strawberry, raspberry, josta, ribes, apple peel, gems of *alnus viridis*, and cobnut, branches of Norway Spruce, leaves and flowers of *Taraxacum officinale*, heather, *Urtica* spp and, sometimes, also ant larvae).

Tab. I. Different Black grouse (*Tetrao tetrix L.*) diets.

			Growth period	Breeder (Autumn-Spring)	Laying period (males+females)
Components	Corn (yellow)	%	26.70	24.50	30.60
	Barley	%	5.00		4.00
	Wheat	%	3.50		
	Weat shorts bran	%	4.40	7.30	16.00
	Wheat bran	%		23.00	10.00
	Barley straw	%		1.00	
	Alfalfa meal (suncured)	%	10.00	10.00	15.00
	Alfalfa meal (dehy)	%		10.00	
	Soybean meal (solvent)	%	31.00	8.00	6.00
	Soybean peels	%		4.00	
	Sunflower seed meal	%		3.00	6.00
	Meat and bone meal	%	5.00		
	Fish meal	%	8.90	4.00	4.00
	Molasses (beet)	%	1.50	1.00	1.00
	Beet pulp dried	%			4.00
	Fat and/or oil	%	2.00	1.00	1.00
	CaCO ₃	%	0.20	0.50	0.50
	CaHPO ₄	%	0.80	1.00	1.00
	NaCl	%	0.10	0.30	0.35
	Premix	%	0.90*	1.40**	0.55***
Dry matter	Dry matter	%	89.60	89.58	87.70
Composition (analysed)	Crude protein	%	29.30	19.58	18.84
	Crude fat	%	4.77	8.72	4.66
	Crude fibre	%	5.21	12.29	10.79
	Ash	%	10.50	8.30	7.58
	N-free extract	%	50.22	51.11	58.13
As feed base Composition (calculated)	M.E.	(Kcal/Kg)	2857	2857	2749
	Metionine	%	0.60	0.388	0.351
	Methionine+ cystine	%	0.98	0.653	0.660
	lysine	%	1.80	0.939	0.902
	Ca	%	1.33	0.860	0.840
	P (total)	%	1.01	0.630	0.690

Premix per Kg of feed: vit. A - UI 15.000; vit. D3 - U.I. 3.000; vit. E mg 15; vit. K mg 5; vit. B1 mg 2; vit. B2 mg 8; vit. B6 mg 1; vit. B12 mg 0,02; Pant. ac. mg 15; fol.ac. mg 1; coline mg 600; Ascorbic acid mg 1500; Mn mg 100; Zn mg 50; Fe mg 22,5; Co mg 0,25; Cu mg 5; J mg 1,5; DL methionine mg 100; L-lysine mg 75; BHT mg 50; ampronilum mg 6.

*Premix per Kg of feed: vit. A - UI 12.500; vit. D3 - U.I. 1.800; vit. E mg 25; vit. K mg 4; vit. B1 mg 2,6; vit. B2 mg 15,6; vit. B6 mg 2,6; vit. B12 mg 0,06; vit PP mg 78; pant. ac. mg 26; fol. ac. mg 2,6; coline mg 1800; Mn mg 80; Zn mg 60; Fe mg 40; Co mg 0,3; Cu mg 20; J mg 1,5; amaduramicine mg 12; BHT mg 50.

**Premix per Kg of feed: vit. A - UI 15.000; vit. D3 - U.I. 3.000; vit. E mg 30; vit. K mg 3; vit. B1 mg 2; vit. B2 mg 8; vit. B6 mg 5; vit. B12 mg 0,03; vit H (biotine) mg 0,1; vit PP mg 40; pant. ac. mg 15; fol. ac. mg 1,2; coline mg 600; Mn mg 150; Zn mg 60; Fe mg 35; Co mg 0,5; Cu mg 10; J mg 0,5; Se 0,1; ethoschizine mg 2,5.

Tab. II. Autumnal composition of black grouse feed, crops and plasma.

		Pelleted feed	pino mugo stems	Intestinal feces	Caecal feces
Chemical analysys	Dry matter	%	89.58	48.98	55.29
	Crude protein	%	19.58	5.85	26.24
	Ether extract	%	8.72	7.45	1.03
	Ash	%	8.30	1.96	15.00
	Crude fibre	%	12.29	34.23	27.41
	N-free extract	%	51.31	50.52	30.32
	N.D.F.	%	28.02	54.08	51.41
	A.D.F.	%	13.70	42.61	34.39
	A.D.L.	%	3.25	18.81	10.11
	Uric acid (24h)	mg/g			53
Adult birds	glucose	mmol/l	17	± 2.3	
	colesterol	mmol/l	37	± 7.9	
	triglycerides	mmol/l	1.1	± .33	
	NEFA	mEq/l	618	± 113.5	
	avg.	Uric acid	μmol/l	401	± 97.2
	±	BUN (urea)	mmol/l	0.84	± .27
	s.d.	Total protein	g/l	47	± 5.2
		albumine	μmol/l	294	± 23.3
		GOT (AST)	IU/l	149	± 40.6
		GPT (ALT)	IU/l	21	± 10.3
Plasma levels	Alcaline phos.	IU/l	43	± 6.9	
	Ca	mmol/l	3.1	± .41	
	P	mmol/l	1.8	± .53	
	Mg	mmol/l	1.5	± ±.59	

RESULTS

Performance

The laying period in the experimental breeding farm starts between the end of May and the first days of June and end in July, (Fig. 3).

Eggs (avg. 4.8 eggs/female) are daily collected then stored (15°-18°C; 70% R.U.) for one week maximum and artificially incubated (99.7°F, 47%R.U). The embryo period is 24.5 days. The average hatchability is 40% (Tab. III).

Chicks are reared in commercial hot cages for the first 3 weeks then transferred to the pens. Couples are formed in the winter. Starting

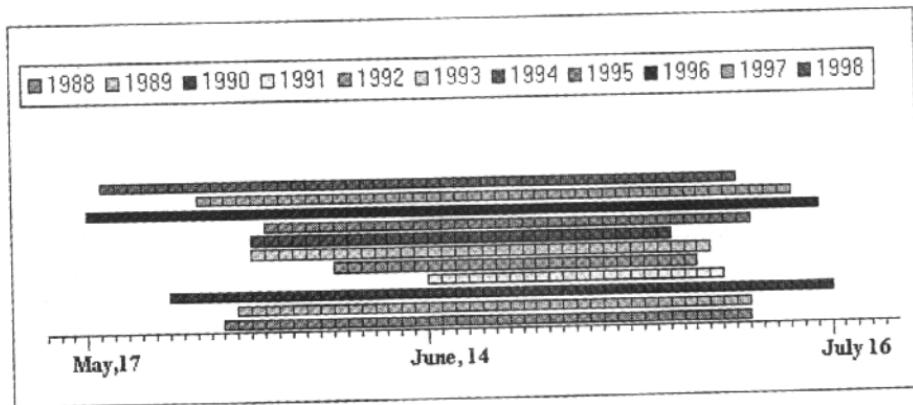


Fig. 3. Egg laying period in different years.

from 1996 part of chicks are produced with the forced broody hens technique with movable coops (cm 80*50) and runs (m 3*2) (Bagliacca M., 1996).

The average weight of adults birds (black grouse of one year old or older) is $1431g \pm 106g$ for males and $978 \pm 43g$ for females. Young animals reaches 78% and 83% of the adult weight in Autumn, at an average age of three months (average weight: $1110 \pm 96g$ and $810 \pm 71g$, for males and females, respectively). The adult weight changes during the year with a maximum in March, and a minimum in June - July.

Cage behaviour

The behaviour of the caged black grouses shows a typical seasonal course (Tab. IV, showed in Fig. 4).

The presence of the animals in the display area of the cage extend in fact to increase from the winter (minimum of presence) to the spring and reaches the maximum presence in May which, to the latitude of the experimental breeding station coincides with the peak of the reproductive activity and with the start of the egg deposition. The activity of wall and net pecking cannot be explained by a stereotype, always index of stress condition, but can be explained by the physiological need to consume the beak. Very few time is spent for feeding and drinking and repetitive movements are very rare. The presence of panic activity, especially in young grouse under the age of one year, in relationship to the passage of a falcon over the cages or of people

Tab. III. Reproductive performance of black grouse during ten years of breeding.

Year	Parents n.		Layed Eggs n.		Hatched Eggs		Chick dead n.	Males n. Females n.	Parents replaced*
	Males	Females	Total	Per Female	n.	%			
1988	6	6	29	4.8	9	31,0	3	(3i)	2
1989	5	7	13	1.9	2	15,4	2	(2l)	2
1990	4	4	29	7,3	10	34,5	2	(1d-1e)	2
1991	7	7	12	1,7	4	33,3	2	(2b)	2
1992	6	6	4	0,6	2	50,0	1	(1i)	0
1993	4	6	23	3,8	9	39,1	7	(5n-1m-1c)	4
1994	4	3	24	8	11	45,8	2	(2n)	0
1995	8	6	24	4	10	41,7	3	(2n-1l)	0
1996	10	9	65	7,2	27	41,5	10	(7l-3n)	2
1997	14	9	73	8,1	28	38,4	22	(8f-10h-4d)	4
1998	12	11	56	5,1	24	42,9	16	(6g-6n-4c)	5
Avg	7.3	6.7	32	4.8	12.4	38.6	6,36	1.6	2

*discarded, sold, or dead. **a** = Histomonias; **b** = trichomonias; **c** = capillariasis; **d** = eimeriosis; **e** = *E.coli* infection; **f** = spirochaetosis; **g** = campylobacteriosis; **h** = heat stroke; **i** = nephritis and uric acid diathesis; **l** = aspecific enteritis; **m** = neoplasms; **n** = traumatisms

Tab. IV. Behavior of caged black grouse.

months:	presence in display area % of time	rest	walking	Feeding drinking % of presence in display area	net-wall picking	preening	others not classified
February	15.8	42.9	57.0	2.1	1.7	0.1	7.7
March	23.2	40.0	56.2	3.3	2.6	1.0	12.7
May*	33.3	58.2	41.7	0.9	0.4	3.1	5.8
August	25.0	53.8	35.9	6.1	0.4	2.9	15.9
September	29.6	77.3	22.6	2.7	0.3	4.5	10.6
November	16.9	54.6	38.0	7.8	0.1	0.6	16.3

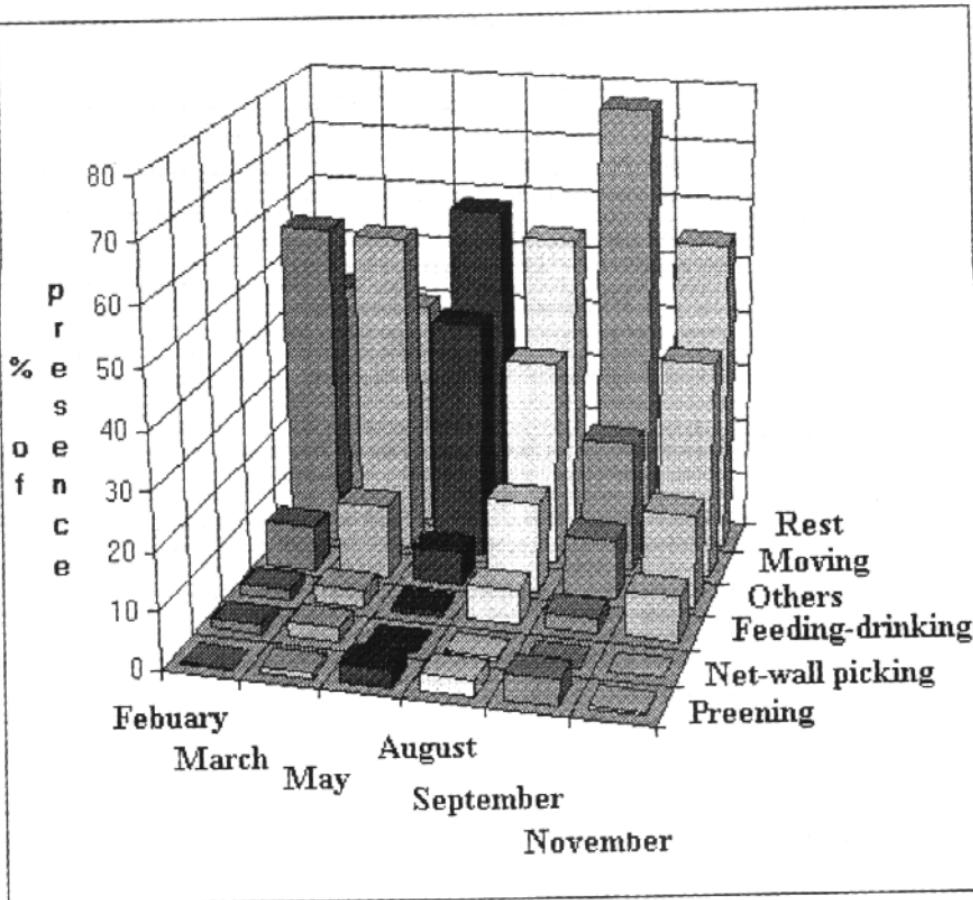


Fig. 4. Black grouse behavior.

walking or talking, also far from the breeding station (not always recorded by the videocamera), indicates that these animals have been bred properly not undergoing to human imprinting and conserving a marked wildness.

Discussion

The experimental breeding of the black grouse (*Tetrao tetrix L.*) at the Orecchiella Park seems to demonstrate that the bird, typical of palearctic and mountainous areas, present in Italy only in a few areas of the Alps, can adapt in captivity even to the Apennine area bordering on the Apuane Alps where it certainly once was present (Couturier M. et A., 1980) and where the environment could have been suitable for its survival (Mirola e coll., 1986). Reared animals maintain their wild behavior and can be used for release projects in Italy.

REFERENCES

- BAGLIACCA M. (1996). Gamebird production for hunting porpoise or release into the wild. Proc. of the XX World's Poultry Cong., Deli, India: 740-749.
- BAGLIACCA M., MANI P., PACI G., FOLLIERO M., BIAGI G., (1994). Alimentazione invernale del Gallo Forcello (*Lyrurus Tetrix*) in cattività. Ann. Fac. Med. Vet. Univ. Pisa, XLVII: 281-288.
- BAGLIACCA M., MARZONI M., CALZOLARI G. (1993b). Allevamento in cattività del gallo forcello. Riv. di Avicoltura 62(12): 37-44.
- BAGLIACCA M., MARZONI M., NESTI F., CALZOLARI G. (1993a). Possibilità di allevamento in cattività del gallo forcello. Atti 28 Simp. Intern. Zootecnia, Milano: 119-135.
- COUTURIER M., COUTURIER A. (1980). Les Coqs de bruyere. Boulogne: F. Dubusc Editeur.
- HANSSEN I., GRAV H. I., STEEN G.B., LYSNES H. (1979). Vitamin C deficiency in growing Willow Ptarmigan (*Lagopus lagopus*). J. of Nutrition, 109: 2260-2276.
- HANSSEN I. AND NESS J. (1982). Chick nutrition and mortality in captive Willow Ptarmigan (*Lagopus lagopus*). Acta vet. Scand., 23: 456-465.
- MIROLA G., POGGI U., CALZOLARI G. (1986). Il Parco Naturale dell'Orecchiella in Garfagnana. Trento: Manfrini, 1986.
- SAVI P. (1829). Ornitologia Toscana ossia Descrizione e Storia degli Uccelli che Trovansi in Toscana. Pisa: Nistri (c/o Biblioteca Storica Universitaria Pisa).
- SCHEMBI A. (1813). Quadro geografico-ornitologico ossia quadro comparativo delle ornitologie di Malta, Sicilia, Roma, Toscana, Liguria Nizza e della provincia di Garda. Bologna: Sassi (c/o Biblioteca Storica Universitaria Pisa).
- TOMEI P.E., BERTACCHI A., MONTI G., LUCCHESI G. (1990). Carta della Vegetazione del Parco dell'Orecchiella (Alta Garfagnana). Roma: C.N.R.