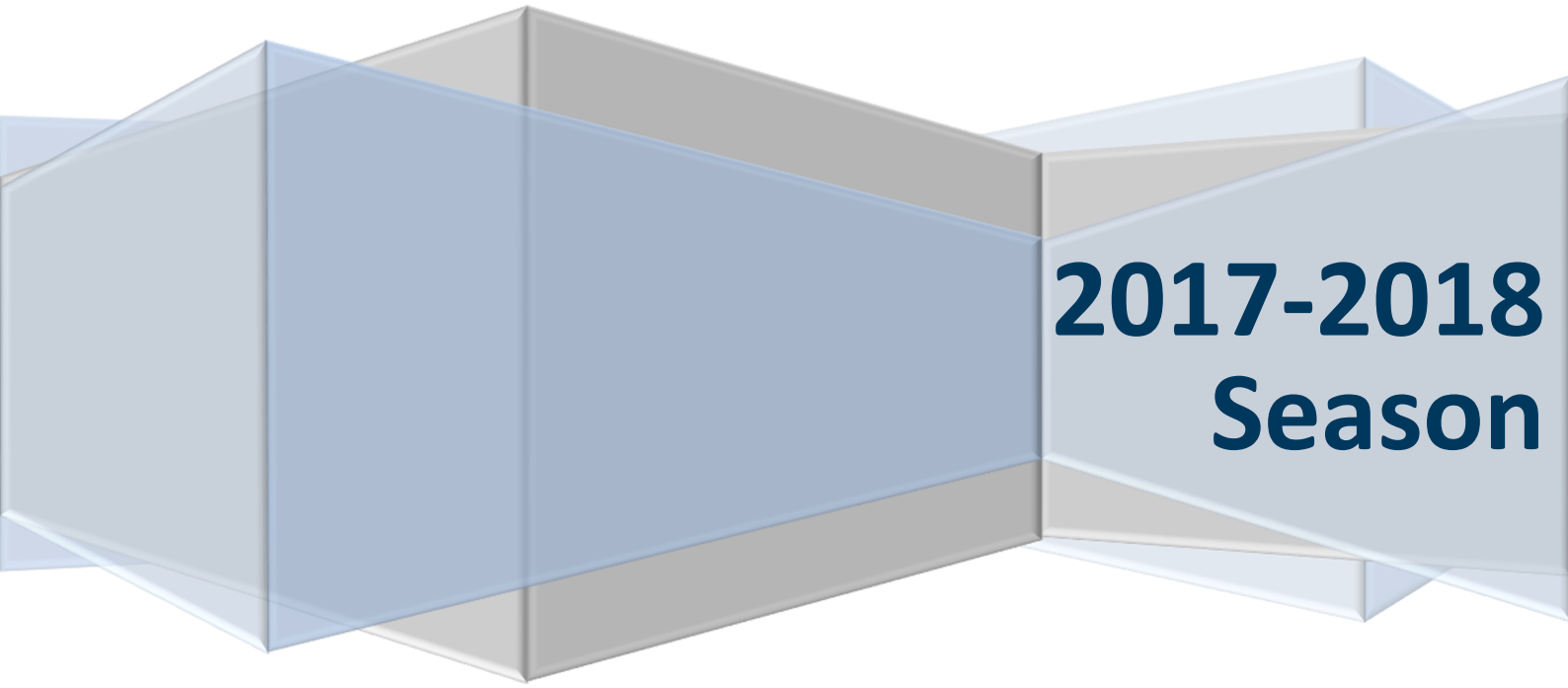
SAEHP

African horse sickness control

Vector Surveillance Report
Kenilworth Quarantine Station



2017-2018 Season

JD Grewar & CT Weyer

Overview

The Kenilworth Quarantine Station (KQS) is a vector protected facility is situated in the AHS free zone in the Western Cape Province. The facility consists of four sealed barns, each with a double door entry-exit and a positive internal pressure system. KQS has been used as the pre-export quarantine facility for horses exported directly from South Africa to the European Union (EU) from 1997, except during periods of suspension as a result of outbreaks of AHS in the AHS controlled area. Vector protection during pre-export quarantine is an additional risk mitigation measure to diminish the risk of exporting horses infected with African horse sickness (AHS), a vector borne disease transmitted by infected *Culicoides* midges. Although South Africa has not traded directly with the EU since 2011, the EU protocol requiring vector surveillance has been maintained for trade to Mauritius from KQS. Vector surveillance is discussed in the OIE (World Organisation for Animal Health) Terrestrial Animal Health Code Chapter on AHS[1] in Article 12.1.13 (5). The requirements are summarised/quoted as follows:

- The ability to differentiate between the various *Culicoides* species.
- Determine seasonality and area risk through:
    - determining various species present in an area,
    - their respective seasonal occurrence and,
    - their respective abundance.
- Long term surveillance can also be used to:
    - assess vector abatement measures or,
    - confirm continued absence of vectors.

Methods

A Standard Operating Procedure (SOP) for vector surveillance at KQS is followed, briefly summarised below:

- One Onderstepoort light trap is set up outside the administration block at KQS to run continuously throughout the year except when there are no staff at the facility during periods when the facility is not used.
- One Onderstepoort light trap is set up within each vector protected barn containing horses – they are activated the first night of quarantine and remain active as long as the shipment's quarantine lasts.
- All traps are set up to run 24 hours a day and are checked each Tuesday to ensure there is adequate fluid in the catchment beaker. Every Friday (i.e. once a week), insects caught during the week are filtered and placed in 70% ethanol and labelled.

All catches are sent to Epidemiology, Parasites and Vectors, Agricultural Research Council - Onderstepoort Veterinary Research where they are counted and speciated. Results are captured per species, sex and parity status (for females). The counts (Figure 1) are aggregated to the mean daily count given the number of nights in the catch series (generally seven) and are depicted using the median date in the date range of the catch series.

[1] http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_ahs.htm

Overall results

During the 2017/2018 AHS season, there were an accumulated total of 276 nights of trapping outside the vector protected facility and 319 nights of trapping inside the vector protected barns. Mean counts per catch series are shown in Figure 1 with the outside catches and inside catches in the top and bottom panels respectively.

Catches outside were generally low with average counts per night only exceeding 10 when horses were in quarantine during the summer and autumn shipments. The maximum catch was during 3rd - 9th March 2018, with a mean of ~60 midges caught per night.

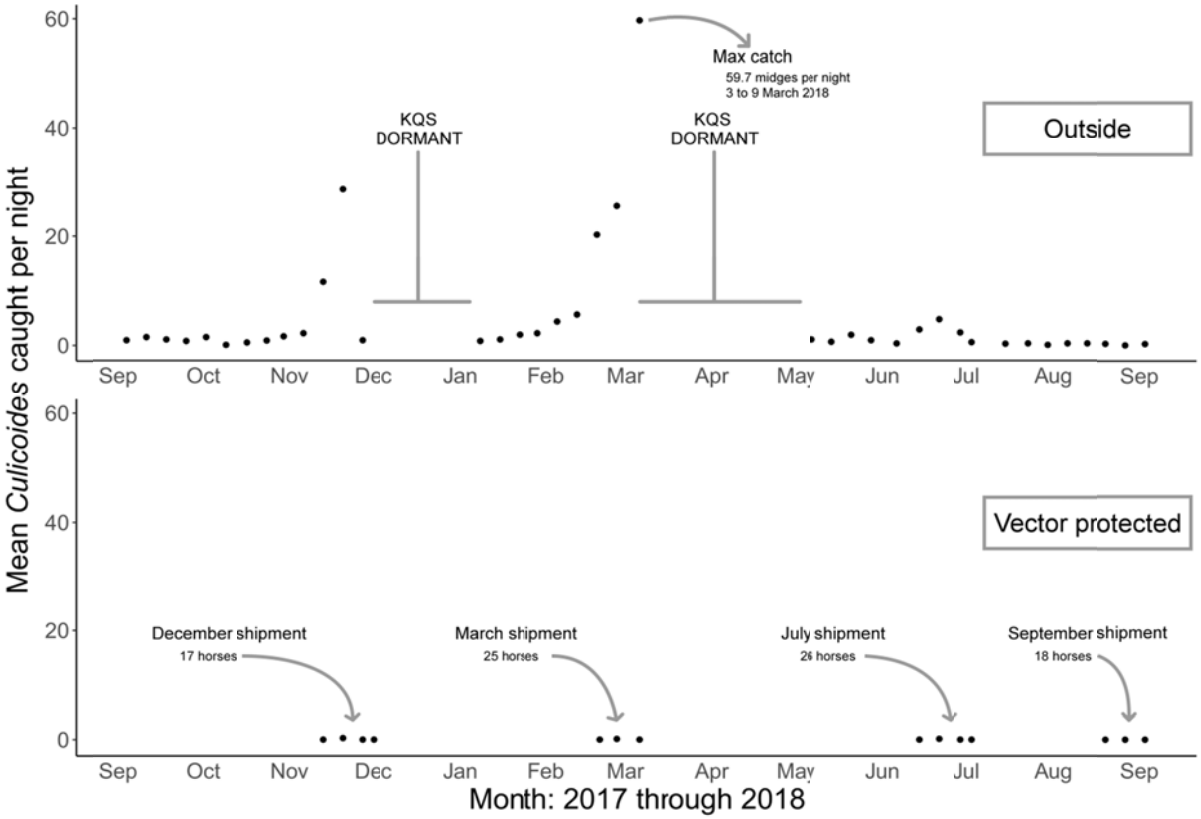


Figure 1: Mean *Culicoides* caught per night (catches are over a period of approximately 7 nights and the point shown is the median date of the catch series). The top panel indicates catches from the outside trap while the bottom panel shows catches from inside the barns when horses were in quarantine. There were four shipments during the season. The top panels indicate "dormant" periods where there were no staff or horses at KQS, i.e. in December 2017 and April and May 2018.

The species distribution is shown in Figure 2. *Culicoides imicola* was by far the most prevalent species caught, accounting for 79% of all midges caught outside and 75% of the 4 midges caught inside.

Culicoides species	outside	vector protected
accraensis	3 (0%)	0 (0%)
bedfordi	4 (0%)	0 (0%)
bolitinos	34 (3%)	0 (0%)
exspectator	1 (0%)	0 (0%)
gulbenkiani	1 (0%)	0 (0%)
imicola	1063 (79%)	3 (75%)
leucostictus	52 (4%)	1 (25%)
magnus	38 (3%)	0 (0%)
nivosus	6 (0%)	0 (0%)
nr angolensis	8 (1%)	0 (0%)
olyslageri	2 (0%)	0 (0%)
pycnostictus	135 (10%)	0 (0%)
sp #90	2 (0%)	0 (0%)
sp #94	1 (0%)	0 (0%)
Total	**1350**	**4**

Figure 2: The *Culicoides* species distribution at KQS during the 2017/2018 AHS season. The number caught is shown according to the location of the trap, i.e. either outside or inside the vector protected barns. The percentage shown is the percentage of the catch for that *Culicoides* species according to the location of the trap, while the colour scale is based on a green – red scale of the log of the catch to give a standardised differential between catches.

Catches inside vector protection

Four midges were caught in 3 trap events during the season within the vector protected environment. The details of these catches are shown in Table 1 below.

Table 1: Details of the four midges caught inside vector protection during the 2017/2018 season.

Location	Period of catch	Species	Midge sex	Midge state
C Barn	17-24 November 2017	*imicola*	Female	Nulliparous
		imicola	Female	Parous
C Barn	23 Feb – 2 March 2018	*leucostictus*	Male	N/A
D Barn	18-25 June 2018	*Imicola*	Female	Parous

Discussion

Culicoides surveillance results in the Kenilworth quarantine station are shown for the period 1 September 2017 to 9 September 2018. With the exception of four midges, all midges were caught in the trap set up outside the barns. As expected, most *Culicoides* midges were caught during the summer and autumn months, with higher trap counts in the outside traps when there were horses in the quarantine facility.

The absolute count of midges was low compared to midges caught during the 2016 Paarl AHS outbreak in two outside traps (Western Cape Department of Agriculture – unpublished data). In that outbreak midge surveillance took place over a two month period and counts per night were consistently above 1000, with a maximum of over 6000 midges per night. The maximum count per night in the outside trap at KQS was 60 midges, caught during March 2018. The dominant species detected at KQS was *C. imicola* at 79% of the total midge catches outside. This is comparable to the dominant species caught during the Paarl 2016 outbreak, where C. *imicola* accounted for over 95% of midges caught.

A study was undertaken to establish the risk of exporting an undetected AHS infected horse from a vector protected facility (Sergeant et al. 2016)[2]. In that study a model parameter included the probability of vector protected breakdown, and this was done using data from 2006-2011 KQS midge catches. Assuming the same 33% trap efficiency as described in Sergeant et al. the daily probability of breakdown at KQS for the 2017/2018 AHS season was 0.9%, compared to the daily probability of breakdown established for the risk study of 1.1% for data between 2006 and 2011. The daily probability of breakdown can be used as a baseline to show the ongoing performance of the KQS vector protection SOP and system. The reason for vector breakdown is difficult to establish given the low number of breakdown events, although either the disregard for the double door entry system or where hay bales are opened inside vector protection would be plausible reasons.

While *C*. *imicola* is considered the important vector for AHSV in the Western Cape, *C*. *leucostictus* is a bird feeder and not considered relatively important. C. *bolitinos*, the other important vector for AHSV often referred to in the Western Cape context wasn't caught inside vector protection, although it was the 5th most prevalent midge caught outside at KQS making up 3% of midges caught outside.

The vector surveillance performed at KQS including the differentiation, proportions and abundance of species caught and the seasonality, shown through changes in average counts per night across the reviewed year, addresses some of the OIE suggestions and requirements for vector surveillance included in the OIE Terrestrial Animal Health Code chapter for AHS.

[2] doi.org/10.1371/journal.pone.0151757

Acknowledgements

We are very grateful to all involved in the vector surveillance programme at the KQS. Ms Sue Mutch, the KQS manager, has managed the programme for many years. This AHS season she was assisted by Ms Shannon Stampe and Ms Stephanie Rogerson. Dr Phillippa Burger from the South African Equine Health and Protocols NPC (SAEHP) was instrumental in developing the systems, SOP and process for midge collection.

Prof Gert Venter and Ms Karien Labuschagne from Epidemiology, Parasites and Vectors, Agricultural Research Council - Onderstepoort Veterinary Research performed the vector counts and identification and Prof Gert Venter provided insight and perspective on the vector numbers and the vector protection breakdown.