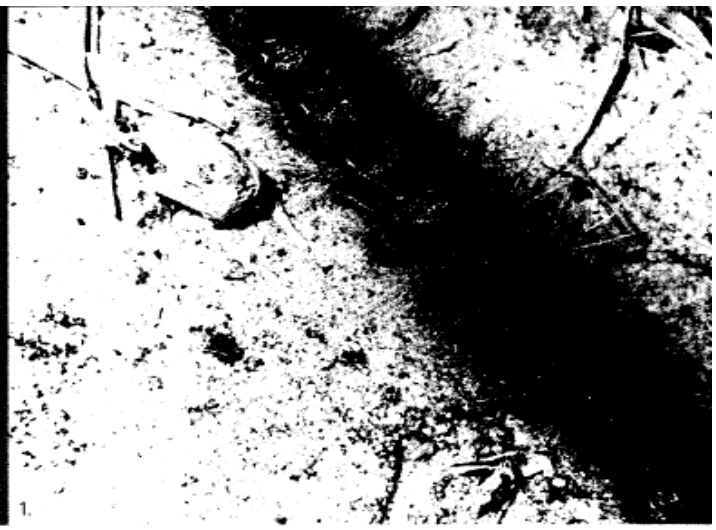
Caterpillars are Aborting our Mares



1.

Article compiled by Francene Neuendorf

The following article is based on contributions from Professor Tom Tobin of Kentucky USA (www.thomastobin.com) and Dr Nigel Perkins AusVet Animal Health Services QLD Australia (www.ausvet.com.au) in regards to the link between foal abortions in horses and 'fluffy' processionary caterpillars.

EQUINE AMNIONITIS AND FETAL LOSS (EAFL)

During the winter of 2004 a number of abortions were reported in Thoroughbred and Quarterhorse broodmares in Australia that involved an unusual and consistent clinical and pathological appearance. Abortions were detected from mid pregnancy to term.

There were a number of characteristics of the abortions that were indicative of what came to be known as EAFL. Mares generally did not show any signs of illness prior to abortion and continued to eat and behave normally with the exception of mild discomfort right around the time of expulsion of the foetus. Abortions appeared to be due to bacterial infection of the foetus and the surrounding foetal membranes, the translucent inner water-bag or amnion. Most cases showed thickening and reddening and occasionally development of adherent yellowish plaques of material that involved the portion of the umbilical cord that lay within the inner water-bag or amnion and the amnion itself. The outer red, velvety chorioallantois was often unaffected though in some chronic cases where the infection appeared to have been continuing for weeks prior to abortion the inflammatory changes had extended through amnion and involved the outer velvety chorioallantois. Changes in aborted foetuses on post-mortem examination were variable and non-specific and considered to be due to inflammation resulting from bacterial infection. A range of unusual and normally non-pathogenic bacteria were recovered on culture of samples from uncontaminated foetal stomach or lung or amnion/umbilical cord.

Based on her review of the scientific literature on caterpillars and equine abortions, a QH breeder in NSW e-mailed Professor Tobin at the University of Kentucky concerning the possible role of caterpillars in the apparently caterpillar related abortions observed on her farm.

The first document Professor Tobin reviewed was dated December 1st 2004. This document connected the 2001 epidemic caterpillar related abortions in Kentucky, known as the Mare Reproductive Loss Syndrome (MRLS), to the dated cyanide theory. Working closely with the QH breeder, and Dr. Nigel Perkins in Australia, Prof. Tobin contacted the relevant authorities and brought them up to date on the specific mechanism of the caterpillar related abortions in Kentucky, MRLS.

In particular, Professor Tobin drew attention to a paper of his that showed that the Kentucky caterpillars produced abortions in mares, as he said, "on dose, on schedule, and on time, and closely following an unusual probabilistic mathematical equation". He then reviewed an early draft of Dr. Perkins overview of the Australian EAFL (Equine Amnionitis and Fetal Loss) abortions.

Professor Tobin was careful to point to the many parallels between the Australian and Kentucky abortion syndromes. In both syndromes, exposure to caterpillars had occurred. In both syndromes the mares show little evidence of illness, other than the abortions. In both Kentucky and Australia, the pathological changes in the aborted fetuses were so similar as to be essentially identical. In Australia, the bacteria recovered from the fetuses consisted of "a range of unusual environmental bacteria". For Professor Tobin, this was an absolutely key finding, and closely matched the MRLS experience of the Kentucky researchers.

As well showing that the MRLS in Kentucky had followed a very unusual probabilistic mathematical model, Professor Tobin had proposed a very simple mechanism for the Kentucky abortions. He and his colleagues had proposed that the Kentucky Mare Reproductive Loss Syndrome was caused by random (probabilistic) intestinal and then blood vessel penetration by the very fine barbed hairs (called setae) on the caterpillars.

The theory was that these setae, well-known to penetrate moving tissues, also entered the bloodstream and distributed, much like drug molecules throughout affected mares, and in so doing carried environmental bacteria throughout the mare, including most importantly to the fetus. The rate at which these setal fragment penetration and redistribution events occurred would be directly related to the intensity of the caterpillar exposure, with heavy (Kentucky 01) exposure to caterpillars rapidly aborting all exposed pregnant mares.

The reason that the environmental bacteria carried on these distributing setal fragments cause problems in the fetus is simple. In most tissues of the mare, the immune response makes short work of small numbers of these environmental bacteria. The equine fetus, however, as every horseman knows, is born immune deprived, and gets its antibodies from the mare's colostrum. Not alone is the fetus unable to mount an effective immune response; in point of fact, it does not particularly need one, since it lives in what is normally an immunologically protected environment, courtesy of the mare.

What the absorbed and distributed caterpillar setal fragment does is short-circuit the mother's defenses, and rapidly carries small numbers of environmental (or other) bacteria essentially directly to the fetus. And

1. Processionary caterpillars
2. Processionary caterpillars in procession
3. Processionary caterpillar nest
4. Aborted foal

2

3.

4.

since there is no effective immune response in the fetus, the bacteria rapidly proliferate, and the infected fetus is aborted.

And, of course, this setal fragment transportation mechanism is entirely nonspecific. It carries, through the mother's bloodstream, very small numbers of bacteria on the setal fragment, which distribute to the fetus through the circulatory system. The late term fetus receives about 15% of the mare's cardiac output (blood flow), so about one in seven of the distributing setal fragments wind up delivered to the late term fetus. Once delivered, the setal fragment lodges in the fetal membranes and, as the mother or the fetus moves, the barbed fragment again migrates through the fetal membranes, carrying the environmental bacteria into the fetus, where they then proliferate, unchecked by any effective immune system

This is a very simple mechanism, and only requires that the fragment be barbed and be small enough to allow distribution through the circulatory system. If the setal fragment was hollow it would also be a more effective passive transporter of bacteria. Its effectiveness depends entirely on the numbers of setal fragments to which the mare is exposed; in most years in Kentucky the rate of caterpillar exposure is so small that the syndrome went unnoticed for years. Then, in 2001, the exposure to the caterpillars was exceptionally intense; the abortions, numbering in the thousands, occurred rapidly, while the caterpillars were literally underfoot, and the ability of high levels of caterpillars to abort mares became clear.

When this mechanism was first proposed, Professor Tobin was careful to note that for this mechanism to work, all that was required were small barbed setal fragments, or indeed any structure mechanically equivalent to an Eastern tent caterpillar setal fragment. He also pointed out that this was probably a very ancient defensive mechanism of caterpillars, and that if similar structures were found in other caterpillars, as seemed likely, then they would likely also produce equine abortions.

So, on this basis, and on the very similar descriptions of the Australian caterpillar related equine abortions to MRLS, Professor Tobin's recommendation to Dr. Perkins was clear and unequivocal; experiments on dosing pregnant mares with processionary caterpillars should be first priority, and all other experiments were second priority.

It now appears that Prof Tobin's advice was sound. Reportedly, mares intubated with 100g of macerated processionary caterpillars have rapidly (1-2 days) aborted test mares, with no abortions in control mares. Just the simple production of an equine abortion is a very significant experimental event; in one full year of work with various candidate

abortigenic toxins in Kentucky, no abortions whatsoever were produced. Given that circumstance, the production of an abortion within about 30 hours after administration of processionary caterpillars, as has also occurred in Kentucky following intubation of a similar dose of ETC, is highly suggestive of a caterpillar setal induced abortion.

It is also worth noting that when the abortions occur very rapidly the bacterial pattern in the fetus may be different from that found in field cases, and the pathologic changes may be less well developed, as was found in high dose/30 hour/acute onset experimental ETC abortions in Kentucky.

To summarize, based on the identification of two now well established and closely related caterpillar abortion syndromes induced in pregnant mares by different caterpillar species in the Northern and Southern hemispheres, it now appears that the role of caterpillars should be immediately considered whenever a mare aborts in association with caterpillars. The role of the Eastern Tent Caterpillar in MRLS abortions is well established and, courtesy of Dr. Perkins and his colleagues, Processionary caterpillars are fully abortigenic and seem very likely to be the driving force in EAFL.

In closing, the ability of two species of caterpillar, Eastern Tent caterpillars in Kentucky and Processionary caterpillars in Australia to produce mare abortions is acknowledged, and two other caterpillar species have also been associated with mare abortions syndromes. The take home message is simple; first, keep your pregnant mares away from caterpillars unless you are quite sure that your local caterpillars are not abortigenic, and second, if a pregnant mare exposed to caterpillars aborts, or simply loses a fetus, have the fetus and the fetal membranes carefully checked for signs of an MRLS/EAFL type syndrome.

CATERPILLARS AND THEIR NESTS.

The main species of interest in Australia is the Processionary Caterpillar or Bag-Shelter Moth (Ochrogaster lunifer), white cedar moth caterpillars (Leptocneria reducta) and mistletoe brown tail moth (Euproctis edwardsi). The processionary caterpillar is commonly found on Acacia sp (Wattle) and eucalypt trees while the mistletoe brown tail moth caterpillar is found on mistletoe.

The Australian Processionary caterpillars build web like nests, which are usually situated at the base or high in the branches of the host trees. The nests can be well camouflaged and hard to detect on trees. The caterpillars usually congregate in these nests during the day for protection from the elements. The caterpillars usually come out at night to eat the leaves and foliage of the tree in the cover of darkness. If the caterpillars are seen during the day moving about and usually in the trademark head to tail processionary caterpillar line, they are moving to a new food source.

When the caterpillars are moving on the ground the shedded setae or the whole caterpillar can be easily ingested by livestock along with fodder. The caterpillars shed their exoskeleton along with the setae hairs usually in the nest when molting. Animals can interfere with the nests releasing the setae into the environment and then be at risk of ingestion or inhalation.

The caterpillars' hairs or setae are what is so dangerous to come into contact with. When disposing of nests or the caterpillars, wear protective clothing and mask, as the setae can be inhaled when air born. People and other livestock are also at risk of irritation and other reactions to the caterpillar's setae and specifically abortion if ingested. Trees and shrubs in the paddocks where mares are housed and also in adjacent paddocks (to allow for windborne movement of caterpillar hairs) should be checked periodically from November to April.

WHAT RECOMMENDATIONS HAVE BEEN MADE TO AUSTRALIAN BROODMARE OWNERS?

The following recommendations were made as a result of the initial investigation into EAFL that concluded in 2005:

1. Ensure that mares do not have access to pennyroyal (Mentha satureioides, M. diemenica) or other poisonous plants in pasture.
2. Minimise exposure of mares to caterpillar hairs (setae)

A variety of methods may be appropriate for control of caterpillars on trees including:

- removal and destruction of egg masses and young nests in December-January before development of caterpillars is complete;
- remove and destruction of nests of maturing caterpillars during daylight hours (later larval stages) by physical removal during Autumn;
- replacement of known host trees with others that do not attract processionary caterpillars;
- use of chemical treatments to kill caterpillars;

i. use only products registered for the purpose of controlling caterpillars in trees;
ii. use products strictly in accordance with label instructions;
iii. in some states you may be required to engage a pest control operator.

3. All abortions occurring in mares should be subjected to a complete post-mortem investigation of the foetus and foetal-membranes with a view to identifying the cause of the abortion. The most effective way to ensure a complete post-mortem is to transport the foetus and placental membranes to a pathology laboratory or a veterinary clinic familiar with investigation of mare abortions.
4. Equine herpes virus (EHV) infection remains as a major threat since it is an infectious condition capable of causing large scale outbreaks of abortion (abortion storms). Management of the aborted mare and any in-contact mares should be based on the need to minimise the risk of spread of a potentially contagious disease such as EHV.

HAS THERE BEEN ANY RESEARCH TO INVESTIGATE EAFL?

The Hunter Valley Equine Research Centre (HVERC) initiated and funded an investigation into EAFL in 2004 in response to interest from within the Thoroughbred breeding industry to find out more about this condition. This initial investigation resulted in the release of a report in April 2005 titled Equine Amnionitis and Foetal Loss (EAFL). The report identified Processionary caterpillars and Australian native pennyroyal as two possible causative factors that could be involved in EAFL.

In 2006 HVERC and the Rural Industries Research and Development Corporation (RIRDC) funded further studies involving a research team. Preliminary results of these studies indicate that Processionary caterpillars are capable of causing abortion in mares. Further work is currently being performed to continue to investigate the role that caterpillars may play abortions in Australian mares.

For more information on caterpillar abortions in Australia go to www.equivetaustraia.com/equineinfo/mare-reproductive-loss.php; information from Equivet Australia, Equine Breeding Centre.