

Inbreeding

The Vizlaclub recently organised a lecture about inbreeding. The lecture was given by Piter Bijma, who is a breeding and genetics researcher at the university of Wageningen. Bijma is specialised in inbreeding of cows and sheep.

Bijma told us the following data in random order

- Every breed that starts with a small number of animals will breed by inbreeding. Meaning that you see in the breed a slow rising of the inbreeding coefficient.
- Some inbreeding is normal, extensive inbreeding is dangerous for the health of the breed
- If you think you have done an outcross breeding you have not looked far enough in the pedigree. A dog with a 9% inbreeding coefficient over 6 generations could have a COI of 28% over ten generations.
- Breeders use the word line breeding instead of inbreeding to say that they do not directly combine mother and son or something alike, but looking over more generations it is still inbreeding. In fact there is no difference between inbreeding and line breeding. And in a breed that is based on only a few dogs there is no real outcross as well.
- The habit of breeders to count only a certain amount of generations and skip the bottom one in their calculations when combining a new generation gives the impression that the inbreeding coefficient is not increasing or even getting lower, while in fact the only thing that happens is that people do not look deep enough into the pedigree.
- Once genes get lost through inbreeding there is no way you can breed them back as long as you stay in your gene pool.
- Each generation (appr. 6 years) requires the use of at least ~50 dogs who are not closely related to each other. It is dangerous to over-use dogs and their offspring. As an example of this he told the story of the dairy cattle bull Bell who was born in 1974 and had been overly used in Europe. Between 1990 and 2000 they found out he was the carrier of two recessive lethal diseases. There was hardly any cow left without him in her pedigree. And even though there are millions of cows over the world it has taken a lot of effort to tackle that problem..
- A rough estimate is that every mammal is the carrier of 2 to 5 genes with a lethal or at least a life damaging effect.
- Through inbreeding the chance that those genes meet increases and the change that you have genes to conquer those problems decreases.
- An inbred male does not necessarily give inbred offspring, but do not use this inbred male when he is too young, because you need more security that he himself is not suffering from certain diseases.
- The inbreeding coefficient of an offspring is solely determined by the relatedness between its parents, not by the inbreeding coefficient of its parents. In other words, inbreeding is not inherited.
- Inbreeding brings recessive genes to the surface.
- As the inbreeding increases the result can be inbreeding depression. With sheep research showed that inbreeding was responsible for less weight, less fertility, less offspring and less age. Inbreeding depression comes with health issues and fertility problems meaning a degeneration of the breed in total.
- The solution is to be found in a very slow increase of the inbreeding and to keep the relationships between the animals as low as possible. Nature then takes care of a kind of balance. Mutations which can spontaneously arise can make the variety a bit larger.
- The solution is also found in the limitations of the relationships between different males. So real variety instead of replacing a dog by his son.
- Make sure that we do not breed all with the same dog
- Do not breed with dogs that are too related to each other.

We found the lecture clear and useful, even though we already knew that inbreeding is not healthy for our breed. He also told that a number of years ago some scientists claimed that because inbreeding brought certain recessive genes to the surface and gave a lot of uniformity one could handle the downside effects and benefit from the upside effects. People thought that it was good to know which diseases you had in your breed. But then they found out that through the inbreeding the loss of variety was so great that you could hardly get rid of those diseases. Nowadays genetic researchers believe

that recessive genes better stay recessive and that you can only keep your breed healthy by keeping your inbreeding as low as possible.

What does it mean for our breed?

How high the COI is in our breed is shown in the first table below. We took 11 existing Tollers and calculated their COI over 6 and 10 generations and from the known beginning of their pedigree. Ten of those Tollers are registered in Holland, number 11 has offspring in the Netherlands. Whether the beginning of the pedigree is totally correct we do not know, because some of the Canadian breeders did not register all their dogs. Since only the names of registered dogs are allowed on pedigrees we are not completely sure whether the names in the very beginning are entirely correct. But even if you disregard the beginning and you only take the first ten generations into account you can see how high the inbreeding is. We have chosen 11 Tollers who are not directly related to each other and from 11 different breeders. Two of the Tollers suffer from an auto-immune disease, the other 9 are healthy as far as we know.

Toller	Country of origin	COI 6 gen.	COI 10 gen.	COI from the start	max gen.
1	Finland	4.3%	26.0%	29.7%	14
2	Netherlands	3.6%	25.6%	26.3%	11
3	Norway	4.7%	27.7%	29.3%	11
4	Canada	9.8%	28.4%	28.8%	11
5	Canada	33.5%	48.4%	49.2%	13
6	USA	6.5%	27.5%	27.5%	10
7	Sweden	13.3%	29.2%	29.5%	11
8	Netherlands	4.0%	27.0%	27.5%	12
9	Netherlands	1.6%	24.9%	26.3%	12
10	Netherlands	2.7%	27.2%	28.9%	13
11	Netherlands	1.8%	26.2%	26.3%	11

Another example to illustrate what happens with the COI you can find in the next table. We wanted to show you what happens with the COI after you bred 5 generations. In Holland the COI over 6 generations usually stays under the 6,25% . We used that principle in our example.

After 5 generations we have bred Toller K. We used 6 existing Tollers from 5 different breeders. The offspring in our table does not exist.

The existing Tollers are great-greatgrandparents A and B, greatgrandparent D, grandfather F, dam H and sire J. The other Tollers do not exist, but these combinations in itself are real enough and possible. So the final result Toller K could have been an existing Toller.

Toller	COI 6 gen.	COI 10 gen.	COI from the start.	Total of gen.
A-bitch	4,7%	27,7%	29.3%	11
B-dog	3.8%	25.1%	25.5%	12
C-bitch (AXB)	1.6%	25.0%	26.4%	12
D-dog	9.8%	28.4%	28.8%	11
E-bitch(CxD)	1.6%	24.7%	26.1%	12
F-dog	2.6%	26.1%	26.3%	12
G-dog (ExF)	2.2%	24.8%	27.2%	12
H-bitch	1.4%	25.1%	25.2%	12
I-bitch (GXH)	0.8%	21.8%	26.2%	13
J-dog	3.6%	25.6%	26.2%	11
K-(JxI)	1.2%	25.2%	26.8%	12

The second table shows us that the COI gets a bit less then goes up again, but does not change considerably. This result is by the by not Toller specific. It is the same for many, many other breeds. In

our opinion it stresses how important it is to lessen the relationships between the animals you breed with. If you look at the Toller from the first table with a COI of 33% over 6 generations and you look at the COI of 48% when you take the first ten generations into account you are in fact breeding with a mother/son or a father/daughter combination. That means an enormous loss of gene variety.

The international study of the genetic background of auto-immune related diseases in our Toller is likely going to show that the variety in our breed concerning a special type of gene, the so-called haplotypes, is dangerously low. If that is true then we need all the variety we have left to keep our breed healthy.

In Holland we have a breeding policy that is in sync with what Bijma claims. We do not want a breeding to get above the 6,25% in 6 generations. Among the import males that have come to Holland, some have a lot more like 13 or even 33%. It is possible to use those males as long as you use them in completely different combinations.

What should we continue to do?

- Keep the inbreeding coefficient for 6 generations under the 6,25%. A lot of breeders take the trouble to go to other countries and strive for inbreeding coefficients under 3%
- Keep the breed limitations for males and females: 10 litters for a dog and 4 litters for a bitch.
- Guard the diversity of the males in breeding. As breeders we do well to avoid the use of males and their sons who have been overly used already..

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