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Inheritance of insect bite hypersensitivity in Friesian horses

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Introduction

Insect bite hypersensitivity, also called 'sweet itch', 'Queensland itch' or Culicoides hypersensitivity' or 'summer eczema', is a recurrent, seasonal dermatitis of horses (Kleider & Lees 1984). It is the most common hypersensitivity and pruritic skin disorder of the horse and it is worldwide in distribution. The major cause of IBH is an allergic reaction, to the bites of midges belonging to the genus Culicoides. (Fadok 1997, Halldorsdottir 1991). IBH is caused by different Culicoides species in different regions of the world. It has been shown that IBH has the characteristics of Type I and Type IV allergic dermatitis. Type I is an acute hypersensitive reaction. Type IV is delayed type hypersensitivity. Clinical signs are seasonal (spring through fall) in temperate climates, paralleling the presence of insects. Also clinical signs are regional, paralleling the preferences of the insects; the midges are likely less seen at coastal areas. The disease may be seen in any breed, in all ages, and in either sex. However, certain breeds appear to be at increased risk: Icelandic, German Shire, ponies, Arabians, Connemaras, and quarter horses. Most horses develop signs at 3 to 4 years of age. Coat and color is not a risk factor.

Differences between families in IBH-prevalence have been demonstrated and Lange (2004) has estimated a moderate heritability for IBH-prevalence in Icelandic horses. The susceptibility of horses to IBH has been reported to segregate with equine leukocyte antigens (ELA) Bel, Be8, W1, W7 and W23 (Fadok 1997, Halldorsdottir 1991). In a study done by Von M. Unkel et al. (1986) observations on 984 Island horses from 36 sires in the district of the Rheinisches Pherdestambuch were analysed in order to test for a genetic basis of IBH in Island horses. Assuming polyfactorial inheritance, heritability of liability for the trait was estimated as well as heritability ranged from 0 to 0,24 (approximately 0,12) on the observation scale. The cure for IBH hasn't been found yet. This is an important reason to breed against IBH in order to reduce the occurrence of this disease in the population..

Also in Friesian horses IBH is occurring, but there has not been any study to the prevalence. An option for reducing the prevalence in the Friesian horse breed might be selection, provided that the disease is heritable.

The aim of the study is to estimate the heritability of IBH in the Friesian Horse population

Material and methods

In the year 2004, from half June, till the beginning of October, 2824 Friesian mares have been examined for insect bite hypersensitivity at meetings for inspection of their foals. The examination was done by 8 different inspectors. Furthermore the way of housing, the date of examination and the postal code of the residence of the horse. The postal codes were divided into country regions West, Middle, South, East and North..

The score was on a 3-point scale:

- 1 indicating no IBH,
- 2 very mildly affected (Mane and/or tail itching without any skin damage).
- 3 when clear signs of IBH were seen. (Mane and/or tail itching with much skin damage).

Age classes were defined corresponding to age at inspection in years. The age was calculated from the inspection date and the birth date. Nine classes were defined of which the last contained 16 years and

older. The pedigree file needed for this study has been supplied by “Het Friesch Paarden-stamboek.” Data screening was performed using the statistical package SAS, version 9.1. Significance of fixed effects to be included in the model of analysis was investigated using Proc GLM of SAS (SAS, Inst, 2002). Although the scores have a discrete character, the data was assumed to be normally distributed .

The estimation of the variance components and the heritability of insect bite hypersensitivity was performed by a linear animal model and the residual maximum likelihood (Reml) using the package ASREML (Gilmour, 2003).

The model contained the fixed effects: Inspector, month of scoring, age category, type of housing, area, month of scoring within inspector, an interaction between area and type of housing and as a random effect the animal.

Results

Table: average percentage of scores for IBH

Score	1	2	3
Percentage	81,97	3.87	14.16

About 18% of the mares scores had some form of IBH. Animals from the costal area had lower incidence of IBH. All the effects included in the model were significant. There is a tendency for higher scores throughout the season, but this was not significant. The significant interaction between area and way of housing showed that animals who are housed indoor in the South and the East have a higher score than animals who are housed indoor in the West. It could be possible that animals that are habituated in the South and the East are housed indoor, because they have IBH. In the West they are housed indoor not so often for that reason.

The heritability, $h^2 = 0.05703 \pm 0.030$ with a $\sigma\epsilon^2$ of 0.2255 and $\sigma\alpha^2$ of 0.1363E-01.

When the score 2 and 3 were combined into one class indicating having IBH, then the h^2 became 0.073 (s.e.= 0.03).

Discussion

The heritability estimate of IBH in Friesian horses in this study is comparable to the one found by Kapell (2005) in Shetland horses of 0.065. These estimates are much lower than the one found by Lange in a study on about 500 Icelandic horses. In her study the incidence of IBH was much higher; 30% , while the incidence in the Friesian horses was 18%.

Although the scoring variable is a categorical trait, it is analyzed as it was a linear trait. It appeared that a maximum likelihood procedure is not appropriate to estimate variance components from a threshold model. The obtained heritability is affected by the incidence of IBH in the population and an underlying heritability can be calculated, which is independent of the incidence in the population, and expresses the liability of insect bite hypersensitivity.

The underlying heritability ranged from 0.22 to 0.29 for the 3-class and for the 2-class observation resp. The higher heritability when the IBH-classes were merged indicates that genetically there is no difference between the IBH-classes.

Conclusion

The incidence of insect bite hypersensitivity in Friesian horses is 18% in this study. The estimated heritability was 0.07, which indicates that there is a genetic background for IBH.