

Policy Position: Inbreeding

Introduction

Inbreeding, where closely related animals are mated, is prevalent in dog breeding and has played a significant part in the development and maintenance of many dog breeds. Inbreeding may be associated with health problems and reduced reproductive viability in dogs. It is implicated in a wide range of breed-related disease conditions in pedigree and purebred dogs.

Inbreeding is linked to the origins of a breed. Many breeds were created in the 20th century with a few founding dogs. All subsequent generations in such breeds are descended from these original dogs whose genes are perpetuated through the generations. This is known as the 'founder effect.' Once a breed is created, to 'fix' breed characteristics, the gene pool is closed and only dogs within this gene pool are allowed to be mated in order to preserve breed 'purity.' New breeds continue to be created in this way.

A measure of inbreeding is the **Effective Population Size (EPS)**. EPS is a measure of how many individuals are contributing genetically to a breed population. It indicates the size of the gene pool in a breed. As a guide, an EPS lower than 100 is considered concerning by conservation biologists while an EPS of below 50 puts a breed at risk in terms of a higher incidence of genetic diseases, reduced reproductive viability, lack of genetic variation, and prejudiced immune system function. Some breeds have low effective population sizes. In 2016, the UK Kennel Club published calculated EPS values for 121 of the 215 KC registered breeds. Of these, 25 breeds were observed to have an EPS of less than 50, and 68 breeds to have an EPS below 100.

<http://www.thekennelclub.org.uk/vets-researchers/publications-statistics-and-health-results/breed-population-analyses/>

Another measure of inbreeding is the **Coefficient of Inbreeding (COI)**. COI is the probability that the two genes present at a locus in that individual (in a litter of puppies) are identical by descent (IBD). That is, they are both identical

copies of a single ancestral allele (a variant of a particular gene) which have been inherited from both the mother and father. Since the COI describes the probability of IBD at each gene, it is a useful indicator of risk. The higher the COI, the greater chance that alleles at any gene locus are IBD and also that any harmful mutant alleles are IBD. Inbreeding therefore is an important influence on the likelihood that diseases associated with deleterious genes is expressed.

As a guide, a COI of 25% represents a mating between siblings, or parent to child; a COI of 12.5% represents grandparent to grandchild or half sibling to half sibling; 6.5% represents great grandparent to great grandchild or first cousins. The accuracy of a COI depends on how many generations are traced. The further ancestry is traced back the more historical relationships may be captured. A COI based on a 5 generation pedigree may give a misleadingly optimistic picture. Optimally, COI would be based on at least 10 ancestral generations.

The UK Kennel Club has calculated the breed average COI for all of its 215 breeds based on their registration records.

www.thekennelclub.org.uk/services/public/mateselect/breed/Default.aspx

A breeder may obtain the COI of an individual dog.

www.thekennelclub.org.uk/services/public/mateselect/inbreed/Default.aspx

A breeder may also obtain the resulting COI of any mating between a proposed sire and dam. www.thekennelclub.org.uk/services/public/mateselect/kinship/Default.aspx

A limited number of dogs may be used repeatedly for breeding. This applies particularly to males, referred to as 'popular sire syndrome.' A 'popular sire' is usually one that has the desired physical characteristics of a breed and may be a show-winning dog.

Issues

Inbreeding can have negative effects both on dog health and reproductive viability. The primary causes of this are increased homozygosity across the genome, increased risk of inheritance of deleterious traits and reduced genetic diversity. There can be particularly negative consequences for immune system function through reduced variability within the major histocompatibility complex.

Some examples of specific problems to which inbreeding has contributed are: hip dysplasia in Labradors and other large dog breeds; chiari-like malformation

(CM) and syringomyelia (SM) in Cavalier King Charles Spaniels and other short-headed, small breeds; dilated cardiomyopathy in Dobermanns; progressive retinal atrophy (PRA) in Cocker Spaniels. (ref. www.dogbreedhealth.com)
Inbreeding can contribute to suffering and reduced longevity in dogs.

DBRG Position

DBRG believes that the health and welfare problems associated with inbreeding need to be tackled as a matter of urgency. Measures can be taken to reduce inbreeding by individual breeders, breed clubs and kennel clubs. Failure to use these methods in the past, often made worse by an attitude of defensiveness and resistance, has contributed significantly to current and historical problems.

Recommendations

- Strategies for the management of genetic variability in pedigree dogs should be made on a breed by breed basis because each breed faces a unique inbreeding situation and history.
- Attention should be devoted to breeds for which the EPS is low and has the potential to create health or other risks. In these cases, outcrossing to another breed is recommended. Breeds with an EPS below 50 require urgent attention. Where breed EPS is low and of concern, breed clubs should take action to enhance genetic diversity seeking advice from a canine geneticist where appropriate.
- Improvements in genetic variability may be achieved by genetic exchanges between subpopulations including, for example, exchanging breeding animals between countries.
- Periodic out-crossing to a related breed would be sensible practice for all breeds. In this way there is reduced risk that the EPS will fall to a dangerously low level.
- To increase the EPS, breeders should consider the practice of ‘assortative mating’, using parents who are only distantly related, based on pedigree information from as many generations as possible.
- DBRG recommends that all breeders of pedigree dogs use the COI calculation when considering a mating. The aim should be to breed only

those dogs whose resulting COI is lower than the breed average. In this way the breed average COI can be lowered, resulting in greater genetic diversity.

- Maintaining a balance of sires and dams should be the aim of individual breeders and breed clubs rather than the overuse of 'popular sires.' This would mean a reduction in the number of times any male is used for breeding and goes against common practice.
- Breed clubs and kennel clubs should consider the use of dogs without pedigree but with the appropriate phenotype

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