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Ecological Advantage of White Horses in the Camargue

For centuries white horses have been considered magical, regal and noble creatures. For that reason it is not surprising that the rarity of the coat coloring has been artificially selected for in many populations even though it seems that the white horses pay a considerable price for their rare external beauty. But what if the white colour in fact has an advantage in the equine's natural environment?

The wild horses of the Camargue in Southern France always possess a grey or white coat coloring and black skin. Much research has been conducted to inquire about the genetic background of this phenomenon. Investigation found that the color gene mutation present in white horses is an autosomal dominant trait (Pielberg *et al.* 2008). White horses carry a specific 4.6-kilo base pair duplication mutation in intron 6 of the syntaxin-17 (STX17) gene (Pielberg *et al.* 2008). The horses with this mutation are all born with a dark coat and slowly whiten over the years until they are completely white by approximately age eight (Pielberg *et al.* 2008). As with all mutations, the allele can only remain viable in the natural population if the carrier obtains an advantage in terms of fitness by expressing the particular trait. This raised the question; what is the advantage of having a light coat color in the Camargue?

Several hypotheses to answer this complex question have been suggested yet only found weak support if any. First, the coloring does not seem to function as an anti-predatorial tactic by disguising the horse in its environment as the light coloring is easily detected within the grasslands and lush marsh typical of the Camargue (Duncan, 1983). Furthermore, the idea that the coat color aids to cool the horses during hot summer temperatures contradicts with other herds living in equally or even hotter environments. Moreover, the light coat color has been found to have a strong linkage to sun sensitivity and melanomas leading to cancer (Horvath *et al.* 2010). Especially white horses that carry a loss of function mutation in the ASIP (agouti signalling protein) gene in addition to the previously mentioned STX17 gene show a higher incidence of melanomas (Pielberg *et al.* 2008). In almost all cases studied by Pielberg (2008), horses over the age of fifteen years who carried these mutations had at least several benign tumours, if not malignant. In turn it seems that white coat colour decreases the fitness of the individual horse.

In an attempt to answer the question: “What is the ecological advantage of a white coat color?”Horvath *et al*. (2010) lead field studies involving horses of different coat colors and horse flies. Horvath had conducted earlier research in light polarization and relative fly attraction behaviour. Extending his research onto the effects of coat coloring on fly resistance was a natural progression of his investigation. Previous studies on the horse fly (Diptera Tabanidae) concluded that individuals are attracted to polarized light only. Polarized light is light that is reflected from a shiny non-metallic surface (Horvath *et al.* 2004). The flies seem to use reflected polarized light to locate their targets, known as polarotactic method (Horvath *et al.* 2004). This tactic is significant because it allows female Tabanids to recognize bodies of water to lay her eggs nearby as well as to find animals via their polarization for blood meals (Horvath *et al.* 2010). Most equine coats are in the dark colour spectrum and easily polarize in the light. White horses’ coats however are depolarizing even in bright sunlight and therefore make it less likely for the flies to detect the horses via the polarotactic method. The experimental data showed a strong decrease in flies harassing light coloured horses versus darker coloured ones. In fact, 3.7 times more flies were attracted to dark horses compared to white ones (Horvath *et al.* 2010). The data showed a high significance with $p>.0001$ (Horvath *et al.* 2010).This information was collected via four separate experiments on white and dark (dark brown/black) horses as well as on polarizing and depolarizing fabric samples and oil traps to classify the Tabanids behaviour more closely. As a control, behavioural assays involving fabric samples of polarizing and depolarizing natures supported that the flies did not simply prefer the dark color or the increased heat dark coloured horses gave off (Horvath *et al.* 2010).

To further support Horvath’s findings, Duncan (1983) formerly studied the effects of horse deltaic wetland with dense Tabanid populations (Duncan, 1983). The Camargue was divided into eight areas of different plant structures and communities ranging from deep marshes to coarse grasslands. The areas were categorized into levels of high quality food (green plant matter) to determine the most popular regions (Duncan, 1983). As expected, the primary means of habitat selection by the horses was to maximize their intake of quality food (Duncan, 1983). The maximal intake of high quality of forage directly translates into fitter individuals. As one antagonist of these lush foraging areas, the Tabanid flies also inhabit these environments. The relative densities of these populations were also considered. As their only defence mechanisms against Tabanids, horses can swish their tails, kick, roll, shake, or bite the insects (Horvath *et al.* 2010). Unmistakably this is a stressor for the equine and consequently it is clear that a method to reduce fly stress by the horse

would in fact convey a large advantage to the equines' fitness. As a consequence, in the Camargue having a light coloured coat decreases the fly stress for the individual horse and the herd of white horses as a whole. Decreased fly stress on individuals and the herd translates into a decrease in parasitic exposure, increased ability of the immune system to function, less potential infections among newborns and a decrease in parasite load of the heard (Duncan, 1983). This is important as the Tabanid flies are well known vectors for blood borne diseases, especially equine infectious anaemia virus (Horvath *et al.* 2004). The blood meals of the flies can also lead to dangerous levels of blood loss in the equine when exposure is especially high (Duncan, 1983). As Duncan found, as the flies become more aggressive during certain periods of the day, the horses will flee to a shaded, forage poor area in order to evade the antagonists (Horvath *et al.* 2010). In fact, it was found that dark horses spend 2.2 times more time in shaded areas resting compared to white horses, especially during the early afternoon when the Tabanids were most active (Horvath *et al.* 2010). Consequently a stronger fly attraction of dark coloured horses showed a higher decrease in grazing and therefore a decrease in productive foraging times when compared to white horses. This in turn should theoretically decrease the long term fitness of the dark horses in comparison to the white.

As the work by Horváth shows with support from Duncan's studies on horses' habitat selection, light coat colour conveys an ecological advantage in the Camargue. The mechanism by which this partial immunity to Tabanid flies is produced is due to the polarization vision and positive polarotactic behaviour of the horse flies, causing them to avoid white horses (Horvath *et al.* 2010). In this sense, a rare mutation that has been selected for by humans has actually produced a surprising ecological advantage in a particular environment against a specific disease vector and stressor; the Tabanid fly. It has therefore been shown that white colour can, in certain situations, increase the fitness of the horse.

Work Cited

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