

Inbreeding — Is it necessary?

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Inbreeding - *The mating together of animals more closely related to one another than the average relationship within the breed.*

Line breeding - *The mating of later generations back to some ancestor or its descendents. Line breeding is a form of inbreeding.*

When we peruse books and articles on dog breeding, especially those written for the hobby breeder, we generally find that inbreeding is defined as the breeding together of closely related individuals such as brother to sister, son to dam, and sire to daughter. Line breeding is presented as matings of relatives that are more distant than one generation, where the breeding is an attempt to concentrate the genes of some outstanding ancestor. While inbreeding is considered dangerous, especially for novice breeders, line breeding is accepted as the favored approach for serious breeders.

Geneticists rarely make such distinctions since they realize that line breeding is a form of inbreeding, and that the mating of individuals separated by more than one generation can produce homozygous gene pairings and concentrate defective alleles just as strongly as matings that are termed inbreeding, or incest breeding, by the hobbyist. Geneticists prefer a more quantitative measure using a precise mathematical formula to determine the proportion of genes for which an individual, or the litter from a proposed mating, is likely to be homozygous. For this, they use Wright's formula to calculate the coefficient of inbreeding, COI.

In a previous article I discussed in some detail the methods used to calculate the COI and the problems that can be associated with very close breeding and high COIs.¹ Using a Dalmatian database of approximately 20,000 pedigrees, the coefficients of inbreeding for each Dal for which detailed pedigrees were available were computed along with the population average. For 8-generation pedigrees, the population average COI was found to be 6.34% with a maximum inbreeding coefficient of 42.55% for one Dalmatian that resulted from a mating of brother to sister, these from a litter that was itself strongly inbred. We should observe that using Wright's formula the COI for a brother to sister mating is 25% if the parents are not inbred. This is the same value obtained for parent to offspring matings when they are not inbred.

COIs for typical matings (assuming that the parents are not inbred) are:

Brother-sister	25%
Parent-offspring	25%
Half-siblings	12.5%
Uncle-niece	12.5%
Grandparent	12.5%
First cousins	6.25%

The advocates of line breeding are legion:

“Line-breeding is the safest course between the Scylla of out-crossing and the Charybdis of in-breeding for the inexperienced navigator in the sea of breeding.”²

“Linebreeding is probably the safest course, and the one most likely to bring results, for the novice breeder.”³

“Linebreeding is the method most commonly used by novice and veteran breeders alike. This is a safe method if the novice concentrates on the bloodlines of a quality dog that produces quality.”⁴

It would not be difficult to continue this list to include quotations from almost every “how to” book for dog breeders. The problem with authors who advocate line breeding but caution breeders on the potential pitfalls of inbreeding is their nearly universal failure to note that if the breeder looks deeper into the pedigrees of his so-called line breeding mating, he might well find that the relationship is far closer than initially assumed, and the COI resulting from such a line breeding can be very high indeed.

Inbreeding and Quality

Quoting from Malcolm Willis: “Some breeders have argued that inbreeding, or line breeding as they prefer to call it, is the only way to success. Thus a famous German Shepherd expert has supported the view that to breed champions one must stick to inbreeding and that to mate dogs and bitches of different bloodlines will produce rubbish in 99% of cases.” Willis clearly disagrees with this breeder's assertions while at the same time noting his high degree of success in the show ring.⁵

This strong advocacy of inbreeding as a mechanism for producing both uniformity and quality, as measured by show wins and champions produced, must give pause to geneticists promoting breed genetic diversity. With this realization - that contrary to all the evidence in support of genetic diversity, inbreeding often wins in the show ring - I wanted to know how the top Dalmatians in the breed stacked up against the average with respect to their inbreeding status.

In order to have a quantitative measure to make the comparison, I again computed the breed average COI for Dals, but this time extended the pedigrees to 10 generations. Reaching deeper into the pedigree backgrounds, I found some common ancestors that were not uncovered in the earlier study.

This return visit to the augmented Dalmatian database yielded an average breed COI of 7.007%, which, as expected, was nominally higher than the previous 8-generation result.

Quality in a Dalmatian may well be in the eye of the beholder, but rather than depending on my own personal preferences - with which you could certainly disagree - I have referred to the statistics lists for the all-time top Dalmatians⁶

1. Top show Dalmatians
2. Top sires of champions
3. Top dams of champions

The top 20 Dals in each of these three categories comprise the subsets used in the comparison of COIs. It should be reiterated that inbreeding has a breed-specific context; a dog is said to be inbred only if its COI is greater than the breed's average COI.

All-time Top Show Dalmatians

The top show Dals in order of number of Best of Breed wins through 1997 is given below:

Name	COI
1. Am Ch Spotlight's Spectacular	1.62487%
2. Am Ch Green Starr's Colonel Joe	14.91985%
3. Am Ch Korcula Midnight Hour	6.89278%
4. Am Ch Korcula Midnight Star Bret D	7.08218%
5. Am/Can Ch Proctor's Dappled Hi-Flyer	3.01781%
6. Am Ch Fireman's Freckled Friend	6.57387%
7. Am/Can Ch PGR Heiloh Samson Am CD	7.07264%
8. Am Ch Tuckaway Winged Foot	8.30383%
9. Am Ch Spottsboro Rebel Streak	9.0271%
10. Am Ch Fanfayre's Beau Of Short Acre	4.4651%
11. Am Ch Green Starr's Shamrock	25.24471%
12. Am Ch Fire Star's Sonny Boy	4.73518%
13. Am/Can/Mex Ch Ye Dal Dark Brilliance	8.84895%
14. Am Ch Deltalyn N Penwiper Kis N Cuzn	7.02076%
15. Am Ch Tallyho Sir Charles	2.15263%
16. Am Ch Colonial Coach Son Of York	5.90897%
17. Am Ch Lord Jim	19.21864%
18. Am Ch Rolenet's Ragtime Dandy	8.58078%
19. Am Ch Panore Of Watseka	10.53944%
20. Am Ch St. Florian Pisces Jordache	1.03283%

AVERAGE **8.11315%**

The average for this subset is marginally greater than the breed average, with half having COIs less than the breed average.

Penny, the all-time top show Dal can be considered a virtual outcross with no common ancestors in a 5-generation

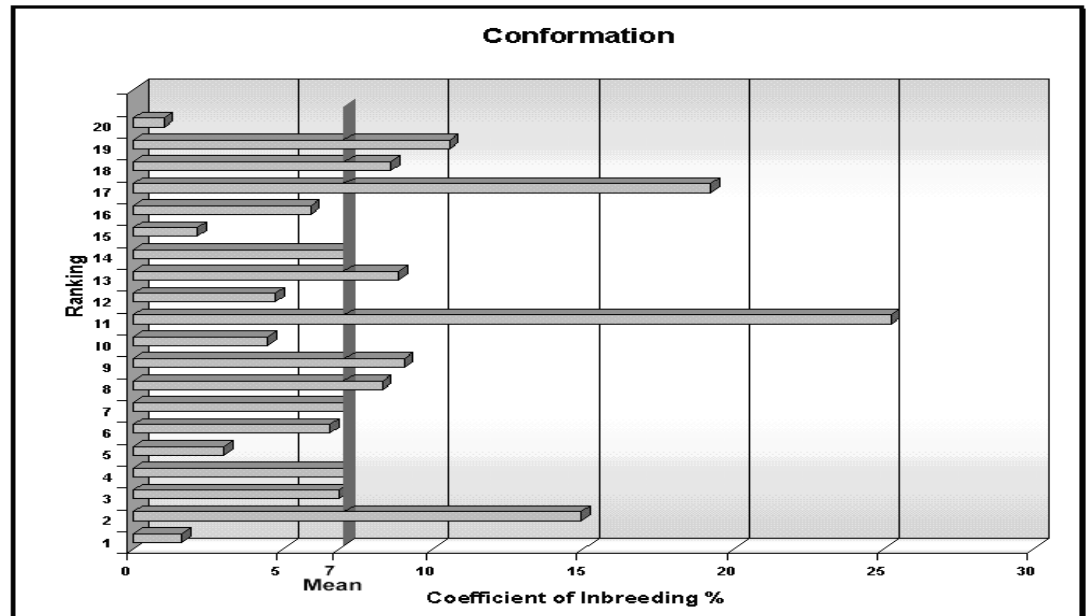


Fig. 1. Coefficients of Inbreeding of top 20 show Dals compared with the breed mean value of 7.007%. Those Dals with COIs greater than the breed mean are considered inbred to the degree that this number is exceeded.

pedigree. Her closest ancestor, common to both her sire and dam, is Ch Colonial Coach Cheshire in the 6th generation. Similarly, Jordache has no common ancestors in a 5-generation pedigree, and, at that level, is an outcross. Sir Charles' pedigree has no common ancestors until we find Ch Reigate Bold Venture appearing on both his sire's and dam's sides at 7 generations. Ch Proctor's Dappled Hi-Flyer's pedigree shows Ch Panore of Watseka and Ch Melody Up Up and Away as common ancestors only at the 4th generation. These Dals won, and won big, even though they have inbreeding coefficients far below the Dal population average.

All-time Top Sires

The top sires in order of number of champions sired through 1997 is given below:

Name	COI
1. Am Ch Fireman's Freckled Friend	6.57387%
2. Am/Can Ch Alfredrich Handsome Tall 'n Dark	0.59414%
3. Am/ Eng Ch Buffrey Jobee	0.89607%
4. Am/Can Ch Long Last Perfect For Paisley Am CD	0.9367%
5. Am/Can Ch Sunnyn Glen's Spencer For Hire	9.79309%
6. Am Ch Karastella Cadillac Of MGR	0.19493%
7. Am Ch Tuckaway Traveler Indalane TT	18.55679%
8. Am Ch Bob Dylan Thomas Of Watseka CD	8.93192%
9. Am Ch Green Starr's Colonel Joe	14.91985%
10. Am Ch Tuckaway Augusta	18.43662%
11. Am Ch Korcula Midnight Star Bret D	7.08218%
12. Am Ch Count Miguel Of Tuckaway	18.55679%
13. Am Ch Panore Of Watseka	10.53944%
14. Am Ch Crown Jewel's Black Diamond	0.81692%
15. Am Ch Colonial Coach Carriage Way	10.62603%
16. Am/Can Ch Countryroad Cool Million	10.98957%
17. Am/Ber/Can Ch Roadcoach Roadster	3.31688%
18. Am Ch Merry Go Round XKE	1.44863%
19. Am/Can Ch Pacifica Pride Of Poseidon	0.84839%
20. Am Ch Tamarack's Tennyson V Watseka	12.84046%

AVERAGE

7.84496%

As with the top show Dals, we observe that the average for this subset differs from the breed average by only a fraction of a percent. On average, these top sires cannot be considered inbred.

Starting from the top: Spotty's nearest common ancestor is Ch Coachman's Chuck-a-Luck who is a great-great grandsire. Chum's first common ancestors appear at the 7th generation where Ch Williamsview High Tide, Ch Beloved Scotch of the Walls and Shadd's Dotter of Whitlee are found on both sire's and dam's side. Jobee's pedigree first reveals a common ancestor, Eng Ch Lazaars Gay Gypsy of Greenmount, in the 6th generation. Rob's closest common ancestor, Ch Colonial Coach Carriage Way, is also 6 generations back.

6. Am Ch Glen Oaks Contessa Leah	7.27444%
7. Crown Jewel's Black Agate	0.42229%
8. Am Ch Indalane's Scarlett O'Hara	10.12154%
9. Am/Can Ch Sugarfrost Top Choice Am CD	3.60374%
10. Am Ch Coachman's Paisley Candy Bar	3.72391%
11. Am Ch Miss Camielle Of Croatia	10.99052%
12. Am Ch Paisley's A Touch Of Class CD	0.75684%
13. Ch Swood-paisly Cyncar Me Special	2.54879%
14. Am Ch Indalane Nellie Bly	10.12154%
15. Am/Can Ch Korcula Midnight Serenade	10.39047%
16. Am/Bra/S.Am/Gr Ch Labyrinth Hi Lili Heiloh	3.21579%
17. Am Ch Labyrinth Sleigh Belle	3.85857%
18. Am Ch Royal Oaks Liberty Belle	6.04401%
19. Aposta De Montjuic	3.64017%
20. Am/Can Ch Cheshire's Northern Lights	6.39114%

AVERAGE

6.22268%

As with the top sires, we observe that the average for this subset differs from the breed average by only a fraction of a percent, but in this case the top dams' average is actually lower than the breed average. These top dams have varied levels of inbreeding, from a few that are significantly inbred relative to the breed average to several that are outcrosses.

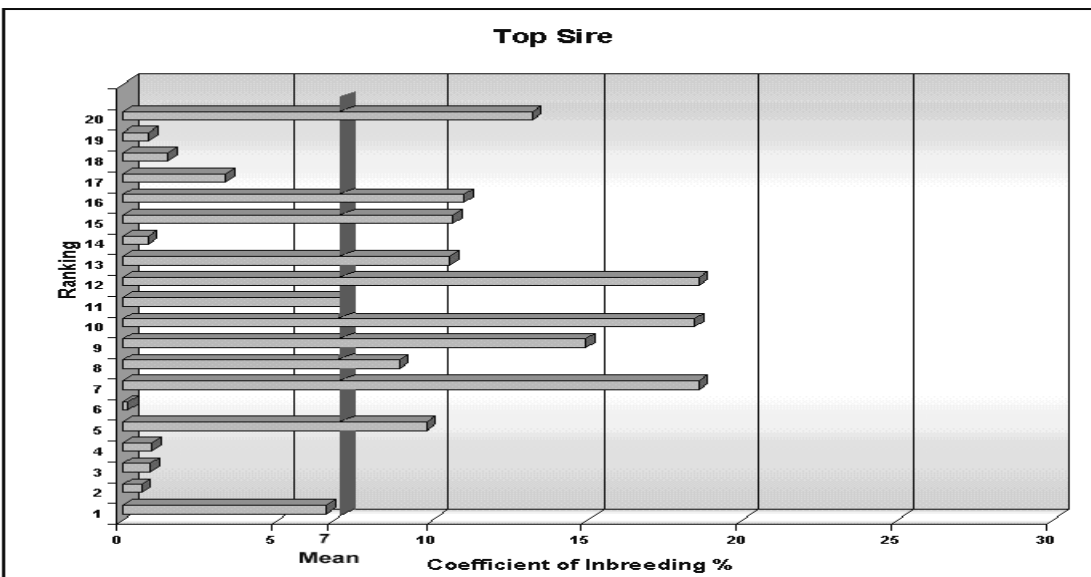


Fig. 2. Coefficients of Inbreeding of all-time top 20 Dalmatian sires compared with the breed mean value of 7.007%

These as well as other Dals in this list sired record numbers of champion get even though several were virtual outcrosses.

All-time Top Dams

The top dams in order of number of champions produced through 1997 is given below:

Name	COI
1. Am Ch Volanta De Montjuic	15.57293%
2. Am Ch Korcula Midnight Mistress	12.75711%
3. Am Ch Melody Sweet CD	1.25122%
4. Am Ch Melody Up Up And Away CD	7.19738%
5. Am Ch Tamara Of Watseka	4.57115%

Producing bitches are the backbone of any breed. They contribute not only their nuclear DNA, as does the sire, but they alone pass the mitochondrial DNA to their produce. Further, they must provide the nurturing environment to the fetuses and the newborn puppies. It is not surprising that when inbreeding depression first manifests, its effects are seen as decreased fertility, lower birth weight and increased early mortality. There is a dearth of information on these effects in dogs. The inbreeding studies done with Beagles showed increased neonatal deaths rising gradually when the litters had COIs exceeding 25%. In sheepdog breedings it was found that certain matings that would have resulted in pups with COIs greater than 25% were infertile or produced weak puppies, although animals with COIs of about 20% were highly satisfactory.⁷ Another report on the Boveigh strain of Border Collies showed no deleterious effects up to 20% inbreeding.⁸ To my knowledge, there are no published reports on deleterious effects on a litter when outcrossing and using a highly inbred dam, however, such effects have been noted in experiments with mice where inbred mothers produced smaller litters even when outcrossed.⁹

None of the top producing Dalmatians in this list was the product of what Denlinger² would term incestuous breeding. Volanta was produced by an uncle to niece mating, which

gives a baseline COI of 12.5% rising to 15.57% due to contributions from other common ancestors.

A more interesting case is that of Ch Korcula Midnight Mistress. Sissy is nominally line bred on Ch Tuckaway Traveler Indalane and Ch Rebecca of Indalane with this pair appearing as great grandparents on her sire's side and as great-

be weighed seriously and must be predicated on both immediate objectives and expected long-term benefits for the individual breeder. A balanced approach between the breeder's personal objectives and the long-term genetic health of the Dalmatian breed must be sought. Long range planning and cooperation among breeders can make it possible to refine and improve breeding lines, produce quality Dals, and maintain acceptable breed-line inbreeding levels.

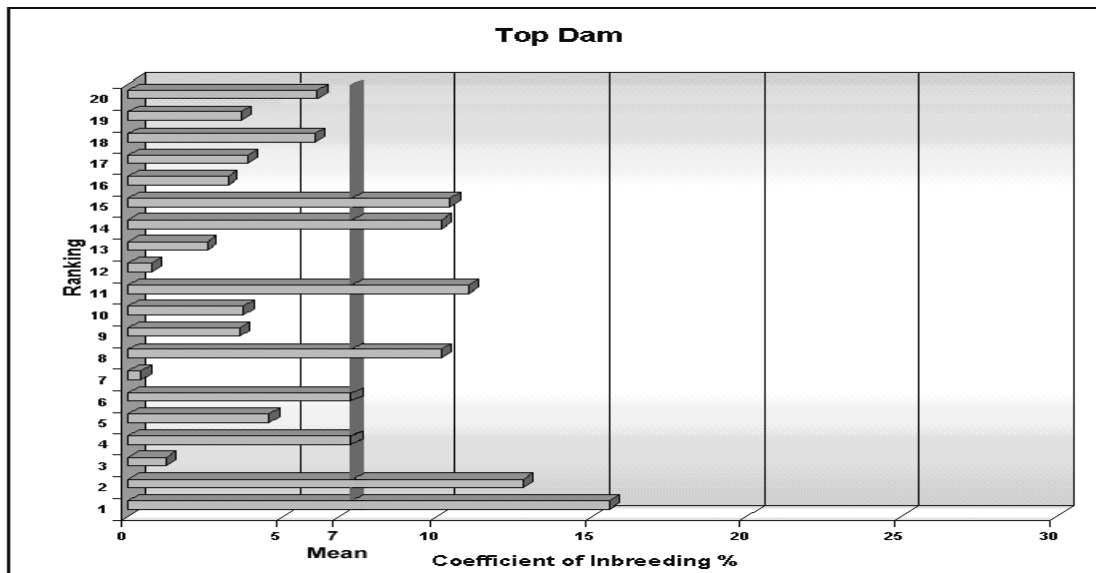


Fig. 3. Coefficients of Inbreeding of all-time top 20 Dalmatian dams compared with the breed mean value of 7.007%

great grandparents on her dam's side. The highest single contributor to Sissy's total COI is Ch Tuckaway Traveler Indalane at only 2.34%. However, it is the many contributions from other common ancestors that caused her total COI to rise to 12.76% overall.

Moving down the list, I find that Ch Melody Sweet and several of the others are outcrosses with no common ancestors in 5-generation pedigrees.

As to the Question...

The title to this article poses a question clearly and succinctly: Inbreeding, is it necessary? From these data the answer is resoundingly no. Inbreeding is not necessary to win in the show ring. Inbreeding is not necessary for a sire to produce champion get. Inbreeding is not necessary for a dam to be a top producer. Top Dals in each of these categories achieved at the highest levels even though they were the results of outcross matings.

Should, therefore, all inbreeding be avoided? From the standpoint of the overall genetic health of the Dalmatian breed, certainly genetic diversity should be extolled and inbreeding minimized. The question as it confronts the average hobby breeder is more difficult to answer, and decisions to inbreed at critical stages in the refinement of a breed line should

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