RESEARCH REGARDING THE BREEDER'S MOTIVATION TOWARDS THE INBREEDING PRACTICES

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RESEARCH ARTICLE

Abstract

Currently there are more than 400 different canine breeds in the world, with various physical aspects and uses (like hunting, herd guard, protection, traction), and all of them have one ancestor: the wolf (Canis lupus). These animals were the first species to be domesticated and have been selectively breed over thousands of years. Since the dog domestication, the human never stopped shaping these animals as he wanted by selecting the individuals which were the most suitable to reproduce to meet the human needs. Consciously or not, voluntarily or not, inbreeding has always existed. The aim of this research was to conduct a statistical study on the actual practice of inbreeding in dog breeding. For this study a questionnaire which had 26 questions was realized and distributed in 34 countries from 4 different continents. It was distributed through Google Forms, social media and physical distribution at different dog shows and breeders meetings. In total, 344 answers were received and analyzed. The majority of answers were from Romania and France, and 136 dog breeds were included in this study. This study shows that dog breeders practice the in-breeding regularly even if they know the advantages and disadvantages of this practice.

Keywords: dogs, breeding, inbreeding, selection, questionnaire
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INTRODUCTION

There are no official statistics regarding the number of dogs in the world, but it is estimated that there are around 500 million, of which 75 million (15%) in Europe. The exact moment where the wolf was domesticated it is unknown, but it is believed that prehistoric man from the Upper Paleolithic begin the wolf domestication around 15000 years ago in Eurasia (Galibert, et al, 2011). To achieve such a huge diversity regarding the number of breeds, the human had to select the ones which were more suitable to transmit their physical qualities and characteristics to their offspring (Morey, 1994). The use of inbreeding, whether it was voluntary and conscious or not, has existed since the time of domestication of the dog, but it remains a sensitive subject, even today.

In 1900, the entomologist Pierre Mégnin created a modern classification of dogs, where he distinguished four groups, depending on their morphology (especially of the head) (Grandjean, et al, 2014). On May 22, 1911the FCI (*Fédération Cynologique Internationale*) was created by five founding countries: Germany, Austria, Belgium, France and Netherlands. The purpose of this association is to encourage and promote the breeding, registration and use of pedigree dogs, and to ensure that their functional health and morphological appearance meet the requirements of the standards of each breed (Lecerf, 1994). In 1987, the FCI approved the Nomenclature of Canine Breeds which is still the same even nowadays. According to that, the dog breeds are classified in ten distinct groups (depending on their use, morphology and other characteristics) and recognize 353 dog breeds. All countries have a national organization, federation, society or association, whether or not it is affiliated with the FCI.

The notion of consanguinity is relative when we speak in dog breeding. Of course, to obtain breeds with very specific phenotypic characteristics all dogs are inbred, but in general a consanguineous individual is an individual whose parents have at least one ancestor in common (Bonarelli, 1987). The concept of

average inbreeding coefficient makes it possible to assess the inbreeding of a given population and no longer that of a single individual. It is equal to the weighted average of the different individual coefficients by the frequencies of different types of crossing performed. Thanks to these two parameters, we can quantify the impact of genetic drift in a canine population (Calboli et al, 2008). Some of the most common purposes of inbreeding are to fix a head type, a bone structure or a temperament (Leroy, 2011). From a practical point of view, the breeder can use inbreeding as a selection tool (Wade, 2011). Inbreeding or close consanguinity consists of mating close relatives (parent and offspring, brother and sister) which allows for some characteristics to persist on a specific individual. Less radical, line-breeding or broad consanguinity consists of more distant unions. This method makes it possible to keep the type, no longer to a specific individual, but to a lineage. The great advantage of consanguineous reproductions is the rapid and constant fixation the qualities of a dog (inbreeding) or of a line (linebreeding), by their genetic transmissibility, but it is also a big drawback because some defects can persist (health, fertility, productivity or behavior problems) (Parker et al, 2004). In order to evaluate the degree of consanguinity there is a coefficient which can be calculated. In view of the potentially disastrous consequences of reckless use of inbreeding in dog breeding, the competent authorities (international and national) have decided to supervise this practice.

The aim of this study was to evaluate the current practice of inbreeding by dog breeders. It provides an overview of the inbreeding situation from 33 different countries (4 continents) and referenced 136 canine breeds using a questionnaire.

MATERIAL AND METHOD

In order to conduct this study we had the following objectives: to make a practical inventory of how inbreeding is perceived and used today by dog breeders; to see if there are notable differences in the approach to the practice of inbreeding between "novice" breeders and "experienced" breeders; between breeders from different countries or; between breeders of different dog breeds; to see if the theoretical data, in particular on the advantages and disadvantages of consanguineous marriages are reflected in reality. To obtain all this information we distributed a questionnaire (in French, English and Romanian), which was created using Google Forms app (free, easy to use, anonymous).

The questionnaire was composed of 26 questions, 19 compulsory and 7 optional, because they only concern breeders practicing consanguinity. Depending on the question, several types of answers were possible: free long answer (to be written), single answers among the proposed choice and multiple responses among the suggested question.

The links for the questionnaire were published on the social media, on author's personal page (in French, English and Romanian). This questionnaire was available on the page for a period of five months, during which we received 344 answers. In addition, the questionnaire was sent directly to French breed clubs, via social media, asking them to share it with their members. The CFCTNL (French Dog Club of Newfoundland and Landseer), the French Whippet Club and the Tibetan Dog Club of France responded favorably to this request by agreeing to broadcast it.

Also, we create and print flyers (1100: 500 in French, 500 in Romanian and 100 in English) to be distributed directly during various dog events. They were equipped with QR-codes that refer to online questionnaires when flashed with a smartphone. These flyers were distributed directly to breeders during different dog events: National and international dog show in Cluj-Napoca (Romania), National dog show in Valence (France).

RESULTS AND DISCUSSIONS

Overall, we received 344 responses: 224 in French, 96 in English and 24 in Romanian. The survey was disseminated internationally, with responses from 34 different countries on four continents From Auvergne Rhône-Alpes (France) were received the most answers, followed by Romania (Figure 1).

All categories of breeders answered the questionnaire: young breeders but also people who have been breeding for more than twenty years, professionals who breed one or more dogs, who have small breeding groups (less than six dogs) or very large (more than thirty-five dogs) (Figure 2)

Regarding the number of the breeding group the most breeders almost a quarter have between 6 to 15 dogs, followed by breeders that have less than 6 dogs (Figure 3).

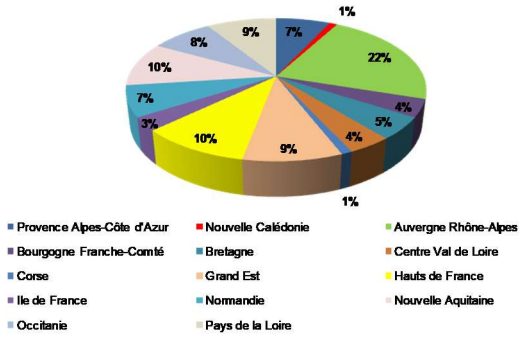

Figure1 **The distribution of answers in France**

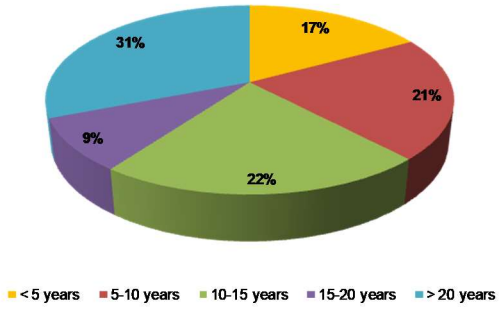

Figure 2. **Repartition of breeders according to their years of breeding**

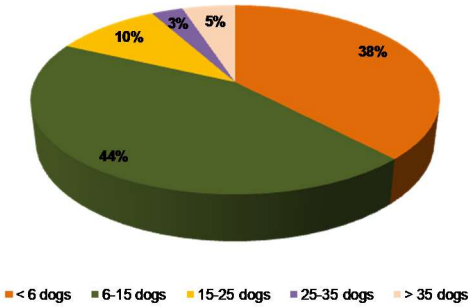

Figure 3. **Repartition of breeders according to the size of their breeding group**

A total of 136 dog breeds are included in this study (including 2 which are not recognized by the FCI, but respectively by the SCC (Central Canine Society) and the AChR (Romanian Kennel Club). Different numbers of individuals from different breeds are represented in Table 1.

Table 1

FCI Group 1: Sheepdogs and cattle dogs (except Swiss Cattle dogs)

Section	Race	France	UK	Romania	TOTAL
1	Beauceron	5	-	-	5
	German Shepherd dog	5	3	1	9
	Australian Shepherd	9			9
	American Shepheard	2	-	-	2
	Belgian Shepherd Malinois	7	3	3	13
	Belgian Shepherd Tervueren		1	-	1
	Swiss white Shepherd	4	1	-	5
	Shetland Shepherd	10	-	-	10
	Duch Shepherd	10	-	-	10
	Bobtail (Old English Sheepdog)	-	2	-	2
	Border Collie	8	1	-	9
	Briard	1	-	-	1
	Czechoslovakian Wolfdog	2	-	-	2
	Long haired Collie	3	1	-	4
	Australian Kelpi	1	-	-	1
	Puli	1	-	-	1
	Schapendoes	3	-	-	3
	Welsh Corgi Cardigan	1	1	-	2
	Welsh Corgi Pembroke	-	4	-	4
2	Australian Cattle Dog	3	1	-	4

Table 2

FCI Group 2: Pinschers and Schnauzers, Molossoid breeds, Swiss Mountain and cattle dogs and other breeds

Section	Race	France	UK	Romania	TOTAL
1	Danish-Swedish Farmdog	-	1	-	1
	Dobermann	-	1	-	1
	Miniature Pinscher	-	1	-	1
	German Pinscher	-	1	-	1
	Miniature Schnauzer	1	4	-	5
	Standard Schnauzer	1	2	-	3
	Giant Schnauzer	1	2	-	3
	Black Russian Terrier	-	2	-	2
2	Central Asian Shepherd	-	-	3	3
	Caucasian Shepherd	1	-	2	3
	English Bulldog	2	-	-	2
	Boxer	3	2	-	5
	Bullmastiff	1	1	-	2
	Cane Corso	3	2	-	5
	Great Dane	3	2	-	5
	Dogo Argentino	-	-	1	1
	Dog de Bordeaux	4	-	-	4
	Dog de Majorque	1	-	-	1
	Fila de Sao Miguel	1	-	-	1
	Landseer	1	1	-	2
	Leonberg	1	-	-	1
	Mastiff	1	1	-	2
	Montagne des Pyrénées	-	1	-	1
	Rottweiler	5	1	-	6
	Saint-Bernard	3	-	-	3
	Shar Peï	1	-	-	1
	Terre-Neuve	28	3	-	30
3	Bernese Mountain dog	4	-	-	4
	Great Swiss Mountain Dog	1	-	-	1

Table 3

FCI Group 3: Terriers

Section	Race	France	UK	Romania	TOTAL
1	Airedale Terrier	-	4	-	4
	Wire Fox Terrier	-	1	-	1
	Brasilian Terrier	-	1	-	1
	Welsh Terrier	1	1	1	3
2	Cairn Terrier	2	1	-	3
	Jack Russell Terrier	2	1	-	3
	Jagd Terrier	-	2	-	2
	Norfolk Terrier	-	1	-	1
	Norwich Terrier	-	1	-	1
	Scottish Terier	1	2	-	3
	Sealyham Terrier	-	1	-	1
	Westie = West Highland White Terrier	1	-	-	1
3	American Staffordshire Terrier = Amstaff	4	1	2	7
	Bull Terrier	1	2	3	6
	Miniature Bull Terrier	1	1	-	2
	Staffordshire Bull Terrier = Staffie	4	-	1	5
4	English Toy Terrier	-	1	-	1
	Yorkshire Terrier	1	1	1	3

Table 4

FCI Group 4: Dachshunds

Section	Race	France	UK	Romania
Teckel Standard	5	5	2	12

Table 5

FCI Group 5: Spitz and Primitive types

Section	Race	France	UK	Romania	TOTAL
1	Alaskan Malamute	6	2	1	9
	Samoyède		3	-	3
	Siberian Husky	6	3	-	9
3	Finnish Lapponian dog	-	1	-	1
	Swedish Vallhund	-	1	-	1
4	German Spitz	4		-	4
5	Akita Américain	-	2	3	5
	Akita Inu	2	1	-	3
	Chow Chow	2	1	-	3
	Shiba Inu	3	1	-	4
	Japanese Spitz	2		-	2
6	Basenji	-	4	-	4
	Canaan Dog	-	1	-	1
7	Cirneco de l'Etna	-	1	-	1
No section Recognized by SCC	Cursinu	1	-	-	1

Table 6

FCI Group 6: Scent hounds and related breeds

Section	Race	France	UK	Romania	TOTAL
1	Basset Hound	5	-	-	5
	Beagle	2	3	-	5
	EnglishFoxhound	-	1	-	1
	Gascon Saintongeois	1	-	-	1
	Griffon Nivernais	1	-	-	1
No section FCI not recognized	Hungarian Hound - Transylvanian Scent Hound	-	-	1	1
3	Dalmatien	1	-	-	1
	Rhodesian Ridgeback	-	1	-	1

Table 7

FCI Group 7: Pointers and Setters

Section	Race	France	UK	Romania	TOTAL
1	German Short- Haired Pointing Dog	1	-	1	2
	Weimaraner	2	-	-	2
	Hungarian Short-Haired Pointer (Vizsla)	-	1	-	1
	Italian Pointing Dog	2	-	-	2
	Epagneul Breton	1	-	-	1
2	English Setter	4	-	-	4

Table 8

FCI Group 8: Retrievers, flushing dogs, water dogs

Section	Race	France	UK	Romania	TOTAL
1	Flat Coated Retriever	1		-	1
	Golden Retriever	5	1	-	6
	Labrador Retriever	6	2	-	8
2	American Cocker Spaniel	5	7	-	12
	English Cocker Spaniel	5	3	-	8
	Springer Spaniel	1		-	1
	Welsh Springer Spaniel	1		-	1
3	Spanish Water Dog		1	-	1
	Romagna Water Dog	2		-	2

Table 9

FCI Group 9: Companion and toy dogs

Section	Race	France	UK	Romania	TOTAL
1	Bichon Frisé	1	-	-	1
	Bichon Havanais	1	-	-	1
	Bichon Maltais	1	-	1	2
2	Caniche Standard	4	2	-	6
	Caniche Toy		1	-	1
3	Belgian Griffon	1	-	-	1

	Griffon Bruxellois	1	-	-	1
	Petit Brabançon	1	-	-	1
4	Chinese Crested Dog		1	-	1
5	Tibetan Spaniel	1	-	-	1
	Lhassa Apso	1	-	-	1
	Shih Tzu	5	-	-	5
6	Chihuahua	7	1	-	8
7	Cavalier King Charles Spaniel	4	1	-	5
	King Charles Spaniel	1	-	-	1
9	Continental Toy Spaniel (Papillon ou Phalène)	-	2	-	2
	Russkiy Toy	1	-	-	1
11	Boston Terrier	3	-	-	3
	French Bulldog	4	4	1	9
	Mops	3	-	-	3

Table 10

FCI Group 10: Sight hounds

Section	Race	France	UK	Romania	TOTAL
1	Barzoi	1	1	-	2
	Afghan Sighthound	1	2	-	3
	Saluki	1	-	-	1
2	Irish Wolfhound	2	-	-	2
3	Azawazh	2	-	-	2
	Galgo	1	-	-	1
	Greyhound	4	-	-	4
	Italian Sighthound	3	-	-	3
	Sloughi	1	-	-	1
	Whippet	4	3	-	7

The most represented breed is Newfoundland, followed by the Belgian Shepherd Malinois, the American Cockers Spaniel, the Standard Wirehaired Dachshund and the Shetland and Duch Shepherds. In view of the results, a comparison between the first three breeds was made. The next 22 questions (5 to 26) were focused on the main topic of this study: the consanguinity of dogs and how the breeders understand and use it in their practice of dog breeding. (Figure 4).

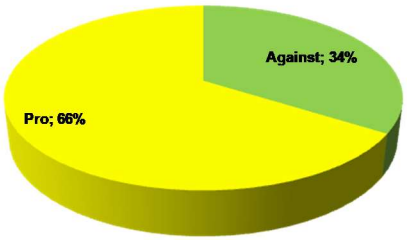

Figure 4 **For or against consanguinity**

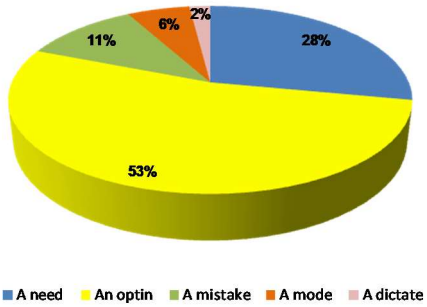

Figure 5 **Perception of the breeders towards the practice of inbreeding**

When question about the perception of the breeders towards the practice of inbreeding, over half answered that it is an option, followed by almost 30%that considered as being a need (Figure 5).

Regarding the practice of breeding without inbreeding, 54% of the breeders answered that they agree with this practice, but when questioned about the formula for calculating the inbreeding coefficient, 59% answered that they didn't knew about it, therefore they didn't apply it in their breeding programs.

For the level of the inbreeding in their practice, the breeders considered an important level of inbreeding being more than 25% (45% of the breeders) and more than 5% only 10% of the breeders (Figure 6).

When questioned if the inbreeding is a determinant factor in their breeding choices for

future reproductions, 34% of the breeders answered positive, 25% answered negative and 41% answered „not always". Questioned about the determinant factors that make the next mattings for their breeding, the most important choices were made towards health, pedigree and beauty (Figure 7).

For the question were the breeders had to classify the characteristics of importance, we can observe a different tendance for each questionnaire (French, English and Romanian):

- French questionnaire: health, pedigree/lines, beauty, consanguinity rate, performance and age
- English questionnaire: health, pedigree/lines, inbreeding rate, performance, beauty and age
- Romanian questionnaire: health, beauty, performance, pedigree/ lineage, inbreeding rate and age

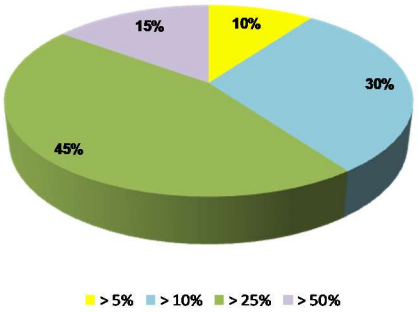

Figure 6 **An important level of inbreeding in breeders' opinion**

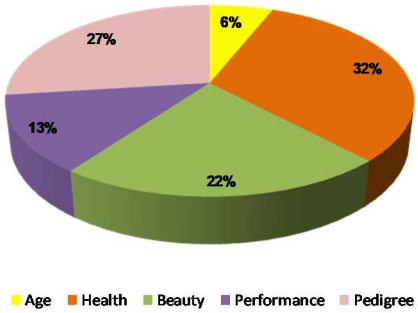

Figure 7 **Determining factors in the choice of upcoming mattings**

When questioned if they used the practice of inbreeding, the majority (81%) had already used it in their practice of breeding. The questions 15 to 26 were focusing on the type of inbreeding used by different breeders. Concerning the types of inbreeding practiced by the breeders, the most common practice of inbreeding was recorded for a common grandparent, and a less common practice was between the parents and their offsprings (Figure 8).

The following question wanted to clarify the expectations of the breeders that used the practice of inbreeding. 37% of the breeders applied the practice of inbreeding to achieve an improvement from the phenotypical point of view (beauty/show), followed by a better temperament (31% of the breeders) (Figure 9). It should be noted that 89% of the breeders that used the practice were satisfied with the result obtained.

Regarding the characteristic's transmissions in the following generation, 87.5% of the breeders affirmed that it was seen and from those that seen it the majority considered that it is frequent in the next generation

From the particular aptitudes that could be transmitted and the frequency of their transmissions in the next generation, 62% of the breeders observed the transmission of the aptitude and seen it frequent in the puppies

For the transmission of the breed associated pathologies observed by the breeders in the next generation, only 31% of the breeders answered that hey observed the transmission of the pathologies, but less frequently and for the transmission of reproductive disorders, the breeders recorded even lower (16%).

When asked if they breed two dogs that belonged to different lines, but both of them having a higher level of inbreeding, half of the breeders answered positive (50%). But, more interestingly, when the breeders are asked if they are paying attention for the level of inbreeding when buying a new puppy for their kennel, 77% answer positive. Also, 92% of the breeders agreed with the use of outcrossing when the dogs belong to a particular line within the breed, but disagreed to use outcross complete, so to introduce foreign blood in the breed (73%).

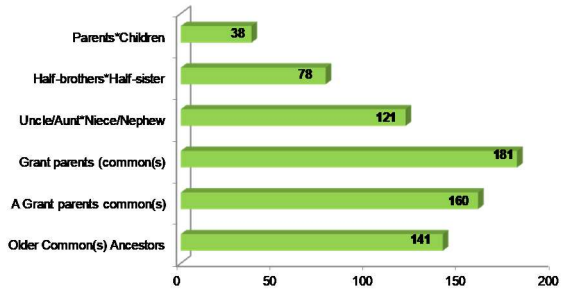

Figure 8 **Types of inbreeding mattings practiced**

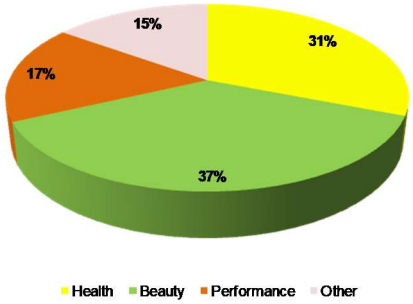

Figure 9 **Expectations of inbreeding mattings**

Asked if the practice of inbreeding is a preoccupation for their clients, the future owners of the puppies, only 34% of the breeders recorded that is a preoccupation for the new owners.

An overall of 344 answers were included in this study, from breeders from 34 countries, which breed 136 different dog breeds. This study shows the current trend in the practice of consanguinity by a population of professionals. The answers that we received separate the breeders in two: novice (who have been breeding for less than 5 years) (17%) and experienced ones (who have been breeding for more than 20 years) (31%).

Comparing the answers of the questions 5 and 7, we can observe that even if 34% of the breeders questioned are against the practice of inbreeding in dogs, 54% consider that it would be illusory to think that we can breed without inbreeding and some of them consider it that is essential.

If we analyze the results of questions 5 and 14 we note that 228 breeders answered that are in favor of inbreeding and 116 are against. However, analyzing the results from the question 14, only 65 people say that they never practiced inbreeding. This difference between the answers is partly explained by the accidental mating which some breeders mentioned in different comments. Although they were not in favor, they produced inbred dogs in "unwanted", unselected litters. This phenomenon is far from being a rare and isolated event.

A third argument in favor of this notable difference between breeders claiming to adhere to the practice of inbreeding and those claiming to have used it, is that certain breeds of dogs have very small and limited dog number, with a high rate of inbreeding (e.g. the Norwegian Lundehund). Under these conditions, making an out-crossing matting is almost impossible.

When the breeders were asked if they knew the formula for calculating a dog's inbreeding coefficient (appearing on its pedigree), 59% of those questioned answered negatively. These probably means that they do not want to share that information.

Regarding the answers for the questions 11, 12, 13 the majority of the breeders consider that the rate of inbreeding of a future litter is an important factor but not the main one. Question 15 asked breeders about the types of consanguineous marriages they have had. Out of a total of 719 inbred mattings, 116 (16%) are close inbred and 603 (84%) are broad inbred. Therefore, we can see that the international recommendation to ban in-breeding is rather well respected by professional breeders. In addition, to this regulatory breeding, an important part is also the ethical aspect of close inbreeding, especially at a time of ever greater anthropomorphization of companion animals.

Analysis of the results of questions 16 and 17 shows that breeders practice inbreeding mainly for health and beauty purposes and that they are generally satisfied with these mattings. The latter meet their expectation 89% of the time. When they were asked to quantify the harmful aspect of the use of in-breeding (appearance of hereditary genetic defects and reproductive disorders), the majority preferred not to give an answer, resulting that is a sensitive, even taboo subject that they prefer not to touch.

CONCLUSIONS

This study shows that professionals are generally in favor of inbreeding and that they practice it regularly, knowing its limits and disadvantages.

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