

## Papillon breeds are not true breeds, but varieties

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**Abstract.** En/en is a major locus, affecting the whole body aspect in rabbits. There are many rabbit breeds which are characterized by a broken color pattern, and are called Papillon, e.g., Giant Papillon, Rhinelander, Small Papillon, English, Dwarf Papillon. Papillon breeds are rabbits having color traits that are not faithfully transmitted to their descendants and they always segregate. Judging scientifically, the Papillon breeds should not be considered true breeds. For exhibition purposes, and for lovers of this art, the Papillons should be accepted as breeds, and they are.

**Key Words:** rabbit genetics, *Oryctolagus cuniculus*, En gene, broken, solid, Charlie, Janet.

**Papillon Breeds.** There are many rabbit breeds which are characterized by a broken color pattern, and are called Papillon, e.g., Giant Papillon, Rhinelander, Small Papillon, English (Figure 1), Dwarf Papillon (Figure 2). Papillon breeds are rabbits having color traits that are not faithfully transmitted to their descendants and they always segregate.

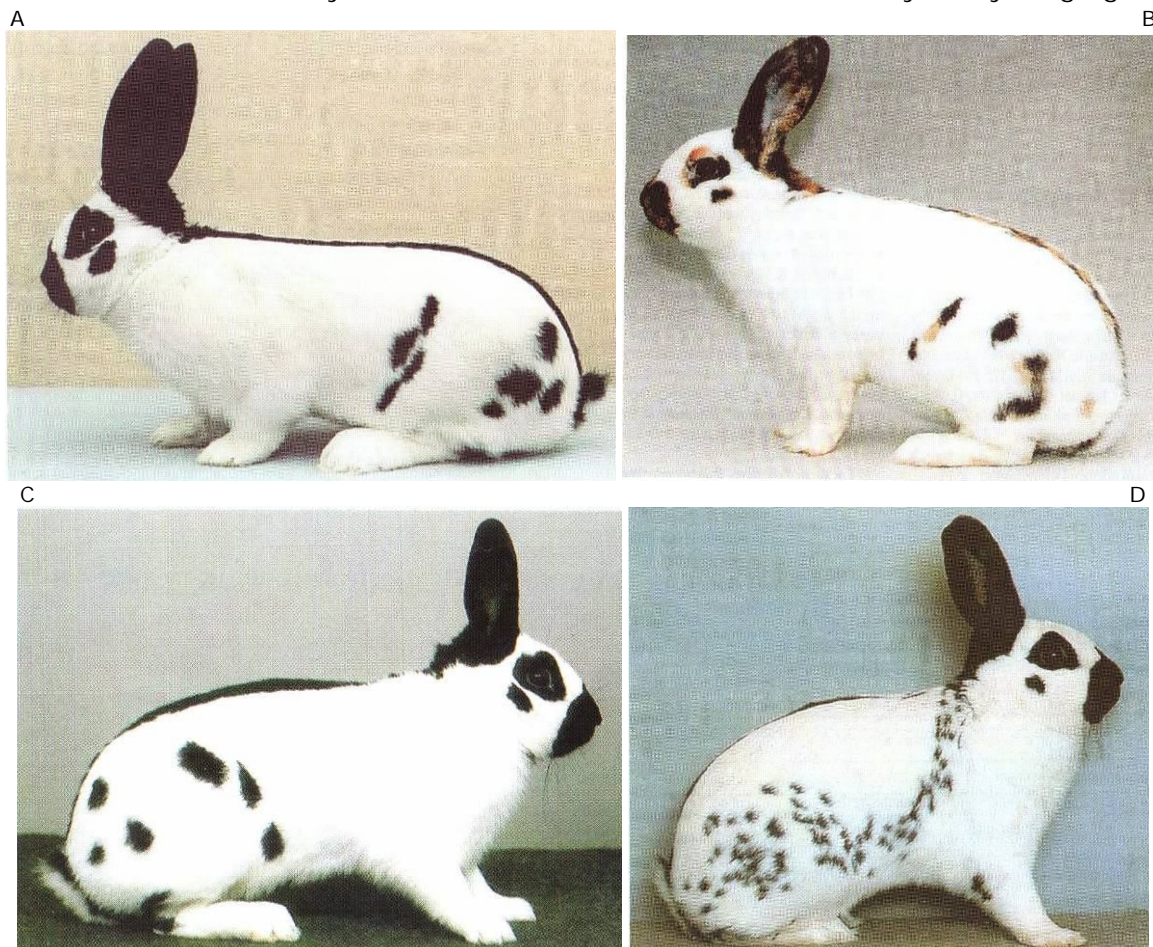


Figure 1. Large, average and small sized Papillon breeds: Giant Papillon (A), Rhinelander (B), Small Papillon (C), English (D) (European Association of Poultry, Pigeon and Rabbit Breeders 2003).

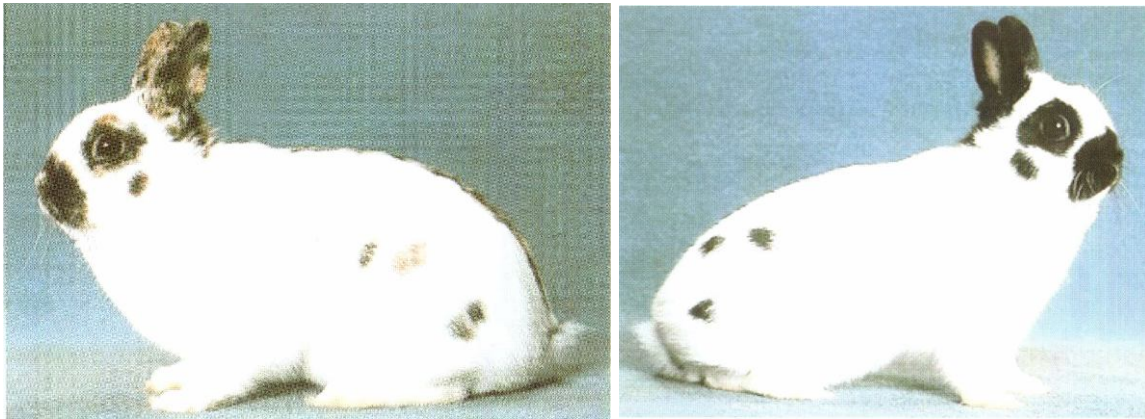


Figure 2. Dwarf Papillon varieties (European Association of Poultry, Pigeon and Rabbit Breeders 2003).

**The Genetics of the Papillon rabbit.** All the Papillon breeds have three basic morphs, namely: broken, Charlie and solid (Figure 3). Solid rabbits are also called Janet (e.g., Blue Janet, Black Janet, Havana Janet). The two extremes, Charlie and solid phenotypes are homozygous, while the broken phenotype is heterozygous. The inheritance of these three color patterns is presented in Figures 4 and 5 and Table 1.

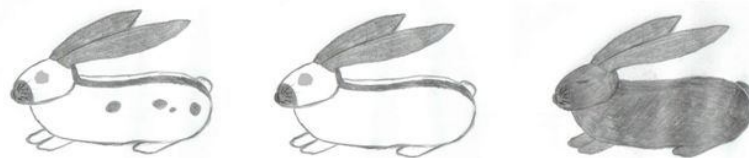


Figure 3. The three morphs which segregate from the Papillon rabbits, from the left to the right: broken, Charlie and solid (original).

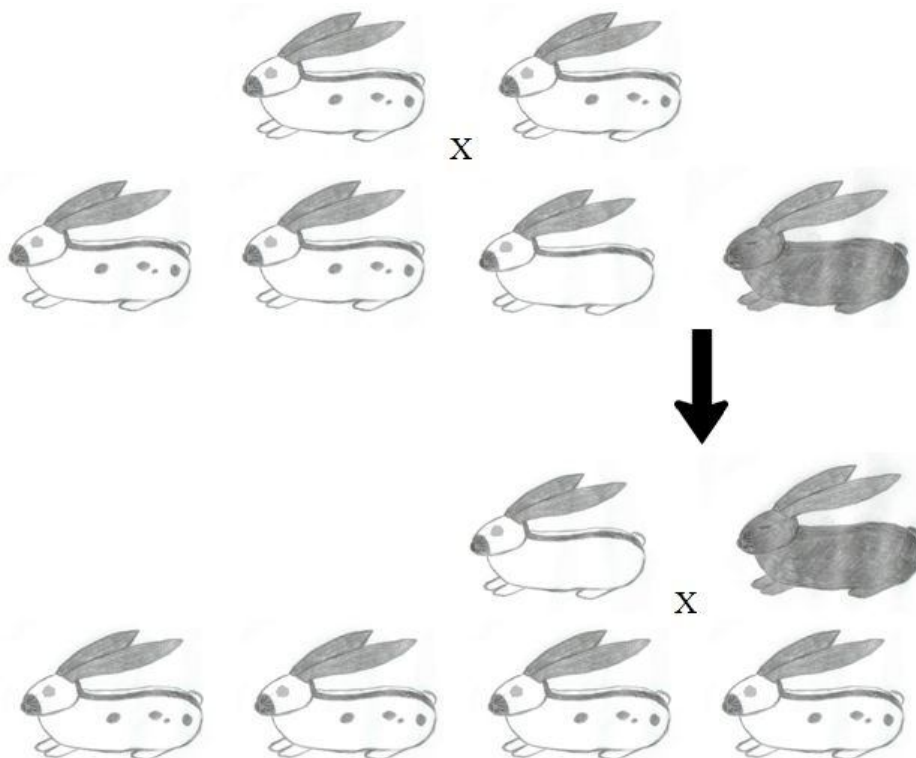


Figure 4. The inheritance of the Papillon pattern, Papillon rabbits being one-locus hybrids (original).

As we can see in Figure 5, two Charlie parents produce 100% Charlie offspring, while two solids produce 100% solids. A Charlie parent crossed with a solid parent produces 100% broken kits.

The situation is different for the other types of crossing. Most commonly, the hobbyists breed two broken parents, resulting in 50% broken, 25% solids, and 25% Charlies. However, this is not the best way to produce optimum numbers of broken rabbits for exhibitions. Unfortunately, for this reason, many Charlie and solid kits end their life at one day old in the trash. The best way to avoid the barbarism is using a solid parent and a Charlie one (see Figure 4 and Table 1), producing 100% broken rabbits.

Breeding a solid with a broken rabbit we obtain 50% solids and 50% broken, while from a Charlie and a broken we obtain 50% Charlies and 50% broken.

Of course, these figures are theoretic and for low number of kits produced they are not confirmed in the field. However, it is sure that two Charlie parents produce 100% Charlie offspring, two solids produce 100% solids, while a Charlie parent crossed with a solid parent produces 100% broken kits, no matter how many kits are introduced in the statistics (Rabbit Color Genetics, [www.thenaturetrail.com](http://www.thenaturetrail.com)).

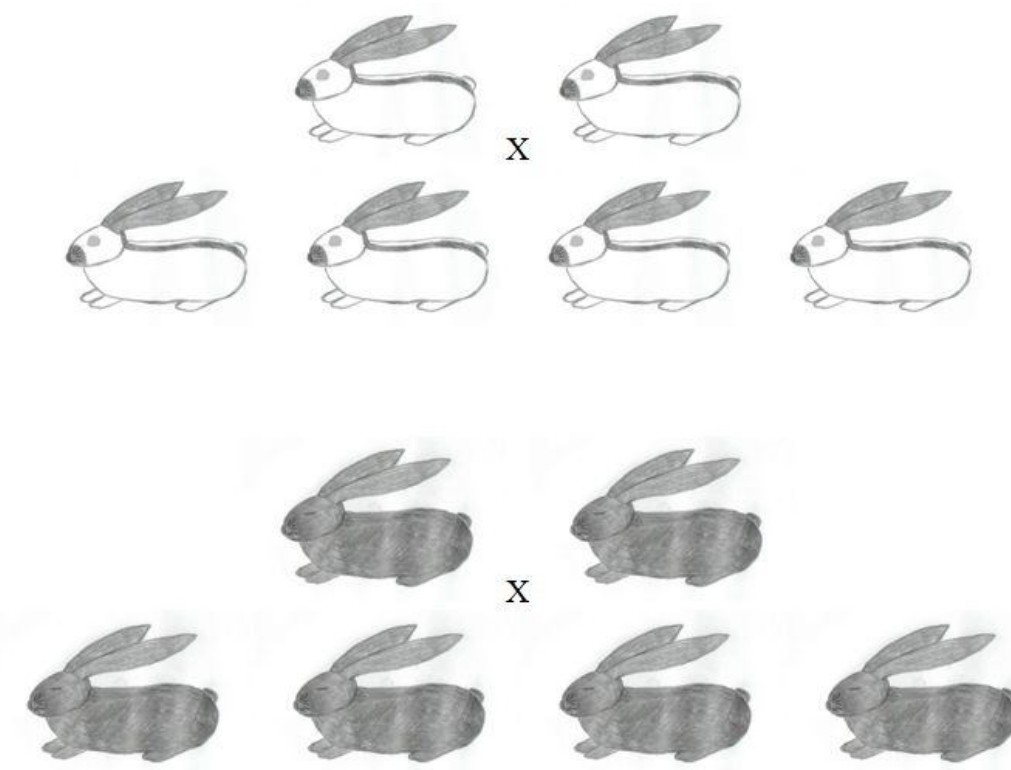


Figure 5. The inheritance of Charlie and solid patterns: the two types which should be considered true breeds in terms of one-locus purity (original).

**What is a breed?** Despite the centrality of the idea of "breed" to animal husbandry and agriculture (Blaga & Burny 2014), no single, scientifically accepted definition of the term exists (Rischkowsky & Pilling 2007). A breed is therefore not an objective or biologically verifiable classification but is instead a term of art amongst groups of breeders who share a consensus around what qualities make some members of a given species members of a nameable subset (Lush 1994). However, trying to define it, a breed is a specific group of domestic animals having homogeneous phenotype, homogeneous behavior, and/or other characteristics that distinguish it from other animals of the same species. Breeds are formed through genetic isolation and either natural adaptation to the environment or selective breeding, or a combination of the two (Rischkowsky & Pilling 2007).

Table 1

The inheritance of the three basic color patterns observed in Papillon breeds

<b>Broken x Broken</b>		<b>Broken Parent</b>	
	<b>En Gene</b>		<b>en Gene</b>
<b>Broken Parent</b>	<b>En Gene</b>	En En Charlie	En en Broken
	<b>en Gene</b>	En en Broken	en en Solid

<b>Solid x Solid</b>		<b>Solid Parent</b>	
	<b>en Gene</b>		<b>en Gene</b>
<b>Solid Parent</b>	<b>en Gene</b>	en en Solid	en en Solid
	<b>en Gene</b>	en en Solid	en en Solid

<b>Solid x Broken</b>		<b>Solid Parent</b>	
	<b>en Gene</b>		<b>en Gene</b>
<b>Broken Parent</b>	<b>En Gene</b>	En en Broken	En en Broken
	<b>en Gene</b>	en en Solid	en en Solid

<b>Charlie x Solid</b>		<b>Charlie Parent</b>	
	<b>En Gene</b>		<b>En Gene</b>
<b>Solid Parent</b>	<b>en Gene</b>	En en Broken	En en Broken
	<b>en Gene</b>	En en Broken	En en Broken

<b>Charlie x Broken</b>		<b>Charlie Parent</b>	
	<b>En Gene</b>		<b>En Gene</b>
<b>Broken Parent</b>	<b>En Gene</b>	En En Charlie	En En Charlie
	<b>en Gene</b>	En en Broken	En en Broken

<b>Charlie x Charlie</b>		<b>Charlie Parent</b>	
	<b>En Gene</b>		<b>En Gene</b>
<b>Charlie Parent</b>	<b>En Gene</b>	En En Charlie	En En Charlie
	<b>En Gene</b>	En En Charlie	En En Charlie

The most important characteristics of a breed is its genetic consolidation, more exactly, the extent of which the breed shows a uniform phenotype over generations (Petrescu-Mag et al 2014). Returning to Papillon rabbits, the official standard defines the broken color pattern (UGCPPAMR 2010). In exhibitions, the judge evaluates broken only, the broken pattern being the only accepted morph for Papillon breeds. However, the standard trait, the broken one, considered a defining element of the breed, is not faithfully transmitted to their descendants and they always segregate. For this reason, scientifically, Papillon breeds should not be considered true breeds. Even so, we all know



that they are officially accepted as breeds and they are among the most popular ones. Why? There are at least two reasons to accept them. 1) Aesthetically, Papillon breeds are among the most beautiful rabbits in the world and they are loved by millions of hobbyists (Figure 6). 2) Genetic variation at the level of one locus,  $En/en$  (maybe there are few nucleotides involved in that mutation), is not significant if we compare two huge genomes.

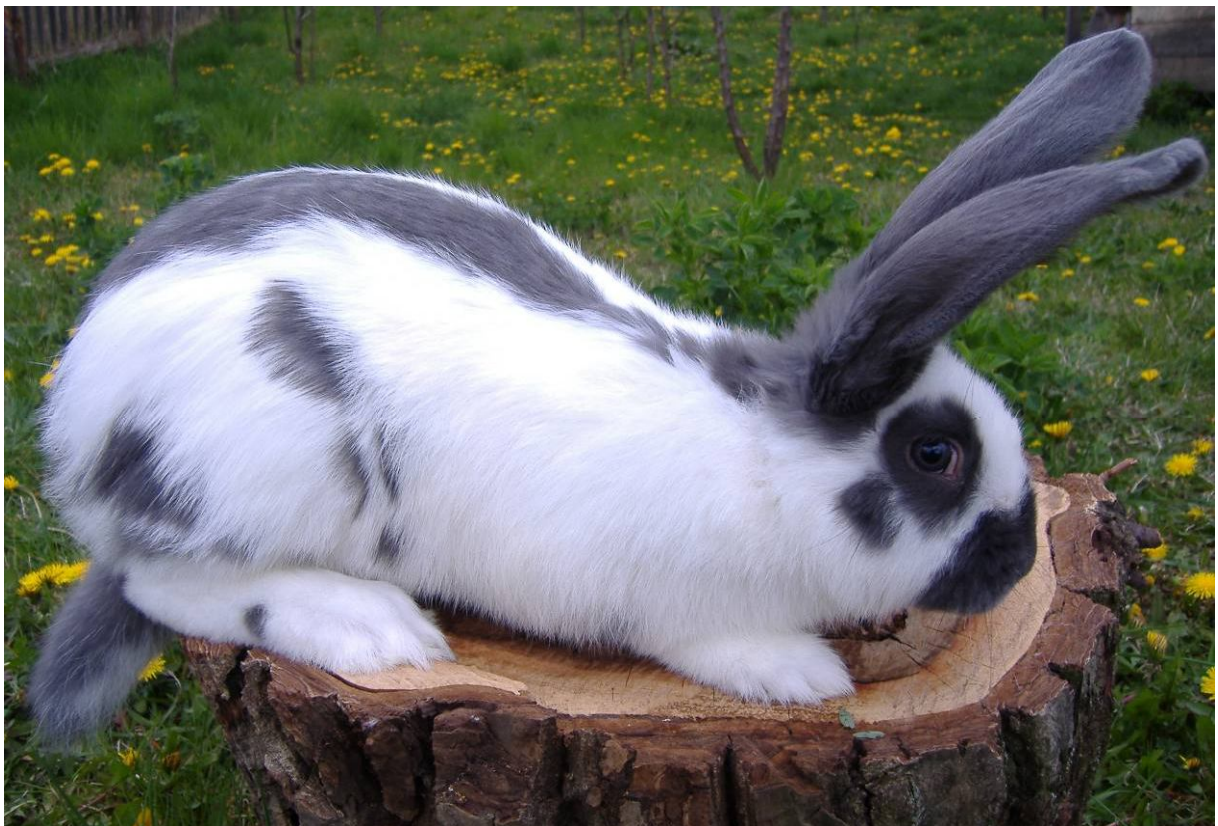


Figure 6. Giant Papillon: black and blue varieties (original).

**Conclusions.** En/en is a major locus, affecting the whole body aspect in rabbits. Judging scientifically, the Papillon breeds should not be considered true breeds. For exhibition purposes, and for lovers of this art, the Papillon rabbits should be accepted as breeds, and they are.

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