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Dyskinetic syndrome in tarantula spiders (Theraphosidae)

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ABSTRACT: There have been increasing reports of cases of erratic movements and ataxia followed by death in tarantula species. This paper covers a brief review of what we know about the condition and what to look for in a tarantula patient. This is the first paper on this syndrome and thus hypotheses on causality and treatment options are in their infancy. The paper concludes with a call for more case reports to be published or sent to the attention of the authors such that we can continue to build on the data we already have to seek a better treatment option.

Keywords: dyskinetic syndrome; DKS; Theraphosidae; tarantula; ganglion disorder

Introduction

Theraphosidae spiders are particularly popular in zoological exhibits as well as being kept as pets. Due to this increasing popularity, Veterinary Surgeons are starting to see more tarantula patients in practice. Several authors have previously described investigation of theraphosid patients and these are good first sources and include Pizzi (2012) and Pellet, Bushell, and Trim (2015). However, there is little mention of locomotion disorders often discussed among keepers. Dyskinetic syndrome (DKS) is the term used to describe a collection of signs affecting the central nervous system. This particular syndrome has been observed in Theraphosidae. The term DKS was agreed upon for Theraphosidae by the steering committee of the Veterinary Invertebrate Society in October 2014. For reference, **Figure 1** shows the king baboon spider (*Pelinobius muticus*) in a normal healthy

posture, **Figure 2** shows the typical death posture of all limbs contracted under the prosoma. This is not to be confused with ecdysis (moulting) as seen in this Mexican red knee (*Brachypelma smithi*; **Figure 3**).



Figure 2. *Pelinobius muticus* death curl.



Figure 1. *Pelinobius muticus*.



Figure 3. *Brachypelma smithi* in moult.

Signs that have been observed are typical of ganglion disorders and include:

- ataxia
- unusual posture and diminished righting reflex
- erratic seizure-like movements
- anorexia
- Intense preening of the pedipalps and appendages
- lethargy
- hydrophobia

Anecdotally, cases were originally seen in *Avicularia* sp. (pink toe tarantula), but have since been documented in both Old World and New World Theraphosidae by various keepers. All age ranges appear to be affected and cases in both male and female specimens have been observed. There have been no reported cases in wild specimens; however, studies have not been put into place to gather the necessary information to rule this out. At the date of publishing one case has been reported in true spiders and similar signs have been documented in other invertebrates such as centipedes and cockroaches. This paper will discuss cases in Theraphosidae only.

Causes

The list of potential causes is lengthy, and it is likely that with further research this syndrome could turn out to be a collection of diseases with differing causality. Key elements are discussed below.

Infection

Arachnids are susceptible to opportunistic bacterial infection (Mitchell & Tully, 2008), although little is known about normal microbial flora of the arachnid body (Pizzi, 2012). It is interesting to mention at this point that three cases of suspected DKS from Instituto Butantan, Brazil were discovered to test positive for *Pseudomonas* spp. infections. Testing of more suspected cases would be required to confirm this as a cause and the authors advise a bacterial culture for any specimens to rule this out. According to Pizzi (2012), two forms of fungal infection are encountered in spiders: opportunistic growth of saprophytic fungi on the cuticle and systemic entomopathogenic fungal infections. The study of viruses among spiders has been exceptionally limited with only a single account of a *Piscaura mirabilis* (nursery web spider) dying as a result of a baculovirus. Pizzi (2012) states that it is “quite likely that spiders will be

susceptible to asymptomatic infection with invertebrate iridoviruses”.

Neurodegenerative disorder

The signs exhibited by afflicted specimens could be indicative of a ganglion disorder. There are various possibilities to examine, including underlying genetic abnormalities or the protein accumulation/misfolding syndromes that cause neurodegenerative conditions in vertebrates (such as prions). Whether these afflict invertebrates in a similar way is unknown and more study in this area is required.

Nutritional deficit

Vitamin B deficiency has been linked with causing neurodegenerative symptoms in vertebrates. It can therefore be speculated that a lack of adequate vitamins could cause the same in Theraphosidae. Other considerations are deficits in Omega 3 and Omega 6 as well as alpha-linolenic acid. Dehydration can also cause ataxia; however, severe dehydration is also recognisable by the spider having a withered, shrunken-looking opisthosoma. This has not been an apparent sign in all suspected cases.

Suboptimal husbandry

Incorrect humidity levels coupled with unsanitary conditions could be precursors to infection due to the build up of bacteria/fungi.

Vectors for transmission

Endo- and exoparasites including nematodes, mites, phorids, other spiders within the collection or prey items could be infected with some form of pathogen or parasite.

Nursing of DKS cases

DKS cases are typically difficult to handle due to the signs presented. Patients will move quickly and erratically when touched. Additional care should be taken with “New World” species (originating from the South Americas) due to urticating setae exclusive to New World tarantulas and found in approximately 90% of the New World species (Bertani & Guadanucci, 2013). The patient may kick setae from the dorsal surface of the abdomen towards the perceived threat. This can be a severe irritant – especially if they come in contact with the handler’s eyes or mucus membranes. Gloves and safety glasses are recommended when handling these animals in the clinic (Pellet, Bushell, & Trim, 2015). “Old World” species should also be handled

with care – although they do not possess urticating setae, they are generally quite aggressive in nature and quick to bite. Although not lethal, a bite from Theraphosidae species can range from mild irritation likened to that of a bee sting to severe pain, muscle cramps and potential long-term nerve damage (Ahmed, Pinkham, & Warrell, 2009). Anaesthesia may be required in order for the Veterinary Surgeon to perform a complete physical examination. The correct depth of anaesthesia is usually achieved by placing the patient within a large mammalian surgical mask (Figure 4) and using isoflurane at a rate of 3% with 2 litres of oxygen until desired depth is achieved. Leg reflexes are lost relatively quickly, with the last being the fang control (touching fangs with some forceps until they move freely). Once the fang reflex is lost this is said to be at a surgical depth of anaesthesia. In tarantulas the abdomen needs to be contained within the mask as the book lungs are located on the ventral abdomen (Pellet, Bushell, & Trim, 2015). Monitoring can be performed with the use of a Doppler on the dorsal surface of the opisthosoma. Spiders have a large heart located in the dorsal abdominal segment, and an open circulatory system (Pellet, Bushell, & Trim, 2015).

Injections can be administered into the heart or ventral aspect of the patella joint. There is a slim chance that the patient will autotomise the limb after injection, but this will usually grow back within a few episodes of ecdysis. Oral medication can be administered via a pipette or 1-ml syringe and dosing catheter directly into the mouth parts of a lightly anaesthetised specimen or awake patient that has lost full righting reflex.

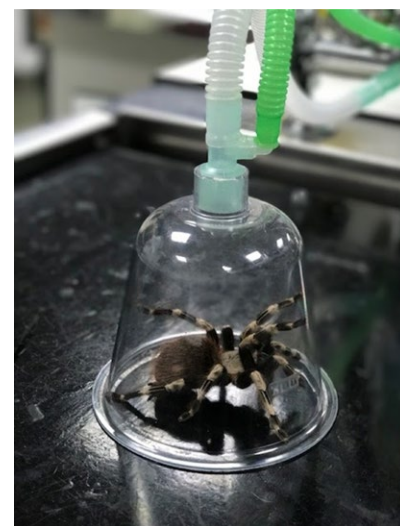


Figure 4. Anaesthesia of Theraphosidae.

General advice for owners is to isolate the affected specimen, and clean and disinfect any enclosures of other invertebrates within their collection.

A potential treatment has been formulated by Venomtech® Ltd that has been successfully used in some cases, but results are inconclusive. This treatment is an electrolyte solution that is administered orally to the patient using a pipette directly into the mouth parts. The authors provide the formulation to encourage this treatment plan to be tested in new cases and the results documented in order to determine its full efficacy.

Spider Saver™ is a solution of 0.3% sodium chloride (NaCl), 0.3% potassium chloride (KCl), 0.03% calcium chloride (CaCl₂) and 0.27% magnesium sulphate (MgSO₄) prepared in sterile water. All amounts w/v.

Case studies

In most cases the first signs documented are ataxia and hypermotility – when touched, the specimens tended to produce erratic movements in order to move away from the source. Most specimens were moved to a quarantine/hospital tank at this stage. A hospital tank usually consists of a plastic tub lined with damp paper towel. A heat mat is placed underneath at one end to provide correct temperatures and to boost humidity. A plastic hide and water bowl may be added. In some cases, the Spider Saver™ was dosed at this time.

Out of the nine case studies reviewed for this paper, six cases died and two were euthanised. In two cases the specimens seemed to recover after fluids or Spider Saver™ were administered. One deteriorated after a few days and the other returned to normal behaviours for over five years. *Pseudomonas* infections have been identified in two cases. It is yet to be determined whether *Pseudomonas* sp. is a commensal or whether it is a true pathogen in Theraphosidae. To date, patients have not been routinely swabbed for infection. Swabs of the oral cavity, body surface, or any lesions can be taken for microbial culture (Cooper, 1985). However, the significance of oral or body surface isolates, or those from external lesions, must be placed in the context that bacteria are widespread in

the environment and may not be clinically relevant. Ideally, such cultures should probably be of haemolymph or freshly harvested post mortem from internal organs, and be correlated with histopathology demonstrating the presence of intralesional bacteria.

In two of the cases a full histopathological examination was performed. The first – *Hogna ingens* (desert wolf spider) – showed significant bacterial infection leading to septicaemia to be the cause of death. The second – *Lasiodora parahybana* (salmon pink bird-eater) – was also positive for bacterial infection.

In most cases investigations have failed to draw conclusions on causality. Bioaccumulation of insecticides has been hypothesised but as yet unproven. Most Theraphosidae in captivity are fed commercially bred feeder insects. These insects will not have been in contact with insecticides directly; however, it is possible that they are fed vegetation where insecticides have been used. Care must be taken if other animals in the household are being treated with commercial flea and tick products and owners could transmit insecticidal agents to Theraphosidae via direct contact (Pizzi, 2010). It is possible that a number of other household chemicals could also directly affect tarantulas, such as nicotine or cleaning products.

Copies of the case studies reviewed can be obtained by contacting the authors.

Request for information

Our knowledge of DKS in Theraphosidae is still very minimal and any cases could contain vital information. If you have a suspected case the authors would appreciate a case study brought to their attention. If you require a treatment plan, please contact either the authors or the Veterinary Invertebrate Society. A list of information required is included below to aid in the gathering of case studies.

Standardised information for case notes

- Species
- Age
- Sex

- Wild-caught or captive-bred
- Details of environment
- Diet
- Supplier of prey items
- Dated entries of changes to condition
- Treatment attempted
- Outcome of treatment
- If specimen deceased – pathologist report

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References

- Ahmed, N., Pinkham, M., & Warrell, D.A. (2009). Symptom in search of a toxin: Muscle spasms following bites by Old World tarantula spiders (*Lampropelma nigerrimum*, *Pterinochilus murinus*, *Poecilotheria regalis*) with review. *QJM: Monthly Journal of the Association of Physicians*, 102, 851–857.
- Bertani, R., & Guadanucci, J. (2013). *Morphology, evolution and usage of urticating setae by tarantulas (Araneae: Theraphosidae)*. Retrieved from <http://www.scielo.br/pdf/zool/v30n4/v30n4a06.pdf>
- Cooper, J.E. (1985). Invertebrates. In J.E. Cooper, & M.F. Hutchison (Eds.), *BSAVA manual of exotic pets*. Cheltenham, UK: BSAVA Publications.
- Mitchell, M., & Tully, T. (2008). *Manual of exotic pet practice*. Philadelphia, PA: Saunders Publishing Ltd.
- Pellet, S., Bushell, M., & Trim, S. (2015). *Tarantula husbandry and critical care. Companion Animal*. London: MA Healthcare Ltd.
- Pizzi, R. (2010). Invertebrates. In A. Meredith & C.A. Johnson-Delaney (Eds.) *BSAVA manual of exotic pets* (5th ed.). Gloucester, UK: BSAVA Publications
- Pizzi, R. (2012). Spiders. In G. Lewbart (Ed.), *Invertebrate medicine* (2nd ed.). Chichester, UK: Blackwell Publishing Ltd.