First contribute to the characterization of coat in *Lepus corsicanus* and *Lepus europaeus* by colorimetric determinations

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ABSTRACT - The trial was carried out on 12 sympatric adult females: 6 Italian hares (Lepus corsicanus) and 6 Brown hares (Lepus europaeus). Colour characteristics were studied by CIEL*a*b* method **on the following anatomical regions: forehead, subocular patch, nape, withers, rump, hind leg,** knee, and belly. Differences between means were tested by t test. The most striking differences were observed in a* and in C indexes. Italian hares resulted more reddish in knee (5.22 *vs*. 3.93, P≤0.001) and in hind leg (2.96 *vs*. 1.34, P≤0.01) and less reddish (P≤0.001) in the regions of subocular patch (3.35 *vs*. 5.34), nape (3.24 *vs*. 6.05) and withers (3.25 *vs*. 4.81) than Brown hare. Colour saturation was lower (nearer to the grey) in the regions forehead (4.78 *vs*. 6.41 P≤0.01), **subocular patch (8.91** *vs*. 11.24, P≤0.05), nape (4.82 *vs*. 10.56, P≤0.001), withers (4.63 *vs*. 8.91, P≤0.001), and rump (5.81 *vs*. 8.30, P≤0.05) and higher in the regions hind leg (11.07 *vs*. 4.46, P≤0.001), knee (15.45 *vs*. 11.14, P≤0.001), and belly (3.30 *vs*. 2.15, P≤0.05) in Italian hare than in Brown hare. These differences are consistent with colour pattern of coat **described in literature.**

Key words: Hare, Colour, Coat.

Introduction – Detailed accounts of species' natural histories put in evidence the principal evolutionary causes of coloration patterns in mammals: camouflage, communication, and physiological processes (Stoner et al., 2003). As regards to the relations between coloration and physiological processes we can refer to what **Gloger's Rule states:** dark pigments increase in animals living in warm and humid habitats. Here we studied coat colour in **Italian hare (Lepus corsicanus) and Brown hare (Lepus europaeus). Morphological** and genetic discrimination keys among the two taxa are already available (De Marinis and Toso, 1998; Pierpaoli et al., 1998 and 1999). Principal characteristics of colour coat of the two species are grey overall coloration in the Brown hare and a reddish overall coloration with a more distinct line defining the white ventral surface in the Italian hare (Trocchi and Riga, 2001). While the general differences described above are clear enough to any observer, observations on colour are usually highly subjective and not susceptible to the sort of exact analysis. For this reason, herein we report the first results of a study on the characterization of colour pelage in Brown and in Italian hare utilizing a colorimeter.

Material and methods – The trial was carried out on 12 adult females: 6 Italian hares and 6 Brown hares living in the area of the Regional park of "Gallipoli Cognato Piccole Dolomiti Lucane". Italian hares were captured during the period May-June 2008. After capture, hares were put inside darkened wooden boxes and, within a period of 30' to 2h, carried to the laboratory for the colour determinations. Brown hares were instead kept in a cage rearing adjacent to the laboratory. The following anatomical regions were con-

Table 1. Colour parameters.

		Lepus corsicanus		Lepus europaeus		Pr> |t|
		mean	SE	mean	SE	
a*	forehead	3.92	0.09	3.96	0.19	ns
	subocular patch	3.35	0.17	5.34	0.36	0.001
	nape	3.24	0.15	6.05	0.31	0.001
	withers	3.25	0.16	4.81	0.33	0.001
	rump	3.07	0.16	3.11	0.32	ns
	hind leg	2.96	0.22	1.34	0.49	0.01
	knee	5.22	0.13	3.93	0.27	0.001
	belly	-0.33	0.12	-0.50	0.25	ns
b*	forehead	-0.10	0.42	3.80	0.89	0.001
	subocular patch	8.19	0.58	8.94	1.22	ns
	nape	3.07	0.41	8.57	0.84	0.001
	withers	2.06	0.44	6.86	0.92	0.001
	rump	4.74	0.47	7.68	0.97	0.001
	hind leg	10.60	0.53	3.86	1.17	0.001
	knee	14.54	0.34	10.39	0.70	0.001
	belly	3.15	0.19	2.10	0.38	0.05
L*	forehead	40.62	0.62	41.42	1.28	ns
	subocular patch	54.50	0.88	47.37	1.87	0.01
	nape	47.74	0.65	46.68	1.36	ns
	withers	49.78	1.11	49.31	2.30	ns
	rump	53.75	1.05	55.34	2.18	ns
	hind leg	67.12	0.73	70.06	1.62	ns
	knee	61.48	0.39	60.05	0.81	ns
	belly	84.59	0.98	88.75	2.08	ns
C	forehead	4.78	0.22	6.41	0.44	0.01
	subocular patch	8.91	0.51	11.24	1.08	0.05
	nape	4.82	0.33	10.56	0.69	0.001
	withers	4.63	0.35	8.91	0.73	0.001
	rump	5.81	0.45	8.30	0.93	0.05
	hind leg	11.07	0.53	4.46	1.18	0.001
	knee	15.45	0.34	11.14	0.72	0.001
	belly	3.30	0.17	2.15	0.36	0.05
H°	forehead	101.51	9.23	66.85	19.33	ns
	subocular patch	65.23	3.14	89.87	6.64	0.01
	nape	60.35	5.91	50.26	12.38	ns
	withers	82.45	7.99	78.65	16.32	ns
	rump	52.39	2.19	65.55	4.54	0.01
	hind leg	74.58	2.43	76.38	5.43	ns
	knee	70.21	0.42	68.81	0.89	ns
	belly	92.24	2.97	100.71	6.28	ns

sidered: 1. forehead, 2. subocular patch, 3. nape, 4. withers, 5. rump, 6. hind leg, 7. knee, and 8. belly. Measurements were effected at "closed pelage" (2., 3., and 7.) or at "open pelage" (1., 4., 5., 6., and 8.) according to the colour characteristics of coat (Palacios, 1996; Trocchi and Riga, 2005). On these regions, the following colour parameters were measured by colorimeter Minolta CM2002 according to CIEL*a*b* method: L* (lightness white-black); a* (red-green direction); b* (yellow-blue direction); chroma [$C=(a^{*2}+b^{*2})^{1/2}$]; hue angle (H°=arctan b*/a*). Differences between means were tested by t test.

Results and conclusions – a*: with the exception of belly (-0.33 and -0.50 in Italian and in European hare, respectively) all regions showed the prevalence of red component (a*>0) (Table 1).

In particular: Italian hares were "more red" in knee (+1.29, P≤0.001) and in hind leg (+1.62, P≤0.01); Brown hares showed instead the higher red component values (P≤0.001) in the regions of subocular patch, of nape, and of withers (+1.99, +2.81, and +1.56, respectively). b*: the yellow component resulted higher in hind leg (+6.74, P≤0.001), in knee (+4.15, P≤0.001), and in belly (+1.05, P≤0.01) of Italian hares. Brown hares showed the highest values of yellow in the head (forehead, +3.70 and nape, +2.81) and in the back (withers, +4.80 and rump, +2.94). L*: no difference was observed between the two species with the exception of the subocular patch that resulted lighter in Italian hare (+7.13, P≤0.001). C: this index gives a measure of chromatic intensity of the sample judged in comparison to a pure white. In other words, samples with lower colour saturation are nearer to the grey. Colour saturation was lower in the regions forehead (4.78 *vs*. 6.41 P≤0.01), subocular patch (8.91 *vs*. 11.24, P≤0.05), nape (4.82 *vs*. 10.56, P≤0.001), withers (4.63 *vs*. 8.91, P≤0.001), and rump (5.81 *vs*. 8.30, P≤0.05) and higher in the regions hind leg (11.07 *vs*. 4.46, P≤0.001), knee (15.45 *vs*. 11.14, P≤0.001), and belly (3.30 *vs*. 2.15, P≤0.05) in Italian hare than in Brown hare. H°: Hue is the attribute of color that is related to the perceived colors: red, yellow, green and blue or a combination of two of them. When we are talking about a named colour we are usually referring to its hue. With the exceptions of subocular patch and rump that showed the highest value in Brown hare (89.87 and 65.55, respectively; P≤0.01), there were not significant differences between the two species. Instrumental determination on coat colour is consistent with colour pattern given by De Winton (1898), Palacios (1996), Trocchi and Riga (2001 and 2005) of the two taxa. Since the historical and present distribution of Italian hare indicates it is an italian endemism (Riga et al., 2001) we can suppose that colour coat, together with other phenotypic aspects (Italian hare is smaller in all external measurements than European brown hare) should be an adaptation to the Mediterranean scrubland. In southern Italy the Brown hare has historically been introduced throughout hunting's restockings, using specimens of the temperate climate (Trocchi and Riga, 2001). Further investigations on coat colour and on its adaptive significance will contribute to a more accurate discrimination between the two taxa and also among the genetically different populations of the Italian hare (Pierpaoli et al., 1999).

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