Hernández, F. A., Sayler, K. A., Bounds, C., Milleson, M. P., Carr, A. N., & Wisely, S. M. (2018). Evidence of pseudorabies virus shedding in feral swine (Sus scrofa) populations of Florida, USA. *Journal of wildlife diseases*, *54*(1), 45-53.

**Abstract:** **Feral swine (*Sus scrofa*) are a pathogen reservoir for pseudorabies virus (PrV).** The virus can be fatal to wildlife and contributes to economic losses in the swine industry worldwide. National surveillance efforts in the US use serology to detect PrV-specific antibodies in feral swine populations, but PrV exposure is not a direct indicator of pathogen transmission among conspecifics or to non-suid wildlife species. **We measured antibody production and the presence of PrV DNA in four tissue types from feral swine populations of Florida, US. We sampled blood, nasal, oral, and genital swabs from 551 individuals at 39 sites during 2014–16.** Of the animals tested for antibody production, 224 of 436 **(51%) feral swine were antibody positive** while 38 of 549 feral swine **(7%) tested for viral shedding were quantitative polymerase chain reaction (qPCR)-positive for PrV**. The detection of PrV DNA across all the collected sample types (blood, nasal, oral, and genital [vaginal] swabs) suggested **viral shedding via direct (oronasal or venereal), and potentially indirect (through carcass consumption), routes of transmission among infected and susceptible animals.** Fourteen of 212 seronegative feral swine were qPCR-positive, indicating **7% false negatives in the serologic assay**. Our findings suggest that **serology may underestimate the actual infection risk posed by feral swine to other species and that feral swine populations in Florida are capable of shedding the virus through multiple routes.**

* Introduction:
  + Feral swine one of the most common exotic invasive ungulates in the US, expanded range and abundance since intro in early 1500s.
    - Disease threat to native ecosystems and livestock.
    - Serologic surveillance efforts.
  + Feral swine harbor and transmit more than 65 agents of disease.
  + Pseudorabies PrV aka Suid alphaherpesvirus 1 aka Aujeszky’s dz.
    - Very high fatality rate in susceptible species after spillover from reservoir host.
    - Mild symptoms adult swine, significant morbidity and mortality in unweaned piglets.
    - Feral swine – lifelong latent infection, relatively decreased neutralizing antibodies.
      * Asymptomatic with sporadic reactivation and circulation of virions when stressed.
        + Virus shed in mucosa (oronasal, venereal contact).
        + Indirect routes via ingestion of contaminated carcasses or contact with fomites.
    - Rapidly fatal infections in carnivores and livestock.
      * Mortalities in raccoons, canids, FL panther.
      * Significant economic losses to commercial producers.
  + Most research focused on seroprevalence or prevalence of PrV DNA in tissues of latently infected swine.
  + Few studies report prevalence of PrV shedding in nasal, oral, genital secretions of free-ranging pigs. Not previously reported in US.
    - Feral swine population in FL est 500,000 – 1 million individuals, second to Texas.
* M+M:
  + Jan 2014 – March 2016, sampled 551 feral swine, 39 sites across FL.
  + Opportunistic, trapped or euthanized during animal-control efforts, or hunted.
  + Recorded sex, age, FPS location, age, collected blood samples, nasal and oral swabs, and genital swabs from females.
  + Blood samples used for PrV serology (ELISA).
  + Blood, nasal, oral, genital swabs used for DNA PCR – PrV glycoprotein B.
* Results/Discussion:
  + qPCR on 439 blood, 498 nasal, 408 oral, 196 genital swabs.
    - Age and sex did not influence probability of shedding.
    - All age classes exhibited similar shedding prevalence except oral swabs that were all negative in juveniles.
    - No animal was found to shed through more than one route simultaneously.
    - 35000-70000 feral swine may be shedding.
    - The presence of DNA in blood could represent source of pathogen transmission to scavenging animals and carnivores.
    - Contributing factors that may promote infection through scavenging may include disposal of offal of feral swine carcasses in hunting areas, above-ground disposal of carcasses by animal control.
    - Remains intact in environment for 1-2 wks.
    - Shedding in nasal and oral mucosa similar to previous reports (1%, 3%).
    - This study confirmed that viral shedding occurred through oronasal route
    - 3% females shed through vaginal tract. Promiscuous mating behaviors enhance opportunities for transmission. Important implications for livestock.
  + 51% swine tested for exposure and shedding exhibited antibodies in serum.
    - 6% seropositive animals were also positive on PCR.
    - 94% seropositive were negative on PCR.
  + 7% of animals shedding were serologically negative, suggests Ab alone does not accurately detect infection. False negatives derived from serologic testing.
    - Possibly due to delay in Ab production after infection.
    - Could also be due to immunosuppression followed by reactivation of the virus.
  + Prevalence of positive FL feral swine similar to that of wild boards in Spain.
  + In FL, swine of all age and sex classes were found to be shedding, suggests that transmission not confined or determined by any one demographic group (other studies in other countries suggest females had more of a role in spreading as well as higher shedding in juveniles in Italian boars.

**Evaluation Of A Partially Reversible Immobilization Protocol Using Medetomidine, Butorphanol, Zolazepam–tiletamine, And Ketamine In Free-ranging Warthogs (*Phacochoerus Africanus*) In Kruger National Park, South Africa**

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Jennie Hewlett, Peter Buss, Francisco Olea-Popelka, Katja Koeppel, Donald Neiffer, Guy Hausler, Leana Rossouw, Tebogo Manamela, Eliza Stout, Michele Miller

Abstract: **Twenty-one free-ranging warthogs (*Phacochoerus africanus*) in the Kruger National Park, South Africa, were immobilized with a combination of medetomidine (0.07 + 0.01 mg/kg), butorphanol (0.26 + 0.04 mg/kg), tiletamine–zolazepam (0.69 + 0.15 mg/kg), and ketamine (1.43 + 0.21 mg/kg) administered intramuscularly by dart. Induction, immobilization, and recovery characteristics were evaluated using a standardized scoring system. In the immobilized warthogs, physiological variables were measured every 5 min and arterial blood gases were analyzed at 15-min intervals. At 45 min after initial drug administration, atipamezole (0.34 + 0.050 mg/kg) and naltrexone (0.53 + 0.079 mg/kg) were administered intravenously.** Overall, induction quality after darting was scored as excellent and the mean time to safe handling was 5.9 + 2.0 min. Based on muscle relaxation, and loss of palpebral and pedal reflexes, most subjects (17 out of 21) reached a plane of surgical anesthesia by 10 and 15 min; 20 out of 21 warthogs were in this plane for the duration of the monitoring period. In the immobilized warthogs the overall mean heart rate was 65 + 15.3 beats per minute, mean respiratory rate was 14.7 + 5.6 breaths per minute, and the mean rectal temperature was 37.9 + 1.48C during the 40 min. Arterial blood gas results showed hypoxemia (mean PaO2 62.1 + 16.2 mmHg), hypercapnia (mean PaCO2 47.1 + 5.1 mmHg), and acidemia (mean pH ¼ 7.36 6 0.04). Values for PaO2 and pH improved over the immobilization period. After antagonist administration, overall recovery quality from immobilization was scored as good, with animals standing at a mean time of 7.3 + 4.9 min. The drug combination proved to be effective in the immobilization of free-ranging warthogs with rapid induction, good anesthesia, and limited cardiorespiratory changes. This anesthetic protocol produces effective, safe, and partially reversible immobilization in warthogs.

**Background**

* Prone to hyperthermia and limb injury during stress/exertion, often paddle with ketamine/telazol
* Warthogs in this study were habituated to people
* Tiletamine-zolazepam reduces dart volume but has longer duration of action, combo with ketamine reduces recovery time by decreasing telazol dose
* Conscious domestic pig Sp02 is low (92-95%). PaO2 (73-92, mean 82 mmHg) is lower than other mammals due to difference in species-specific hemoglobin affinity (shifts dissociation curve to right) and possibly to higher average suid body temp.
* Conscious domestic pig pH (7.4-7.53), ‘7.35 considered acceptable in wildlife immobilization’

**Key points**

* Most ran a short distance after darting, mild ataxia and minimal excitement with induction
* If approached too soon after recumbency and still blinking, would try to get up and move away prolonging induction
* Minor procedures during anesthesia: ears notched and arterial blood sampling - medial saphenous A.
* Degree of induction: excellent, smooth and rapid
* Degree of immobilization: initially light or moderate, plane of surgical anesthesia by 10 min
* No sudden arousals or spontaneous recoveries, no mortalities
* Stable HR, RR, BT. 2 developed hyperthermia (one ran, one processed in the sun)
* Arterial blood gas: pH initial acidemia that improved over time, generally normal lactate levels, initial hypoxemia that increased over time (higher PaO2 with lighter plane of anesthesia), persistently elevated PaCO2
* Smooth recovery over a few minutes after reversal, standing/walking avg 7 min after reversal

**Conclusions**

* MBTZK consistently produced rapid immobilization with good muscle relaxation and minimal cardiorespiratory changes.
* Analgesia was sufficient for minor procedures.
* Smooth recovery with rapid controlled transition from recumbency to standing and walking after reversal
* Do not approach for at least 2-3 minutes after recumbency to avoid stimulation
* Cost and availability may be prohibitive

Montenegro, Olga L., et al. "Serologic survey for selected viral and bacterial swine pathogens in Colombian collared peccaries (Pecari tajacu) and feral pigs (Sus scrofa)." *Journal of wildlife diseases* 54.4 (2018): 700-707

ABSTRACT: In South America, wild populations of peccaries coexist with domestic and feral pigs, with poorly understood consequences. We captured 58 collared peccaries (Pecari tajacu) and 15 feral pigs (Sus scrofa) in locations of Colombia where coexistence of these species is known. Blood samples were tested for antibodies against four viral agents, classical swine fever virus (CSFV), Aujeszky’s disease virus (ADV), porcine circovirus (PCV-2), and vesicular stomatitis virus (New Jersey and Indiana subtypes) and two bacterial agents, Brucella spp. and six serovars of Leptospira interrogans. The prevalence of CSFV was 5% (3/58) in collared peccaries and 7% (1/15) in feral pigs. The prevalence of PCV-2 was 7% (1/15) in collared peccaries and 67% (2/3) in feral pigs. Vesicular stomatitis prevalence was 33% (8/24) in collared peccaries and 67% (4/6) in feral pigs. Leptospira prevalence was 78% (39/50) in collared peccary and 100% (8/8) in feral pigs; bratislava, grippotyphosa, icterohaemorrhagiae, and pomona were the most frequent serovars. Also, the only white-lipped peccary (Tayassu pecari) sampled was positive for L. interrogans serovar bratislava and for vesicular stomatitis virus, New Jersey strain. No samples were positive for ADV or Brucella. The seroprevalence of antibodies against L. interrogans was similar to that observed in other studies. Icterohaemorrhagiae appears to be a common serovar among in situ and ex situ peccary populations. Positive antibodies against PVC-2 represent a novel report of exposure to this pathogen in Colombian peccaries. Our results indicate the possible transmission of various pathogens, important for pig farms, in the studied pig and peccaries.

Intro

* Whitelipped peccary (WLP; Tayassu pecari) and collared peccary (CP; Pecari tajacu) are found in Colombia
* These populations coexist with domestic pigs.
* The Colombian pig industry is affected by several infectious agents, such as classical swine fever virus (CSFV), porcine reproductive and respiratory syndrome virus, porcine circovirus type II (PCV-2), swine influenza virus, Salmonella spp., Haemophilus parasuis, Streptococcus suis type II, Mycoplasma hyopneumoniae, and Lawsonia intracellularis, among others.
* Most of these occur in peccaries as well
* Study objective: A serologic survey in several regions of Colombia to identify exposure of selected viral and bacterial swine pathogens in feral and domestic pigs and in two species of peccaries

M&M

* Sampled in 14 different municipalities where there were high peccary occurrence as well as intermingling and/or shared food/water sources with domestic pigs
* Captured animals and collected blood either with physical restraint or anesthesia with ketamine/xylazine
* Serum antibodies against CSFV, VSV and Aujeszky’s disease virus, PCV-2, Lepto (5 serovars), Brucella

Results

* 58 CP, 15 Feral pigs (FP) and 1 WLP
* 59 samples submitted for lepto, positive in 78% (39/50) of CP, all FP, and the only WLP examined.
  + Bratislava was the most common serovar in CP and FP and the only serovar found in WLP
* 31 samples submitted for VSV
  + Eight CP, four FP, and the single WLP were positive animals. We found two VSV subtypes: New Jersey (NJ) and Indiana (I)
* 19 samples submitted for PCV-2
  + Occurrence was low in both CP and FP, with only one positive animal of each species. The WLP sample was negative
* 72 samples analyzed for CSF
  + Four suspect animals were identified: three CP and one FP
* 74 samples analyzed for Aujeszky’s disease virus, and 32 samples (25 CP, six FP, one WLP) for Brucella sp.; all samples were negative

Discussion

* High lepto prevalence in all species examined – 78% in CP, 100% in FP
  + Bratislava and icterohaemorrhagiae were the most common serovars that we detected.
  + Microagglutination used but sensitivity and specificity can be quite variable, therefore results should be interpreted with caution
* Seropostivie cases of VSV in all species. Previous vaccination may confound results. Feral pigs were positive as well, can act as a potential host for the amplification of this pathogen
* PCV-2 detected in one CP, clinical relevance uncertain
* Antibodies to CSFV found in 3 CP, though previous vaccination could confound this result
  + However, also found in FP, may play an important role in trasmission
* Brucella and Aujeszky’s disease negative

**A SEROLOGIC SURVEY OF PATHOGENS IN WILD BOAR (SUS SCROFA) IN SWEDEN**

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**Abstract**: The wild boar (Sus scrofa) population has increased markedly during the last three decades in Sweden and in other parts of Europe. This population growth may lead to increased contact between the wild boar and the domestic pig (Sus scrofa scrofa), increasing the risk of transmission of pathogens. The objective of our study was to estimate the seroprevalence of selective pathogens, known to be shared between wild boars and domestic pigs in Europe, in three wild boar populations in Sweden. In total, 286 hunter-harvested female wild boars were included in this study. The sera were analyzed for antibodies against nine pathogens using different commercial or in-house enzyme-linked immunosorbent assays. Antibodies were detected against porcine parvovirus (78.0%), porcine circovirus type 2 (99.0%), swine influenza virus (3.8%), Erysipelothrix rhusiopathiae (17.5%), Mycoplasma hyopneumoniae (24.8%), and Toxoplasma gondii (28.6%). No antibodies were detected against porcine respiratory and reproductive syndrome virus, Brucella suis, or Mycobacterium bovis. Our results highlight the potential importance of the wild boar as a reservoir for pathogens potentially transmissible to domestic pigs and which also may affect human health.

**Intro:**

* wild boar - reservoir of various pathogens
* objective - estimate the seroprevalence of selective pathogens, known to be shared between wild boars and domestic pigs in Europe, in three wild boar populations in Sweden

**Methods:**

* blood collected from female boars >30 kg in 2013-2015 during hunting at 3 estates located in 3 counties in S. Sweden
* 286 serum samples tested for antibodies against PPV, PCV-2, PRRSV, SIV, E. rhusiopathiae, M. hyopneumoniae, and M. Bovis
* 276 samples tested for antibodies against T. gondii
* 92 samples tested for antibodies against B. suis

**Results/Discussion:**

* Positive serology:
  + PPV – 78%
  + PCV-2 - 99%
  + SIV – 4%
  + E. rhusiopathiae -18%
  + M. hyopneumoniae - 25%
  + T. gondii – 29%
* PRRSV, B. suis, or M. bovis – negative serology
* age classes positively correlated to prevalence of antibodies against PPV, SIV, M. hyopneumoniae, E. rhusiopathiae, and T. gondii
  + SIV - highest in juveniles
  + PPV and T. gondii – antibody prevalence increased with age
  + E. rhusiopathiae - higher prevalence in adults
  + M. hyopneumoniae - yearlings displayed highest risk of exposure
  + age class not associated with PCV-2 antibody prevalence
* region of sampling associated w/ prevalence of antibodies for PPV and M. hyopneumoniae only
  + prevalence of PPV higher in S¨odermanland
  + M. hyopneumoniae prevalence highest in County of Blekinge
* **overall high seroprevalence for PCV-2, PPV, E. rhusiopathiae, M. hyopneumoniae, T. gondii** 
  + wild boar potential source of pathogens for domestic pigs and humans

**UROLITHIASIS IN A GROUP OF VISAYAN WARTY PIGS (*SUS CEBIFRONS NEGRINUS*)**

**Chatterton** J, Unwin S, Lopez J, Chantrey J.

J Zoo Wildl Med. 2017 Sep;48(3):842-850

**Taxa:** Mammalia → Artiodactyla → Suidae

**Abstract*:*** Four cases of obstructive urolithiasis occurred in male Visayan warty pigs (*Sus cebifrons negrinus*) during a 12-mo period. One animal died, two were euthanized, and one was treated successfully with a tube cystotomy procedure and a subsequent urinary acidification diet. Uroliths from two cases of urethral obstruction were analyzed and confirmed as calcium carbonate. A fifth nonobstructive case was suspected in an adult female in which calcium carbonate crystalluria was diagnosed, and that case was resolved with medical management. Possible causes of these uroliths included reduced water intake, increased calcium in the diet through use of lucerne hay, and concurrent urinary tract infections. Changes to the diet and access to water were correlated with cessation of further cases, and no recurrence has been seen to date. To the authors' knowledge, this is the first report of calcium carbonate urolithiasis and the first use of a tube cystotomy in a nondomestic pig species.

**Background:**

* Urolithiasis is reported in pigs:
  + Calcium phosphate in domestic pigs
  + Magnesium calcium phosphate in Potbellied pigs
  + Calcium carbonate in farmed European pigs
* Etiology of urolithiasis is affected by nutritional imbalance (Ca:P imbalance), reduced water intake, urinary tract infections, and genetic predispositions
  + Outbreaks of fatal urolithiasis reported in pigs when water intake reduced, high urinary pH, and cystitis
* Calcium carbonate uroliths occur predominantly in herbivores due to their alkaline pH
  + In farmed pigs, normal is urine pH of 7 and no crystalluria

**Cases:**

* Visayan warty pigs in this series were given lucerne hay to increase calcium content in diet about 4 months prior
  + Moved to new enclosure about 2 weeks prior to index case
* Case 1: Adult male with urolith at sigmoid and unable to pass urinary catheter → euthanized
  + Calcium oxalate crystals, urine pH 8.5
* Case 2: Adult male with sudden death
  + Calcium carbonate crystals and cystoliths, and uroperitoneum
* Case 3: Adult female with calcium carbonate crystals and no symptoms
  + Treated with Clavamox and more water stations → crystalluria resolved
* Case 4: Juvenile male with urethral obstruction catheterized with lateral preputial incision
  + Recurred one month later and catheterization retrograde or normograde → euthanasia
  + Urethral narrowing at sigmoid flexure, no uroliths, calcium oxalate crystals
* Case 5: Adult male urethral obstruction at sigmoid flexure → tube cystostomy for 10 days, calcium carbonate urolith
  + Treated with canine urinary acidification diet that decreased urine pH to 6.5
    - Hills canine S/d at 360g/10kg body weight
  + Discontinuation of diet put urine pH at 8.5
* Outbreak of urolithiasis suspected to be due to increased dietary calcium and reduced water intake
  + Pigs were noted to not use the holding pen (where water was kept) during the day
  + SIgns of tail-lifting was misinterpreted by keepers to be constipation and not dysuria

**Conclusion:** A case series describing an outbreak of calcium carbonate urolithiasis in Visayan warty pigs, suspected to be due to increased dietary calcium and reduced water intake.