Hybrid vigour, what is it how does it work and how can it help improve game and hunting dogs?

Heterosis or hybrid vigour is the opposite of inbreeding depression. Inbreeding depression often occurs naturally when out breeding animals or plants are inbred. This can be recognised by loss of overall fitness, lowering or loss of fertility and reduced competitiveness. It is generally assumed that this occurs because deleterious (disadvantageous) alleles (genes) that would be harmless in an out bred population (which is more heterozygous) become fixed during inbreeding. Thus you get an increase in fixed deleterious alleles. If two such lines are crossed however the resulting F1 hybrid may recover much of the lost vigour and indeed can become more vigorous than either of the two originally naturally out breeding parents. The phenomenon of an F1 generation being superior to or even the better than the best parent is known as "heterosis" or "hybrid vigour". (This is defined in quantitative terms as the difference between the F1 generation mean and the mean of the better of its parents).

There have been some very famous hybrid dogs such as; Stormer (Stafford* Stormer's dam ebt), Flint (Stormer's dam * Psycho Irish Stafford), the famous badger dog Kilwilkie lad (Stafford male * ebt bitch), B&W's Psycho (Stafford * ebt bitch) and Lance (ebt Red Hand of Ulster * Wheaton bitch). These dogs and in particular Stormer are often classed as one offs or freaks. No doubt much of their success was due to their hybrid vigour. However it is often thought that dogs that express hybrid vigour or heterosis must be a cross between different breeds such as an Ebt and a Stafford. Dogs of the same breed i.e. Staffordshire bull terriers crossed with Staffordshire bull terriers can also express varying degrees of heterosis; when a highly inbred line is crossed with another highly inbred line of the same breed heterosis can be strongly expressed. If those two lines have been kept apart for sometime many of their genes will show dominance and recessiveness for different traits at different loci. This will result in heterosis in exactly the same way as the crossing of two different breeds.

But why don't hybrids always result in an improvement? Well remember the definition of heterosis as the progeny being superior to either of the two parents. Obviously if those two parents are not as good as the dog you are competing against then the progeny will not be as good as that dog. Remember hybrid vigour only results in improving on the parents. So don't expect to take two low performing parents and get progeny that are superior to the best game dogs already out there. My advice is to exploit two highly successful inbred lines that show good genetic distance between them and make a cross between those lines.

Hybrids are often criticised for not producing. Well that is not surprising as the progeny of a hybrid has less hybrid vigour than the parent. It is only the hybrid itself that has the hybrid vigour. So if you have a successful hybrid the best option for producing, is to continue making crosses from the parents of the successful hybrid. Stormer's dam was a good example of a dog that has been used to produce dogs displaying useful hybrid vigour such as Stormer and Flint.

How can we tell if two lines have good genetic distances between them? If you have a lot of money then genetic testing is the answer. Different methods of DNA analysis

can now score the level of genetic distance between two lines. Allowing you to make a cross within a breed and achieve heterosis. Yea but lets face it not many of us are not going to be prepared to fork out that kind of money, although to be fair the prices for these kind of tests are dropping like a lead balloon. The other way is to examine the pedigree of the two lines, looking for as much difference as possible; hopefully the two parents will have no shared ancestors for as many generations as possible.

How does it happen on the genetic level?

Hybrid vigour can be explained in two ways. The first hypothesis is the dominance hypothesis, incorporates the obvious reversal of inbreeding depression, which inevitably must occur in out crossing. Consider a cross between 2 strains of corn with the following genotypes

Strain A   Strain B
AaBBCCddee   *   AAbbccDDEE
            This results in the following progeny
            AaBbCcDdEe

The progeny is heterozygous at all the loci shown i.e. Aa rather that aa or AA.
Deleterious recessive alleles present in the homozygous form will be masked by more favourable dominant alleles in the hybrids. Such masking is thought to cause hybrid vigour.
The second theory is called over-dominance. This holds that in many cases the heterozygote i.e. Aa is superior to either AA or aa. Thus the cumulative effect of heterozygosity at many loci accounts for hybrid vigour. Most likely the answer is a mixture of the above two theories.
Main points to remember when exploiting hybrid vigour.
- Achieved by crossing unrelated inbred lines or breeds
- The more distantly related the lines, the greater the heterozygosity in the crosses.
- The greater degree of dominance at loci affecting a trait, the more hybrid vigor possible
- Traits exhibiting the most hybrid vigor are the lowly heritable traits.

Doug MSc (plant breeding and genetics)
www.oldtymebullterrier.com

Filename: Hybrid vigor is a word that is often heard
Directory: C:\Users\user\Documents
Template:
                   C:\Users\user\AppData\Roaming\Microsoft\Templates\Normal.dot
    m
Title: Hybrid vigor is a word that is often heard, but wgat does it actually
    mean, what causes it and how can it be used in a breedin
Subject:
Author: doug
Keywords:
Comments:
Creation Date: 2/28/2031 11:40:00 PM
Change Number: 4
Last Saved On: 4/23/2013 12:27:00 AM
Last Saved By: user
Total Editing Time: 9 Minutes
Last Printed On: 4/23/2013 12:32:00 AM
As of Last Complete Printing
    Number of Pages: 2
    Number of Words: 811 (approx.)
    Number of Characters: 4,625 (approx.)