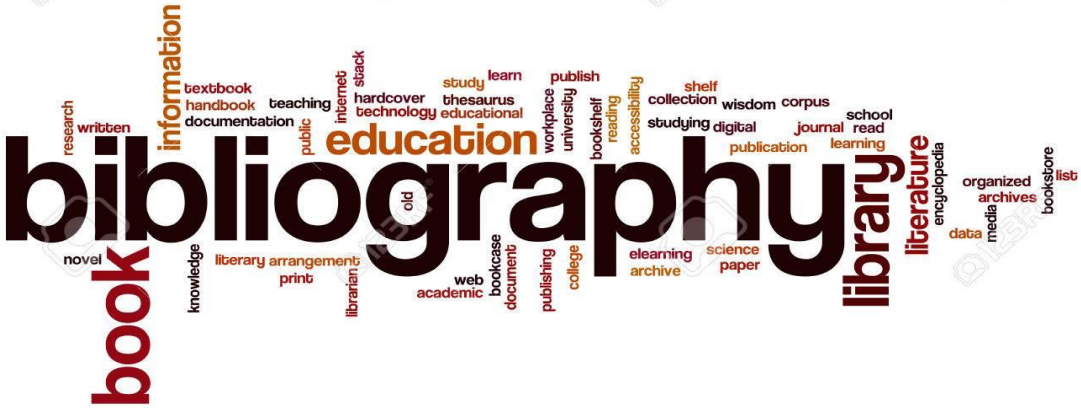


Bibliografía Científica

Anexo 2019

SERIDA

Servicio Regional de Investigación y Desarrollo Agroalimentario

Unidad de Archivo y Biblioteca

[Ana Rodríguez Navarro, septiembre 2020]

PRESENTACIÓN

Uno de los resultados más visibles de la actividad científica de una institución son las publicaciones de sus miembros y colaboradores en revistas científicas de prestigio internacional. En este contexto, la *Bibliografía* que ahora se presenta, recopila la producción científica del SERIDA en el año 2019 que aparece recogida en las diversas bases de datos multidisciplinares y de carácter internacional que integran la *Web of Science (WoS*).

La *Web of Science* permite, por una parte, la recuperación de los trabajos científicos de una institución indexados en las revistas científicas de mayor visibilidad e impacto y por otra, su caracterización desde el punto de vista bibliométrico. El objetivo ha sido recuperar todos los artículos con al menos un autor perteneciente al SERIDA, por lo que se definió una estrategia de búsqueda usando el campo "Dirección"; mientras la consolidación del nombre que ha sido solicitada, no se encuentre del todo operativa, y por ello en las ecuaciones de búsqueda empleadas se usaron distintas variantes del nombre del centro. El resto de opciones fueron las establecidas por defecto en la interfaz de búsqueda, excepto el período que se acotó al año 2019, aceptándose además para su inclusión en la bibliografía aquellos registros que tuvieran fecha *acceso anticipado* en 2019, aunque la fecha de publicación definitiva sea de un año posterior. Efectivamente, la plataforma permite recuperar aquellos artículos "en prensa" que, aunque estén pendientes de que se les asigne un volumen o un número específico en una publicación, se encuentran ya publicados electrónicamente, indexados y pueden acumular citas. No obstante, cuando se ha producido este hecho, ambas fechas, tanto la de acceso anticipado, como la de publicación definitiva han quedado convenientemente reflejadas en las respectivas entradas bibliográficas y lógicamente no serán incluidas en la bibliografía del próximo año.

Esta nueva actualización se compone de 50 artículos y como en recopilaciones anteriores, los registros se han organizado y redactado en el estilo bibliográfico Harvard que asocia autor y año por orden alfabético. Cada referencia, se ha completado con el resumen o abstract del artículo, indicando además si está publicado en acceso abierto.

En esta ocasión el repertorio se ha enriquecido además con varios índices y gráficos: un índice alfabético de los autores que pertenecen al SERIDA (Índice A), un índice alfabético de los 34 títulos de las revistas en las que aparecen publicados los artículos, con indicación del factor de impacto de cada una de ellas y del cuartil de importancia al que pertenecen según el *Journal Citation Reports (JCR)* (Índice B), y un índice de los artículos según el área de investigación del SERIDA al que se adscriben los investigadores (Índice C).

Las figuras por su parte, pretenden resaltar gráficamente los porcentajes de producción según las áreas de investigación del centro (Figura 1), los países con los que se ha colaborado (Figura 2), los títulos de las revistas en las que más se ha publicado (Figura 3), y la importancia de las revistas en las que aparecen publicados los artículos (Figura 4 y 5).

Sistematizando y difundiendo los resultados de la investigación del centro, creemos que la biblioteca contribuye de forma eficaz a aumentar la visibilidad de la institución y de sus investigadores, puesto que además el repertorio se publicará como en ocasiones anteriores, en el Repositorio Institucional de Asturias (RIA).

Ana Rodríguez Navarro
Responsable de la Unidad de Archivo y Biblioteca

LISTADO DE ABREVIATURAS

[a]	Fecha de acceso anticipado
CHF	Área de Cultivos Hortofrutícolas y Forestales
EDA	Área de Experimentación y Demostración Agroforestal
GRA	Área de Genética y Reproducción Animal
NPF	Área de Nutrición, Pastos y Forrajes
SA	Área de Sanidad Animal
SRA	Área de Selección y Reproducción Animal
SPA	Área de Sistemas de Producción Animal
TA	Área de Tecnología de los Alimentos
OA	Acceso Abierto
[p]	Fecha de publicación

LISTADO DE REFERENCIAS

1.- ACEVEDO, P., PRIETO, M., QUIRÓS, P., MEREDIZ, I., DE JUAN, L., ANTONIO INFANTES-LORENZO, J., TRIGUERO-OCAÑA, R. & BALSEIRO, A. 2019. Tuberculosis Epidemiology and Badger (Meles meles) Spatial Ecology in a Hot-Spot Area in Atlantic Spain. *Pathogens*, 8 (4) DOI: 10.3390/pathogens8040292. (OA).[SA]

Abstract: We provide a temporal overview (from 2012 to 2018) of the outcomes of tuberculosis (TB) in the cattle and badger populations in a hot-spot in Asturias (Atlantic Spain). We also study the badger's spatial ecology from an epidemiological perspective in order to describe hazardous behavior in relation to TB transmission between cattle and badgers. Culture and single intradermal tuberculin test (SITT) were available for cattle as part of the National Program for the Eradication of TB. A field survey was also carried out in order to determine the paddocks and buildings used by each farm, and the information obtained was stored by using geographic information systems. Moreover, eighty-three badgers were submitted for necropsy and subsequent bacteriological studies. Ten badgers were also tracked, using global positioning system (GPS) collars. The prevalence of TB in cattle herds in the hot-spot increased from 2.2% in 2012 to 20% in 2016; it then declined to 0.0% in 2018. In contrast, the TB prevalence in badgers increased notably (from 5.55% in 2012-2015 to 10.64% in 2016-2018). Both cattle and badgers shared the same strain of Mycobacterium bovis. The collared badgers preferred paddocks used by TB-positive herds in spring and summer (when they were more active). The males occupied larger home ranges than the females (Khr95: males 149.78 +/- 25.84 ha and females 73.37 +/- 22.91 ha; Kcr50: males 29.83 +/- 5.69 ha and females 13.59 +/- 5.00 ha), and the home ranges were smaller in autumn and winter than in summer. The averages of the index of daily and maximum distances traveled by badgers were 1.88 +/- (SD) 1.20 km and 1.99 +/- 0.71 km, respectively. One of them presented a dispersive behavior with a maximum range of 18.3 km. The most preferred habitat was apple orchards in all seasons, with the exception of winter, in which they preferred pastures. Land uses and landscape structure, which have been linked with certain livestock-management practices, provide a scenario of great potential for badger-cattle interactions, thus enhancing the importance of the badgers' ecology, which could potentially transmit TB back to cattle in the future.

2.-ADALID, R., TORRES, J., MIÑARRO, M., MIQUEL, J., FUENTES, M. V. & EIRA, C. 2019. Mercury, Lead and Cadmium concentrations in Talpa occidentalis and in their Digeneans of the Genus Ityogonimus. *Acta Parasitologica*, 64 (3)**,** 464-470. DOI: 10.2478/s11686-019-00089-x. [CHF]

Abstract: Introduction: Many parasites living in aquatic ecosystems are useful indicators of environmental health. On the other hand, information is scarcer with respect to the use of helminth parasites of vertebrates living in terrestrial ecosystems as monitoring tools for toxic element environmental pollution. The present study evaluates the suitability of the model Talpa occidentalis/Ityogonimus spp. as a bioindicator system for mercury (Hg), lead (Pb) and cadmium (Cd) contamination in agricultural soils from Asturias (Spain).
Methods: Kidney and liver samples collected from T. occidentalis specimens (n = 36) and Ityogonimus spp. samples collected from 14 infected hosts were analyzed by ICP-MS.
Results: The highest mean levels of Hg and Pb were found in Ityogonimus individuals (20.9 and 12.4 mu g g(-1) wet weight, respectively). Considering renal and hepatic concentrations in T. occidentalis, bioaccumulation factors of Ityogonimus for Hg were 83.7 and 58.6, respectively, whereas concerning Pb

bioaccumulation factors were 38.2 and 82.9, respectively. No bioaccumulation was detected in Ityogonimus in the case of Cd.
Conclusions: More studies involving digenean parasites of small mammals are needed, especially when biomonitoring environmental toxic element pollution in terrestrial ecosystems. The present results support the above-mentioned model as a suitable biomonitoring system to evaluate environmental Hg and Pb contamination in terrestrial non-urban Iberian habitats. Similar models involving other species (Talpa spp./Ityogonimus spp.) might be used in a much wider geographical range.

3.- ALONSO-HEARN, M., CANIVE, M., BLANCO-VÁZQUEZ, C., TORREMOCHA, R., BALSEIRO, A., AMADO, J., VARELA-MARTÍNEZ, E., RAMOS, R., JUGO, B. M. & CASAIS, R. 2019. RNA-Seq analysis of ileocecal valve and peripheral blood from Holstein cattle infected with Mycobacterium avium subsp. paratuberculosis revealed dysregulation of the CXCL8/IL8 signaling pathway. *Scientific Reports,* 9. DOI: 10.1038/s41598-019-51328-0. (OA).[SA]

Abstract: Paratuberculosis is chronic granulomatous enteritis of ruminants caused by Mycobacterium avium subsp. paratuberculosis (MAP). Whole RNA-sequencing (RNA-Seq) is a promising source of novel biomarkers for early MAP infection and disease progression in cattle. Since the blood transcriptome is widely used as a source of biomarkers, we analyzed whether it recapitulates, at least in part, the transcriptome of the ileocecal valve (ICV), the primary site of MAP colonization. Total RNA was prepared from peripheral blood (PB) and ICV samples, and RNA-Seq was used to compare gene expression between animals with focal or diffuse histopathological lesions in gut tissues versus control animals with no detectable signs of infection. Our results demonstrated both shared, and PB and ICV-specific gene expression in response to a natural MAP infection. As expected, the number of differentially expressed (DE) genes was larger in the ICV than in the PB samples. Among the DE genes in the PB and ICV samples, there were some common genes irrespective of the type of lesion including the C-X-C motif chemokine ligand 8 (CXCL8/IL8), apolipoprotein L (APOLD1), and the interferon inducible protein 27 (IF127). The biological processes (BP) enriched in the PB gene expression profiles from the cows with diffuse lesions included the killing of cells of other organism, defense response, immune response and the regulation of neutrophil chemotaxis. Two of these BP, the defense and immune response, were also enriched in the ICV from the cows with diffuse lesions. Metabolic analysis of the DE genes revealed that the N-glycan biosynthesis, bile secretion, one-carbon pool by folate and purine metabolism were significantly enriched in the ICV from the cows with focal lesions. In the ICV from cows with diffuse lesions; the valine, leucine and isoleucine degradation route, purine metabolism, vitamin digestion and absorption and the cholesterol routes were enriched. Some of the identified DE genes, BP and metabolic pathways will be studied further to develop novel diagnostic tools, vaccines and immunotherapeutics.

4.- ALONSO-HEARN, M., MAGOMBEDZE, G., ABENDAÑO, N., LANDIN, M. & JUSTE, R. A. 2019. Deciphering the virulence of Mycobacterium avium subsp. paratuberculosis isolates in animal macrophages using mathematical models. *Journal of Theoretical Biology,* 468**,** 82-91. DOI: 10.1016/j.jtbi.2019.01.040. [SA]

Abstract: Understanding why pathogenic Mycobacterium avium subsp. paratuberculosis (Map) isolates cause disparate disease outcomes with differing magnitudes of severity is important in designing and implementing new control strategies. We applied a suite of mathematical models: i) general linear, and neurofuzzy logic, to explain how the host of origin of several Map isolates, Map genotype, host, macrophage based in vitro model and time post-infection contributed to the infection. A logistic growth ordinary differential equation (ODE) model was applied to estimate within macrophage growth rates for the

different Map isolates. The models revealed different susceptibilities of bovine and ovine macrophages to Map infection and confirmed distinct virulence profiles for the isolates, judged by their ability to grow within macrophages. Ovine macrophages were able to internalize Map isolates more efficiently than bovine macrophages. While bovine macrophages were able to internalize Map isolates from cattle with more efficiency, ovine macrophages were more efficient in internalizing ovine isolates. Overall, Map isolates from goat and sheep grew minimally within macrophages or did not grow but were able to persist by maintaining its initial population. In contrast, the ability of the bovine isolates and the non-domesticated animal isolates to grow to higher CFU numbers within macrophages suggests that these isolates are more virulent than the sheep and goat isolates, or that these isolates are better adapted to infect domestic ruminants. Overall, our study confirms the different virulence levels for the Map isolates and susceptibility profiles of host macrophages, which is crucial in increasing our understanding of Map infection

5.- ÁLVAREZ, I., FERNÁNDEZ, I., SOUDRE, A., TRAORÉ, A., PÉREZ-PARDAL, L., SANOU, M., TAPSOBA, S. A. R., MENÉNDEZ-ARIAS, N. A. & GOYACHE, F. 2019. Identification of genomic regions and candidate genes of functional importance for gastrointestinal parasite resistance traits in Djallonke sheep of Burkina Faso. *Archives Animal Breeding,* 62**,** 313-323. DOI: 10.5194/aab-62-313-2019. (OA). [GRA]

Abstract: A total of 184 Djallonke lambs from Burkina Faso with phenotypes for packed-cell volume (PCV), log-transformed fecal egg count (lnFEC), and FAffa MAlan CHArt (FAMACHA (c)) eye scores were typed with the OvineSNP50 BeadChip of Illumina to contribute to the knowledge of the genetic basis of gastrointestinal (GIN) parasite resistance in sheep. Association analysis identified a total of 22 single-nucleotide polymorphisms (SNPs) related with PCV (6 SNPs), lnFEC (7), and FAMACHA scores (9) distributed among 14 Ovis aries chromosomes (OAR). The identified SNPs accounted for 18.76% of the phenotypic variance for PCV, 21.24% for lnFEC, and 34.38% for FAMACHA scores. Analyses pointed out the importance of OAR2 for PCV, OAR3 for FAMACHA scores, and OAR6 for lnFEC. The 125 kb regions surrounding the identified SNPs overlapped with seven previously reported quantitative trait loci (QTLs) for the traits analyzed in the current work. The only chromosome harboring markers associated with the three traits studied was OAR2. In agreement with the literature, two different chromosomal areas on OAR2 can play a major role in the traits studied. Gene-annotation enrichment analysis allowed us to identify a total of 34 potential candidate genes for PCV (6 genes), lnFEC (4), and FAMACHA scores (24). Annotation analysis allowed us to identify one functional term cluster with a significant enrichment score (1.302). The cluster included five genes (TRIB3, CDK4, CSNK2A1, MARK1, and SPATA5) involved in immunity-related and cell-proliferation processes. Furthermore, this research suggests that the MBL2 gene can underlie a previously reported QTL for immunoglobulin A levels on OAR22 and confirms the importance of genes involved in growth and size (such as the ADAMTS17 gene on OAR18) for GIN resistance traits. Since association studies for the ascertainment of the genetic basis of GIN resistance may be affected by genotype-environment interactions, obtaining information from local sheep populations managed in harsh environments contributes to the identification of novel genomic areas of functional importance for GIN resistance for that trait.

6.- BALSEIRO, A., OLEAGA, A., ÁLVAREZ MORALES, L. M., GONZÁLEZ QUIRÓS, P., GORTÁZAR, C. & PRIETO, J. M. 2019. Effectiveness of a calf-selective feeder in preventing wild boar access. *European Journal of Wildlife Research,* 65.DOI: 10.1007/s10344-019-1276-4. [SA]

Abstract: Tuberculosis (TB) transmission between wildlife and domestic animals is usually indirect when

they share an interface or visit the same location at different times in order to use the same food and water resources. Preventing aggregation and subsequent contact between domestic and wild animals is a valuable and cheap tool for improving farm biosafety. This study was carried out in a beef cattle farm located in Asturias (Atlantic Spain). Wild boar (Sus scrofa) visited the farm facilities every night to feed in the farm's calf feeders. Our aim was to design and test the efficacy of a selective feeder for calves that could hinder its use by wild boar. We analyzed the effectiveness of the design using camera trapping. Pictures showed a reduction of 97.8% and 56.3% in the number of wild boar accessing to the selective feeder and in the number of wild boar around it, respectively. Those data demonstrate that the selective feeder hindered the access of wild boar to the feed and therefore, reduced the feed-mediated indirect interspecies contacts. Biosecurity measures are promising, cheap, and cost-effective tools for preventing TB and other diseases.

7.- BALSEIRO, A., PÉREZ, V. & JUSTE, R. A. 2019. Chronic regional intestinal inflammatory disease: A trans-species slow infection? *Comparative Immunology Microbiology and Infectious Diseases,* 62**,** 88-100. DOI: 10.1016/j.cimid.2018.12.001. [SA]

Abstract: Crohn's disease and ulcerative colitis in humans and paratuberculosis in domestic and wild ruminants can be defined as chronic regional intestinal inflammatory diseases (CRIID). This review is a literature overview on these diseases in humans, non-human primates, dogs, cats, rabbits, equids and ruminants with a focus on pathological and microbiological features aimed identifying common characteristics that could lead to a unified pathological classification for a better understanding of their mechanisms and causes. The result is a framework of inflammatory forms throughout the different species indicative of common mechanisms of the slow infection type characterized by a time course varying from weeks to months or even years, and where the inflammatory component would be more prominent in the intestinal interphase between host and environment and be morphologically characterized by an infiltrate ranging from lymphoplasmacytic to histiocytic. This should provide new insights for causation demonstration and therapeutic approaches in human IBD.

8.- BALSEIRO, A., ROYO, L. J., GAYO, E. & GARCÍA MARÍN, J. F. (Abr 2019[a], Ene 2020[p]). Cholangiocarcinoma in a free-ranging eurasian brown bear (Ursus arctos arctos) from northern Spain. *Journal of Wildlife Diseases*, 56 (1), 251-254. DOI: 10.7589/2019-03-054. [SA] [NPF]

Abstract: A hepatic cholangiocarcinoma with metastases in the gallbladder, left elbow joint, adrenal glands, and lungs was observed in a female 21-yr-old free-ranging Eurasian brown bear (Ursus arctos arctos) found in the Principality of Asturias (northern Spain). Gross and histopathologic findings are described.

9.- CAAMAÑO, J. N., PARRILLA, I., TAMARGO, C., PADILLA, L., FUEYO, C., FERNÁNDEZ, A., MERINO, M. J. & HIDALGO, C. O. 2019. The effects of boar age and incubation time of sperm on post-thawing sperm quality from the breed Gochu Asturcelta. *Reproduction in Domestic Animals,* 54**,** 112-113. [Meeting Abstract]. [SRA]

Abstract: Semen cryopreservation is a key technique for the conservation of valuable or endangered breeds. The aim of this study was to assess the overall post-thawing sperm quality of the pig breed "Gochu Asturcelta". The effects of boar age and incubation time on post-thaw quality were evaluated. Frozen semen doses from 18 Gochu Asturcelta boars, ranging from 8 to 71 months of age, were used in this

experiment. Two straws per boar were thawed in a water bath (38°C/20-s), pooled and assessed after 30 and 150 min of incubation at 38°C. Motility was recorded and analysed in a CASA system and sperm viability, acrosomal status, mitochondrial activity, apoptosis and free radicals (ROS) were assessed by flow cytometry after staining with propidium iodide, PNA-FITC (peanut agglutinin), Mitotracker deep red, Annexin V and CM-H2DCFDA respectively, using Hoechst 33342 to discard debris. Data were analysed with the R statistical environment v.3.4.3. The effects of age and incubation on sperm post-thawing quality were determined by using linear mixed-effects models. The boar age did not influence any of the parameters under study ($p > 0.05$). Incubation of the samples at 38°C for 150 min caused a general decrease in sperm quality, affecting total motility ($p < 0.001$), progressive motility ($p < 0.001$), viability ($p < 0.001$), number of viable sperm with damaged acrosome ($p < 0.001$), mitochondrial membrane potential ($p < 0.001$), apoptosis ($p < 0.003$) and ROS ($p < 0.022$). In conclusion, our findings demonstrated that post-thawing quality of Gochu Asturcelta sperm was affected by incubation time after thawing. Supported by: INIA RZP2013-00006-00-00 and SENECA foundation 19892/GERM/15.

10.- CASAIS, R., LARRINAGA, A. R., DALTON, K. P., DOMÍNGUEZ LAPIDO, P., MÁRQUEZ, I., BÉCARES, E., CARTER, E. D., GRAY, M. J., MILLER, D. L. & BALSEIRO, A. 2019. Water sports could contribute to the translocation of ranaviruses. *Scientific Reports*, 9. DOI: 10.1038/s41598-019-39674-5. (OA).[SA]

Abstract: Ranaviruses have been identified as the cause of explosive disease outbreaks in amphibians worldwide and can be transmitted between hosts both via direct and indirect contact, in which humans might contribute to the translocation of contaminated material. The aim of this study was to evaluate the possible role of water sports in the human translocation of ranavirus, Batrachochytrium dendrobatidis (Bd), and B. salamandrivorans (Bsal). A total of 234 boats were sampled during the spring Spanish Canoe Championship which took place in Pontillon de Castro, a reservoir with a history of ranavirosis, in May 2017. Boats were tested for the presence of ranavirus and Batrachochytrium spp. DNA, using quantitative real-time polymerase chain reaction techniques (qPCR). A total of 22 swabs (22/234, 9.40%) yielded qPCR-positive results for Ranavirus DNA while Bd or Bsal were not detected in any of the samples. We provide the first evidence that human-related water sports could be a source of ranavirus contamination, providing justification for public disinfecting stations in key areas where human traffic from water sports is high.

11.- CIORDIA, M., GARCÍA, J. C. & LOUREIRO, M. D. (Dic 2019[a] May 2020[p]). Hot water treatment: an effective method for disinfecting Castanea sativa Mill. dormant scions against Dryocosmus kuriphilus Yasumatsu. *Pest Management Science*, 76 (5), 1944-1948. DOI: 10.1002/ps.5727.[CHF] [EDA] [TA]

Abstract: Backgoaund The Asian chestnut gall wasp (ACGW) Dryocosmus kuriphilus Yasumatsu is the most severe pest of the genus Castanea worldwide. After its arrival in Europe, the insect dispersed rapidly from Italy to other European countries, as well as spreading over long distances within each country because of the unintentional transport of infested chestnut material owing to the fact that infestation inside the dormant buds is visually undetectable. Hot water treatment (HWT) has been tested in terms of pest and diseases control in propagation processes with a wide range of plant material and species, including the Asian chestnut Castanea mollissima cv 'Qing'. Taking into account the different thermal tolerances of plant species, an experiment to disinfect Castanea sativa scions from ACGW by HWT was performed. The effects of the immersion of dormant scions for 10 min at two water temperatures (49 and 52 degrees C), with and without a previous period of water hydration, were tested.

Results: A 10 min soak at 49 degrees C was effective in killing ACGW larvae while retaining an excellent percentage of successful grafts. The pre-HWT hydration stage did not influence the success of the treatment. Positive shoot growth was also recorded after HWT.
Conclusions: We report for the first time the effectiveness of a simple and environmentally friendly protocol based on hot water for the disinfection of European chestnut (C. sativa) scions against D. kuriphilus. This will enable nurseries to supply plants free from this pest, preventing the insect dispersion, which will have a positive socio-economic impact to the chestnut tree sector. Also positive environmental impact will be favoured as gall wasp proliferation will decrease

12.- COTS-RODRÍGUEZ, P., SÁNCHEZ-FÉREZ, J., GÓMEZ, E., LÓPEZ-FORTÚN, N., GONZÁLEZ-BRUSI, L., MOROS-NICOLÁS, C., IZQUIERDO-RICO, M. J. & AVILÉS, M. 2019. Polarized light microscopy (Polscope) analysis reveals differences in zona pellucida structure of cat oocytes. *Reproduction in Domestic Animals,* 54**,** 119-120. [Meeting Abstract]. [GRA]

Abstract: The Zona Pellucida (ZP) is an extracellular matrix involved in important roles during folliculogenesis and fertilization. In cats, ZP consists of four glycoproteins: ZP1, ZP2, ZP3 and ZP4. The aim of this study was to analyse the ZP resistance to trypsin digestion and the ZP structure in cat oocytes (n = 50) using Polscope microscopy. Birefringence and structural parameters of the ZP were analysed by Oosight Meta® software (CRI, USA). Oocytes were incubated with trypsin solution (5 mg/ml) at 37°C; the time of ZP digestion with trypsin was recorded. According to birefringence, oocytes can be classified in two groups depending on the presence of three or two layers. Three-layered (3L) oocytes showed inner, middle and outer layer. In contrast, two-layered (2L) oocytes contained only inner and outer layer. The diameter of 3L oocytes is lower ($p < 0.05$) than that of 2L oocytes (165.2 ± 3.5 µm, 188.7 ± 2.5 µm, respectively). In contrast, ZP thickness is higher in 3L oocytes than in 2L oocytes (28.88 ± 0.9 µm and 23.2 ± 1.00 µm, respectively). In both groups, the inner layer is the most birefringent layer (3L oocytes 2.0 ± 0.2 nm; 2L oocytes 4.3 ± 0.4 nm). However, 3L and 2L oocytes did not differ in ZP resistance to digestion (3L 17.9 ± 1.4 min; 2L 19.2 ± 0.9 min). In conclusion, two differentiated structural ZP patterns were found in cat oocytes. The mechanism involved in these structural changes remains unknown, but it could be related with cat oocyte maturation. Further studies are required to evaluate the fertilization capacity of these oocytes.
Supported by MINECO AGL2015-70159-P, FEDER and AGL2016-81890-REDT.

13.- DALTON, K. P., MARTÍN, J. M., NICIEZA, I., PODADERA, A., DE LLANO, D., CASAIS, R., GIMÉNEZ, S., BADIOLA, I., AGÜERO, M., DURAN, M., BUITRAGO, D., ROMERO, L. J., GARCÍA, E. & PARRA, F. 2019. Myxoma virus jumps species to the Iberian hare. *Transboundary and Emerging Diseases,* 66 **(**6), 2218-2226. DOI:10.1111/tbed.13296. [SA]

Abstract: The study of myxoma virus (MYXV) infections in the European rabbit (Oryctolagus cuniculus) has produced one of the most accepted host-pathogen evolutionary models. To date, myxomatosis has been limited to the European rabbit with sporadic reports in hares. However, reports of widespread mortalities in the Iberian hare (Lepus granatensis) with myxomatosis-like clinical signs indicate a potential species jump has occurred. The presence of MYXV DNA was confirmed by PCR in 244 samples received from regional veterinary services, animal health laboratories, hunters or rangers over a 5-month period. PCR analysis of 4 MYXV positive hare samples revealed a 2.8 kb insertion located within the M009 gene with respect to MYXV. The presence of this insertion was subsequently confirmed in 20 samples from 18 Spanish provinces. Sanger sequencing and subsequent analysis show that the insert contained 4 ORFs which are

phylogenetically related to MYXV genes M060, M061, M064 and M065. The complete MYXV genome from hare tissue was sequenced using Ion torrent next-generation technology and a summary of the data presented here. With the exception of the inserted region, the virus genome had no large scale modifications and 110 mutations with respect to the MYXV reference strain Lausanne were observed. The next phase in the evolution of MYXV has taken place as a host species jump from the European rabbit to the Iberian hare an occurrence which could have important effects on this naive population.

14.- DÍEZ-DELGADO, I., SEVILLA, I. A., GARRIDO, J. M., ROMERO, B., GEIJO, M. V., DOMÍNGUEZ, L., JUSTE, R. A., ARANAZ, A., DE LA FUENTE, J. & GORTÁZAR, C. 2019. Tuberculosis vaccination sequence effect on protection in wild boar. *Comparative Immunology Microbiology and Infectious Diseases,* 66. DOI: 10.1016/j.cimid.2019.101329. [SA]

Abstract: The Eurasian wild boar (Sus scrofa) is a reservoir for tuberculosis (TB) in which vaccination is a valuable tool for control. We evaluated the protection and immune response achieved by homologous and heterologous regimes administering BCG and heat-inactivated Mycobacterium bovis (IV). Twenty-one wild boar piglets were randomly allocated in five groups: Control, homologous BCG, homologous IV, heterologous IV-BCG, heterologous BCG-IV. Significant 67% and 66% total lesion score reductions were detected in homologous IV (IVx2) and heterologous IV-BCG groups when compared with Control group ($F_{4,16} = 6.393$, $p = 0.003$; Bonferroni (Control vs rvx2) $p = 0.026$, Tukey (control vs IV-BCG) $p = 0.021$). No significant differences were found for homologous BCG (although a 48% reduction in total lesion score was recorded) and BCG-IV (3% reduction). Heterologous regimes did not improve protection over homologous regimes in the wild boar model and showed variable results from no protection to similar protection as homologous regimes. Therefore, homologous regimes remain the best option to vaccinate wild boar against TB. Moreover, vaccine sequence dramatically influenced the outcome underlining the relevance of studying the effects of prior sensitization in the outcome of vaccination.

15.- DOLTRA, J., GALLEJONES, P., OLESEN, J. E., HANSEN, S., FROSETH, R. B., KRAUSS, M., STALENGA, J., JONCZYK, K., MARTÍNEZ-FERNÁNDEZ, A. & PACINI, G. C. 2019. Simulating soil fertility management effects on crop yield and soil nitrogen dynamics in field trials under organic farming in Europe. *Field Crops Research,* 233**,** 1-11. DOI: 10.1016/j.fcr.2018.12.008. [NPF]

Abstract: Soil fertility building measures should be explored at the short and long-term for an adequate evaluation of their impact on sustaining yields and of its environmental consequences in crop rotations under organic farming. For such a purpose, process-based crop models are potential useful tools to complement and upscale field observations under a range of soil and climatic conditions. Organic rotations differ in soil fertility dynamics in comparison to conventional farming but very few modelling studies have explicitly considered this specific situation. Here, we evaluate the FASSET model to predict the effects of different fertility management options in organic crop rotations on dry matter (DM) and nitrogen (N) yield, and soil N dynamics, including N_2O emissions. For that, we used data from seven short and long-term field experiments in different agro-climatic environments in Europe (Norway, Denmark, Poland, Switzerland, Italy and Spain) including climate, soil and management data. Soil fertility building measures covered fertilization type, green manures, cover crops, tillage, crop rotation composition and management (organic or conventional). Model performance was evaluated by comparing observed and simulated values of crop DM and N yield, soil mineral N and nitrous oxide (N_2O) emissions using five complementary statistical indices. The model closely reproduced most observed DM and N yield trends and effects of soil fertility

building measures in arable crops, particularly in cereals. Contrary, yields of grass-clover, especially N, were generally reproduced with low degree of accuracy. Model performance for simulating soil mineral N depended on site and the availability of soil and management information. Although high uncertainty was associated to the simulation of soil N dynamics, differences of cumulative N2O emissions between fertility building measures were reflected in model outputs. Aspects for modelling improvement include cover crop growth and decomposition, biological N fixation (BNF) or weed and pest soil-crop interactions. It is concluded that FASSET can be successfully used to investigate the impact of fertilization type, green manures, tillage and management (organic or conventional) on crop productivity and to a certain extent on soil N dynamics including soil N2O emissions at different soils and climates in organic farming in Europe.

16.- FUENTE-GARCÍA, C., ALDAI, N., SENTANDREU, E., OLIVÁN, M., GARCÍA-TORRES, S., FRANCO, D., ZAPATA, C. & SENTANDREU, M. A. 2019. Search for proteomic biomarkers related to bovine pre-slaughter stress using liquid isoelectric focusing (OFFGEL) and mass spectrometry. *Journal of Proteomics,* 198**,** 59-65. DOI: 10.1016/j.jprot.2018.10.013.[SPA]

Abstract: Proteome changes derived from animals that have suffered pre-slaughter stress are a fact. In this study, Proteomic analysis was carried out on 20 bovine loin samples from Asturiana de los Valles and crossbreds cattle previously classified as normal and DFD meat at 24 h post-mortem using pH measurements. Sarcoplasmic sub-proteome of Longissimus thoracic at 24 h post-mortem was fractionated by the use of liquid isoelectric focusing (OFFGEL) in the pH range 3-10, followed by SDS-PAGE analysis of each retrieved fraction. The protein fractionation profile showed high reproducibility along the different sample groups. Five protein bands showed significant differences ($p < 0.05$) between the two groups, allowing discrimination between them. Proteins present in these bands, which were identified by LC-MS, were actin, phosphoglucomutase-1, alpha-crystallin B, heat shock protein beta-6 and heat shock protein beta-1.Significance: The significance of this study relies on the optimization of OFFGEL fractionation as a promising technology to search for reliable biomarkers of pre-slaughter stress. This method separates proteins along different liquid fractions according to their isoelectric point; the obtained fractions can be further characterized by SDS-PAGE or directly identified by LC-MS. This achievement stands out as an alternative to the use of 2-DE electrophoresis in protein separation and analysis.

17.- GAYO, E., POLLEDO, L., MAGALDE, A., BALSEIRO, A., GARCÍA IGLESIAS, M. J., PÉREZ MARTÍNEZ, C., PREZIUSO, S., ROSSI, G. & GARCÍA MARÍN, J. F. 2019. Characterization of minimal lesions related to the presence of visna/maedi virus in the mammary gland and milk of dairy sheep. *Bmc Veterinary Research*, 15 (109). DOI: 10.1186/s12917-019-1855-3. (OA). [SA]

Abstract: Background: In order to characterize the complete range of lesions, especially minimal, affecting mammary gland and viral antigen distribution and target cells using immunohistochemistry in naturally Visna/maedi (VM) 84 infected sheep were studied, forty-four from flocks with clinical cases (A) and 35 randomly sampled from two abattoirs (B) together with five negative controls (C). An immunocytochemistry technique was developed and further milk samples (n=39) were used to study viral excretion, carrier cells and the role of milk and colostrum in the transmission of the disease.
Results: All sheep from group C and three sheep from group B were negative to VM in tissue sections by histopathology, immunohistochemistry and PCR, and also in serum using ELISA. Several degrees of CD3+lymphocytic interstitial mastitis were observed in groups A and B: minimal (+) n=26 sheep; moderate (++), n=32 and severe (+++), n=12. No differences in lesion distribution were observed between groups A

and B. Viral presence was confirmed by immunohistochemistry using two different antibodies and/or PCR in every tissue with lesions while serology was negative in six sheep with lesions. Two milk samples taken from milk tanks from two flocks from group A and fourteen milk samples from 29 infected sheep from group B were positive to VM (most of them from animals with moderate and severe lesions). Positivity was only found in macrophages, even in focal and minimal lesions, while no positivity was observed in epithelial or any other cells in either tissue and milk samples.
Conclusions: This new observation of the minimal lesions described in this work increased the prevalence of VM lesions in mammary gland up to 90.9% and VM should be considered as a differential diagnosis when minimal interstitial lesions are detected. A high prevalence of VM was observed in intensive milk-producing sheep, ELISA serology did not detect as positivity all infected animals, while histology, IHC or PCR showed higher sensitivity. The cytological technique developed was very useful in milk-cell studies using hematoxylin and eosin and immunocytochemistry. Viral detection in milk samples (16/39) confirms a potential but limited role of milk/colostrum in viral transmission.

18.- GÓMEZ, E., SALVETTI, P., MARTÍN, D., GATIEN, J., CARROCERA, S. & MUÑOZ, M. 2019. Improved selection of beef recipients for IVP embryos by blood plasma metabolomics. *Reproduction in Domestic Animals,* 54**,** 109-109. [Meeting abstract]. [GRA]

Abstract: Developing methodologies for recipient selection is a major objective in bovine embryo transfer (ET). Fresh (F), and particularly vitrified (V), in vitro produced (IVP) embryos, show lower pregnancy rates that in vivo embryos. We used nuclear magnetic resonance to analyze recipient blood plasma on Day-0 (estrus) and Day-7 (ET), allowing to quantify N = 36 metabolites. IVP embryos were first transferred as F (N = 26) and V (N = 48) to Asturiana de los Valles recipients (training group). Metabolites with ANOVA < 0.05, FDR < 0.05, and ROC-AUC > 0.650 ($p < 0.05$) for F and V embryos were identified on Day-40 (N) (F = 4; V = 2), Day-62 (F = 12; V = 2) and birth (F = 5; V = 2). All these metabolites were only found on Day-7, but π-Methylhistidine by subtracting Day-0 and Day-7 concentrations. Biomarker metabolites were validated in independent groups of Holstein (N) (F = 44; V = 40), Asturiana de la Montaña (F = 11; V = 10) and crossbred (F = 12; V = 13) cattle, and overall classification accuracy (OCA) was calculated for each metabolite. Generally, all biomarkers were represented in one or more breeds (except π-Methylhistidine on Day-40), with OCA > 0.650 and $p < 0.001$ to $p < 0.06$ on Day-62. Relevant metabolites were 2-oxoglutarate (F embryos) and 2-hydroxybutyrate (V embryos), both with ROC-AUC > 0.650 in all breeds on Day-62 and significant OCA > 0.650 ($p < 0.01$). At birth, 2-oxoglutarate, but not 2-hydroxybutyrate, showed significant OCA ($p = 0.023$). Interestingly, acetone was the only biomarker identified at birth in V embryos (OCA = 0.730; $p = 0.002$) and not at previous pregnancy stages. The biomarkers identified _ill improve recipient selection in ET with IVP embryos in cattle. Acknowledgements: projects AGL2016-78597R and AGL2016-81890-REDT; FEDER, COST Action 16119; ASEAVA, Cooperativa de Agricultores de Gijón.

19.- GONZÁLEZ, A. J. & CIORDIA, M. (Nov 2019[a], Mar 2020[p]). Brenneria goodwinii and Gibbsiella quercinecans isolated from weeping cankers on Quercus robur L. in Spain. *European Journal of Plant Pathology,* 156 (3), 965-969.DOI: 10.1007/s10658-019-0189. [CHF]

Abstract: In Asturias, northern region of Spain, pedunculate oak (Quercus robur L.) with symptoms of disease such as cracks in the bark with dark exudates, was observed in June 2017. Two different bacteria were isolated from the recovered sample. The two bacteria were biochemically very similar and so were identified by 16S rDNA sequences. The sequence of strain LPPA 3463 had 99% similarity with that of the type strain of the species Brenneria goodwinii Denman et al., and the sequence of strain LPPA 3461 showed

the same result with respect to the sequence of the type strain of the species Gibbsiella quercinecans Brady et al. For more accurate identification, gyrB and atpD genes were also sequenced. Pathogenicity tests were initially carried out by puncture with the two bacteria on acorns and after 15 days, a rotten area was observed in the nuts while the controls, inoculated with sterile water, remained healthy. B. goodwinii and G. quercinecans have been consistently associated with Acute Oak Disease (AOD) affecting native oak trees in the UK, usually with presence of galleries produced by the buprestid beetle Agrilus. However, larval galleries of the Agrilus were not present in the pedunculate oak sample. G. quercinecans was reported in Spain on both Quercus ilex L. (holm oak) and Q. pyrenaica Willd. (pyrenean oak), but not on Q. robur. The bacterium B. goodwinii has not been described in Spain, and consequently this is the first report of these bacteria in pedunculate oak in Spain.

20.- GUARDIA, L., SUÁREZ, L., QUEREJETA, N., RODRÍGUEZ MADRERA, R.., SUÁREZ, B. & CENTENO, T. A. 2019. Apple Waste: A Sustainable Source of Carbon Materials and Valuable Compounds. *Acs Sustainable Chemistry & Engineering,* 7 (20)**,** 17335-17343. DOI:10.1021/acssuschemeng.9b0426. [TA]

Abstract: The implementation of sustainable strategies based on the integral valorization of residues is the most efficient way to achieve a profitable circular economy. This comprehensive study highlights the potential of apple waste from juice and cider production as a precursor of porous carbons and provides guidelines to achieve a wide spectrum of physicochemical properties. Hydrothermal carbonization (HTC) of apple bagasse is proposed as a feasible integrated process with zero waste that allows stabilizing this highly pollutant residue in the form of a carbon-enriched solid while extracting valuable compounds in the aqueous phase. The liquid fraction resulting from HTC at 200 degrees C contains a high total phenolic content and antioxidant activity, the major products being catechol (1,2-dihydroxybenzene) and 5-hydroxymethyl-2-furfural (HMF). The successful upgrading of the solid byproduct into porous carbons provides additional advantage for a more cost-effective waste management. It is reported that a simple one-step activation leads to apple- derived carbons with specific surface areas up to 2000 m(2) g(-1) and electrochemical capacitances as high as 260-290 F g(-1). Their excellent performance as supercapacitor electrodes make them very promising for the storage of electrical energy from renewable sources.

21. HAPPE, A. K., ALINS, G., BLUTHGEN, N., BOREUX, V., BOSCH, J., GARCÍA, D., HAMBACK, P. A., KLEIN, A. M., MARTÍNEZ-SASTRE, R., MIÑARRO, M., MULLER, A. K., PORCEL, M., RODRIGO, A., ROQUER-BENI, L., SAMNEGARD, U., TASIN, M. & MODY, K. 2019. Predatory arthropods in apple orchards across Europe: Responses to agricultural management, adjacent habitat, landscape composition and country. *Agriculture Ecosystems & Environment,* 273**,** 141-150.DOI: 10.1016/j.agee.2018.12.012. [CHF]

Abstract: Local agri-environmental schemes, including hedgerows, flowering strips, organic management, and a landscape rich in semi-natural habitat patches, are assumed to enhance the presence of beneficial arthropods and their contribution to biological control in fruit crops. We studied the influence of local factors (orchard management and adjacent habitats) and of landscape composition on the abundance and community composition of predatory arthropods in apple orchards in three European countries. To elucidate how local and landscape factors influence natural enemy effectiveness in apple production systems, we calculated community energy use as a proxy for the communities' predation potential based on biomass and metabolic rates of predatory arthropods. Predator communities were assessed by standardised

beating samples taken from apple trees in 86 orchards in Germany, Spain and Sweden. Orchard management included integrated production (IP; i.e. the reduced and targeted application of synthetic agrochemicals), and organic management practices in all three countries. Predator communities differed between management types and countries. Several groups, including beetles (Coleoptera), predatory bugs (Heteroptera), flies (Diptera) and spiders (Araneae) benefited from organic management depending on country. Woody habitat and IP supported harvestmen (Opiliones). In both IP and organic orchards we detected aversive influences of a high-quality surrounding landscape on some predator groups: for example, high covers of woody habitat reduced earwig abundances in German orchards but enhanced their abundance in Sweden, and high natural plant species richness tended to reduce predatory bug abundance in Sweden and IP orchards in Spain. We conclude that predatory arthropod communities and influences of local and landscape factors are strongly shaped by orchard management, and that the influence of management differs between countries. Our results indicate that organic management improves the living conditions for effective predator communities.

22.- HIDALGO, C. O., SALMAN, A., TAMARGO, C., MARTÍNEZ-PASTOR, F., FUEYO, C., MERINO, M. J., FERNÁNDEZ, A. & CAAMAÑO, J. N. 2019. Characterization of sperm chromatin status of the Spanish native pig breed "Gochu Asturcelta". *Reproduction in Domestic Animals,* 54**,** 116-116. [Meeting Abstract]. [SRA]

Abstract: Germplasm banks are a tool for the preservation of native, rare or genetically relevant breeds. The aim of this study was to assess the sperm chromatin status, a critical parameter for sperm fertility, of the pig breed “Gochu Asturcelta”. Doses from 18 boars (8–71 months old), stored in the SERIDA cryobank, were assessed by SCSA (Sperm Chromatin Structure Assay). Two straws per boar were thawed (38°C, 20 s), pooled and analysed by flow cytometry after 30 and 150 min of incubation at 38°C (testing susceptibility to post-thawing damage). The effects of male, season and incubation were tested for DNA fragmentation index (%DFI) and chromatin immaturity (%HDS) (R software, ANOVA and linear mixed-effects models; results as mean ± SD). Values were mostly below the threshold for impaired fertility in pig (%DFI: 6%; %HDS: 15%), ranges [0.04, 3.05] for %DFI and [2.6, 16.6] for %HDS. The effect of incubation was small ($p < 0.001$), decreasing %DFI (0.8% ± 0.7 to 0.6% ± 0.4) and increasing %HDS (10.0% ± 3.0 to 12.0% ± 1.9). Boar variability was important ($p < 0.001$) despite of the narrow ranges. At 30 min, autumn samples showed lower %DFI ($p < 0.05$), no effect for %HDS. At 150 min, winter showed higher %DFI ($p < 0.05$), and %HDS followed winter>autumn>spring˜summer ($p < 0.05$). In conclusion, the doses showed excellent chromatin status after thawing, with little susceptibility to further damage. Boar and seasonal variability in this autochthonous breed were small in magnitude but significant, possibly relevant for the cryobank management. Supported by INIA RZP2013-00006-00-00 and Asociación de Criadores de Gochu Asturcelta (ACGA).

23.- HIDALGO-CANTABRANA, C., MORO-GARCÍA, M.A., BLANCO-MÍGUEZA, A., FDEZ-RIVEROLA, F., OLIVÁN, M., ROYO, L. J., RIESTRA, S., MARGOLLES, A., LOURENÇO, A., ALONSO-ARIAS, R. & SÁNCHEZ, B. (Oct 2019[a], Ene 2020[p]).The extracellular proteins of Lactobacillus acidophilus DSM 20079T display anti-inflammatory effect in both in piglets, healthy human donors and Crohn’s Disease patients. *Journal of Functional Foods*, 64, 103660. DOI: 10.1016/j.jff.2019.103660. (OA). [NPF][SPA]

Abstract: Lactobacillus genus includes both probiotic and representative strains of the human gut microbiota. Independent studies have reported on the anti-inflammatory properties of different

Lactobacillus strains, although we are far from understanding the underlying molecular interplay. In this work we show that a daily administration of Lactobacillus acidophilus DSM20079(T) (DSM20079) to healthy piglets resulted in plasmatic increases of the antiinflammatory IL10, whilst IL12 and the pro-inflammatory ratio IL12+ TNF alpha/IL10 decreased. The extracellular protein fraction of DSM20079 was identified as the responsible for the crosstalk interaction that elicited these tolerogenic effects. This strain was able to activate innate immune pathways in dendritic cells and to decrease the production of pro-inflammatory cytokines in both CD4(+)/CD8(+) T cell subsets in healthy donors and in Crohn's Disease patients. The tolerogenic effect exerted by the extracellular proteins of this strain suggests their potential use as coadjutant for therapeutic applications targeting chronic inflammatory illnesses.

24.- INFANTES-LORENZO, J. A., DAVE, D., MORENO, I., ANDERSON, P., LESELLIER, S., GORMLEY, E., DOMÍNGUEZ, L., BALSEIRO, A., GORTÁZAR, C., DOMÍNGUEZ, M. & SALGUERO, F. J. 2019. New serological platform for detecting antibodies against Mycobacterium tuberculosis complex in European badgers. *Veterinary Medicine and Science,* 5 (1)**,** 61-69. DOI: 10.1002/vms3.134. (OA).[SA]

Abstract: European badgers (Meles meles) have been identified as wildlife reservoirs for Mycobacterium bovis in the UK and Ireland, and may also have a role in the epidemiology of animal tuberculosis in other European regions. Thus, detection of M. bovis-infected badgers may be required for the purposes of surveillance and monitoring of disease levels in infected populations. Current serological assays to detect M. bovis infection in live badgers, while rapid and inexpensive, show limited diagnostic sensitivity. Here we describe and evaluate new ELISA platforms for the recognition of the P22 multiprotein complex derived from the purified protein derivative (PPD) of M. bovis. The recognition of IgG against P22 multiprotein complex derived from PPD-B was tested by ELISA in the serum of badgers from the UK, Ireland and Spain. TB infection in the badgers was indicated by the presence of M. bovis in tissues by culture and histology at post-mortem examination and TB-free status was established by repeated negativity in the interferon gamma release assay (IGRA). In experimentally infected badgers, humoral antibody responses against P22 developed within 45 days post-infection. The ELISA tests showed estimated sensitivity levels of 74-82% in experimentally and naturally infected badgers with specificities ranging from 75% to 100% depending on the badger population tested. The P22 multi-antigen based ELISAs provide a sensitive and specific test platform for improved tuberculosis surveillance in badgers.

25.- INFANTES-LORENZO, J. A., MORENO, I., ROY, A., RISALDE, M. A., BALSEIRO, A., DE JUAN, L., ROMERO, B., BEZOS, J., PUENTES, E., AKERSTEDT, J., TESSEMA, G. T., GORTÁZAR, C., DOMÍNGUEZ, L. & DOMÍNGUEZ, M. 2019. Specificity of serological test for detection of tuberculosis in cattle, goats, sheep and pigs under different epidemiological situations. *Bmc Veterinary Research,* 15 (70). DOI: 10.1186/s12917-019-1814-z. (OA). [SA]

Abstract: Background Serum antibody detection has potential as a complementary diagnostic tool in animal tuberculosis (TB) control, particularly in multi-host systems. The objective of the present study was to assess the specificity (Sp) of an enzyme-linked immunosorbent assay (ELISA) based on the new multiprotein complex P22 for the detection of specific antibodies against the Mycobacterium tuberculosis complex (MTC) in the four most relevant domestic animals acting as MTC hosts: cattle, goat, sheep and pig. We used sera from an officially TB-free (OTF) country, Norway, and from a non-OTF one, Spain. The samples included sera from goats that had been vaccinated against M. avium subsp. paratuberculosis (MAP) and sheep from a herd in which Corynebacterium pseudotuberculosis had been isolated.ResultsIn

cattle, the Sp ranged from 92.5 (IC95% 90.7-94) to 99.4% (IC95% 98.3-99.8) depending on the cut-off used and the origin of the samples (Spain or Norway). Sp in cattle (cut-off point 100) was significantly higher ($P<0.05$) for Norwegian samples. By contrast, Sp in goats was consistently low at the 100 cut-off [30.9 (CI95%23.4-39.5)-78% (CI95% 68.9-85)]. A higher cut-off of 150 improved Sp in Norwegian goats [97% (CI95% 91.6-99)], but still yielded a poor Sp of 56.1% (CI95% 47.3-64.6) in Spanish goats. In Norway at the 100 cut-off the Sp was 58.3 (CI95% 42.2-72.9) and 90.6% (CI95% 81-95.6) in MAP vaccinated and non-vaccinated goats, respectively, indicating interference due to MAP vaccination. Sp in sheep was between 94.4 (CI95% 91.7-96.3) and 100% (CI95% 96.3-100) depending on the cut-off and country, and no diagnostic interference due to infection with C. pseudotuberculosis was recorded. Sp in pigs was 100%, regardless the cut-off point applied, and no significant differences were observed between pigs from Norway and from Spain. Conclusions: Due to its excellent Sp in pigs and acceptable Sp in cattle and sheep, this ELISA may constitute a suitable option for TB screening at herd level, particularly in OTF-countries.

26.-JIMÉNEZ-CALDERÓN, J. D., MARTÍNEZ-FERNÁNDEZ, A., SOLDADO, A., GONZÁLEZ, A. & VICENTE, F. (Sep. 2019[a], Mar 2020[p]). Faba bean-rapeseed silage as substitute to Italian ryegrass silage: effects on performance and milk quality of grazing dairy cows. *Animal Production Science*, Vol. 60 (7), 913-922. DOI: 10.1071/AN1790.[NPF]

Abstract: Three trials were conducted to study the effect of including in the ration of dairy cows the intercrop faba bean-rapeseed or Italian ryegrass silages on feed intake, milk quality and enteric methane emissions. Ten lactating Holstein cows, randomly allocated in two groups, were used in each trial in a crossover design. Dry matter intake and milk yield were recorded daily for each data period. Milk was sampled for analyses three times per period. Enteric methane emission was estimated applying a model that includes bodyweight, dry matter intake, nutritional values of feeds and milk composition. Concentrate and grass intake did not differ between treatments, while total mixed ration intake was higher with Italian ryegrass silage. Milk yield and protein concentration also increased with the Italian ryegrass treatment. The milk urea concentration was higher with the faba bean and rapeseed diet. Fatty acid profiles were affected by feeding strategy. Thereby, t11 18:1, c9 18:1 and total unsaturated fatty acid were higher when the intercrop silage was fed. As consequence, atherogenicity index and thrombogenicity index were lower under that treatment. Estimated enteric methane emissions did not differ between treatments. In conclusion, faba bean-rapeseed intercrop can be an alternative to Italian ryegrass to feed dairy cows. The rations formulated with the intercrop silage have potential to improve the milk fatty acid content, and show healthier profiles for consumers. However, it would be useful to study the protein content of these crops to avoid possible excess urea in milk and to maintain sustainable milk yield and milk protein content.

27- JIMÉNEZ-PELAYO, L., GARCÍA-SÁNCHEZ, M., VAZQUEZ, P., REGIDOR-CERRILLO, J., HORCAJO, P., COLLANTES-FERNANDEZ, E., BLANCO-MURCIA, J., GUTIERREZ-EXPÓSITO, D., ROMÁN-TRUFERO, A., OSORO, K., BENAVIDES, J. & ORTEGA-MORA, L. M. 2019. Early Neospora caninum infection dynamics in cattle after inoculation at mid-gestation with high (Nc-Spain7)- or low (Nc-Spain1H)-virulence isolates. *Veterinary Research,* 50 (1). DOI: 10.1186/s13567-019-0691-6. (OA). [SPA]

Abstract: Early Neospora caninum infection dynamics were investigated in pregnant heifers intravenously inoculated with PBS (G-Control) or 10(7) tachyzoites of high (G-NcSpain7)- or low (G-NcSpain1H)-virulence isolates at 110 days of gestation. Serial culling at 10 and 20 days post-infection (dpi) was performed. Fever was detected at 1 dpi in both infected groups ($P < 0.0001$), and a second peak

was detected at 3 dpi only in G-NcSpain7 ($P < 0.0001$). At 10 dpi, Nc-Spain7 was detected in placental samples from one animal related to focal necrosis, and Nc-Spain7 transmission was observed, although no foetal lesions were associated with this finding. The presence of Nc-Spain1H in the placenta or foetuses, as well as lesions, were not detected at 10 dpi. At 20 dpi, G-NcSpain7 animals showed almost 100% positive placental tissues and severe focal necrosis as well as 100% transmission. Remarkably, foetal mortality was detected in two G-NcSpain7 heifers. Only one animal from G-NcSpain1H presented positive placental samples. No foetal mortality was detected, and lesions and parasite transmission to the foetus were not observed in this group. Finally, 100% of G-NcSpain7 heifers at 20 dpi presented specific antibodies, while only 60% of G-NcSpain1H animals presented specific antibodies at 20 dpi. In addition, earlier seroconversion in G-Nc-Spain7 was observed. In conclusion, tachyzoites from Nc-Spain7 reached the placenta earlier and multiplied, leading to lesion development, transmission to the foetus and foetal mortality, whereas Nc-Spain1H showed delayed infection of the placenta and no lesional development or transmission during early infection.

28.- LLANO-SUÁREZ, P., BOUZAS-RAMOS, D., COSTA-FERNÁNDEZ, J. M., SOLDADO, A. & FERNÁNDEZ-ARGUELLES, M. T. 2019. Near-infrared fluorescent nanoprobes for highly sensitive cyanide quantification in natural waters. *Talanta,* 192**,** 463-470. DOI: 10.1016/j.talanta.2018.09.073. [NPF]

Abstract: Near infrared (NIR) emitting Ag2S quantum dots have been synthesized, characterized and evaluated for chemical sensing applications. After their optical characterization, it was observed that the Ag2S quantum dots present both, excitation and emission in the NIR region, and an excellent quantum yield of 33.2%. These features are of great value for many biological applications, since autofluorescence of biological tissues or cells is minimized, and also for environmental applications, where other fluorescent concomitant species with excitation and emission in the ultraviolet-visible region might be present.
Different purification procedures were evaluated in order to obtain a stable and homogeneous population of nanoparticles, which is necessary to perform quantitative analysis (e.g.: mass spectrometry-based applications), as well as to obtain a narrow NIR emission spectrum for optical applications.
Comprehensive characterization using X-ray diffraction, transmission electron microscopy, and asymmetric flow field flow fractionation coupled to inductively coupled plasma-mass spectrometry has been performed to obtain parameters not easily achieved and of great interest in different research areas, such as the nanoparticle concentration NIR-emitting nanoparticles, and the surface ligand density, which directly affects to the interactions of the nanoparticles with their close environment, including unspecific adsorptions, cellular uptake, macrophage interaction, etc.
Finally, the capability for sensing analytes of environmental interest based on direct-interactions of a reactive compound with the surface of the nanoparticle has been also evaluated. Quenching of the NIR emission upon interaction of the Ag2S quantum dots with cyanide ions was observed. Hence, a rapid, selective and highly sensitive methodology was developed for the detection of cyanide in natural waters.

29.- LÓPEZ LÓPEZ, C., CELAYA, R., FERREIRA, L. M. M., GARCÍA, U., RODRIGUES, M. A. M. & OSORO, K. 2019. Comparative foraging behaviour and performance between cattle and horses grazing in heathlands with different proportions of improved pasture area. *Journal of Applied Animal Research,* 47**,** 377-385.DOI: 10.1080/09712119.2019.1649679. (OA). [SPA]

Abstract: The objective of this study was to compare the diet selection and productive performance of beef cattle (Asturiana de los Valles breed) and crossbred horses grazing on heather-gorse shrublands with

different available surface of improved pasture (IP): 80% (IP80) or 25% (IP25). Twelve and 10 lactating dams per species with their offspring were managed in IP80 (19 ha) and IP25 (22 ha), respectively, during two grazing seasons (spring-autumn). Visual recordings at IP25 indicated that horses grazed for longer than cattle. Both species grazed preferentially on IP and increased the utilization of shrublands as season advanced and available sward height in the IP area decreased. Diet composition estimates using faecal markers showed greater dietary percentages of white clover in cows than in mares during spring-summer. During autumn cows selected greater percentages of heather and lower of gorse than mares. Mares achieved more favourable body weight (BW) changes than cows during the whole grazing season, although differences were mainly confined to IP80. Calves showed higher BW gains than foals during the whole grazing season, with scarce differences between vegetation mixtures. Mares compete with cattle for the use of quality pastures, negatively affecting BW recoveries of cows when both species graze together.

30.- MUÑIZ, R., CUEVAS-VALDÉS, M. & DE LA ROZA-DELGADO, B. (Dic 2019[a], Ene 2020[p]). Milk quality control requirement evaluation using a handheld Near Infrared Reflectance spectrophotometer and a bespoke mobile application. *Journal of Food Composition and Analysis*, 86. DOI: doi.org/10.1016/j.jfca.2019.103388. [NPF]

Abstract: This research introduces a novel approach for real-time analysis of individual cow milk samples in order to get an estimation of required quality control parameters such as lactose, protein, fat, and solids-non-fat (SNF), in order to distinguish their concentrations in conventional cow milk. This will permit the classification of milk samples according to their quality, and help to avoid penalties over quality issues in dairy facilities. To fulfil this goal a newly developed mobile application has been implemented, along with a neural network based model fed with spectral data from a handheld near infrared reflectance (NIR) spectrophotometer. With the combination of this application and a portable NIR sensor, milk quality parameters can be estimated by dairy farms on their own premises.
The model was obtained by means of the widely used machine learning framework TensorFlow provided by Google Inc. A total of 903 fresh cow milk samples collected over a 3 year period, were used to train and validate the models.
The advantages provided by this mobile application at the milking stage allows us to know in real-time the quality control parameters for each cow milk sample, individually. This offers an immediate management change capability along with enhanced decision making potential at farm level, thus leading to the optimisation of the quality of milk production.

31.- MURUBE, E., CAMPA, A. & FERREIRA, J. J. 2019. Integrating genetic and physical positions of the anthracnose resistance genes described in bean chromosomes Pv01 and Pv04. *Plos One*, 14 (2). DOI: 10.1371/journal.pone.0212298. (OA). [CHF]

Abstract: A complex landscape of anthracnose resistance genes (Co-) located at the telomeric regions of the bean chromosomes Pv01 and Pv04 has been reported. The aim of this work was to investigate the genetic and physical positions of genes conferring resistance to races 6, 38, 39, 357, 65, and 73 as well as the relationships among the resistance genes identified herein and the previously described Co- genes in these telomeric regions. The linkage analysis using a genetic map of 497 SNPs from the recombinant inbred line population Xana/BAT93 revealed that the gene conferring resistance to race 65 in cultivar Xana (Co-1(65-X)) was located in the Co-1 cluster, at the distal end of chromosome Pv01. The fine mapping of Co-1(65-X) indicated that it was positioned between the physical positions 49,512,545 and 49,658,821 bp. This delimited physical position agrees with the positions of the previously mapped genes Co-1(4), Co-x, Co-14, Co-1(HY), and Co-Pa. Responses to races 6, 38, 39, and 357 in BAT93 exhibited co-segregation suggesting that the same gene, or very closely linked genes, were involved in the control. The linkage

analysis showed that the resistance gene to race 38 in the genotype BAT93 (Co-3(38-B)) was located at the beginning of chromosome Pv04, in the genetic position of the Co-3 cluster, and was flanked by markers with physical positions between 1,286,490 and 2,047,754 bp. Thus, the genes Co-3, Co-9, Co-10, Co-16, and Co-3(38-B), found in this work, form part of the same anthracnose resistance cluster at the beginning of chromosome Pv04, which is consistent with the discontinuous distribution of typical R genes annotated in the underlying genomic region. Resistance loci involved in the response to race 73 in the genotypes Xana (R) and BAT93 (R) were mapped to the same positions on clusters Co-1 and Co-3, respectively. The positioning of the resistance genes in the bean genome based on fine linkage mapping should play an important role in the characterization and differentiation of the anthracnose resistance genes. The assignment of Co- genes to clusters of race specific genes can help simplify the current scenario of anthracnose resistance.

32- MURUBE, E., CAMPA, A., SONG, Q., MCCLEAN, P. & FERREIRA, J. J. 2019. Toward validation of QTLs associated with pod and seed size in common bean using two nested recombinant inbred line populations. *Molecular Breeding,* 40 (1). DOI: 10.1007/s11032-019-1085-1. [CHF]

Abstract: The common bean is an important legume worldwide. The aim of this study was to identify quantitative trait loci (QTLs) associated with seed and pod phenotypes and to evaluate the consistency of these QTLs across different environments and genetic backgrounds. Two nested recombinant inbred populations obtained from the crosses "Xana"/ "Cornell 4924" (XC) and "Xana"/ "BAT93" (XB) were used. The populations were phenotyped with respect to pod and seed size and number of seeds per pod and seed weight over two (XB) or five seasons (XC) using a randomized complete block design. The XC population was re-genotyped, and an updated linkage map, with 732 markers and a total length of 1390 cM, was developed. The XB population was genotyped using genotyping by sequencing (GBS), and the corresponding genetic linkage map consisted of 497 single-nucleotide polymorphisms (SNPs) with a total length of 1547 cM. Altogether, 13 and 18 QTLs for pod traits and 21 and 25 QTLs for seed traits were detected in the XC and XB populations, respectively. In addition, 20 and 27 significant epistatic interactions between QTLs were detected in the XC and XB populations, respectively. The overlap among identified QTLs in the two nested populations was also investigated. Results revealed four overlapping regions for pod traits and eight for seed traits between the XC and XB populations. QTLs for seed or pod phenotypes detected on telomeric genomic regions of chromosomes Pv01, Pv05, Pv06, Pv07, Pv08, and Pv11 overlapped with QTLs associated with pod or seed phenotypes previously reported in other studies. The results showed the complex architecture of the genetic control of the pod and seed phenotype and the use of the bean genome for the integration and validation of QTLs.

33.- OLEAGA, A., GARCÍA, A., BALSEIRO, A., CASAIS, R., MATA, E. & CRESPO, E. 2019. First description of sarcoptic mange in the endangered Iberian lynx (Lynx pardinus): clinical and epidemiological features. *European Journal of Wildlife Research,* 65 (3). DOI: 10.1007/s10344-019-1283-5. (OA).[SA]

Abstract: A 6-month-old female Iberian lynx (Lynx pardinus) cub that was severely affected by mange died in September 2016 in the Montes de Toledo (Spain) with crusts and fissures on its face, outer ears, nipples and footpads. The body condition of the cub was very poor, and it also had a mandibular abscess and a severely ankylosed luxation on its left knee. After confirming that the origin of the deceased cub's dermal lesions was Sarcoptes scabiei, the subsequent search for ectoparasites and a comparison of histopathological and immunohistochemical findings in all sympatric lynxes handled (n=30) and submitted

for necropsy (n=4) during 2016 and 2017 revealed the presence of S. scabiei mites and/or milder mange compatible lesions in five members of her family group, which was treated against mange together with two exposed contiguous family groups. An ELISA developed by the authors showed the presence of antibodies against S. scabiei in the deceased female cub and one brother. The presence of concomitant immunosuppressive factors in the dead female cub and the results obtained for the other sympatric lynxes studied since 2016 suggest that S. scabiei had a limited effect on immune-competent Iberian lynxes in the local population of the Montes de Toledo. However, a different evolution and relevance of sarcoptic mange in different populationsor even in the same one in the presence of immunosuppressive factorscannot be ruled out, thus confirming the need for further research in order to attain a complete comprehension of the epidemiology and the real threat that this ectoparasitic disease may imply for L. pardinus.

34.- PANDO BEDRIÑANA, R., PICINELLI LOBO, A. & SUÁREZ VALLES, B. 2019. Influence of the method of obtaining freeze-enriched juices and year of harvest on the chemical and sensory characteristics of Asturian ice ciders. *Food Chemistry*, 274**,** 376-383. DOI: 10.1016/j.foodchem.2018.08.14. [TA]

Abstract: Ice cider is a special product made from apple juices enriched by freezing. In this paper, the method of obtaining the ice juices (cryo-extraction and exhaustion) and the year of harvest have been evaluated. For this purpose, a controlled raw apple mixture and an autochthonous Saccharomyces bayanus strain were used throughout the study. Both the enrichment system and the year of harvest significantly influenced the levels of total phenols, sucrose, malic acid, ethyl acetate and 2-phenylethanol. The ciders made by cryo-extraction presented the higher sugar/acidity and sugar/polyphenol ratios. These ciders were more fruity, less astringent and scored better for quality than those obtained by exhaustion. Additionally, a preliminary assay of juice enrichment by cryo-concentration is described. The corresponding ciders presented higher methanol and lower 2-phenylethanol contents than those obtained by the cryo-extraction and exhaustion methods.

35.- PANDO BEDRIÑANA, R., PICINELLI LOBO, A., RODRIGUEZ MADRERA, R. & SUÁREZ VALLES, B. (Oct. 2019[a], Abr 2020[p]). Characteristics of Ice Juices and Ciders made by cryo-extraction with different cider apple varieties and yeast strains. *Food Chemistry*, 310. DOI doi.org/10.1016/j.foodchem.2019.125831. [TA]

Abstract: Two sets of nine ciders were made by cryo-extraction for two consecutive harvests combining three types of ice cider apple juices (mono-varietal, bi-varietal and multi-varietal) and three autochthonous Saccharomyces bayanus yeast strains. The type of juice significantly influenced the pH values and the contents of sorbitol and shikimic acid in the ice juices. The strains used as starters did develop the fermentation producing ciders with alcoholic degrees between 8.75 and 11.52 (% v/v) and volatile acidities lower than 0.55 g acetic acid/L. Regarding the ice ciders, the apple mixture significantly influenced the levels of methanol (higher in monovarietal ciders), 2-phenylethanol, and some minor acetate esters (higher in the bi-varietal ciders). The last ciders were also more floral, buttery, acidic and bitter than those made from mono- and multi-varietal juices. In the first harvest, the ciders obtained from the bi-varietal apple mixture scored lower for overall sensory quality.

36.- POTES, Y., PÉREZ-MARTÍNEZ, Z., BERMEJO-MILLO, J. C., RUBIO-GONZALEZ, A., FERNANDEZ-FERNANDEZ, M., BERMÚDEZ, M., ARCHE, J. M., SOLANO, J. J., BOGA, J. A., OLIVÁN, M., CABALLERO, B., VEGA-NAREDO, I. &

COTO-MONTES, A. 2019. Overweight in the Elderly Induces a Switch in Energy Metabolism that Undermines Muscle Integrity. *Aging and Disease*, 10**,** 217-230. DOI: 10.14336/AD.2018.0430. (OA). [SPA]

Abstract: Aging is characterized by a progressive loss of skeletal muscle mass and function (sarcopenia). Obesity exacerbates age-related decline and lead to frailty. Skeletal muscle fat infiltration increases with aging and seems to be crucial for the progression of sarcopenia. Additionally, skeletal muscle plasticity modulates metabolic adaptation to different pathophysiological situations. Thus, cellular bioenergetics and mitochondrial profile were studied in the skeletal muscle of overweight aged people without reaching obesity to prevent this extreme situation. Overweight aged muscle lacked ATP production, as indicated by defects in the phosphagen system, glycolysis and especially mostly by oxidative phosphorylation metabolic pathway. Overweight subjects exhibited an inhibition of mitophagy that was linked to an increase in mitochondrial biogenesis that underlies the accumulation of dysfunctional mitochondria and encourages the onset of sarcopenia. As a strategy to maintain cellular homeostasis, overweight subjects experienced a metabolic switch from oxidative to lactic acid fermentation metabolism, which allows continued ATP production under mitochondrial dysfunction, but without reaching physiological aged basal levels. This ATP depletion induced early signs of impaired contractile function and a decline in skeletal muscle structural integrity, evidenced by lower levels of filamin C. Our findings reveal the main effector pathways at an early stage of obesity and highlight the importance of mitochondrial metabolism in overweight and obese individuals. Exploiting mitochondrial profiles for therapeutic purposes in humans is an ambitious strategy for treating muscle impairment diseases.

37.- RODRÍGUEZ MADRERA, R. & SUÁREZ VALLES, B. (Oct 2019[a], Ene 2020[p]). Development and validation of ultrasound assisted extraction (UAE) and HPLC-DAD method for determination of polyphenols in dry beans (Phaseolus vulgaris). *Journal of Food Composition and Analysis*, 85. DOI: 10.1016/j.jfca.2019.103334. (OA). [TA]

Abstract: An analytical method for extraction and quantitative determination of the main phenolic compounds (hydroxycinnamic acids and derivatives, anthocyanins and flavonols) in dry beans (Phaseolus vulgaris) is described. The best extraction conditions were: 100% sonication amplitude, 10.3 min extraction, 46% ethanol, 1.5 g dry bean flour and 30 mL of solvent. The developed method was validated in terms of accuracy and precision. Good linearity was obtained, with correlation coefficients exceeding 0.999 and the quantification limits ranged from 0.25 mu g/g (p-coumaric acid) to 1.38 mu g/g (kaempferol). The accuracy ranged between 88 and 92% and the reproducibility of the method was always < 5.8% (RSD). The method was applied to a set of 17 accessions with different phenotypes. Results showed a greater presence, in all cases, of ferulic acid derivatives, compared to the sinapic acid and p-coumaric acid derivatives. Except for the white variety Xana, flavonoids were detected in all samples. Higher levels of anthocyanins were detected in Black Turtle Soup, a black bean, characterized by a higher content of delphinidin 3-O-glucoside, petunidin 3-O-glucoside and malvidin 3-O-glucoside. The flavonols showed a remarkable diversity, the 3-glucoside derivatives being the most abundant in all samples.

38.- RODRÍGUEZ MADRERA, R., FERREIRA FERNÁNDEZ, J., CAMPA NEGRILLO, A. & SUÁREZ VALLES, B. 2019. Physicochemical Characterization of Blueberry (vaccinium spp.) Juices from 55 Cultivars Grown in Northern Spain. *Acta Alimentaria*, 48 (2), 260-268. DOI: 10.1556/066.2019.48.2.14. (OA). [TA] [CHF]

Abstract: Blueberry (Vaccinium spp.) cultivation has experienced a notable increase both for its good

organoleptic characteristics and the nutritional and functional properties of this berry. The aim of this study was the physicochemical characterization of blueberry juices obtained from 55 blueberry cultivars grown under the same environmental conditions for 2-4 years. The results provide a broad and robust database. both for the number of cultivars and the periods of monitoring thereof, in order to cover different aspects of blueberry processing, and more specifically, production of juices. Blueberries belonging to V. virgatum cultivars showed the higher values of total anthocyanin content, total phenolic content, antioxidant activity, soluble solids, and pH, and V. corymbosum cultivars the higher level of titratable acidity. Results also showed a high variability among cultivars. Observed variations can be used in plant breeding and classification of blueberry cultivars, at least, at the species level.

39.- ROMAN-TRUFERO, A., GARCÍA-PRIETO, V., MARTÍNEZ, A., OSORO, K. & CELAYA, R. 2019. Beef steer production from two local breeds under two management systems differing in the utilisation of mountain pastures. *Italian Journal of Animal Science,* 18 (1)**,** 1174-1185. DOI: 10.1556/066.2019.48.2.14.(OA). [SPA]

Abstract: Steer meat production is insufficient to meet market demand in northern Spain. This study aimed to compare steer production from two local beef breeds, Asturian Valley (AV) and Asturian Mountain (AM), and two management strategies, differing in yearling steers grazing summer mountain pastures (M treatment) or lowland grasslands (L treatment). A total of 83 calves born in winter-spring were studied during four whole life-cycles. During their first year of life, calves were managed with their dams on summer pastures and weaned when returned to lowlands. Once castrated, half of the yearlings of each breed were randomly assigned to treatment M or L. After summer grazing, all steers were managed at lowlands until they were slaughtered at an age of approximately 33 months after a finishing period of 3-4 months with maize silage and concentrate diet. In general, bodyweight gains were greater in AV than in AM breed, resulting in greater slaughter (714 versus 616 kg) and carcase weights. During the second summer season, AM steers gained more bodyweight than AV in summer pastures, resulting in a breed x management interaction. In the next periods (autumn grazing, winter and spring grazing), M steers showed a compensatory growth counterbalancing their previous lower performance, whereas no differences between treatments or breeds were found in the finishing period. As a result, no differences between managements were observed in final bodyweight at slaughter or carcase weight. Summer pastures offer opportunities to manage yearling steers without adversely affecting saleable product yields.

40.- ROMAN-TRUFERO, A., MARTÍNEZ, A., FERREIRA, L. M. M., GARCÍA-PRIETO, V., ROSA-GARCÍA, R., OSORO, K. & CELAYA, R. 2019. Foraging behaviour and performance of steers from two local breeds (Asturian Valley and Asturian Mountain) grazing in Cantabrian (N Spain) summer pastures. *Spanish Journal of Agricultural Research,* 17 (1). DOI: 10.5424/sjar/2019171-13541. (OA). [SPA][NPF]

Abstract: Steer meat production in northern Spain is deficient to attend market demand. This research aimed to compare the foraging behaviour and production of yearling steers from two local breeds differing in body weight (BW), Asturian Valley (AV, 372 kg) and Asturian Mountain (AM, 307 kg), grazing in summer pastures consisting of 70% grassland and 30% heathland. Bodyweight gains from a total of 42 steers were recorded during four grazing seasons (from June to October). In two years, in July and September, plant community selection and diet composition were estimated by direct observation and using faecal markers, respectively. Grazing time increased from July to September (488 vs. 557 min/day; $p<0.001$) as sward height in the grassland decreased. Although AV steers grazed proportionally for longer on herbaceous pastures than AM steers (81.3 vs. 73.3%; $p<0.05$), no differences between breeds were found in diet composition. AM steers showed greater mean daily BW gains than AV steers (252 vs. 133 g/day;

p<0.01). From June to August, steers from both breeds gained BW (487 vs. 360 g/day for AM and AV, respectively; p<0.01), but thereafter BW gains decreased (120 vs. -12 g/day for AM and AV, respectively; p<0.05), because of reduced availability of grassland herbage. Yearling steers from AM breed seem to be better suited to mountain conditions than those from AV breed, probably because of their smaller body size and lower total nutrient requirements for maintenance.

41.- ROMÁN-TRUFERO, A.; MARTÍNEZ, A.; OSORO, K., GARCÍA-PRIETO, V. & CELAYA, R. (Jun 2019[a], Ene 2020[p]). Beef production from yearling calves under conventional or organic management. *Animal Production Science*, 60 (4), 584-594. DOI: 10.1071/AN18462. [SPA]

Abstract: The objective of this research was to compare yearling beef calf production (bodyweight - BW gains and carcass characteristics) under organic and conventional (semi-extensive) management. The study comprised three production cycles (from weaning to slaughter) with a total of 67 calves. For the grazing periods, three replicates (1.6-ha paddocks with Lolium perenne-Trifolium repens pasture) per treatment were established, and 4-5 animals per paddock were managed. Conventional paddocks were fertilised with synthetic NPK, whereas manure was used in the organic ones. During finishing, conventional feeding consisted of concentrate ad libitum with straw (CC). Under organic regulation, pasture grazing (PG), herbage silage (HS) and maize silage (MS), all supplemented with organic concentrate, were tested. Results showed similar individual performances before finishing in both treatments. Daily BW gain per unit area during spring was greater in conventional than in organic system (5.62 vs 4.27 kg/ha; P < 0.01), propitiating greater final production in the former, a result of greater herbage production allowing higher stocking rates managed on conventional pastures. During finishing, CC yearlings had greater (P < 0.001) BW gains (1340 g/day) compared with organic feeding systems, although MS feeding enhanced the gains (1116 g/day) over those achieved in PG or HS (average 709 g/day). There were no differences among feeding systems in carcass weight and conformation, while the rib dissection revealed greater fat contents in CC and MS relative to PG and HS (10.2 vs 7.5%; P < 0.05). Feeding with maize silage during finishing could be a good option to achieve organic beef production levels close to the conventional ones. However, the high price of organic concentrate raised feeding costs during finishing in a way that organic beef fattening was 36% less efficient than the conventional system in terms of product sales (applying the same price per kg carcass weight) minus feeding costs per unit of land area.

42.- ROSA GARCÍA, R. & FRASER, M. D. 2019. Impact of management on foliage-dwelling arthropods and dynamics within permanent pastures. *Scientific Reports*, 9. DOI: 10.1038/s41598-019-46800-w. (OA). [NPF]

Abstract: The restoration of biodiversity within previously improved grasslands is an important objective worldwide. In some areas farmers receive remuneration for using specific strategies but the environmental responses to them are still uncertain. This study explored the short and long-term impacts of sheep grazing and/or hay cutting on arthropod foliage communities and flora within Welsh upland permanent pastures (UK). We measured arthropod abundance and diversity plus sward surface height, flower numbers and percentage of forbs and grasses. Data were collected during summer; twice before hay cutting and once shortly after. Total arthropod abundance was higher in grazed plots (due to Symphypleona flourishing) and family richness in hay cut plots, but taxa-specific responses occurred. Short-term effects reflected phenological changes (e.g. in Symphypleona or Cantharidae) and arthropod reductions after hay cut, when mostly Diptera remained. Arthropod communities were more abundant and diverse in flower-rich and forb-dominated plots managed by hay cutting and by hay cutting with aftermath grazing, although certain groups flourished in grazed only grass-dominated plots. The two managements based on a hay cut provided

more heterogeneous environmental conditions than other management treatments, and these supported more diverse arthropod communities. The results make a valuable addition to the evidence base on which to base future land use policy at a time when tradeoffs between agricultural production and nature conservation are under scrutiny across Europe.

43.- SALINAS, L.M., BALSEIRO, A., JIRÓN, W., PERALTA, A., MUÑOZ, D., FAJARDO, J., GAYO, E., ZORHAYA MARTÍNEZ, I., RIET-CORREA, F., GARDNER, D. R. & GARCÍA MARÍN, J. F. 2019. Neurological syndrome in goats associated with Ipomoea trifida and Ipomoea carnea containing calystegines. *Toxicon,* 157**,** 8-11.DOI: 10.1016/j.toxicon.2018.11.291. [SA]

Abstract: A disease characterized by ataxia, tremors and nystagmus had been observed in goats in Nicaragua. The main histologic lesions were loss and neuronal vacuolation of Purkinje cells and Wallerian-like degeneration mainly in the cerebellum, suggesting a glycoprotein storage disease. Ipomoea cornea and Ipomoea trifida found in the paddocks were negative for swainsonine, but contained calystegines at 0.02% and 0.06% suggesting that the disease was caused by these substances, which are competitive inhibitors of beta-glucosidase and alpha-galactosidase activities.

44.- SAMNEGARD, U., ALINS, G., BOREUX, V., BOSCH, J., GARCÍA, D., HAPPE, A. K., KLEIN, A. M., MIÑARRO, M., MODY, K., PORCEL, M., RODRIGO, A., ROQUER-BENI, L., TASIN, M. & HAMBACK, P. A. 2019. Management trade-offs on ecosystem services in apple orchards across Europe: Direct and indirect effects of organic production. *Journal of Applied Ecology,* 56 (4)**,** 802-811. DOI: 10.1111/1365-2664.13292. (OA). [CHF]

Abstract: Apple is considered the most important fruit crop in temperate areas and profitable production depends on multiple ecosystem services, including the reduction of pest damage and the provision of sufficient pollination levels. Management approaches present an inherent trade-off as each affects species differently. We quantified the direct and indirect effects of management (organic vs. integrated pest management, IPM) on species richness, ecosystem services, and fruit production in 85 apple orchards in three European countries. We also quantified how habit composition influenced these effects at three spatial scales: within orchards, adjacent to orchards, and in the surrounding landscape. Organic management resulted in 48% lower yield than IPM, and also that the variation between orchards was large with some organic orchards having a higher yield than the average yield of IPM orchards. The lower yield in organic orchards resulted directly from management practices, and from higher pest damage in organic orchards. These negative yield effects were partly offset by indirect positive effects from more natural enemies and higher flower visitation rates in organic orchards. Two factors other than management affected species richness and ecosystem services. Higher cover of flowering plants within and adjacent to the apple trees increased flower visitation rates by pollinating insects and a higher cover of apple orchards in the landscape decreased species richness of beneficial arthropods. The species richness of beneficial arthropods in orchards was uncorrelated with fruit production, suggesting that diversity can be increased without large yield loss. At the same time, organic orchards had 38% higher species richness than IPM orchards, an effect that is likely due to differences in pest management.Synthesis and applications. Our results indicate that organic management is more efficient than integrated pest management in developing environmentally friendly apple orchards with higher species richness. We also demonstrate that there is no inherent trade-off between species richness and yield. Development of more environmentally friendly means for pest control, which do not negatively affect pollination services, needs to be a priority for sustainable apple production.

45.- TAMARGO, C., HIDALGO, C. O., CAAMAÑO, J.N., SALMAN, A., FUEYO, C., ARIJA, C., FERNÁNDEZ, A., MERINO, M. J. & MARTÍNEZ-PASTOR, F. 2019. Assessment of a germplasm bank for the autochthonous cattle breed Asturiana de la Montana: Extender (Biociphos vs. BIOXCell) affected sperm quality but not field fertility. *Reproduction in Domestic Animals,* 54**,** 90-93. DOI: 10.111/rda.13502. (OA). [SRA]

Abstract: Semen banking is critical to preserving rare and autochthonous breeds. However, protocols can change with time, leaving heterogeneous semen batches. The objective of this study was to assess differences in sperm quality and field fertility. We report differences between batches frozen with the Biociphos and BIOXCell extenders in the Asturiana de la Montana cryobank (autochthonous and endangered breed, Northern Spain). Doses from 48 bulls were analysed by CASA and flow cytometry. The 85-days non-return rates from AI records were used to assess the fertility of 23,853 AI. BIOXCell showed higher quality post-thawing. Differences increased after a 5-hr incubation at 37 degrees C, and Biociphos yielded doses with lower resilience. Field fertility did not differ between extenders (Biociphos: 57.4% +/- 1.2; BIOXCell: 56.6% +/- 3.0), possibly because of AI protocols compensating for differences in quality. However, this needs to be confirmed by controlled intervention studies. In conclusion, batches frozen with Biociphos may require specific strategies for compensating for the lower sperm quality. Regular surveys and evaluation of cryobank procedures may be useful to characterizing stored batches and defining strategies to guaranteeing success in their future use.

46.- TANNER, E., WHITE, A., ACEVEDO, P., BALSEIRO, A., MARCOS, J. & GORTAZAR, C. 2019. Wolves contribute to disease control in a multi-host system. *Scientific Reports,* 9. DOI: 10.1038/s41598-019-44148-9. (OA.) [SA]

Abstract: We combine model results with field data for a system of wolves (Canis lupus) that prey on wild boar (Sus scrofa), a wildlife reservoir of tuberculosis, to examine how predation may contribute to disease control in multi-host systems. Results show that predation can lead to a marked reduction in the prevalence of infection without leading to a reduction in host population density since mortality due to predation can be compensated by a reduction in disease induced mortality. A key finding therefore is that a population that harbours a virulent infection can be regulated at a similar density by disease at high prevalence or by predation at low prevalence. Predators may therefore provide a key ecosystem service which should be recognised when considering human-carnivore conflicts and the conservation and re-establishment of carnivore populations.

47.- THOMAS, J., INFANTES-LORENZO, J. A., MORENO, I., ROMERO, B., GARRIDO, J. M., JUSTE, R., DOMÍNGUEZ, M., DOMÍNGUEZ, L., GORTAZAR, C. & RISALDE, M. A. 2019. A new test to detect antibodies against Mycobacterium tuberculosis complex in red deer serum. *Veterinary Journal,* 244**,** 98-103. DOI: 10.1016/j.tvjl.2018.12.021.[SA]

Abstract: Red deer (Cervus elaphus) farming is a growing economic activity worldwide. However, the capacity of this species to act as reservoir of animal tuberculosis (TB) poses a threat to other wildlife and to livestock. Diagnostic assay accuracy in this species is therefore highly relevant for prevention and control measures. Our aim was to evaluate the diagnostic performance of the protein complex P22, obtained from Mycobacterium bovis derived purified protein derivative (bPPD), as a candidate antigen for the detection of antibodies against Mycobacterium tuberculosis complex (MTC). We assessed the performance of this new

antigen in indirect enzyme-linked immunosorbent assays (ELISA) in TB-positive and TB-negative red deer, in comparison with a bPPD-based ELISA.
The P22 ELISA achieved a higher specificity (Sp) and similar sensitivity (Se) in comparison with the bPPD ELISA at all the cut-off points considered. The P22 ELISAyielded optimal Sp (99.02%; 95% confidence intervals [CI95%]: 96.5-99.8) and appropriate Se (70.1%; CI95%: 63.6-76) at the selected cut-off point of 100%. These results suggest that P22 can be used as an alternative antigen in the immunodiagnosis of animal TB through the use of an ELISA-type detection of antibodies against MTC in red deer, thus contributing to the diagnosis of animal TB in this species as a measure for further disease prevention and control programs.

48.- VÁZQUEZ, P., OSORO, K., FERNÁNDEZ, M., ROMÁN-TRUFERO, A., REGIDOR-CERRILLO, J., JIMÉNEZ-PELAYO, L., GARCÍA-SÁNCHEZ, M., ROJO-MONTEJO, S., BENAVIDES, J., HORCAJO, P. & ORTEGA-MORA, L. M. 2019. Effects of challenge dose and inoculation route of the virulent Neospora caninum Nc-Spain7 isolate in pregnant cattle at mid-gestation. *Veterinary Research,* 50 (68). DOI: 10.1186/s13567-019-0686-3. (OA). [SPA]

Abstract: Parameters such as pathogen dose and inoculation route are paramount in animal models when studying disease pathogenesis. Here, clinical findings, including foetal mortality, parasite transmission rates and lesion severity, and immune responses were evaluated in Asturiana pregnant heifers at day 110 of gestation challenged with a virulent (Nc-Spain7) Neospora caninum isolate. Four different doses of parasite tachyzoites were inoculated intravenously (IV1, 10(7) parasites, n = 6; IV2, 10(5), n = 6; IV3, 10(3), n = 6; and IV4, 10(2), n = 5), and the subcutaneous (SC) inoculation route was also assessed for the dose of 10(5) tachyzoites (SC, n = 6). In addition, a control group (n = 4 pregnant heifers) was evaluated. Foetal death was observed in all infected groups from 25 to 62 days post-infection, varying with the dose (IV1:4/6, IV2:3/6; IV4:2/5, IV3:1/6), and was three times less frequently associated with the SC route than IV inoculation (1/6 vs. 3/6). A dose-dependent effect for parasite loads in placental and foetal brain tissues was also detected. After SC challenge, a reduced number of tachyzoites were able to reach foetal brain tissues, and no lesions were observed. In calves, specific IgG responses in precolostral sera were mainly associated with high-dose groups (IV1 [100.0%] and IV2 [66.7%]), and cerebral parasite DNA detection was scarce (3/18). In dams, IFN-gamma production and the dynamics of anti-N. caninum IgG antibodies varied with the dose, and the cell-mediated immune response was also found to be route-dependent. Our results confirm the influence of parasite dose and inoculation route on the outcome and dynamics of bovine neosporosis at mid-gestation.

49.-VELARDE-GUILLEN, J., ESTRADA-FLORES, J. G., RAYAS-AMOR, A. A., VICENTE, F., MARTÍNEZ-FERNÁNDEZ, A., HEREDIA-NAVA, D., CELIS-ÁLVAREZ, M. D., AGUIRRE-UGARTE, I. K., GALINDO-GONZÁLEZ, E. & ARRIAGA-JORDÁN, C. M. 2019. Supplementation of dairy cows with commercial concentrate or ground maize grain under cut-and-carry or grazing of cultivated pastures in small-scale systems in the highlands of central Mexico. *Animal Production Science,* 59 (2)**,** 368-375. DOI: 10.1071/AN15357.[NPF]

Abstract: Small-scale dairy systems (SSDS) in Mexico represent over 78% of dairy farms and 37% of milk production. In the central highlands, many SSDS base the feeding of herds on irrigated cultivated pastures (mostly cut-and-carry), straws, and large amounts of commercial concentrates that result in high feeding costs and low economic sustainability. Intensive grazing may result in lower feeding costs when compared with cut-and-carry strategies. The high protein content of pasture may meet requirements of dairy cows

with moderate milk yield (16-20 kg milk/cow.day), so that lower protein supplements, like ground maize grain, may substitute for commercial concentrates. An on-farm experiment following a participatory rural research approach was undertaken with seven farmers evaluating commercial concentrate (CC) or ground maize grain (MG) as supplement; and two pasture managements, grazing (G) or cut-and-carry (C) of irrigated ryegrass/white clover pastures to assess productive performance and feeding costs. Six farmers participated with four milking cows each and one farmer with two groups of four milking cows in a 2 by 2 factorial experiment. Daily milk yield per cow before the experiment was used as covariate. The experiment lasted 12 weeks. There is a trend in G for higher protein content in milk ($P < 0.10$). CC showed higher body condition score than MG with a significant interaction for body condition score with the highest body condition score in CCC ($P < 0.05$). Feeding costs were 15% higher per kg of milk yield and 19% per kg of energy-corrected milk under cut-and-carry but no statistical differences were detected ($P > 0.05$) in comparison with the grazing strategy. Supplementing with home-grown ground maize grain resulted in 28.5% higher margins per kg of milk produced. Implementing grazing involves less work burden for small-scale dairy farmers, and combined with home-grown grains as supplement is a viable option that may reduce feeding costs in these systems.

50.- WHITTINGTON, R., DONAT, K., WEBER, M. F., KELTON, D., NIELSEN, S. S., EISENBERG, S., ARRIGONI, N., JUSTE, R., LUIS SÁEZ, J., DHAND, N., SANTI, A., MICHEL, A., BARKEMA, H., KRALIK, P., KOSTOULAS, P., CITER, L., GRIFFIN, F., BARWELL, R., SCATAMBURLO MOREIRA, M. A., SLANA, I., KOEHLER, H., SINGH, S. V., YOO, H. S., CHÁVEZ-GRIS, G., GOODRIDGE, A., OCEPEK, M., GARRIDO, J., STEVENSON, K., COLLINS, M., ALONSO, B., CIRONE, K., PAOLICCHI, F., GAVEY, L., RAHMAN, M. T., DE MARCHIN, E., VAN PRAET, W., BAUMAN, C., FECTEAU, G., MCKENNA, S., SALGADO, M., FERNANDEZ-SILVA, J., DZIEDZINSKA, R., ECHEVERRIA, G., SEPPANEN, J., THIBAULT, V., FRIDRIKSDOTTIR, V., DERAKHSHANDEH, A., HAGHKHAH, M., RUOCCO, L., KAWAJI, S., MOMOTANI, E., HEUER, C., NORTON, S., CADMUS, S., AGDESTEIN, A., KAMPEN, A., SZTEYN, J., FROESSLING, J., SCHWAN, E., CALDOW, G., STRAIN, S., CARTER, M., WELLS, S., MUNYEME, M., WOLF, R., GURUNG, R., VERDUGO, C., FOURICHON, C., YAMAMOTO, T., THAPALIYA, S., DI LABIO, E., EKGATAT, M., GIL, A., NUÑEZ ALESANDRE, A., PIAGGIO, J., SUANES, A. & DE WAARD, J. H. 2019. Control of paratuberculosis: who, why and how. A review of 48 countries. *Bmc Veterinary Research*, 15. DOI: 10.1186/s12917-019-1943-4 (OA).[SA]

Abstract: Paratuberculosis, a chronic disease affecting ruminant livestock, is caused by Mycobacterium avium subsp. paratuberculosis (MAP). It has direct and indirect economic costs, impacts animal welfare and arouses public health concerns. In a survey of 48 countries we found paratuberculosis to be very common in livestock. In about half the countries more than 20% of herds and flocks were infected with MAP. Most countries had large ruminant populations (millions), several types of farmed ruminants, multiple husbandry systems and tens of thousands of individual farms, creating challenges for disease control. In addition, numerous species of free-living wildlife were infected. Paratuberculosis was notifiable in most countries, but formal control programs were present in only 22 countries. Generally, these were the more highly developed countries with advanced veterinary services. Of the countries without a formal control program for paratuberculosis, 76% were in South and Central America, Asia and Africa while 20% were in Europe. Control programs were justified most commonly on animal health grounds, but protecting market access and public health were other factors. Prevalence reduction was the major objective in most countries, but Norway and Sweden aimed to eradicate the disease, so surveillance and response were their major objectives. Government funding was involved in about two thirds of countries, but operations tended

to be funded by farmers and their organizations and not by government alone. The majority of countries (60%) had voluntary control programs. Generally, programs were supported by incentives for joining, financial compensation and/or penalties for non-participation. Performance indicators, structure, leadership, practices and tools used in control programs are also presented. Securing funding for long-term control activities was a widespread problem. Control programs were reported to be successful in 16 (73%) of the 22 countries. Recommendations are made for future control programs, including a primary goal of establishing an international code for paratuberculosis, leading to universal acknowledgment of the principles and methods of control in relation to endemic and transboundary disease. An holistic approach across all ruminant livestock industries and long-term commitment is required for control of paratuberculosis.

ÍNDICES

A) ÍNDICE ALFABÉTICO DE AUTORES DEL SERIDA

- ROSA GARCÍA, Rocío (NPF): *(40), (42)*
- ROYO MARTÍN, Luís José (NPF): *(8), (23)*
- SOLDADO CABEZUELO Ana Belén (NPF): *(26), (28)*
- SUÁREZ VALLES, María Belén (TA): *(20), (34), (35), (37), (38)*
- TAMARGO DE MIGUEL, Carolina (SRA): *(9), (22), (45)*
- VICENTE MAINAR, Fernando (NPF): *(26), (49)*

B) INDICE ALFABÉTICO DE TÍTULOS DE REVISTAS CON INDICACIÓN DE SU FACTOR DE IMPACTO

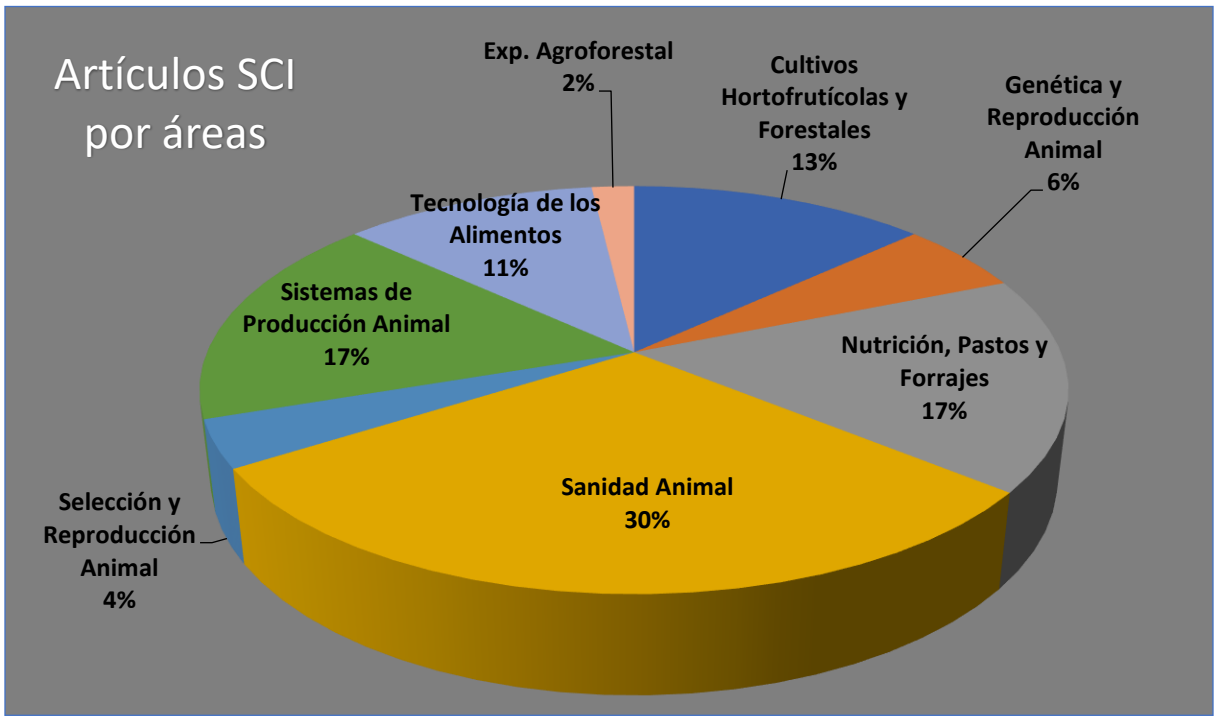
TÍTULO	CUARTIL	FI 2019	REFERENCIA
Acs Sustainable Chemistry Engineering	Q1	7,63	*(20)*
Acta Alimentaria	Q4	0,45	*(38)**
Acta Parasitologica	Q4	1,01	*(2)*
Aging and Disease	Q1	5,40	*(36)**
Agriculture Ecosystems & Environment	Q1	4,24	*(21)*
Animal Production Science	Q3	1,21	*(26),(41,) (49)*
Archives Animal Breeding	Q3	0.99	*(5)**
Bmc Veterinary Research	Q1	1,83	*(17)*, (25*), (50)**
Comparative Immunology Microbiology and Infectious Diseases	Q2	1,57	*(7), (14)*
European Journal of Plant Pathology	Q2	1,58	*(19)*
European Journal of Wildlife Research	Q3	1,38	*(6), (33)**
Field Crops Research	Q1	4,30	*(15)*
Food Chemistry	Q1	6,30	*(34), (35)*
Italian Journal of Animal Science	Q1	1,80	*(39)**
Journal of Applied Animal Research	Q3	1.24	*(29)**
Journal of Applied Ecology	Q1	5.84	*(44)**
Journal of Funcional Foods	Q1	3,70	*(23)**
Journal of Food Composition and Analysis	Q1	3,72	*(30,)(37)**
Journal of Proteomics	Q2	3,50	*(16)*
Journal of Theoretical Biology	Q2	2,32	*(4)*
Journal of Wildlife Diseases	Q2	1,18	*(8)*
Molecular Breeding	Q2	2,14	*(32)*
Pathogens	Q2	3,18	*(1)**
Pest Management Science	Q1	3,75	*(11)*
Plos One	Q2	2,74	*(31)**
Reproduction in Domestic Animals	Q2	1,64	*(9), (12), (18), (22), (45)**
Scientific Reports	Q1	3,99	*(3)*, (10)*, (42)*, (46)**
Spanish Journal of Agricultural Research	Q2	1,03	*(40)**
Talanta	Q1	5,33	*(28)*
Toxicon	Q3	2,20	*(43)*
Transboundary and Emerging Diseases	Q1	4,18	*(13)*
Veterinary Journal	Q1	2,11	*(47)*
Veterinary Medicine and Science	Q3	0,95	*(24)**
Veterinary Research	Q1	3,35	*(27)*, (48)**

**Artículos Open Acces*

ARTÍCULOS POR ÁREAS DE INVESTIGACIÓN DEL SERIDA

- ÁREA DE CULTIVOS HORTOFRUTÍCOLAS Y FORESTALES:*(2), (11), (19), (21), (31), (32), (38), (44)*
- AREA DE EXPERIMENTACIÓN Y DEMOSTRACIÓN AGROFORESTAL: *(11)*
- ÁREA DE GENÉTICA Y REPRODUCCIÓN ANIMAL: *(5), (12), (18)*
- ÁREA DE NUTRICIÓN, PASTOS Y FORRAJES: (8), *(15), (23), (26), (28),(30),(40), (42), (49).*
- ÁREA DE SANIDAD ANIMAL: *(1), (3), (4), (6), (7), (10), (13), (14) (17), (24), (25), (33), (43), (46), (47), (50)*
- ÁREA DE SELECCIÓN Y REPRODUCCIÓN ANIMAL: *(9), (22), (45)*
- ÁREA DE SISTEMAS DE PRODUCCIÓN ANIMAL: *(16), (23), (27), (29), (36), (39), (40),(41), (48)*
- ÁREA DE TECNOLOGÍA DE LOS ALIMENTOS*: (11), (20), (34), (35), (37), (38)*

Figura 1: Artículos por áreas de investigación del SERIDA



Fuente: Elaboración propia

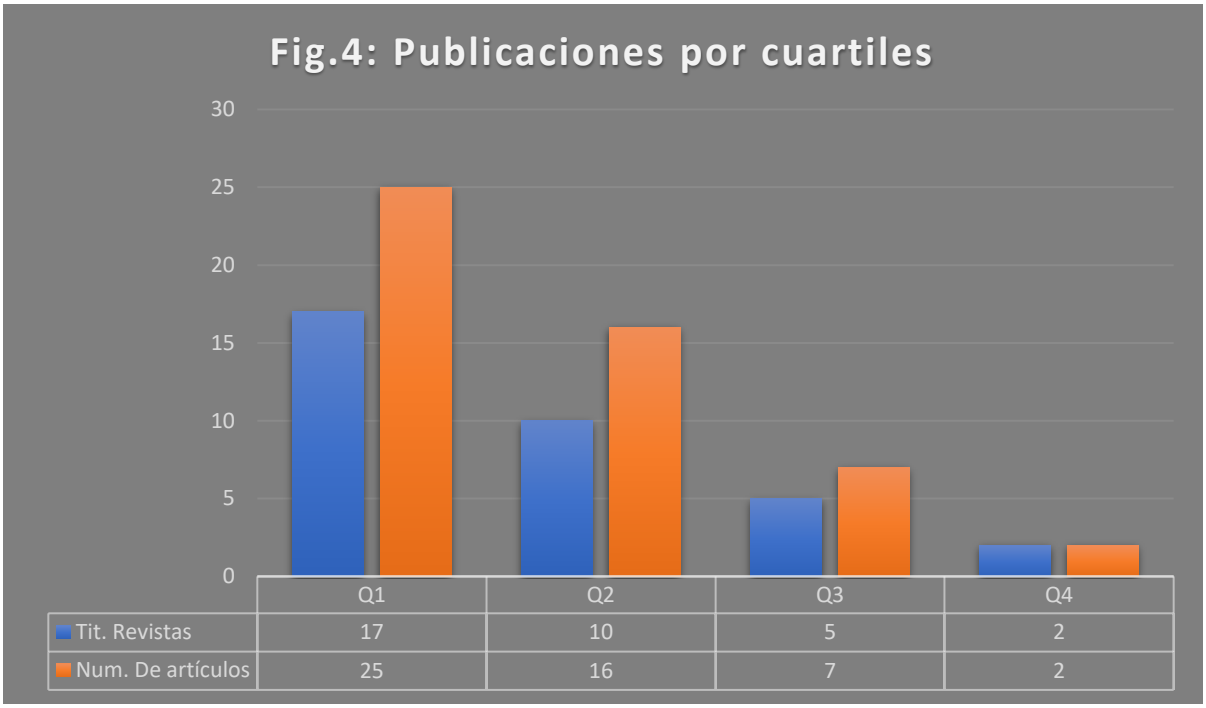
Figura 2: Número de artículos realizados en colaboración con otros países

Fuente: WOS

Figura 3: Número de artículos según título de la revista

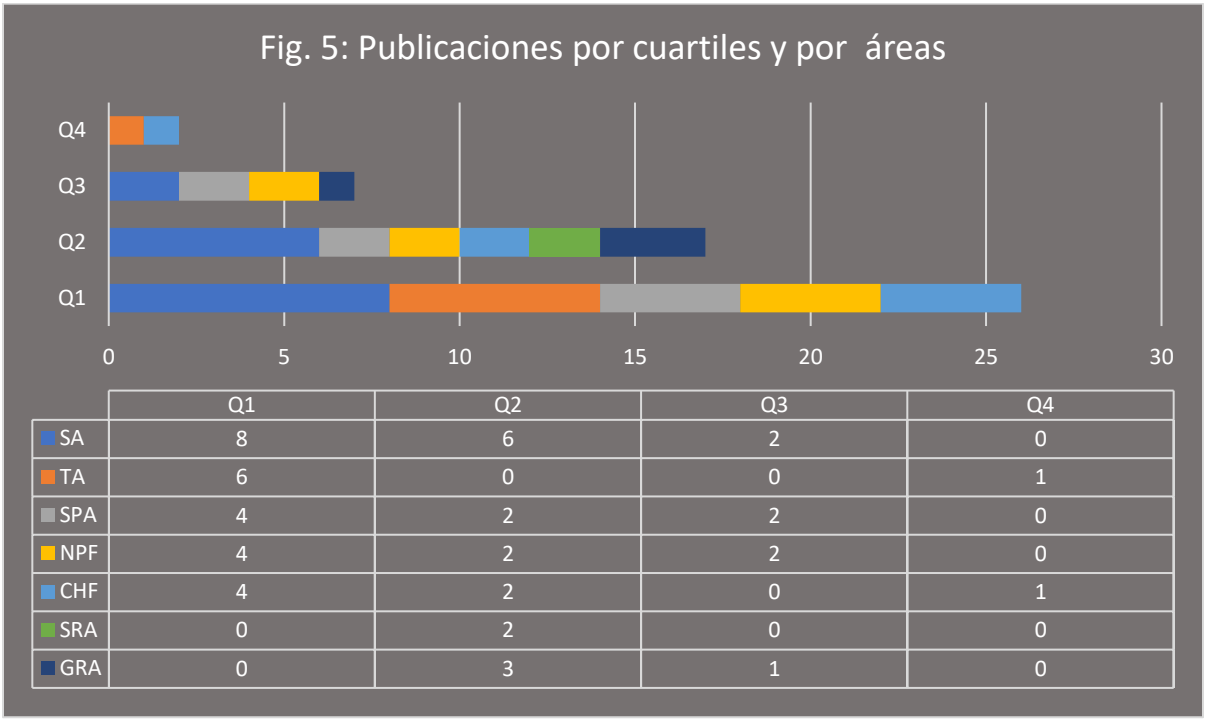
Fuente: WOS

Figura 4: Cuartiles de las revistas en las que aparecen publicados los artículos del SERIDA



Fuente: Elaboración propia

Figura 5: Cuartiles de las revistas en las que aparecen publicados los artículos del SERIDA según las distintas áreas de investigación



Fuente: Elaboración propia