

The white marking pattern in Boxers



Arja, Boxer, female, brindle/white



Benny, Boxer male, brindle/white



How are these two different?

Genetically they are the same:

- They are brindle
- They both have white markings S sw
- They have both inherited the gene S from one parent, and the gene sw from the other

Arja is registered with the Norwegian Kennel Club, as are both her parents



Benny isn't eligible for registration with the Norwegian Kennel Club, even though both his parents are registered



How can this be?

Father



Mother



These two are *Arja's* parents

Father



Mother



These two are *Benny's* parents

(These photos are just illustrations, but the dogs pictured have the same colors and marking patterns as his actual parents)

Why can't the boxer male **Benny** be registered?

- In Norway the breed clubs can apply for a registration ban on dogs with disqualifying faults.
 - In Norway there is a registration ban on offspring of boxers with more than 1/3 white
 - Even though more than 1/3 white is NOT a disqualifying fault according to the FCI standard
 - The Norwegian Boxer Club's general assembly of 2016 has voted to ask the Norwegian Kennel Club to lift this registration ban (which some breeders are strongly against).

Why can't the boxer male **Benny** be registered?

- Up until 1998/1991 there was no registration ban on boxers with more than 1/3 white.
- If the breeders wanted to, they could use a parent with two genes for white for breeding, and the resulting litter would have been registered in the NKK (The Norwegian Kennel Club)

More information on the two boxers:

- **Arja** is born 1997, she is from a litter of 9, her littermates had the following marking patterns (all were brindle):
 - Two solid coloured – S S (expectation 25%)
 - Four with white markings – S sw (expectation 50%)
 - Three white – sw sw (expectation 25%), registered without restrictions as the ban was not in place yet.

More information on the two boxers:

- **Benny** is born 2005, he is from a litter of 7, all his litter mates are brindle as well, and all have white markings – S sw (expectation 100%).
 - The combination whas done twice, and the second litter consists of 8 with the same color and marking pattern, as expected

Father **SS**



Mother **sww**

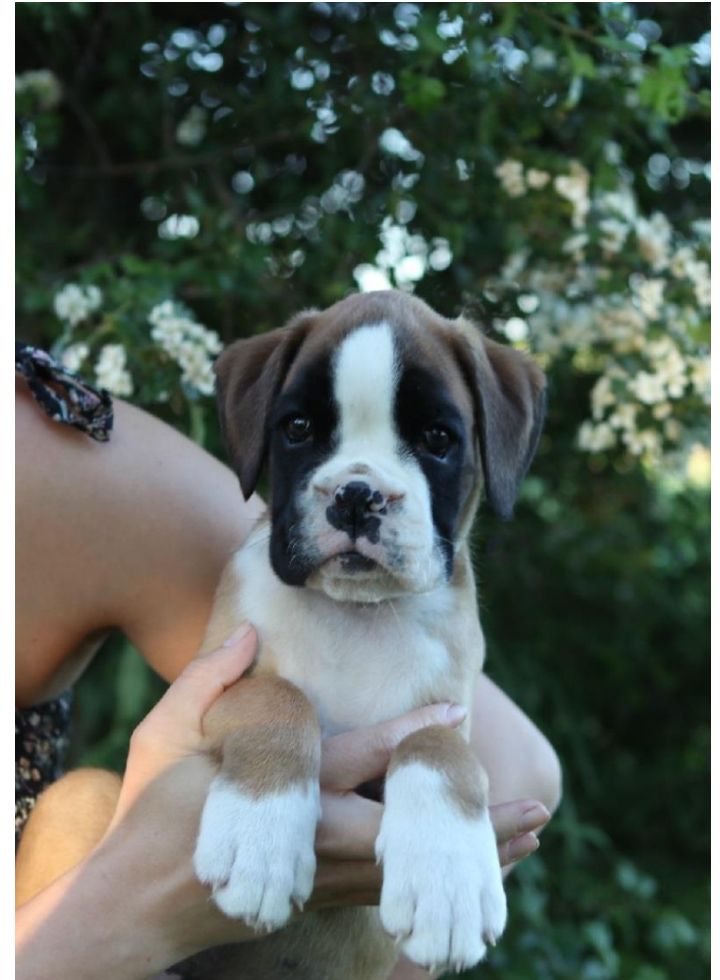


Kristoffer Hedström

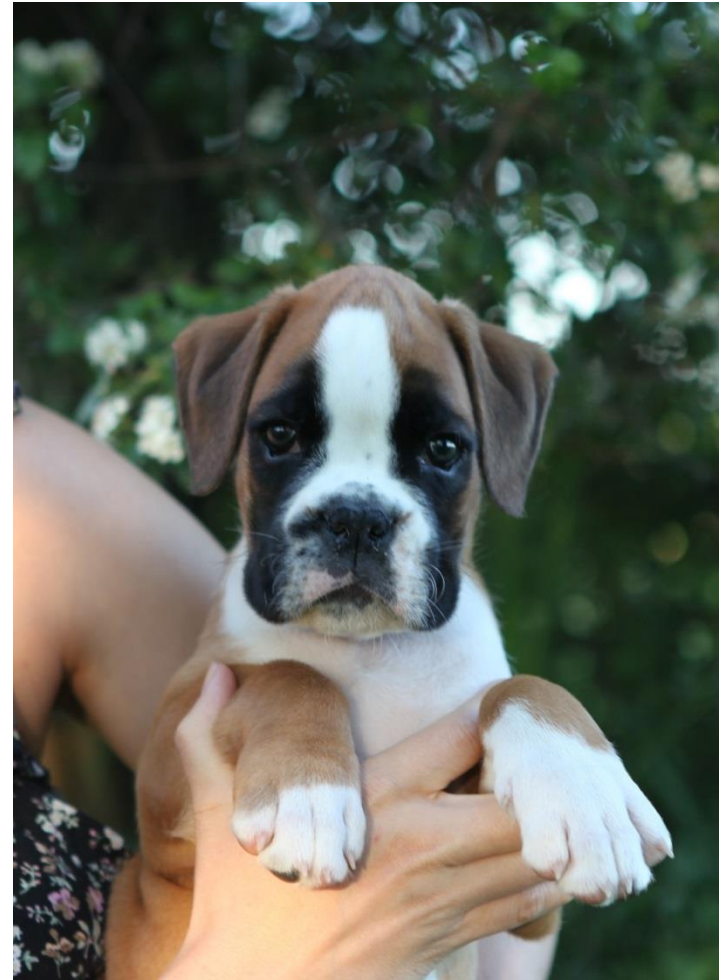
Sweden has a different set of rules

*these two are the parents of a litter registered in the Swedish Kennel Club in
2014*

Here are the offspring



All are registered in SKK (The Swedish Kennel Club)
like any other boxer



6 red males with white markings as expected (100%)

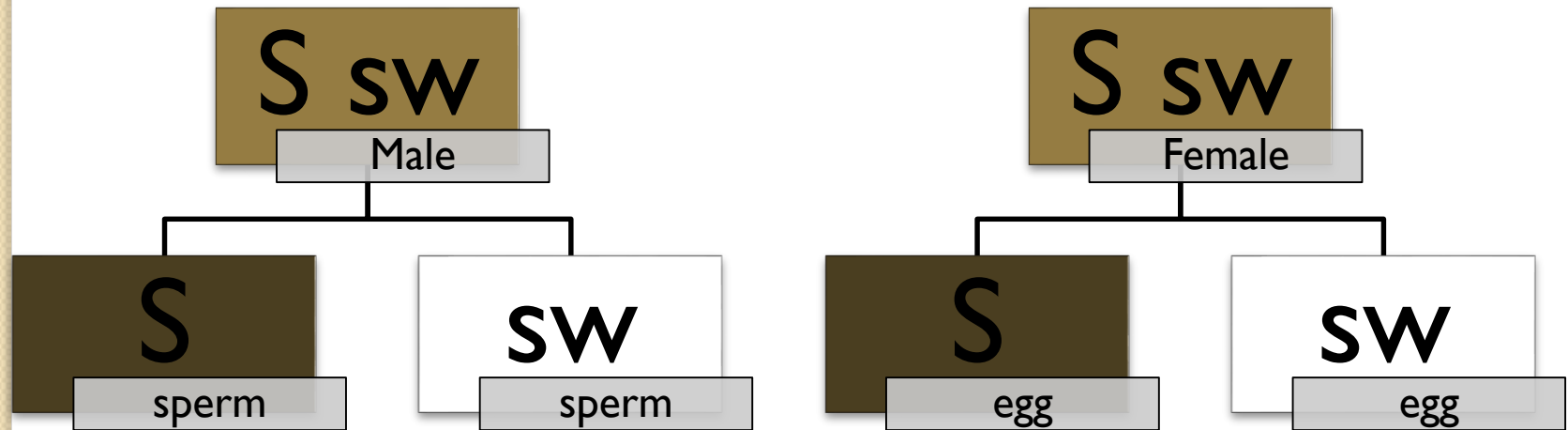




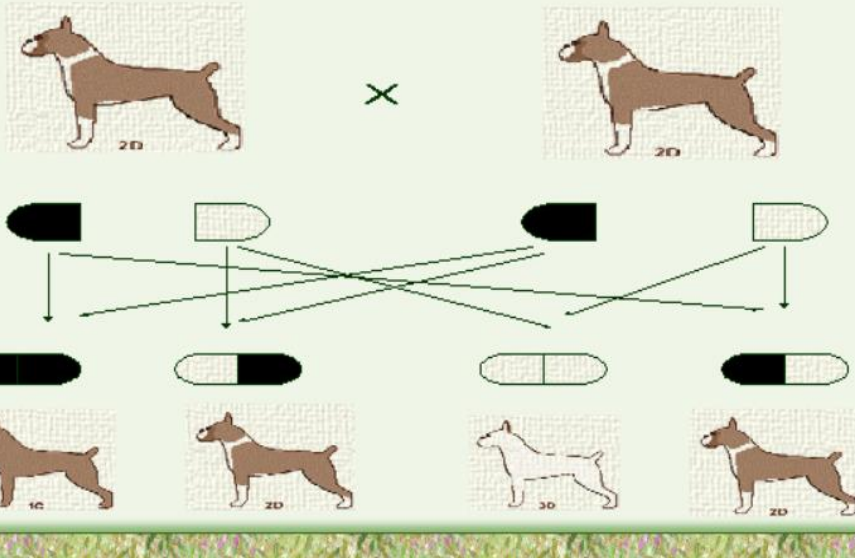
How is the white marking pattern inherited, and how can we avoid producing white puppies?

This figure illustrates the most common mating of boxers these days. Flashy mated to flashy.

Once the genes enter into the gametes (eggs and sperm) they never meet again.



Kombinasjonsmulighet 4



As you can see, a flashy boxer is a white parent to 50% of it's offspring

Here are the combination possibilities you have when mating two flashy boxers

Traditional crossing table for this combination

		<i>Father</i>	
		SW sperm	S sperm
<i>Mother</i>	SW egg	SWSW	Ssw
	S egg	Ssw	SS

Resulting puppies

with the expected ratio of white marking patterns



HOW CAN WE AVOID PRODUCING WHITE PUPPIES?

There is only one way

One parent has to be solid: SS, no combination with a genetically solid boxer will ever produce white puppies.

(A few boxers that look solid will have one copy of the sw gene and genetically have white markings – and a few boxers will look like they have the white markings, but be genetically solid SS)

Father sw sw

Mother S S



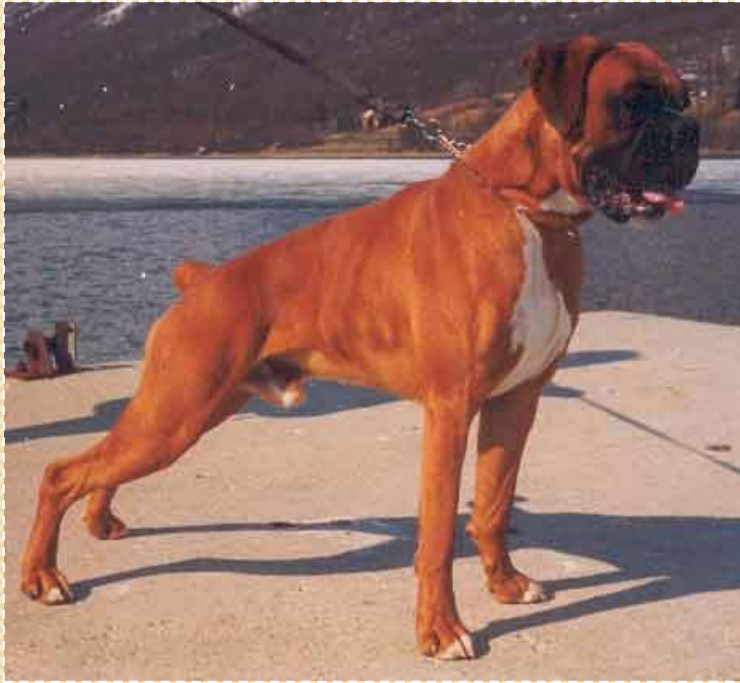
This combination will not result in any whites, but the whole litter will have white markings, they will be flashy, S sw

Traditional crossing table for this combination

		<i>Father</i>	
		SW sperm	S sperm
<i>Mother</i>	S egg	Ssw	Ssw
	S egg	Ssw	Ssw

Father S S

Mother Sw Sw



This combination will not result in any whites, but the whole litter will have white markings, they will be flashy, S sw

Traditional crossing table for this combination

		<i>Father</i>	
		S sperm	S sperm
<i>Mother</i>	SW egg	Ssw	Ssw
	SW egg	Ssw	Ssw

Father S Sw

Mother S S



**This combination will give us 50%
with white markings and 50 %
solids – no whites**

Traditional crossing table for this combination

		<i>Father</i>	
		SW sperm	S sperm
<i>Mother</i>	S egg	Ssw	SS
	S egg	Ssw	SS

Father S S

Mother S Sw



**This combination will give us 50%
with white markings and 50 %
solids – no whites**

Traditional crossing table for this combination

		<i>Father</i>	
		S sperm	S sperm
<i>Mother</i>	SW egg	Ssw	Ssw
	S egg	SS	SS

Mother S S

Father S S



The result will be a litter of solid colored boxers

Traditional crossing table for this combination

		Father	
		S sperm	S sperm
Mother	S egg	SS	SS
	S egg	SS	SS

Consequences of the registration ban

- It is not possible to use a white boxer for breeding, even if it can be done without producing white offspring.
- With this ban we only have 80 % of the population left to choose breeding animals from based on conformation, health and temperament.

Consequences of the registration ban

- About 20 % of the population is excluded from breeding for cosmetic reasons
- The registration ban does not prevent the birth of white puppies – they are born in the majority of litters because the preferred breeding animals (those that are doing well in the show ring) have the white marking pattern . Genetically they are S
SW

Consequences of the registration ban

- The golden rule is not to have regulations that are so strict that you exclude more than 50% of the population from breeding. For us that means we can exclude a maximum of 30% based on conformation, health and temperament. In other breeds the breeders can exclude 50% based on the same criteria.

Practical example of the consequence for a breeder

- Both parents are red with white markings
- 9 puppies, 6 males and 3 females
- 4 red with white markings
- 5 white
- Two of the three females are white



The breeder wants to keep a female puppy for her breeding program



Choosing a female in the litter

- 3 females to choose from
- 2 white – so they can't be bred from
- Has to choose the red and white – despite the fact that one of the white puppies is the best
- These puppies are now over a year old, and the white female is still the better of the three
- Health and temperament has to be good as well
- What if the red and white is not good enough in those areas, but the two whites were?

References

- <http://www.steynmere.co.uk/Boxerama74.html>
- <http://www.steynmere.co.uk/WHITE-MARKINGS.html>
- http://www.iessc.org/html/genetics_-_a_study.html
- <http://www.lsu.edu/deafness/Karlsson%20Nat%20Genet%20MITF%20piebald.pdf> (less than 2%)
- <http://jhered.oxfordjournals.org/content/95/6/526.long>
- <http://jhered.oxfordjournals.org/content/98/5/549.long>
- <http://fci.be/en/nomenclature/BOXER-I44.html>

What does the breed standard say?

Germany is the country of origin, and the German Boxer Club is responsible for the FCI standard:

- The breed standard is the «blueprint» for our breed, and describes the ideal boxer that breeders are trying to create

What does the breed standard say?

About the head:

- The dark mask is confined to the muzzle and must be in sharp contrast to the colour of the head so that the face does not appear sombre.

About Colour

- Fawn or brindle :
- Fawn comes in various shades from light fawn to dark deer red but the most attractive shades are in the middle range (red fawn). Black mask.
- The brindle variety : fawn background of varying shades has dark or black stripes running parallel to ribs. Stripes must contrast distinctly to ground colour.
- White markings should not be discarded. They can be quite pleasant

Which colour faults are mentioned in the FCI standard?

Generally: Any departure from the foregoing points should be considered a fault and the seriousness with which the fault should be regarded should be in exact proportion to its degree and its effect upon the health and welfare of the dog.

Faults relating to colour:

Colour of coat : Mask extending beyond muzzle. Stripes (brindling) too close together or too sparse. Sooty ground colour. Mingled colours. Unattractive white markings such as a entirely white head or white on one side of the head. Other colours and white markings exceeding one third of the ground colour

Which faults are disqualifying?

DISQUALIFYING FAULTS

- Aggressive or overly shy.
- Any dog clearly showing physical or behavioural abnormalities shall be disqualified.
- N.B.: · Male animals should have two apparently normal testicles fully descended into the scrotum.
- Only functionally and clinically healthy dogs, with breed typical conformation should be used for breeding

Strangely enough – a natural bobtail is a disqualifying fault in the Norwegian and German version of the FCI breed standard, but not in the FCI official version on the FCI webpage (English language)

Faults regarding colour or marking patterns are not mentioned among the disqualifying faults

Food for thought

- All boxers with white marking patterns is a white parent to 50% of it's offspring.
The genetic makeup beeing $S sw$. The S gene will go to 50% of the gametes – and the other 50% will be sw (and a white parent to the resulting puppies)
- Why is it OK to produce white puppies, but not OK to breed from them in a way that will not produce whites? (Combining a solid SS boxer with a white $swsw$ boxer will always result in 100% flashy offspring)

And a question in the end

- Can we afford to continue to discard around 20% of our boxer population on cosmetics alone?
- Is a cosmetic fault really worse than one that compromises the dog's functionality?