Genetics and Miniature horses

Munro Marx
Unistel Medical laboratories
Miniature Horses

• Miniature horses are bred all over the world
• They are particularly popular in Europe and the USA
• Over the last number of years they have also become very popular in South Africa
• Miniature horses qualify by height
  • Normally between 34 to 38 inches (86 cm to 97 cm)
  • Normally measured from the shoulder to ground
  • Miniature horses retain all their true horse attributes
Miniature Horses

• The oldest living miniature horse on record Angel who lived to be over 50.
• The world’s smallest horse is also a horse affected by dwarfism
• Thumbelina stands 17 inches (43 cm) tall.
• Miniature horses have endured selective inbreeding over the past 350 years.
• It is estimated that there are more than 100,000 Miniature Horses in the United States.
Dwarfism and miniatures

- Dwarfism is a concern within the miniature horse world.
- Dwarfism is defined:
  - “underdevelopment of the body characterized by an abnormally short stature often with underdeveloped limbs and other defects”
- Dwarf horses (just a few issues)
  - generally have incorrect conformation
  - may have significant health and soundness issues.
  - can have trouble walking,
  - can have severe dental problems that can lead to episodes of colic.
  - can suffer from chronic pain caused by their malformed limbs and spine
  - are susceptible to obesity and can have difficulties carrying a foal
Dwarfism and miniatures

• Many miniature horse registries try to avoid accepting miniatures affected by dwarfism, especially for breeding stock.

• Dwarfism is a recessive genetic disorder

• Both parents therefore must pass on an affected allele to the offspring.

• Equine dwarfism is prevalent in the miniature horse breed (also present in normal horse breeds)

• Recorded in Friesians, mustangs, Shetland ponies and even the miniature donkey.
Genetics of Dwarfism in Miniatures

- There are four types of dwarfism in miniature horses of which Chondroplasia is most prevalent.
- Chondroplasia is a recessively inherited genetic disorder.
- Four different causative mutations in the ACAN gene have been characterised namely D1, D2, D3 and D4.
- The D1 mutation has been found to be lethal in combination with any other mutation.
- It is therefore advisable not to breed carriers of the D1 mutation to any other ACAN gene mutation carriers.
Dwarfism and miniatures

• In the miniature horse breed, dwarfism is estimated to be in over 50% of the population and affects all miniature horse bloodlines.

• Dwarfism cannot be culled by phenotypic characteristics because of the fact that the carriers have normal phenotypes and have even lead successful show careers.

  • D1D1 Dwarfs. Abort early in pregnancy

  • D1/D2; D1/D3 and D1/D4 foals aborted during pregnancy
Dwarfism and miniatures

• D2D2 Dwarfs. can live normal lives with some problems

• D2/D3; D2/D4 (live) and D2/D1 (aborted during pregnancy)

A.  B.  C.
Dwarfism and miniatures

- D3D2; D3D4 and D3D1 (aborted during pregnancy)
  A. 
  B. 
  C. 

- D4/D2; D3/D4 and D4/D1 (aborted during pregnancy)
  A. 
  B. 
  C.
Miniature horse parentage verification

- Breeders should be encouraged to provide proof of parentage of all foals.
  - Ensures the integrity of not only the herd book of the breeder but also the society data base
  - Ensures the integrity of the seller and clients will be prepared to pay a premium for proof of a bloodline.

- DNA is the technology of choice
  - A DNA profile is the only tamper proof form identification
  - Provides proof of identity in cases of theft

- Important to include both parents in the test, especially in closely related matings.
Miniature horse parentage verification

- Horse DNA profiles compiled using 12 STR markers
- Parentage only verified if 12 from 12 markers are matched.
In Summary

- Dwarfism is estimated to be present in over 50% of the population and affects all miniature horse bloodlines.
- ACAN gene mutations are the most common cause of dwarfism in the miniature horses.
- This is an unwanted recessive genetic trait. Many miniature horse registries try to avoid accepting miniatures affected by dwarfism, especially for breeding stock.
- Breeders should be encouraged to test their horses and make use of the information to make wise breeding (mating) decisions.
- Breeders must make the results of tests known to clients (Consumer Protection Act).
- Progeny of parents tested clear do not have to be tested again.
- Breeding should always be verified.
Thank you for listening.
Any questions?