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PAPER

Estimates of non-genetic effects for measures of hunting performance in short-haired and rough-haired Italian hound

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ABSTRACT

The aim of this work was to estimate the effects of eight non-genetic factors (sex, type of coat, pigmentation, type of the trial, the number of the judges in the jury, the location where the competition took place, the subjectivity of the judge and the breeders) on the assessment of seven hunting traits (morphology, the breed style, search, approach, find, pursuit and voice) for the short-haired and rough-haired Italian Hound. The data consisted of 3172 field trial records between the years 2016 and 2017. The Mann–Whitney test and Kruskal–Wallis test showed that each factor was statistically significant for some traits: the sex of the dogs was statistically significant only for the evaluation of the morphology the type of coat for breed style, search, approach, find and voice; the pigmentation for all traits excluding approach; the number of judges for morphology, approach and find; the type of trial for all traits excluding voice. Spearman's ρ (rho) correlation showed that high phenotypic correlations were between morphology, breed style and search. These traits showed low to moderate correlations with the other traits except breed style and search vs. pursuit. Furthermore, principal component analysis for the factor judge, location and breeders showed that among the seven traits assessed during the trials, the morphology and the breed style had the highest loading on the final score. Our results suggest that the effect of all the non-genetic factors analysed must be taken into account by the judges during the evaluation of the dogs.

HIGHLIGHTS

- We evaluated the effects of eight non-genetic factors on the assessment of seven hunting traits for the Italian Hound.
- All the non-genetic factors had influence on some of the hunting traits considered.
- Principal component analysis showed that the highest loading for morphology and breed style are on location, judge and breeder.
- High phenotypic correlations were between morphology, breed style, search and pursuit.

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Introduction

Sixteen Italian dog breeds are described in the Italian Kennel Club (ENCI) database. Among these, four breeds named short-haired Italian Hound (Segugio Italiano a pelo raso, FCI code 337), rough-haired Italian Hound (Segugio Italiano a pelo forte, FCI code 198), Segugio Maremmano (FCI code 361) and Segugio dell'Appennino (FCI code 901), are classified under the FCI (International Cynological Federation) group 6, the class that groups the scent hounds and related breeds (ENCI 2020). The short-haired Italian Hound and rough-haired Italian Hound are the two most widespread scent hound breeds in Italy counting 41 and 17 affixes (breedings officially recognised by the FCI) respectively, whereas only 3 and 12 affixes are recorded for Segugio dell'Appennino and Segugio Maremmano. Mainly used for hunting hares and wild boars, in the past, the early Italian hound breeds were subjected to strong divergent selection based on the type of the coat and pigmentation of the hair (Pallotti et al. 2017). The breeding strategy led to the development of the two phenotypes later officially recognised as two different breeds by the FCI (International Cynological Federation): the short-haired Italian Hound, which is characterised by a short-haired coat all over the body, and the rough-haired Italian Hound,

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which is characterised by a hair length of no more than 5 cm. For both breeds, the permissible colours are the whole range of solid fawn, shading from the dark red fawn with black overlay to light fawn, and black and tan. The breeds were accepted on a definitive basis by the FCI in two different periods. In fact, while the rough-haired Italian Hound breed was officially recognised in the far 1956, the short-haired Italian Hound was accepted only years later, in the 1993. Nevertheless, for both breeds an official valid standard was not available until the 2015. Concerning the morphology, dogs from both breeds are of medium proportion and robust structure perfectly adapted to the most difficult terrains and can be used as well in the mountains as in plains. The height at the withers ranged from 52 cm to 58 cm for males and from 48 cm to 56 cm for females while the weight range from 18 kg to 28 kg in both sex. According to the official standard's proportions, the length of the body has to be equal to the height at the withers (fits into a square) while the depth of the chest has to be equal to half of the height at the withers. With regard to the cranial region proportions, the length of the muzzle has to be equal to half the length of the head while the neck must reach in length 4/l0th of the height at the withers. During the hunting trials, any departure from the foregoing points is considered a fault by the judge. The seriousness with which the fault is regarded is in proportion to its degree and its effect on the dog's ability to perform his work. Very resistant and fast, such dogs are extremely eager, whether working alone or in a pack (ENCI 2020).

Little is known about the genetic background of the breeds and the information available is limited to genetic variability study in which the two breed were found to belong to the same genetic pool. Furthermore, the study found very low genetic distance between these breeds and the other related Segugio Maremmano and Segugio dell'Appennino suggesting a small number of common ancestors shared among the four hound breeds (Pallotti et al. 2017). Although relevant scientific literature is scarcely available, both breeds have been widely documented and described in popular press that deal with hunting or with canine breeding and some historical information on the breeds are supplied by the ENCI database. According to the Italian Kennel Club, these breeds are supposed to be two of the most ancient in Italy. The first depictions of the Italian Hounds are portrayed on the painting of 'Diane the huntress' in the Naples Museum (1601–1603), on a painting in the castle of Borso d'Este (1600) and in the statue of 'Diane with bow and arrow' in the Vatican Museum (1860) (ENCI 2020). Furthermore, in a Lombard necropolis of Povegliano (province of Verona) (VII century AD), there have been discovered two skeletons in perfect state of conservation, of which the conformation is identical to that of the modern Italian Hounds (Riedel 1995).

Nowadays the selection based on phenotypes is the most common method utilised by dog breeders, based on the scores obtained during the hunting trials. The hunting abilities of the breeding individuals are assessed through the subjective evaluation of seven traits, performed by considering only non-genetic factors as sources of variations for the traits. Moving from these considerations, the aim of the study was to estimate the effect of eight non-genetic factors on the assessment of the dog hunting traits.

Materials and methods

Field trials for Italian hound

The data consisted of 3172 field trial records for Italian Hound between the years 2016 and 2017. All the hare-hunting trials were held in 40 different locations in Italy. Because not all dogs were assessed for all the seven traits, and not all field trial records contained information on all effects, all the seven measures were not necessarily evaluated in every test. The actual numbers of observations vary between measures as indicated in Tables 2 and 3. Field trials are held in any season of the year as long as the soil is not completely or mostly covered in snow. The minimum time for one trial session is 45 min. The trials are reserved for single, couple and pack classes (from at least four dogs up to a maximum of eight dogs). Only dog registered in the ENCI stud book are admitted to the trials. Moreover, dogs older than 10 years are not allowed. The hunting trial does not require a preliminary standardised training, depending on the single breeders. The hunting abilities are evaluated by one or more judges, who award scores for various measures of hunting performance based on direct observation of the single dog or of the dogs in a pair or in a pack while performing the trial. Score is given based on the type of hunted pray (Table 1). The three hunted species are the European wild hare or brown hare (*Lepus europaeus*), Eastern cottontail rabbit or mini-hare (*Sylvilagus floridanus*) and the European wild rabbit (*Oryctolagus cuniculus*). As several field trial records reported a score over 30 points for pursuit, the mean score values for this trait given in the Table 1 are above the maximum score achievable. The final score (i.e. the trial record of the tried dog) is formed by

Table 1. Descriptive statistics for the maximum achievable scoring result for the seven hunting traits based on the type of hunted pray and mean score (± standard deviation) achieved for the three type of the trial.

	Maximum score achievable based on the type of pray						
	European wild hare (*L. europaeus*)		Eastern cottontail rabbit (*S. floridanus*) European wild rabbit (*O. cuniculus*)		Mean score[a] ± standard deviation achieved for the three type of the trial		
	Single	Pair/Pack	Single	Pair/Pack	Single	Pair	Pack
Hunting trait	points	points	points	points	points	points	points
Morphology	30	30	30	30	23.6 ± 2.4	23.9± 2.3	24.6± 2
Breed style	40	40	40	40	25.9 ± 11.6	25.6 ± 11.8	28.2 ± 12.2
Search	20	20	40	40	11.1 ± 4.2	11.1 ± 4.2	11.9 ± 4.2
Approach	30	30	10	10	21.9 ± 3.5	22 ± 3.4	22.6 ± 3
Find	20	20	30	30	22 ± 4.1	21.9 ± 3.8	22.4 ± 3.3
Pursuit	30	30	20	20	33.2 ± 7	32.8 ± 7.2	34 ± 7
Voice	30	30	30	30	23.9 ± 2	24 ± 2	24.2 ± 2
Final score	200	200	200	200	121.3 ± 52	110.4 ± 59	122.5 ± 56.6

[a]Mean scores were computed without considering the type of pray.

summing the scores achieved for the seven hunting traits. Based on final score, each dog is assigned to one of the following categories:

- *C.A.C. or certificate of attitude to championship* (i.e. excellent dog with special skills that make him significantly beyond the general average) = minimum of 180 point
- *Excellent* = minimum of 160 points
- *Very good* = minimum of 150 points
- *Good* = minimum of 140 points
- *Quite good* = minimum of 130 points
- *Sufficient* = minimum of 120 points

The title of 'working champion' is given by the Council of the ENCI to those dog who has obtained three C.A.C. and one 'very good' qualification in field trials. Moreover, a dog is proclaimed 'breeding champion' when two of his descendants have obtained the title of 'working champion' or the 'excellent' qualification.

More detailed information on the test are included in rule book for the hunting performances test provided by the Italian Kennel Club (ENCI 2009).

Measures of hunting performance

The following seven traits considered in our study are those under evaluation through the hunting trials. The *morphology* score is provided on the bases of visual evaluation of the head, the body, the tail, the forequarters and the hindquarters, the movement when hunting, the skin and the coat (hair-type and pigmentation). The *breed style* is defined by the Italian kennel club as 'a set of manifestations, attitudes and movements, which in dogs belonging to the same breed, become characteristic of the breed. Those movements are uniform in performing a given activity.' *Search* score is given from the evaluation of the dog's ability when searching for trail of the nocturnal hare passage. When searching, the dog must be methodical, energetic, and must shows adequate cooperation with its handler. The *approach* shall be assessed when the dog, after he found the pray passage, proceeds near the hare's lair. Dogs from a pack are 'in approach' only they proceed together (not moving along in single file) to arrive near the lair. *Find* score describe the ability of the dog to demonstrate through his physical behaviour, frequency of barks and tones in voice that the prey is near. *Pursuit* starts after the dog found the pray and chase it for at least 20 min. Long and continuous pursuit results in high score. *Voice* score describes the vocal expressiveness, rhythmic frequency and tone of voice. Barking without cause is considered a serious fault. The above mentioned traits are detailed in the rule book for the hunting performances test provided by the Italian Kennel Club (ENCI 2009).

Based on data provided by the field trial records, eight non-genetic factors have been deduced which could affect the assessment of the dog hunting traits. Therefore, the non-genetic factors considered in our study were the sex, the type of the coat (rough-haired or short-haired), the pigmentation of the coat (fawn or black and tan), the number of the judges in the jury (one judge, two judges and three or more judged), the type of the trial (individual, in pair or in pack), the location where the competition took place, the subjectivity of the judge and the breeders.

Statistical analysis

The Mann–Whitney test (Siegel and Castellan 1988) was used to compare males with females, rough-

haired dog with short-haired dog, black and tan dogs with fawn dogs for each of the seven hunting traits. The Kruskal–Wallis test was used to compare the number of the judge in the jury (one judge, two judges, three or more judges) and the type of the trial (individual, in pair or in pack) for each of the seven hunting traits. Multiple comparisons were made using Dunn's multiple comparison procedure. Principal component analysis was performed using score records from 40 locations, 27 judges and 51 breeders. The sampling adequacy was validated using the Kaiser–Meyer–Olkin (KMO) measure. Phenotypic correlations were estimated using the Spearman's ρ (rho) non-parametric correlation coefficient. All the statistical analyses were performed using SPSS version 12.0 statistical software.

Results and discussion

Distribution of scores and effects of non-genetic factors

Results from Mann–Whitney test and Kruskal–Wallis test indicated that all the five non-genetic factors had influence on some of the hunting traits considered ($p < .05$). The sex of the dogs was statistically significant only for the evaluation of the morphology in which the females gained slightly higher score than the males (Table 2). This higher mean was probably the result of judges' preference for certain physical features possessed by the female dogs that fit better into the breed standard. Likewise, the effect of sex on dog performance was also described in Maremmano Hound, English Setter, Finnish Spitzs, Swedish Flatcoated Retrievers, Hovawart dog and Korean native Jindo dog (Karjalainen et al. 1996; Lindberg et al. 2004; Boenigk et al. 2006; Kim et al. 2010; Arvelius and Klemetsdal 2013; Riganelli et al. 2016). Significant effect of sex was also found in other type of competitions as in herding behaviour and defence ability observed in Border Collie, Belgian Shepherd, German Sheperd and Labrador Retrievers (Ruefenacht et al. 2002; Courreau and Langlois 2005; Van der Waaij et al. 2008; Arvelius et al. 2013) and the aggressive behaviour in English Cocker Spaniels (Podberscek and Serpell 1996; Pérez-Guisado et al. 2006). Conversely, despite our results, sex was not statistically significant on any of the studied measures in Finnish Hound (Liinamo et al. 1997). The type of the coat was statistically significant in the evaluation scores for the breed style, search, approach, find and voice with the rough-haired dogs owning a higher score for these parameters (Table 2). The pigmentation of the coat

Table 2. Effects of sex, type of coat and pigmentation on hunting performances and their measurement.

		Sex				Type of coat				Pigmentation			
Hunting trait	Type	M	SD	*N*	Min–max	Type	M	SD	*N*	Min–max	Type	M	SD	*N*	Min-max
Morphology	Male	24.33[a]	2.24	880	8–29	Rough	24.38[a]	2.11	1578	12–29	BT	24.26[a]	2.22	1221	12–29
	Female	24.57[b]	2.07	1480	13–30	Short	24.57[a]	2.12	520	15–33	F	24.65[b]	1.93	871	19–33
Breed style	Male	27.03[a]	12.16	1327	7–47	Rough	28[a]	12.17	2497	6–47	BT	28.16[a]	12.25	1973	6–47
	Female	27.57[a]	12.21	2288	6–47	Short	26.35[b]	26.35	729	8–45	F	26.86[b]	12	1248	7–46
Search	Male	11.61[a]	4.23	1351	4–20	Rough	11.97[a]	4.2	2583	4–20	BT	11.9[a]	4.2	2004	4–20
	Female	11.71[a]	4.22	2346	4–20	Short	10.85[b]	4.15	748	4–18	F	11.48[b]	4.2	1325	4–22
Approach	Male	22.47[a]	3.24	1183	9–30	Rough	22.69[a]	3.15	2246	9–30	BT	22.41[a]	3.13	1754	9–29
	Female	22.46[a]	3.11	2068	10–30	Short	21.78[b]	3.17	674	10–28	F	22.58[a]	3.24	1164	10–30
Find	Male	22.01[a]	3.64	1153	9–30	Rough	22.46[a]	3.41	2186	9–30	BT	22.23[a]	3.31	1722	9–30
	Female	22.30[a]	3.39	2025	9–30	Short	21.99[b]	3.44	669	9–30	F	22.44[b]	3.61	1131	10–30
Pursuit	Male	33.8[a]	7.01	1149	10–50	Rough	33.9[a]	6.98	2158	10–50	BT	33.31[a]	6.7	1717	10–50
	Female	33.84[a]	6.93	2022	10–48	Short	33.38[a]	7	665	10–48	F	34.5[b]	7.2	1130	10–48
Voice	Male	24.06[a]	2.15	1427	10–40	Rough	24.17[a]	2.18	2686	10–45	BT	24[a]	2.11	2132	10–28
	Female	24.28[a]	2.08	2454	10–45	Short	24.02[b]	1.9	800	13–28	F	24.37[b]	2.12	1351	12–45

M: mean; SD: standard deviation; *N*: number of observations; min–max: minimum and maximum value recorded; BT: Black and tan; F: Fawn.
The results were analysed by Mann–Whitney test comparisons between group means. Means with different superscripts are significantly different at $p \leq .05$.

Table 3. Effects of number of the judges in the jury and type of trial on hunting performances and their measurement.

	Number of the judges in the jury					Type of trial				
Hunting trait	Type	M	SD	*N*	min–max	Type	M	SD	*N*	min–max
Morphology	1	24.51[a]	2.13	2212	8–33	Individual	23.62[a]	2.38	84	18–29
	2	24.02[b]	2.22	133	15–29	Pair	23.93[a]	2.28	425	15–28
	3	24.53[a,b]	2.26	15	18–27	Pack	24.6[b]	2.02	1583	12–33
Breed style	1	27.38[a]	12.22	3419	6–47	Individual	25.87[a,b]	11.57	113	12–45
	2	27.75[a]	11.88	181	10–45	Pair	25.58[a]	11.8	577	7–47
	3	23.18[a]	10.34	17	14–40	Pack	28.20[b]	12.22	2531	6–47
Search	1	11.68[a]	4.24	3512	4–20	Individual	11.08[a,b]	4.21	114	4–18
	2	11.55[a]	4.05	173	4–18	Pair	11.11[a]	4.19	614	4–19
	3	12.64[a]	2.87	14	9–16	Pack	11.91[b]	4.2	2601	4–22
Approach	1	22.41[a]	3.19	3078	9–30	Individual	21.96[a,b]	3.55	101	9–28
	2	23.04[a,b]	2.48	165	15–28	Pair	21.97[a]	3.41	504	10–28
	3	24.8[b]	2.09	10	22–28	Pack	22.61[b]	3.1	2313	10–30
Find	1	22.16[a]	3.52	3005	10–30	Individual	22.06[a,b]	4.14	100	9–30
	2	22.63[a]	2.8	165	15–30	Pair	21.86[a]	3.79	497	9–30
	3	25.10[b]	1.85	10	24–29	Pack	22.43[b]	3.31	2256	9–30
Pursuit	1	33.76[a]	7.01	2997	9–50	Individual	33.2[a,b]	6.9	100	10–48
	2	34.76[a]	5.84	166	20–50	Pair	32.84[a]	7.17	493	10–50
	3	36.2[a]	7.91	10	25–46	Pack	34.01[b]	6.9	2254	10–50
Voice	1	24.21[a]	2.11	3687	2–45	Individual	23.89[a]	2	126	18–28
	2	24[a]	2.15	179	10–28	Pair	23.98[a]	2.3	631	10–28
	3	24.28[a]	2.6	18	16–27	Pack	24.19[a]	2	2726	2–45

M: mean; SD; standard deviation; N: number of observations; Min–max: minimum and maximum value recorded; Type 1: one judge; Type 2: two judges; Type 3: three or more judges.
The results were analysed by Kruskal–Wallis test comparisons between group means. Multiple comparisons were made, when appropriate, using Dunn's multiple comparison procedure. Means with different superscripts are significantly different at $p \leq .05$.

had significant effect on all the evaluation of the hunting performances except for the approach trait. In particular, fawn dogs showed to perform better activities related to the predatory behaviour such as find, pursuit and voice. It must be noted that significant effect of the coat colour on fearful and submissive reactivity and on scent-marking was described in Korean native Jindo dog. In this breed, dogs of fawn coat colour possess stronger temperament than those of white coat colour and exhibit a significantly lower intensity of fearful and submissive reactivity (Kim et al. 2010). Likewise, studies related to the dog's aggressiveness in the English Cocker Spaniel showed that solid colour dogs and red/goldens were significantly more likely to show aggression than particolours and blacks. (Podberscek and Serpell 1996; Pérez-Guisado et al. 2006). Furthermore, it may be assumed that, being crucial the colour pattern in predator–prey interaction, a fawn coat allows a better camouflage of the dog which lead to a better hunting performance. However, unlike our observations, no significant effect of the coat colour was found for Maremmano Hound (Riganelli et al. 2016). The results from three types of jury were analysed (Table 3). The number of the judges in the jury had significant effect on the evaluation score for morphology, approach and find. In the evaluation of the morphology, the jury of the type 2 (two judges) assigned a slightly lower score respect the jury of the type 1 (one judge). This differences in the means score may reflect a greater accuracy in the evaluation of the physical features carried out by the jury of the type 2 which results in a careful and most severe rating. Results from the rating of the approach and find showed significant differences between the type of the jury. In both cases, the type-3-jury assigned the higher score in the evaluation of the two hunting traits. Here too, such differences may reflect a different accuracy in the assessment process performed by the types of jury. For three or more judges it may be more easy to follow the dogs during the trial. Such evaluation practice is reflected in the more confidence in giving high scores.

The effect of three different types of trial were considered (the individual trial, the pair trial and the pack trial). It should be note, however, that the database used for the analysis contained unbalanced data (Table 3). Significant effect of the factor was found between the evaluation in pair and pack trials for all the considered traits except for the voice. Dogs evaluated in pack trial always gained a higher score respect those evaluated in pair trials. The higher mean scores for search, approach, find and pursuit suggests that dogs perform better when working in pack. The higher means recorded for pack trials in the evaluation of morphology and breed style, on the other hand, may be the result of a more inaccurate assessment of

Table 4. Principal component eigenvalues for location, judge and breeder.

	Factor								
	Location			Judge			Breeder		
Component	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	3.17	45.31	45.31	2.84	40.58	40.58	3.07	43.9	43.9
2	1.57	22.54	67.86	1.73	24.74	65.33	1.51	21.6	65.51

Table 5. Component matrix for location, judge and breeder.

	Factor					
	Location		Judge		Breeder	
	Component		Component		Component	
Hunting trait	1	2	1	2	1	2
Morphology	0.95	0.049	0.95	−0.47	0.93	0.2
Breed style	0.96	−0.01	0.95	−0.136	0.96	0.16
Search	0.92	.0.08	0.89	−0.044	0.91	0.25
Approach	−0.08	0.75	0.21	0.78	−0.19	0.78
Find	−0.11	0.73	0.19	0.66	−0.24	0.76
Pursuit	−0.62	0.22	−0.25	0.72	−0.57	0.41
Voice	0.26	0.63	0.269	0.37	0.05	0.71

the physical features of the dogs which may be harder and defective if performed on several animals simultaneously.

Principal component analysis

The principal component analysis was carried out considering the average scores achieved in each location for each one of the seven traits, in order to see how the seven traits group together in the first two components. The analysis was repeated again considering the average scores achieved by each of 51 breeders and then considering the average scores assigned from each of 27 judges.

Results shown that the first two components explained a cumulative variance ranging from 65.33 to 67.86 (Table 4). As shown in the Table 5, morphology, breed style and search were highly correlated with the first component while approach, find and pursuit were highly correlated with the second component. It should be stressed that the two traits which had the highest loading on the first component, the morphology and the breed style respectively, are the most subjective and the less descriptive of the dog's hunting abilities. On the contrary, search, approach, find, pursuit and voice are more valued factors for the assessment of the dog's skills.

Phenotypic correlations

Table 6 shows the results from the phenotypic correlations estimated through the Spearman's ρ (rho) correlation coefficient.

As general trend, in our study the highest phenotypic correlations were between morphology, breed style and search, and between breed style and pursuit. This result suggests that the selection for the morphology could lead to an improvement of the search abilities while selecting for the breed style could improve traits such as search and pursuit. However, it should be noted that our data are the results of phenotypic observations therefore further studies on the genetic relationships among traits are needed in order to provide these information. Our observations are in contrast to the phenotypic observation in Maremanno Hound where the morphology was negatively correlated with search (Riganelli et al. 2016). However, authors recorded a negative correlation between search and pursuit as we observed for the Italian Hound. Furthermore, our record is in contrast to the genetic observation carried out for the Finnish Spitzs (Karjalainen et al. 1996) for which the genetic correlation between search and pursuit was found to be positive and moderate.

It should be noted that the correlations between morphology, breed style, search and the others skills, i.e. approach and find, were moderate or even low. Therefore, the traits are useless selection criteria for the improvement of such hunting abilities. Finally, low correlation was found between voice and all the others traits.

Conclusions

Our results suggest that all the non-genetic effects analysed in our study influence the assessment of the hunting abilities in the Italian Hound. Therefore, their effect must be taken into account by the judges during the evaluation of the dog's skills. The phenotypic correlation suggests that the morphology and the breed style could be useful selection criteria for improving some hunting skills such as search and pursuit. However, our result should be corroborated by the estimation of the genetic correlations among the traits. Finally, the current assessment system for hunting skills is not totally reliable and some parts of it should be revised. In fact, the multivariate analysis showed that morphology and the breed style

Table 6. Spearman's ρ (rho) phenotypic correlations.

Hunting trait	Morphology	Breed style	Search	Approach	Find	Pursuit	Voice
Morphology	–	.998**	.48**	.126**	.104**	.072*	.136**
Breed style		–	.48**	.127**	.104**	.71*	.136**
Search			–	.202**	.115**	−.75**	.105**
Approach				–	.385**	.146**	.098**
Find					–	.248**	.036
Pursuit						–	.108**
Voice							–

**$p < .01$; *$p < .05$.

respectively, despite being the traits less descriptive of the dog's hunting abilities, had the highest loading on the first component.

These findings presented here have some practical conclusions to offer on this matter. The suggestion is to simplify the scoring system by merging the morphology and the breed style traits in one single parameter and by narrowing the scale of score, for example from 1 to 30 to 1 to 15. This would facilitate the assessment of the traits for the judges. Another recommendation is to promote a rotation system of the judges throughout the forty different locations in which the hunting trials take place. This would reduce the judge's personal bias thus promoting a more objective evaluation of the dog's hunting skills. Furthermore, as proposed for other breeds, a more objectively defined measures might be considered to improve the reliability of the scoring system as well (Liinamo et al. 1997).

Regarding the future perspectives for the breeding improvement of the Italian Hound, a genetic evaluation of its hunting abilities is strongly needed. Adopting a joint genetic-phenotypic evaluation would increase the accuracy of the hunting skills improvement.

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Ethical approval

No ethical committee permission was required as no animal was involved in the study.

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